MULTISTACK
Originators. Innovators. Never the Imitators.

Building Automation Protocol Site Survey

Provide the information requested below by typing in the blank fields.

Please save as the Multistack Job Name and return to BuildingAutomation@multistack.com

****This form must be filled out and returned to Building Automation before configuration of a portal can be started****

Multistack Job Name:	**Chiller ID:**
Multistack Job #:	**Controls Contractor:**
Local Rep Office:	**Phone & Email:**

PORTAL SELECTION AND CONFIGURATION: Please select the desired protocol below (check one only) and supply any required information for that selected protocol. If no information is provided the Default values will be used.
Please use a different form for each interoperability portal ordered (one per chiller).

❑ **BACnet over Ethernet:**

Device Instance/Node ID: _____ Range – 1 to 4194303 (Default – 610001)

❑ **BACnet over MS/TP:** (RS-485 3 wire)

Device Instance/Node ID: _____ Range – 1 to 4194303 (Default – 610001)
MAC Address: _____ Range – 0 to 126 (Default – 1)
Max Masters: _____ Range – 1 to 127 (Default – 127)
Max Info Frames: _____ Range – 1 to 255 (Default – 10)
Baud Rate (check one): ❑ 9600 ❑ 19200 ❑ 38400 ❑ 76800 (Default – 38400)

❑ **BACnet over IP:** (DHCP Available)

Device Instance/Node ID: _____ Range – 1 to 4194303 (Default – 610001)
IP Address: _____ (Default – 10.100.50.40)
Subnet Mask: _____ (Default – 255.255.255.0)
Gateway Address: _____ (Default – 0.0.0.0)
UDP: _____ (Default – 47808/BAC0)

❑ **Modbus TCP:** – No Additional information needed (Select box only)

❑ **Modbus RTU:** (RS-485 3 wire) – No Additional information needed (Select box only)

❑ **LonWorks:** (via FieldServer Bridge) – No Additional information needed (Select box only)

***Please verify that LonWorks was ordered with your chiller as there is an additional cost for LonWorks versus the cost for BACnet or Modbus. Please contact an inside sales representative if you require LonWorks and this was not included in the original order.**

Please "Save as" the name of the Multistack job and return as an email attachment to
BuildingAutomation@multistack.com

Failure to return this completed form to BuildingAutomation@multistack.com may result in delays.

IF YOU ARE UNABLE TO PROVIDE THE INFORMATION ON THIS SHEET,
PLEASE PASS THIS ON TO THE CORRECT PERSON TO DO SO.

Multistack·1065 Maple Ave·PO Box 510·Sparta, WI 54656·Phone: (608)366-2400·FAX: (608)366-2450

ARA060X

Chiller Submittal

Model Number:
(3) ARA060XNHCNABAH2I--DLAGAAIWCA---A

[Table of Contents]

MULTISTACK

Mechanical Modules: (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A
Accessory Modules:

Performance with Al/Cu coils

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

COOLING PERFORMANCE DATA											
Load	Cooling (tons)	Input kW	kW/Ton	EER	COP	Fan kW	Flow Rate (GPM)	Entering Temp. °F	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	182.8	212.0	1.160	10.35	3.030	24.00	337.2	58.01	45.00	8.040	95.00

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

SIMULTANEOUS PERFORMANCE DATA											
Load	Cooling (tons)	Input kW	Heating (MBH)	kW/Ton	Heating & Cooling COP	Flow Rate (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Cond Flow (GPM)	Leaving Temp. °F	ΔP (ft H2O)
100%	185.9	178.9	2842	0.9623	8.300	342.9	45.00	8.040	378.9	115.0	7.119

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

HEATING PERFORMANCE DATA									
Load	Heating (MBH)	Input kW	Heating COP	Fan kW	Cond Flow (GPM)	Entering Temp. °F	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	1746	209.7	2.440	24.00	232.5	100.0	115.0	7.119	33.00

COOLING DESIGN DATA-LOAD SIDE	(Based on Water)
Entering Temperature °F	58.00
Leaving Temperature °F	45.00
Design Flow (GPM)	337.2
Pressure Drop (Full Load)	3.481 PSI / 8.040 ft H2O
Chiller Minimum Flow (GPM)	112.4
Min. GPM For Sizing System Bypass	168.6

COOLING MODE AMBIENT DESIGN DATA	Based On Sea Level Elevation
Ambient Temperature °F	95.00
Minimum Ambient °F	60.00
Coil Type	Al/Cu Condenser Coils-Electrofin

SIMULTANEOUS COOLING DESIGN DATA	(Based on Water)
Entering Temperature °F	58.00
Leaving Temperature °F	45.00
Design Flow (GPM)	342.9
Pressure Drop (Full Load)	3.481 PSI / 8.040 ft H2O
Chiller Minimum Flow (GPM)	112.4

SIMULTANEOUS HEATING DESIGN DATA	(Based on Water)
Entering Temperature °F	100.0
Leaving Temperature °F	115.0
Design Flow (GPM)	378.9
Pressure Drop (Full Load)	3.082 PSI / 7.119 ft H2O
Chiller Minimum Flow (GPM)	77.50

HEATING MODE AMBIENT DESIGN DATA	
Ambient Temperature °F	33.00
Maximum Ambient °F	55.00
Coil Type	Al/Cu Condenser Coils-Electrofin

HEATING DESIGN DATA-LOAD SIDE	(Based on Water)
Entering Temperature °F	100.0
Leaving Temperature °F	115.0
Design Flow (GPM)	232.5
Pressure Drop (Full Load)	3.082 PSI / 7.119 ft H2O
Chiller Minimum Flow (GPM)	77.50
Min. GPM For Sizing System Bypass	116.2

EVAPORATOR HEAT EXCHANGER DETAIL	
Heat Exchanger Style	Brazed Plate
Fouling Factor (h-ft2-°F/Btu)	.000100
Header Connection Size (in.)	8
Header Connection Type	Grooved Coupling
Max Water Side Working ΔP (PSI)	150 PSI

CONDENSER HEAT EXCHANGER DETAIL	
Heat Exchanger Style	Brazed Plate
Fouling Factor (h-ft2-°F/Btu)	.000100
Header Connection Size (in.)	6"
Header Connection Type	Grooved Coupling
Max Water Side Working ΔP (PSI)	150 PSI

PHYSICAL DATA	
Length (in.)	See Multistack for Details
Width (in.)	See Multistack for Details
Height (in.)	See Multistack for Details
Estimated Dry Weight (lbs.)	See Multistack for Details
Estimated Operating Weight (lbs.)	See Multistack for Details
Refrigerant Type	410A
Refrig. Charge (lbs per circuit)	215 per module

ELECTRICAL DATA	1	2	3	4
(3) ARA060X	3	0	0	0
MCA	*440			
MOP	500			
Voltage	460/60/3			

CHILLER DATA	
Compressor Descr	Scroll
Compressor RLA (per cor	60
# of Compress. (per mod.	2
Fan Qty (per module)	4
Fan FLA (A) (per fan)	5.4

MOUNTING/LIFTING FRAME	
Materials	Carbon Steel Painted
Design	Standard - no walkway/passage
I-Beam Size	6"
Width of Walkway/Passage	N/A
Bolt together frame - # of piece	1
End Type	Flush Ends - Both

Software Version #: 1.0.4435.26000

Performance Run Date: 12/2/2021 10:30:51 AI

*Parallel feeds required.

Outside the scope of AHRI Air-Cooled Water-Chilling Packages Certification Program, but is rated in accordance with AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI).
Combined units or modular chiller array rating is outside of the scope of the AHRI Air-Cooled Water-Chilling Packages Certification Program. Individual unit ratings are subject to the governing documents of the AHRI Certification Program.
Unit contains freeze protection fluids in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] and is certified when rated per the Standard with water.

Part Load Performance

COOLING PERFORMANCE DATA										
Load	Capacity (tons)	Input kW	kW/Ton	EER	COP	Fan kW	Flow Rate (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	182.9	211.7	1.158	10.37	3.040	24.00	337.5	45.00	8.040	95.00
75%	137.2	116.8	0.8512	14.10	4.130	10.50	337.5	45.00	8.040	80.00
50%	91.45	60.03	0.6564	18.28	5.360	10.50	337.5	45.00	8.040	65.00
25%	45.73	26.03	0.5692	21.08	6.180	1.500	337.5	45.00	8.040	55.00

HEATING PERFORMANCE DATA								
Load	Heating (MBH)	Input kW	Heating COP	Fan kW	Cond Flow (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	1749	209.7	2.440	24.00	233.1	115.0	7.119	33.00
75%	1312	137.2	2.800	10.50	233.1	115.0	7.119	40.00
50%	874.5	82.49	3.110	10.50	233.1	115.0	7.119	48.00
25%	437.2	36.92	3.470	1.500	233.1	115.0	7.119	55.00

MULTISTACK®

Variable Flow Design Requirements

Chilled Water System (Evaporator)

Ensure a chiller DP transmitter (DP1) is incorporated into the piping design and set to: **3.48 PSI**
DP1 to be installed directly after the chiller with no pressure adding devices between the chiller and DP1. *(mechanical only ΔP)*

Ensure a system DP transmitter(s) (DP2) is incorporated into the piping design

Ensure a system bypass valve(s) (V1) is incorporated into the piping design

Design of system bypass (V1) must be a characterized ball or globe type valve and be pressure dependent

System bypass valve (V1) stroke time needs to be selected for less than 60 seconds

Chiller minimum flow is: **112.5 GPM**

System bypass valve must be design for a minimum of: **168.8 GPM**

Note: this is a minimum requirement for the chiller ONLY! Other system components such as pumps or air handling units may have higher minimum flow requirements and bypass sizing may be adjusted accordingly.

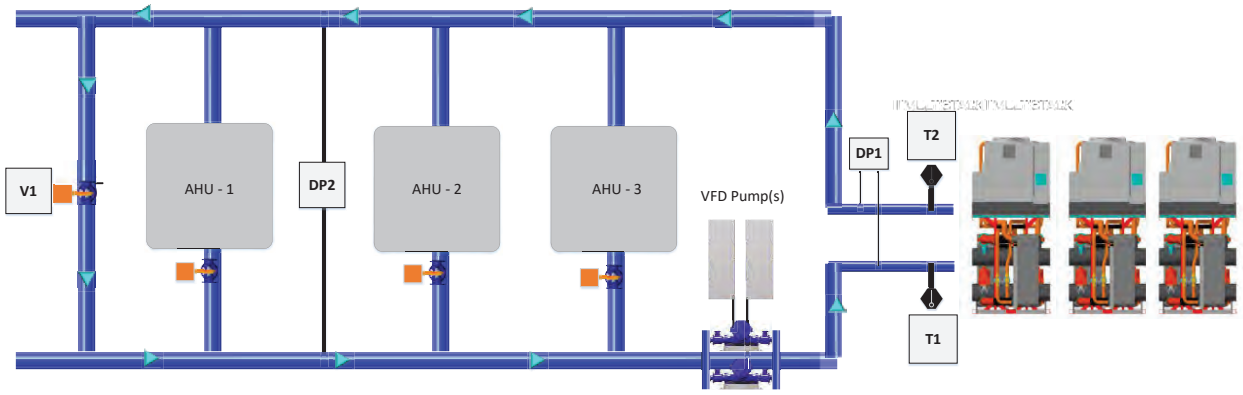
Bypass loop volume (Includes piping between V1 & chiller): **438.8 Gallons**

Note: the bypass loop should be designed for a minimim of a 2 minute loop at all conditions. To obtain ensure the above volume is met.

Refer to Multistack Variable Flow Engineering Bulletin for more details

The pump or the bypass valve must control to maintain chiller DP setpoint, the opposite device (Pump or Bypass Valve) must maintain system DP setpoint.

When a pump module is supplied by Multistack it will be factory configured to control to DP across the chiller unless otherwise specified and noted on the chiller selection.



LEGEND

WIRED & CONTROLLED BY CONTROLS CONTRACTOR
V1 – SYSTEM BYPASS VALVE
DP1 – CHILLER DIFFERENTIAL PRESSURE
DP2 – SYSTEM DIFFERENTIAL PRESSURE
VFD Pump(s)

WIRED TO CHILLER MASTER CONTROLLER
T1 – CHW RETURN TEMP SENSOR
T2 – CHW SUPPLY TEMP SENSOR

SCHEMATIC ONLY – REFER TO JOB SPECIFIC DRAWING FOR CONSTRUCTION

MULTISTACK®

Variable Flow Design Requirements

Hot Water System (Condenser)

Ensure a chiller DP transmitter (DP1) is incorporated into the piping design and set to: **3.082** **PSI**

DP1 to be installed directly after the chiller with no pressure adding devices between the chiller and DP1.

Ensure a system DP transmitter(s) (DP2) is incorporated into the piping design

Ensure a system bypass valve(s) (V1) is incorporated into the piping design

Design of system bypass (V1) must be a characterized ball or globe type valve and be pressure dependent

System bypass valve (V1) stroke time needs to be selected for less than 60 seconds

Chiller minimum flow is: **77.70** **GPM**

System bypass valve must be design for a minimum of: **116.6** **GPM**

Note: this is a minimum requirement for the chiller ONLY! Other system components such as pumps or air handling units may have higher minimum flow requirements and bypass sizing may be adjusted accordingly.

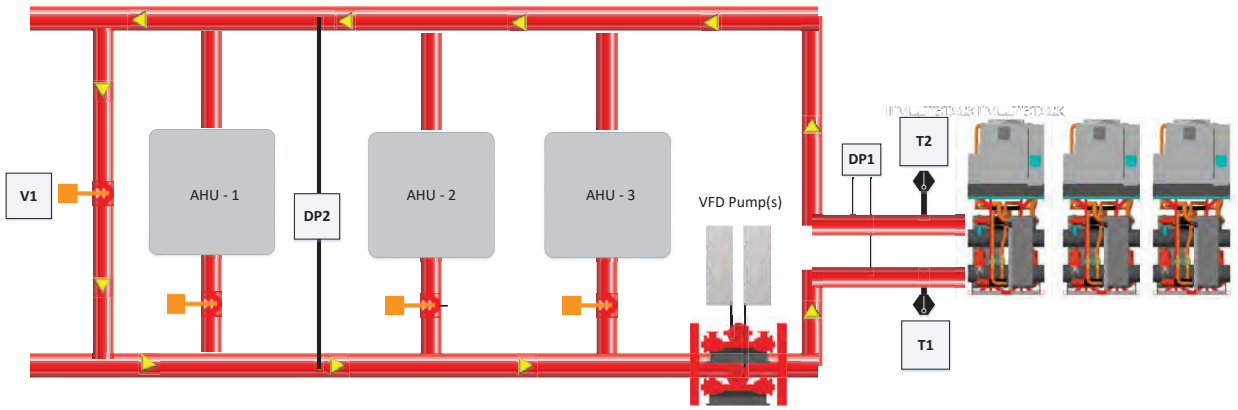
Bypass loop volume: (Includes piping between V1 & chiller) **379** **Gallons**

Note: the bypass loop should be designed for a minimim of a 2 minute loop at all conditions. To obtain, ensure the above volume is met.

Refer to Multistack Variable Flow Engineering Bulletin for more details

The pump or the bypass valve must control to maintain chiller DP setpoint, the opposite device (Pump or Bypass Valve) must maintain system DP setpoint.

When a pump module is supplied by Multistack it will be factory configured to control to DP across the chiller unless otherwise specified and noted on the chiller selection.



LEGEND

WIRED & CONTROLLED BY CONTROLS CONTRACTOR

V1 – SYSTEM BYPASS VALVE
DP1 – CHILLER DIFFERENTIAL PRESSURE
DP2 – SYSTEM DIFFERENTIAL PRESSURE
VFD Pump(s)

WIRED TO CHILLER MASTER CONTROLLER

T1 – HW RETURN TEMP SENSOR
T2 – HW SUPPLY TEMP SENSOR

SCHEMATIC ONLY – REFER TO JOB SPECIFIC DRAWING FOR CONSTRUCTION

P.O. Box 510 - Sparta, WI 54656 - (608)366-2400 / Fax (608)366-2450
www.multistack.com - www.airstack.com

Glycol in an ARA

1. Multistack recommends the use of glycol in both the chilled water and hot water loops in an ARA system for freeze protection. The design of this unit is such that the non-active heat exchanger is always open to the suction side of the compressor. Operation in a HEATING ONLY mode will use the fin and tube coil as the evaporator. During this mode of operation the saturated evaporation temperature can easily drop below the freezing point based on ambient conditions. The approach on the fin and tube evaporator at that point will most likely be between 20-30F. Any refrigerant in the non-active brazed plate evaporator will stabilize out at the same suction pressure that the compressor is operating at. At that point, the formation of ice in the heat exchanger would be dependent upon the ambient temperature conditions. Hence, the recommendation for glycol in the chilled water loop. We also recommend glycol in the hot water loop as freezing could also occur in an inactive hot water loop heat exchanger if the ambient temperature were to get too low for too long a period of time.

2. If glycol will not be used in the application, then the customer should incorporate the monitoring of the Multistack Pump START/STOP outputs at the Master Control to aid in knowing when the water temperature inside each heat exchanger is getting too cold. The Multistack software for valve control will incorporate logic that will modulate open the water valve in the individual module if the module leaving water temperature gets to within 2.0F of the low temperature lockout setting. Anytime a module is in a LOW TEMP WARNING condition (and is communicating to the Master Controller), the associated pump output will be energized at the Master Control. NOTE: The system must provide a path for the water to flow to prevent dead heading of the pump at this point in time! Once the temperature leaving the heat exchanger reaches a safe value again (and no other modules are in a LOW TEMP WARNING condition) the pump output will then turn off.

3. The customer could also choose to incorporate logic in the BAS control that would keep the pump running when the ambient temperature is below a pre-defined safe value.

4. A fourth option to help aid in the effort to prevent a frozen heat exchanger would be to add optional heat tracing to the heat exchangers and associated water piping.
NOTE: Multistack provides heat tracing at the customer's request only. Heat tracing can fail and requires power at ALL times for it to be effective.

Failure to follow the above recommendations from Multistack could result in a frozen heat exchanger under active or even inactive operation of the equipment. Multistack does not warranty frozen heat exchangers. It is in the customer's best interest to proceed with glycol for heat exchanger freeze protection.

Other Services & Special Features:

- Chiller Waterside Maximum Working Pressure is 150 PSIG
- Filters in Evaporator and Condenser Supply Headers
- Stainless Steel Inlet Headers
- Stainless steel evaporator and condenser
- Heat exchanger maximum working pressure (refrigerant 565 PSI)
- Lead compressor sequencing(24hrs)
- Automatic internal rescheduling if fault occurs
- Multiple, independent refrigeration systems
- Automatic logging of any fault condition
- Electronic chilled water control
- Quick interconnect modular design
- R-410A Refrigerant
- Electrical Connection Type - Junction Box
- Carbon Steel Painted Lifting Frame
- Warranty: Compressor (5 Year)
- Warranty: All Parts (1 Year)
- Warranty: Parts (less Compressor) (2 Year)
- 3/4" Closed Cell Foam Insulation
- Var. Flow Cond (Mot. Valve Supply Only)
- Var. Flow Evap (Mot. Valve Supply Only)
- Cu/Al Condenser Coils
- Main Power Door Interlock Disconnect Switch
- Single Point Power Connection
- Electrofin Coated Coils
- Brazed Plate Evaporator
- 4 Condenser Fans per module
- External Master Controller Box
- ECM Fans
- Evap Flow Switch-Thermal Dispersion Type (24 Volt Factory Powered & Installed On Each Module)
- Cond Flow Switch-Thermal Dispersion Type (24 Volt Factory Powered & Installed On Each Module)
- Interoperability Web Portal for Mechanicals (BACnet TCP/IP)
- Increased 65kA SCCR
- MultiPro One Multipro connected to all modules.

Excluded By Multistack

- Any Travel and Diagnosis for Warranties
- Multistack recommends a 2-3 minute minimum loop time. Contact Multistack if you have questions regarding system loop time design
- WARRANTY OF COMPONENTS DUE TO FREEZING. Glycol has not been incorporated into the design of this equipment and the design ambient temperature is close to or below the freezing point of water. Multistack highly recommends the use of glycol at these conditions. Multistack will not warant failures that are the result of freezing.

MULTISTACK

Mechanical Modules: (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A
Accessory Modules:

Performance with Al/Cu coils

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

COOLING PERFORMANCE DATA											
Load	Cooling (tons)	Input kW	kW/Ton	EER	COP	Fan kW	Flow Rate (GPM)	Entering Temp. °F	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	182.8	212.0	1.160	10.35	3.030	24.00	337.2	58.01	45.00	8.040	95.00

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

SIMULTANEOUS PERFORMANCE DATA											
Load	Cooling (tons)	Input kW	Heating (MBH)	kW/Ton	Heating & Cooling COP	Flow Rate (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Cond Flow (GPM)	Leaving Temp. °F	ΔP (ft H2O)
100%	185.9	178.9	2842	0.9623	8.300	342.9	45.00	8.040	378.9	115.0	7.119

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

HEATING PERFORMANCE DATA									
Load	Heating (MBH)	Input kW	Heating COP	Fan kW	Cond Flow (GPM)	Entering Temp. °F	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	1746	209.7	2.440	24.00	232.5	100.0	115.0	7.119	33.00

COOLING DESIGN DATA-LOAD SIDE	(Based on Water)
Entering Temperature °F	58.00
Leaving Temperature °F	45.00
Design Flow (GPM)	337.2
Pressure Drop (Full Load)	3.481 PSI / 8.040 ft H2O
Chiller Minimum Flow (GPM)	112.4
Min. GPM For Sizing System Bypass	168.6

COOLING MODE AMBIENT DESIGN DATA	Based On Sea Level Elevation
Ambient Temperature °F	95.00
Minimum Ambient °F	60.00
Coil Type	Al/Cu Condenser Coils-Electrofin

SIMULTANEOUS COOLING DESIGN DATA	(Based on Water)
Entering Temperature °F	58.00
Leaving Temperature °F	45.00
Design Flow (GPM)	342.9
Pressure Drop (Full Load)	3.481 PSI / 8.040 ft H2O
Chiller Minimum Flow (GPM)	112.4

SIMULTANEOUS HEATING DESIGN DATA	(Based on Water)
Entering Temperature °F	100.0
Leaving Temperature °F	115.0
Design Flow (GPM)	378.9
Pressure Drop (Full Load)	3.082 PSI / 7.119 ft H2O
Chiller Minimum Flow (GPM)	77.50

HEATING MODE AMBIENT DESIGN DATA	
Ambient Temperature °F	33.00
Maximum Ambient °F	55.00
Coil Type	Al/Cu Condenser Coils-Electrofin

HEATING DESIGN DATA-LOAD SIDE	(Based on Water)
Entering Temperature °F	100.0
Leaving Temperature °F	115.0
Design Flow (GPM)	232.5
Pressure Drop (Full Load)	3.082 PSI / 7.119 ft H2O
Chiller Minimum Flow (GPM)	77.50
Min. GPM For Sizing System Bypass	116.2

EVAPORATOR HEAT EXCHANGER DETAIL	
Heat Exchanger Style	Brazed Plate
Fouling Factor (h-ft2-°F/Btu)	.000100
Header Connection Size (in.)	8
Header Connection Type	Grooved Coupling
Max Water Side Working ΔP (PSI)	150 PSI

CONDENSER HEAT EXCHANGER DETAIL	
Heat Exchanger Style	Brazed Plate
Fouling Factor (h-ft2-°F/Btu)	.000100
Header Connection Size (in.)	6"
Header Connection Type	Grooved Coupling
Max Water Side Working ΔP (PSI)	150 PSI

PHYSICAL DATA	
Length (in.)	See Multistack for Details
Width (in.)	See Multistack for Details
Height (in.)	See Multistack for Details
Estimated Dry Weight (lbs.)	See Multistack for Details
Estimated Operating Weight (lbs.)	See Multistack for Details
Refrigerant Type	410A
Refrig. Charge (lbs per circuit)	215 per module

ELECTRICAL DATA	1	2	3	4
(3) ARA060X	3	0	0	0
MCA	*440			
MOP	500			
Voltage	460/60/3			

CHILLER DATA	
Compressor Descr	Scroll
Compressor RLA (per cor	60
# of Compress. (per mod.	2
Fan Qty (per module)	4
Fan FLA (A) (per fan)	5.4

MOUNTING/LIFTING FRAME	
Materials	Carbon Steel Painted
Design	Standard - no walkway/passage
I-Beam Size	6"
Width of Walkway/Passage	N/A
Bolt together frame - # of piece	1
End Type	Flush Ends - Both

Software Version #: 1.0.4435.26000

Performance Run Date: 12/2/2021 10:35:31 AI

*Parallel feeds required.

Outside the scope of AHRI Air-Cooled Water-Chilling Packages Certification Program, but is rated in accordance with AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI).
Combined units or modular chiller array rating is outside of the scope of the AHRI Air-Cooled Water-Chilling Packages Certification Program. Individual unit ratings are subject to the governing documents of the AHRI Certification Program.
Unit contains freeze protection fluids in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] and is certified when rated per the Standard with water.

Part Load Performance

COOLING PERFORMANCE DATA										
Load	Capacity (tons)	Input kW	kW/Ton	EER	COP	Fan kW	Flow Rate (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	182.9	211.7	1.158	10.37	3.040	24.00	337.5	45.00	8.040	95.00
75%	137.2	116.8	0.8512	14.10	4.130	10.50	337.5	45.00	8.040	80.00
50%	91.45	60.03	0.6564	18.28	5.360	10.50	337.5	45.00	8.040	65.00
25%	45.73	26.03	0.5692	21.08	6.180	1.500	337.5	45.00	8.040	55.00

HEATING PERFORMANCE DATA								
Load	Heating (MBH)	Input kW	Heating COP	Fan kW	Cond Flow (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	1749	209.7	2.440	24.00	233.1	115.0	7.119	33.00
75%	1312	137.2	2.800	10.50	233.1	115.0	7.119	40.00
50%	874.5	82.49	3.110	10.50	233.1	115.0	7.119	48.00
25%	437.2	36.92	3.470	1.500	233.1	115.0	7.119	55.00

MULTISTACK®

Variable Flow Design Requirements

Chilled Water System (Evaporator)

Ensure a chiller DP transmitter (DP1) is incorporated into the piping design and set to: **3.48 PSI**
DP1 to be installed directly after the chiller with no pressure adding devices between the chiller and DP1. *(mechanical only ΔP)*

Ensure a system DP transmitter(s) (DP2) is incorporated into the piping design

Ensure a system bypass valve(s) (V1) is incorporated into the piping design

Design of system bypass (V1) must be a characterized ball or globe type valve and be pressure dependent

System bypass valve (V1) stroke time needs to be selected for less than 60 seconds

Chiller minimum flow is: **112.5 GPM**

System bypass valve must be design for a minimum of: **168.8 GPM**

Note: this is a minimum requirement for the chiller ONLY! Other system components such as pumps or air handling units may have higher minimum flow requirements and bypass sizing may be adjusted accordingly.

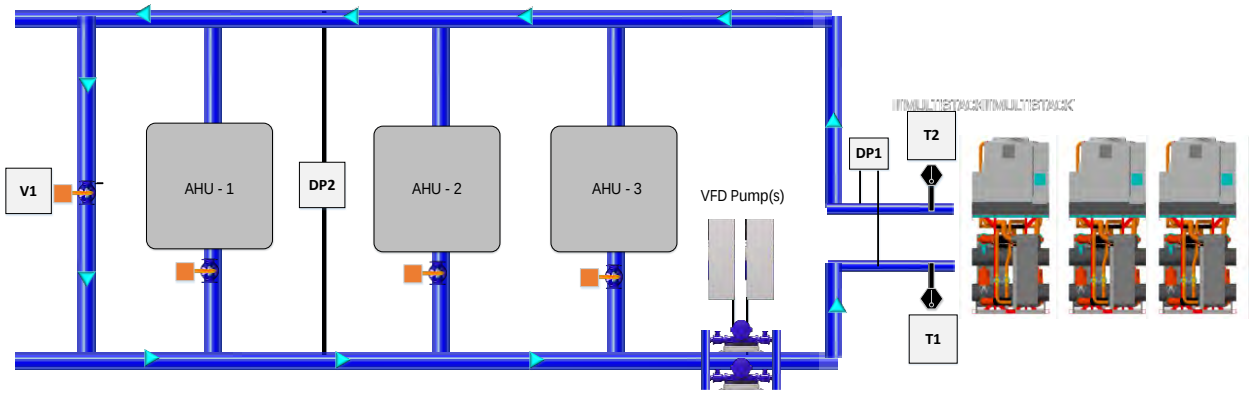
Bypass loop volume (Includes piping between V1 & chiller): **438.8 Gallons**

Note: the bypass loop should be designed for a minimim of a 2 minute loop at all conditions. To obtain ensure the above volume is met.

Refer to Multistack Variable Flow Engineering Bulletin for more details

The pump or the bypass valve must control to maintain chiller DP setpoint, the opposite device (Pump or Bypass Valve) must maintain system DP setpoint.

When a pump module is supplied by Multistack it will be factory configured to control to DP across the chiller unless otherwise specified and noted on the chiller selection.



LEGEND

WIRED & CONTROLLED BY CONTROLS CONTRACTOR
V1 – SYSTEM BYPASS VALVE
DP1 – CHILLER DIFFERENTIAL PRESSURE
DP2 – SYSTEM DIFFERENTIAL PRESSURE
VFD Pump(s)

WIRED TO CHILLER MASTER CONTROLLER
T1 – CHW RETURN TEMP SENSOR
T2 – CHW SUPPLY TEMP SENSOR

SCHEMATIC ONLY – REFER TO JOB SPECIFIC DRAWING FOR CONSTRUCTION

MULTISTACK®

Variable Flow Design Requirements

Hot Water System (Condenser)

Ensure a chiller DP transmitter (DP1) is incorporated into the piping design and set to: **3.082** **PSI**
DP1 to be installed directly after the chiller with no pressure adding devices between the chiller and DP1.

Ensure a system DP transmitter(s) (DP2) is incorporated into the piping design

Ensure a system bypass valve(s) (V1) is incorporated into the piping design

Design of system bypass (V1) must be a characterized ball or globe type valve and be pressure dependent

System bypass valve (V1) stroke time needs to be selected for less than 60 seconds

Chiller minimum flow is: **77.70** **GPM**

System bypass valve must be design for a minimum of: **116.6** **GPM**

Note: this is a minimum requirement for the chiller ONLY! Other system components such as pumps or air handling units may have higher minimum flow requirements and bypass sizing may be adjusted accordingly.

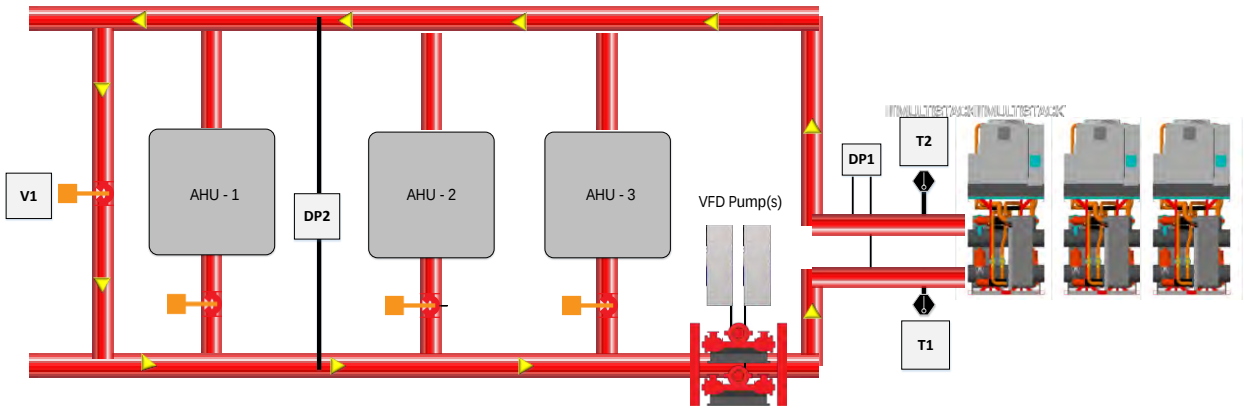
Bypass loop volume: (Includes piping between V1 & chiller) **379** **Gallons**

Note: the bypass loop should be designed for a minimim of a 2 minute loop at all conditions. To obtain, ensure the above volume is met.

Refer to Multistack Variable Flow Engineering Bulletin for more details

The pump or the bypass valve must control to maintain chiller DP setpoint, the opposite device (Pump or Bypass Valve) must maintain system DP setpoint.

When a pump module is supplied by Multistack it will be factory configured to control to DP across the chiller unless otherwise specified and noted on the chiller selection.



LEGEND

WIRED & CONTROLLED BY CONTROLS CONTRACTOR
V1 – SYSTEM BYPASS VALVE
DP1 – CHILLER DIFFERENTIAL PRESSURE
DP2 – SYSTEM DIFFERENTIAL PRESSURE
VFD Pump(s)

WIRED TO CHILLER MASTER CONTROLLER
T1 – HW RETURN TEMP SENSOR
T2 – HW SUPPLY TEMP SENSOR

SCHEMATIC ONLY – REFER TO JOB SPECIFIC DRAWING FOR CONSTRUCTION

P.O. Box 510 - Sparta, WI 54656 - (608)366-2400 / Fax (608)366-2450
www.multistack.com - www.airstack.com

Glycol in an ARA

1. Multistack recommends the use of glycol in both the chilled water and hot water loops in an ARA system for freeze protection. The design of this unit is such that the non-active heat exchanger is always open to the suction side of the compressor. Operation in a HEATING ONLY mode will use the fin and tube coil as the evaporator. During this mode of operation the saturated evaporation temperature can easily drop below the freezing point based on ambient conditions. The approach on the fin and tube evaporator at that point will most likely be between 20-30F. Any refrigerant in the non-active brazed plate evaporator will stabilize out at the same suction pressure that the compressor is operating at. At that point, the formation of ice in the heat exchanger would be dependent upon the ambient temperature conditions. Hence, the recommendation for glycol in the chilled water loop. We also recommend glycol in the hot water loop as freezing could also occur in an inactive hot water loop heat exchanger if the ambient temperature were to get too low for too long a period of time.

2. If glycol will not be used in the application, then the customer should incorporate the monitoring of the Multistack Pump START/STOP outputs at the Master Control to aid in knowing when the water temperature inside each heat exchanger is getting too cold. The Multistack software for valve control will incorporate logic that will modulate open the water valve in the individual module if the module leaving water temperature gets to within 2.0F of the low temperature lockout setting. Anytime a module is in a LOW TEMP WARNING condition (and is communicating to the Master Controller), the associated pump output will be energized at the Master Control. NOTE: The system must provide a path for the water to flow to prevent dead heading of the pump at this point in time! Once the temperature leaving the heat exchanger reaches a safe value again (and no other modules are in a LOW TEMP WARNING condition) the pump output will then turn off.

3. The customer could also choose to incorporate logic in the BAS control that would keep the pump running when the ambient temperature is below a pre-defined safe value.

4. A fourth option to help aid in the effort to prevent a frozen heat exchanger would be to add optional heat tracing to the heat exchangers and associated water piping.
NOTE: Multistack provides heat tracing at the customer's request only. Heat tracing can fail and requires power at ALL times for it to be effective.

Failure to follow the above recommendations from Multistack could result in a frozen heat exchanger under active or even inactive operation of the equipment. Multistack does not warranty frozen heat exchangers. It is in the customer's best interest to proceed with glycol for heat exchanger freeze protection.

Other Services & Special Features:

- Chiller Waterside Maximum Working Pressure is 150 PSIG
- Filters in Evaporator and Condenser Supply Headers
- Stainless Steel Inlet Headers
- Stainless steel evaporator and condenser
- Heat exchanger maximum working pressure (refrigerant 565 PSI)
- Lead compressor sequencing(24hrs)
- Automatic internal rescheduling if fault occurs
- Multiple, independent refrigeration systems
- Automatic logging of any fault condition
- Electronic chilled water control
- Quick interconnect modular design
- R-410A Refrigerant
- Electrical Connection Type - Junction Box
- Carbon Steel Painted Lifting Frame
- Warranty: Compressor (5 Year)
- Warranty: All Parts (1 Year)
- Warranty: Parts (less Compressor) (2 Year)
- 3/4" Closed Cell Foam Insulation
- Var. Flow Cond (Mot. Valve Supply Only)
- Var. Flow Evap (Mot. Valve Supply Only)
- Cu/Al Condenser Coils
- Main Power Door Interlock Disconnect Switch
- Single Point Power Connection
- Electrofin Coated Coils
- Brazed Plate Evaporator
- 4 Condenser Fans per module
- External Master Controller Box
- ECM Fans
- Evap Flow Switch-Thermal Dispersion Type (24 Volt Factory Powered & Installed On Each Module)
- Cond Flow Switch-Thermal Dispersion Type (24 Volt Factory Powered & Installed On Each Module)
- Interoperability Web Portal for Mechanicals (BACnet TCP/IP)
- Increased 65kA SCCR

Excluded By Multistack

- Any Travel and Diagnosis for Warranties
- Multistack recommends a 2-3 minute minimum loop time. Contact Multistack if you have questions regarding system loop time design
- WARRANTY OF COMPONENTS DUE TO FREEZING. Glycol has not been incorporated into the design of this equipment and the design ambient temperature is close to or below the freezing point of water. Multistack highly recommends the use of glycol at these conditions. Multistack will not warant failures that are the result of freezing.

MULTISTACK

Mechanical Modules: (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A
Accessory Modules:

Performance with Al/Cu coils

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

COOLING PERFORMANCE DATA											
Load	Cooling (tons)	Input kW	kW/Ton	EER	COP	Fan kW	Flow Rate (GPM)	Entering Temp. °F	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	182.8	212.0	1.160	10.35	3.030	24.00	337.2	58.01	45.00	8.040	95.00

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

SIMULTANEOUS PERFORMANCE DATA											
Load	Cooling (tons)	Input kW	Heating (MBH)	kW/Ton	Heating & Cooling COP	Flow Rate (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Cond Flow (GPM)	Leaving Temp. °F	ΔP (ft H2O)
100%	185.9	178.9	2842	0.9623	8.300	342.9	45.00	8.040	378.9	115.0	7.119

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

HEATING PERFORMANCE DATA									
Load	Heating (MBH)	Input kW	Heating COP	Fan kW	Cond Flow (GPM)	Entering Temp. °F	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	1746	209.7	2.440	24.00	232.5	100.0	115.0	7.119	33.00

COOLING DESIGN DATA-LOAD SIDE	(Based on Water)
Entering Temperature °F	58.00
Leaving Temperature °F	45.00
Design Flow (GPM)	337.2
Pressure Drop (Full Load)	3.481 PSI / 8.040 ft H2O
Chiller Minimum Flow (GPM)	112.4
Min. GPM For Sizing System Bypass	168.6

COOLING MODE AMBIENT DESIGN DATA	Based On Sea Level Elevation
Ambient Temperature °F	95.00
Minimum Ambient °F	60.00
Coil Type	Al/Cu Condenser Coils-Electrofin

SIMULTANEOUS COOLING DESIGN DATA	(Based on Water)
Entering Temperature °F	58.00
Leaving Temperature °F	45.00
Design Flow (GPM)	342.9
Pressure Drop (Full Load)	3.481 PSI / 8.040 ft H2O
Chiller Minimum Flow (GPM)	112.4

SIMULTANEOUS HEATING DESIGN DATA	(Based on Water)
Entering Temperature °F	100.0
Leaving Temperature °F	115.0
Design Flow (GPM)	378.9
Pressure Drop (Full Load)	3.082 PSI / 7.119 ft H2O
Chiller Minimum Flow (GPM)	77.50

HEATING MODE AMBIENT DESIGN DATA	
Ambient Temperature °F	33.00
Maximum Ambient °F	55.00
Coil Type	Al/Cu Condenser Coils-Electrofin

HEATING DESIGN DATA-LOAD SIDE	(Based on Water)
Entering Temperature °F	100.0
Leaving Temperature °F	115.0
Design Flow (GPM)	232.5
Pressure Drop (Full Load)	3.082 PSI / 7.119 ft H2O
Chiller Minimum Flow (GPM)	77.50
Min. GPM For Sizing System Bypass	116.2

EVAPORATOR HEAT EXCHANGER DETAIL	
Heat Exchanger Style	Brazed Plate
Fouling Factor (h-ft2-°F/Btu)	.000100
Header Connection Size (in.)	8
Header Connection Type	Grooved Coupling
Max Water Side Working ΔP (PSI)	150 PSI

CONDENSER HEAT EXCHANGER DETAIL	
Heat Exchanger Style	Brazed Plate
Fouling Factor (h-ft2-°F/Btu)	.000100
Header Connection Size (in.)	6"
Header Connection Type	Grooved Coupling
Max Water Side Working ΔP (PSI)	150 PSI

PHYSICAL DATA	
Length (in.)	See Multistack for Details
Width (in.)	See Multistack for Details
Height (in.)	See Multistack for Details
Estimated Dry Weight (lbs.)	See Multistack for Details
Estimated Operating Weight (lbs.)	See Multistack for Details
Refrigerant Type	410A
Refrig. Charge (lbs per circuit)	215 per module

ELECTRICAL DATA	1	2	3	4
(3) ARA060X	3	0	0	0
MCA	*440			
MOP	500			
Voltage	460/60/3			

CHILLER DATA	
Compressor Descr	Scroll
Compressor RLA (per cor	60
# of Compress. (per mod.	2
Fan Qty (per module)	4
Fan FLA (A) (per fan)	5.4

MOUNTING/LIFTING FRAME	
Materials	Carbon Steel Painted
Design	Standard - no walkway/passage
I-Beam Size	6"
Width of Walkway/Passage	N/A
Bolt together frame - # of piece	1
End Type	Flush Ends - Both

Software Version #: 1.0.4435.26000

Performance Run Date: 12/2/2021 10:38:45 AI

*Parallel feeds required.

Outside the scope of AHRI Air-Cooled Water-Chilling Packages Certification Program, but is rated in accordance with AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI).
Combined units or modular chiller array rating is outside of the scope of the AHRI Air-Cooled Water-Chilling Packages Certification Program. Individual unit ratings are subject to the governing documents of the AHRI Certification Program.
Unit contains freeze protection fluids in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] and is certified when rated per the Standard with water.

Part Load Performance

COOLING PERFORMANCE DATA										
Load	Capacity (tons)	Input kW	kW/Ton	EER	COP	Fan kW	Flow Rate (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	182.9	211.7	1.158	10.37	3.040	24.00	337.5	45.00	8.040	95.00
75%	137.2	116.8	0.8512	14.10	4.130	10.50	337.5	45.00	8.040	80.00
50%	91.45	60.03	0.6564	18.28	5.360	10.50	337.5	45.00	8.040	65.00
25%	45.73	26.03	0.5692	21.08	6.180	1.500	337.5	45.00	8.040	55.00

HEATING PERFORMANCE DATA								
Load	Heating (MBH)	Input kW	Heating COP	Fan kW	Cond Flow (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	1749	209.7	2.440	24.00	233.1	115.0	7.119	33.00
75%	1312	137.2	2.800	10.50	233.1	115.0	7.119	40.00
50%	874.5	82.49	3.110	10.50	233.1	115.0	7.119	48.00
25%	437.2	36.92	3.470	1.500	233.1	115.0	7.119	55.00

MULTISTACK®

Variable Flow Design Requirements

Chilled Water System (Evaporator)

Ensure a chiller DP transmitter (DP1) is incorporated into the piping design and set to: **3.48 PSI**
DP1 to be installed directly after the chiller with no pressure adding devices between the chiller and DP1. *(mechanical only ΔP)*

Ensure a system DP transmitter(s) (DP2) is incorporated into the piping design

Ensure a system bypass valve(s) (V1) is incorporated into the piping design

Design of system bypass (V1) must be a characterized ball or globe type valve and be pressure dependent

System bypass valve (V1) stroke time needs to be selected for less than 60 seconds

Chiller minimum flow is: **112.5 GPM**

System bypass valve must be design for a minimum of: **168.8 GPM**

Note: this is a minimum requirement for the chiller ONLY! Other system components such as pumps or air handling units may have higher minimum flow requirements and bypass sizing may be adjusted accordingly.

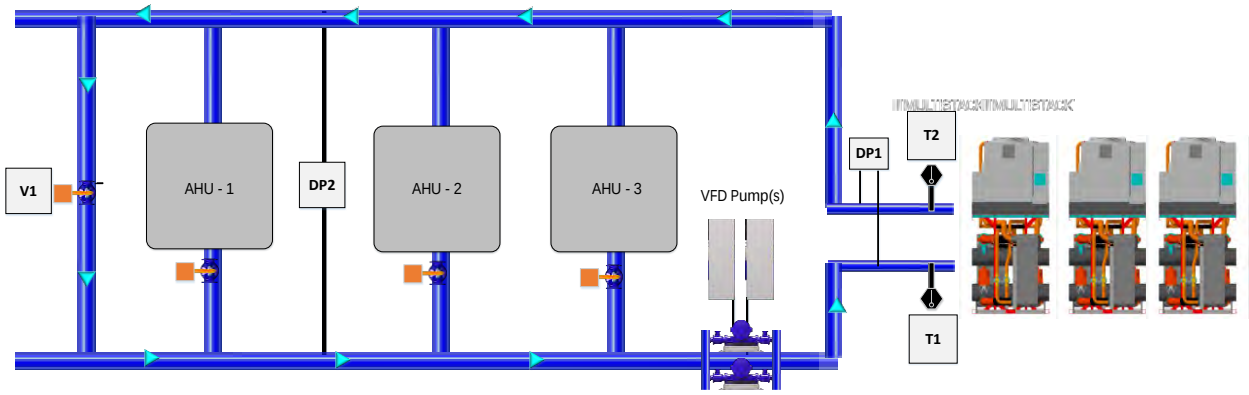
Bypass loop volume (Includes piping between V1 & chiller): **438.8 Gallons**

Note: the bypass loop should be designed for a minimim of a 2 minute loop at all conditions. To obtain ensure the above volume is met.

Refer to Multistack Variable Flow Engineering Bulletin for more details

The pump or the bypass valve must control to maintain chiller DP setpoint, the opposite device (Pump or Bypass Valve) must maintain system DP setpoint.

When a pump module is supplied by Multistack it will be factory configured to control to DP across the chiller unless otherwise specified and noted on the chiller selection.



LEGEND

WIRED & CONTROLLED BY CONTROLS CONTRACTOR
V1 – SYSTEM BYPASS VALVE
DP1 – CHILLER DIFFERENTIAL PRESSURE
DP2 – SYSTEM DIFFERENTIAL PRESSURE
VFD Pump(s)

WIRED TO CHILLER MASTER CONTROLLER
T1 – CHW RETURN TEMP SENSOR
T2 – CHW SUPPLY TEMP SENSOR

SCHEMATIC ONLY – REFER TO JOB SPECIFIC DRAWING FOR CONSTRUCTION

MULTISTACK®

Variable Flow Design Requirements

Hot Water System (Condenser)

Ensure a chiller DP transmitter (DP1) is incorporated into the piping design and set to: **3.082** **PSI**
DP1 to be installed directly after the chiller with no pressure adding devices between the chiller and DP1.

Ensure a system DP transmitter(s) (DP2) is incorporated into the piping design

Ensure a system bypass valve(s) (V1) is incorporated into the piping design

Design of system bypass (V1) must be a characterized ball or globe type valve and be pressure dependent

System bypass valve (V1) stroke time needs to be selected for less than 60 seconds

Chiller minimum flow is: **77.70** **GPM**

System bypass valve must be design for a minimum of: **116.6** **GPM**

Note: this is a minimum requirement for the chiller ONLY! Other system components such as pumps or air handling units may have higher minimum flow requirements and bypass sizing may be adjusted accordingly.

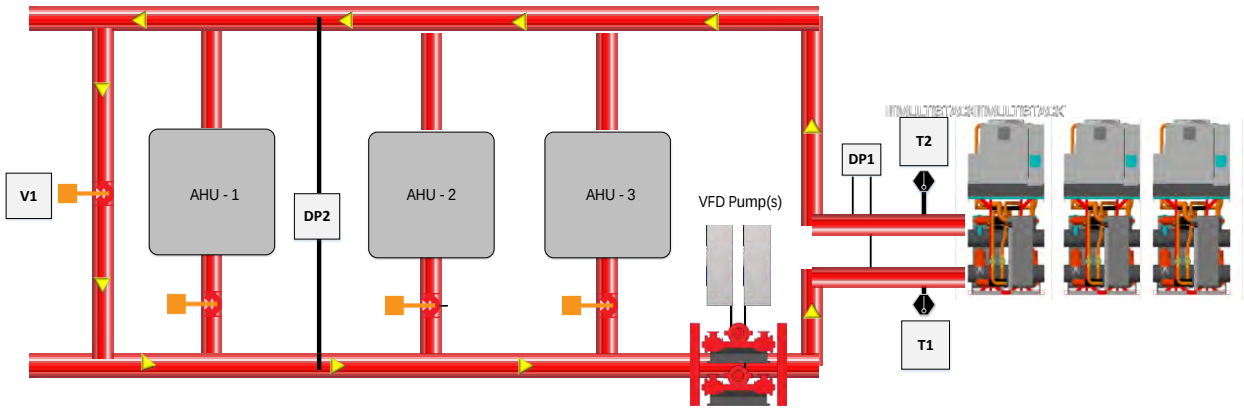
Bypass loop volume: (Includes piping between V1 & chiller) **379** **Gallons**

Note: the bypass loop should be designed for a minimim of a 2 minute loop at all conditions. To obtain, ensure the above volume is met.

Refer to Multistack Variable Flow Engineering Bulletin for more details

The pump or the bypass valve must control to maintain chiller DP setpoint, the opposite device (Pump or Bypass Valve) must maintain system DP setpoint.

When a pump module is supplied by Multistack it will be factory configured to control to DP across the chiller unless otherwise specified and noted on the chiller selection.



LEGEND

WIRED & CONTROLLED BY CONTROLS CONTRACTOR
V1 – SYSTEM BYPASS VALVE
DP1 – CHILLER DIFFERENTIAL PRESSURE
DP2 – SYSTEM DIFFERENTIAL PRESSURE
VFD Pump(s)

WIRED TO CHILLER MASTER CONTROLLER
T1 – HW RETURN TEMP SENSOR
T2 – HW SUPPLY TEMP SENSOR

SCHEMATIC ONLY – REFER TO JOB SPECIFIC DRAWING FOR CONSTRUCTION

P.O. Box 510 - Sparta, WI 54656 - (608)366-2400 / Fax (608)366-2450
www.multistack.com - www.airstack.com

Glycol in an ARA

1. Multistack recommends the use of glycol in both the chilled water and hot water loops in an ARA system for freeze protection. The design of this unit is such that the non-active heat exchanger is always open to the suction side of the compressor. Operation in a HEATING ONLY mode will use the fin and tube coil as the evaporator. During this mode of operation the saturated evaporation temperature can easily drop below the freezing point based on ambient conditions. The approach on the fin and tube evaporator at that point will most likely be between 20-30F. Any refrigerant in the non-active brazed plate evaporator will stabilize out at the same suction pressure that the compressor is operating at. At that point, the formation of ice in the heat exchanger would be dependent upon the ambient temperature conditions. Hence, the recommendation for glycol in the chilled water loop. We also recommend glycol in the hot water loop as freezing could also occur in an inactive hot water loop heat exchanger if the ambient temperature were to get too low for too long a period of time.

2. If glycol will not be used in the application, then the customer should incorporate the monitoring of the Multistack Pump START/STOP outputs at the Master Control to aid in knowing when the water temperature inside each heat exchanger is getting too cold. The Multistack software for valve control will incorporate logic that will modulate open the water valve in the individual module if the module leaving water temperature gets to within 2.0F of the low temperature lockout setting. Anytime a module is in a LOW TEMP WARNING condition (and is communicating to the Master Controller), the associated pump output will be energized at the Master Control. NOTE: The system must provide a path for the water to flow to prevent dead heading of the pump at this point in time! Once the temperature leaving the heat exchanger reaches a safe value again (and no other modules are in a LOW TEMP WARNING condition) the pump output will then turn off.

3. The customer could also choose to incorporate logic in the BAS control that would keep the pump running when the ambient temperature is below a pre-defined safe value.

4. A fourth option to help aid in the effort to prevent a frozen heat exchanger would be to add optional heat tracing to the heat exchangers and associated water piping.
NOTE: Multistack provides heat tracing at the customer's request only. Heat tracing can fail and requires power at ALL times for it to be effective.

Failure to follow the above recommendations from Multistack could result in a frozen heat exchanger under active or even inactive operation of the equipment. Multistack does not warranty frozen heat exchangers. It is in the customer's best interest to proceed with glycol for heat exchanger freeze protection.

Other Services & Special Features:

- Chiller Waterside Maximum Working Pressure is 150 PSIG
- Filters in Evaporator and Condenser Supply Headers
- Stainless Steel Inlet Headers
- Stainless steel evaporator and condenser
- Heat exchanger maximum working pressure (refrigerant 565 PSI)
- Lead compressor sequencing(24hrs)
- Automatic internal rescheduling if fault occurs
- Multiple, independent refrigeration systems
- Automatic logging of any fault condition
- Electronic chilled water control
- Quick interconnect modular design
- R-410A Refrigerant
- Electrical Connection Type - Junction Box
- Carbon Steel Painted Lifting Frame
- Warranty: Compressor (5 Year)
- Warranty: All Parts (1 Year)
- Warranty: Parts (less Compressor) (2 Year)
- 3/4" Closed Cell Foam Insulation
- Var. Flow Cond (Mot. Valve Supply Only)
- Var. Flow Evap (Mot. Valve Supply Only)
- Cu/Al Condenser Coils
- Main Power Door Interlock Disconnect Switch
- Single Point Power Connection
- Electrofin Coated Coils
- Brazed Plate Evaporator
- 4 Condenser Fans per module
- External Master Controller Box
- ECM Fans
- Evap Flow Switch-Thermal Dispersion Type (24 Volt Factory Powered & Installed On Each Module)
- Cond Flow Switch-Thermal Dispersion Type (24 Volt Factory Powered & Installed On Each Module)
- Interoperability Web Portal for Mechanicals (BACnet TCP/IP)
- Increased 65kA SCCR

Excluded By Multistack

- Any Travel and Diagnosis for Warranties
- Multistack recommends a 2-3 minute minimum loop time. Contact Multistack if you have questions regarding system loop time design
- WARRANTY OF COMPONENTS DUE TO FREEZING. Glycol has not been incorporated into the design of this equipment and the design ambient temperature is close to or below the freezing point of water. Multistack highly recommends the use of glycol at these conditions. Multistack will not warant failures that are the result of freezing.

MULTISTACK

Mechanical Modules: (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A
Accessory Modules:

Performance with Al/Cu coils

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

COOLING PERFORMANCE DATA											
Load	Cooling (tons)	Input kW	kW/Ton	EER	COP	Fan kW	Flow Rate (GPM)	Entering Temp. °F	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	182.8	212.0	1.160	10.35	3.030	24.00	337.2	58.01	45.00	8.040	95.00

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

SIMULTANEOUS PERFORMANCE DATA											
Load	Cooling (tons)	Input kW	Heating (MBH)	kW/Ton	Heating & Cooling COP	Flow Rate (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Cond Flow (GPM)	Leaving Temp. °F	ΔP (ft H2O)
100%	185.9	178.9	2842	0.9623	8.300	342.9	45.00	8.040	378.9	115.0	7.119

Based on (3) ARA060XNHCNABAD2I--DLAGAAIWCA---A operating

HEATING PERFORMANCE DATA									
Load	Heating (MBH)	Input kW	Heating COP	Fan kW	Cond Flow (GPM)	Entering Temp. °F	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	1746	209.7	2.440	24.00	232.5	100.0	115.0	7.119	33.00

COOLING DESIGN DATA-LOAD SIDE	(Based on Water)
Entering Temperature °F	58.00
Leaving Temperature °F	45.00
Design Flow (GPM)	337.2
Pressure Drop (Full Load)	3.481 PSI / 8.040 ft H2O
Chiller Minimum Flow (GPM)	112.4
Min. GPM For Sizing System Bypass	168.6

COOLING MODE AMBIENT DESIGN DATA	Based On Sea Level Elevation
Ambient Temperature °F	95.00
Minimum Ambient °F	60.00
Coil Type	Al/Cu Condenser Coils-Electrofin

SIMULTANEOUS COOLING DESIGN DATA	(Based on Water)
Entering Temperature °F	58.00
Leaving Temperature °F	45.00
Design Flow (GPM)	342.9
Pressure Drop (Full Load)	3.481 PSI / 8.040 ft H2O
Chiller Minimum Flow (GPM)	112.4

SIMULTANEOUS HEATING DESIGN DATA	(Based on Water)
Entering Temperature °F	100.0
Leaving Temperature °F	115.0
Design Flow (GPM)	378.9
Pressure Drop (Full Load)	3.082 PSI / 7.119 ft H2O
Chiller Minimum Flow (GPM)	77.50

HEATING MODE AMBIENT DESIGN DATA	
Ambient Temperature °F	33.00
Maximum Ambient °F	55.00
Coil Type	Al/Cu Condenser Coils-Electrofin

HEATING DESIGN DATA-LOAD SIDE	(Based on Water)
Entering Temperature °F	100.0
Leaving Temperature °F	115.0
Design Flow (GPM)	232.5
Pressure Drop (Full Load)	3.082 PSI / 7.119 ft H2O
Chiller Minimum Flow (GPM)	77.50
Min. GPM For Sizing System Bypass	116.2

EVAPORATOR HEAT EXCHANGER DETAIL	
Heat Exchanger Style	Brazed Plate
Fouling Factor (h-ft2-°F/Btu)	.000100
Header Connection Size (in.)	8
Header Connection Type	Grooved Coupling
Max Water Side Working ΔP (PSI)	150 PSI

CONDENSER HEAT EXCHANGER DETAIL	
Heat Exchanger Style	Brazed Plate
Fouling Factor (h-ft2-°F/Btu)	.000100
Header Connection Size (in.)	6"
Header Connection Type	Grooved Coupling
Max Water Side Working ΔP (PSI)	150 PSI

PHYSICAL DATA	
Length (in.)	See Multistack for Details
Width (in.)	See Multistack for Details
Height (in.)	See Multistack for Details
Estimated Dry Weight (lbs.)	See Multistack for Details
Estimated Operating Weight (lbs.)	See Multistack for Details
Refrigerant Type	410A
Refrig. Charge (lbs per circuit)	215 per module

ELECTRICAL DATA	1	2	3	4
(3) ARA060X	3	0	0	0
MCA	*440			
MOP	500			
Voltage	460/60/3			

CHILLER DATA	
Compressor Descr	Scroll
Compressor RLA (per cor	60
# of Compress. (per mod.	2
Fan Qty (per module)	4
Fan FLA (A) (per fan)	5.4

MOUNTING/LIFTING FRAME	
Materials	Carbon Steel Painted
Design	Standard - no walkway/passage
I-Beam Size	6"
Width of Walkway/Passage	N/A
Bolt together frame - # of piece	1
End Type	Flush Ends - Both

Software Version #: 1.0.4435.26000

Performance Run Date: 12/2/2021 10:41:43 AI

*Parallel feeds required.

Outside the scope of AHRI Air-Cooled Water-Chilling Packages Certification Program, but is rated in accordance with AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI).
Combined units or modular chiller array rating is outside of the scope of the AHRI Air-Cooled Water-Chilling Packages Certification Program. Individual unit ratings are subject to the governing documents of the AHRI Certification Program.
Unit contains freeze protection fluids in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] and is certified when rated per the Standard with water.

Part Load Performance

COOLING PERFORMANCE DATA										
Load	Capacity (tons)	Input kW	kW/Ton	EER	COP	Fan kW	Flow Rate (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	182.9	211.7	1.158	10.37	3.040	24.00	337.5	45.00	8.040	95.00
75%	137.2	116.8	0.8512	14.10	4.130	10.50	337.5	45.00	8.040	80.00
50%	91.45	60.03	0.6564	18.28	5.360	10.50	337.5	45.00	8.040	65.00
25%	45.73	26.03	0.5692	21.08	6.180	1.500	337.5	45.00	8.040	55.00

HEATING PERFORMANCE DATA								
Load	Heating (MBH)	Input kW	Heating COP	Fan kW	Cond Flow (GPM)	Leaving Temp. °F	ΔP (ft H2O)	Ambient °F
100%	1749	209.7	2.440	24.00	233.1	115.0	7.119	33.00
75%	1312	137.2	2.800	10.50	233.1	115.0	7.119	40.00
50%	874.5	82.49	3.110	10.50	233.1	115.0	7.119	48.00
25%	437.2	36.92	3.470	1.500	233.1	115.0	7.119	55.00

MULTISTACK®

Variable Flow Design Requirements

Chilled Water System (Evaporator)

Ensure a chiller DP transmitter (DP1) is incorporated into the piping design and set to: **3.48 PSI**
DP1 to be installed directly after the chiller with no pressure adding devices between the chiller and DP1. *(mechanical only ΔP)*

Ensure a system DP transmitter(s) (DP2) is incorporated into the piping design

Ensure a system bypass valve(s) (V1) is incorporated into the piping design

Design of system bypass (V1) must be a characterized ball or globe type valve and be pressure dependent

System bypass valve (V1) stroke time needs to be selected for less than 60 seconds

Chiller minimum flow is: **112.5 GPM**

System bypass valve must be design for a minimum of: **168.8 GPM**

Note: this is a minimum requirement for the chiller ONLY! Other system components such as pumps or air handling units may have higher minimum flow requirements and bypass sizing may be adjusted accordingly.

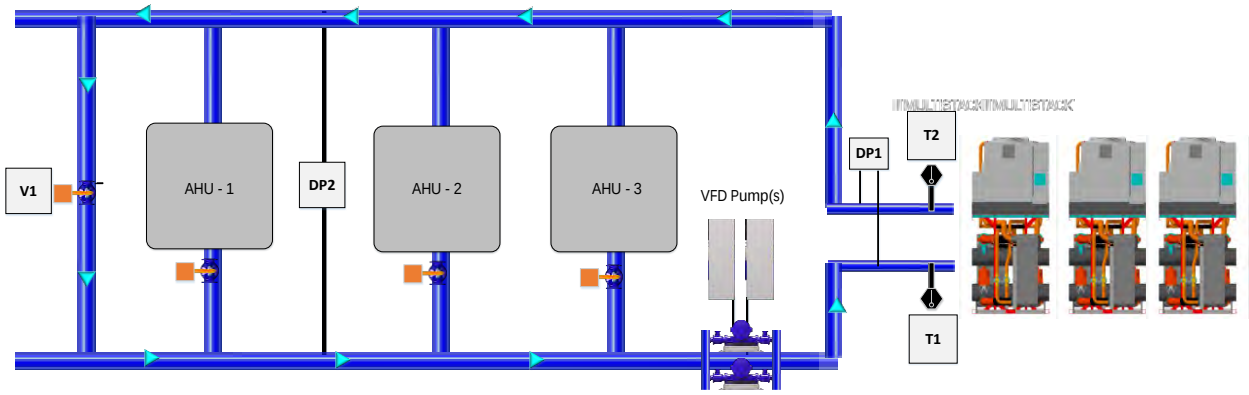
Bypass loop volume (Includes piping between V1 & chiller): **438.8 Gallons**

Note: the bypass loop should be designed for a minimim of a 2 minute loop at all conditions. To obtain ensure the above volume is met.

Refer to Multistack Variable Flow Engineering Bulletin for more details

The pump or the bypass valve must control to maintain chiller DP setpoint, the opposite device (Pump or Bypass Valve) must maintain system DP setpoint.

When a pump module is supplied by Multistack it will be factory configured to control to DP across the chiller unless otherwise specified and noted on the chiller selection.



LEGEND

WIRED & CONTROLLED BY CONTROLS CONTRACTOR
V1 – SYSTEM BYPASS VALVE
DP1 – CHILLER DIFFERENTIAL PRESSURE
DP2 – SYSTEM DIFFERENTIAL PRESSURE
VFD Pump(s)

WIRED TO CHILLER MASTER CONTROLLER
T1 – CHW RETURN TEMP SENSOR
T2 – CHW SUPPLY TEMP SENSOR

SCHEMATIC ONLY – REFER TO JOB SPECIFIC DRAWING FOR CONSTRUCTION

MULTISTACK®

Variable Flow Design Requirements

Hot Water System (Condenser)

Ensure a chiller DP transmitter (DP1) is incorporated into the piping design and set to: **3.082** **PSI**
DP1 to be installed directly after the chiller with no pressure adding devices between the chiller and DP1.

Ensure a system DP transmitter(s) (DP2) is incorporated into the piping design

Ensure a system bypass valve(s) (V1) is incorporated into the piping design

Design of system bypass (V1) must be a characterized ball or globe type valve and be pressure dependent

System bypass valve (V1) stroke time needs to be selected for less than 60 seconds

Chiller minimum flow is: **77.70** **GPM**

System bypass valve must be design for a minimum of: **116.6** **GPM**

Note: this is a minimum requirement for the chiller ONLY! Other system components such as pumps or air handling units may have higher minimum flow requirements and bypass sizing may be adjusted accordingly.

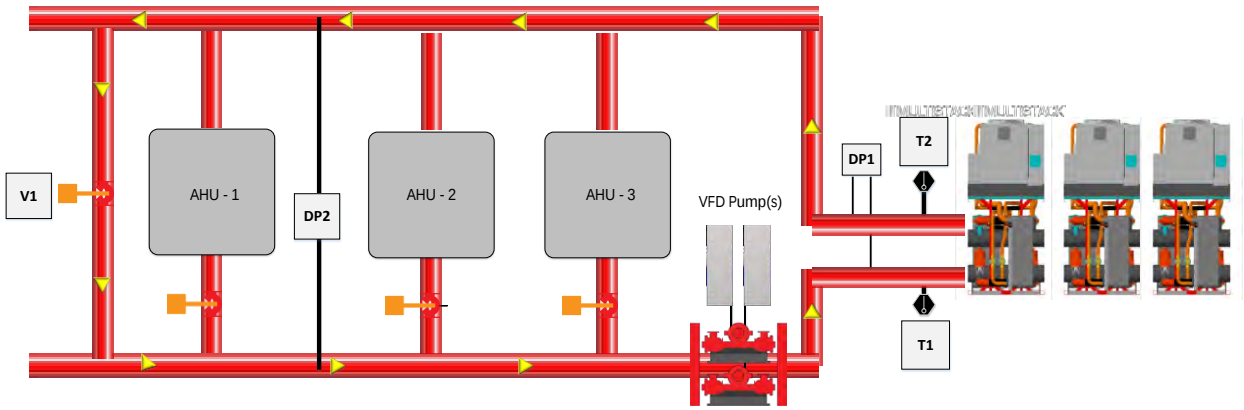
Bypass loop volume: (Includes piping between V1 & chiller) **379** **Gallons**

Note: the bypass loop should be designed for a minimim of a 2 minute loop at all conditions. To obtain, ensure the above volume is met.

Refer to Multistack Variable Flow Engineering Bulletin for more details

The pump or the bypass valve must control to maintain chiller DP setpoint, the opposite device (Pump or Bypass Valve) must maintain system DP setpoint.

When a pump module is supplied by Multistack it will be factory configured to control to DP across the chiller unless otherwise specified and noted on the chiller selection.



LEGEND

WIRED & CONTROLLED BY CONTROLS CONTRACTOR
V1 – SYSTEM BYPASS VALVE
DP1 – CHILLER DIFFERENTIAL PRESSURE
DP2 – SYSTEM DIFFERENTIAL PRESSURE
VFD Pump(s)

WIRED TO CHILLER MASTER CONTROLLER
T1 – HW RETURN TEMP SENSOR
T2 – HW SUPPLY TEMP SENSOR

SCHEMATIC ONLY – REFER TO JOB SPECIFIC DRAWING FOR CONSTRUCTION

P.O. Box 510 - Sparta, WI 54656 - (608)366-2400 / Fax (608)366-2450
www.multistack.com - www.airstack.com

Glycol in an ARA

1. Multistack recommends the use of glycol in both the chilled water and hot water loops in an ARA system for freeze protection. The design of this unit is such that the non-active heat exchanger is always open to the suction side of the compressor. Operation in a HEATING ONLY mode will use the fin and tube coil as the evaporator. During this mode of operation the saturated evaporation temperature can easily drop below the freezing point based on ambient conditions. The approach on the fin and tube evaporator at that point will most likely be between 20-30F. Any refrigerant in the non-active brazed plate evaporator will stabilize out at the same suction pressure that the compressor is operating at. At that point, the formation of ice in the heat exchanger would be dependent upon the ambient temperature conditions. Hence, the recommendation for glycol in the chilled water loop. We also recommend glycol in the hot water loop as freezing could also occur in an inactive hot water loop heat exchanger if the ambient temperature were to get too low for too long a period of time.

2. If glycol will not be used in the application, then the customer should incorporate the monitoring of the Multistack Pump START/STOP outputs at the Master Control to aid in knowing when the water temperature inside each heat exchanger is getting too cold. The Multistack software for valve control will incorporate logic that will modulate open the water valve in the individual module if the module leaving water temperature gets to within 2.0F of the low temperature lockout setting. Anytime a module is in a LOW TEMP WARNING condition (and is communicating to the Master Controller), the associated pump output will be energized at the Master Control. NOTE: The system must provide a path for the water to flow to prevent dead heading of the pump at this point in time! Once the temperature leaving the heat exchanger reaches a safe value again (and no other modules are in a LOW TEMP WARNING condition) the pump output will then turn off.

3. The customer could also choose to incorporate logic in the BAS control that would keep the pump running when the ambient temperature is below a pre-defined safe value.

4. A fourth option to help aid in the effort to prevent a frozen heat exchanger would be to add optional heat tracing to the heat exchangers and associated water piping.
NOTE: Multistack provides heat tracing at the customer's request only. Heat tracing can fail and requires power at ALL times for it to be effective.

Failure to follow the above recommendations from Multistack could result in a frozen heat exchanger under active or even inactive operation of the equipment. Multistack does not warranty frozen heat exchangers. It is in the customer's best interest to proceed with glycol for heat exchanger freeze protection.

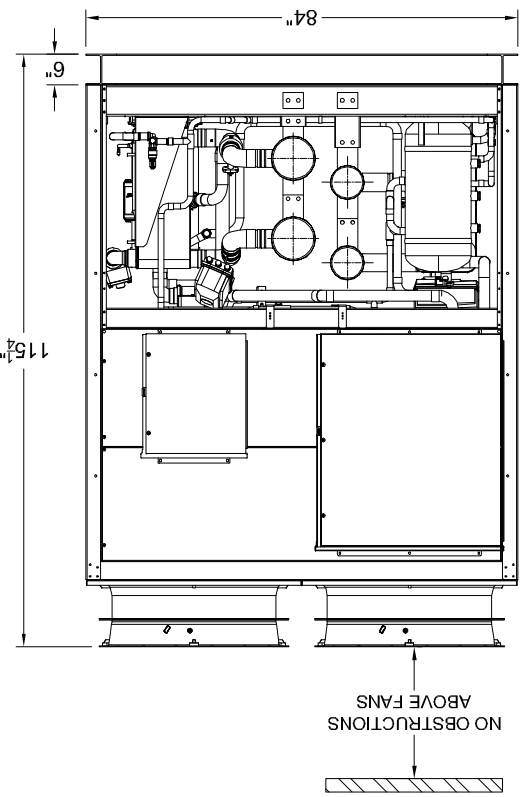
Other Services & Special Features:

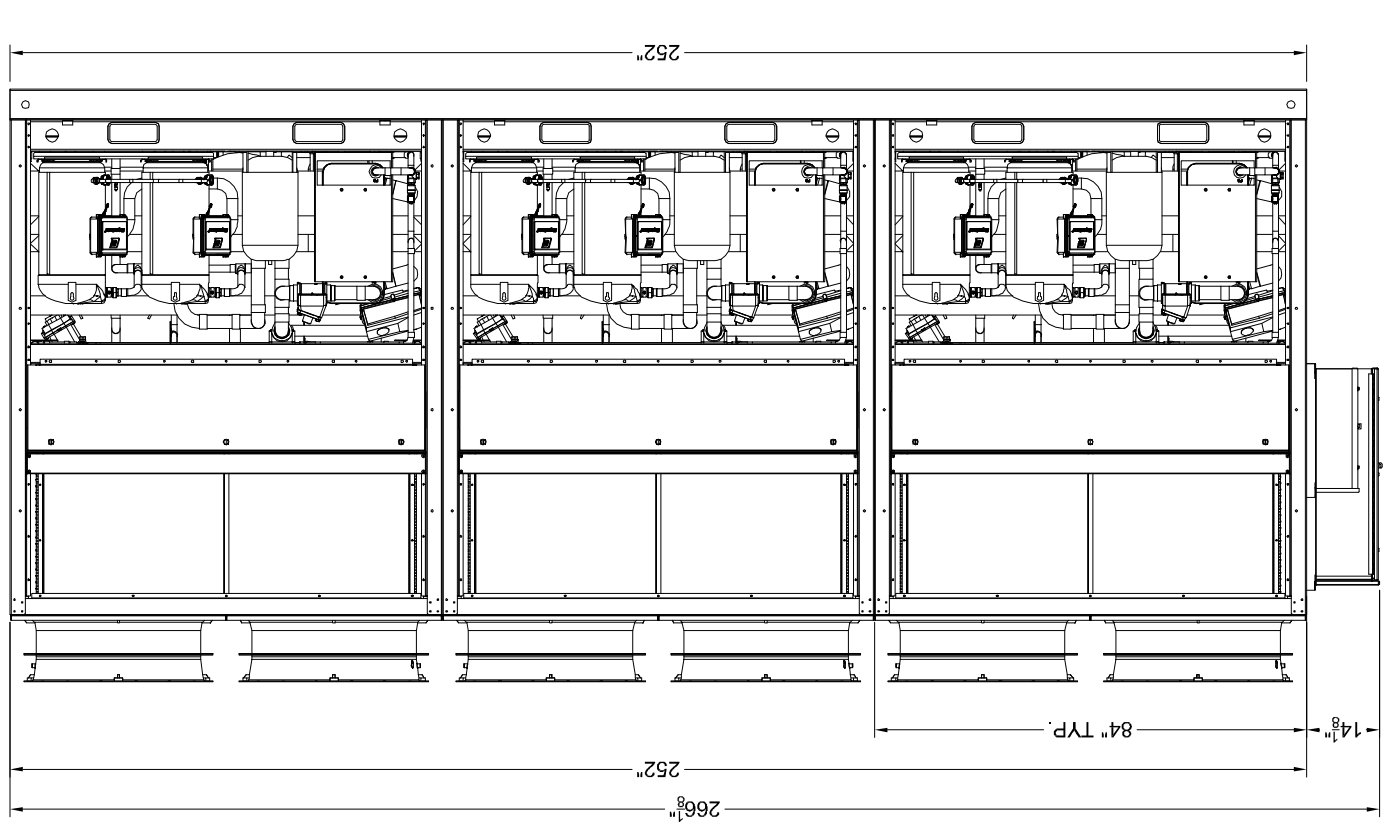
- Chiller Waterside Maximum Working Pressure is 150 PSIG
- Filters in Evaporator and Condenser Supply Headers
- Stainless Steel Inlet Headers
- Stainless steel evaporator and condenser
- Heat exchanger maximum working pressure (refrigerant 565 PSI)
- Lead compressor sequencing(24hrs)
- Automatic internal rescheduling if fault occurs
- Multiple, independent refrigeration systems
- Automatic logging of any fault condition
- Electronic chilled water control
- Quick interconnect modular design
- R-410A Refrigerant
- Electrical Connection Type - Junction Box
- Carbon Steel Painted Lifting Frame
- Warranty: Compressor (5 Year)
- Warranty: All Parts (1 Year)
- Warranty: Parts (less Compressor) (2 Year)
- 3/4" Closed Cell Foam Insulation
- Var. Flow Cond (Mot. Valve Supply Only)
- Var. Flow Evap (Mot. Valve Supply Only)
- Cu/Al Condenser Coils
- Main Power Door Interlock Disconnect Switch
- Single Point Power Connection
- Electrofin Coated Coils
- Brazed Plate Evaporator
- 4 Condenser Fans per module
- External Master Controller Box
- ECM Fans
- Evap Flow Switch-Thermal Dispersion Type (24 Volt Factory Powered & Installed On Each Module)
- Cond Flow Switch-Thermal Dispersion Type (24 Volt Factory Powered & Installed On Each Module)
- Interoperability Web Portal for Mechanicals (BACnet TCP/IP)
- Increased 65kA SCCR

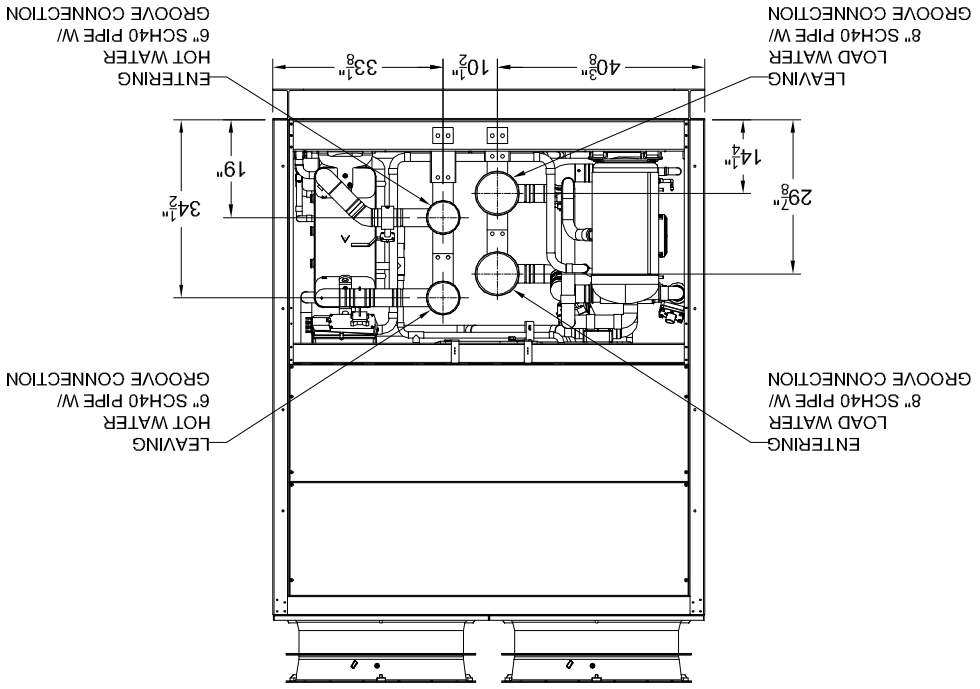
Excluded By Multistack

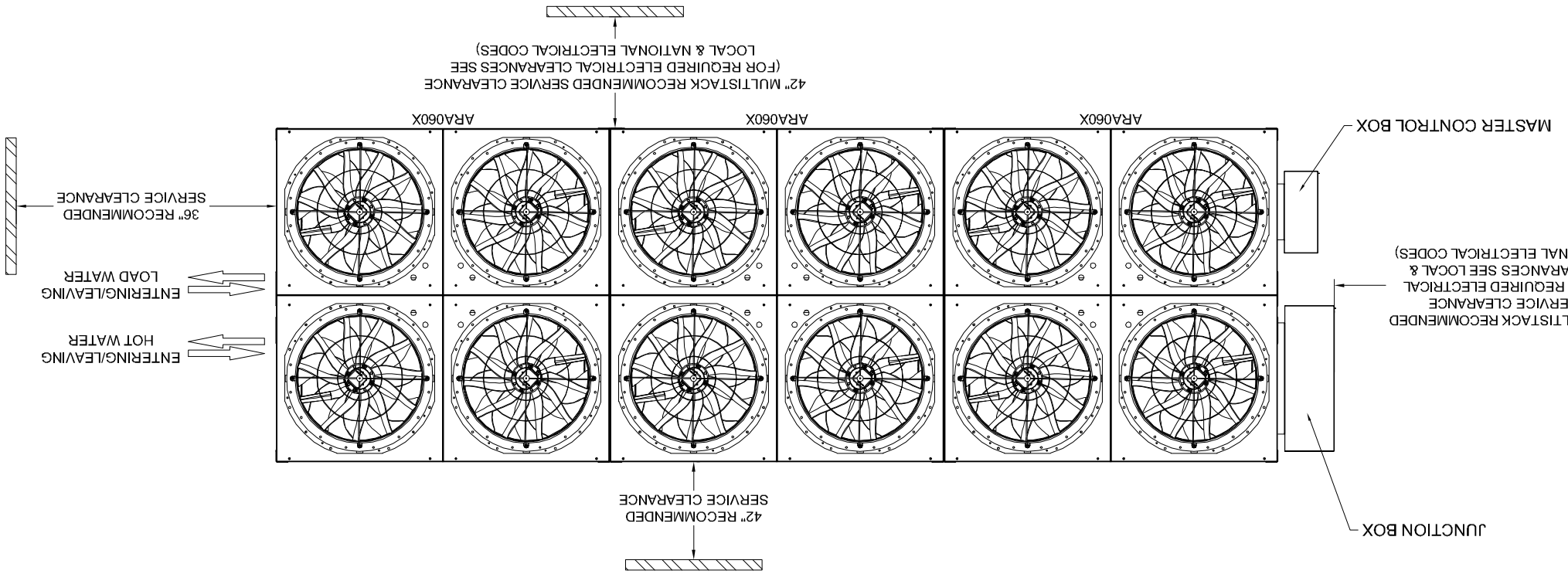
- Any Travel and Diagnosis for Warranties
- Multistack recommends a 2-3 minute minimum loop time. Contact Multistack if you have questions regarding system loop time design
- WARRANTY OF COMPONENTS DUE TO FREEZING. Glycol has not been incorporated into the design of this equipment and the design ambient temperature is close to or below the freezing point of water. Multistack highly recommends the use of glycol at these conditions. Multistack will not warant failures that are the result of freezing.

IF CHILLER IS GOING TO BE INSTALLED IN A PIT, CONTACT FACTORY.
LAYOUT DRAWINGS ARE FOR REFERENCE ONLY, DIMENSIONAL DATA IS SUBJECT TO CHANGE UPON FINAL DESIGN









ESTIMATED WEIGHTS

SHIPPING - 22,295 LBS

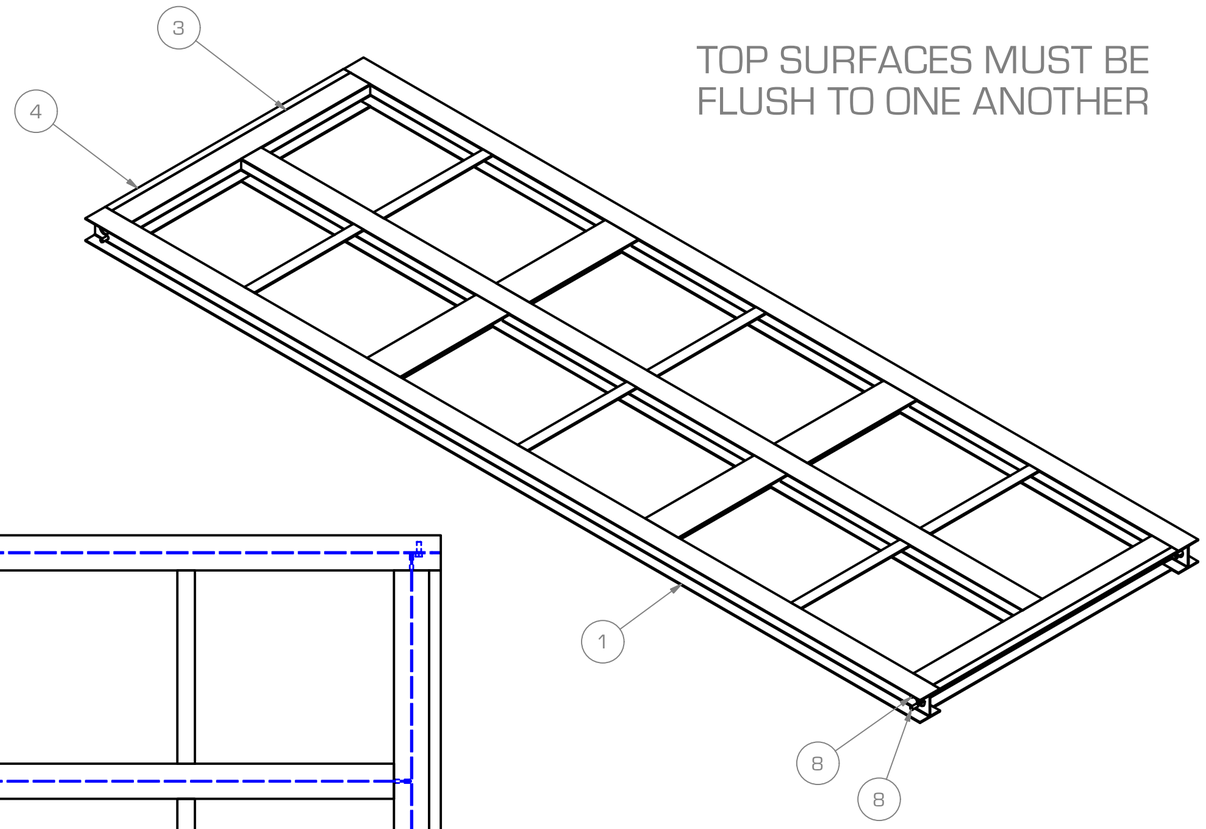
OPERATING - 24,125 LBS

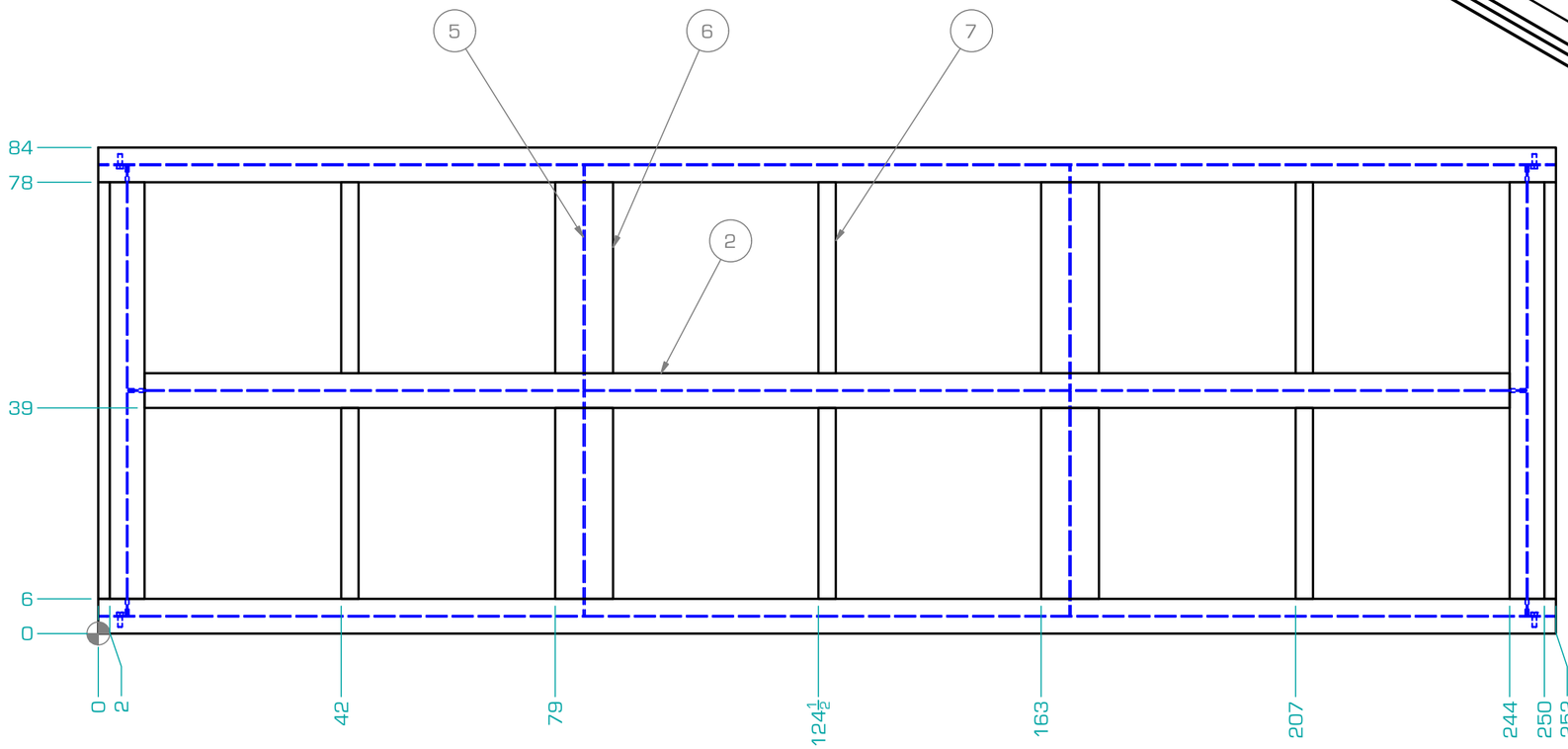
BRKBP69-V004-RF19-CG (001-004)
(3) ARA060X

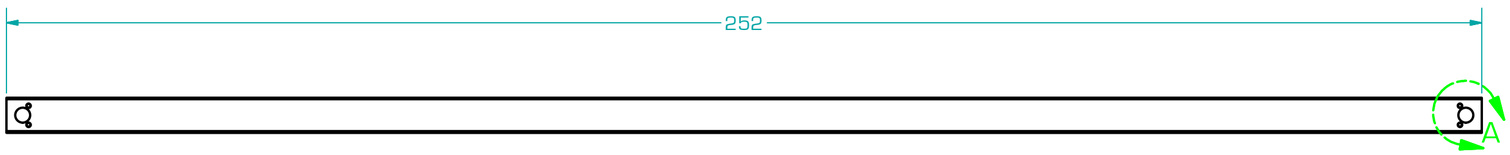
MULTISTACK
ORIGINATORS. INNOVATORS. NEVER THE IMITATORS.
1065 MAPLE AVENUE SPARTA, WI 54656

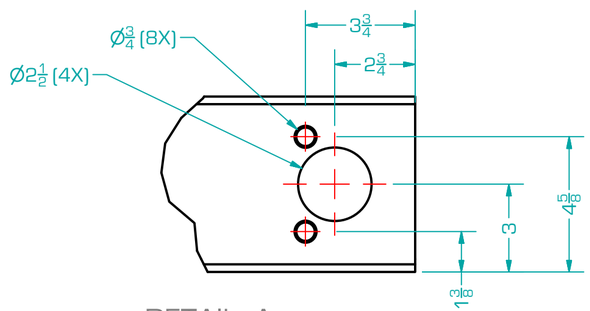
DRAWN BY: RS	DATE: 12/14/21

TOP SURFACES MUST BE
FLUSH TO ONE ANOTHER









DETAIL A
SCALE 1 / 4

PARTS LIST		
ITEM	QTY	DESCRIPTION
1	2	W-BEAM, W 6 X 15 - 252" LG.
2	1	W-BEAM, W 6 X 15 - 241 3/4" LG.
3	2	W-BEAM, W 6 X 15 - 77 3/4" LG.
4	2	PLATE, 72" X 2" X 5/16" THK.
5	4	PLATE, 38 3/4" X 5 1/2" X 5/16" THK.
6	4	PLATE, 33" X 10" X 5/16" THK.
7	6	PLATE, 33" X 3" X 5/16" THK.
8	8	BOLT, HEX HEAD 3/4"-10 X 2" LG. GRADE 8

MULTISTACK
ORIGINATORS. INNOVATORS. NEVER THE IMITATORS.

1065 MAPLE AVENUE SPARTA, WI 54656 WWW.MULTISTACK.COM

LIFTING FRAME

W6X15 - 84X84 - 3X1 - W0

WEIGHT: 1382 LBS

FINISH: PAINT BLACK

ALL UNITS ARE INCHES WITH TOLERANCES OF ±.031 UNLESS SPECIFIED

BY		SHEET
JDN	7/9/2020	1 OF 1

SIZE		REV
C	2500-0415	

MultiPRO CORE

MULTISTACK®

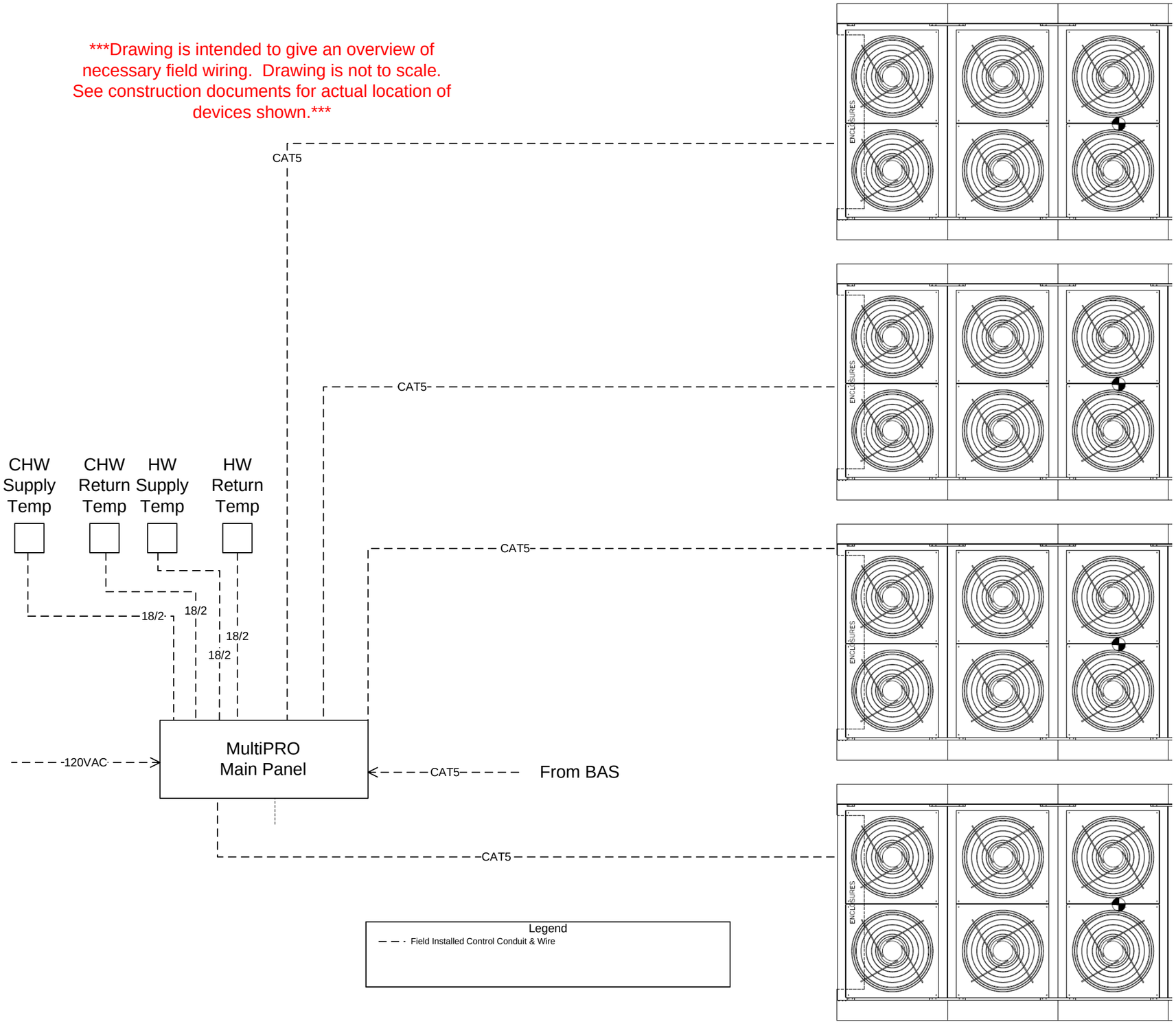
	Title:	Project:		Author:	Date:	Rev.	Page #		
	Cover					Rev 1	1	MultiPRO™	**IMPORTANT: PLEASE READ ALL NOTES ON THIS DRAWING- IF IN DOUBT- ASK**

	Title:	Project:		Author:	Date:	Rev.	Page #		
	Index					Rev 1	2	MultiPRO	IMPORTANT: PLEASE READ ALL NOTES ON THIS DRAWING- IF IN DOUBT- ASK

Runtime Balancing

MultiPRO CORE Runtime Balancing is ideal for plants with similarly sized chillers where lead chiller switching is applicable.
MultiPRO CORE will switch lead chillers at a configurable interval to balance the run time between all of the available chillers. At the cessation of the Runtime Balancing recalculation interval, or when the recalculation is scheduled on the calendar, MultiPRO CORE will modify the chiller start priority to ensure that chillers are ordered based on their run hours at that time from lowest to highest, so that the first chiller has the lowest run hours. By default, MultiPRO CORE will only use the new calculated chiller priority when a stage event occurs, such as plant start, staging up or down, or when a chiller faults. This means that the current running chillers will not change when the recalculation occurs. However, Runtime balancing can be configured to force the new chiller priority on the plant when it is calculated. In this case, when the new priority is calculated, it will immediately be applied and the current running chillers will change. For instance, if the first two chillers in the priority are running and a new priority is calculated, the first two chillers in the new priority will replace the current running chillers.
MultiPRO CORE will monitor the cooling demand and will stage on the next priority chiller when the demand outweighs the user stage up factor for plant staging. MultiPRO CORE will stage down and shut off unrequired chillers when the load conditions allow and chilled water supply temperature is below configured set point.
In the instance where an active chiller enters fault, the next available chiller will be activated. If the fault on that chiller clears, it will be included again when the plant starts or stages up or down.
Upon field unloading the last running chiller will be ramped down, but not shut down until cooling call is disabled or plant enable is deactivated.

Drawing is intended to give an overview of necessary field wiring. Drawing is not to scale. See construction documents for actual location of devices shown.



	Title: Wiring Overview	Project:		Author:	Date:	Rev. Rev 1	Page # 4	MultiPRO	IMPORTANT: PLEASE READ ALL NOTES ON THIS DRAWING- IF IN DOUBT- ASK

MULTISTACK

PARTS LIST

Chiller

MultPRO CORE

QTY	*DESCRIPTION*	*MULTISTACK PART #*
	Main Panel	
1	Panel Enclosure	PANEL3016
1	24V DC Power Supply	POWERSUPPLY415
1	18.5" Touch Computer	TOUCHSCREEN4001
1	MultiPRO EdgX1 Master Controller 1250 points	BOARD2009
1	IP I/O board	BOARD2004
1	8-Port Unmanaged Ethernet Switch	ROUTER103
	Sensors	
4	Insertion Temperature Sensor with Welll	SENSOR_KIT110
	MultiPRO Software	
1	MultiPRO CORE Software	MPSW2100
1	MultiPRO 1 year Software Support	MPSW2103

CI-EdgeX1

Deliver the Reliability of Niagara® to the Edge

Conserve It Edge IoT controllers are a new generation of IoT controllers using the Niagara Framework®. A first-of-its-kind, the CI-EdgeX1 combines a quad core processor with a wide range of peripherals to deliver fully programmable controller that leverages Niagara, provides expandable IO ports, and web server duties into a single device. Taking Niagara to the edge with real-time control – the CI-EdgeX1 utilizes the same familiar Workbench software, Niagara programming tools and Fox Protocol.

Conserve It EdgeX1 (CI-EdgeX1) Specifications

- Supports full HTML5 web user interface running Niagara 4 framework
- Supports JAVA Web Start without JAVA Plug-Ins
- Standard Drivers – Niagara Network (Fox), BACnet, Modbus, Web & oBIX
- Compatible with many additional IP drivers
- Expandable I/O available
- 10/100 Mbps Ethernet (2), RS-485 (2)
- 8/16/32G eMMC Flash memory
- Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.2GHz Quad core
- Wired 24 VAC/DC power input, ideal for equipment control and monitoring applications
- 35mm DIN rail or flat panel mounting

Features

- CI-EdgeX1IoT = fully programmable Niagara controller
  - Fox Protocol
  - Workbench/Web Browser
  - Same programming tools
- Expandable Serial expansion, 4G, Lora receiver & IO ports
- Super powerful quad-core processor
- 1GB RAM
- Multiple storage options (8/16/32 GB)
- Fast and increased memory capacity
- Small unit footprint (11.2cm x 10.7cm x 5.6cm)

Connect & Access Data - Anytime, Anywhere

Reduce Engineering Time & Installation Costs

The Conserve It EdgeX1 utilises Niagara and a proven IoT edge hardware platform, enabling facility managers, operators, system integrators and contractors to use a known user interface (Workbench/Web Browser) to achieve operational efficiencies between multiple systems and/or devices, facility management functions, equipment control and business applications. Ultimately, the CI-EdgeX1 licencing is well-suited to take Niagara into smaller or mid-sized and price-sensitive applications. The following are available: 100 points, 250 points, 500 points, 1250 point, 5,000 point and 10,000 point variations.

conserveitiot.com

CI-EdgeX1-N4-Module Specifications

PLATFORM	
Processor	Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.2GHz
Memory	1GB LPDDR2 SDRAM, 32GB eMMC storage
Real-Time Clock (RTC)	Battery-powered clock included to store description/setup values including: year, month, date, hours, minutes, seconds
COMMUNICATION PORTS	
2 Ethernet Ports	10/100 Mbps
2RS-485 Ports	Optically-isolated RS-485 serial port with 3-screw co nector
Micro USB	Serial shell access
IO network	4 x RJ12 Edge Connect breakout, expandable IO
POWER	
Power Supply	24VAC +/-3%, 24VDC +/-10%, Consumption 400mA
CHASSIS	
Construction	Base: Plastic, DIN rail or screw mount Cover: Plastic
Cooling	Internal air convection
Dimensions	11.2cm width x 10.7cm length x 5.6cm depth
Mounting	Flat panel and 35mm DIN rail mounting options standard
ENVIRONMENT	
Operating Temperature	-25 - 80C (32-140F)
Relative Humidity Range	5 - 95% RH, non-condensing
CERTIFICATIONS	
Compliance	AS/NZS CISPR 32:2015
WEIGHT	
CI-EdgeX1	0.4kg
PART NUMBER	**DESCRIPTION**
CI-Edgex1-00100	CI-EdgeX1 Controller for 100 points
CI-EdgeX1-00250	CI-EdgeX1-N4 Controller for 250 points
CI-EdgeX1-00500	CI-EdgeX1-N4 Controller for 500 points
CI-EdgeX1-01250	CI-EdgeX1-N4 Controller for 1250 points
CI-EdgeX1-05000	CI-EdgeX1-N4 Controller for 5000 points
CI-EdgeX1-10000	CI-EdgeX1-N4 Controller for 10000 points

conserveitiot.com

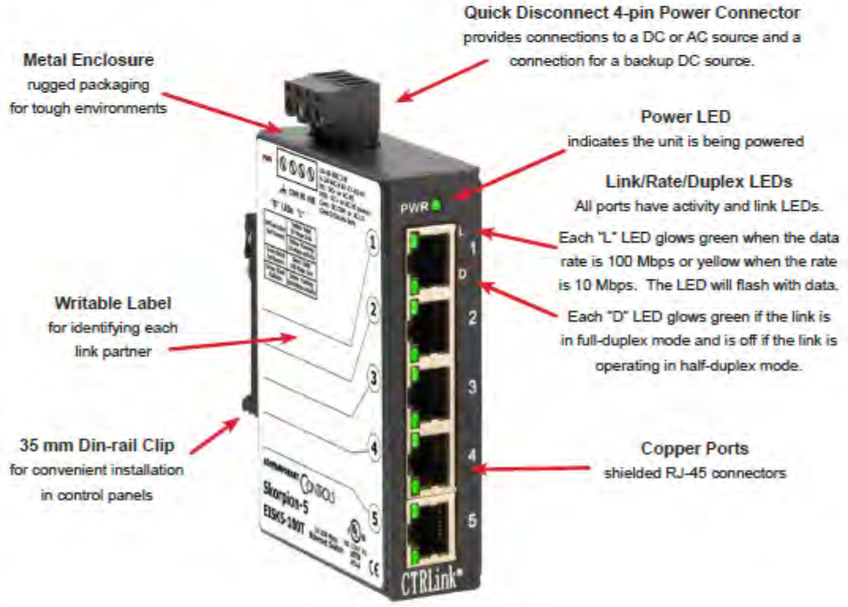
Overview

The Skorpion Switch is intended for control panel installations where DIN-rail space is at a premium by requiring a width of only one inch (26 mm) of rail space. A metal DIN-rail clip attached to the aluminium enclosure can survive the toughest installation. A writable side label allows the installer an opportunity to document field cabling locations right on the unit.

The switch can be powered from either a 10–36 VDC or 24 VAC (±10%) source. Its half-wave rectified low-voltage power supply allows the sharing of power with other 24 VAC/VDC control devices from a common power supply. With redundant power connections, a backup power scheme can be supported. A removable power connector facilitates the servicing of the unit.

LEDs built into the connector indicate data rate and activity on each of the five ports. For each port, the data rate will be indicated along with port activity thereby greatly assisting in troubleshooting connection issues.

The switch is UL 508 Listed and c-UL Listed for Industrial Control Equipment. It complies with CFR 47 Part 15 Class A, and carries the CE Mark. It is RoHS compliant.



Data Sheet — EISK5-100T

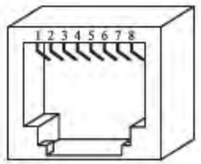
Specifications

Power Requirements	10–36 VDC 3 W or 24 VAC ±10% 6 VA 47–63 Hz
Operating Temperature	0°C to 60°C
Storage Temperature	–40°C to 85°C
Relative Humidity	10–95%, non-condensing
Protection	IP30
Mounting	TS-35 DIN-rail
Shipping Weight	1 lb (0.45 kg)
Ethernet Communications	IEEE 802.3 10/100 Mbps data rate using RJ-45 connectors, 100 m (max)
LEDs	Power: Green = power OK "L" LEDs: Green = 100 Mbps communication established; Yellow = 10 Mbps communication established; Flashing = data transmissions occurring "D" LEDs: Green = Full-duplex communication established; Off = Half-duplex communication established
Regulatory Compliance	CE Mark; CFR 47, Part 15 Class A; RoHS; UL 508 Industrial Control Equipment

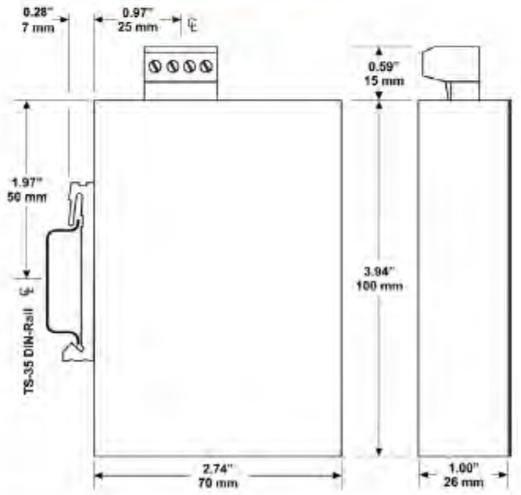
RJ-45 Connector Pin Assignments

Pin	Function
1	TD+
2	TD–
3	RD+
4	Not Used
5	Not Used
6	RD–
7	Not Used
8	Not Used

MDI and MDIX



Mechanical Drawing



	Title: Ethernet Switch	Project:		Author:	Date:	Rev. Rev 1	Page # 7	MultiPRO™

IMPORTANT: PLEASE READ ALL NOTES ON THIS DRAWING- IF IN DOUBT- ASK

3PH AC - DC DIN RAIL MOUNTABLE POWER SUPPLY
INDUSTRIAL CONTROL EQUIPMENT

FEATURES

- 3 PHASE AC INPUT VOLTAGE
- COMPACT DESIGN
- PARALLEL FUNCTION AVAILABLE (SWITCH)
- 3 YEARS WARRANTY

SELECTION CHART

MD120-XX-3C

Wattage — Output Volts (DC) 12Vdc/24Vdc — Three-Phase

INPUT VOLTAGE	OUTPUT WATTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	EFF. (min.)	EFF. (typ.)
Single Output Models					
3ø 340~575 VAC	120 WATTS	+ 12 VDC	10 A	85%	87%
3ø 340~575 VAC	120 WATTS	+ 24 VDC	5 A	87%	89%

SPECIFICATION

All Specifications Typical At Nominal Line, Full Load, 25°C Unless Otherwise Noticed

GENERAL

Characteristics	Conditions		min.	typ.	max.	unit
Switching frequency	Vi nom, Io nom			70		KHz
Isolation voltage	Input-Output		3,000 / 4,242			VAC / VDC
	Input-FG		1,500 / 2,121			VAC / VDC
	Output-FG		500 / 710			VAC / VDC
Isolation resistance	Input-Output, @ 500VDC		100			MΩ
Ambient temperature	Operating at Vi nom		-40		+ 71	°C
Derating (see derating curve)	Vi nom, from + 61 to + 71 °C				2.5	%/°C
Storage temperature	Non operational		-40		+ 85	°C
Relative humidity	Vi nom, Io nom		20		95	% RH
Temperature coefficient	Vi nom, Io min				± 0.03	%/°C
MTBF	Bellcore Issue 6 @40°C, GB	12V		569,000		Hours
		24V		572,000		Hours
Altitude during operation	EN 60950-1				5,000	m
Dimension	Screw terminal type		L124 x W74.3 x D118.8			mm
Cooling	Free air convection					
Installation position	Vertical (other direction may derating using)					
Pollution degree				2		

INPUT SPECIFICATIONS

Characteristics	Conditions		min.	typ.	max.	unit
Nominal voltage *1			1ø or 3ø 380 / 480 VAC			
Rated input voltage	Io nom		400		500	VAC
Absolute input max. range	Ta min ... Tamax,	AC in	340		575	VAC
	Io nom	DC in	490		820	VDC
Input current	Vi : 400 / 500 VAC, Io nom			0.36 / 0.3		A
Rated input current	Vi : 340 VAC, Io nom				0.5	A
Line frequency	Vi nom, Io nom		47		63	Hz

*1. Single phase input is permissible, but output load is derated to 75%

*DIN*ergy™ MD120-XX-3C SERIES

SPECIFICATION

All Specifications Typical At Nominal Line, Full Load, 25°C Unless Otherwise Noticed

INPUT SPECIFICATIONS

Characteristics	Conditions		min.	typ.	max.	unit
Inrush current	Vi nom, Io nom			10	12	A
Power dissipation	Vi: 400 VAC, Io nom	12V		20		W
		24V		16		W
Leakage current	Input-Output				0.25	mA
	Input-FG				3.5	mA
Power factor (Passive)	Vi nom, Io nom			0.55		

OUTPUT SPECIFICATIONS

Characteristics	Conditions		min.	typ.	max.	unit
Output voltage accuracy (Adjusted before shipment)	Vi nom, Io max		0		+ 1	%
Minimum load	Vi nom		0			%
Line regulation	Io nom, Vi min ...Vi max				± 1	%
Load regulation	Vi nom, Io min ...Io nom				± 1	%
Voltage trim range	Vi nom, 0.8 Io nom	12V	11.4		14.5	VDC
		24V	22.5		28.5	VDC
Rated continuous loading	Vi nom	12V	10 A @ 12Vdc / 8.2 A @ 14.5Vdc			
		24V	5 A @ 24Vdc / 4.2 A @ 28.5Vdc			
Hold up time	Vi nom , Io nom		20			ms
Turn on time	Vi nom, Io nom				1,000	ms
	Vi nom, Io nom ⟶ 12V model : with 7000 µF CAP				1,500	ms
	24V model : with 3500 µF CAP					
Rise time	Vi nom, Io nom				150	ms
	Vi nom, Io nom ⟶ 12V model : with 7000 µF CAP				500	ms
	24V model : with 3500 µF CAP					
Fall time	Vi nom, Io nom				150	ms
Transient recovery time	Vi nom, 1~0.5 Io nom				2	ms
Ripple & noise	Vi nom, Io nom, BW = 20MHz				100	mV
Power back immunity	Vi nom, Io nom	12V	18			VDC
		24V	35			VDC
Capacitor load	Vi nom, Io nom	12V			7,000	µF
		24V			3,500	µF
DC ON indicator threshold at start up (Green LED)	Vi nom, Io nom	12V	10		11.2	VDC
		24V	17.6		19.4	VDC
DC LOW indicator threshold after start up (Red LED)	Vi nom, Io nom	12V	10		11.2	VDC
		24V	17.6		19.4	VDC
Efficiency	Vi nom, Io nom, Po / Pi		Up to 89%, See model list and typ efficiency curve			

CONTROL AND PROTECTION

Characteristics	Conditions		min.	typ.	max.	unit
Input fuse				2 A / 600 VAC internal / phase		
Internal surge voltage protection	IEC 61000-4-5			Varistor		
Rated over load protection	Vi nom (see typ current limited curve)		115		135	%
Power Rdy (for 24V model only)	Threshold voltage of contact closed (at start up)		17.6		19.4	VDC
	Electrical isolation		500			VDC
	Contact rating at 60VDC				0.3	A
Over voltage protection	Vi nom, 0.8 Io nom (Auto Recovery)	12V	15		16.5	VDC
		24V	30		33	VDC
Output short circuit				Hiccup mode		
Over temperature	Detect on heat sink, shut down O/P voltage, recovers automatically after temperature goes down		100		110	°C
Degree of protection				IP20		

www.micronpower.com +1.630.516.1222 Rev: 042015

APPROVALS AND STANDARDS

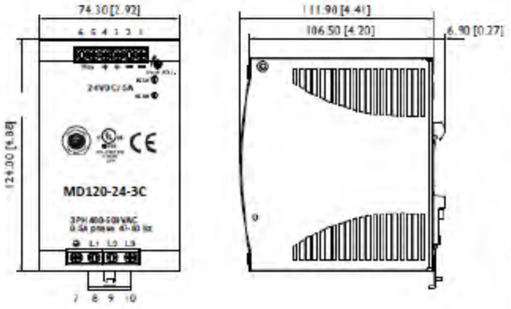
UL / cUL	UL 508 Listed UL 60950-1 Recognized ISA 12.12.01(Class I, Division 2, Groups A, B, C and D)
CE	EN 61000-6-3, EN 55022 Class B, EN 61000-3-2, EN 61000-3-3 EN 61000-6-2, EN 55024, EN 61000-4-2 Level 4, EN 61000-4-3 Level 3 EN 61000-4-4 Level 4, EN 61000-4-5 L-N Level 3, L / N-FG Level 4 EN 61000-4-6 Level 3, EN 61000-4-8 Level 4, EN 61000-4-11 ENV 50204 Level 3, EN 61204-3
CQC	GB4943.1, GB9254, GB17625.1
Vibration resistance	meet IEC 60068-2-6 (Mounting on rail : 10-500 Hz, 3G, along X, Y, Z each Axis, 60 min for each Axis)
Shock resistance	meet IEC 60068-2-27 (15G, 11ms, 3 Axis, 6 Faces, 3 times for each Face)

PHYSICAL CHARACTERISTICS

Case size	Screw terminal type 124 x 74.3 x 118.8 mm (4.88 x 2.92 x 4.68 inches)
Case material	Metal
Weight	800g
Packing	0.92kg ; 20 pcs / 19.5kg / 2.02CU.FT

MECHANISM & PIN CONFIGURATION

mm [inch]



CONSTRUCTION

Easy snap-on mounting onto the DIN-Rail (TS35/7.5 or TS35/15), unit sits safely and firmly on the rail.

INSTALLATION

Ventilation / Cooling
- Normal convection
- All sides 25mm free space
- For cooling recommended

Connector size range
- AWG24-10 (0.2~4mm²) flexible / solid cable, -Input connector can withstand torque at maximum 9 pound-inches.
- -Output connector can withstand torque at maximum 5.5 pound-inches
- 8 m/m stripping at cable end recommends
- Use copper conductors only, 60 / 75°C

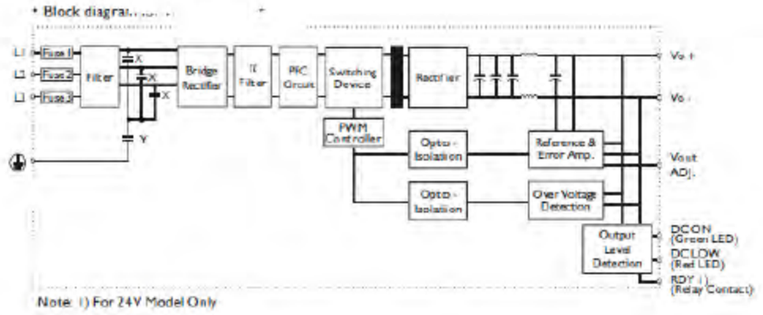
GENERAL TOLERANCE	
0.00[0.00] ~ 30.00[1.18]	±0.30[0.01]
30.00[1.18] ~ 120.00[4.72]	±0.50[0.02]
120.00[4.72] ~ 400.00[15.75]	±0.80[0.03]

PIN ASSIGNMENT

PIN NO.		Designation	Description
1, 2	OUTPUT	V -	Negative output terminal
3, 4		V +	Positive output terminal
5		RDY	A normal open relay contact for DC ON level control
6			(Never connect except 24V model)
7		⏚	Ground this terminal to minimize high-frequency emissions
8	INPUT	L1	Input terminals
9		L2	Input terminals
10		L3	Input terminals
	CONTROL	DC ON	Operation indicator LED
		DC LO	DC LOW voltage indicator LED
		Vout ADJ.	Trimmer-potentiometer for Vout adjustment

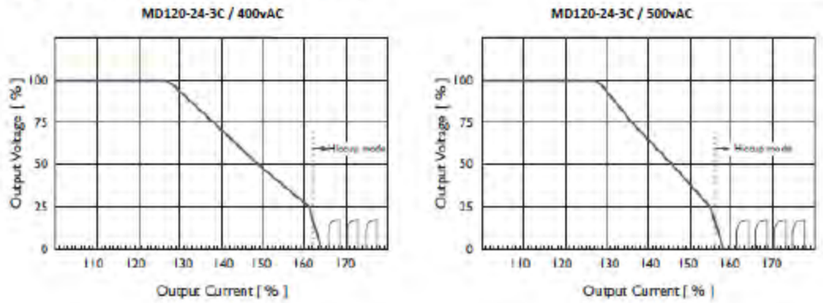
*DIN*ergy™ MD120-XX-3C SERIES

CIRCUIT SCHEMATIC

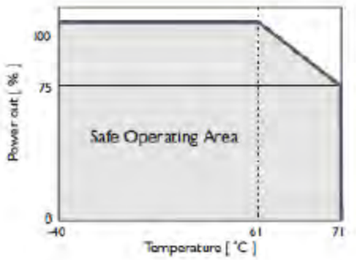


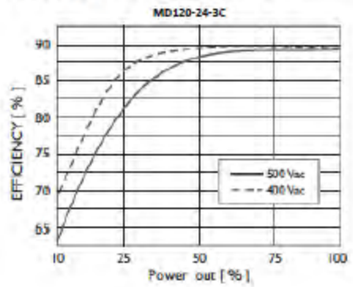
Note: 1) For 24V Model Only

TYP. CURRENT LIMITED CURVE



TYP. EFFICIENCY CURVE





	Title:	Project:		Author:	Date:	Rev.	Page #		
	Power Supply Cont.					Rev 1	9	MultiPRO™	IMPORTANT: PLEASE READ ALL NOTES ON THIS DRAWING- IF IN DOUBT- ASK

Immersion Temperature Sensors

TI Series

Corrosion Resistant Stainless Steel Probe

FEATURES

- Cost-effective high accuracy thermistors/RTDs
- Corrosion resistant stainless steel probe design...durable
- 1/2" NPT threads standard...ease of selection
- Variety of enclosures include duct mount, service entry body, threaded, and water resistant to fit your application
- Thermowells available...enables easy servicing

DESCRIPTION

These immersion probe type temperature sensors are both highly accurate and cost effective. Installation could not be easier. The sensor is encased in a corrosion-resistant stainless steel probe for durability, with a choice of service entry body, indoor junction box, or threaded enclosures. A variety of RTD or thermistor sensor options and probe lengths are available for maximum application versatility.

APPLICATIONS

- Tanks
- Pipes
- Chillers

To compute Unitemp temperature:
mV reading/10 - 273.15 = Temperature in °C

SPECIFICATIONS

5 Year Warranty

Wiring	22 AWG; 2-wire: RTD/Thermistor; 3-wire: Unitemp
Probe	Stainless Steel
Test Pressure	200 psi
Operating Temp	-25° to 105°C (-13° to 221°F)
TEMPERATURE TRANSMITTER OPTION	
Input Power	4-20mA models: Loop powered Class 2, 12-30VDC only, 30mA max; 0-5/0-10V models: Class 2, 12-30VDC/24VAC, 50/60Hz, 15mA max
Temp Output	2-wire, loop powered 4-20mA
Sensor Type	Thermistor/RTD
Transmitter Accuracy	±1°C*
Ranges	-25° to 105°C (available ranges; model number specifies exact range)
UNITEMP OPTION	
Input Power	Class 2; 5 to 30VDC
Output	10mV/°C
Operating Temp	-25° to 105°C (-13° to 221°F)
Calibration Error	1.5°C (2.7°F) typical; 2.5°C (4.5°F) max. at 25°C (77°F)*
Error over Temp	1.8°C (3.24°F) typical; 3.0°C (5.4°F) max. over 0° to 70°C (32° to 158°F) range; 2.0°C (3.6°F) typical, 3.5°C (6.3°F) max. over -25° to 105°C (-13° to 221°F) range

** Add the transmitter accuracy to the RTD/thermistor accuracy to get the total product accuracy. For RTD and thermistor accuracies and ranges, see the table below.*

***Room temperature error documented on each unit.*

Class	Pt RTD		Balco RTD	THERMISTOR											
Type	100 Ohm	1000 Ohm	1000 Ohm	2.2k	5k	10k Type 2	10k Type 3	10k Custom	10k 3A2251	10k*G*105	20k	20k "D"	100k	10k Type 2	10k Type 3
Accuracy	±0.3°C 0.00385 curve	±0.3°C 0.00385 curve	±1% @ 0°C	±0.2°C 0/70°C	±0.2°C 0/70°C	±1.0°C -50/150°C	±0.2°C 0/70°C	±0.2°C -20/70°C	±1.7°C 0/70°C	±0.2°C 0/70°C	Consult Factory	Consult Factory	Consult Factory	±0.1°C 25/70°C ±0.2°C 0/200°C	±0.1°C 0/70°C
Temp. Response*	PTC	PTC	PTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC	NTC
														High Accuracy	

**PTC: Positive Temperature Coefficient*
**NTC: Negative Temperature Coefficient*

STANDARD RTD AND THERMISTOR VALUES (Ohms Ω)

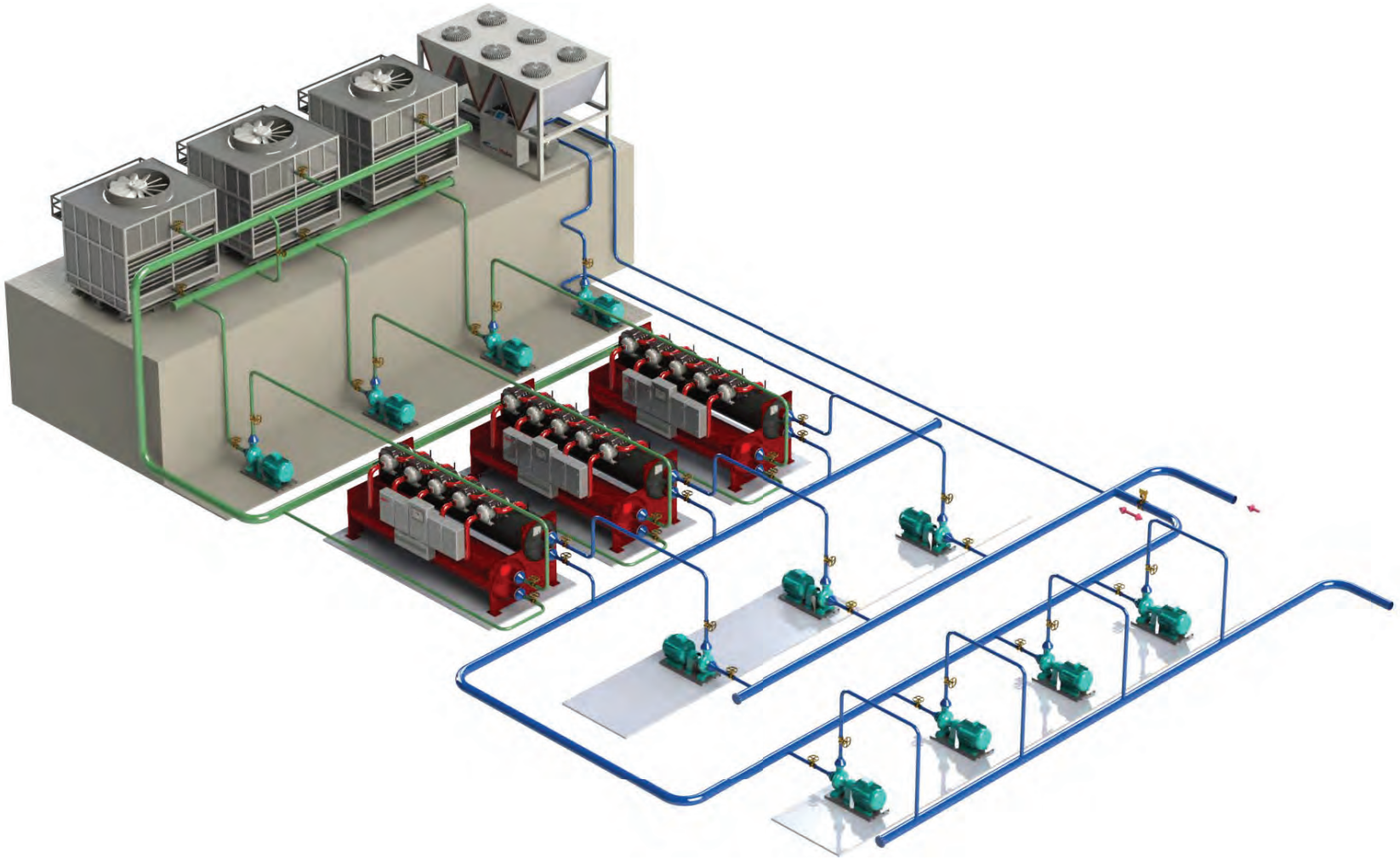
°C	°F	100 Ohm	1000 Ohm	1000 Ohm	2.2k	5k	10k Type 2	10k Type 3	10k Custom	10k 3A2251	10k*G*105	20k NTC	20k "D"	100k	10k Type 2	10k Type 3
-50	-58	80.306	803.06	740.46	154,464	205,800	692,700	454,970	672,300	-	441,200	1,267,600	-	-	692,700	454,970
-40	-40	84.277	842.77	773.09	77,881	102,690	346,700	245,089	337,200	223,562	239,900	643,800	882,200	3,364,000	346,700	245,089
-30	-22	88.223	882.23	806.82	40,130	53,730	180,100	137,307	177,200	126,081	135,300	342,000	472,800	1,770,000	180,100	137,307
-20	-4	92.142	921.42	841.80	22,032	29,346	98,320	79,729	97,130	96,807	78,910	195,980	269,600	971,200	98,320	79,729
-10	14	96.086	960.86	877.46	12,519	16,674	55,790	47,843	55,940	55,257	47,540	108,380	122,400	553,400	55,790	47,843
0	32	100.000	1,000.00	913.66	7,373	9,822	32,770	29,588	32,660	32,639	29,900	64,160	70,290	326,600	32,770	29,588
10	50	103.903	1,039.03	952.25	4,427	5,976	19,930	18,833	19,900	19,901	18,780	39,440	41,600	199,000	19,930	18,833
20	68	107.794	1,077.94	991.82	2,814	3,750	12,500	12,272	12,490	12,491	12,262	24,930	25,140	124,900	12,500	12,272
25	77	109.735	1,097.35	1,013.50	2,252	3,000	10,000	10,000	10,000	10,000	10,000	20,000	20,000	100,000	10,000	10,000
30	86	111.673	1,116.73	1,035.18	1,814	2,417	8,055	8,195	8,056	8,053	8,199	16,144	15,884	80,580	8,055	8,195
40	104	115.541	1,155.41	1,077.68	1,199	1,598	5,323	5,593	5,326	5,324	5,592	10,686	10,170	53,260	5,323	5,593
50	122	119.397	1,193.97	1,120.52	811.5	1,081	3,599	3,894	3,602	3,600	3,895	7,234	6,718	36,020	3,599	3,894
60	140	123.242	1,232.42	1,166.73	561.0	747	2,486	2,763	2,489	2,486	2,760	4,992	4,518	24,880	2,486	2,763
70	158	127.075	1,270.75	1,210.75	395.5	527	1,753	1,994	1,753	1,757	1,990	3,532	3,100	17,570	1,753	1,994
80	176	130.897	1,308.97	1,254.55	284.0	378	1,258	1,467	1,258	1,255	1,458	2,576	2,168	12,560	1,258	1,467
90	194	134.707	1,347.07	1,301.71	207.4	-	919	1,088	917	915	1,084	1,835	1,542	9,164	919	1,088
100	212	138.506	1,385.06	1,348.38	153.8	-	682	821	679	678	816.3	1,356	1,134	6,790	682	821
110	230	142.293	1,422.93	1,394.53	116.8	-	511	628	511	509	623.6	1,016	836	5,108	513	633
120	248	146.068	1,460.68	1,447.44	88.3	-	392	486	389	388	481.8	770	606	3,894	392	486
130	266	149.832	1,498.32	1,496.28	68.3	-	303	380	301	299	376.4	591	456	3,006	303	380
Sensor Codes		B	C	I	E	F	D	H	J	S	R	W	U	T	W	Y

Title: Temp Sensors	Project:		Author:	Date:	Rev. Rev 1	Page # 10	MultiPRO	IMPORTANT: PLEASE READ ALL NOTES ON THIS DRAWING- IF IN DOUBT- ASK

CH. BRKBP69-V004-RF19-CG001 & connecting to all 4 Chillers

MultiPRO™

The Central Plant Controller from Multistack



MULTISTACK®
Originators. Innovators. Never the Imitators.

MultiPRO™

The Central Plant Controller from Multistack

The Central Plant Control and Optimization System:

1) provides an integrated chiller plant control and optimization solution designed to minimize consumption of electrical power and reduce CO^2 emissions

2) is furnished in factory wired metal panels consisting of a Master Panel with an optional touch screen interface and slave panels for chillers, cooling towers, pumps and other ancillary plant components

3) The system hardware contains factory programmed software, easily configured, using a series of input screens and wizards

MULTISTACK
Originators. Innovators. Never the Imitators.

Multi**PRO**™ will control:

* Up to ten (10) chillers:
    * Can be water-cooled and/or air-cooled or mixed
    * Mixed chiller manufacturers OK
* Primary CHW and CW pumps
    * Constant or variable speed
    * Dedicated to a chiller or headered together
    * Lead/Lag
* Secondary pumps (where applicable)
    * Constant or variable speed
* Cooling towers
    * Constant & variable speed fans
    * Dedicated to a chiller or headered together
* Chilled water bypass valve
* Cooling tower bypass valve
* Chiller isolation valves
    * Analog
    * Digital single input
    * Digital dual input
* Other ancillary equipment as required

Multi**PRO**™ will NOT interfere with any chiller's stand alone operating or safety algorithms but shall enhance the operation by adjusting control variables to optimize the efficiency of each chiller.

MULTISTACK®
Originators. Innovators. Never the Imitators.

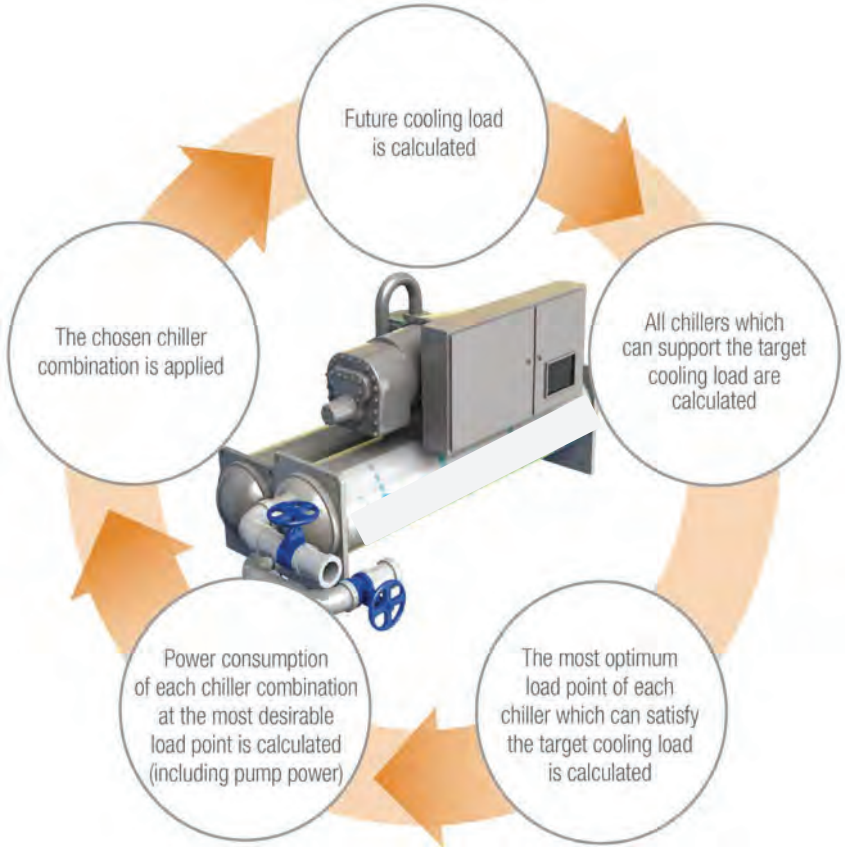
MultiPRO™ will provide the following Optimization Strategies to reduce total electrical and CO^2 emissions:

1) Dynamic Intelligent Chiller Sequencing Algorithm

a. Runs the most efficient combination of chillers for the given conditions, even when some of the chillers may be out of service.

b. selects the most efficient load point for each chiller running.

c. If a chiller's performance drops below the nominal efficiency of that chiller, it is noted so service will be scheduled to bring it back to peak operating efficiency.



d. Learns chiller performance as it operates, and uses this information to predict chiller performance at any conditions.

e. Uses peer reviewed ASHRAE chiller models as its basis.

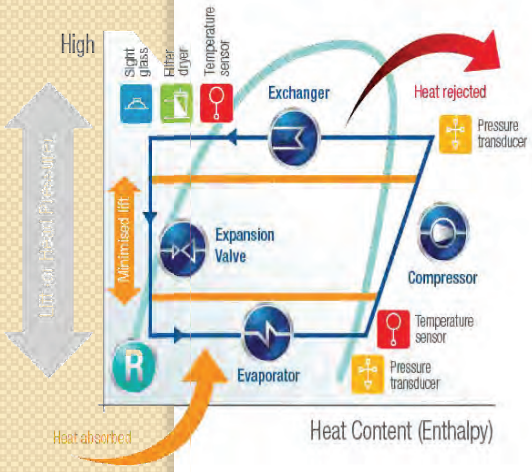
f. Predicts the future cooling load of the chiller plant to accommodate and adapt to future chiller plant needs smoothly.

MULTISTACK®
Originators. Innovators. Never the Imitators.

MultiPRO™ will provide the following Optimization Strategies to reduce total electrical and CO^2 emissions:

2) Chiller Lift Optimization:

a. Controls chilled water set points and entering condenser water temperatures to reduce the load on chillers.



* Chilled water reset strategies include:
  * Return water temperature
  * Plant Load
  * Outside air temperature
  * Field valve position

* Condenser water strategies include:
  * Active plant efficiency control
  * Wet bulb temperature control

Chilled water and condenser water strategies are to be highly flexible and reactive to plant conditions.

* Other control and optimization strategies required include:
  * Chiller runtime balancing
  * Demand Limiting
  * Optimized start/stop

MULTISTACK®
Originators. Innovators. Never the Imitators.

Multi**PRO™**

The Central Plant Controller from Multistack

Multi**PRO™** provides real time chiller plant **measurement and verification**:

1) By calculating chiller efficiency based on manufacturer's data or by learning chiller performance over time during operation. Multi**PRO™** will analyze the operation of each chiller individually and the whole chiller plant system.
2) By measuring real time performance of each chiller in COP terms and by comparing performance to the manufacturer's ARI 550/590 IPLV/NPLV rated performance data and against an extended performance algorithm that calculates performance data at any conditions.

3) Provides real time cost of chilled water production in cents/kWr for each chiller and the whole plant.

MULTISTACK
Originators. Innovators. Never the Imitators.

MultiPRO™

The Central Plant Controller from Multistack

MultiPRO™ provides chiller diagnostics:

1) The diagnostics engine will analyze heat exchanger efficiency in real time.

2) The diagnostics engine will analyze the vapor compression gas cycle of each chiller in real time.

3) When the real time performance of any chiller falls below the rated performance, the diagnostics engine will determine the operational issues affecting performance.

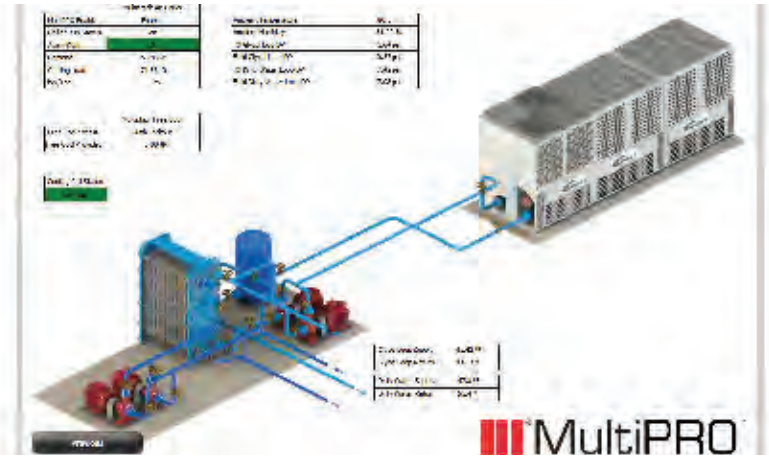
4) Diagnostics will be captured and stored within the system. It will be displayed in order of priority as a percentage of run time for each chiller on reports.

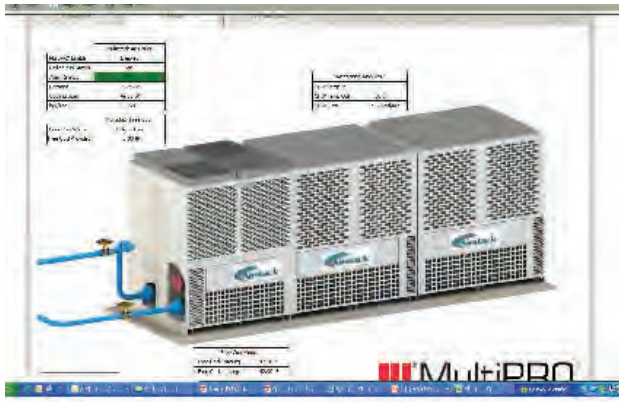
5) The diagnostic engine will initiate email alerts to user defined recipients.

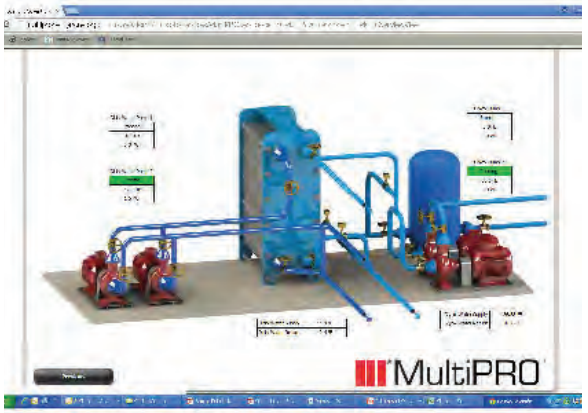
MULTISTACK
Originators. Innovators. Never the Imitators.

MultiPRO™

Sample of Custom Graphics Available







MULTISTACK®
Originators. Innovators. Never the Imitators.

September 2020

MULTISTACK

Sound Level Estimate

ARA060X (3 front, 0 rear)

- 2-coil condenser design
- Ziehl-Abegg ZN080 ECM fans

Octave Band Center Frequency (Hz)	Sound pressure level at 30ft, dB re: 20 µPa
63	74
125	69
250	67
500	72
1000	66
2000	62
4000	55
8000	47
Total dBA	**72**

Notes:

1. The sound levels are typical of what may be measured in an acoustic free-field environment.
2. Octave band levels are linear (non-weighted); “total” levels are A-weighted.
3. Sound levels are given for a position 30ft away from the chiller assemble, 1.5m above ground, centered on the front or back side of chiller. Left and right sides are quieter.

LUVATA
Partnerships beyond metals

ElectroFin® E-coat

Factory-Applied Corrosion-Resistant Coil Coating

ElectroFin® E-coat is a water-based, flexible epoxy polymer coating process engineered specifically for HVAC/R heat transfer coils. ElectroFin® uses a PPG POWERCRON® e-coat formulation specifically designed to provide excellent edge coverage of fins with a unique polymer that controls the flow characteristics of the coating.

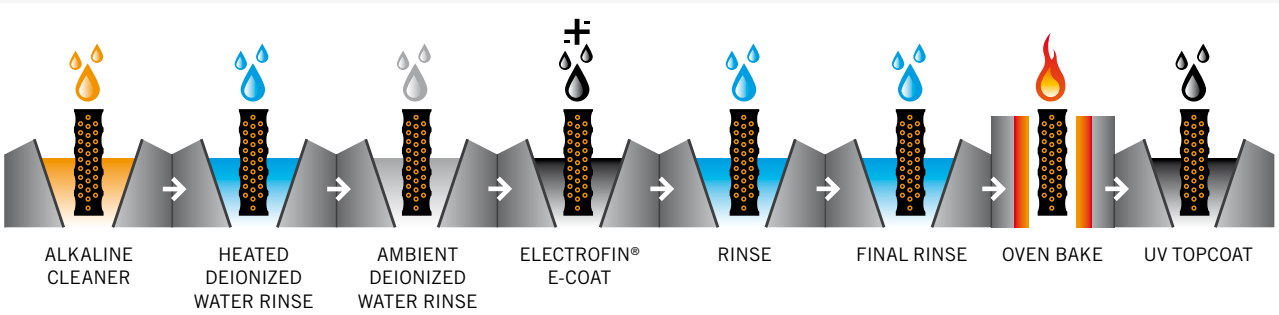
Benefits of ElectroFin's factory-applied electrocoating process:

- The preferred corrosion-resistant coil coating choice for every major HVAC/R OEM
- The only process that can guarantee 100% coil coverage without bridging, including enhanced fin designs
- Proven corrosion protection for new all-aluminum microchannel coils
- Excellent corrosion and UV resistance make it suitable for coastal environments

About Luvata
Luvata is a world leader in metal fabrication, component manufacturing and related engineering and design services. We are committed to partnering with our customers to help them increase their competitiveness. Our products and services enable our customers to improve operational efficiency, improve products and reduce tied-up capital. Because we focus on our customers' results and are unfailingly reliable, we are the partner on which our customers base their future development.

LUVATA
Partnerships beyond metals

ElectroFin® E-coat Process



Electrocoating is the process by which a metallic workpiece (coil) is submerged in a paint / water bath where electricity is used to deposit paint onto it. ElectroFin® E-coat is a factory-applied corrosion-resistant coil coating which is applied in one of our two e-coat facilities.

Corrosion Resistance

In the electrocoating process, the coil acts in the same way as a magnet. The coating molecules are electrically attracted to the metallic coil surfaces, meaning the entire coil is completely and uniformly coated. The result is a finish which provides excellent resistance to coastal marine (salt-air), industrial and urban environments. When properly maintained, you can expect ElectroFin® e-coated coils to provide protection for years.

Resistance to UV Degradation

When coils are to be subjected to ultraviolet exposure, they receive a spray-applied, UV-resistant urethane mastic topcoat. As a result, UV degradation of the epoxy e-coat polymer molecules is eliminated and the film integrity is maintained.

Proven Effective

The electro-deposition process is the most automatic, controllable, and efficient method for applying a corrosion inhibiting coating to a metallic workpiece. The process dictates that all metal surfaces are coated in an even, uniform finish. All coil surfaces reach an average e-coat dry film thickness of 1 mil (0.001").

Specifications

Coil will have a flexible epoxy polymer e-coat uniformly applied to all coil surface areas with no material bridging between fins. The coating process will ensure complete coil encapsulation and a uniform dry film thickness from 0.6 – 1.2 mils on all surface areas including fin edges and meet 5B rating cross-hatch adhesion per ASTM B3359-93. Corrosion durability will be confirmed through testing to no less than 5,000 hours salt spray resistance per ASTM B117-90 using scribed aluminum test coupons. Coils subjected to ultraviolet (UV) exposure will receive a spray-applied, UV-resistant urethane mastic topcoat to prevent UV degradation of epoxy e-coat film.

Technical Performance

Test	Standard	Qualification
Dry Film Thickness	ASTM D7091-05	0.6-1.2 mils
Gloss - 60°	ASTM D523-89	65 - 90%
Pencil Hardness	ASTM D3363-00	2 H Minimum
Water Immersion	ASTM D870-02	>1000 hours @ 100°F
Cross Hatch Adhesion	ASTM D3359-97	4B - 5B
Impact Resistance	ASTM D2794-93	160 in./lbs. Direct
Salt Spray	ASTM B117-97	6,048+ Hours
Humidity	ASTM D2247-99	1,000 Hours Minimum
Durability	-	Very Flexible, Consistent Film
Heat Transfer Reduction	ARI 410	Less Than 1%
Bridging	-	No Bridging Guaranteed
Coating Of Enhanced Fins	-	Up to 30 fins per inch
pH Range	-	3 - 12
Temperature Limits		-40° F to 325° F

ElectroFin® E-coat meets these test standards

- MIL-C-46168 Chemical Agent Resistance - DS2, HCl Gas
- CID A-A-52474A (GSA)
- MIL-STD 810F, Method 509.4 (Sand and Dust)
- MIL-P-53084 (ME) –TACOM Approval
- MIL-DTL-12468 Decontamination Agent (STB)
- DPG (Dugway Proving Grounds) Soil & Water Exposure Tests
- GM9540P-97 Accelerated Corrosion Test (120 cycles)
- ASTM B117-G85 Modified Salt Spray (Fog) Testing – 2,000 hours (tested by ARL for Lockheed Martin)

ElectroFin® E-coat vs. Others

	ElectroFin® E-coat	Dip Phenolics	Elastomerics	Other E-coats
Application Method	Complete Immersion Cathodic Deposition	Manual Dip or Flow	Manual Dip or Flow	Anodic or Cathodic Deposition
Flexibility	Excellent	Poor – Good	Excellent	Good
Coating Uniformity	Computer-controlled, Consistent (0.6-1.2 mils)	Manual Inconsistent (2-6 mils)	Manual Inconsistent (2-6 mils)	Inconsistent (0.4 – 1.5 mils)
Coating Penetration	Computer-controlled Consistent	Manual "Dip and Pray"	Manual "Dip and Pray"	Inconsistent to Bare Metal
Bridging	None – Up to 30 fpi & 16 rows	Limited to 16 fpi with some bridging	Limited to 14 fpi with some bridging	Limited to 14 fpi with bridging
Thermal Loss	< 1%	2% – 6%	2% – 6%	1% – 4%

Luvata ElectroFin Kentucky
Louisville, KY
1423 West Ormsby Avenue
Louisville, KY 40210
Telephone: 502.634.9458
Fax: 502.634.1130

Luvata ElectroFin Texas
Jacksonville, TX
224 Talley Nichols Drive
Jacksonville, TX 75766
Toll-Free: 877.589.0009
Telephone: 903.589.0009
Fax: 903.589.0017

Luvata ElectroFin California
Temecula, CA (INSITU)
27633 Commerce Center Drive
Temecula, CA 92590
Toll-Free: 866.488.0217
Telephone: 951.699.8528
Fax: 951.587.9738

Luvata ElectroFin Florida
Tampa, FL (INSITU)
10225 Elizabeth Place
Tampa, FL 33619
Telephone: 813.689.4282
Fax: 813.689.4630

Luvata ElectroFin, Inc.
14551 Griffith Street
San Leandro, CA 94577
Telephone: 510.895.8198
Fax: 510.895.1669

www.luvata.com/electrofin

FANselect

fan data

09.11.2021

version FANselect V 1.01 (211109), AMCA V 1.03 September, 2021 / 1.21.11.09 | 28256 | (user ZAFS18256)

1

type		ZN080-ZIQ.GL.V7P3
article no.		180820 | Portfolio STD-WW

technical data

motor		ECblue
Efficiency class		IE5
mains supply	-	3~ 460V 60Hz
ambient temperature, max. limit (t_r)	°C	65
efficiency grade η_{statA}	%	58,0
efficiency grade **N_{actual}** | N_{target}		**61,6** | 40
ErP-conformity		2015 | EC controller integrated
grille | influence		pressure side | measured

fan data

SFP-class | SFP-value (P_{SFP})	- | Ws/m³	**1** | 426
airflow volume (q_V)	ft³/min	12000.0
pressure, **stat. (p_{sF})** | tot. (p_F)	in.wg.	**0.800** | 1.096
electrical power input (P_{sys})	W	2413
system eff., **stat. ($\eta_{sF,sys}$)** | tot. ($\eta_{F,sys}$)	%	**46.8** | 64.1
fan speed **(n)** | max. (n_{max})	rpm	**1067** | 1100
fan speed, set value (%n_{max})	%	97
frequency **(f_{BP})** | (f_{max})	Hz	**60** | 60
voltage (U_{DP})	V	460
current (I_{DP})	A	3.22
acoustics, suction side **($L_{w(A),5}$)** | ($L_{w,5}$)	dB	**81** | 85
acoustics, pressure side **($L_{w(A),6}$)** | ($L_{w,6}$)	dB	**83** | 87
dimensions (w x h x d)	in	38.19 x 38.19 x 13.66
product weight (m_{pr})	lb	99.9

PF:PF_50; Ano:180820; STol:+-10 %

FANselect

performance curve / acoustics

09.11.2021

version FANselect V 1.01 (211109), AMCA V 1.03 September, 2021 / 1.21.11.09 | 28256 | (user ZAFS18256)

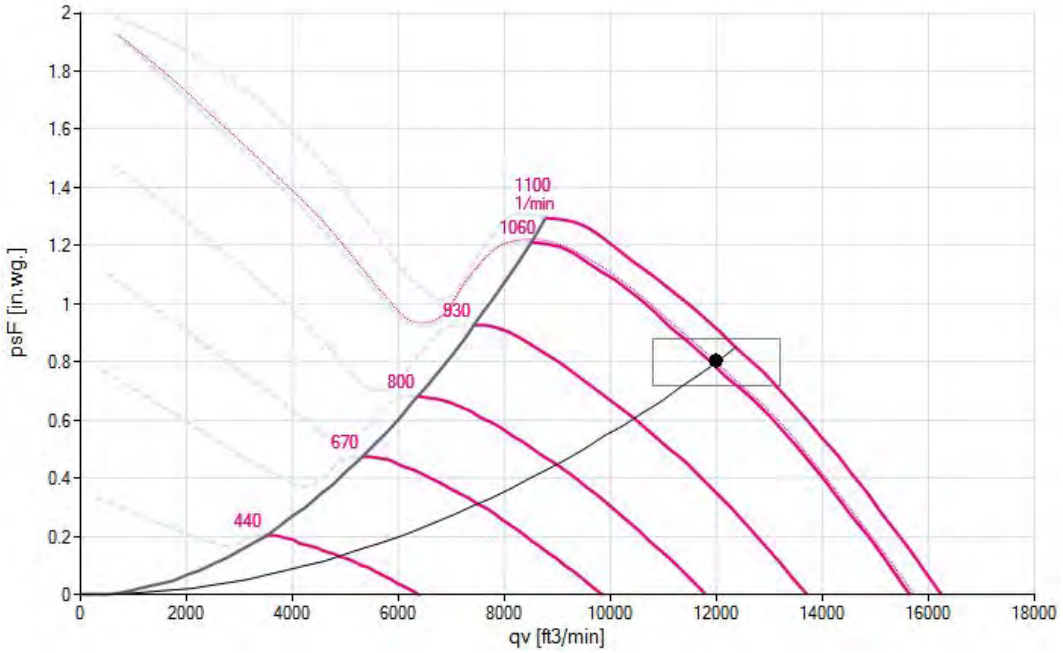
1 ZN080-ZIQ.GL.V7P3

180820 | Portfolio STD-WW

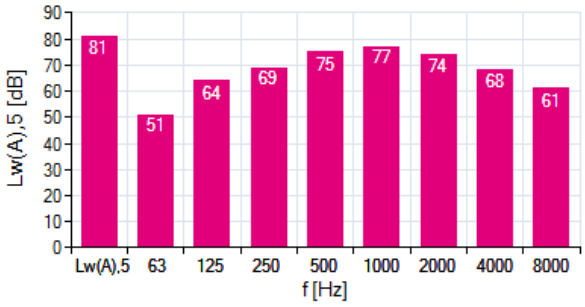
Measured in ZAplus with pressure side guard grille in air flow direction V in installation type A according to ISO5801

measurement density 0.072 [lbs/ft³]

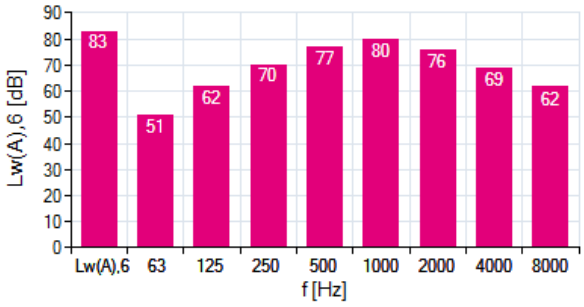
air performance p_{sF}



acoustics ($L_{w(A),5}$)



acoustics ($L_{w(A),6}$)



1 ZN080-ZIQ.GL.V7P3									
f [Hz]	sum	63	125	250	500	1000	2000	4000	8000
$L_{w(A),5}$	81	51	64	69	75	77	74	68	61
$L_{w,5}$	85	78	80	77	78	77	73	67	62

f [Hz]	sum	63	125	250	500	1000	2000	4000	8000
$L_{w(A),6}$	83	51	62	70	77	80	76	69	62
$L_{w,6}$	87	78	78	78	81	80	75	68	62

FANselect

efficiency grade / power input

09.11.2021

version FANselect V 1.01 (211109), AMCA V 1.03 September, 2021 / 1.21.11.09 | 28256 | (user ZAFS18256)

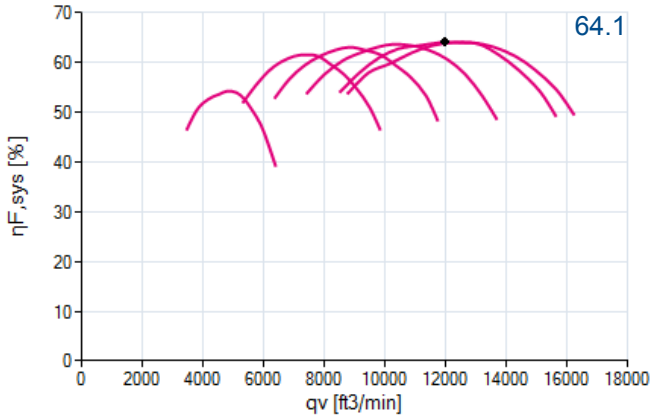
1 ZN080-ZIQ.GL.V7P3

180820 | Portfolio STD-WW

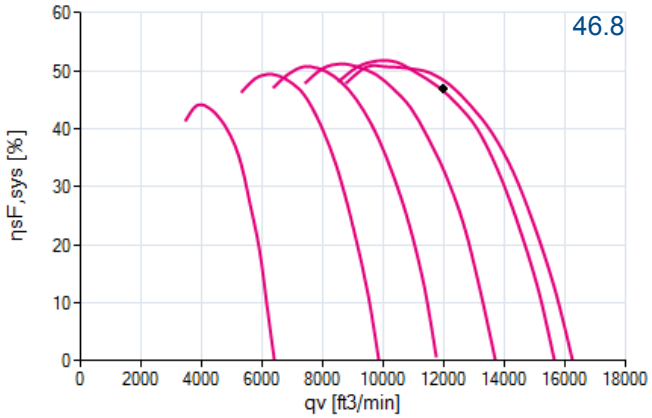
Measured in ZAplus with pressure side guard grille in air flow direction V in installation type A according to ISO5801

measurement density 0.072 [lbs/ft³]

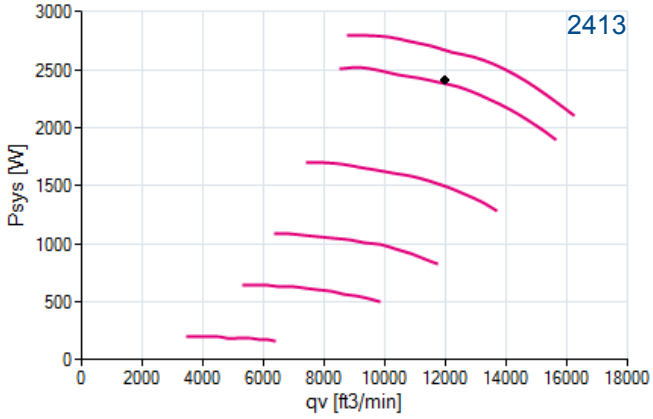
efficiency grade $\eta_{F,sys}$



efficiency grade $\eta_{sF,sys}$



power input P_{sys}



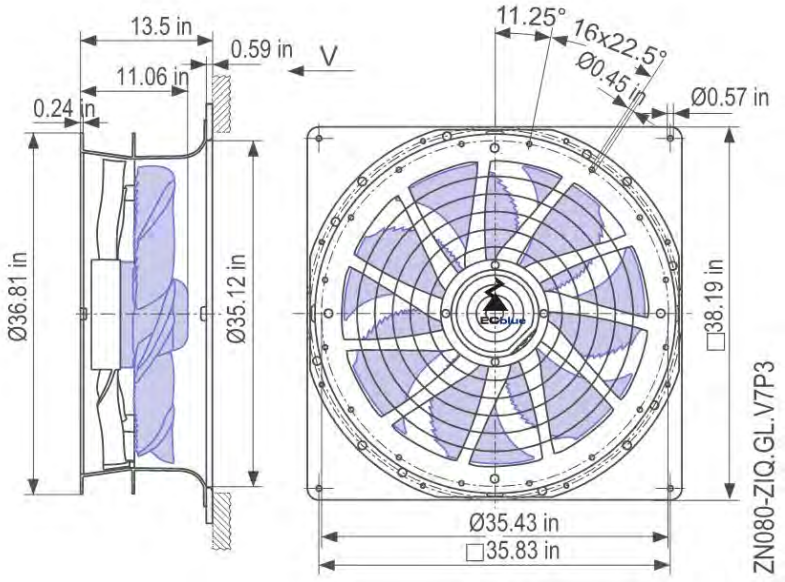
FANselect

drawing

09.11.2021
version FANselect V 1.01 (211109), AMCA V 1.03 September, 2021 / 1.21.11.09 | 28256 | (user ZAFS18256)

1

ZN080-ZIQ.GL.V7P3
180820

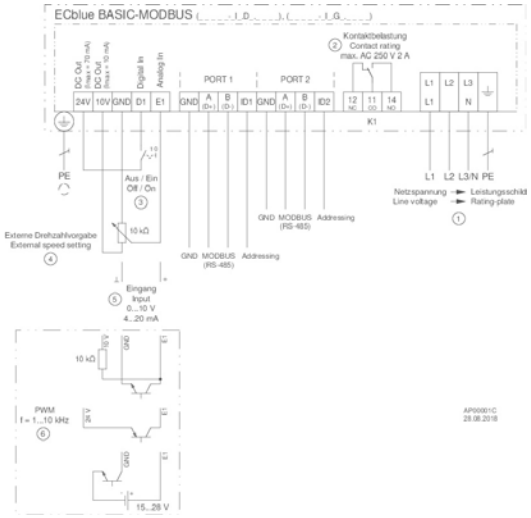


wiring diagram

09.11.2021
version FANselect V 1.01 (211109), AMCA V 1.03 September, 2021 / 1.21.11.09 | 28256 | (user ZAFS18256)

1

ZN080-ZIQ.GL.V7P3
180820



SUBMITTAL

AEROCEL®

EPDM SHEET

Aerocel® EPDM Elastomeric Sheet Insulation is a flexible closed cell and lightweight elastomeric material with a smooth and durable surface, designed for insulating large pipes, tanks, vessels, air ducts, inside air handling panels and more. It is available in 3' x 4' flat sheets and rolls in thicknesses of 1/8", 1/4", 3/8", 1/2", 5/8", 3/4", 1", 1-1/4", 1-1/2" and 2".

Air Duct Systems

Besides being the ideal insulation for many kinds of piping systems and equipment, Aerocel® is also used as insulation for all kinds of HVAC ducting systems, including supply, return and intake air. Aerocel® EPDM Elastomeric Sheet is an excellent choice for insulating duct work, both internally lined and externally wrapped. Aerocel® has been favored over fibrous insulating materials mainly because of the possible dangers and health concerns with the use of fibrous materials. Aerocel®, made from special modified elastomeric material, ensures a long service life and can be safely handled without any concern of skin irritation. It is also not hazardous to health, so no special precautions are needed for application or service. Aerocel® offers superior resistance to moisture, fungus growth, vermin and rodent attack. Clean and easy to install, it offers a neat installed appearance because of its smooth surface.

Aerocel® sheet also meets the standards stated in UL 181 for mold growth/humidity, air erosion and passes ASTM G 21 Fungal Resistance. See the complete line of specifications listed on back of this page.

Key Features:

- UV Resistant
- Low Thermal Conductivity
- Easy to install
- 25/50 rated through 2" wall
- Fiber Free

Application

AEROCEL® EPDM elastomeric sheet is flexible and easy to use for a wide variety of jobs including large OD pipes, tanks, vessels, air ducts and inside air handling panels. When used in duct lining applications, SMACNA duct lining practices are to be used for gluing and pinning Aerocel® to the sheet metal. An ASTM C 916 compliant duct liner adhesive** is to be used. Different adhesives will yield different performance characteristics when holding Aerocel® to sheet metal. Pins that mechanically attach or adhere to the sheet metal, and have a shank equal to the thickness of the insulation must be used. Weld-type fasteners are not to be used.

In addition to the specifications listed below, Aerocel® EPDM sheet also conforms to the following standards or holds the following approvals/acceptances: ASTM C 534 Type II, ASTM C 1534 Type I, ASTM G 21 Fungal Resistance, UL 181 Section 12 Mold Growth/Humidity, UL 181 Section 17 Air Erosion, NY City MEA #171-04-M, City of LA RR-8413, NFPA 90A & 90B, CAN/ULC-S102-07, and MIL 15280J.

Aerocel Sheet insulation meets the energy savings requirements of International Energy Conservation Code (IECC) and ASHRAE of R-4 at 1" wall thickness.

Aerocel EPDM Elastomeric Sheet Insulation has inherent Microbial Resistance based on the standard composition of this superior insulator.

Specifications

PHYSICAL PROPERTY	RESULT	TEST METHOD
Apparent Thermal Conductivity	0.245 k-Value	ASTM C 177 / C 518
Surface Burning Characteristics, Through 2" Thick	Flame Spread – 25 Max. Smoke Dev. – 50 Max.	ASTM E 84
	UL 94 5V-A, V-O	UL File E228536
	Self-Extinguishing	ASTM D 635
Service Temperature, CONTINUOUS	-297°F to +300°F -57°C to +149°C	ASTM C 411
Water Vapor Sorption	0.00% max.	ASTM C 1104
Water Absorption	0.2% max	ASTM C 209
Water Vapor Permeability	.03 perm (4.38 x 10-11)	ASTM E 96
Dimensional Stability	7% max.	ASTM C 356
Odor Emission	Pass	ASTM C 1304
Corrosiveness	Pass	ASTM C 665/C 692/DIN 1988
Fungi/Resistance	No Growth	ASTM C 1338/G 21/ UL181
Erosion Resistance	Pass	ASTM C 1071/UL181
UV Resistance	Good	ASTM G 7/ G 90
Ozone Resistance	No Cracking	ASTM D 1171
Nitrosamine Content	None Detected	U.S. FDA CPG No. 7117.11 BSEN 12868
Noise Reduction Coefficient	½" thick - .20 1" thick - .35	ASTM C 423

Thickness	3/8"	1/2"	3/4"	1"	1-1/2"	2"
R-value	1.5	2	3.1	4.1	6.1	8.2

Sound Absorption Coefficients, ASTM C423 Type "A", Mounting Practice E 795							
Frequency, Hz	125	250	500	1000	2000	4000	NRC
Type I: 1⁄2 in. (13 mm)	0.03	0.06	0.08	0.27	0.47	0.23	0.20
1 in. (25 mm)	0.15	0.10	0.31	0.57	0.36	0.40	0.35

** Acceptable Adhesives for Duct Lining – MEI 22-24 Eco-Spray N.F. Adhesive and Foster® 85-65™ STIC-FAS™ ADHESIVE

Aerocel can work efficiently as an insulation and sound dampening material internally and externally.

Air Duct Systems

Aerocel® sheet makes an ideal choice for HVAC duct systems because it is a low density, light weight product that also serves as an efficient acoustical absorber and an excellent thermal insulator. With low moisture absorption and low water vapor transmission, Aerocel can be used both as an internal and external insulation for all kinds of ducting systems.

To suit different decorative purposes, Aerocel® can also be coated with Aerocoat, acrylic latex emulsion paint.

AEROFLEX USA, INC.

282 Industrial Park Road • Sweetwater, TN 37874
1-866-AEROCEL • 1-877-337-7675 fax
Toll Free: (866) AEROCEL
Website: www.aeroflexusa.com

Montageanleitung
Installation Instructions
Notice de Montage

efector300

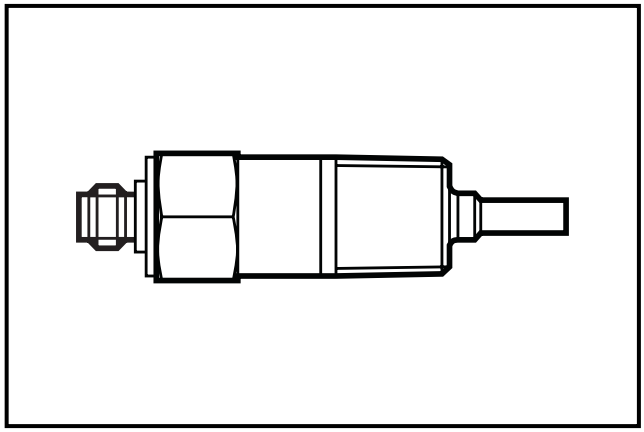
Strömungswächter
Flow monitor compact
Contrôleur de débit compact

SC0505

DEUTSCH

ENGLISH

FRANÇAIS



Sachnr. 704065/00 03/06

Function and features

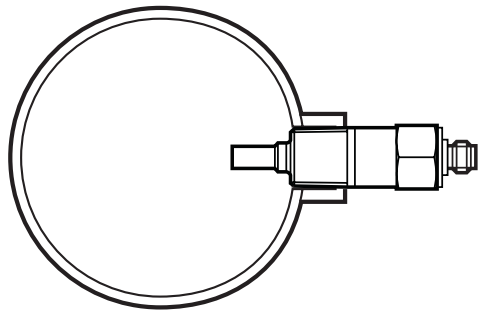
The flow monitor monitors liquid media. It senses whether there is a preset flow and provides a switching signal.
The switch point can be set: minimum value (< 10) - 10 - 15 - 20 ... 55 - 60 - maximum value (> 60).
This value is valid for water and installation in pipes 4". It changes with other media/other pipe diameters.

Installation

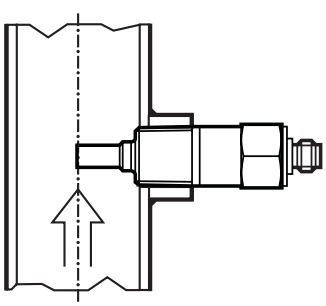
Max. tightening torque: 100 Nm.
The sensor tip must be completely immersed in the medium.

- In the case of horizontal pipes mount the unit from the side, if possible (fig. 1).
  When the unit is to be mounted at the bottom of the pipe, it should be free from deposits. When the unit is to be mounted at the top of the pipe, it should be completely filled with the medium to be monitored.
- In the case of vertical pipes mount the unit in a place where the medium flows upwards (fig. 2).

1



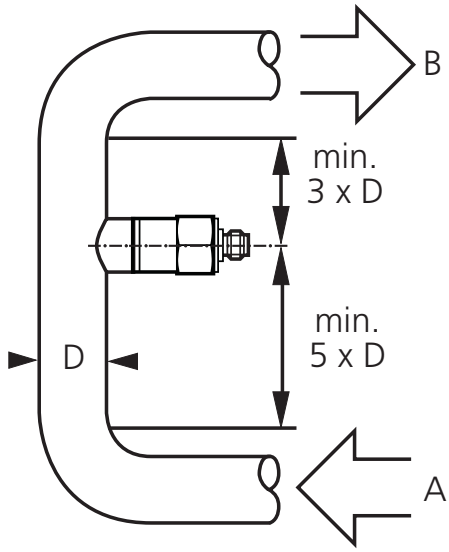
2



To avoid malfunction a minimum distance between the flow monitor and bends, valves, changes in cross-section or such like must be observed:

- Min. 5 x pipe diameter upstream (A),
- min. 3 x pipe diameter downstream (B).

3

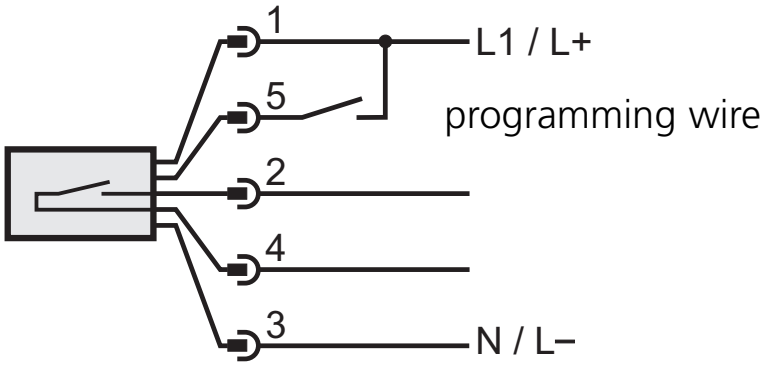


ENGLISH

Electrical connection

The unit must only be mounted by an electrician.
The national and international regulations for the installation of electrical equipment must be observed.
Voltage supply and contact rating for the relay to EN50178, SELV, PELV.
The device shall be supplied from an isolating source and protected by an overcurrent device such that the limited voltage circuit requirements in accordance with UL 508 are met.

Disconnect power before connecting the unit as follows (max. cable length: < 10 m).



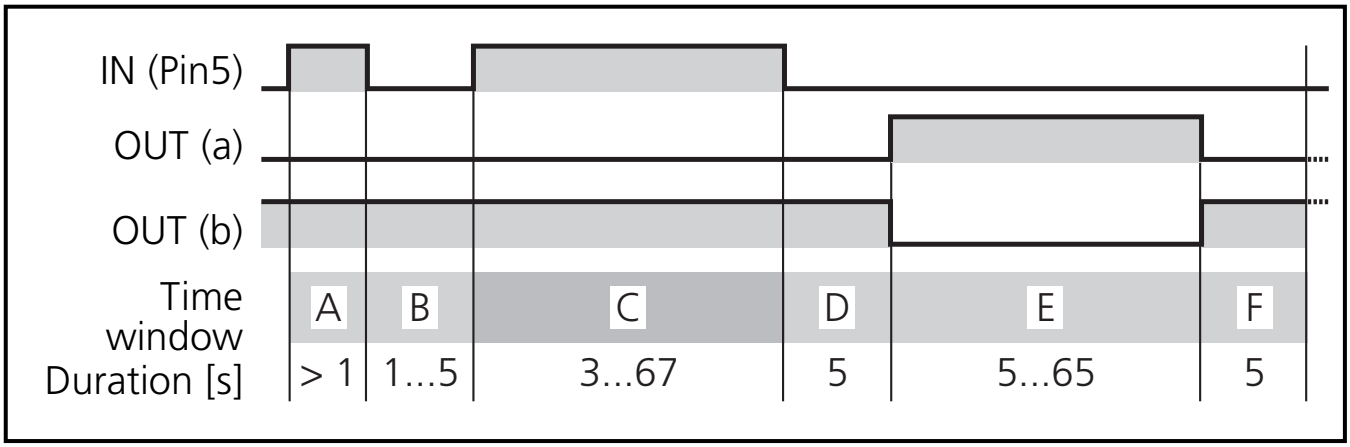
Operating voltage [V]	24 AC / DC ± 15% (AC: 47...63 Hz)
Contact rating [V]	30 AC / 42 DC
Current rating [mA]	45 AC / 65 DC
Voltage drop [V]	< 0,8
Current consumptio [mA]	< 50
Output	normally open

The maximum current rating must not be exceeded.
Even if it is exceeded for a short time the unit is destroyed.

ENGLISH

Switch point setting

Apply the operating voltage (+U**B**) to pin 5 for the specified time.



OUT (a): flow < SP; OUT (b): flow ≥ SP

Time window	Operation							
A	Inititalisation of the setting operation							
B	Confirmation of the initialisation							
C	Switch point setting*							
	Signal U**B** at pin 5 [s]:	5	10	15	20	...	55	60	65
	results in SP [cm/s]:	min	10	15	20	...	55	60	max
D	Internal monitoring (end of the setting time)							
E	Confirmation of the setting (output signal is inverted; duration = setting time of the selected switch point)							
F	Internal monitoring, SP_{NEW} is then active							

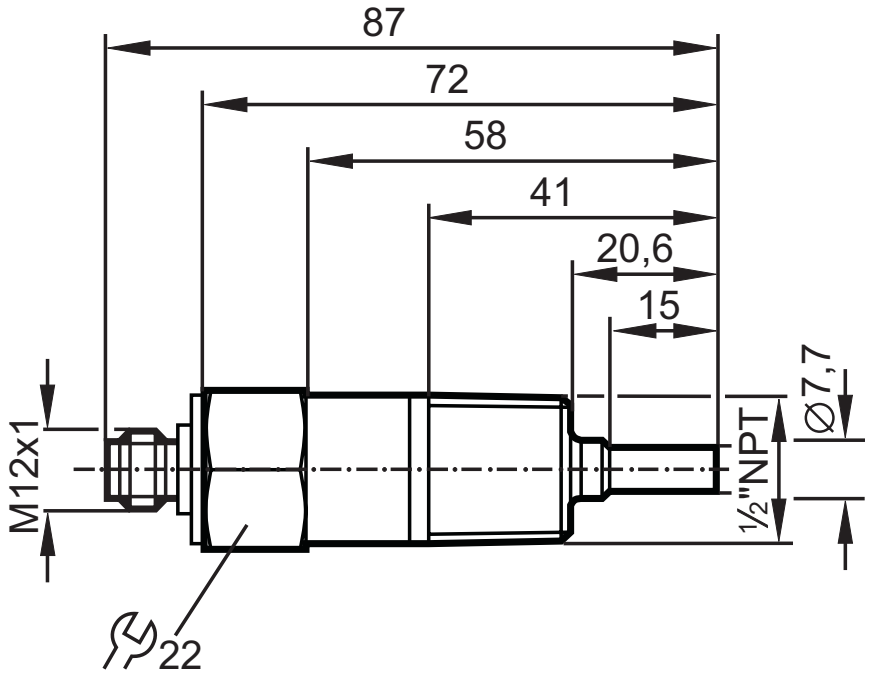
*Accuracy: ± 1 s; factory setting: SP = 15 cm/s
If flow rises or falls during the setting operation, the switching state of the output can change. In the time windows D and F it is kept in the existing state, in the time window E it is inverted.

Operation

After mountingand wiring check whether the unit operates correctly.
Recommended maintenance
Check the sensor tip for build-up from time to time. Clean it with a soft cloth. If necessary, build-up which adheres firmly (e.g. lime) can be removed with a common vinegar cleansing agent.

ENGLISH

Maßzeichnung / Scale drawing / Dimensions



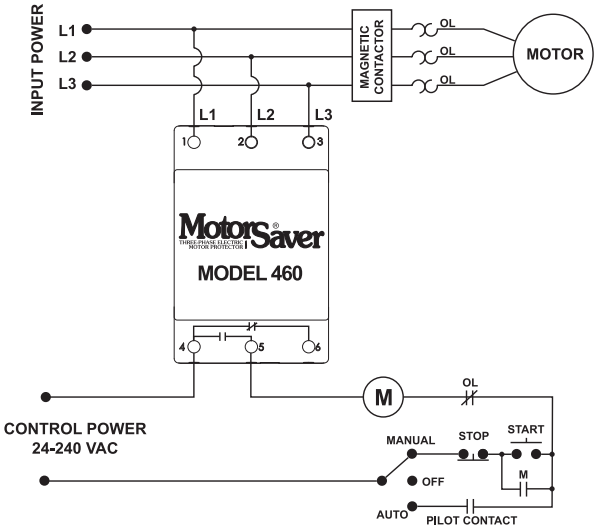
Littelfuse
Expertise Applied | Answers Delivered

460 SERIES

3-Phase Voltage Monitor

Wiring Diagram

TYPICAL WIRING DIAGRAM FOR MODEL 460 WITH MOTOR CONTROL



Description

The 460 is a 3-phase voltage monitor that protects 190-480VAC or 475-600V, 50/60Hz motors regardless of size. The product provides a user selectable nominal voltage setpoint and the voltage monitor automatically senses line voltage.

This unique microcontroller-based voltage and phase-sensing device constantly monitors the 3-phase voltages to detect harmful power line conditions such as low, high, and unbalanced voltage, loss of any phase, and phase reversal. When a harmful condition is detected, the MotorSaver® output relay is deactivated after a specified trip delay. The output relay reactivates after power line conditions return to an acceptable level for a specified amount of time (restart delay). The trip and restart delays prevent nuisance tripping due to rapidly fluctuating power line conditions.

All 460 models feature adjustable 1-30 second trip delay, 1-500 second restart delay, 2-8% voltage unbalance trip point, and one form C contact except where noted below.

Features & Benefits

FEATURES	BENEFITS
Auto-sensing wide voltage range	Automatically senses system voltage between 190 - 480VAC or 475-600VAC. Saves set-up time
Adjustable trip & restart delay settings	Prevent nuisance tripping due to rapidly fluctuating power line conditions
Microcontroller based circuitry	Improved accuracy and higher reliability
Advanced LED diagnostics	Quick visual indicator for cause of trip and relay status
Adjustable voltage unbalance trip setting	Provides reliable protection when regenerative voltage is present

Ordering Information

MODEL	VOLTAGE	DESCRIPTION
460	190-480VAC	Automatically senses line voltage, adjustable 1-30 second trip delay, 1-500 second restart delay, and 2-8% voltage unbalance trip point
460-L	190-480VAC	Fixed 4 second trip delay and 1 second for single-phase faults, and fixed 6% voltage unbalance trip point
460-14	190-480VAC	Equipped with 2 sets of contacts: Form A (NO) and Form B (NC). Used for applications requiring 2 different voltages such as 5VDC for a PLC input and 115VAC for an alarm
460-575	475-600VAC	Commonly used in Eastern Canada and on generator units that generate 600 VAC power
460-575-14	475-600VAC	Commonly used in Eastern Canada and on generator units that generate 600 VAC power. Equipped with 2 sets of contacts: Form A and Form B
460-15	190-480VAC	Equipped with 2 sets of Form A (NO) contacts. Used on applications where two different units are to be controlled at once such as a unit that has separate contacts for a compressor and a fan
460-MR	190-480VAC	Equipped with a 2-prong connection for a normally open push button mounted outside the panel. Used in applications requiring an external manual reset button
460-VBM	190-480VAC	Fixed 6% voltage unbalance trip point. User adjustable low and high voltage trip points
460-400HZ	190-480VAC	For use with 400Hz power supply
460-OEM	190-480VAC	Bulk package of 460, 20 units
460L-OEM	190-480VAC	Bulk package of 460-L, 20 units

460 SERIES

Specifications

Frequency	50/60Hz
Low Voltage (% of setpoint)	
Trip	90% ±1%
Reset	93% ±1%
High Voltage (% of setpoint)	
Trip	110% ±1%
Reset	107% ±1%
Voltage Unbalance (NEMA)	
Trip	2-8% adjustable
Reset	Trip setting minus 1% (5-8%) Trip setting minus 0.5% (2-4%)
460L	6% UB fixed (4.5% reset)
Trip Delay Time	
Low, High and Unbalanced Voltage	1-30 seconds adjustable
460L	4 seconds fixed
Single-Phase Faults (>15% UB)	1 second fixed
Restart Delay Time	
After a Fault	1-500 seconds adjustable
After a Complete Power Loss	1-500 seconds adjustable
Output Contact Rating	
Form C	
Pilot Duty	480VA @ 240VAC, B300
General Purpose	10A @ 240VAC
Form A & Form B	
Pilot Duty	360VA @ 240VAC, B300
General Purpose	8A @ 240VAC

Ambient Temperature Range	
Operating	-20° to 70°C (-4° to 158°F)
Storage	-40° to 80°C (-40° to 176°F)
Maximum Input Power	6 W
Class of Protection	IP20, NEMA 1 (finger safe)
Relative Humidity	10-95%, non-condensing per IEC 68-2-3
Terminal Torque	4.5 in.-lbs.
Wire Type	Stranded or solid 12-20 AWG, one per terminal
Standards Passed	
Electrostatic Discharge (ESD)	IEC 61000-4-2, Level 3, 6kV contact, 8kV air
RFI, Radiated	150 MHz, 10V/m
Fast Transient Burst	IEC 61000-4-4, Level 3, 3.5kV input power and controls
Surge	
IEC	IEC 61000-4-5, Level 3, 4kV line-to-line; Level 4, 4kV line-to-ground
ANSI/IEEE	C62.41 Surge and Ring Wave Compliance to a level of 6kV line-to-line
Hi-potential Test	Meets UL508 (2 x rated V +1000V for 1 minute)
Safety Marks	
UL	UL508 (File #E68520)
CE	IEC 60947-6-2
Enclosure	Polycarbonate
Dimensions	**H** 88.9 mm (3.5"); **W** 52.9 mm (2.08"); **D** 59.69 mm (2.35")
Weight	0.7 lb. (11.2 oz., 317.51 g)
Mounting Method	35 mm DIN rail or Surface Mount (#6 or #8 screws)
460-MR (manual reset)	External NO pushbutton required.

III MULTISTACK

Interconnect ARA
(Line Powered) Wiring Diagram

III MULTISTACK®
1065 Maple Ave.
Sparta, WI
Phone #: (608) 366-2400
Fax #: (608) 366-2450
E-mail: info@multistack.com
Web Site: www.multistack.com

REV.	DATE	REVISION	BY
A	2/12/16	CORRECTED FLOW SWITCH AND REMOTE START/STOP INPUTS	MLG
B	2/16/16	ADDED NOTE FOR USE WITH HIGH SCCR & 575V	ESF
C	5/26/16	CHANGED MS1 & MS2 TERMINOLOGY IN LEGEND	ESF
D	12/18/17	ADDED ALARM OUTPUT	ESF

CpCO WITH ELECTRONIC EXPANSION VALVE

MULTISTACK
Sparta, Wisconsin 54656
ALL DIMENSIONS IN INCHES / DO NOT SCALE DRAWINGS

JOB NAME:

DRAWN BY: MLG
DATE: 10/27/14

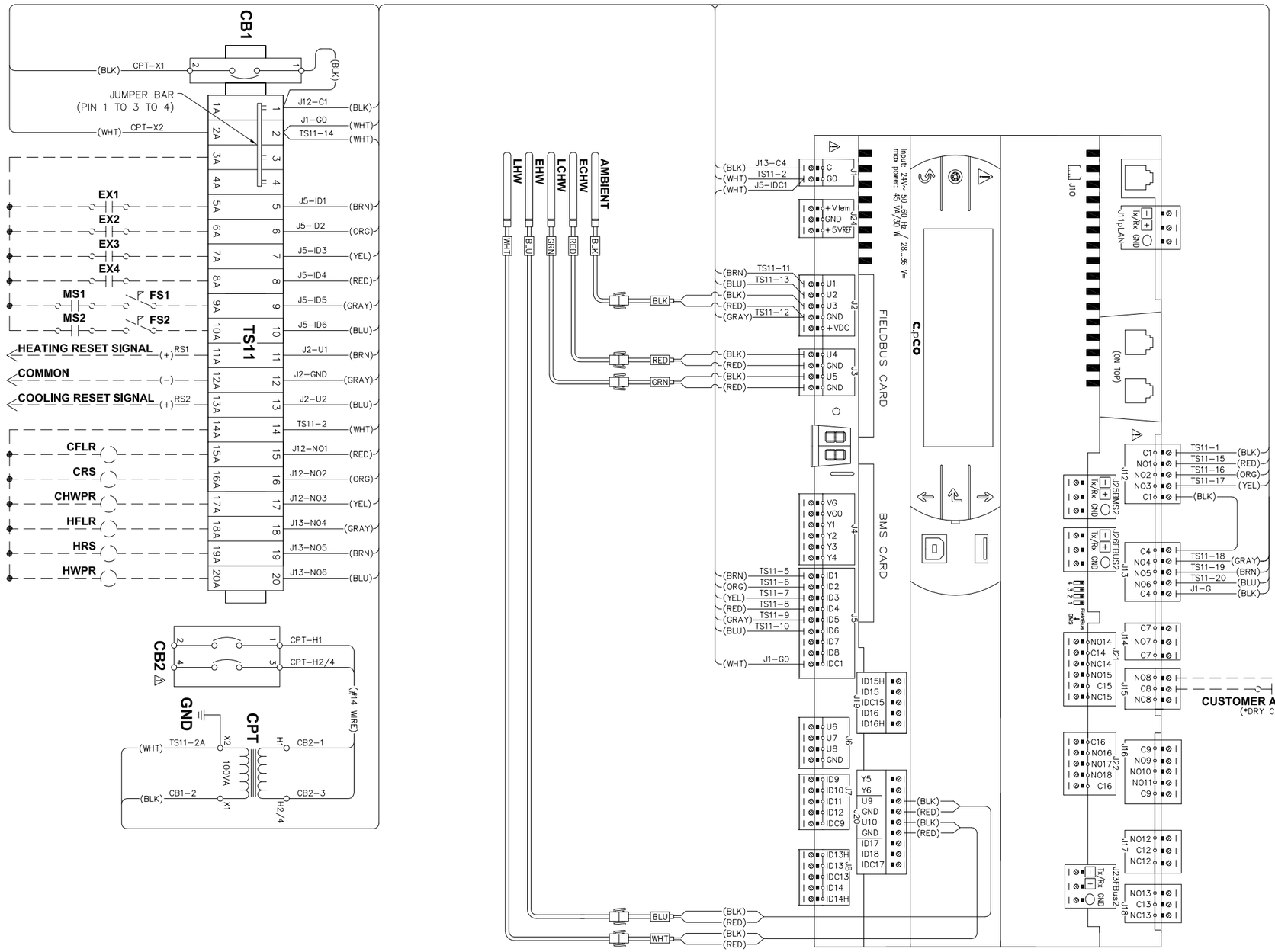
CHECKED BY:
DATE:

ENGR:
APPR:
DATE:

B | 2000-7903 | D

WIRING DIAGRAM
ARA__X APPLICATION MASTER CONTROL
(LINE POWERED)

SCALE: NONE



LEGEND

1. ---- COMPONENTS & WIRING BY OTHERS. (18 AWG MIN. WIRE)
2. INPUTS TO TERMINALS 4 THRU 10 OF TS11 MUST BE WIRED CLOSED IF NOT USED.
3. EXTERNAL INPUTS: (CLOSED TO OPERATE)
   - EX1 – REQUIRES MANUAL RESET TO RESUME OPERATION
   - EX2 – COOLING REMOTE START/STOP
   - EX3 – HEATING REMOTE START/STOP
   - EX4 – AUTO RESET (POWER PHASE MONITOR INPUT)
   - FS1 – FLOW SWITCH (COOLING WATER)
   - FS2 – FLOW SWITCH (HEATING WATER PUMP STARTER)
   - MS1 – AUX. INTERLOCK (COOLING WATER PUMP STARTER)
   - MS2 – AUX. INTERLOCK (HEATING WATER PUMP STARTER)
   - RS1 – HEATING WATER RESET SIGNAL (SOFTWARE SELECTABLE 0-10VDC, 4-20mA)
   - RS2 – COOLING WATER RESET SIGNAL (SOFTWARE SELECTABLE 0-10VDC, 4-20mA)
4. EXTERNAL OUTPUTS:
   - CAR – CUSTOMER ALARM RELAY (24VAC, 5VA MAX.)
   - CRS – COOLING REMOTE STATUS
   - HFLR – HEATING FULL LOAD RELAY OUTPUT (24VAC, 5VA MAX.)
   - HRS – HEATING RUN STATUS
   - CFLR – COOLING FULL LOAD RELAY OUTPUT (24VAC, 5VA MAX.)
   - HWPR – HEATING WATER PUMP RELAY OUTPUT (24VAC, 5VA MAX.)
   - CHWPR – COOLING WATER PUMP RELAY OUTPUT (24VAC, 5VA MAX.)
5. SENSOR INPUTS:
   - ECHW – ENTERING CHILLED WATER
   - LCHW – LEAVING CHILLED WATER
   - EHW – ENTERING HOT WATER
   - LHW – LEAVING HOT WATER

⚠ THESE OUTPUTS ARE "DRY CONTACT" CLOSURES ON HIGHER SHORT CIRCUIT CURRENT RATING (SCCR) AND 575 VOLT UNITS, CB2 WILL BE A COMPACT CIRCUIT PROTECTOR (CCP) (A MINIATURE FUSED DISCONNECT WITH CLASS CC FUSES) WHEN USING CCPs, TERMINALS 1 & 3 WILL BE CONSIDERED ON THE LINE SIDE SO FUSES ARE ON THE LOAD SIDE

REV.	REVISION	BY	DATE
A	CHANGED TERMINATION RESISTOR TO 120 OHM	TJG	7/19/2021

MULTISTACK

Sparta, Wisconsin 54656

ALL DIMENSIONS IN INCHES / DO NOT SCALE DRAWINGS

SIMILAR TO:	FIRST USED ON ASSY NO:	STD ENGR SPEC
DRAWN BY: MLG DATE: 10/27/14	CHECKED BY: DATE:	ENGR: APPR: DATE:

B | 2000–7904 | A

COMMUNICATIONS INTERCONNECT DIAGRAM

ARA__X SERIES

SCALE: NONE

NETWORK ADDRESSING

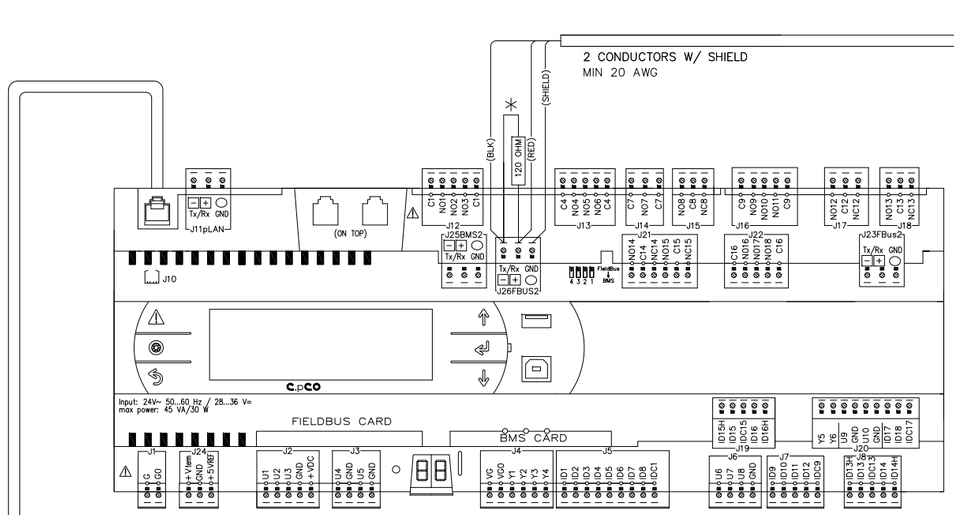
EACH CONTROL BOARD IN THE NETWORK MUST HAVE AN UNIQUE pLAN ADDRESS. TO SET THE ADDRESS OF EACH CONTROLLER PRESS AND HOLD THE ALARM AND UP ARROW KEYS SIMULTANEOUSLY DURING THE POWER UP OF EACH BOARD. USE THE UP AND DOWN ARROW KEYS TO SELECT THE pLAN ADDRESS.

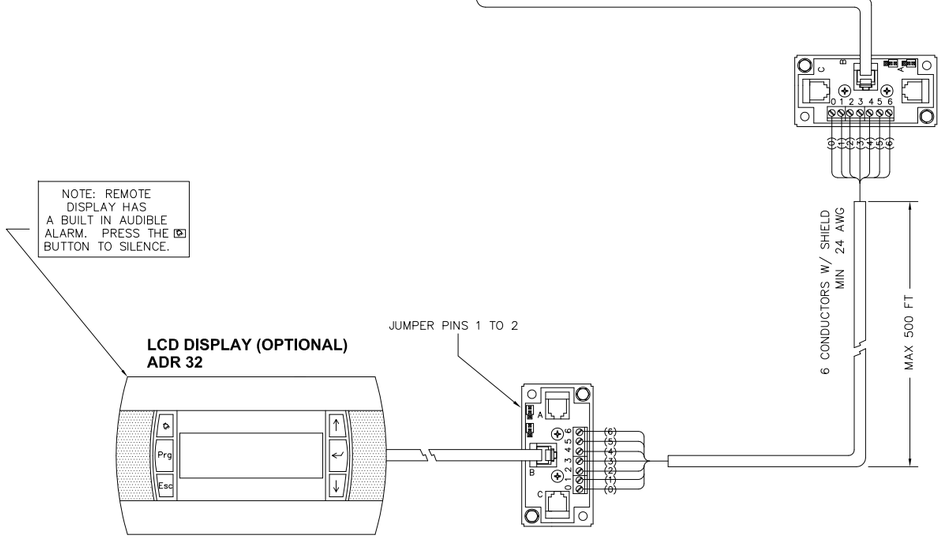
VALID MODULE NUMBERS ARE 1 THRU 14
MASTER CONTROL ADDRESS = 30
REMOTE DISPLAY (OPTIONAL) = 32

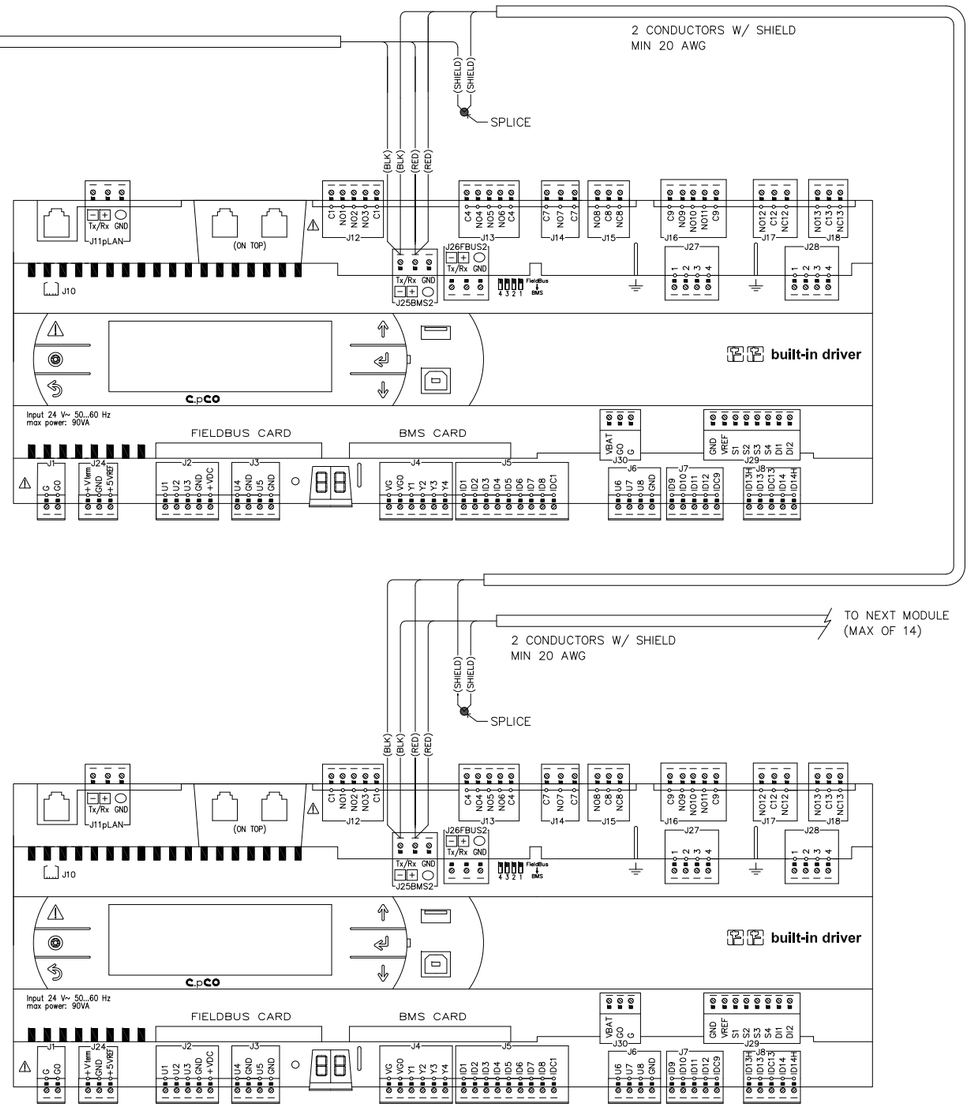
*120 OHM; ¼ WATT TERMINATION RESISTORS AT MASTER CONTROLLER AND LAST ADDRESSED MODULE BOARD BETWEEN (–) AND (+)

SCREEN DISPLAY

pLAN ADDRESS: 30
UP: INCREASE
DOWN: DECREASE
ENTER: SAVE AND EXIT

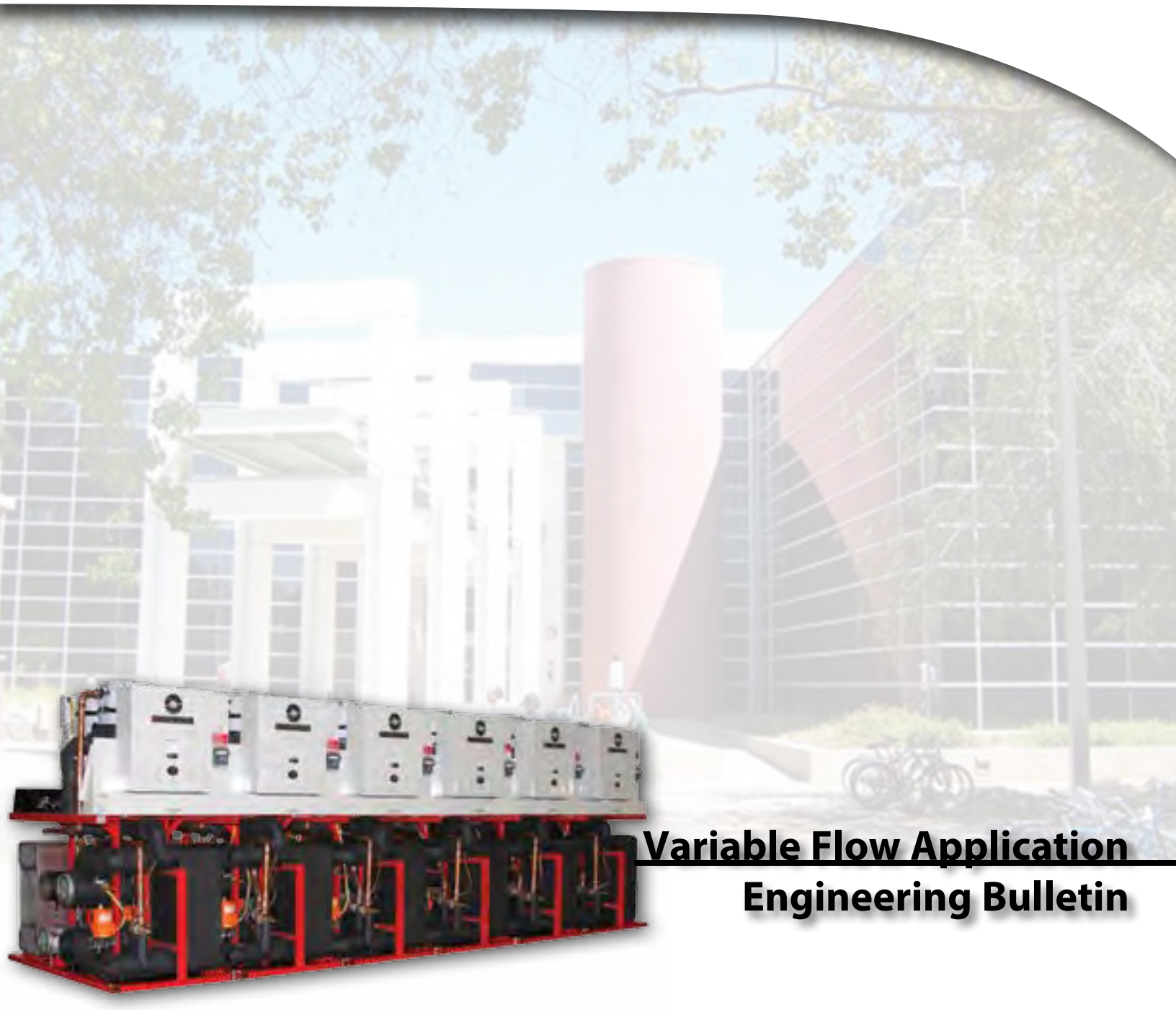






MULTISTACK®

Originators. Innovators. Never the Imitators.sm



Variable Flow Application Engineering Bulletin

For:

Multistack Modular Scroll Only Applications

Variable Flow Application Engineering Bulletin

Product Information

MULTISTACK MODULAR CHILLERS OR HEAT PUMPS AND VARIABLE PRIMARY FLOW PUMPING SYSTEMS

The Multistack Modular Chiller and Heat Pump design offers some unique advantages when used in a variable primary flow system. These advantages include precise temperature control while providing infinite flow modulation with minimum flows significantly lower than traditional chillers. The Multistack Modular Chiller, however, has some subtle differences from a conventional system. These differences must be understood to properly design a variable primary flow system. This document will outline the basic requirements for a variable primary flow application utilizing the Multistack Modular System. The following three factors must be considered:

1. Pump VFD Control
2. System Bypass Sizing and Control (Minimum flow requirement at full load)
3. Minimum Chiller Flow – (Minimum flow requirement at low load)

PUMP VFD CONTROL

The application of the Multistack Chiller or Heat Pump in a variable flow system requires a different control approach when compared to conventional systems. In place of a single machine with one heat exchanger, the Multistack system incorporates multiple heat exchangers, each with its own motorized, fully modulating isolation valve. The internal header system of a Multistack Modular Chiller manifolds all modules' evaporators and condensers in a parallel flow arrangement and provides proper flow distribution to each active heat exchanger. As a result the differential pressure across the MULTISTACK MODULAR CHILLER or HEAT PUMP can be directly correlated to the flow across all active heat exchangers.

Proper water flow to each operating heat exchanger must be maintained at all load conditions. This can be accomplished one of two ways:

1. The variable speed drive of the pump is controlled directly by a differential pressure transmitter installed at the inlet and outlet of the Multistack Modular System. The pump will modulate to maintain the required pressure differential across the Multistack Modular System. (Drawing 1).
2. The variable speed drive of the pump is controlled directly to a pressure transmitter installed in the building piping. The pump will modulate to control system pressure at the point of measurement (Drawing 2).

Design Note: To maintain acceptable temperature variance and avoid nuisance faults Multistack incorporates fast acting modulating valves with a stroke times less than 30 seconds. As a result it is critical that there is no delay associated with the Pump VFD control or the System bypass valve. The system bypass valve must be a pressure dependent valve with a similar stroke time to the Multistack onboard valve.

MINIMUM FLOW REQUIREMENT AT FULL LOAD and SYSTEM BYPASS SIZING and CONTROL

One reality of a variable primary flow system, regardless of which of the above pump control methods is utilized (based on the chiller ΔP or the system pressure), is that there will be some control lag between the load seen by the chilled water distribution system and the Multistack chiller or heat pump. Because of this, it is possible for the chiller to temporarily have a different flow requirement than the air handler (or other terminal device) . To avoid potential operational issues due to this phenomenon the system must incorporate a bypass valve. One example of how this operational issue could occur is:

The chiller is operating at full load (perhaps in a pull down situation). The air handlers gain control of their load and all simultaneously drive their chilled water control valves closed (this can happen quite abruptly in some variable primary flow systems). At this point the system has a very low water flow requirement to the air handlers. Simultaneously, the chiller (whose capacity is being controlled by chilled water temperature) has not yet seen a drop in required capacity at its system sensors due to the system water volume (which creates a time lag between a change in leaving temperature at the air handlers and a change in entering temperature at the Multistack Chiller). As a result of this lag, the MULTISTACK MODULAR CHILLER or HEAT PUMP would require more flow than the rest of the system until the chiller controls can unload the chiller/heater to match the system load condition. Without a system bypass valve in place the result of this condition would be to either provide too much flow to the air handlers or not enough flow to the MULTISTACK MODULAR CHILLER or HEAT PUMP.

When controlled properly the system bypass valve ensures each system component receives the proper flow at all times (including the potential lag period). There are two control methods for the system bypass valve (which directly correlate to the control of the pump as described above):

1. When using the first pump control method (differential pressure drop across the chiller controlling the pump speed) the system bypass valve is controlled directly to a differential pressure transmitter installed in the building piping. The system bypass valve will modulate to control pressure differential as shown in (Drawing 1).
2. When using the second pump control method (system pressure controlling the pump speed) the system bypass valve is controlled directly to a differential pressure transmitter installed at the inlet and outlet of the Multistack Modular System. The system bypass will modulate to maintain the required differential pressure across the MULTISTACK MODULAR CHILLER or HEAT PUMP.(Drawing 2)

When sizing the system bypass all load conditions must be taken into account. For this reason the system bypass is not sized to the minimum system flow, rather it is sized to provide minimum flow at full load of the chiller. Contact your local Multistack sales representative for proper bypass sizing.

Design Note: The minimum flow bypass should be located on the load side of the piping system and is typically accomplished by installing the valve as an end-of-loop bypass. Some systems may not allow for an end-of-loop bypass. In these situations the valve may be installed closer to the chiller, however, a minimum system volume equaling a minimum of a 2-minute loop time must be maintained to ensure proper operation.

MINIMUM CHILLER FLOW (MINIMUM FLOW REQUIREMENT AT LIGHT LOAD)

The Multistack control system together with the modulating valves at each evaporator and or condenser allows for maximum flow turndown. The MULTISTACK MODULAR CHILLER or HEAT PUMP can have a minimum flow at light load equivalent to the flow required for one circuit. Often the pumping system has a higher flow requirment than the Multistack Chiller. Additionally, by keeping the lead circuit's modulating valve open (which is rotated each day to follow the lead circuit) the pumping system will not be "dead-headed" by the chiller under a no-load condition. If the pumps minimum turndown is more than one circuit of flow, the MULTISTACK MODULAR CHILLER or HEAT PUMP can be programmed to set the number of open valves to satisfy the minimum flow of the pump, eliminating the need for an external chiller bypass.

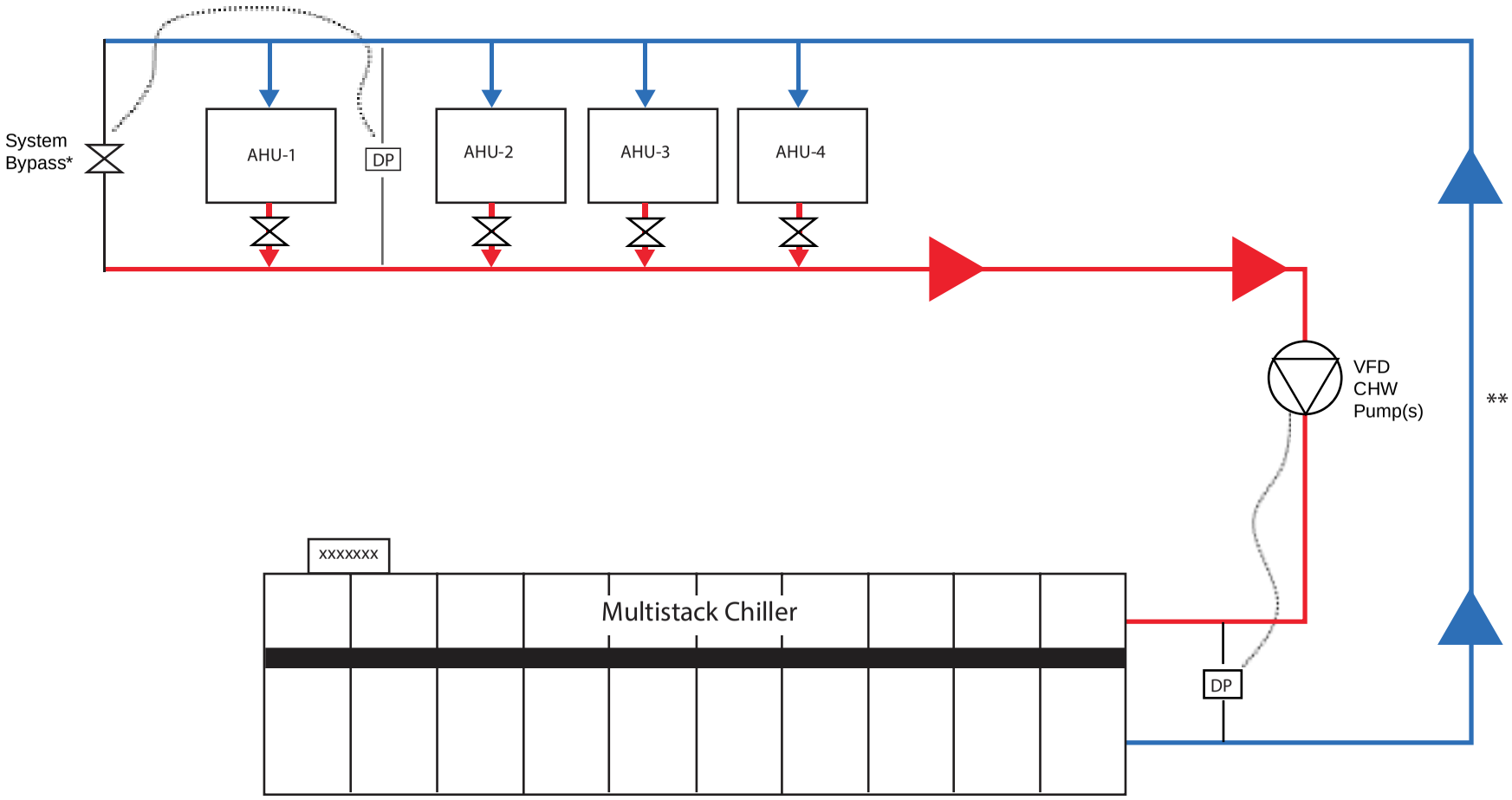
Design Note: This is the minimum operating point for MULTISTACK MODULAR CHILLER or HEAT PUMP only. It does not determine the system's minimum flow requirement or the system bypass valve sizing.

In summary, the Multistack Variable Flow Chiller or Heat Pump can offer significant control and turn-down advantages in variable primary flow pumping systems that will improve the energy profile of the system. Please contact us with any questions or concerns that you may have. We will listen, and do our best to support you in making your system the best it can be.

OPTIONAL FRM CONTROLS

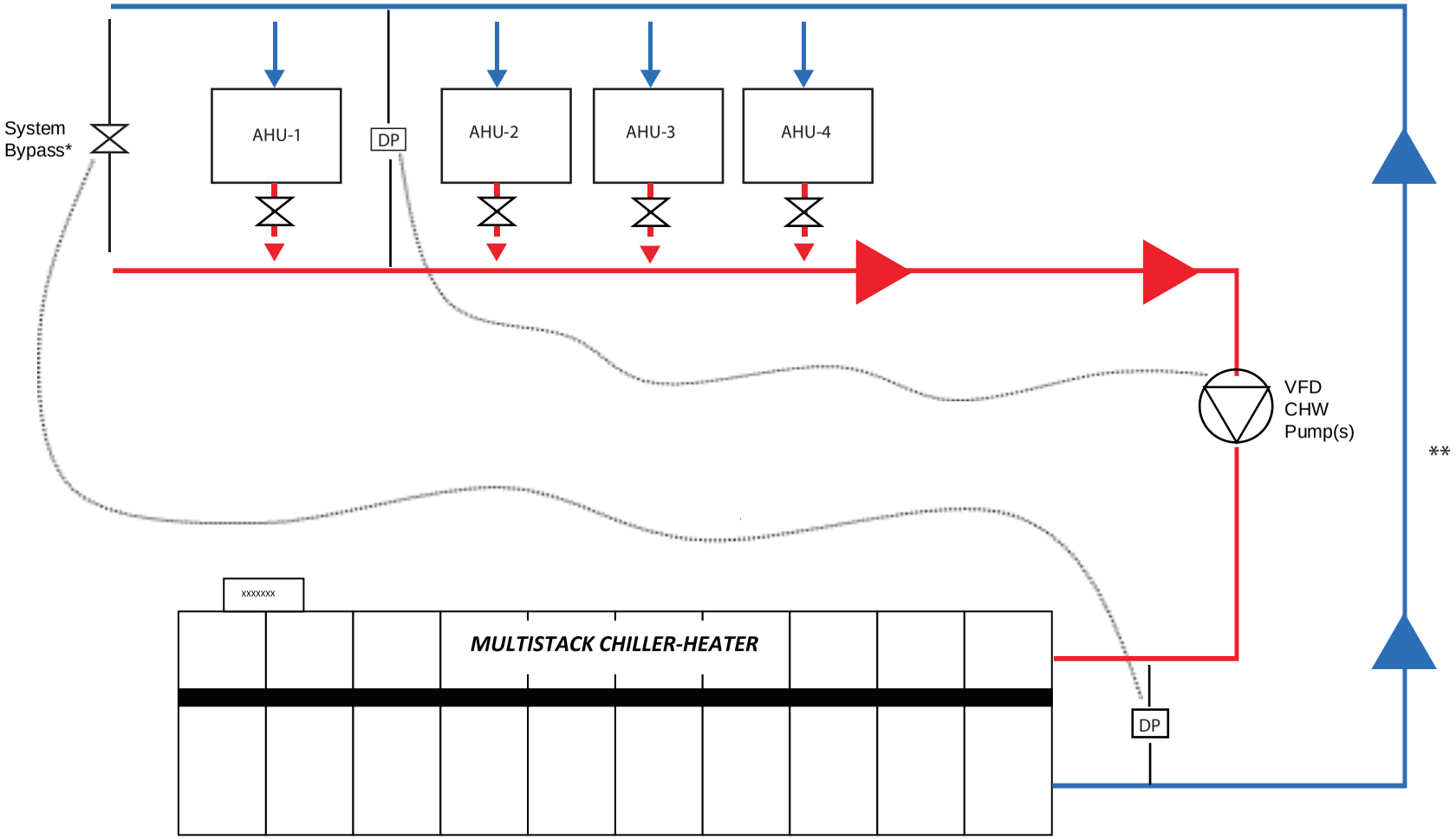
Contact your Multistack representative for proper bypass sizing for a chiller selected with FRM control options.

Multistack Variable Flow Schematic
Chiller DP to control Pump Speed - System DP to control Bypass Valve



*Less than 30 second stroke time required.
**Maintain 2 minute loop time at all load conditions.
***External chiller bypass may be required with VME configurations. Contact your Multistack representative to confirm.

Multistack Variable Flow Chiller Schematic
System DP to control Pump Speed - Chiller DP to control Bypass Valve



*Less than 30 second stroke time required.
**Maintain 2 minute loop time at all load conditions.
***External chiller bypass may be required with VME configurations. Contact your Multistack representative to confirm.

Originators…

Multistack invented the modular water chiller. It started with a radically simple idea: chiller modules that could be brought into the equipment room one at a time, through standard doorways and down elevators, to form a fully integrated chiller system. The idea launched a revolution and transformed Multistack into a leader in the commercial water-chiller industry.

Innovators…

Multistack perfected the modular chiller and leads the industry in innovative and environmentally friendly modular solutions. Since founding in the late 1980s, Multistack has engineered, manufactured, and distributed an impressive array of modular air conditioning firsts: the first on-board strainer, the first modular automatic blow-down device, the first modular chiller for variable flow, the first modular chiller-heater (heat pump), the first modular heat-recovery chiller, the first modular air-to-water heat pump, the first modular chiller to utilize MagLev™ compressor technology, and the first modular chiller to utilize R-134a.

Never the Imitators…

Multistack sets the standard in the industry for superior customer service, fast and on time shipment, superior product quality, and new product development. Our pioneering leadership in environmental issues is well documented. If you want the best, be sure to specify the original – Multistack®.

MULTISTACK®

1065 Maple Avenue P.O. Box 510 Sparta, WI 54656
Phone 608-366-2400 • Fax 608-366-2450
www.multistack.com

c ETL LISTED us

F168_0914

MULTISTACK®

Originators. Innovators. Never the Imitators.

ARA/Versa Temp

Controller user manual for C.PCO controls on ARA/ASP product line

Table of contents:

Section 1.1 Introduction:

The Multistack ARA Modular Liquid Chiller/Heater is a modular water-cooled system with auxiliary air side condenser/evaporator, composed of one or more modules controlled by one master controller, to provide chilled and hot liquid to their own external circuits. Each chiller/heater may be comprised of up to 16 mechanical modules. These mechanical modules interconnect through a common header system. Each module contains two scroll compressors in tandem, with their associated evaporator and condenser heat exchangers, air side coil, expansion valves, etc., to be utilized by the system to provide the cooling and/or heating required by the loads. The chiller/heater is operated by a microprocessor based controller that monitors the status of each refrigerant circuit and provides a signal to operate the compressors as needed. The system leaving chilled water temperature and/or system leaving hot water temperature is used for control of compressor staging, when in auto mode, to determine the need for cooling or heating to the external circuit. In auto mode, the controls will choose what mode of operation each module will operate in. Those modes of operation are cooling mode, heating mode, DHRC mode, and defrost mode. When a module is in cooling mode, the valves in that module change to give only cooling out of that module. When in heating mode, the valves in that module change to give only heat from that module. When in DHRC mode, the valves in that module change to give simultaneous heating and cooling from that module. Lastly when in defrost mode, the valves in that module change to heat the airside coil from having ice buildup on it, if there is no cooling load.

System Control Components:

Master Controller

Each chiller system has a master controller board which communicates with and manages all modules within that chiller system. The master controller is equipped with an 8X22 character display with backlight and a six button keypad. These aid the operator in changing settings, checking faults, monitoring the status of the chiller system, and monitoring the status of the individual modules. The master controller is also the interface to field supplied remote connections such as: Remote start/stop, flow switch inputs, customer alarm outputs, and chilled water reset and load limit reset signals. There is also an optional communication link for either Modbus or BacNet remote monitoring and control of the chiller system.

As Multistack is always improving product performance and reliability, software logic discussed in this document is subject to change without notice.

Module Controller

Each module has its own control board, which sends information to the master controller regarding the temperatures, pressures, and activity of the module. The feedback from the module board determines the status of its circuits. The module board performs safety checks and alerts the master when something is wrong. Loss of communication with the master controller results in the shutdown of that module unless it is in manual mode. The individual module controllers are equipped with an 8x22 character display with backlight and a six button keypad similar to the master controller. These aid the operator in monitoring the status of the individual modules as well as changing settings that are used by that module.

EVD Controller

Also in each Heating/Cooling module will be a secondary control board known as an EVD controller. This EVD controller is used to control additional electronic expansion valves beyond the two that are controlled by the module board. In total there are 4 electronic expansion valve controllers in each module. 1. Cooling EXV 2. Low ambient control valve (ASP only) 3. Heating EXV (ARA only) 4. Defrost valve (ARA only).

Master and Module Controller Buttons

The UP arrow button is used to navigate the menus and to increase the value of digit in a numeric variable field.

The DOWN arrow button is used to navigate the menus and to decrease the value of digit in a numeric variable field.

 The ENTER button is used to make selections when navigating through the menu screens as well as to accept any changes made to settings.

 The ALARM button Displays the current system or module faults. When lit, it indicates that a fault has occurred.

 The PROGRAM button accesses the password protected areas. There are 3 password levels. User, Service, and Manufacturer. Each of these has its own password and will allow different levels or amounts adjustment.

 The ESCAPE button allows the controller to back out of the current menu it is in or if changing a setting, backs out of the change before the ENTER button can be pressed.

Controller Addressing:

Each controller must be assigned an address which uniquely identifies it on the chiller/heater's internal network. The Master Controller must be assigned the address of 30 and module controllers need to be assigned sequential numbers (starting with 1) from 1 through 16. If a remote display is used, it must be assigned an address of 32.

To set the address for the controllers, perform the following steps:

1. Locate the LED screen at the bottom of the controller.
2. Press and hold the button next to the LCD screen until screen brightens.
3. Press the same button as many times as necessary to achieve the address wanted for that board.
4. Wait for the LCD screen to dim, this locks in the address for that board.

Basic operation:

Compressor Staging:

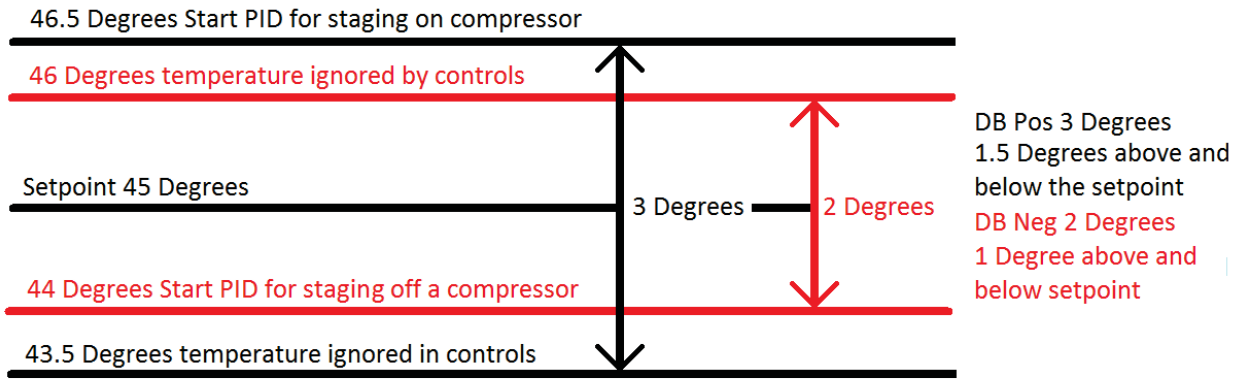
Auto Mode

When the modules are in auto mode, all of the staging of compressors is based on the system (master controller) leaving cold and hot water temperatures. These settings are found in the master controller

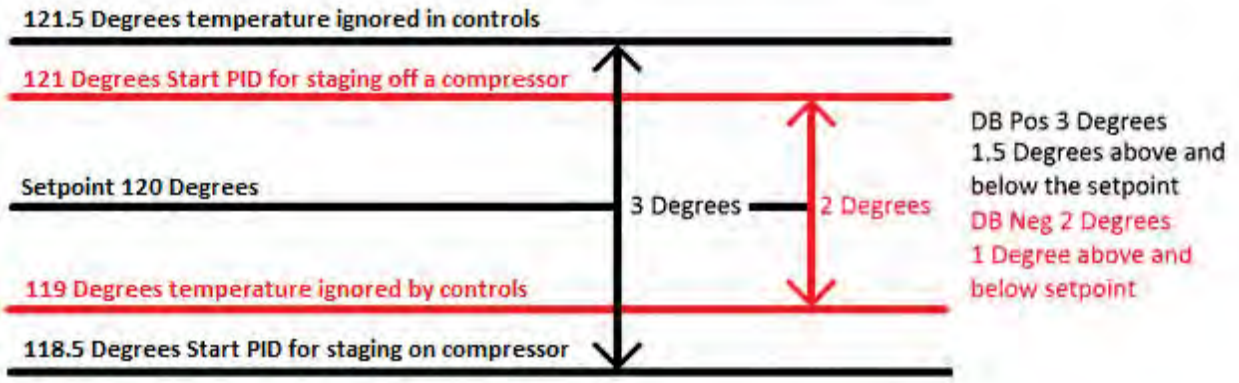
Settings:	Definition
Cooling reg.outlet	
Set (setpoint)	Chill water temperature to be maintained
DB Neg	Dead band around setpoint to start PID for staging off a compressor based on chill water temp. Only half of this value is used
Kp Neg	Proportional setting for PID to stage off a compressor based on chill water temp.
Ti Neg	Integral setting for PID to stage off a compressor based on chill water temp.
DB Pos	Dead band around setpoint to start PID for staging on a compressor based on chill water temp. Only half of this value is used.
Kp Pos	Proportional setting for PID to stage on a compressor based on chill water temp.
Ti Pos	Integral setting for PID to stage on a compressor based on chill water temp.
Heating reg.outlet	
Set (setpoint)	Hot water temperature to be maintained
DB Neg	Dead band around setpoint to start PID for staging off a compressor based on hot water temp. Only half of this value is used.
Kp Neg	Proportional setting for PID to stage on a compressor based on hot water temp.
Ti Neg	Integral setting for PID to stage on a compressor based on hot water temp.
DB Pos	Dead band around setpoint to start PID for staging on a compressor based on hot water temp. Only half of this value is used.
Kp Pos	Proportional setting for PID to stage off a compressor based on hot water temp.
Ti Pos	Integral setting for PID to stage off a compressor based on hot water temp.

The dead bands are both above and below the setpoint so that when looking at the numerical value of the dead band setting, only half that value is used. Note the diagrams below, to see how the dead bands work.

Cooling:



Heating:

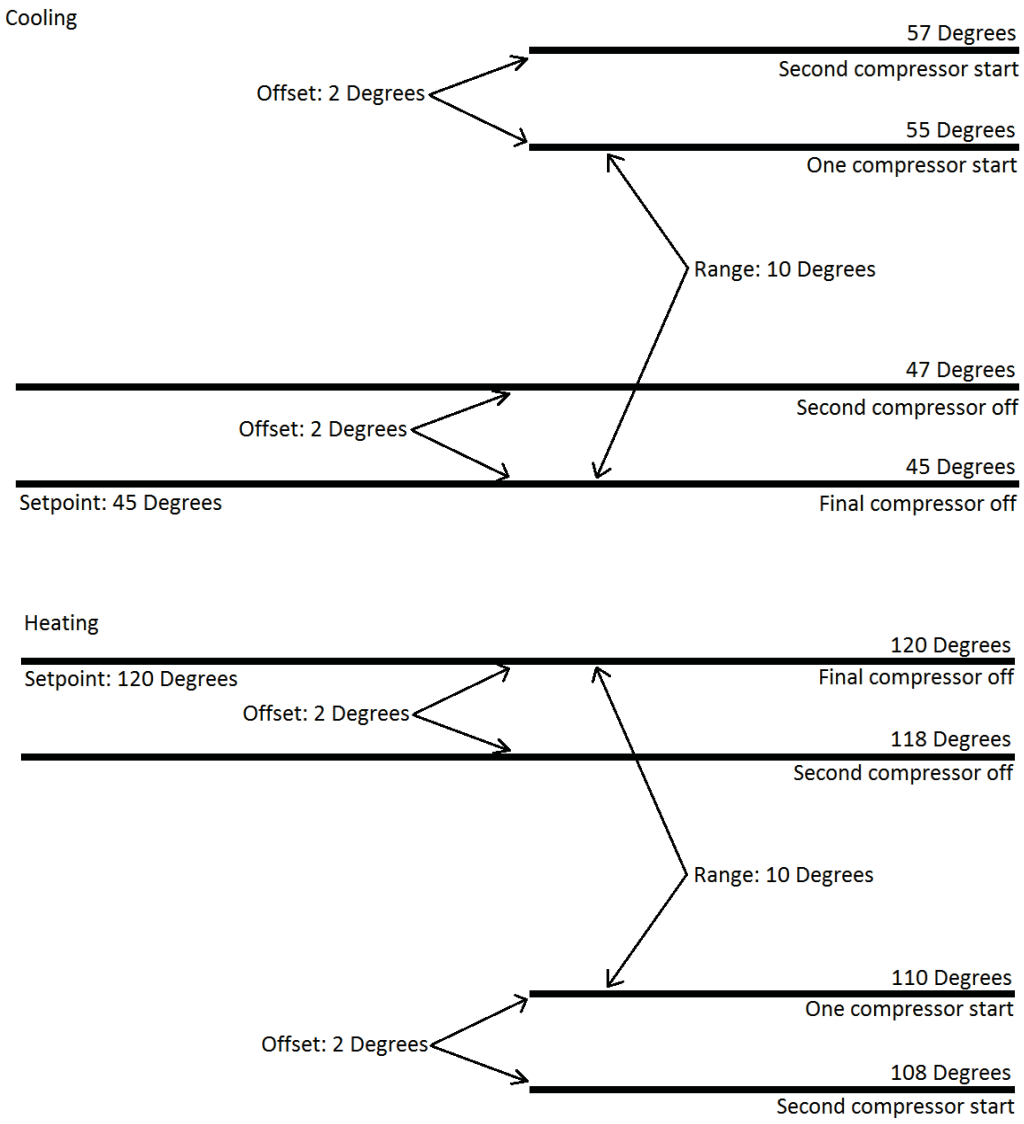


These setpoints do not stage the compressors. These setpoints start the operation of either an on (pos) or an off (Neg) PID control loop. This allows for smoother sequencing of compressors on and off. When between the DP Pos and the DB Neg the PID will not change and compressors will not start or stop. Once outside the dead bands, the PID will increase or decrease to the next demand level that will start or stop the next compressor.

Manual Mode

In manual mode operation, each module can be set to act independently. The modules operation will be dependent on the leaving hot and/or chill water sensors in that module. The settings for the manual mode are found in the module controllers.

Settings:	Cooling	Heating	Definitions
Manual Setpoint	45	120	Temperature where both compressors are off
Manual range	10	10	Temperature difference from setpoint where first compressor starts
Manual offset	2	2	Temperature difference beyond compressor first compressor start point where second starts, and temperature difference from setpoint where second compressor shuts off



Defrost mode:

The defrost mode is used when in heat and the airside coil begins to ice up. There are 2 forms of defrost mode, cooling defrost, and heating defrost. The cooling defrost forces the module into cooling mode so that the chill water that is created can supply chill water to the building. If the chill water pumps are disabled, or if the chill water temperature is already too cold, then the module entering defrost mode will go into heating defrost where the waterside condenser becomes an evaporator to draw heat from the hot water loop to de-ice or defrost the airside coil.

The defrost mode is entered when the saturated suction temperature drops below the current threshold for defrost. That threshold is a changing value based on the ambient temperature. The lower the ambient temperature is the colder the saturated suction has to get to enable defrost based on the settings below:

Defrost		
	E036 Min thr.:	The minimum saturated suction temperature to engage defrost
	Ext.temp:	The ambient temperature that sets the Min thr.
	E037 Max thr.:	The Maximum saturated suction temperature to engage defrost
	Ext.temp:	The ambient temperature that sets the Max thr.
Defrost threshold		
	E038 End:	Saturated discharge temp that will disable defrost mode
Cool Vlv Cutoff/Offset		
	E0xx Defrost:	Temperature of chill water leaving the module where the defrost mode will be done in heat defrost
	E0xx Valve:	Temperature above Defrost that the module will be allowed to run in cooling defrost.

Section 1.2 System Interface: Master Controller

Main Screen

The Main screen displays the heating and cooling entering and leaving temperatures, their setpoints, and what mode we are in using arrows pointing to Heat and/or Cool. There are also status lines showing what the machine is currently doing via: Standby, Comp on, etc. In the lower right corner is a quick reference menu for viewing all of the operating conditions. By pressing the up or down arrow buttons the choice within the quick reference menu will change. The choices are  Information/status,  On/Off control, and  Inputs and outputs. By pressing the enter button on any one of these it will bring you into that menu.

The pages within the information/status  menu are as follows:

Page 1. Info – system

Cooling req.: Shown in percentage, notes the amount of the machine that wants to be running based on cooling demand.

Heating req.: Shown in percentage, notes the amount of the machine that wants to be running based on heating demand.

Cap: Shown in percentage, notes how many compressors by percentage of the whole that are currently running for cooling and for heating.

Comps ON: Shown numerically, notes how many compressors are physically running.

Page 2 & 3. Info – system

Countdown timers: Shown in seconds for cooling stage up and down, heating stage up and down as well as simultaneous DHRC stage up and stage down. The stage up timers are the time left after the start of a compressor before another compressor will be allowed to start in that mode. The stage down timers are the time left after the stop of a compressor before another compressor will be allowed to stop when in normal operation.

Page 4. Module 1 – Comps

Envelope: Shown in various text statements, notes how the compressors are operating within their operating envelopes.

Discharge Pressure: Shown in pressure and saturated temperature, notes the current operating discharge pressure that the compressors in that module are currently operating under. Most compressor safeties are based on the saturated temperature that is calculated from that discharge pressure.

Comp.1 and Comp.2: Shown in On or Off, operating status of compressors in that module

Suction Temperature: Shown as temperature (F or C), notes the actual temperature of the suction line that feeds back to the compressor.

Suction Pressure: Shown in pressure and saturated temperature, notes the current operating suction pressure that the compressors in that module are currently operating under. Most compressor safeties are based on the saturated temperature that is calculated from that suction pressure.

Suction SH: Superheat shown as temperature (F or C), notes the temperature difference between the actual suction temperature and the saturated suction temperature.

Page 5. Module 1 – EEV

Regulation: Shown in percentage and number of steps, notes how far open each electronic valve is in the module. In an ARA module the available valves are cooling valve, heating valve, and a defrost valve. In a cooling only ASP module, the available valves are cooling valve, and hot gas valve (this valve is incorrectly labeled should be low ambient control valve).

Page 6. Module 1 – Source

Temp: Shown as temperature (F or C), Shows first the saturated suction temperature then the saturated discharge temperature. These temperatures are used to control the fans in heating mode and cooling mode respectively.

Set: Shown as temperature (F or C), Notes the setpoint for the saturated suction temperature and saturated discharge temperature for controlling the fans.

Fan #: Shown in percentage, notes the demand signal sent to each fan. There could be as many as 4 fans on a module.

Page 7. Module 1 – Plant

Cool Outlet: Shown as temperature (F or C), notes the leaving chill water temperature leaving the module.

Valve: Shown as Percentage or Close/Open dependent on type of valve used, notes what the output to the chill water valve currently is.

Feedback: Shown as Percentage or Close/Open dependent on type of valve used, notes the response from the valve actuator telling its actual position.

To see the information from module 2 on, continue scrolling down. Pages 4-7 repeat for each module.

Page 8. Info

From this page you could press enter to access the 

menu or, access it from the main screen.

The Pages within the input/output 

menu are as follows:

Page 1. Inputs/outputs

Heating and cooling reset: Shown in percentage, notes the external inputs to the controller that can reset the chill water and hot water temperature setpoints by as much as 10 degrees each.

Ambient temp.: Shown as a temperature (F or C), notes the outside air temperature around the machine.

Page 2. Inputs/outputs

Entering and leaving (in and out) cooling and heating water temperatures: Shown as temperature (F or C), notes the actual entering and leaving temperatures from the system (all of the modules not individual modules).

Page 3 & 4. Inputs/outputs

Digital inputs: each digital input is shown with a switch to show if the connection is open or closed and an On/Off value. The digital inputs at the system level are as follows:

Ex1 customer in: emergency shut down for the controller needs to be closed for the machine to operate.

Cool start: hardwired cooling mode enable, must be closed to operate the machine.

Heat start: hardwired heating mode enable, must be closed to operate the machine.

Phase monitor: main power safety input, must be closed to operate the machine.

Cool flow sw.: main chill water flow safety, must be closed to operate the machine, has a delay between enable and first looking for flow.

Heat flow sw.: main hot water flow safety, must be closed to operate the machine, has a delay between enable and first looking for flow.

Glycol feeder: input from level sensor in glycol feeder does not stop unit from operating, creates alarm.

Page 5 & 6. Inputs/outputs

Digital outputs: Each digital output is shown with a switch to show if the connection is open or closed and an On/Off value. The digital outputs at the system level are as follows:

Cool full load: 24 Volt AC output to note that all available compressors are currently running in cooling.

Cool run: 24 Volt AC output to note that at least one compressor is running in cooling.

Cool pump: 24 Volt AC output to start a chill water pump.

Heat full load: 24 Volt AC output to note that all available compressors are currently running in heating.

Heat run: 24 Volt AC output to note that at least one compressor is running in heating.

Heat Pump: 24 Volt AC output to start a hot water pump.

Page 7. Inputs/outputs U1

The Master currently displays the inputs and outputs for the first module only. To see the rest of the module I/O you will need to do so at the module controller.

Compressor sensors

Suct. press: Shown in pressure, notes actual current suction pressure.

Suct. temp: Shown as temperature (F or C), notes actual current suction temperature.

Disch. press: Shown in pressure, notes actual current discharge pressure.

Page 8. Inputs/outputs U1

Water sensors

Cooling: Shown as temperature (F or C), notes the actual current leaving chill water temperature from the first module.

Heating: Shown as temperature (F or C), notes the actual current leaving hot water temperature from the first module.

Cool valve fbk: Shown in percentage, notes the reported position of the chill water control valve in the first module.

Heat valve fbk: Shown in percentage, notes the reported position of the hot water control valve in the first module.

Page 9, 10, & 11. Inputs/outputs U1

Digital inputs: each digital input is shown with a switch to show if the connection is open or closed and an On/Off value. The digital inputs at the first module are as follows:

Manual mode: Shows if the first module is in manual mode.

Auto mode: Shows if the first module is in auto mode.

High press.: Shows if the head pressure switch is open or closed. It must be closed to operate the module.

Phase monitor: Shows if the Power monitor in the first module is in alarm. Its contact must be closed to operate the module.

Circ.1 aux: Shows the feedback from the contactor of compressor 1.

Circ.1 overload: Shows the status from the motor temperature safety in compressor 1.

Circ.2 aux: Shows the feedback from the contactor of compressor 1.

Circ.2 overload: Shows the status from the motor temperature safety in compressor 1.

Cool water flow: Shows status of chill water flow switch.

Cool 4way feedback: Shows the 4 2way valves used for mode change are in cooling position.

Cool water feedback: Shows the position of an on/off chill water valve.

Heat water flow: Shows status of hot water flow switch.

Heat 4way feedback: Shows the 4 2way valves used for mode change are in heating position.

Heat water feedback: Shows the position of an on/off hot water valve.

Page 12, 13, & 14. Inputs/outputs U1

Digital outputs: Each digital output is shown with a switch to show if the connection is open or closed and an On/Off value. The digital outputs at the first module are as follows:

Compressor 1: Output from module board that pulls in compressor 1 contactor.

Compressor 2: Output from module board that pulls in compressor 2 contactor.

Solenoid valve: Output from module board to open or close the liquid line solenoid (used in ASP only).

4way cooling: Output to move the 4 2-way valves into cooling position.

4way heating: Output to move the 4 2-way valves into heating position.

General alarm: Output to turn on alarm light on manual/off/auto switch housing.

Condenser fan 1: Output to enable the first set of fans in the first module.

Condenser fan 2: Output to enable the second set of fans in the first module.

Panel fan: Output to enable the control panel cooling fan

Receiver valve: Output to control a solenoid valve to disable the dynamic receiver. NOT USED IN CURRENT DESIGN.

Open cool valve: Output to open an optional on/off chill water valve.

Open Heat valve: Output to open an optional on/off hot water valve.

Page 15. Inputs/outputs U1

Analog outputs: Each analog output is shown as a percentage for the amount of signal being sent out to that device.

Condenser VFD 1: Output signal for the speed of the first set of fans.

Condenser VFD 2: Output signal for the speed of the first set of fans.

Cool valve: Output signal for control of the modulating chill water valve.

Heat valve: Output signal for control of the modulating hot water valve.

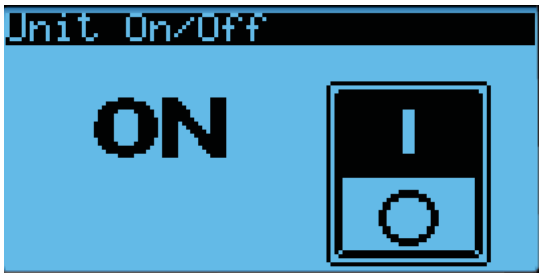
Page 16, 17. Info

These three screens have information not currently used by Multistack.

Page 18. Info

This page contains the program version. This program version must match the program version on the modules for them to communicate correctly.

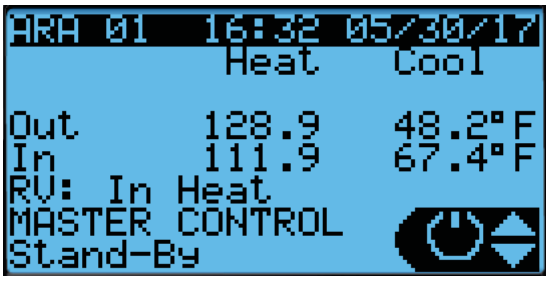
From the Main screen if the  On/Off control quick menu is chosen it will bring up an on-screen switch:



This switch can be turned on and off by use of the up and down arrows. If BAS communications are starting and stopping the machine, then this will only temporarily shut off the machine.

Section 1.3 System interface: Module Controller

Main screen



The Main screen displays the number of the module, and if that module is designated for heating and cooling (ARA), or cooling only (ASP). It then displays the time and date, as well as the heating and cooling entering and leaving temperatures from the module, and what mode it is in using arrows pointing to Heat and/or Cool. There are also status lines showing what the machine is currently doing via: In Heat, High Delta Pressure, Off By Alarm, etc. In the lower right corner is a quick reference menu for viewing all of the operating conditions. By pressing the up or down arrow buttons the choice within the quick reference menu will change. The choices are  for

Information/status,  for On/Off control, and  for Inputs and outputs. By pressing the enter button on any one of these it will bring you into that menu.

The pages within the information/status  menu are as follows:

Page 1. Module # – Comps

Envelope: Shown in various text statements, notes how the compressors are operating within their operating envelopes.

Discharge Pressure: Shown in pressure and saturated temperature, notes the current operating discharge pressure that the compressors in that module are currently operating under. Most compressor safeties are based on the saturated temperature that is calculated from that discharge pressure.

Comp.1 and Comp.2: Shown in On or Off, operating status of compressors in that module

Suction Temperature: Shown as temperature (F or C), notes the actual temperature of the suction line that feeds back to the compressor.

Suction Pressure: Shown in pressure and saturated temperature, notes the current operating suction pressure that the compressors in that module are currently operating under. Most compressor safeties are based on the saturated temperature that is calculated from that suction pressure.

Suction SH: Superheat shown as temperature (F or C), notes the temperature difference between the actual suction temperature and the saturated suction temperature.

Page 2. Module # – EEV

Regulation: Shown in percentage and number of steps, notes how far open each electronic valve is in the module. In an ARA module the available valves are cooling valve, heating valve, and a defrost valve. In a cooling only ASP module, the available valves are cooling valve, and hot gas valve (this valve is incorrectly labeled should be low ambient control valve).

Page 3. Module # – Source

Temp: Shown as temperature (F or C), Shows first the saturated suction temperature then the saturated discharge temperature. These temperatures are used to control the fans in heating mode and cooling mode respectively.

Set: Shown as temperature (F or C), Notes the setpoint for the saturated suction temperature and saturated discharge temperature for controlling the fans.

Fan #: Shown in percentage, notes the demand signal sent to each fan. There could be as many as 4 fans on a module.

Page 4. Module # – Plant

Cool Outlet: Shown as temperature (F or C), notes the leaving chill water temperature leaving the module.

Valve: Shown as Percentage or Close/Open dependent on type of valve used, notes what the output to the chill water valve currently is.

Feedback: Shown as Percentage or Close/Open dependent on type of valve used, notes the response from the chill water valve actuator telling its actual position.

Page 5. Module # – Plant

Heat Outlet: Shown as temperature (F or C), notes the leaving chill water temperature leaving the module.

Valve: Shown as Percentage or Close/Open dependent on type of valve used, notes what the output to the hot water valve currently is.

Feedback: Shown as Percentage or Close/Open dependent on type of valve used, notes the response from the hot water valve actuator telling its actual position.

Page 6. Module # - Plant

Reversing valves

DeltaP: Shown in pressure, gives the difference in pressure between the discharge and the suction. If that difference is too high the module will open the cooling and the heating expansion valves to equalize the pressures across the 4 2-way valves so that the valves do not get bound up.

Hold Comps Off: Shown as Yes or No, this denotes if the compressors are being kept off until the pressures equalize.

Current State: Shown as text, this denotes if the compressors are running, waiting, or off. If the compressors are waiting, it will also denote what the reason is, such as high delta pressure.

Act Feedback: Shown as Yes or No for both Heating and Cooling. This denoted the feedback from the 4 2-way valves to show what position they are in.

Page 7. Info

From this page you could press enter to access the 

menu or, access it from the main screen.

Page 1. Inputs/outputs

Compressor sensors

Suct. press: Shown in pressure, notes actual current suction pressure.

Suct. temp: Shown as temperature (F or C), notes actual current suction temperature.

Disch. press: Shown in pressure, notes actual current discharge pressure.

Page 2. Inputs/outputs

Water sensors

Cooling: Shown as temperature (F or C), notes the actual current leaving chill water temperature from the first module.

Heating: Shown as temperature (F or C), notes the actual current leaving hot water temperature from the first module.

Cool valve fbk: Shown in percentage, notes the reported position of the chill water control valve in the first module.

Heat valve fbk: Shown in percentage, notes the reported position of the hot water control valve in the first module.

Page 3, 4, & 5. Inputs/outputs

Digital inputs: each digital input is shown with a switch to show if the connection is open or closed and an On/Off value. The digital inputs at the first module are as follows:

Manual mode: Shows if the first module is in manual mode.

Auto mode: Shows if the first module is in auto mode.

High press.: Shows if the head pressure switch is open or closed. It must be closed to operate the module.

Phase monitor: Shows if the Power monitor in the first module is in alarm. Its contact must be closed to operate the module.

Circ.1 aux: Shows the feedback from the contactor of compressor 1.

Circ.1 overload: Shows the status from the motor temperature safety in compressor 1.

Circ.2 aux: Shows the feedback from the contactor of compressor 1.

Circ.2 overload: Shows the status from the motor temperature safety in compressor 1.

Cool water flow: Shows status of chill water flow switch.

Cool 4way feedback: Shows the 4 2way valves used for mode change are in cooling position.

Cool water feedback: Shows the position of an on/off chill water valve.

Heat water flow: Shows status of hot water flow switch.

Heat 4way feedback: Shows the 4 2way valves used for mode change are in heating position.

Heat water feedback: Shows the position of an on/off hot water valve.

DHrc fbk: Information not currently used in operation

CoolOnly fbk: Information not currently used in operation (possibly internal logic instead of actual input)

Cond fan ovld: Shows fan overload/fault response

Page 6, 7, & 8. Inputs/outputs

Digital outputs: Each digital output is shown with a switch to show if the connection is open or closed and an On/Off value. The digital outputs at the first module are as follows:

Compressor 1: Output from module board that pulls in compressor 1 contactor.

Compressor 2: Output from module board that pulls in compressor 2 contactor.

Solenoid valve: Output from module board to open or close the liquid line solenoid (used in ASP only).

4way cooling: Output to move the 4 2-way valves into cooling position.

4way heating: Output to move the 4 2-way valves into heating position.

General alarm: Output to turn on alarm light on manual/off/auto switch housing.

Condenser fan 1: Output to enable the first set of fans in the first module.

Condenser fan 2: Output to enable the second set of fans in the first module.

Panel fan: Output to enable the control panel cooling fan

Receiver valve: Output to control a solenoid valve to disable the dynamic receiver. NOT USED IN CURRENT DESIGN.

Open cool valve: Output to open an optional on/off chill water valve.

Open Heat valve: Output to open an optional on/off hot water valve.

Page 9. Inputs/outputs

Analog outputs: Each analog output is shown as a percentage for the amount of signal being sent out to that device.

Condenser VFD 1: Output signal for the speed of the first set of fans.

Condenser VFD 2: Output signal for the speed of the first set of fans.

Cool valve: Output signal for control of the modulating chill water valve.

Heat valve: Output signal for control of the modulating hot water valve.

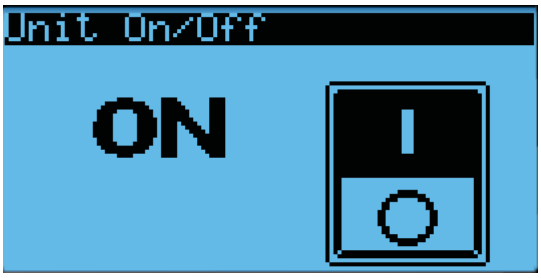
Page 10,11. Info

These three screens have information not currently used by Multistack.

Page 12. Info

This page contains the program version. This program version must match the program version on the master and the other modules for them to communicate correctly.

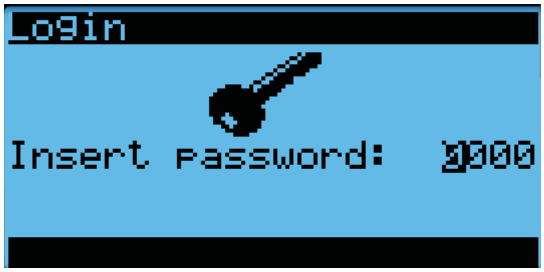
From the Main screen, if the  On/Off control quick menu is chosen it will bring up an on-screen switch:



This switch can be turned on and off by use of the up and down arrows. Turning it off will disable the module you are currently working with. The module will need to be turned back on in order to run.

Section 1.4 Main menu: Master Controller

To enter the main menu, press the target button. The controller will ask for a password. There are three levels of password:



User: Can be used to view settings but not change them.

Technician: Gives access to change most of the more common settings.

Manufacturer: Gives access to all settings.

To input a password, use the up and down arrows to choose a number in the first digit then press the enter button to continue to the next digit until all of the digits are filled.

If the correct password is inputted you will have access to the main menu. The main menu consists of 7 other menus. Those menus are:

A. Plant: System wide control
B. EEV: Electronic valve control
C. Comps: Compressor control
D. Source: Ambient and fan control
E. Alarm logs: Does not currently operating at the master controller level
F. Settings: Basic setup: communications, unit of measurement, etc…
G. Logout: Logs out of from secure password areas

Menus A, B, C, and D are for the main staging of compressors and the operation of valves. Note, in the master control, or the system control, there are no electronic valves or compressors so there are little to no settings in these menus at the master.

The following are all of the settings from menus A-D in the master controller.

	Menu Item	Options	Description
Plant Menu			
	Cooling pump		
	A000 Next thr.:	Hours	How many hours until maintanance alarm
	Reset h.:	yes/no	Resets run hours to zero

		A001 Manual:	Auto/Manual/ON	How the chill water pump is operated
	Heating Pump			
		A002 Next thr.:	Hours	How many hours until maintanance alarm
		Reset h.:	yes/no	Resets run hours to zero
		A003 Manual:	Auto/Manual/ON	How the chill water pump is operated
	Bypass Settings - Cool			
		Cool Bypass type:	Continuous / Chiller on	Chill water minimum flow bypass always open or only open when cooling is enabled
		Axxx Cool Min:	Percentage	How much of the modulating valves are open to allow for chill water system minimum flow
	Bypass Settings - Heat			
		Heat Bypass type:	Continuous / Chiller on	Chill water minimum flow bypass always open or only open when heating is enabled
		Axxx Heat Min:	Percentage	How many of the modulating valves are forced open to allow for hot water system minimum flow
	Regulation type			
		Axxx Type:	Inlet/Outlet	Only Outlet is currently available at this time
	Cooling Regulation			
		Axxx DB Neg.:	Temperature	Deadband for unloading
		Axxx Ti Neg.:	Seconds	Integral time for unloading. (set Lower to Speed Up Higher to Slow Down)
		Axxx DB Pos.:	Temperature	Deadband for loading
		Axxx Ti Pos.:	Seconds	Integral time for loading. (set Lower to Speed Up Higher to Slow Down)
	Heating Regulation			
		Axxx DB Neg.:	Temperature	Deadband for unloading
		Axxx Ti Neg.:	Seconds	Integral time for unloading. (set Lower to Speed Up Higher to Slow Down)
		Axxx DB Pos.:	Temperature	Deadband for loading
		Axxx Ti Pos.:	Seconds	Integral time for loading. (set Lower to Speed Up Higher to Slow Down)
	Cooling reg.outlet			
		Axxx Set:	Temperature	Chill water setpoint
		Axxx Kp Neg.:		Proportional Gain for Unloading
		Axxx Kp Pos.:		Proportional Gain for loading
	Heating reg.outlet			
		Axxx Set:	Temperature	Chill water setpoint
		Axxx Kp Neg.:		Proportional Gain for Unloading
		Axxx Kp Pos.:		Proportional Gain for loading
	Cool Flow Alarm			
		A0xx Enable:	On/Off	Enables or disables chill water flow safety
		A030 Startup:	seconds	Time after start of pumps till flow switch fault can occour

		A031 Running:	seconds	Time during operation that the flow switch needs to be closed before a response
	Delay cooling pumps			
		A032 Pump On to Comp On:	seconds	Amount of time from the Pumps being started until the first compressor is allowed to try and start
		A033 Comp Off to pump Off:	seconds	Amount of time from the last compressor to stop till the pumps are disabled.
	Rotation Staging			
		A0xx Comp Fbk Wait :	yes/no	Does not work at this time
		Stage Delay:	seconds	Does not work at this time
		A0xx Overstage:	seconds	Does not work at this time
	Heat Flow Alarm			
		A0xx Enable:	On/Off	Enables or disables hot water flow safety
		A030 Startup:	seconds	Time after start of pumps till flow switch fault can occour
		A031 Running:	seconds	Time during operation that the flow switch needs to be closed before a response
	Delay heating pumps			
		A032 Pump On to Comp On:	seconds	Amount of time from the Pumps being started until the first compressor is allowed to try and start
		A033 Comp Off to pump Off:	seconds	Amount of time from the last compressor to stop till the pumps are disabled.
	Cooling antifreeze			
		Thresh:	Temperature	Saturated Suction temp for low temperature safety
		Diff.:	Temperature	Amount of temp rise from freeze protection for reset
		Delay:	seconds	Time from reaching freeze protection point to causing a fault.
	% of Comp in Alarm			
		Max %	Percentage	Total percentage of machine that needs to fail before sending a physical alarm output
	Heating Overheat			
		Thresh:	Temperature	Leaving hot water temp for high temp safety
		Diff.:	Temperature	Amount of temp drop from overheat protection for reset
		Delay:	seconds	Time from reaching overheat protection point to causing a fault.
	Outlet water offset			
		Cooling A040 Offset:	Temperature	Calibration point for leaving chill water temperature sensor
		Heating A041 Offset:	Temperature	Calibration point for leaving hot water temperature sensor

	Reset Signal			
		Axxx Cooling Reset:	None/Load Limit/Reset	sets what type of reset is being used on the cooling side of the machine
		Axxx Heating Reset:	None/Load Limit/Reset	sets what type of reset is being used on the heating side of the machine
	Inlet water offset			
		Cooling Axxx Offset:	Temperature	Calibration point for leaving chill water temperature sensor
		Heating Axxx Offset:	Temperature	Calibration point for leaving hot water temperature sensor
	Custom reset			
		Cooling Axxx Offset:	%	Calibration point for chill water reset input
		Heating Axxx Offset:	%	Calibration point for hot water reset input
	Digital input logic			
		A042 Water flow:	Alarm if open/Alarm if closed	choice of fault condition to create flow alarm
		A0## System type:	Auto/Heat/Cool/DHRC	Auto – switched from heat/cool/DHRC as demand allows. Heat – like heat mode on a heat pump with the airside coil as the evaporator. Cool – operates like any air cooled chiller. DHRC – simultaneous heating and cooling with the air side coil disabled.
		A0## Priority:	Cool/Heat	When in Auto Mode, which of the two systems has priority.
	Cooling reset signal			
		Axxx Act Set:	Temperature	Actual Heating setpoint (not adjustable on this page)
		Axxx Type:	0-10V/0-1V/.5 – 4.5V/0-20 mA/0-5VDC/0-5V/4-20 mA	Signal for input
		Axxx Direction:	DIR/REV	to allows for forward or reverse acting input signal
		Axxx Range:	Temperature	Total amount of temperature reset allowed
		Axxx Min: % :		Minimum percentage of reset signal during operation
		Axxx Max: % :		Maximum percentage of reset signal during operation
	Heating reset signal			
		Axxx Act Set:	Temperature	Actual Heating setpoint (not adjustable on this page)
		Axxx Type:	0-10V/0-1V/.5 – 4.5V/0-20 mA/0-5VDC/0-5V/4-20 mA	Signal for input

		Axxx Direction:	DIR/REV	to allows for forward or reverse acting input signal
		Axxx Range:	Temperature	Total amount of temperature reset allowed
		Axxx Min: % :	Percentage	Minimum percentage of reset signal during operation
		Axxx Max: % :	Percentage	Maximum percentage of reset signal during operation
	Module			
		Axxx Module number:		Total number of modules in chiller
		Comps Per Module:		number of compressors per module
Compressor Menu				
	Staging time			
		Ca00 Stage up:	seconds	time delay in master between starts of compressors
		Ca01 Stage down:	seconds	time delay in master between stops of compressors
Source Menu				
	Probe offset			
		E051 Offset:	Temperature	Calibration point for ambient temperature sensor

Menu E. Alarm logs, is not currently operating in the master controller

Menu F. Settings, both the master and module controllers share these choices except those noted below.

Settings Menu				
	Date/Time			
		Format:	MM/DD/YY, DD/MM/YY, YY/MM/DD,	This will allow choice of how the date is displayed on the main screen
		Date:	MM/DD/YY	Allows the setting of the date. Always displays here as month/day/year
		Hour:	HH/MM/SS	Allows for the setting of the clock. The clocks in each board are not currently linked in the software. They have to be set separately.
		Day:	Day of week	allows for the setting of day of the week in this controller.
	UoM			
		Unit of measurement UI:	USA/CAN/UK/SI/NC	Allows for a choice of what units of measurement are shown on the display of this controller

		Unit of measurement BMS:	USA/CAN/UK/SI/NC	Allows for a choice of what units of measurement are shown to the BMS from this controller (only available in the master)
	Language			
		Language:	English	Don't try to change it you will mess things up
	Serial ports			
		Serial ports		there is nothing to change here in the master. The module level settings are not active either.
	Pwd Change			
		Change Password	3 levels of password	Only your level of password and lower will be displayed and be available for change
	Initilization			
		Delete alarm logs	Y or N	Clears fault history. Not currently active in the master controller
		Clear counters	Y or N	Clears all timers currently running
		Enable buzzer	Y or N	enables or disables the BEEP heard with each button push
		Unit Conf.		
		Import/Export	IMPORT/EXPORT	Allows the uploading or downloading of settings to a separate file
		Memory type:	INTERNAL FLASH MEMORY/USB	Choice of where to save or retrieve the settings from
		File name:	EXPORT_XX	Name of file to save or recall will always be EXPORT but the XX is a changeable numerical value
		Confirm:	NO/YES	Once the previous three settings are complete, this verifies if you want to save or recall that file
	Input/Output			
		These settings are for the manufacturer level user		Other than setting the BAS communications settings in the master, do not adjust without permission from Multistack

Menu G. Logout, this menu simply allows someone with a higher level password to log out so others can't make changes. The main menu is logged out any time buttons aren't pressed for about 2 minutes.

Section 1.5 Main menu: Module Controller

To enter the main menu, press the target button. The controller will ask for a password. There are three levels of password:

User: Can be used to view settings but not change them.

Technician: Gives access to change most of the more common settings.

Manufacturer: Gives access to all settings.

To input a password, use the up and down arrows to choose a number in the first digit then press the enter button to continue to the next digit until all of the digits are filled.

If the correct password is inputted you will have access to the main menu. The main menu consists of 7 other menus. Those menus are:

A. Plant: System wide control
B. EEV: Electronic valve control
C. Comps: Compressor control
D. Source: Ambient and fan control
E. Alarm logs: Does not currently operating at the master controller level
F. Settings: Basic setup: communications, unit of measurement, etc…
G. Logout: Logs out of from secure password areas

Menus A, B, C, and D are for the operation of the refrigerant circuit and the accompanying components.

	Menu Item	Options	Description
Plant Menu			
	Manual mode		
	Axxx Type:	Cooling/Heating/DHRC	Choose what mode is preferred when Manual mode switch is made.
	Manual cooling reg.		
	Axxx Set:	Temperature	Cooling setpoint in Manual mode
	Axxx Range:	Temperature	Temp above Cooling setpoint where the first compressor starts
	Axxx Offset:	Temperature	Temp above both Cooling setpoint and range where the second compressor stages on and off
	Manual heating reg		
	Axxx Set:	Temperature	Heating setpoint in Manual mode
	Axxx Range:	Temperature	Temp below heating setpoint where the first compressor starts
	Axxx Offset:	Temperature	Temp below both heating setpoint and range where the second compressor stages on and off
	Cool valve regulation		
	Axxx Tau:		Carel logic to slow rate of change of the physical 2 to 10vcd signal (input or output)
	Axxx Setpoint:	Temperature	Chill water valve control valve setpoint.
	Axxx Kp:		Proportional Gain (set lower to Speed up, Higher to slow down)
	Axxx Ti Neg:	seconds	Integral time when below setpoint (Set lower to speed up, higher to slow down
	Axxx TI Pos:	seconds	Integral time when above setpoint (Set lower to speed up, higher to slow down

	Heat valve regulation		
	Axxx Tau:		Carel logic to slow rate of change of the physical 2 to 10vcd signal (input or output)
	Axxx Setpoint:	Temperature	Chill water valve control valve setpoint.
	Axxx Kp:		Proportional Gain (set lower to Speed up, Higher to slow down)
	Axxx Ti Neg:	seconds	Integral time when below setpoint (Set lower to speed up, higher to slow down)
	Axxx TI Pos:	seconds	Integral time when above setpoint (Set lower to speed up, higher to slow down)
	Mod.Cooling valve		Water valve control
	Axxx Reverse:	Yes/No	notes if this valve is reverse acting (10 to 2 VDC rather than 2 to 10 VDC)
	A056 Regulation	MOD/ I/O /None	sets if the valve is modulating, on/off, or disabled.
	Axxx Offset Chk:	Percentage	Amount of difference between actual valve position and expected valve position before faulting the valve
	Mod.Heatling valve		Water valve control
	Axxx Reverse:	Yes/No	notes if this valve is reverse acting (10 to 2 VDC rather than 2 to 10 VDC)
	A056 Regulation	MOD/ I/O /None	sets if the valve is modulating, on/off, or disabled.
	Axxx Offset Chk:	Percentage	Amount of difference between actual valve position and expected valve position before faulting the valve
	Mod.valve conf.		
	Cooling		Water valve control
	Axxx Min Volt:	DC Voltage	Minimum voltage sent to the valve to close it
	Axxx Max Volt:	DC Voltage	Maximum Voltage sent to the valve to open it fully
	Axxx Min Open:	Percentage	Minimum Percentage the valve can be open during operation
	Axxx Max Open:	Percentage	Maximum percentage the valve can be open during operation
	Mod.valve conf.		
	Heating		Water valve control
	Axxx Min Volt:	DC Voltage	Minimum voltage sent to the valve to close it
	Axxx Max Volt:	DC Voltage	Maximum Voltage sent to the valve to open it fully
	Axxx Min Open:	Percentage	Minimum Percentage the valve can be open during operation
	Axxx Max Open:	Percentage	Maximum percentage the valve can be open during operation
	Cool flow alarm		
	A0xx Enable:	On/Off	Enables flow fault in module

		A030 Startup:	Seconds	Amount of time before flow switch is looked at to create a flow fault on start of the refrigerant circuit
		A031 Running:	Seconds	Amount of time till a flow switch creates a fault when the refrigeration circuit is in normal operation
	Delay cooling pumps			This page should not be in module to be removed
		A032 Pump ON to Comp ON:	Seconds	amount of time till a compressor can start after the master sends a signal to start a pump
		A033 Comp OFF to pump OFF:	Seconds	amount of time from the shutting off of a compressor to till the master disabling the pumps
	Rotation Staging			
		A0xx Comp Fbk Wait	Yes/No	Not Currently Used
		Stage Delay	Seconds	Not Currently Used
		A0xx Overstage	Seconds	Not Currently Used
	Heat flow alarm			
		A0xx Enable:	On/Off	Enables flow fault in module
		A030 Startup:	Seconds	Amount of time before flow switch is looked at to create a flow fault on start of the refrigerant circuit
		A031 Running:	Seconds	Amount of time till a flow switch creates a fault when the refrigeration circuit is in normal operation
	Flow alarm			
	Auto reset untill count			
		A0xx Enable:	On/Off	enables auto resetting. If off, any flow fault is an manual reset
		A0xx Max counts:		Number of times a flow fault can happen within the time of the Retry Limit before a manual reset is necessary
		A0xx Retry Limit	Hours	Amount of time allowed for Max Counts of flow faults to happen before manual reset is necessary
		A0xx Reset Delay	Seconds	Amount of time between an auto resetting flow fault and its ability to reset
	Delay heating pumps			This page should not be in module to be removed
		A032 Pump ON to Comp ON:	Seconds	amount of time till a compressor can start after the master sends a signal to start a pump
		A033 Comp OFF to pump OFF:	Seconds	amount of time from the shutting off of a compressor to till the master disabling the pumps
	Cooling antifreeze			

		Thresh:	Temperature	SATURATED SUCTION TEMPERATURE where a freeze protection fault will occur
		Diff.:	Temperature	Amount of rise in Saturated suction temperature to allow for reset of freeze protection fault
		Delay:	Seconds	Amount of time Saturated suction temperature needs to be below threshold to initiate a freeze protection fault
	Heating overheat			
		Thresh:	Temperature	Leaving hot water temperature where a overheat protection fault will occur
		Diff.:	Temperature	Amount of drop in Hot water temperature to allow for reset of freeze protection fault
		Delay:	Seconds	Amount of time Hot water temperature needs to be above threshold to initiate a freeze protection fault
		Defrost:	Temperature	Water Valve leaving water control setpoint for condenser when in defrost
	Heating antifreeze			Settings when in Heating Defrost mode
		Thresh:	Temperature	SATURATED SUCTION TEMPERATURE where a freeze protection fault will occur
		Diff.:	Temperature	Amount of rise in Saturated suction temperature to allow for reset of freeze protection fault
		Delay:	Seconds	Amount of time Saturated suction temperature needs to be below threshold to initiate a freeze protection fault
	Outlet water offset			Cooling
		A040 Offset	Temperature	Amount of adjustment to chill water leaving sensor for calibration
	Outlet water offset			Heating
		A041 Offset	Temperature	Amount of adjustment to hot water leaving sensor for calibration
	Digital input logic			
		A042 Water flow	Open/Closed	what condition does the flow switch signal need to have to create a fault
	Digital output logic			
		A047 Water valves:	Open/Closed	Condition of output to water valves when active
		A048 Panel fan:	Open/Closed	Condition of output to Panel fan when active
	Board Temp			
		A0xx Panel Fan Set:	Temperature	Temperature where the cooling fan for the control panel is started
	Unit type			
		A056 Unit type:	Chiller/Heatpump / Chiller only	Choice of control for ARA or ASP

Logs			
	Log Running:	Yes/No	Enables logging of readings
	Force Log Export:	Yes/No	Creates log file in internal memory for transfer
Valve			
	Cool/Heat valve alarm Disable:	Yes/No	If enabled, will allow for alarms if the heating or cooling water valves are not operating correctly
	Isolation Valves	Yes/No	Allows the controls to know if they are to control refrigerant isolation valves on the original 4-way valve design
	Mode Delay Switch	Seconds	Delay between modes of operation
Compressor Low Pressure Shutdown			
	Set Point:	Pressure	Suction pressure when a fault will occur
	Differential:	Pressure	Rise in Suction pressure necessary to reset fault
	Enable Delay:	Seconds	Time from reaching Low Pressure setpoint until fault occurs
EXV Menu			
Manual positioning			
Valve A			
	B000 Enable:	Check Box	Enabling override of the cooling expansion valve
	B001 Position:	Steps	How many steps the valve is being overridden to
Valve B			Not Changeable on ARA Only ASP
	Bxxx Enable:	Check Box	Enabling override of low ambient valve
	Bxxx Position:	Steps	How many steps the valve is being overridden to
Solenoid Valve			Not Changeable on ARA Only ASP
	Control:	W/Compressor / Always Open	what condition will control the opening of the liquid line solenoid valve in the module
Chiller suction SH			These settings apply to the primary chill water evaporator expansion valve
	B002 Setpoint:	Temperature	Suction superheat setpoint
	B003 Prop.gain:		Proportional setting for superheat control
	B004 Integ.:	Seconds	Integer setpoint for superheat control
	B005 Deriv.:	Seconds	Derivative setpoint for superheat control
	Start op.:	Percentage	Percentage open of expansion valve on start of cooling operation
Heatpump suction SH			These settings apply to the airside evaporator expansion valve
	B002 Setpoint:	Temperature	Suction superheat setpoint
	B003 Prop.gain:		Proportional setting for superheat control
	B004 Integ.:	Seconds	Integer setpoint for superheat control

	B005 Deriv.:	Seconds	Derivative setpoint for superheat control
	Start op.:	Percentage	Percentage open of expansion valve on start of heat pump operation
Defrost suction SH			These settings apply to the hot water heatexchanger expansion valve
	B002 Setpoint:	Temperature	Suction superheat setpoint
	B003 Prop.gain:	Numerical value	Proportional setting for superheat control
	B004 Integ.:	Seconds	Integer setpoint for superheat control
	B005 Deriv.:	Seconds	Derivative setpoint for superheat control
	Start op.:	Percentage	Percentage open of expansion valve on start of defrost operation
Chiller low SH			These settings apply to the primary chill water evaporator expansion valve
	B006 Thresh.:	Temperature	Low superheat reading where response time of valve is increased quickly raise superheat
	B007 Integ.:	Seconds	Integer time for response faster valve response
Heatpump low SH			These settings apply to the airside evaporator expansion valve
	B006 Thresh.:	Temperature	Low superheat reading where response time of valve is increased quickly raise superheat
	B007 Integ.:	Seconds	Integer time for response faster valve response
Defrost low SH			These settings apply to the hot water heatexchanger expansion valve
	B006 Thresh.:	Temperature	Low superheat reading where response time of valve is increased quickly raise superheat
	B007 Integ.:	Seconds	Integer time for response faster valve response
Chiller LOP			
	B009 Thresh.:	Temperature	Lowest operating suction pressure in chiller mode
	B010 Integ.:	Seconds	Integer time for response faster valve response
Heatpump LOP			
	B009 Offset:	Temperature	Lowest operating suction pressure in heat pump mode
	B010 Integ.:	Seconds	Integer time for response faster valve response
Defrost LOP			
	B009 Offset:	Temperature	Lowest operating suction pressure in defrost mode
	B010 Integ.:	Seconds	Integer time for response faster valve response
Chiller MOP			

		B012 Thresh.:	Temperature	Maximum operating suction pressure in chiller mode
		B013 Integ.:	Seconds	Integer time for response faster valve response
	Heatpump MOP			
		B012 Thresh.:	Temperature	Maximum operating suction pressure in heat pump mode
		B013 Integ.:	Seconds	Integer time for response faster valve response
	Defrost MOP			
		B012 Thresh.:	Temperature	Maximum operating suction pressure in defrost mode
		B013 Integ.:	Seconds	Integer time for response faster valve response
	Delays			
		Low SH:	Seconds	Time to operate below low SH before the low SH control takes over
		LOP:	Seconds	Time to operate below LOP before LOP control takes over
		MOP:	Seconds	Time to operate above MOP before MOP control takes over
	Low suct.temperature			
		B015 Alarm Threshold	Temperature	Suction temperature where alarm is initiated
		B016 Alarm timeout	Seconds	Time from crossing the alarm threshold until the alarm is occurs
	Condensing modulation			For use only in ASP not for ARA
		Set:	Temperature	Ambient temperature? To begin closing the low ambient control valve
		Prop.gain:	Numerical value	Proportional setting for control of the low ambient control valve
		Integ.:	Seconds	Integral setting for control of the low ambient control valve
		Enable:	On/Off	Enable/disable of the Low ambient controls
		Off Pos.:	Steps	When off, step position to at which to hold the valve
	Pre-positioning			
		B024 Pre-positioning time	Seconds	Position for the EXV to be set before start of compressor
	Stand-by			
		B025 Stand-by open:	Check Box	when compressor is not running should the EXV be held open
		B026 Position:	Percentage	how far open the EXV will be held when check box is checked
	Cooling ExV			
		B020 Valve:	Too many choices to name	Choice of preprogrammed valve manufacturer and model type to make valve setup easier

	Custom cooling ExV		
	Min.steps:	Steps	Minimum open for this valve during operation
	Max.steps	Steps	Total number of steps from fully closed to fully open
	Closing steps:	Steps	number of steps greater than the max. steps for recalibration of valve when disabled
	Custom cooling ExV		
	Nom.step rate:	Hz	How many steps per second in normal operation
	Closing rate:	Hz	How many steps per second to close the valve when disabled
	Move current:	mA	Amperage required to move the valve
	Holding current:	mA	Max amperage used to hold the valve from moving
	Custom cooling ExV		
	Duty cycle:	Percentage	Defined by valve documentation How much of the time of operation the valve is allowed to drive open or closed
	Opening synchr.:	Yes/No	Not Currently Used
	Closing synchr.:	Yes/No	Not Currently Used
	Hot gas ExV		
	Enable	Yes/No	
	Valve	Too many choices to name	Choice of preprogrammed valve manufacturer and model type to make valve setup easier
	Custom hot gas ExV		
	Min.steps:	Steps	Minimum open for this valve during operation
	Max.steps	Steps	Total number of steps from fully closed to fully open
	Closing steps:	Steps	number of steps greater than the max. steps for recalibration of valve when disabled
	Custom hot gas ExV		
	Nom.step rate:	Hz	How many steps per second in normal operation
	Closing rate:	Hz	How many steps per second to close the valve when disabled
	Move current:	mA	Amperage required to move the valve
	Holding current:	mA	Max amperage used to hold the valve from moving
	Custom hot gas ExV		
	Duty cycle:	Percentage	Defined by valve documentation How much of the time of operation the valve is allowed to drive open or closed
	Opening synchr.:	Yes/No	Not Currently Used
	Closing synchr.:	Yes/No	Not Currently Used
	Defrost ExV		

		B020 Valve:	Too many choices to name	Choice of preprogrammed valve manufacturer and model type to make valve setup easier
	Custom defrost ExV			
		Min.steps:	Steps	Minimum open for this valve during operation
		Max.steps	Steps	Total number of steps from fully closed to fully open
		Closing steps:	Steps	number of steps greater than the max. steps for recalibration of valve when disabled
	Custom defrost ExV			
		Nom.step rate:	Hz	How many steps per second in normal operation
		Closing rate:	Hz	How many steps per second to close the valve when disabled
		Move current:	mA	Amperage required to move the valve
		Holding current:	mA	Max amperage used to hold the valve from moving
	Custom defrost ExV			
		Duty cycle:	Percentage	Defined by valve documentation How much of the time of operation the valve is allowed to drive open or closed
		Opening synchr.:	Yes/No	Not Currently Used
		Closing synchr.:	Yes/No	Not Currently Used
	Heating ExV			
		B020 Valve:	Too many choices to name	Choice of preprogrammed valve manufacturer and model type to make valve setup easier
	Custom heating ExV			
		Min.steps:	Steps	Minimum open for this valve during operation
		Max.steps	Steps	Total number of steps from fully closed to fully open
		Closing steps:	Steps	number of steps greater than the max. steps for recalibration of valve when disabled
	Custom heating ExV			
		Nom.step rate:	Hz	How many steps per second in normal operation
		Closing rate:	Hz	How many steps per second to close the valve when disabled
		Move current:	mA	Amperage required to move the valve
		Holding current:	mA	Max amperage used to hold the valve from moving
	Custom heating ExV			
		Duty cycle:	Percentage	Defined by valve documentation How much of the time of operation the valve is allowed to drive open or closed
		Opening synchr.:	Yes/No	Not Currently Used
		Closing synchr.:	Yes/No	Not Currently Used

Comp config.			
	Compressor 1 circuit 1		
	Caxx Next thr.:	Hours	How many total run hours for this compressor before a maintenance alarm
	Reset h.:	Yes/No	reset hours already counted?
	Caxx Manual:	On/Off/Auto	manual override of compressor operation
	Compressor 2 circuit 1		
	Caxx Next thr.:	Hours	How many total run hours for this compressor before a maintenance alarm
	Reset h.:	Yes/No	reset hours already counted?
	Caxx Manual:	On/Off/Auto	manual override of compressor operation
	Minimum timings		
	Caxx Min.ON:	Seconds	Minimum amount of time the compressors in this module can run in normal operation
	Caxx Min.OFF:	Seconds	Minimum amount of time the compressors in this module must be off after shutting down.
	Ca02 Min ON same:	Seconds	Amount of time between a compressor starting and that compressor being allowed to restart
	Staging time		
	Ca00 Stage up:	Seconds	Time between starts of compressors in this module, can be changed from here but will be over written from the master controller's version of this setting
	Ca01 Stage down:	Seconds	Time between stops of compressors in this module, can be changed from here but will be over written from the master controller's version of this setting
	Circ.1 probe offset		
	Suct temp Ca18 Offset:	Temperature	Allows calibration of suction temperature readings in this module
	Disch Pressure Ca19 Offset:	Pressure	Allows calibration of discharge pressure readings in this module
	Suct Pressure Ca20 Offset:	Pressure	Allows calibration of suction pressure readings in this module
	Digital input logic		
	Ca19 High pressure:	Alarm if Open/ Alarm is Closed	Position of HP switch that will cause a fault or alarm
	Digital input offset		
	Ca19 Comp.overload:	Alarm if Open/ Alarm is Closed	Position of overload switch that will cause a fault or alarm
	Caxx Comp.Aux Delay	Seconds	time between the overload going into alarm and the controller responding to the input from the overload

	Digital output logic		
	Ca19 Reverse valve:	On if Open / On if Close	Output needed from the controller to reverse operation of the 4 way valves
	Suction press.probe		
	Type:	RAZ. 0-5V / 4-20mA EXTERNAL / 4-20mA REMOTE / 4-20mA	Allows choice of type of sensor used for suction pressure sensor
	Min:	Pressure	Minimum reading for the suction pressure sensor used in scaling the sensor
	Max:	Pressure	Maximum reading for the suction pressure sensor used in scaling the sensor
	Discharge press.probe		
	Ca26 Type:	0-1V / 0-10V / 0.5-4.5V / 0-20mA / 0-5VDC / 0-5V / 4-20mA	Allows choice of type of sensor used for discharge pressure sensor
	Ca27 Min:	Pressure	Minimum reading for the discharge pressure sensor used in scaling the sensor
	Ca28 Max:	Pressure	Maximum reading for the discharge pressure sensor used in scaling the sensor
	Suction temp.probe		
	Type:	NTC Carel / 0-10V EXT. SIGNAL / NTC SPKP**T0 / CAREL NTC-HT /	Allows choice of type of sensor used for suction temperature sensor
	Min:	Temperature	Minimum reading for the suction temperature sensor used in scaling the sensor
	Max:	Temperature	Maximum reading for the suction temperature sensor used in scaling the sensor
	Caxx Gas:	R410A / R407C / R134A / ETC…	Allows choice of refrigerant type used in the calculation of super heats and other controls. There are many more choices within the controller but the three listed are all that Multistack currently uses.
	Caxx Rotation:	No / Yes	Rotation of compressors in module
	Caxx Module sequence:	GROUPED / EQUALIZED	Not Currently used
	Ca31 Comp.1:	kW	Not Currently used
	Comp.2	kW	Not Currently used
	2Stage Oil Management		
	Caxx SingleRun:	Minutes	length of time only one compressor can run before starting a second in that module to allow for greater oil flow

		Caxx Duration:	Minutes	Length of time that the second compressor will run for in the oil management control
		Caxx Enable:	Yes / No	Enable or disable 2 stage oil management control (normally left disabled)
Envelope Data				
		Manufacture:	Danfoss / Copeland / J&E HALL / FUSHENG / HANBELL / FRASCOLD / REFCOMP / BITZER / CUSTOM	Choice of manufacturer of compressor in the unit. Used for envelope control of the compressors
		Model:	Too many to list	Choice of model of compressor in the unit. Used for envelope control of the compressors
	Envelope alarm delay			
		Start-up:	Seconds	delay on any envelope alarm at the start of a circuit
		Running:	Seconds	Delay on any envelope alarm once initial start occurs
	Condensation			
		Min:	Temperature	Temperature settings to define a custom compressor envelope
		Max:	Temperature	Temperature settings to define a custom compressor envelope
	Evaporation			
		Min:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		Max:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
	Min delta pressure			
		X P1:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		Y P1:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		X P2:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		Y P2:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
	Min pressure rate			
		X P1:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		Y P1:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		X P2:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F

		Y P2:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
	Max pressure rate			
		X P1:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		Y P1:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		X P2:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		Y P2:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
	Max current			
		X P1:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		Y P1:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		X P2:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
		Y P2:	Temperature	Temperature settings to define a custom compressor envelope. See Appendix F
Source				
	Source fan circuit 1			
		E004 Next thr.:	Hours	How many hours until maintenance alarm
		Reset h.:	No / Yes	Resets hour counter to 0
	Source fan 2 circuit 1			
		E008 Next thr.:	Hours	How many hours until maintenance alarm
		Reset h.:	No / Yes	Resets hour counter to 0
	Source fan regulation Chiller			
		E0xx Setpoint:	Temperature	Fan control setpoint in cooling
		E0xx Diff:	Temperature	Amount of rise above setpoint to enable fans
		E0xx Cut Off:	Temperature	Amount of drop below setpoint to disable fans
		Eoxx Frc Set:	Temperature	Setpoint outside of normal operating range to force more fan operation
		E0xx Frc Diff:	Temperature	amount of change from Frc Set to return to normal operation
	Source fan regulation Heatpump			
		E0xx Setpoint:	Temperature	Fan control setpoint in heating
		E0xx Diff:	Temperature	Amount of drop below setpoint to enable fans
		E0xx Cut Off:	Temperature	Amount of rise above setpoint to disable fans
		Eoxx Frc Set:	Temperature	Setpoint outside of normal operating range to force more fan operation

		E0xx Frc Diff:	Temperature	amount of change from Frc Set to return to normal operation
	Source fan speed			
		E0xx Tau:		Not currently an adjustable value
		E034 Min:	Percentage	Normal operation minimum speed of the fans in both heat and cooling
		E035 Max Cool:	Percentage	Normal operation maximum signal to the fans in cooling
		E035 Max Heat:	Percentage	Normal operation maximum signal to the fans in heating
		E0xx Min Frc:	Percentage	Minimum signal sent to the fans when outside of normal operation range
		E0xx Max Frc:	Percentage	Maximum signal sent to the fans when outside of normal operation range
	Pressure Equalization			
		E0xx Rev Vlv En DeltaP	Pressure	Pressure difference between suction and discharge above which the reversing valves are not allowed to change mode
		Rev Vlv Wait Delta P Min:	Seconds	Minimum amount of time for the controls to wait for pressure equalization to happen before change of mode
		Rev Vlv Wait Delta P Max:	Seconds	Maximum amount of time for the controls to wait for pressure equalization to happen before change of mode
		Pos. Feedback Alm Dly	Seconds	amount of time from the drive signal for the reversing valves till the faulting of the valves due to the end switches not closing
		Drive After Feedback	Seconds	amount of time for the drive signal for the reversing valves to continue after the end switches have been made
	Pressure Equalization EXV			
		E0xx Vlave Pos.:	Percentage	Position expansion valves are driven to to equalize the discharge and suction
	Defrost			
		E036 Min thr.:	Temperature	The minimum saturated suction temperature to engage defrost
		Ext.temp:	Temperature	The ambient temperature that sets the Min thr.
		E037 Max thr.:	Temperature	The Maximum saturated suction temperature to engage defrost
		Ext.temp:	Temperature	The ambient temperature that sets the Max thr.

	Defrost threshold		
	E038 End:	Temperature	Saturated discharge temp that will disable defrost mode
	Cool Vlv Cutoff/Offset		
	E0xx Defrost:	Temperature	Temperature of chill water leaving the module where the defrost mode will be done in heat defrost
	E0xx Valve:	Temperature	Temperature above Defrost that the module will be allowed to run in cooling defrost.
	Defrost valve reverse		
	E039 Time before:	seconds	Not Currently used
	E040 Time after:	seconds	Not Currently used
	Defrost timings		
	E041 Startup:	Minutes	Time after start of compressor before defrost is allowed
	E042 Min:	Minutes	Minimum time that defrost cycle will run
	E043 Max:	Minutes	Maximum time that defrost cycle will run
	E044 Dripping:	Seconds	amount of time after defrost that fans will remain off before fans are allowed to run
	E045 Post-drip.:	Seconds	Amount of time after the Dripping time for running the fans at full speed to remove any excess water
	E046 Interval:	Minutes	Minimum time between defrost cycles
	Manual Defr Lockout		
	Ext temp:	Temperature	Ambient temperature above which the system will not go into defrost
	Digital output logic		
	E055 Fan:	On if Close / On if Open	Signal choice for enabling fans
	E056 Fans number	Numerical value	total number of fans on this module
	E058 Fan type:	INVERTER / ON-OFF	Choice of how fans are being controlled
	E059 Startup:	Seconds	Delay to start fans after compressors start
	E060 Delay Off:	Seconds	Amount of time fans can stay enabled after compressors have shut off

Menu E. Alarm logs, this menu gives a historical fault log for the module controller the faults occurred on. It gives a record of basic operating readings from when the fault occurred.

Menu F. Settings, See the Menu F portion of section 1.4 for details.

Menu G. Logout, this menu simply allows someone with a higher level password to log out so others can't make changes. The main menu is logged out any time buttons aren't pressed for about 2 minutes.

Section 1.6 Controller Faults:

All faults are shown through the master controller. Any time a fault occurs, the alarm bell button will light up red. Pressing this button will bring the controller into a list of faults that have happened since they were last cleared. By scrolling down through the faults so that they can all be seen will bring the controller to a final fault screen that instructs the user how to then clear the faults by pressing and holding the alarm button for 3 seconds.

Available faults at the master controller screen and those visible in Menu E. of the module controllers are as listed below:

Fault Name	Fault Description
Error in the number of T memory writings	Internal memory error for fault log, will almost always be first fault
Error in retain memory writings	Fault in memory for retaining trends
External temperature probe	Ambient air temperature sensor failure
Alarm discharge probe pressure	Discharge pressure transducer failure
Alarm suction probe pressure	Suction pressure transducer failure
Alarm suction probe temperature	Suction temperature sensor failure
Envelope - High compression ratio	Saturated suction and discharge temperatures are outside the operating envelope. See appendix F for where high compression ratio is located on the envelope
Envelope - High discharge pressure	Saturated suction and discharge temperatures are outside the operating envelope. See appendix F for where high discharge pressure is located on the envelope
Envelope - High motor current	Saturated suction and discharge temperatures are outside the operating envelope. See appendix F for where motor high current is located on the envelope. This is not an actual amperage fault.
Envelope - High suction pressure	Saturated suction and discharge temperatures are outside the operating envelope. See appendix F for where high suction pressure is located on the envelope
Envelope - Low compression ratio	Saturated suction and discharge temperatures are outside the operating envelope. See appendix F for where low compression ratio is located on the envelope
Envelope - Low differential pressure	Saturated suction and discharge temperatures are outside the operating envelope. See appendix F for where low differential pressure is located on the envelope

Envelope - Low discharge pressure	Saturated suction and discharge temperatures are outside the operating envelope. See appendix F for where low discharge pressure is located on the envelope
Envelope - Low suction pressure	Saturated suction and discharge temperatures are outside the operating envelope. See appendix F for where low suction pressure is located on the envelope
Envelope - High discharge temperature	Saturated suction and discharge temperatures are outside the operating envelope. This is not currently operable, high discharge pressure is used instead. See appendix F for where high discharge temperature is located on the envelope
ExV - Low SH	Superheat has been too low for too long
ExV - LOP	The refrigerant circuit has been below the minimum operating suction pressure for too long
ExV - MOP	The refrigerant circuit has been above the maximum operating suction pressure for too long
ExV - Low suction temperature	the refrigerant circuit has been below the minimum suction temperature for too long
Cool ExV - Motor error	The motor on the cooling EXV has a short or an open
Hot Gas ExV - Motor error	The motor on the Low ambient control EXV has a short or an open (only seen in ASP)
Defrost ExV - Motor error	The motor on the Heating defrost EXV has a short or an open (only seen in an ARA)
Heat ExV - Motor error	The motor on the Heating EXV has a short or an open (only seen in an ARA)
Compressor 1,2 maintenance	Alarm created from the run hours of the individual compressors
Source fan 1,2 maintenance	Alarm created from the run hours of the individual fans
High pressure alarm by pressure switch	High pressure fault based on the physical high pressure switch
Alarm heating outlet probe	Leaving hot water temperature sensor failure
Alarm heating inlet probe	Entering hot water temperature sensor failure
Alarm cooling outlet probe	Leaving chill water temperature sensor failure
Alarm cooling inlet probe	Entering chill water temperature sensor failure
Alarm heating reset signal	0 to 10VDC or 4 to 20mA hot water reset signal failure
Alarm cooling reset signal	0 to 10VDC or 4 to 20mA chill water reset signal failure
Alarm cooling modulation feedback	Chill water modulating valve not correctly responding to the output to that valve (not currently an operable fault)
Alarm heating modulation feedback	Hot water modulating valve not correctly responding to the output to that valve (not currently an operable fault)
Alarm overload compressor 1, 2	Compressor motor temperature controller has reported an issue, 24 VAC signal from the MTC is giving 0 VAC
Alarm auxiliary compressor 1, 2	Auxiliary from the compressor contactor did not close or open correctly when the contactor was set to do so
Cooling water valve pos.not reached	Chill water On/Off valve not correctly responding to the output to that valve (not currently an operable fault)
Heating water valve pos.not reached	Hot water On/Off valve not correctly responding to the output to that valve (not currently an operable fault)

4 Way Valve Heat Position Failure	End Switches on the 4 2-way valves did not close to denote the machine reached heating position
4 Way Valve Cool Position Failure	End Switches on the 4 2-way valves did not close to denote the machine reached cooling position
Phase monitor alarm	Signal from the power phase monitor has opened denoting a power issue
Overload condenser fan	fault in either fan VFD or from ECM motor
Offline alarm to Master	Module board communications not seen by the master
Alarm overheat outlet	Hot water leaving is too hot
Cooling flow switch alarm	Chill water flow switch has opened
Heating flow switch alarm	Hot water flow switch has opened
Alarm Low Heat outlet	hot water leaving too cold
Alarm glycol low	Glycol feeder is near empty (does not stop operation)
Alarm freeze outlet	Chill water freeze protection fault
Very Low Suction Pr	Absolute minimum suction pressure has been reached
Gas valve position not reached	Not currently used
EVD 1,2 - Setting out of bound	Fault from EVD controller, setting written to EVD controller is out of maximum limit for that setting
EVD 1,2 - Settings range error	Fault from EVD controller, setting written to EVD controller is out of minimum limit for that setting
EVD 1,2 - Offline	Fault from EVD controller, EVD controller is not communicating to the module board
EVD 1,2 - Low battery	Fault from EVD controller, backup battery in EVD controller is below specified voltage
EVD 1,2 - EEPROM	Fault from EVD controller, Failure in EVD control memory
EVD 1,2 - Incomplete valve closing	Fault from EVD controller, EVD controller was unable to complete the closure procedure for a valve
EVD 1,2 - FW not compatible	Fault from EVD controller, Firmware not compatible, Module controller will not correctly communicate to the EVD controller
EVD 1,2 - Configuration error	Fault from EVD controller, Configuration in EVD controller conflicts with other settings in same EVD controller
Simultaneous_EndSw	Not currently used
CoolOnly_EndSw	Not currently used

Appendix A

	Input and output definitions on control boards		
Master controller (C.PCO Large)			
Universal Inputs		Analog outputs	
U1	Customer Reset Signal (heating options: CW reset/load limit)	Y1	
U2	Customer Reset Signal (heating options: CHW reset/load limit)	Y2	
U3	Ambient temperature	Y3	
U4	System entering chilled water temperature (NTC Type)	Y4	
U5	System leaving chilled water temperature (NTC Type)	Y5	
U6		Y6	
U7			
U8		Digital outputs	
U9	System entering hot water temperature (NTC Type)	NO1	Cooling full load relay
U10	System leaving hot water temperature (NTC Type)	NO2	Cooling run status relay
		NO3	Cooling pump start relay
Digital Inputs		NO4	Heating full load relay
ID1	EX1 Customer Input	NO5	Heating run status relay
ID2	Remote S/S input (Cooling) input	NO6	Heating pump start relay
ID3	Remote S/S input (Heating) input	NO7	
ID4	System power phase monitor input	NO8	Fault Status relay
ID5	System chilled water flow switch input	NC8	
ID6	System hot water flow switch input	NO9	
ID7	Glycol feeder low level input	NO10	
ID8		NO11	
ID9		NO12	
ID10		NC12	
ID11		NO13	
ID12		NC13	
ID13		NO14	
ID13H		NC14	
ID13		NO15	
ID14		NC15	
ID14H		NO16	
ID15H		NO17	
ID15		NO18	
ID16			
ID16H			
ID17			
ID18			

Module controller (C.PCO Medium w/built in EVD)			
Universal Inputs		Analog outputs	
U1	High pressure transducer (0-5VDC ratio metric, 0-652PSIG)	Y1	Fan VFD/ECM output #1`
U2		Y2	Fan VFD/ECM output #2
U3	Cooling water modulating valve feedback	Y3	Chilled water modulating valve control
U4	Module leaving hot water temperature sensor (NTC type ARA only)	Y4	Heating water modulating valve control (ARA only)
U5	Module leaving chilled water temperature sensor (NTC type)		
U6		Digital outputs	
U7		NO1	Compressor #1 start signal
U8	Heating water modulating valve feedback	NO2	Compressor #2 start signal
		NO3	Liquid line solenoid valve signal (ASP only)
Analog inputs for built in EVD		NO4	4 2way refrigerant valve signal(heating, ARA only)
S1	Low pressure transducer (0-5VDC ratio metric, 0-250PSIG)	NO5	4 2way refrigerant valve signal(cooling, ARA only)
S2	Suction temperature sensor (NTC type)	NO6	Module alarm signal
S3		NO7	Condenser fan enable #1
S4		NO8	
		NC8	
Digital Inputs		NO9	Electrical panel fan start signal
ID1	Manual mode	NO10	
ID2	Auto mode	NO11	Condenser fan enable #2
ID3	High pressure switch	NO12	On/off motorized chilled water valve (power to close)
ID4	Module power phase monitor	NC12	On/off motorized chilled water valve (power to open)
ID5	Compressor 1 contactor auxiliary input	NO13	On/off motorized hot water valve (power to close)
ID6	Compressor 1 thermal overload input	NC13	On/off motorized hot water valve (power to open)
ID7	Compressor 2 contactor auxiliary input		
ID8	Compressor 2 thermal overload input	EVD A Built in EVD	
ID9		Cooling/Simultaneous mode superheat control	
ID10	ECM/VFD fault input	1	Electronic expansion valve - Cooling/simultaneous mode (green)
ID11	Module chilled water flow switch	2	Electronic expansion valve - Cooling/simultaneous mode (red)
ID12	Module hot water flow switch	3	Electronic expansion valve - Cooling/simultaneous mode (black)
ID13H		4	Electronic expansion valve - Cooling/simultaneous mode (white)

ID13	4 2way refrigerant valve feedback (heating, ARA only)		
ID14	4 2way refrigerant valve feedback (cooling, ARA only)	EVD B Built in EVD	
ID14H		Low ambient head pressure control (ASP only)	
		1	Low ambient head pressure control valve (green)
Digital inputs for built in EVD		2	Low ambient head pressure control valve (red)
DI1	Hot water on/off valve feedback	3	Low ambient head pressure control valve (black)
DI2	Chill water on/off valve feedback	4	Low ambient head pressure control valve (white)

External expansion valve driver (twin) - ARA only: heating and defrost EXVs			
Analog Inputs			
S1			
S2			
S3			
S4			
Digital Inputs			
DI1			
DI2			
EVD A Built in EVD			
Defrost mode superheat control			
1	Electronic expansion valve - defrost mode (green)		
2	Electronic expansion valve - defrost mode (red)		
3	Electronic expansion valve - defrost mode (black)		
4	Electronic expansion valve - defrost mode (white)		
EVD B Built in EVD			
Heating mode superheat control			
1	Electronic expansion valve - heating mode (green)		
2	Electronic expansion valve - heating mode (red)		
3	Electronic expansion valve - heating mode (black)		
4	Electronic expansion valve - heating mode (white)		

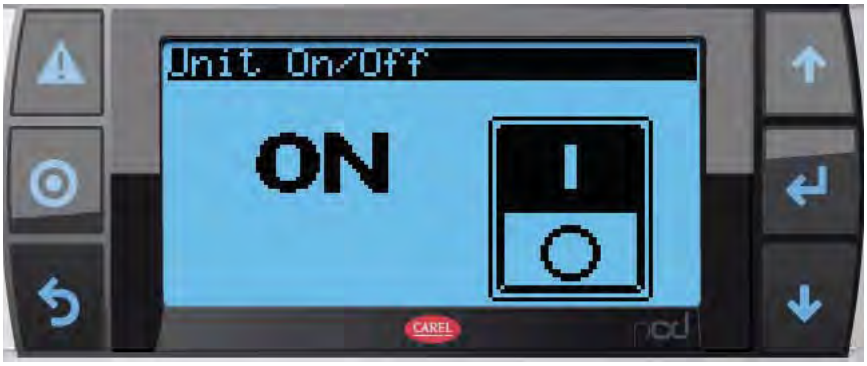
Appendix B

Saving setpoints: This should be done before the installation of new software. This can and should be done on master and module boards. The last step is restoring the setpoints from the saved file.

Step 1.

Use up and down arrows to choose the on/off quick menu then press enter.

Step 2.



Use the up and down arrows to shut off the unit.

Step 3.

Press the Target / Program button and input the password for either technician level or manufacturer level

Step 4.

Scroll down to the Settings menu press the enter button

Step 5.

Scroll down to the Initialization menu and press the enter button

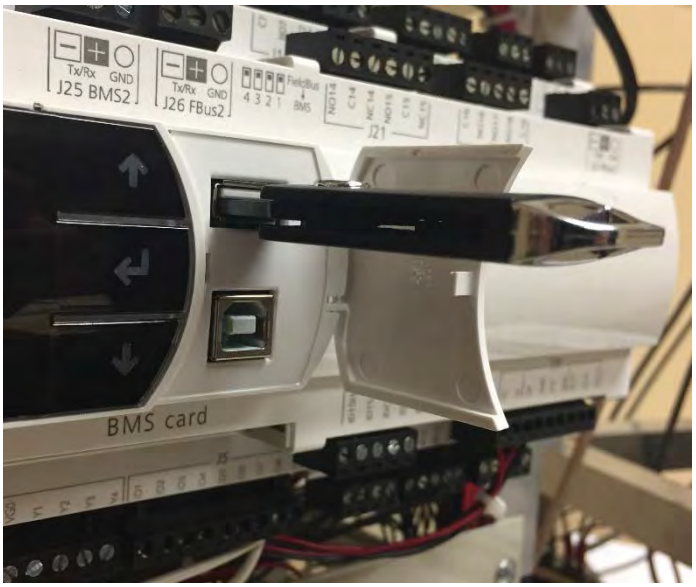
Step 6.

Press enter to move to Import, use the up and down arrows to change to export. Press enter again to move to the next line where you will choose if you are saving to the Internal memory or to a thumb drive. Press enter again to move to the file name. You can change what number the file is (example: EXPORT_01 or EXPORT_12). Remember what you have named this file. Pressing enter one more time allows you to change the confirm from NO to YES which will allow the settings to be copied

Step 7.
Follow the same instructions to install new settings the only difference is the information on this page. Instead of setting the controller to EXPORT it needs to be set to IMPORT.

Appendix C

Connecting a thumb drive to the controllers.



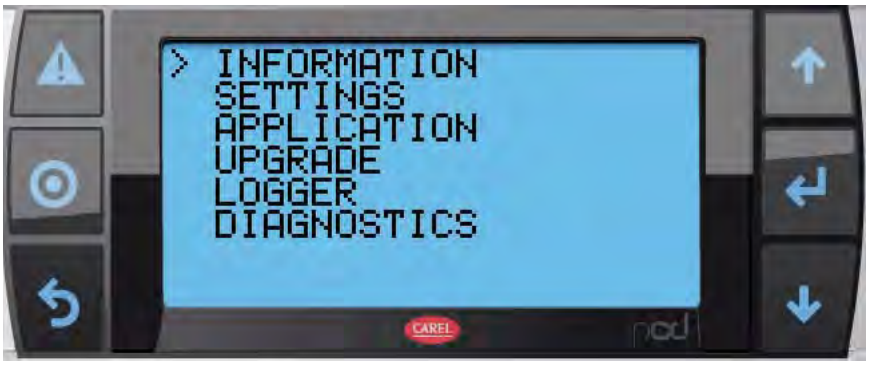
The USB connections are found in a compartment next to the display on any C.PCO controller. The photo above shows a USB thumb drive connected to the controller. This thumb drive could be used to either store trends from this controller stored since midnight or to install a new program into the controller.

Setting up a thumb drive for upgrading a controller:

1. Create an “Upgrade” directory on the thumb drive, exactly how it is in this sentence, uppercase U everything else lowercase.
2. Put new software flies in that directory.
3. Plug thumb drive into controller.

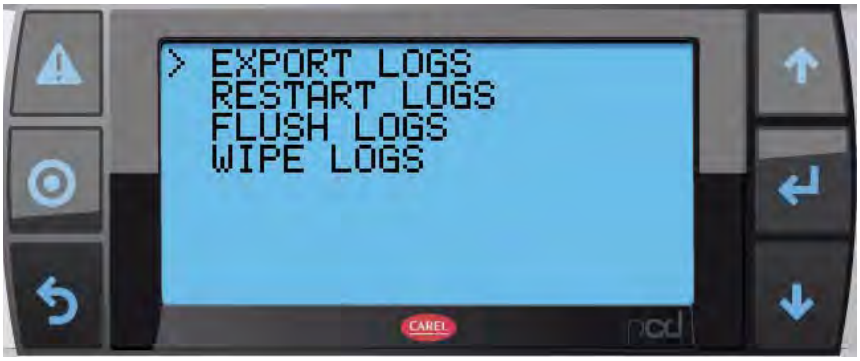
Using the thumb drive to pull a trend log:

Step 1.



Press the Alarm and the Enter Buttons together until the next menu appears. Then scroll down to the Logger menu and press Enter.

Step 2.



Press enter on the Export logs menu.

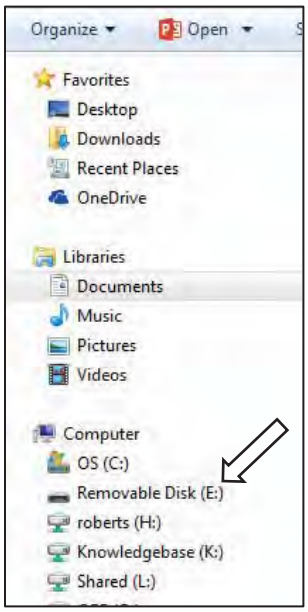
Step 3.

Press enter on the [export all] selection, this will record all trends that have occurred since around midnight on the controller's internal clock.

Appendix D

Connecting a laptop to the controllers.

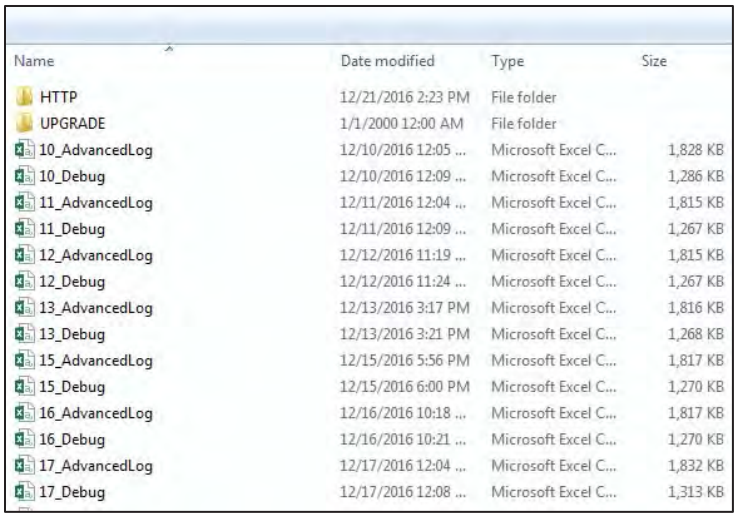
Plugging a USB A to USB B cable into a laptop and the other end into the controller will allow information from the controller to be read on the laptop as if it were a thumb drive.



NOTE: the controller connected to this computer has come up as drive E: (Removable Disk (E:)

If the installation of new software does not work or gives an error, there is probably not enough space left in the internal memory to install the program. Use this to remove any excess log files or other saved programs.

The files found in the directory will depend on if the computer plugged into a master or a module controller. The Master when entered will show:

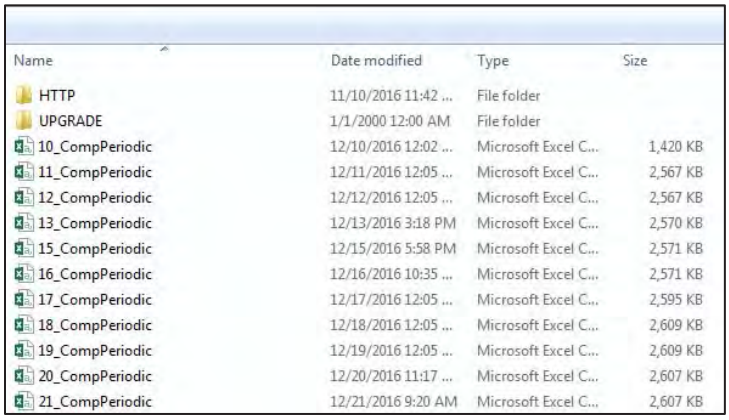


Name	Date modified	Type	Size
HTTP	12/21/2016 2:23 PM	File folder	
UPGRADE	1/1/2000 12:00 AM	File folder	
10_AdvancedLog	12/10/2016 12:05 ...	Microsoft Excel C...	1,828 KB
10_Debug	12/10/2016 12:09 ...	Microsoft Excel C...	1,286 KB
11_AdvancedLog	12/11/2016 12:04 ...	Microsoft Excel C...	1,815 KB
11_Debug	12/11/2016 12:09 ...	Microsoft Excel C...	1,267 KB
12_AdvancedLog	12/12/2016 11:19 ...	Microsoft Excel C...	1,815 KB
12_Debug	12/12/2016 11:24 ...	Microsoft Excel C...	1,267 KB
13_AdvancedLog	12/13/2016 3:17 PM	Microsoft Excel C...	1,816 KB
13_Debug	12/13/2016 3:21 PM	Microsoft Excel C...	1,268 KB
15_AdvancedLog	12/15/2016 5:56 PM	Microsoft Excel C...	1,817 KB
15_Debug	12/15/2016 6:00 PM	Microsoft Excel C...	1,270 KB
16_AdvancedLog	12/16/2016 10:18 ...	Microsoft Excel C...	1,817 KB
16_Debug	12/16/2016 10:21 ...	Microsoft Excel C...	1,270 KB
17_AdvancedLog	12/17/2016 12:04 ...	Microsoft Excel C...	1,832 KB
17_Debug	12/17/2016 12:08 ...	Microsoft Excel C...	1,313 KB

Directories:
HTTP: Settings for the web interface (do not change)
Upgrade: Directory for the files used in installing a new program (place new software here)

Files:
AdvancedLog: Log of readings from the Master Controller
Debug: Carel log (not used by Multistack)

Module when entered will show:



Name	Date modified	Type	Size
HTTP	11/10/2016 11:42 ...	File folder	
UPGRADE	1/1/2000 12:00 AM	File folder	
10_CompPeriodic	12/10/2016 12:02 ...	Microsoft Excel C...	1,420 KB
11_CompPeriodic	12/11/2016 12:05 ...	Microsoft Excel C...	2,567 KB
12_CompPeriodic	12/12/2016 12:05 ...	Microsoft Excel C...	2,567 KB
13_CompPeriodic	12/13/2016 3:18 PM	Microsoft Excel C...	2,570 KB
15_CompPeriodic	12/15/2016 5:58 PM	Microsoft Excel C...	2,571 KB
16_CompPeriodic	12/16/2016 10:35 ...	Microsoft Excel C...	2,571 KB
17_CompPeriodic	12/17/2016 12:05 ...	Microsoft Excel C...	2,595 KB
18_CompPeriodic	12/18/2016 12:05 ...	Microsoft Excel C...	2,609 KB
19_CompPeriodic	12/19/2016 12:05 ...	Microsoft Excel C...	2,609 KB
20_CompPeriodic	12/20/2016 11:17 ...	Microsoft Excel C...	2,607 KB
21_CompPeriodic	12/21/2016 9:20 AM	Microsoft Excel C...	2,607 KB

Directories:
HTTP: Settings for the web interface (do not change)
Upgrade: Directory for the files used in installing a new program (place new software here)

Files:
CompPeriodic: Log of readings from the Module controller

Note: for the master's AdvancedLog and the module's CompPeriodic files, the number prior to any log is the day it was saved. The file with the number 15 is all the data saved from the 14th based on the calendar in the controller.

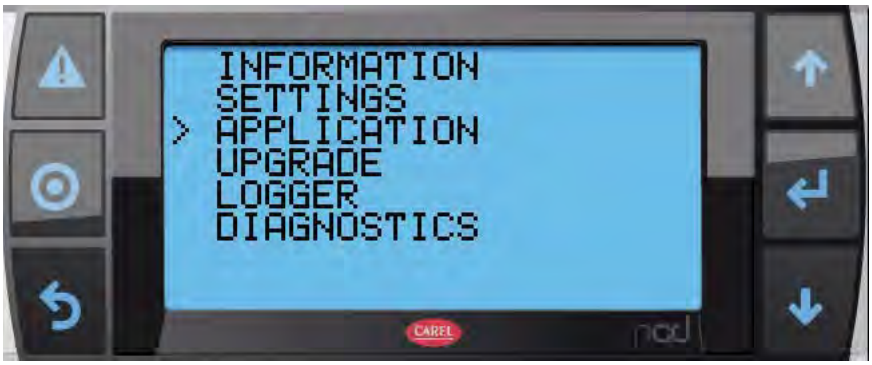
Appendix E

Installing or Upgrading software on controllers: If installing new software for one board it must be done to all boards so that they all share the same program version and can correctly communicate with each other.

Step 1.

In the C.Pco, there are hidden screens that Carel has built in for internal diagnostics and programming updates it can be accessed by pressing the Alarm and the Enter Buttons together until the next menu appears.

Step 2.



Most of the Hidden menu is not used in Multistack at this time. Press the down arrow to point at the Application menu and press enter.

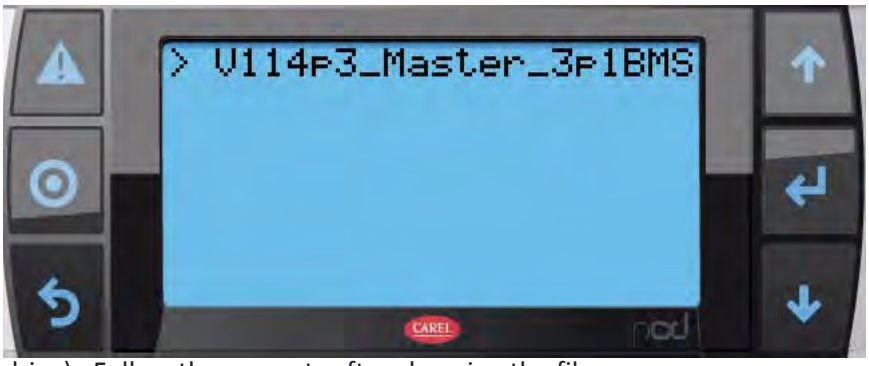
Step 3.

Stop Application: Before installing new software, the running software needs to be stopped. Once stopped, the screen will say Loading…… and not change from that.

Step 4.

Press the Alarm and the Enter Buttons together until the next menu re-appears. Scroll down to the Upgrade menu and press enter.

Step 5.



The Upgrade file can be brought up from either the internal memory or from a USB thumb drive. The Upgrade directory in the internal memory can be accessed through a direct USB connection to a laptop. (works like a USB thumb drive). Follow the prompts after choosing the file.

Step 6.

The Main screen will appear if there are no issues. Press the alarm and enter buttons together until the hidden menu reappears.

Step 7.

Scroll down to the Application menu and press the enter button.

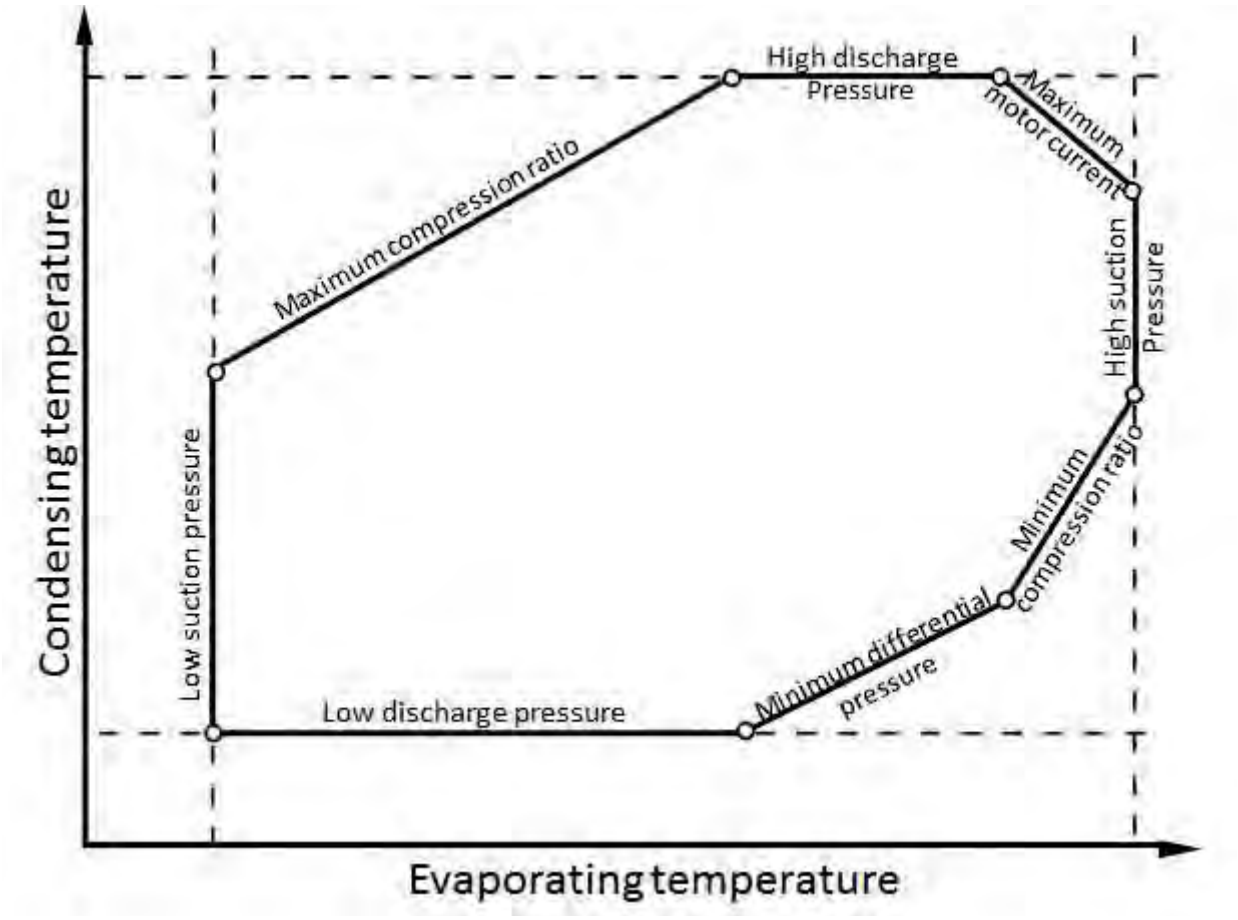
Step 8.

A factory reset needs to be done before the controller can be correctly used. To do this, scroll down to Wipe Retain and press the enter button. Once this is done, the controller will return to its main screen ready for the settings to be loaded back into it as per the procedures in Appendix B.

Appendix F

Understanding the compressor envelope safeties:

Each model of compressor has different pressures and temperatures it can operate within. These temperatures and pressures as defined by the compressor manufacturer are either preprogrammed into the module controllers or can be manually inputted into them. Below, is a diagram showing where the safeties correspond to the envelope overall.

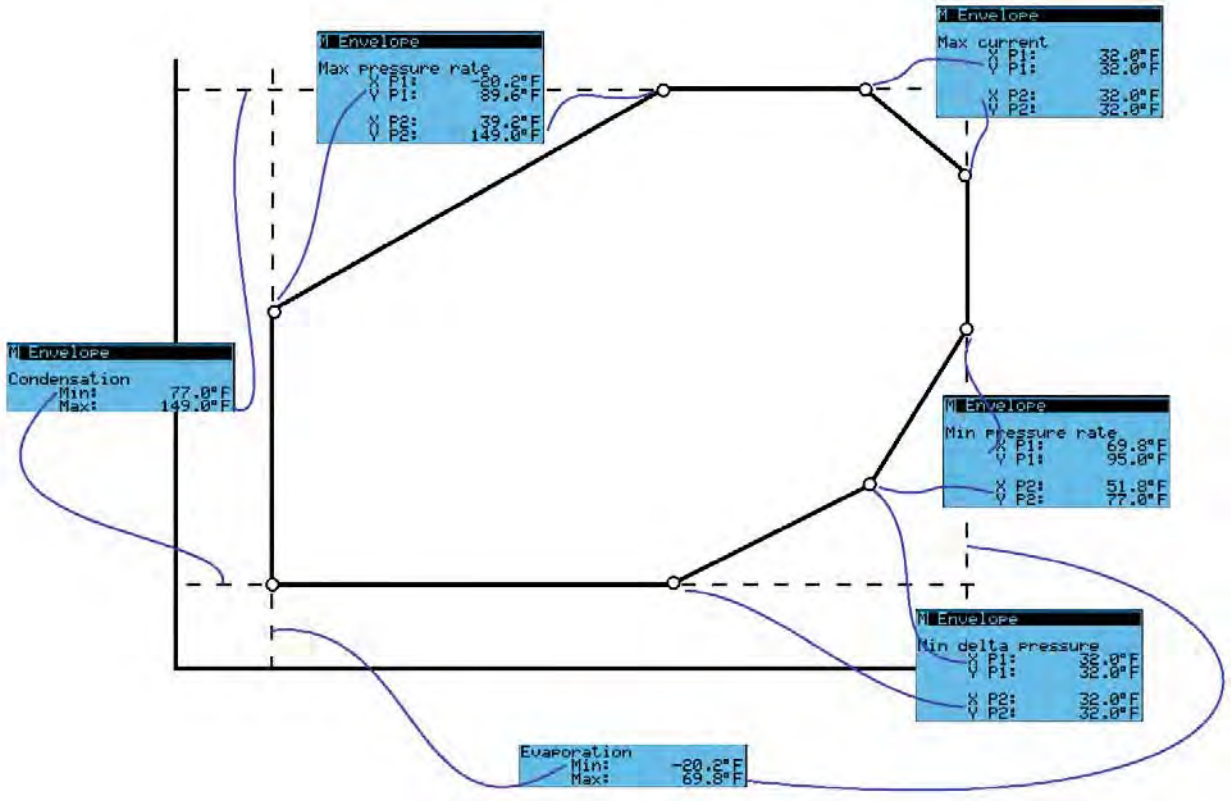


The settings associated with the envelope can be found in menu C. Comps of the main menu within the module controller. Below are the settings that are found there:

Condensation	
Min:	Temperature
Max:	Temperature
Evaporation	
Min:	Temperature
Max:	Temperature
Min delta pressure	
X P1:	Temperature

	Y P1:	Temperature
	X P2:	Temperature
	Y P2:	Temperature
Min pressure rate		
	X P1:	Temperature
	Y P1:	Temperature
	X P2:	Temperature
	Y P2:	Temperature
Max pressure rate		
	X P1:	Temperature
	Y P1:	Temperature
	X P2:	Temperature
	Y P2:	Temperature
Max current		
	X P1:	Temperature
	Y P1:	Temperature
	X P2:	Temperature
	Y P2:	Temperature

Below is the Envelope again, this time showing which settings effect the areas that the operating safeties are based on.



Airstack®

VersaTemp™

Water-to-Water Heat Pump

with Auxiliary Air-Cooled Condenser

Model ARA

Installation, Operation, Maintenance

Table of Contents

Multistack has a policy of continual improvement and reserves the right to change product design, literature and specifications without notice.

General Information

This manual describes proper installation, operation and maintenance of Multistack VersaTemp™ water-to-water heat pumps with auxiliary air-cooled condenser. Review this manual carefully before beginning installation, operating or performing maintenance on this equipment. The information and illustrations contained in this manual are generalized. Your installation, operation and maintenance procedures may be customized to an extent that consultation with a Multistack representative may be necessary in order to provide details not covered in this manual.

Good electrical and piping practices must be followed and in accordance with procedures in this manual and all applicable national and local codes. Use of this equipment must meet all applicable rules. Personnel servicing Multistack equipment must have a minimum Class II EPA certification.

This equipment must not be installed near open flame per national and local codes and American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) specifications.

Questions regarding the content of this manual relative to the application, installation, operation and maintenance of Multistack chillers and components should be directed to an authorized Multistack representative or the Multistack Service Department at 608-366-2400 (FAX 608- 366-2450).

Safety Information

This manual includes warnings, cautions and notes.

DANGER conveys serious hazards for injury or death.

WARNING indicates risk of injury or death.

CAUTION warns of possible injury or damage.

NOTE calls out work practices that can result in optimal operations.

Danger, Warning, Caution and Note include:

DANGER: To avoid the risk of electrical shock, personal injury or death, disconnect all electrical power to the unit before performing any maintenance or service. The unit may have more than one electrical power supply. Assume all electrical wires are energized. Use lock-out/tag-outs.

DANGER: Use extreme caution when working around electrical components, wiring and connections to avoid injury or death by electric shock.

DANGER: Never remove a lockout from equipment unless you placed it there. Each person shall place his/her own lock/tag when required to isolate an energy source. Do not start any adjustment, service or repair without verifying that the tag/lock out switch or control cannot be by-passed or over-ridden. Verify that the locked-out switch or control cannot be overridden. Test the equipment to be certain that the locked-out switch is de-energized and not malfunctioning. Press all start buttons to confirm that the equipment WILL NOT START. Confirm that the system being serviced or repaired is the system that has been locked out. Before restarting equipment, verify all tools and other items have been removed, all machine guards are in place, all electric systems are reconnected, and personnel are clear of equipment.

General Information

DANGER: During installation, testing, servicing and troubleshooting this product, it may be necessary to work with live electrical components. Only qualified licensed electricians or other properly trained persons may perform these tasks. Failure to follow all electrical safety precautions can result in death or serious injury. All HVAC (heating, ventilating and air conditioning) equipment must be installed per National Electric Code (NEC) and all applicable state/local codes.

DANGER: Incorrect handling of HVAC equipment can result in explosions, electrical shock or fire, causing property damage, injury and/or fatality.

DANGER: HVAC liquids and chemicals can be dangerous if used incorrectly or if spills or accidents occur. Handle detergents and solvents with care to avoid spills and burns.

DANGER: Refrigerant cylinders can explode causing serious injury and/or death if not handled and stored properly.

WARNING: Working with HVAC equipment can be hazardous due to electricity, moving parts, chemicals, combustion and other hazards. Use safe work habits including proper tools and personal protective equipment. Understand and heed all safety information, installation guidelines and operation and maintenance procedures.

WARNING: Only qualified, licensed electricians with proper personal protection equipment should wire Multistack chillers. Injury or death my result if not properly wired due to electric shock hazard.

WARNING: Danger of electrical shock. Many types of HVAC equipment have switches and/or components with electrical current on even if other parts of the equipment appear to be turned off. Main circuit breakers must be turned off before servicing equipment to avoid injury or death.

WARNING: Use lifting slings with lifting capacity to safely handle unit weight. Consult the unit's as-built submittal drawings for unit weight data.

WARNING: If welding on chiller water connections, use proper electrical grounding to avoid damaging the compressors or chiller controls. Never weld directly on the heat exchanger shells. Only an authorized ASME-certified repair agency may weld directly on ASME-certified shells. After welding, an "R" stamp is required.

CAUTION: The thermal dispersion flow sensors are factory calibrated. Special tools are needed to adjust calibration in the field.

CAUTION: Pressurized application of cleaning substances or refrigerants must be done with the correct procedures to ensure the safety of technicians and others, and avoid property damage.

NOTE: Use correct tools for HVAC equipment installation, maintenance and adjustment. Use the right type and size tools to make tight connections without stripping threads or breaking screws and bolts. Use accurate refrigerant and electrical meters to properly maintain and diagnose HVAC equipment.

NOTE: Use proper personal protective equipment when working with HVAC equipment. For example, shoes and boots that protect ankles and feet, safety glasses for eye protection, and gloves to protect hands are common protective items for HVAC technicians. Injuries and accidents can be prevented or minimized by using appropriate protective equipment.

NOTE: Understand and pay attention to all safety information including all equipment manufacturer safety instructions, labels and signs. Always follow original equipment manufacturer's instructions, and local building codes and ordinances.

NOTE: Do not begin work until barricades, warning signs or other protective devices have been installed to isolate the work area from local traffic.

Multistack VersaTemp™ high efficiency heat pumps use a four-pipe design to meet all building HVAC needs: cooling only, heating only, and simultaneous heating and cooling—with a single unit. VersaTemp units provide all the advantages of Multistack's industry-leading modular design and include the Carel cPCO controller with remote access capability. VersaTemp units eliminate the need for auxiliary heat sink or heat source, cooling towers, dry coolers and well fields.

VersaTemp Heat Pump Model Number Description

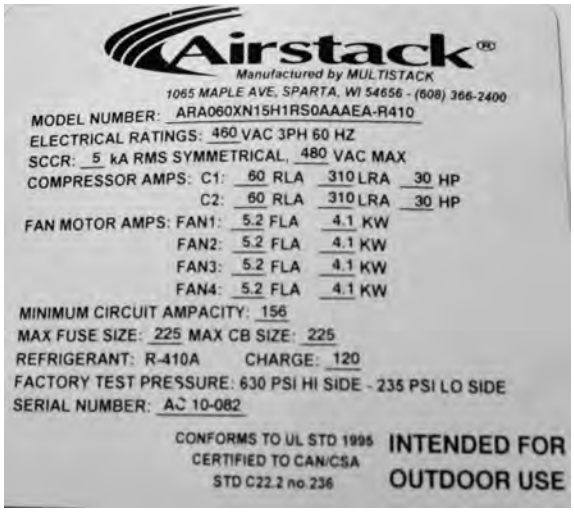
ARA 030 X N 1 1 H 1 R S _ A A A S _ 410A

- 410A — Refrigerant[8]
- _ — N/A
- S — Fan Configuration[7]
- A — Source/sink heat exchanger Coating[6]
- A — Source/sink heat exchanger[5]
- A — Evaporator[4]
- _ — N/A
- S — Ambient (L - Low, S - Standard, H - high, C - low & high)
- R — Application[3]
- 1 — Power Connection (1 - Direct Connect, 2 - Multiple Module Connections)
- H — Voltage[2]
- 1 — Frame Designation 1 - 32 x 58, 2 - 36 x 72, 3 - 36 x 84, 4 - 72 x 84, 5 - other)
- 1 — No. of Refrigerant Circuits (1 - single)
- N — Certification: N - Not certified
- X — Compressor Type[1]
- 030 — Module Nominal Capacity (10-250 tons, needs 3 digits)
- ARA — Series: ARA-VersaTemp Water-to-Water Heat Pump with Auxiliary Air-Cooled Condenser

[1] X - Copeland Scroll (ZP),
[2] A - 208/3/60, L - 230/3/60, H - 460/3/60, C - 575/3/60, D - 200/3/50, E - 400/3/50, F - 380/3/60, S - 220/230/1/60, V - Other
[3] R - Heat Pump
[4] A - Brazed SS, V - Other
[5] A - Cu tube Al fin, B - Cu tube Cu fin, V - Other
[6] A - None, B - Bronzeglow, H - Heresite, E - Electrofin, S - Standard, V - Other
[7] E - ECM Fan (except 575 V), H - High static, L -Single Fan, V -Other
[8] R-410A

Serial Number

Module nameplates are located inside and outside of the electrical control box door. Nameplates include model and serial number, refrigerant type and charge, electrical data and Multistack contact information. This information is important when servicing, repairing or ordering parts.



VersaTemp™ Chiller Description

Model ARA VersaTemp units provide all the benefits of a Dedicated Heat Recovery Chiller:

- High effective COP ensures reduced operating expense
- Fast payback
- Reduced carbon footprint
- Can produce hot and chilled water simultaneously

Innovative Design for Maximum Flexibility

- Integrated refrigerant-to-air heat exchanger—no need for well field or backup heat sinks
- Four-pipe operation with brazed plate condenser sized for full heat rejection—NOT A DESUPERHEATER
- Four to six times more heat than a desuperheater
- Built-in automatic controls for full, partial (with multiple modules), or no hot water production; surplus heat is rejected via the integral air-cooled condenser

Leverages the Advantages of a Modular Design

- Redundant systems up to 600 tons capactiy
- EC fan motors (except 575 volt units) paired with low-sound fan blade technology for quiet operation
- Optional integrated chilled water and/or hot water pumping packages
- Optional integrated tanks, air separators, and accessories
- Integrated controls with multiple connectivity options

Model ARA VersaTemp units use scroll compressors and are available as 20, 30 or 60-ton modules which may be assembled into an array to provide the required jobsite capacity and redundancy. Each refrigerant circuit includes two compressors, common single-circuit evaporator, single-circuit refrigerant-to-hot water heat exchanger, single-circuit air-to-refrigerant heat exchanger, electronic expansion valves, reversing valve, and control system. Each refrigeration and electrical circuit is independent of other circuits.

Modules are shipped wired and charged with refrigerant and are factory run-tested prior to shipment on an AHRI certified test stand.

Model ARA modules are ETL listed according to UL Standard 1995, and CSA certified per Standard C22.2#236.

Compressors

Each module includes two hermetic scroll compressors in a tandem piping arrangement mounted to the module with rubber-in-shear isolators. Each system also includes high discharge pressure and low suction pressure safety cut-outs. Refer to unit nameplate for specific refrigerant charge.

Hot and Chilled Water Heat Exchangers

The evaporator is a brazed plate heat exchanger constructed of 316 stainless steel; designed, tested, and stamped according to UL 1995 code for 650 psig working pressure. The condensers is a brazed-plate heat exchanger also constructed of 316 stainless steel; designed, tested, and stamped in accordance with UL 1995 code for 650 psig working pressure.

Refrigerant to Air Heat Exchanger

Each module contains dual (four in ARA60X) variable speed axial fans for each refrigerant circuit. Fan blades are of aluminum construction using ultra-quiet owlet design. Each fan has seven blades and an integral EC motor (except 575 V units).

Control System

VersaTemp module operation is controlled by a microprocessor Master Controller that monitors entering and leaving chilled water and hot water temperatures to determine both the chilled water and hot water system demand. The control system uses demand to make staging mode decisions (cooling, heating, or simultaneous heat recovery) and select the needed number of compressor circuits. Mode decisions are available from the controller as well as via remote input. Response times and set points are adjustable. The Master Controller provides for variable time between compressor sequencing and temperature sensing in order to optimize chiller performance and efficiency at varying building loads.

VersaTemp Modules Capabilities

- Full cooling capacity with zero need for hot water.
- Full simultaneous heating and cooling capacity
- Full heating capacity with zero need for chilled water.

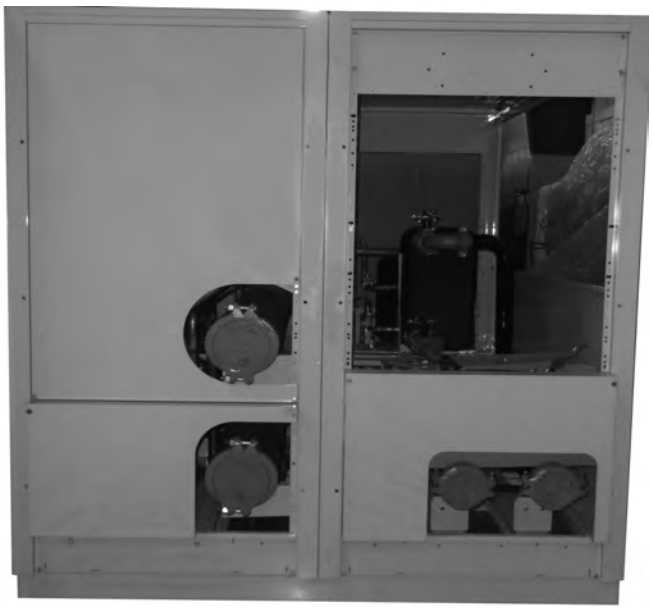
The Master Controller is powered by the VersaTemp module single point power connection and monitors and reports these system parameters:

- Chilled Water Entering and Leaving Temperature
- Discharge and Suction Refrigerant Pressure
- Proof of Chilled Water Flow
- Hot Water Entering and Leaving Temperature
- Refrigerant Suction Temperature
- Proof of Hot Water Flow

An out of tolerance indication will cause a "fault" indication at the Master Controller, shutting down the associated compressor and transferring heating/cooling load to the next available compressor. In the case of a System Fault the entire chiller is shut off and the Master Controller will record conditions at the time of the fault and store the data for recall. This information can be recalled through the Master Controller keypad and displayed on the Master Controller's two-line, 40-character LCD. A fault history, including date and time is maintained up to the last 20 occurrences. The Master Controller also monitors Individual refrigeration system leaving water temperatures to protect against freeze-up and excessive head pressure conditions.
The Master Controller selects a new lead compressor every 24 hours to assure even compressor run time distribution, and monitors and reports the following on each refrigeration module:
a. Discharge Pressure Fault
b. Suction Pressure Fault
c. Compressor Winding Temperature
d. Suction Temperature
e. Leaving Chilled Water Temperature
f. Leaving Hot Water Temperature

VersaTemp modules are capable of interfacing with a building automation system through an Interoperability Web Portal and is capable of communicating via BACNet, Modbus or LON. External inputs and outputs are compatible with the building management system to provide remote start/stop capability and cooling alarm output.

Multistack recommends a MINIMUM two to three minute water piping loop time. Contact your Multistack sales representative with any questions regarding this water piping loop design requirement.



Installation

Shipping Information

NOTE: Before accepting delivery of the Multistack chiller, check the overall condition of the equipment for visible damage including broken copper lines, oil leaks, damaged controls and/or electrical component housing, or any major component torn loose from its mounting. If the Multistack unit is damaged during transportation or handling by the transportation company or its agent, the installing contractor MUST promptly file a claim with the transportation company and advise Multistack. Any discrepancies must be noted on the bill of lading.

Electric bussbars, ground strap, power connectors, junction box, j-box throat, j-box phase monitor and sensor wells are packaged and shipped separately from the unit.

Handling Modules

If modules are damaged during shipping and handling by the transportation company or its agents, promptly file a claim with the transportation company and advise Multistack. It is very important to note any damage on the bill of lading when signing for the heat pump delivery. Digital photos of the damage are also helpful.

Fork Lift or Pallet Jack

The modules can be safely lifted and maneuvered with a forklift or pallet jack. Position lifting forks under the frame channels.

Crane or Other Lifting Devices

If lifting units by crane, ensure that the slings (do not use chains) do not damage the modules. The lift points are at the corners of the base of the unit. Use a spreader bar to prevent damage.

Typical lifting arrangement using pallet jack.

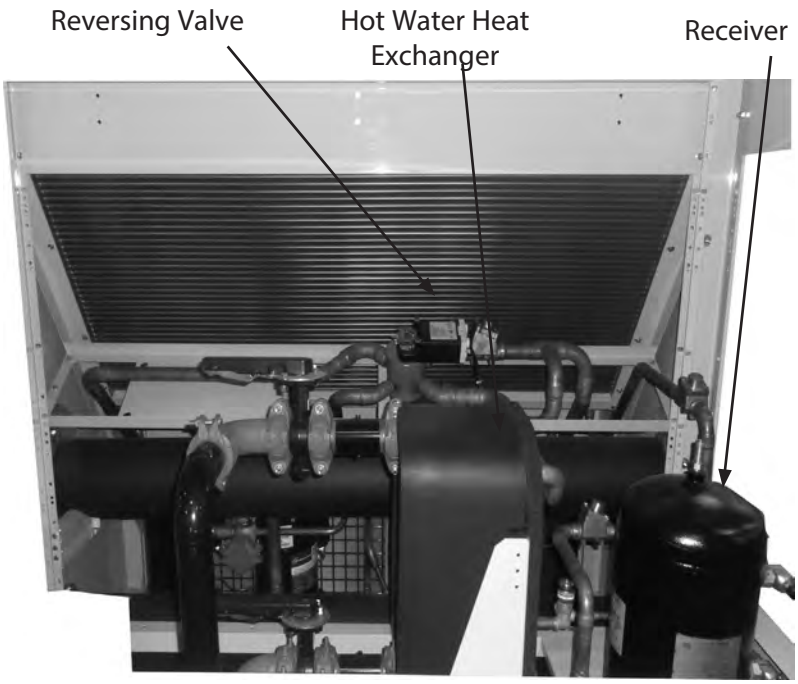
Clearances

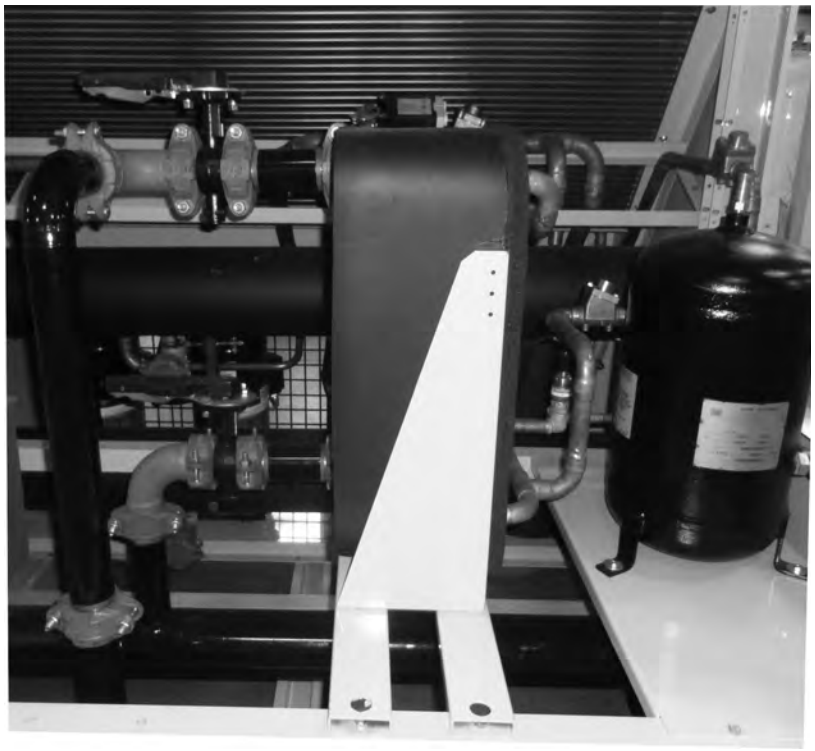
Recommended clearances for VersaTemp water-to-water heat pumps are 42 inches both the front and back for service. 32 inches on each end of the modules. At the electrical junction box end the 32 inches starts at the box's end. 36 inches minimum overhead clearance is recommended. Note: These recommendations are for service. Local code requirements take precedence.

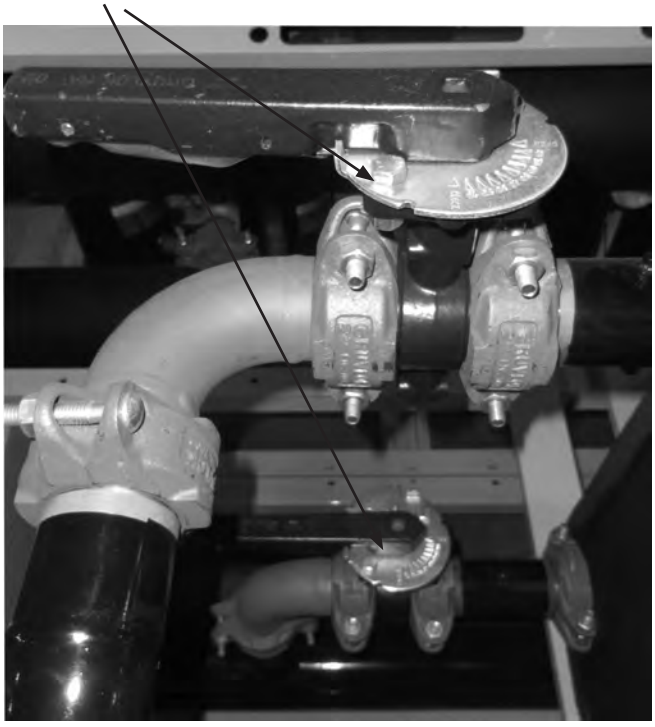
Site Preparation

Modules are to be mounted on steel rails, preferably 4x4-inch, using rubber insulators. After installation the chiller should be level to within 1/8-inch over the length of the chiller.

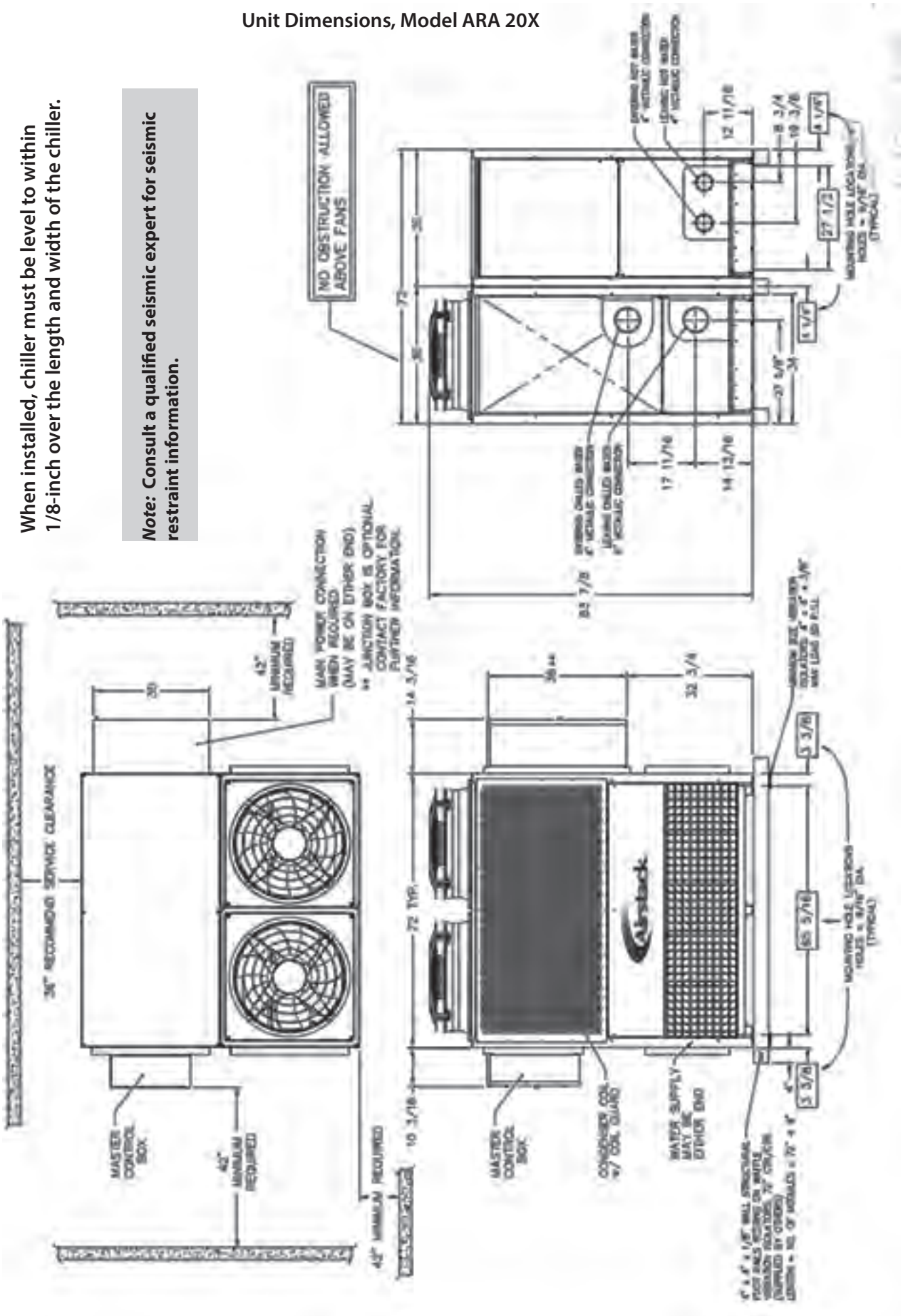
Typical Component Arrangement





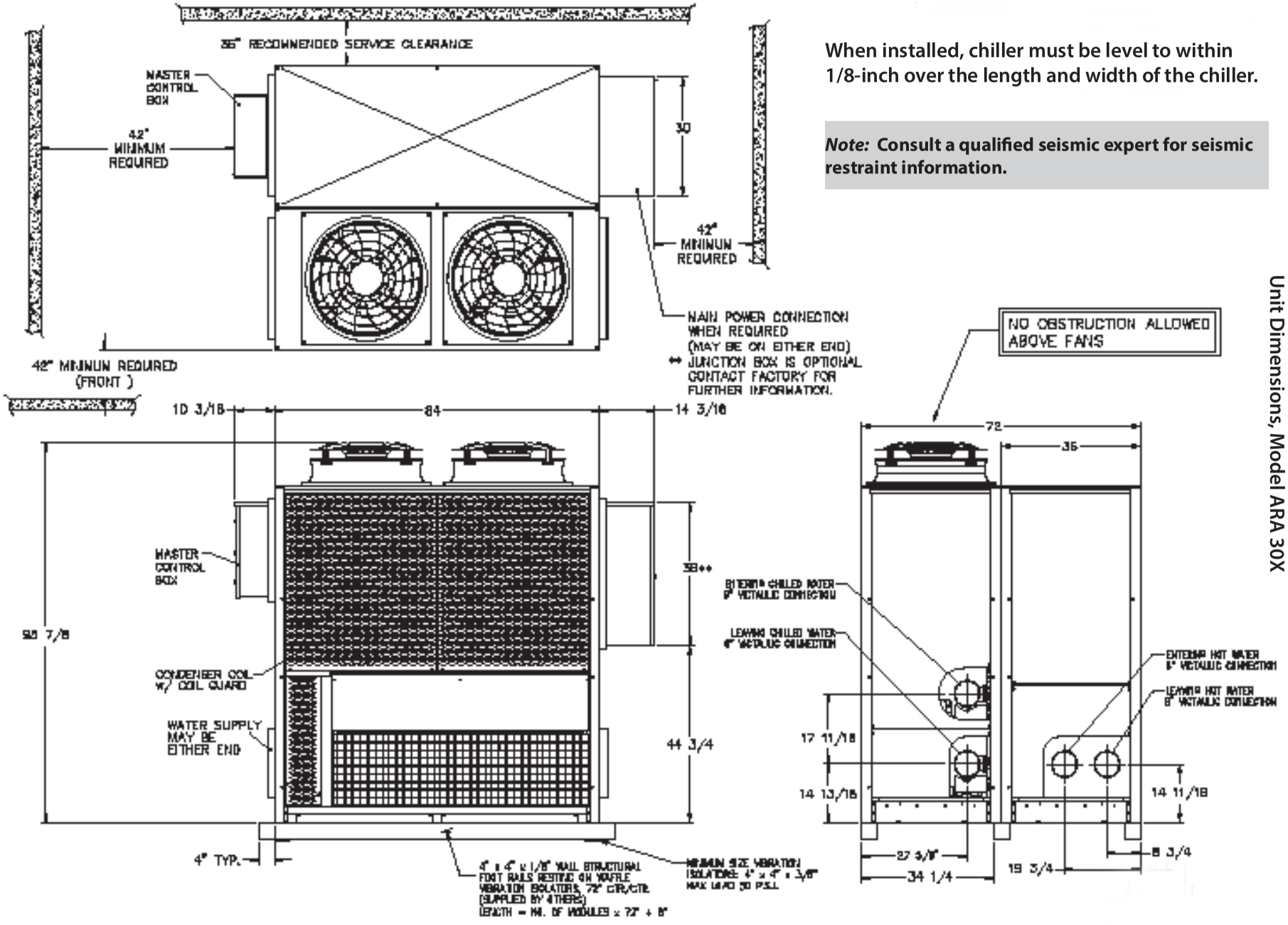


Unit Dimensions, Model ARA 20X



When installed, chiller must be level to within 1/8-inch over the length and width of the chiller.

Note: **Consult a qualified seismic expert for seismic restraint information.**



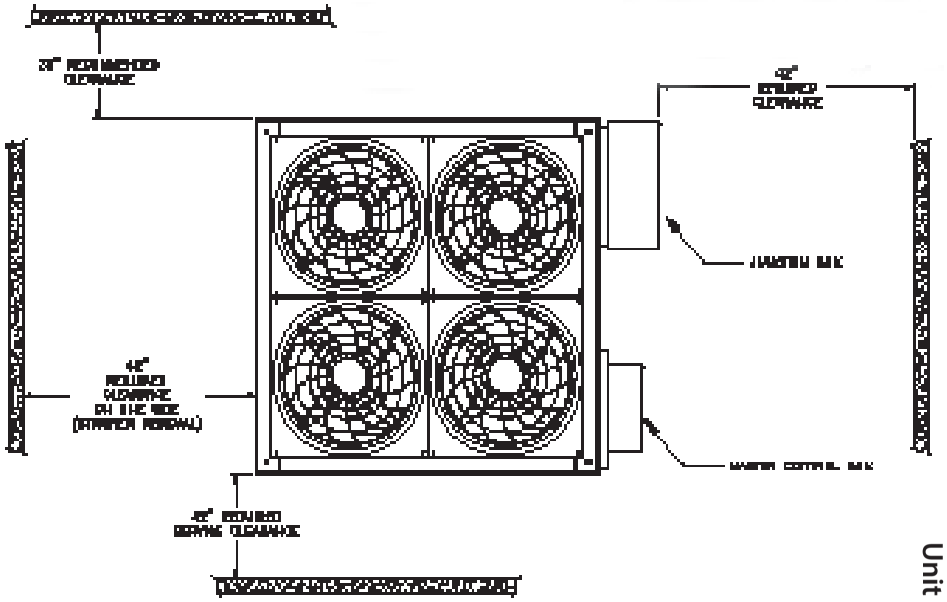
When installed, chiller must be level to within 1/8-inch over the length and width of the chiller.

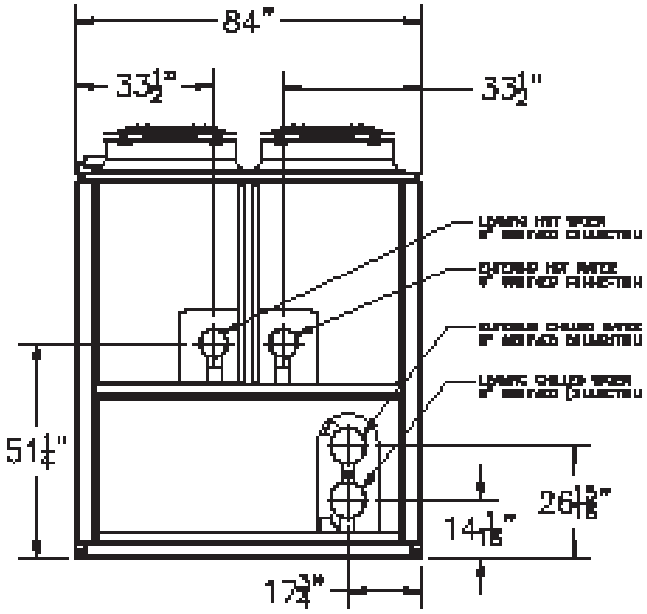
Note: **Consult a qualified seismic expert for seismic restraint information.**

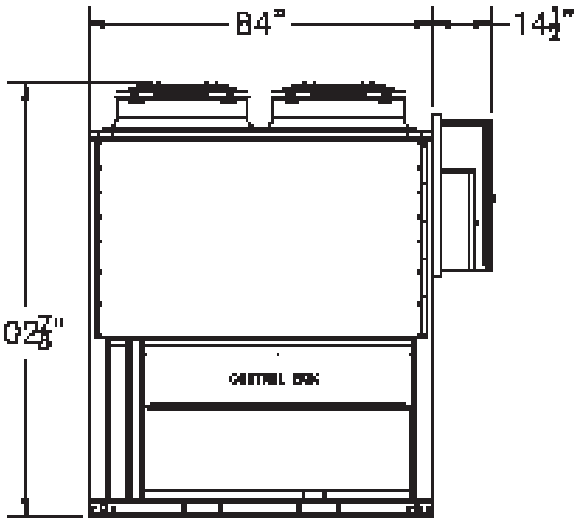
Note: **Consult a qualified seismic expert for seismic restraint information.**

When installed, chiller must be level to within 1/8-inch over the length and width of the chiller.

ESTIMATED WEIGHTS:
6568 LB DRY
7180 LB WET







Unit Dimensions, Model ARA 60X

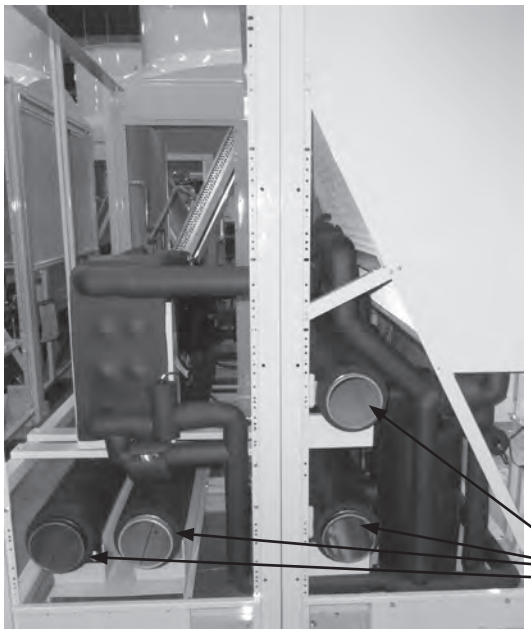
Module Assembly

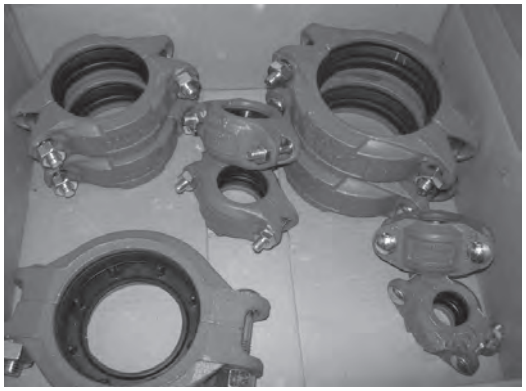
VersaTemp™ units are to be installed on a level surface with steel rails to ensure proper alignment of all fittings. Modules are to be level to within 1/8-inch over the length of the units. Rails should run parallel with module water flow (headers). For maximum stability three rails should be used, one rail for each outside edge and one center rail. The outside rails should be placed flush with outside frame. Internal rail shares half the distance (two inches) with rear and front modules.

To ensure all warranties and a successful installation, a factory authorized technician is required to start the VersaTemp system. If start-up is to be performed directly by Multistack, at least two weeks notice is required. Call the Multistack Service Department at (608) 366-2400 to schedule.

To install multiple Model ARA VersaTemp units as a single array, follow Steps 1 through 16, and refer to the piping requirements, diagrams and information on Pages 14 and 15.

1. Determine piping location before setting VersaTemp™ units in place.
2. Install unit on 4x 4-inch steel rails. Outside rails to be placed flush with edge of frame.
3. Place waffle type vibration eliminators every 32 inches under rails.
4. Lubricate rails with non-petroleum lubricant.
5. Place first module on the rails.
6. Slide module into position.
7. Place subsequent modules onto rails.
8. Leave space between modules to install coupling gaskets.
9. Lubricate gaskets with non-petroleum lubricant.
10. Slide modules together, lining up footing holes and install bottom joining bolts.
11. Install top joining bolts.
12. Starting with lower header, install the couplings. Position coupling bolts as shown for proper frame installation. frame. (Bolts @ 1:00 and 7:00)
13. If adjustment is needed when tightening bolts, loosen center header. bolt.
14. Loosen the heat exchanger grooved couplings.
16. Install the header blank ends, start with the bottom then move to the top which includes the drain valves.
17. After connecting the modules, tighten the grooved couplings.
18. Before initial startup, check the water piping system for leaks.





Grooved couplings for attaching pipe headers on modules. Size and number of couplings shipped is based on specific Multistack units shipped.

Installation

Water Piping

Sensor Wells

Sensor wells are provided by Multistack and must be installed at least 30 inches from the entering and leaving water connections at the chiller. See diagrams on Pg. 15.

Sensor Well

Leak Testing

When all connections are complete, static pressure test the piping and seal any leaks. When saisfactory, start the system pumps and purge any remaining air from the system. Seal any additional leaks.

Piping System Flushing Procedure

Before connecting the chiller to the hot and chilled water piping, the piping loops (including new and existing systems) must be flushed with a detergent and hot water mixture to remove dirt and organic residue. After removing organic residue, continue flushing using a dilute phosphoric acid, sulfamic acid or citric acid and water mixture to remove any inorganic scale in the pipe.

Cleaning chemicals such as Nu-Calgon "Imperial Scale Remover" (Part Number 4360-84 or equivalent) suitable for both organic residue and scale removal may be substituted. Otherwise detergents and acids shall not be combined unless approved by the chemical manufacturers. Only chemicals compatible with 316 stainless steel, copper and carbon steel may be used. Chemicals containing hydrochloric or sulfuric acid or chlorides must not be allowed to contact the copper brazed 316 stainless steel heat exchangers.

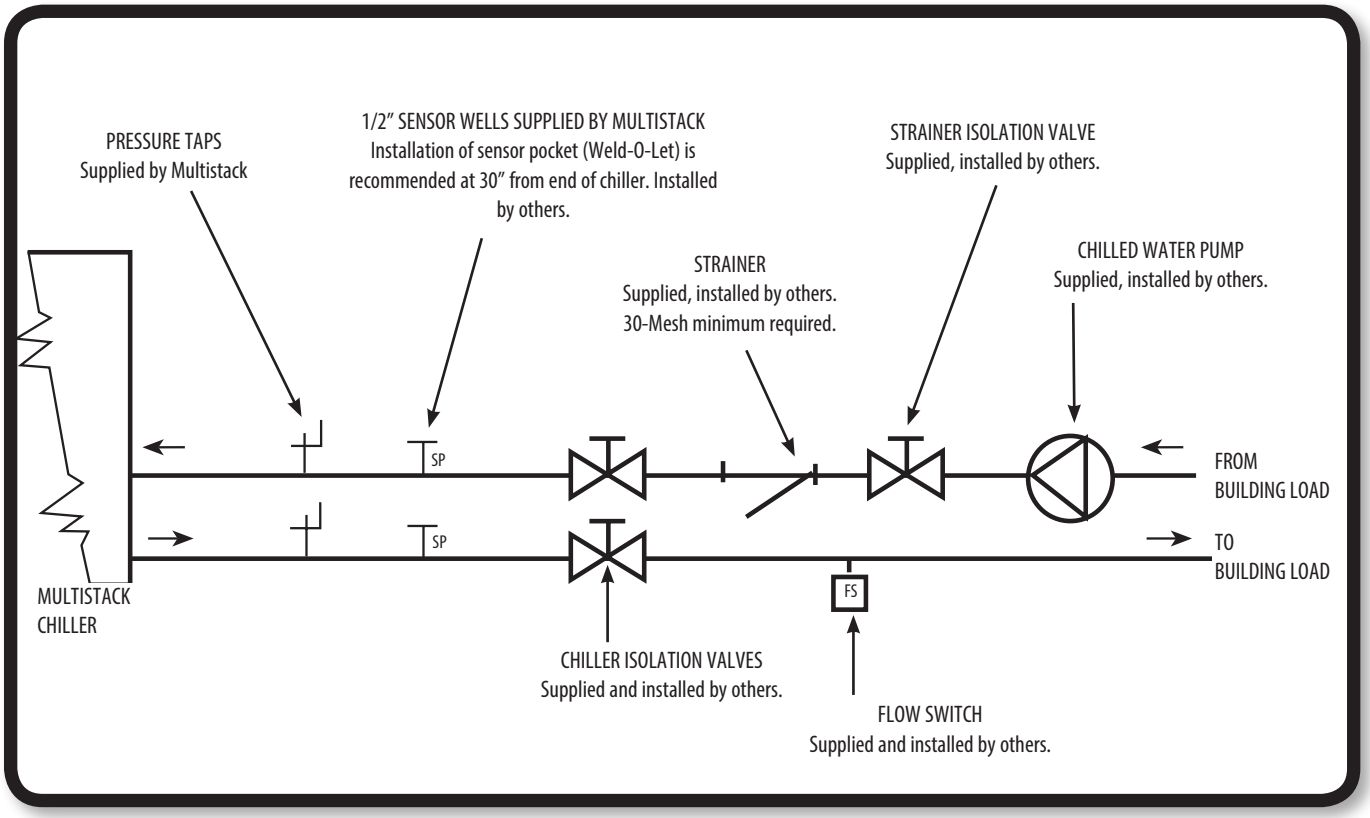
30-mesh (minimum) strainers (or equivalent) must be in place in the system piping while flushing. Examine the strainer frequently to remove residue. Continue flushing the loop at least six hours or until the strainers remain clean. Older piping systems with heavy scale must be flushed a minimum of 24 hours and may require as much as 48 hours of flushing before the filters remain clean. Detergent and acid concentrations may only be used according to the respective chemical manufacturers instructions. After flushing with detergent and/or dilute acid concentrations, the system loop must be purged with clean water for at least one hour to help ensure that all residual cleaning chemicals have been flushed out. Before connecting water to the chiller, review the water treatment specifications. Consult the maintenance and off-season shutdown procedures.

Water Treatment, Specifications

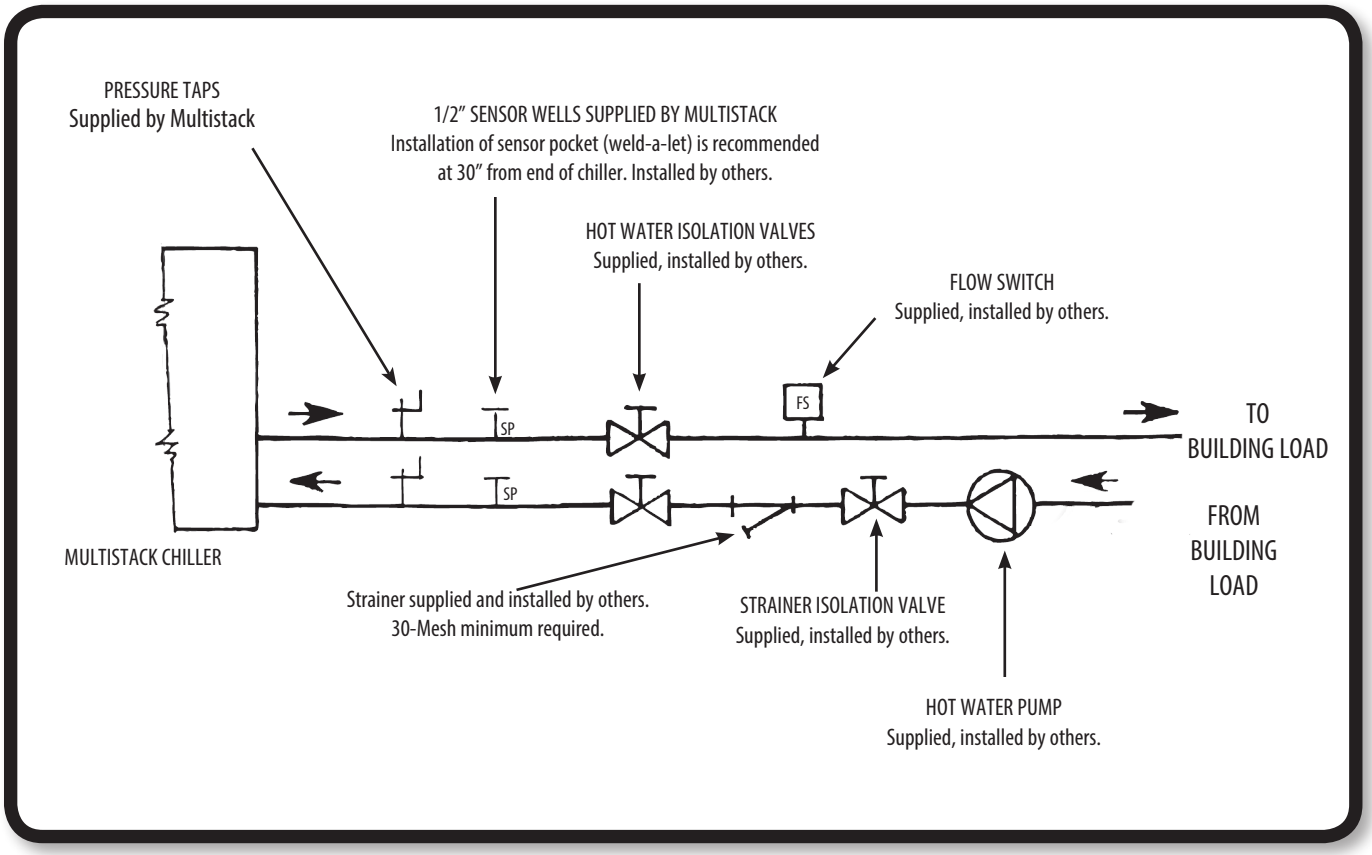
Supply water for both chilled and hot water circuits must be analyzed and treated by a professional water treatment specialist familiar with the operating conditions and materials used in Multistack chiller heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for modular chillers using 316 stainless steel brazed plate heat exchangers and carbon steel headers is maintained within the following parameters (for straight water). Glycol numbers will show higher for TDS and alkalinity.

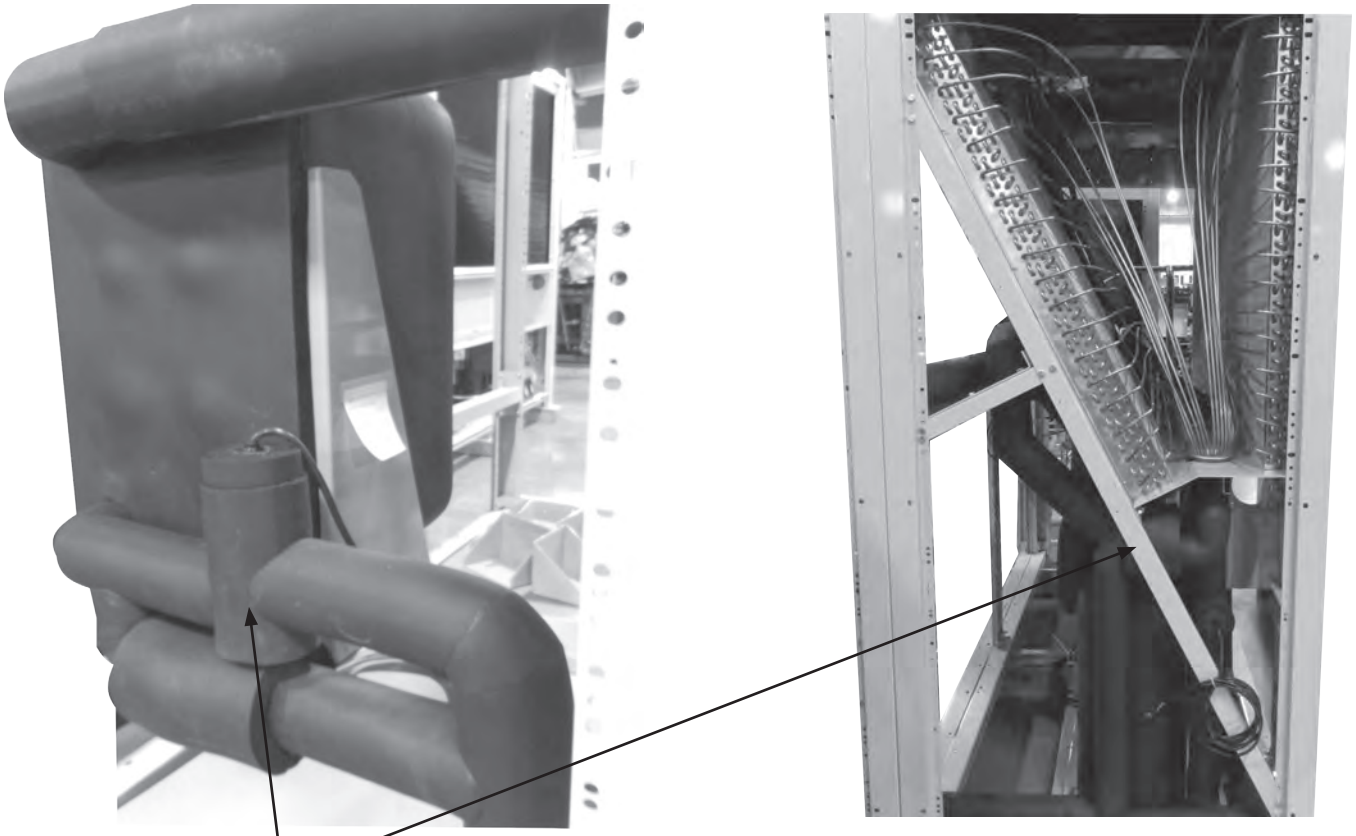
ph:	>7 and <9
Total Dissolved Solids (TDS):	Less than 1000 ppm
Hardness as CaC03:	30 to 500 ppm
Alkalinity as CaC03:	0 to 500 ppm
Chlorides:	Less than 200 ppm
Sulfates:	Less than 200 ppm

Required Chilled Water Piping



Required Hot Water Piping

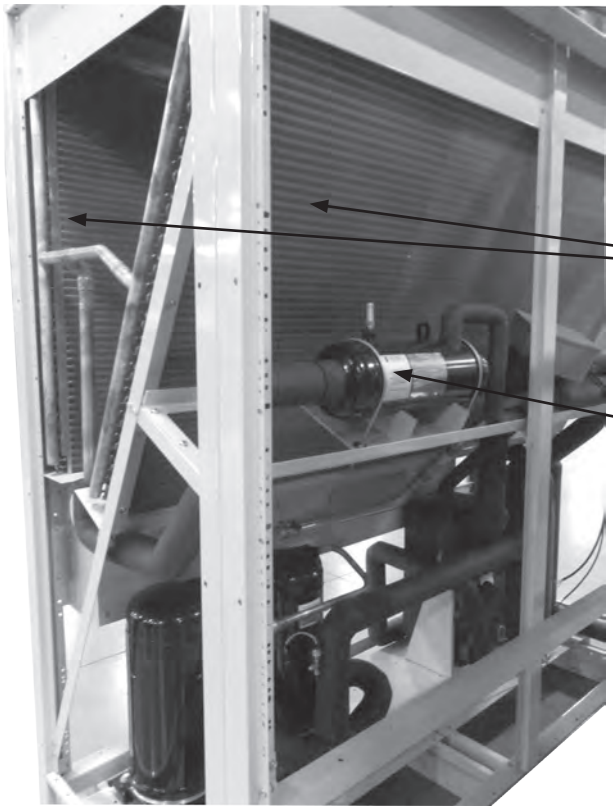




Electronic Refrigerant Expnasion Valves

ECM Condenser Fans
(Except 575 V units)

Scroll Compressors



System Wire & Fuse Sizing Specifications

(Applicable codes may require different wire sizing)

Compressor Rated Load Amps (RLA) and Locked Rotor Amps (LRA)

NOTE: RLA and LRA are for each compressor.

Wiring Sizing: Minimum Circuit Ampacity (MCA)
MCA = (1.25 x RLA1*) + RLA2 + RLA3+ RLA4

RLA/LRA Per Compressor

	No. of Compressors	208/3/60 RLA/LRA	230/3/60 RLA/LRA	460/3/60 RLA/LRA	575/3/60 RLA/LRA
ARA020X	2	44/239	40/239	20/125	16/80
ARA030X	2	68/340	61/340	31/173	25/132
ARA060	2	N/A	N/A	60/310	48/239

Fuse Sizing: Maximum Overcurrent Protection (MOP), Type RK5 Fuse, or HACR Time Delayed Circuit Breaker
MOP= (2.25 x RLA1*) + RLA2
Where the MOP does not equal a standard size rating, the next larger size should be used. The MOP should not exceed 800 amps.

NOTES:

*RLA1 = RLA of the largest compressor in the system; RLA2 , RLA3 & RLA4 = RLA of the other compressors in the system.

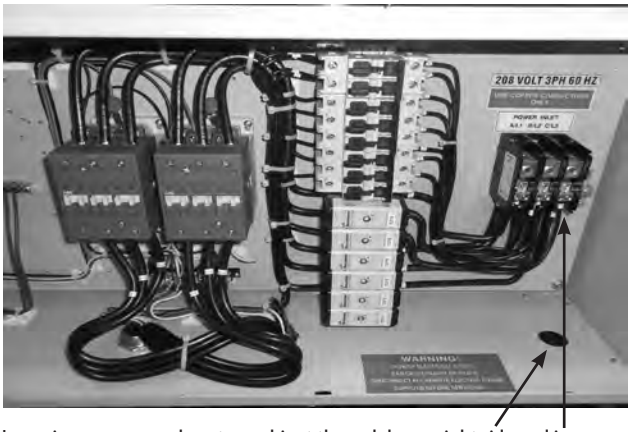
The total system Minimum Circuit Ampacity (MCA) shall not exceed 760A. Wire sizing is based on the National Electric Code (NEC) rating for 75°C copper wire, three wires per conduit. Wiring distance from branch circuit shall not exceed 100 feet.

MCA	3 CONDUCTORS 1 CONDUIT	6 CONDUCTORS 2 CONDUIT
50	8	--
65	6	--
85	4	--
100	3	--
115	2	--
130	1	--
150	1/0	--
175	2/0	--
200	3/0	--
230	4/0	--
255	250 MCM	--
285	300 MCM	--
310	350 MCM	2/0
335	400 MCM	2/0
380	500 MCM	3/0
420	600 MCM	4/0
460	--	4/0
510	--	250 MCM
570	--	300 MCM
620	--	350 MCM
670	--	400 MCM
760	--	500 MCM
800	--	600 MCM

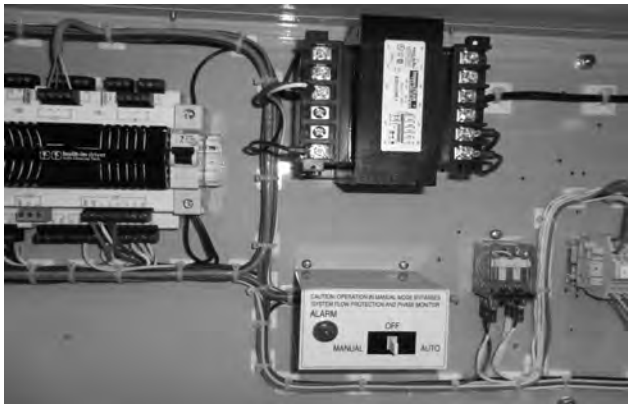
Main Power Connection Terminal Block -- Located on lower right side of control panel.

Electrical Panels

DANGER: To avoid the risk of electrical shock, personal injury or death, disconnect all electrical power to the unit before performing any maintenance or service. The unit may have more than one electrical power supply. Assume all electrical wires are energized. Use lockout/tagouts.



Incoming power supply enters cabinet through lower right side and is connected at A/L1, B/L2 and C/L3 and grounded to cabinet.



Unit Start-Up

After installation and all water piping, electrical wiring, sensors and controls are connected and checked, the unit may be started by a Multistack authorized service technician. The start-up technician is to complete the following checklist and start-up log.

Start-Up Log

Start-Up Date:_____ Ship Date: _____
Job Name: _____ Job Number: _____
Address: _____
Model Number: _____

Module Serial Numbers

1. _____ 7._____
2. _____ 8._____
3. _____ 9._____
4. _____ 10._____
5. _____ 11._____
6. _____ 12._____

Design Parameters

1. ECHW _____
2. LCHW _____
3. CHW GPM_____
4. CHW P Drop_____
5. ECW _____
6. LCW _____
7. CW GPM_____
8. CW P Drop _____

Water Side and Installation Checklist

		Circle Correct Response
1. Chiller mounted on rails and isolators?		YES NO
2. Any visible damage, oil or refrigerant leaks?		YES NO
If yes, detail: _____		
3. All pipe work independently supported from chiller?		YES NO
4. System sensor wells installed:	CHILLED WATER: IN _____ OUT _____	
	CONDENSER WATER: IN _____ OUT _____	
5. Flow or differential switches installed:	CHILLED:_____ CONDENSER: _____	
6. Operation of flow or differential switches with reduction of 50%		P _____
7. Condenser 3 way bypass valve?		YES NO
	If yes - Temperature set point: °F	
8. System strainers installed?	CONDENSER_____ EVAPORATOR _____	
9. Install System sensors with thermal paste?		YES NO

Electrical and Controls Checklist

1. All electrical connections tight and correct?	YES NO
2. Power wiring sufficient to carry F.L.A.?	YES NO
3. Voltage levels: PHASES 1 + 2 _____ 2 + 3 _____ 1 + G _____ 2 + G _____ 3 + G _____	
4. Set module board addresses, run communication wire, do factory reset on Master Control	YES NO
5. Program system variables to site conditions, program date & time	YES NO
6. Verify demand for cooling?	YES NO
7. Check temperature and pressure sensors through microprocessor display?	YES NO
8. Check interlock operation:	
Stop chilled water pump?	YES NO
Stop condenser water pump?	YES NO
9. Provide training to contractor or owner?	YES NO
Names of those trained: _____	
10. Leave system in full operation?	YES NO
11. Notify contractor of any problems?	YES NO

Start-up Service Technician _____ Owner or Contractor Acceptance _____

System Variables

Chiller Setup	Value
CONTROL TO	
ENTERING SETPTS	
UPPER SETPT	
LOWER SETPT	
VSP	
LEAVING SETPTS	
LCHW SETPOINT	
LCHW OFFSET	
LCHW STAGE OFF	
LOAD LIMIT	
TDIFF	
FAIL INDICATOR	
# OF COMPRESSORS	
SEQUENCING	
INDEXING	
HP CUTOUT	
FLUSH TIME	
FLUSH DURATION	
CUSTOMER RESETS	
TEMP DISPLAY	
COMMISSION DATE	
BAS INTERFACE	
BAS ENABLE	
PROTOCOL	
BAUD RATE	
ID #	
VARIABLE FLOW	
BYPASS	

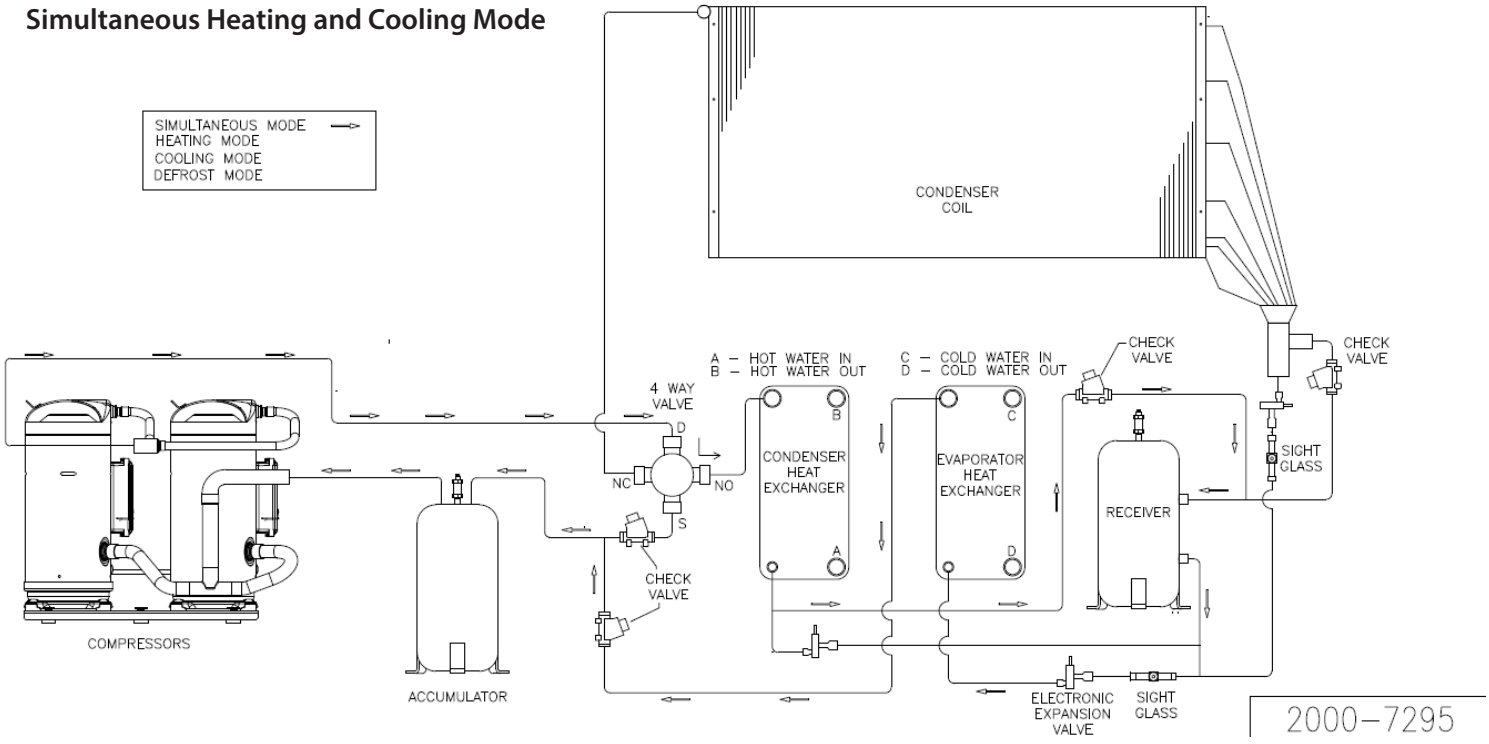
Factory Setup

PROGRAM	
CHILLER	
REFRIGERANT	
HEATEX TYPE	
EV FLOW RESET	
CW FLOW RESET	
COMP MIN OFF TIME	
COMP CYCLE TIME	
SUCTION CUTOUT	
PULL DOWN	
MOD LCW SENSOR	
VARIABLE FLOW	
VARIABLE FLOW	
BYPASS	
VALVE DELAY	
CHW VALVE	
CHW FLOW BYPASS	
CHW BYPASS	
CHW MIN OUTPUT	
CW VALVE	
CW FLOW BYPASS	
CW BYPASS	
CW SETPOINT	
CW MIN OUTPUT	
PID SETUP	
CONDENSER	
K	
Ti	
Td	
EVAPORATOR	
K	
Ti	
Td	
MODULE FLOW SWITCHES	
EVAP FLOW SWITCH	
COND FLOW SWITCH	
CUSTOMER SETTINGS (SAVE VARIABLES)	

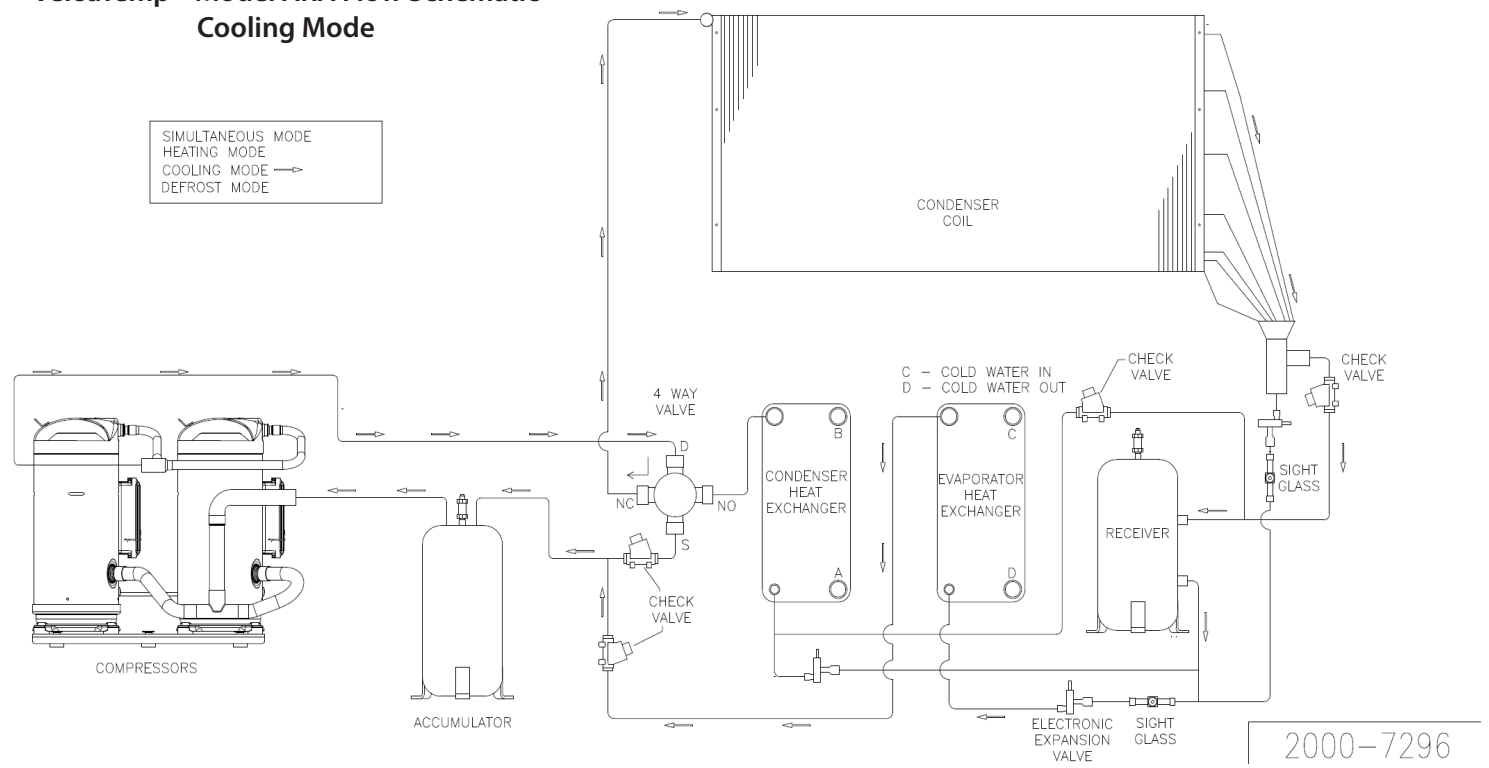
Normal Operating Conditions

The diagrams on Pages 22 and 23 schematically illustrate unit operation.

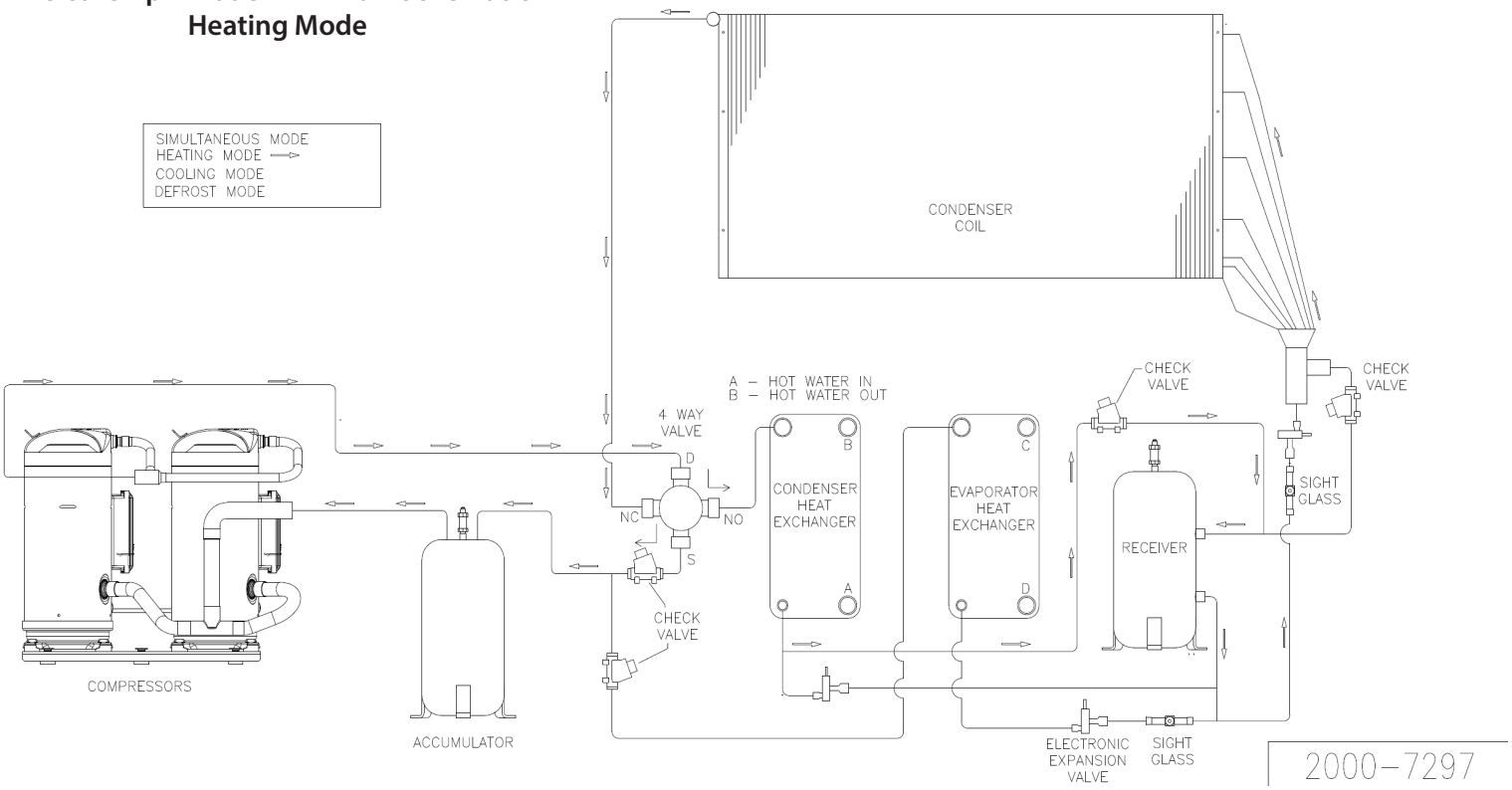
VersaTemp™ Model ARA Flow Schematic Simultaneous Heating and Cooling Mode



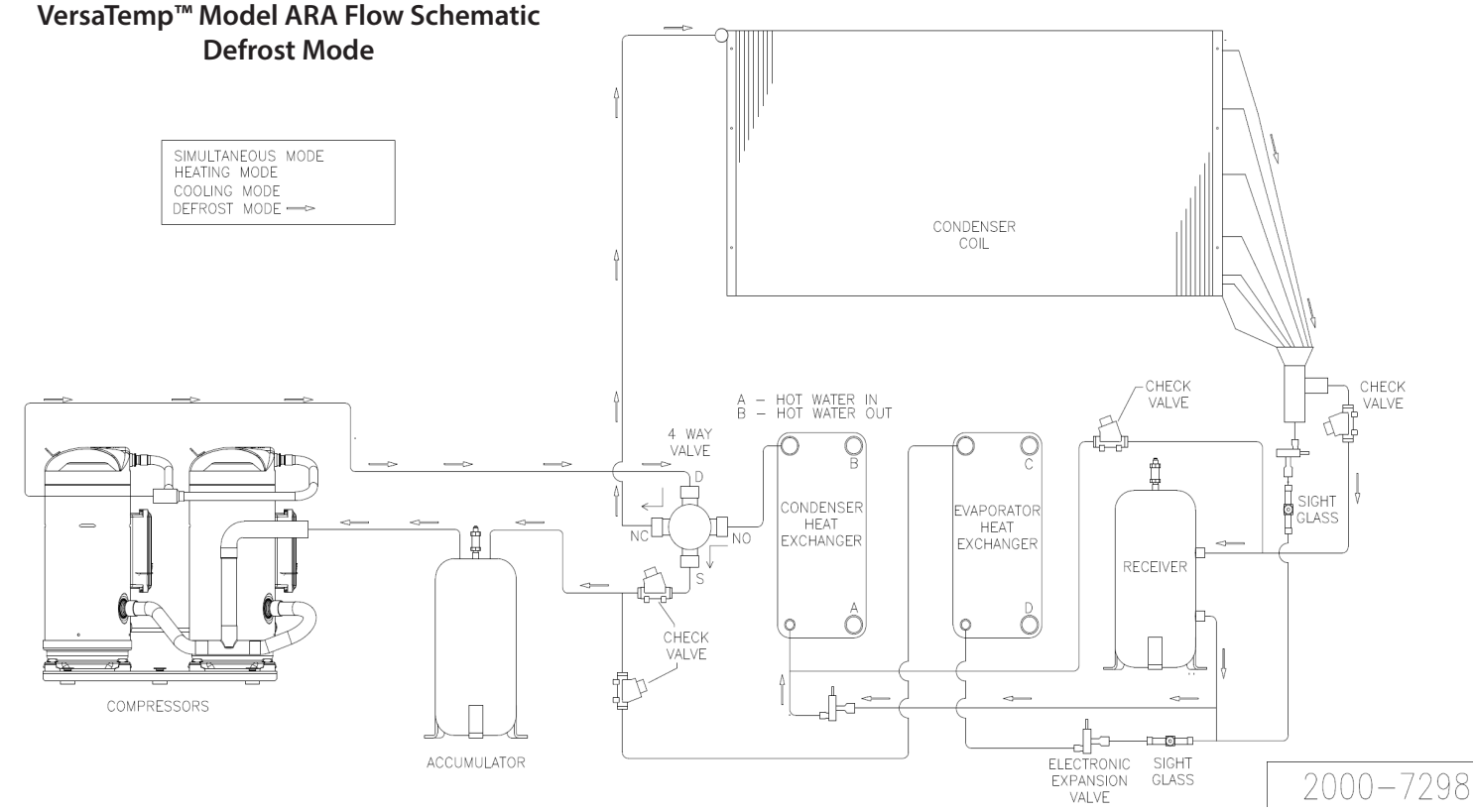
VersaTemp™ Model ARA Flow Schematic Cooling Mode



VersaTemp™ Model ARA Flow Schematic Heating Mode



VersaTemp™ Model ARA Flow Schematic Defrost Mode



Daily Log Sheet

Page 29 of this manual includes a chiller information log sheet. The log sheet can be used daily, weekly or as desired to record operation characteristics of the chiller. The information recorded on the log sheet can also be very helpful for diagnosing potential problems in the system.

Pressure Readings

The operating suction and discharge pressures in the system are directly related to water flow, condenser temperatures, chilled water set-points, and system cleanliness.

For a R410A chiller at standard water-cooled conditions of 55 degrees F entering chilled water (ECHW) temperature, 45 degrees F leaving chilled water (LCHW) temperature, 85 degrees F entering hot water (ECW) and 95 degrees F leaving hot water (LCW) the suction pressure should be approximately 109 psig and 342 psig discharge pressure.

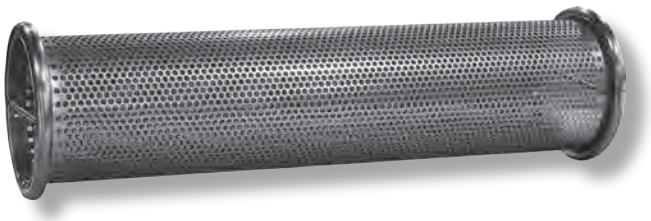
All Multistack modules have a high pressure (HP) cut out safety device. The HP cut out for water-cooled MS modules is 465 psig. Each Multistack module also has a low pressure (LP) safety device. The LP cut out is 50 psig. If circuits are faulting on HP the first action to be taken should be checking the hot water strainer for debris. An LP fault can be an indication of low refrigerant charge in the system. If a circuit is going out on a LP fault check the static pressure of the system while the circuit is in the off mode. If pressures are low check the circuit for possible leaks. The circuit can be pressurized to 15 psig with refrigerant and topped to 160 psig with dry nitrogen.

Water Treatment

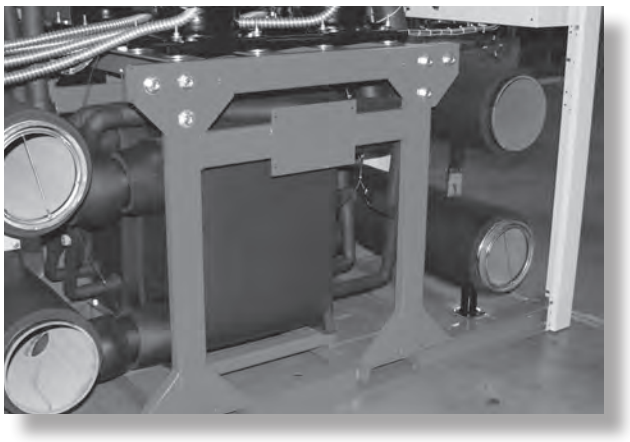
Proper Water treatment is essential to ensure the peak efficiency and performance of the chiller. The hot and chilled water quality should be kept within the following parameters to prevent heat exchanger damage. The use of hydrochloric, sulfuric, and muriatic acids as well as household bleach can cause stress corrosion to the stainless steel in the heat exchangers. Use of these or any other unapproved chemicals is not covered under the Multistack warranty.

Multistack Water Guidelines

PH	> 7 - < 9
TDS	< 1000 ppm
Hardness	30 - 500 ppm
Alkalinity	30 - 500 ppm
Chlorides	< 200 ppm
Sulfates	< 200 ppm

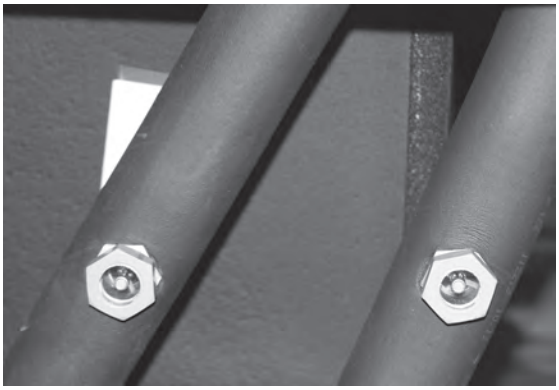


Heat exchanger water header inlets include a built in 30-mesh strainer to prevent heat exchanger fouling. Strainers provide 100 percent flow filtration.



Refrigerant Charge / Evacuation

All Multistack chiller modules are factory-charged with the recommended refrigerant volume. Before field charging, each circuit is to be evacuated to 500 microns and held 15 minutes. Correct refrigerant charge for each module appears on the module data plate.



Typical Liquid Line Refrigerant Sight Glasses

Filter Driers

Multistack modules have very short refrigerant piping runs, requiring minimal refrigerant charge. As a result, liquid line filter driers are not factory installed. However, when changing a major component, a replaceable core suction line filter kit can be added to reduce contamination. A suction liquid line filter drier kit with installation instructions can be purchased from the Multistack representative.

Superheat/Subcooling

Superheat is set at the factory at 10–12 degrees in the electronic expansion valve.

Sub cooling is necessary in the system to prevent flash gas as the refrigerant enters the expansion valve. Multistack condensers are sized so that sub cooling of the liquid refrigerant will take place with no separate sub cooler being needed. Proper sub cooling range is 8 -12 degrees.

Pressure Relief Valve

Multistack modules do not have pressure relief valves as standard. If desired or required by local code, a pressure relief valve may be added at the jobsite. Contact a Multistack representative for instructions.

Compressor Oil Level

All Multistack module compressors include an oil level sight glass. Each module is run tested and the compressor oil level is factory set. Scroll compressors with R-410A are all single stage. The factory oil level is set at 1/8 – ¼ full sight glass. Compressors use POE refrigeration oil. Factory oil charge volume for each compressor is found on the compressor nameplate.

Compressor Replacement

In the event of a compressor failure, determine the cause of the failure. A compressor motor burnout due to a fault in the motor insulation is quite rare. Most burnouts are caused by a mechanical condition or lubrication problems. In the event of a burnout, proper clean up procedures should be followed .

1. Check all electrical circuit components (contactors, fuses, wires, etc.)
2. If necessary, do a system clean up. Nu-Calgon RX-11 flush, or Sporlan System Cleaner work well.
3. Install a suction line filter drier with burnout core.
4. Evacuate system to a minimum of 500 microns and hold for 20 minutes.
5. Charge the circuit with virgin liquid refrigerant into the discharge side. See refrigerant charge on nameplate data of unit.
6. Run system two to three weeks with burnout filter core. Replace with standard core drier.
7. Check superheat, pressure gauges, oil levels, master control operation and sensor accuracy.

Heat Exchangers

Multistack uses brazed plate stainless steel hot and chilled water heat exchangers. Without proper water treatment or due to abuse, heat exchangers can corrode over time and eventually develop internal leaks, requiring replacement.

Heat Exchanger Testing

1. Shut down chiller, valve off, and drain water from side to be tested.
2. Remove grooved pipe couplings and header pipes at module with suspected leak.
3. Place a seal over the water connections such as balloons or plastic gloves.
4. Pressurize refrigerant side with up to 160 psig nitrogen.
5. If there is a water-to-refrigerant leak the seals on the water side should expand.

Heat Exchanger Replacement

1. If the refrigerant has not been lost, recover the refrigerant.
2. Isolate the chiller and drain the water from the side to be worked on.
3. Remove the water header pipes by unbolting the grooved couplings.
4. Support the bottom of the defective heat exchanger and the other circuit heat exchanger as needed. A 2x4-inch and 1x4-inch board should fit.
5. Cut the refrigerant piping to remove the heat exchanger. Cut on the bottom side of the elbow and sweat off remaining portion of old elbow.
6. Remove the red support brace that holds both heat exchangers in place. Once removed, remove the defective hanger.
7. Set the new heat exchanger in place and re-install the support brace.
8. Fit the couplings and refrigerant piping into the heat exchanger. It may be necessary to loosen the Rotolock connector at the compressor.
9. Braze in the new exchanger while purging with low pressure nitrogen.
10. After brazing, leak test and evacuate to 500 microns. Charge the circuit according to the name plate charge.

If the heat exchanger failure has caused water to enter the refrigerant side, the compressor and opposite side heat exchanger must also be checked for contamination. If water has entered the compressor it is recommended that the compressor be replaced as removing all moisture from the oil is very difficult. Replacement of the other contaminated heat exchanger, the expansion valve, and installation of a suction drier with a water core cartridge is also recommended. Evacuate the circuit to 500 microns and hold 20 minutes. Charge the circuit and run two to three weeks with a water core cartridge, then replace with a standard core.

Annual Maintenance

Most annual maintenance for Multistack chillers involves proper shut-down and heat exchanger cleaning. Preventative Maintenance bulletin #021594PM and Heat Exchanger Cleaning Procedures bulletin #091594CP describe the procedures. Multistack also makes available a cleaning kit available to help with this process.

Task	Daily	Monthly	Qtrly	6 Mos	Yearly	5 Yrs	As Req'd
Quick check for any faults	x						
Water Treatment Readings check on Condenser		x					
Visual Inspection for Mechanical Damage				x			
Check for Excessive Vibration				x			
Check main power supply voltage					x		
Check all electrical connections					x		
Visual inspection of all wiring for hot spots					x		
Verify/Test all interlocks and safeties					x		
Clean all PCB's to remove dust build up					x		
Check Evaporator water quality					x		
Clean Condenser Filter strainers (minimal)				x			x
Clean Evaporator Filter strainers					x		x
Clean Condenser Heat Exchanger						x	x
Clean Evaporator Heat Exchanger						x	
Verify EEV Operation					x		
Visual leak Check of Chiller			x				
Leak Check Entire Chiller					x		
Torque compressor rotolocks					x		
Review Trend Logs to verify chiller perf.			x				
Check subcooling and superheat readings					x		
Check compressor oil level			x				
Check Evap and Condenser Approach Temps					x		
Check water side pressure drop across chiller		x					
Check Temperature drop across heat exchangers		x					

Troubleshooting

The following guide may be used for troubleshooting the modules and controls.

FAULT	SOLUTION
No Display on Master Module	Check main disconnect for power
	Check circuit breakers in module
	Check transformer in modules
	Check for 24V at J1 on board
EX 1,2, Interlock	Check appropriate interlock component
	Check jumpers on TB11 in master control
EX 4 Interlock	Check for proper rotation, phasing
	Check PPM device
Waiting For Chilled Water Flow	Check CHW pump
	Check flow switch operation
	Check filter strainers
	Check TB11 inputs #3 - #7
Waiting For Condenser Water Flow	Check CW pump
	Check flow switch operation
	Check filter strainers
	Check TB11 inputs #3 - #8
Low Chilled Water Temp	Check LCHW sensor
	Check set points in system variables
	Check for flow restriction
No Demand	Check entering CHW sensor
	Check set points in system variables
	Check sensor location
100% Demand all the time	Check entering CHW sensor
	Check set points in system variables
100% Demand, chiller won't load	Turn chiller on
	Check sensors
	Check load limit setting in system variables
Excessive Cycling	Check VSP setting in system variables
	Check entering CHW sensor location
	Look for system problem (low water Volume, low load)
High Discharge Pressure (HP)	Check strainers in condenser headers
	Check condenser water flow
Low Suction Pressure (LP)	Check refrigerant charge / leaks
	Check expansion valve
Low Suction Temperature	Check suction sensor
	Check set points in system variables
	Check for flow restriction
Communication Error	Check settings in system variables
	Check cables at J11 comm ports
	Check dip switch settings
Circuit Fault	Check components in control circuit
	Check wire crimps in control circuit
	Check ratio of HP to LP
P Lan Error	Check cables at J11 comm ports
	Check for possible power issues

Operating Log

Use this log sheet to record daily, weekly or monthly operating settings and conditions.

Job Name:						
Job Number:						
Chiller Serial Number:						
Date:						
	ECHWT	**LCHWT**	**DISCH PRESS**	**DISCH TEMP**	**SUCT PRESS**	**SUCT TEMP**
Comp #1						
Comp #2						
Notes:						

MULTISTACK®

Originators. Innovators. Never the Imitators.

1065 Maple Avenue P.O. Box 510 Sparta, WI 54656

Phone 608-366-2400 • Fax 608-366-2450

www.multistack.com

ARA-IOM-001 022017

Supersedes 102015

FWB

Shipping Information

NOTE: Before accepting delivery of the Multistack chiller, check the overall condition of the equipment for visible damage including broken copper lines, oil leaks, damaged controls and/or electrical component housing, or any major component torn loose from its mounting. If the Multistack unit is damaged during transportation or handling by the transportation company or its agent, the installing contractor MUST promptly file a claim with the transportation company and advise Multistack. Any discrepancies must be noted on the bill of lading.

Electric bussbars, ground strap, power connectors, junction box, j-box throat, j-box phase monitor and sensor wells are packaged and shipped separately from the unit.

Handling Modules

If modules are damaged during shipping and handling by the transportation company or its agents, promptly file a claim with the transportation company and advise Multistack. It is very important to note any damage on the bill of lading when signing for the heat pump delivery. Digital photos of the damage are also helpful.

Fork Lift or Pallet Jack

The modules can be safely lifted and maneuvered with a forklift or pallet jack. Position lifting forks under the frame channels.

Crane or Other Lifting Devices

If lifting units by crane, ensure that the slings (do not use chains) do not damage the modules. The lift points are at the corners of the base of the unit. Use a spreader bar to prevent damage.

Typical lifting method using a pallet jack.

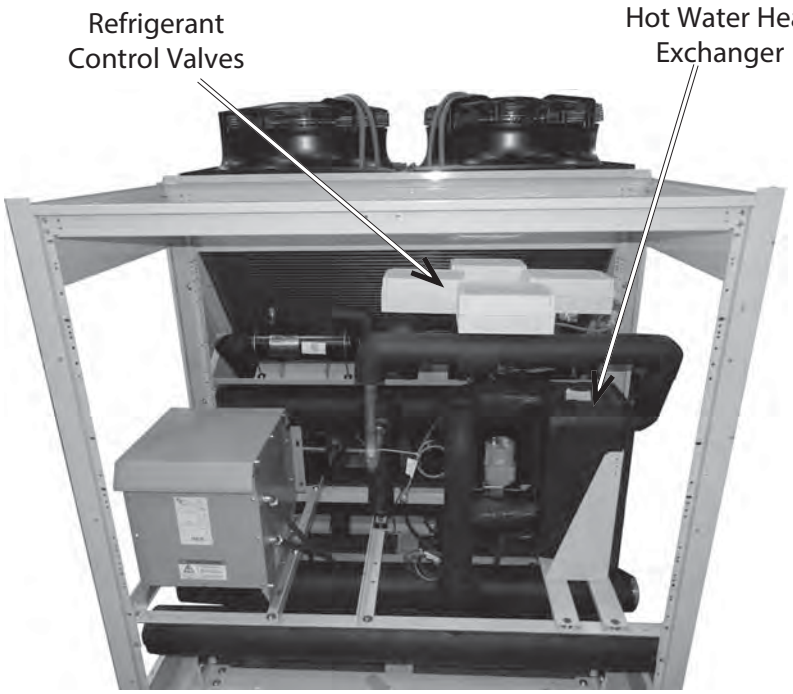
Clearances

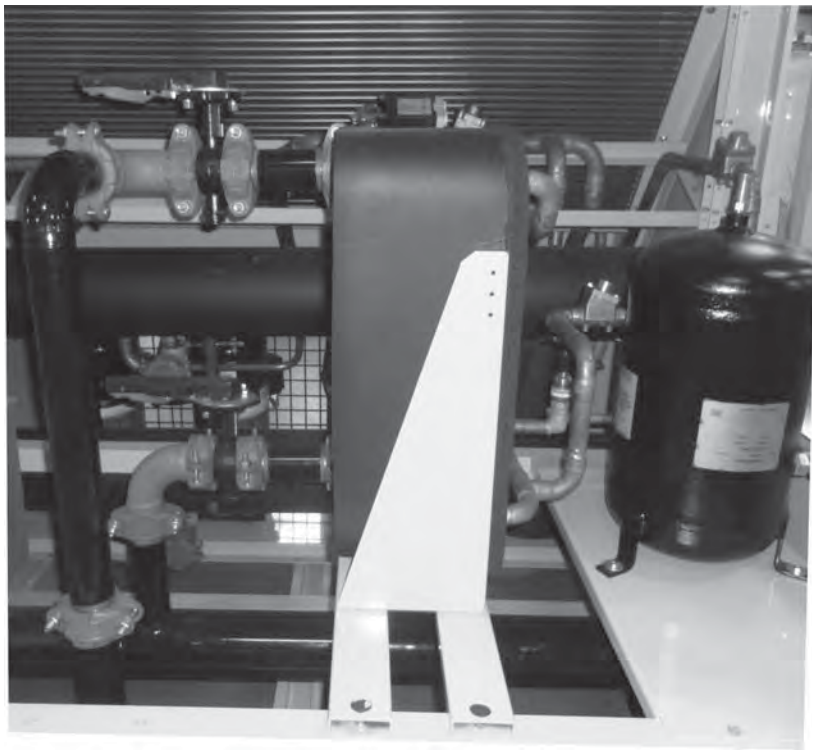
Recommended clearances for VersaTemp water-to-water heat pumps are 42 inches both the front and back for service. 32 inches on each end of the modules. At the electrical junction box end the 32 inches starts at the box's end. 36 inches minimum overhead clearance is recommended. Note: These recommendations are for service. Local code requirements take precedence.

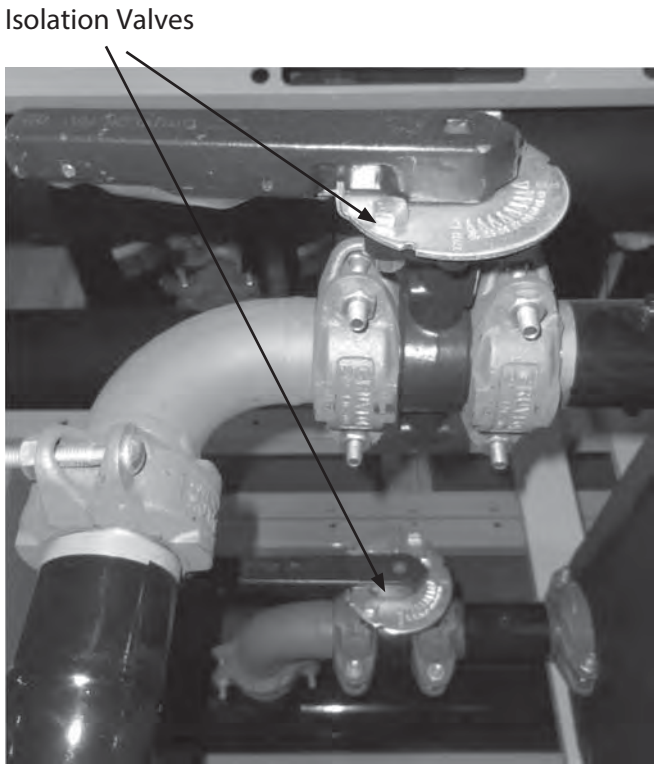
Site Preparation

Modules are to be mounted on steel rails, preferably 4x4-inch, using rubber insulators. After installation the chiller should be level to within 1/8-inch over the length of the chiller.

Typical Component Arrangement







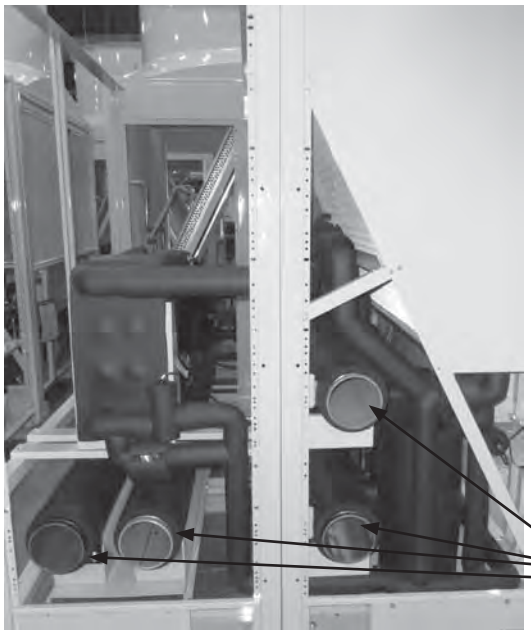
Module Assembly

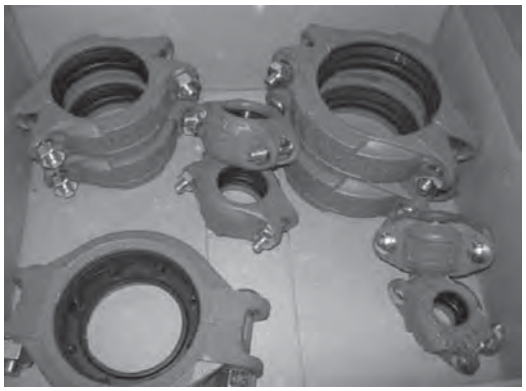
VersaTemp™ units are to be installed on a level surface with steel rails to ensure proper alignment of all fittings. Modules are to be level to within 1/8-inch over the length of the units. Rails should run parallel with module water flow (headers). For maximum stability three rails should be used, one rail for each outside edge and one center rail. The outside rails should be placed flush with outside frame. Internal rail shares half the distance (two inches) with rear and front modules.

To ensure all warranties and a successful installation, a factory authorized technician is required to start the VersaTemp system. If start-up is to be performed directly by Multistack, at least two weeks notice is required. Call the Multistack Service Department at (608) 366-2400 to schedule.

To install multiple Model ARA VersaTemp units as a single array, follow Steps 1 through 16, and refer to the piping requirements, diagrams and information on Pages 14 and 15.

1. Determine piping location before setting VersaTemp™ units in place.
2. Install unit on 4x 4-inch steel rails. Outside rails to be placed flush with edge of frame.
3. Place waffle type vibration eliminators every 32 inches under rails.
4. Lubricate rails with non-petroleum lubricant.
5. Place first module on the rails.
6. Slide module into position.
7. Place subsequent modules onto rails.
8. Leave space between modules to install coupling gaskets.
9. Lubricate gaskets with non-petroleum lubricant.
10. Slide modules together, lining up footing holes and install bottom joining bolts.
11. Install top joining bolts.
12. Starting with lower header, install the couplings. Position coupling bolts as shown for proper frame installation. frame. (Bolts @ 1:00 and 7:00)
13. If adjustment is needed when tightening bolts, loosen center header. bolt.
14. Loosen the heat exchanger grooved couplings.
16. Install the header blank ends, start with the bottom then move to the top which includes the drain valves.
17. After connecting the modules, tighten the grooved couplings.
18. Before initial startup, check the water piping system for leaks.





Grooved couplings for attaching pipe headers on modules. Size and number of couplings shipped is based on specific Multistack units shipped.

Water Piping

Sensor Wells

Sensor wells are provided by Multistack and must be installed at least 30 inches from the entering and leaving water connections at the chiller. See diagrams on Pg. 15.

Sensor Well

Leak Testing

When all connections are complete, static pressure test the piping and seal any leaks. When saisfactory, start the system pumps and purge any remaining air from the system. Seal any additional leaks.

Piping System Flushing Procedure

Before connecting the chiller to the hot and chilled water piping, the piping loops (including new and existing systems) must be flushed with a detergent and hot water mixture to remove dirt and organic residue. After removing organic residue, continue flushing using a dilute phosphoric acid, sulfamic acid or citric acid and water mixture to remove any inorganic scale in the pipe.

Cleaning chemicals such as Nu-Calgon "Imperial Scale Remover" (Part Number 4360-84 or equivalent) suitable for both organic residue and scale removal may be substituted. Otherwise detergents and acids shall not be combined unless approved by the chemical manufacturers. Only chemicals compatible with 316 stainless steel, copper and carbon steel may be used. Chemicals containing hydrochloric or sulfuric acid or chlorides must not be allowed to contact the copper brazed 316 stainless steel heat exchangers.

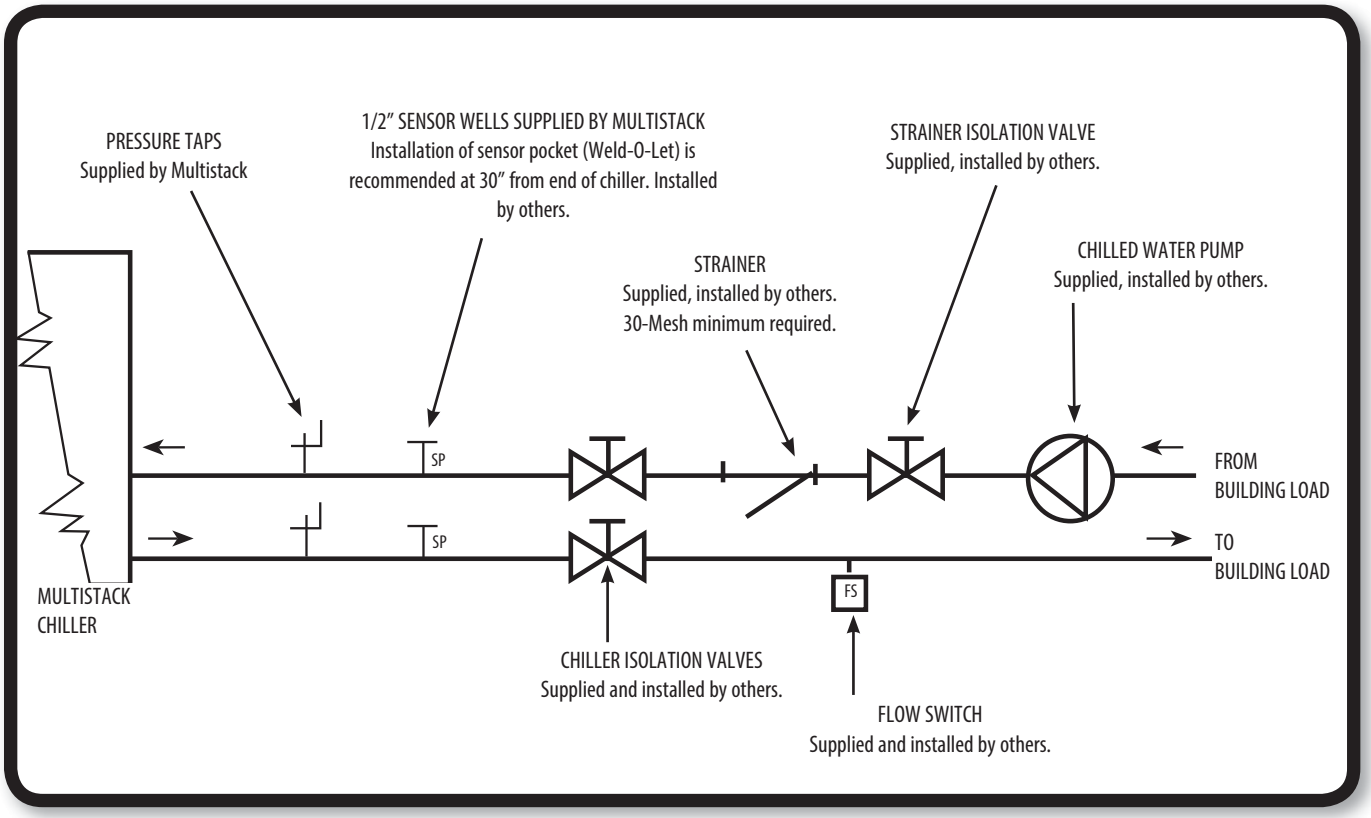
30-mesh (minimum) strainers (or equivalent) must be in place in the system piping while flushing. Examine the strainer frequently to remove residue. Continue flushing the loop at least six hours or until the strainers remain clean. Older piping systems with heavy scale must be flushed a minimum of 24 hours and may require as much as 48 hours of flushing before the filters remain clean. Detergent and acid concentrations may only be used according to the respective chemical manufacturers instructions. After flushing with detergent and/or dilute acid concentrations, the system loop must be purged with clean water for at least one hour to help ensure that all residual cleaning chemicals have been flushed out. Before connecting water to the chiller, review the water treatment specifications. Consult the maintenance and off-season shutdown procedures.

Water Treatment, Specifications

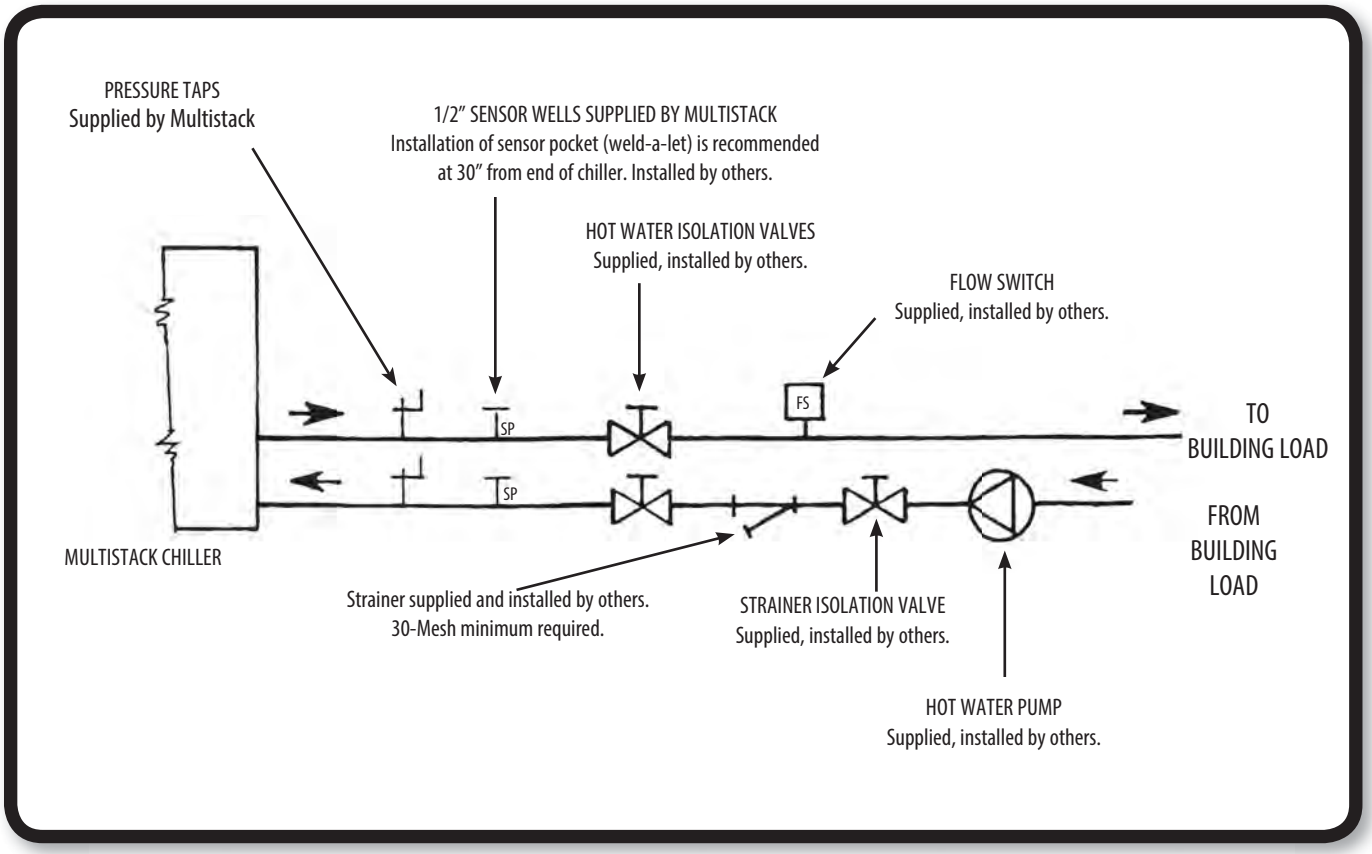
Supply water for both chilled and hot water circuits must be analyzed and treated by a professional water treatment specialist familiar with the operating conditions and materials used in Multistack chiller heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for modular chillers using 316 stainless steel brazed plate heat exchangers and carbon steel headers is maintained within the following parameters (for straight water). Glycol numbers will show higher for TDS and alkalinity.

ph:	>7 and <9
Total Dissolved Solids (TDS):	Less than 1000 ppm
Hardness as CaC03:	30 to 500 ppm
Alkalinity as CaC03:	0 to 500 ppm
Chlorides:	Less than 200 ppm
Sulfates:	Less than 200 ppm

Required Chilled Water Piping

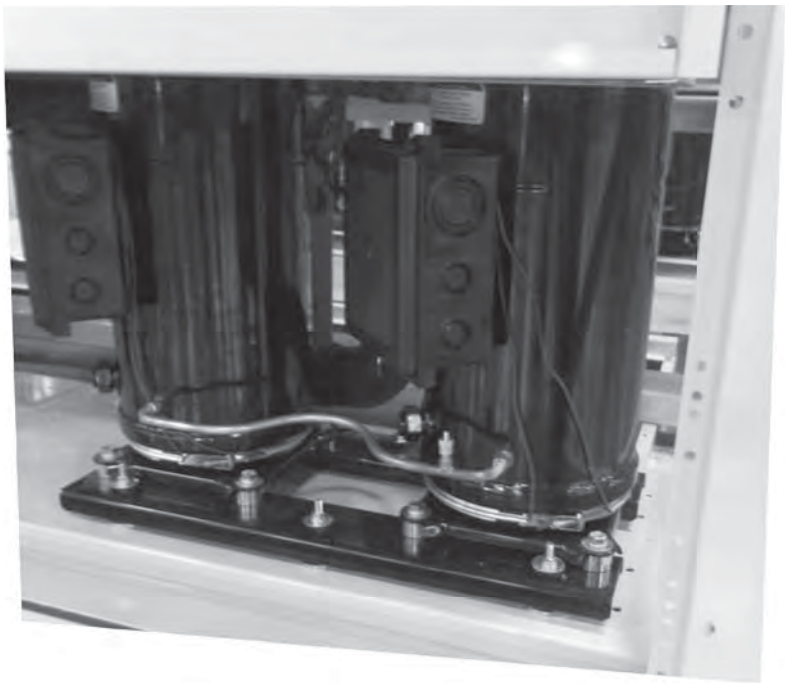


Required Hot Water Piping

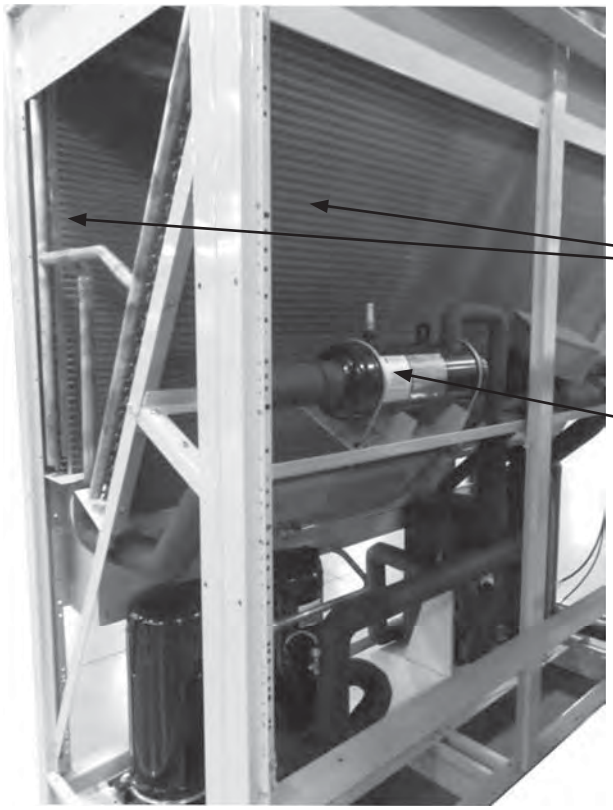


Electronic Refrigerant Expnasion Valves

ECM Condenser Fans
(Except 575 V units)



Scroll Compressors



System Wire & Fuse Sizing Specifications

(Applicable codes may require different wire sizing)

Compressor Rated Load Amps (RLA) and Locked Rotor Amps (LRA)

NOTE: RLA and LRA are for each compressor.

Wiring Sizing: Minimum Circuit Ampacity (MCA)
MCA = (1.25 x RLA1*) + RLA2 + RLA3+ RLA4

RLA/LRA Per Compressor

	No. of Compressors	208/3/60 RLA/LRA	230/3/60 RLA/LRA	460/3/60 RLA/LRA	575/3/60 RLA/LRA
ARA020X	2	44/239	40/239	20/125	16/80
ARA030X	2	68/340	61/340	31/173	25/132
ARA060	2	N/A	N/A	60/310	48/239

Fuse Sizing: Maximum Overcurrent Protection (MOP), Type RK5 Fuse, or HACR Time Delayed Circuit Breaker
MOP= (2.25 x RLA1*) + RLA2
Where the MOP does not equal a standard size rating, the next larger size should be used. The MOP should not exceed 800 amps.

NOTES:

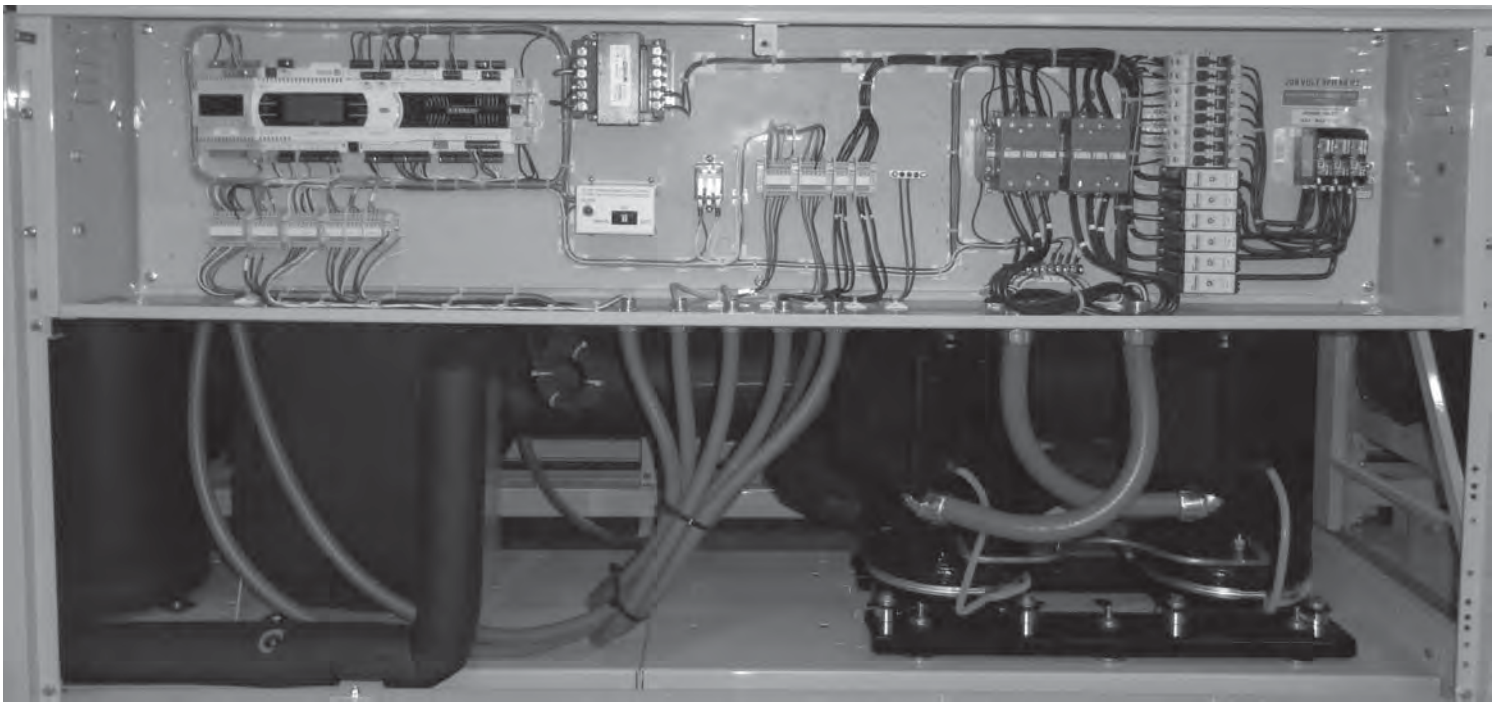
*RLA1 = RLA of the largest compressor in the system; RLA2 , RLA3 & RLA4 = RLA of the other compressors in the system.

The total system Minimum Circuit Ampacity (MCA) shall not exceed 760A. Wire sizing is based on the National Electric Code (NEC) rating for 75°C copper wire, three wires per conduit. Wiring distance from branch circuit shall not exceed 100 feet.

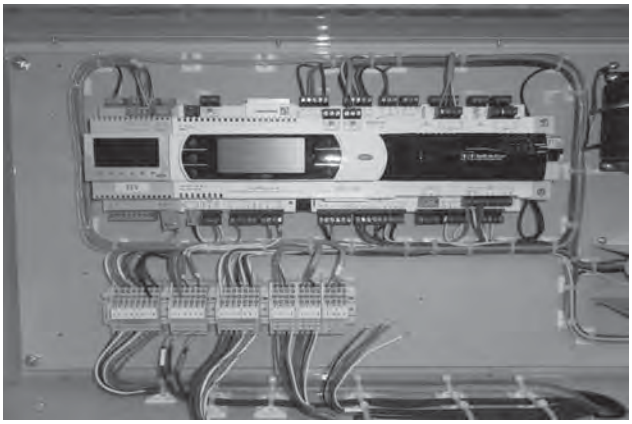
MCA	3 CONDUCTORS 1 CONDUIT	6 CONDUCTORS 2 CONDUIT
50	8	--
65	6	--
85	4	--
100	3	--
115	2	--
130	1	--
150	1/0	--
175	2/0	--
200	3/0	--
230	4/0	--
255	250 MCM	--
285	300 MCM	--
310	350 MCM	2/0
335	400 MCM	2/0
380	500 MCM	3/0
420	600 MCM	4/0
460	--	4/0
510	--	250 MCM
570	--	300 MCM
620	--	350 MCM
670	--	400 MCM
760	--	500 MCM
800	--	600 MCM

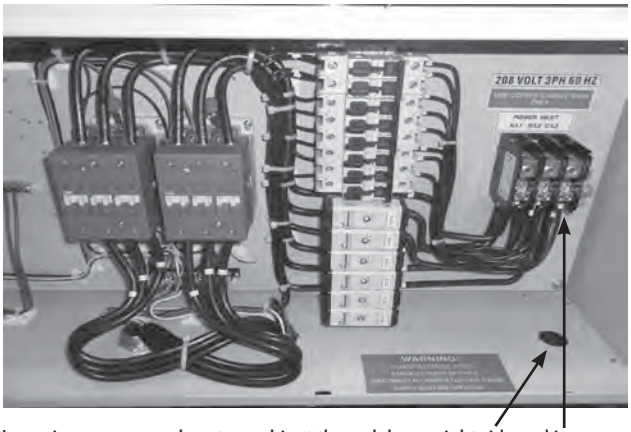
Main Power Connection Terminal Block -- Located on lower right side of control panel.

Electrical Panels



DANGER: To avoid the risk of electrical shock, personal injury or death, disconnect all electrical power to the unit before performing any maintenance or service. The unit may have more than one electrical power supply. Assume all electrical wires are energized. Use lockout/tagouts.





Incoming power supply enters cabinet through lower right side and is connected at A/L1, B/L2 and C/L3 and grounded to cabinet.