CALOREK | GEOTHERMAL HEAT-PUMP

MULTI-ZONE HEATING AND AIR CONDITIONING SYSTEM

INSTALLATION MANUAL



-WTW series residential

-Water to water geothermal heat pump

-Residential packaged unit

-Model sizes 3 ton, 5 ton variable speed

-DC Inverter with adaptive algorithm technology

-R-410A

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TABLE OF CONTENT

WARNING 5

1 SPECIFICATIONS 6

2 GENERAL DESCRIPTION 7

2.1 ELECTRICAL PANEL COMPONENTS 7

2.2 MECHANICAL COMPONENTS 8

3 MECHANICAL INSTALLATION 9

3.1 CLEARANCES 9

3.2 WATER CONNECTIONS 12

3.3 SOURCE SIDE MODULATING WATER VALVE INSTALLATION 12

3.4 OUTDOOR TEMPERATURE SENSOR INSTALLATION 13

4 POWER CONNECTIONS 14

5 CONTROL CONNECTIONS 15

5.1 THERMOSTATS/CONTROLS CONNECTIONS 15

5.1.1 CONTROL TERMINALS LOCATION IN WTW036 15

5.1.2 CONTROL CONNECTIONS SCHEMATIC FOR FLOOR SYSTEM ONLY 16

5.1.3 CONTROL CONNECTIONS SCHEMATIC FOR AIR HANDLER ONLY 16

5.1.4 CONTROL CONNECTIONS SCHEMATIC FOR FLOOR SYSTEM + AIR HANDLER 17

5.1.5 CONTROL CONNECTIONS SCHEMATIC FOR FLOOR SYSTEM + DOMESTIC HOT WATER 18

5.1.6 CONTROL CONNECTIONS SCHEMATIC FOR FLOOR SYSTEM + AIR HANDLER + DOMESTIC HOT WATER 19

5.2 OUTDOOR TEMPERATURE SENSOR CONNECTIONS 20

5.2.1 OUTDOOR TEMPERATURE SENSOR CONNECTIONS LOCATION IN WTW036 20

5.2.2 CONTROL CONNECTIONS SCHEMATIC FOR OUTDOOR TEMPERATURE SENSOR 20

6 SYSTEM OPERATION 21

6.1 CONTROL INPUTS FUNCTIONS 21

6.2 COOLING OR HEATING MODES PRIORITY 21

6.3 COMPRESSOR OIL RETURN SEQUENCE 21

6.4 FREEZE PROTECTION 22

6.5 FORCE EXPANSION VALVES TO FULLY OPEN 23
7 ALARM CODES LED INDICATOR 23
7.1 ALARM CODES DESCRIPTIONS 24
8 GRAPHIC USER INTERFACE (GUI) 25
8.1 GUI MAIN PANEL 25
8.2 GUI SETPOINTS PANEL - HEAT MODE TAB 26
8.2.1 SETTING OF Y1 AND Y2 WATER TEMPERATURE SETPOINTS IN HEAT MODE 27
8.2.2 SIMULATION OF WATER TEMPERATURE SETPOINTS SETTINGS 28
8.2.3 SETPOINTS UPLOAD TO UNIT'S MAIN CONTROL MEMORY 28
8.2.4 Y3 WATER TEMPERATURE SETPOINT IN HEAT MODE 28
8.2.5 DOWNLOAD STORED SETPOINTS TO GUI 29
8.2.6 CONTROL SETPOINTS IN COOL MODE 29
9 DIMENSIONAL DRAWINGS 30
9.1 WTW036 HEAT PUMP UNIT DIMENSIONS 31

WARNING

- **Before installing or using this product, you must read and understand these guidelines and keep them for future reference. The manufacturer will not be held responsible for anything that happens and the warranty will not be valid if the installer and/or the user does not meet these guidelines. This product must be installed by a qualified person and connected by a certified electrician in accordance with the different codes in force in your area.**
- **The non-compliance of these guidelines could result in personal injury, property damage, serious injury and electric shocks potentially fatal.**
- **Make sure that all screws and connections of electrical connection are tight before attempting to operate the device in the case they are released during transport.**
- **Protect the device using the circuit breakers or fuses appropriate in referring to the codes in force in your area.**
- **It is necessary to install an air filter in the return duct.**
- **Make sure that the power supply (voltage) corresponds to that indicated on the rating plate.**
- **This appliance must be grounded.**
- **Turn off the power supply to the appliance at the circuit breaker/fuse before proceeding with the installation, repair, and maintenance.**
- **Make sure that the appliance is designed for the intended use (if necessary, consult the catalog of products or a representative).**
- **Observe the distances and the positions mentioned in the installation section of this guide.**
- **If the installer or user modified the device in any way, it will be held liable for any damages resulting from this change and the UL certification and warranty will be canceled.**
- **This device must not meet a source of water and must be protected from splashing (ex.: water mop). Do not use if any part has been submerged. In addition, do not enable or do not disable when your feet are in the water, or you have wet hands.**
- **When you cut a section of steel for the installation of the return duct, make sure that you do not damage the electrical wiring of the unit.**
- **Do not insert foreign objects into the air inlets and outlets of the appliance, as this could damage it and cause an electric shock or a fire.**
- **The machine can produce electrical arcs (sparks). It is not designed to be used or stored in damp areas or containing flammable liquids, combustible materials and corrosive products, abrasives, chemical or explosives such as, but not limited to, paint, gasoline, chlorine, and cleaning products.**
- **Some places are dustier than others. It is therefore the responsibility of the user to evaluate whether it should change the filter according to the quantity of dirt accumulated on the latter.**
- **There is a risk of fire if the product is not installed and cleaned in accordance with these guidelines.**
- **If this device is damaged or defective, cut its electric power supply to the circuit breaker/fuse and do the repair in a repair center recognized (refer previously under the terms of the limited warranty).**
- **Identify all wires before disconnecting the device to ensure you to connect correctly by the suite. A bad connection can cause a malfunction and present a danger.**

1 SPECIFICATIONS

Model			WTW036	WTW060
AHRI reference #			205145525	207474490
Energy star			yes	yes
Power supply		V/ph/Hz	208-240/1/60	208-240/1/60
Heating	Capacity	Btu/h	36,000	60,000
	Capacity min-max	Btu/h	6,000 - 36,000	12,000 - 60,000
	Current	A	14	32
	Input	W	2912	6656
	Full load COP (GLHP)	W/W	3.04	3.05
	Part load COP (GLHP)	W/W	3.83	3.68
Cooling	Capacity	Btu/h	36,000	60,000
	Capacity min-max	Btu/h	6,000 - 36,000	12.000 - 60,000
	Current	A	14	32
	Input	W	2912	6656
	Full load EER (GLHP)	Btuh/W	13.67	13.39
	Part load EER (GLHP)	Btuh/W	21.08	20.96
Design pressure	High	PSIG	550	550
	Low	PSIG	240	240
Electrical data				
Maximum breaker or fuse		A	20	40
Minimum ampacity		A		
Refrigeration system				
Factory charge R410A		Lb (oz)	6.5 (104)	3.5 (56)
Compressor	Model		TNB306FPGMC	ZPV0382E-2E9-130
	Type		Variable speed rotary	Variable speed scroll
	Brand		Mitsubishi electric	Emerson
Metering device type			EEV	EEV
Source side heat Exchanger	Model		C-6611-01	R051-64W-S79
	Type		Coax	Brazed plate Ex.
	Water Connections		3/4” MPT	1” MPT
	Stainer mandatory		no	yes
Load side heat Exchanger	Model		C-6609-01	R051-64W-S79
	Type		Coax	Brazed plate Ex.
	Water Connections		3/4” MPT	1” MPT

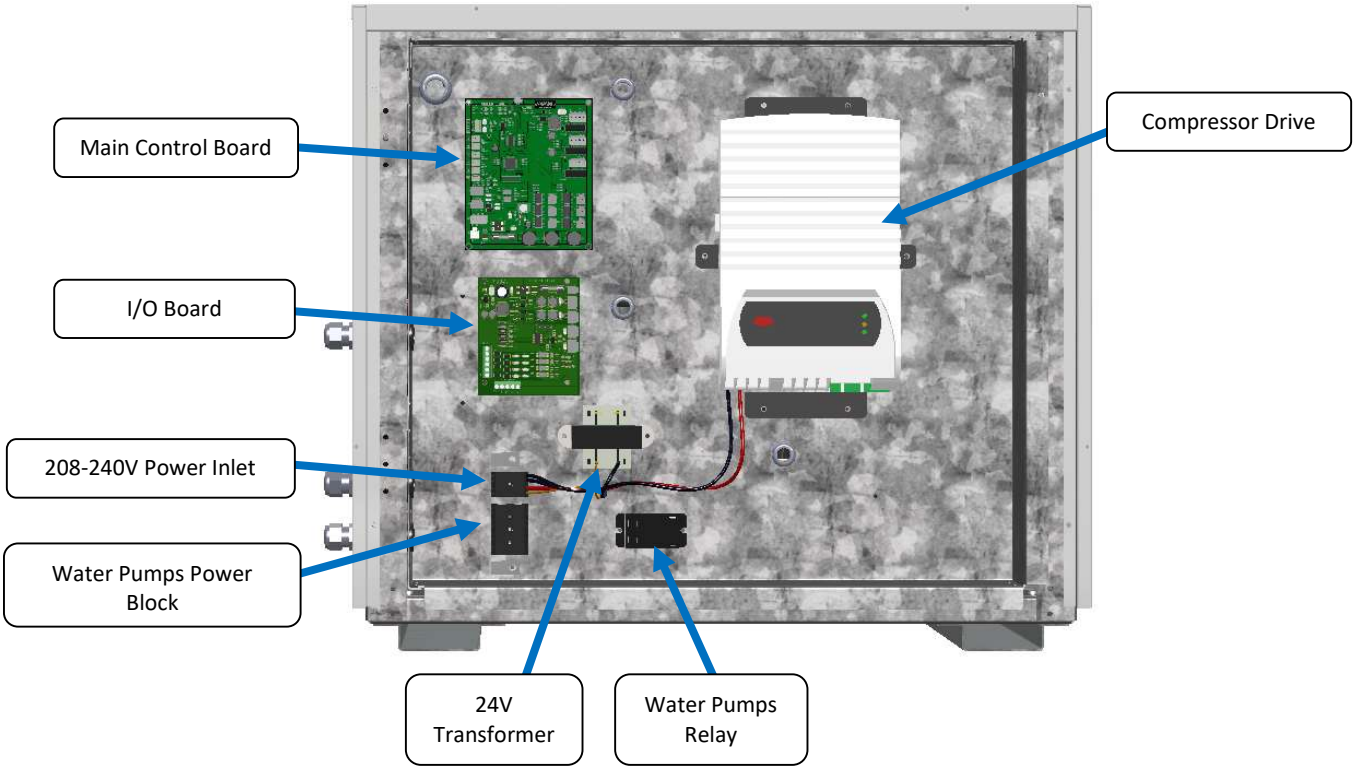
2 GENERAL DESCRIPTION

The WTW036 - Water to Water Heat Pump is a variable capacity geothermal heat pump. It features a variable speed compressor that modulate as per the load changing conditions.

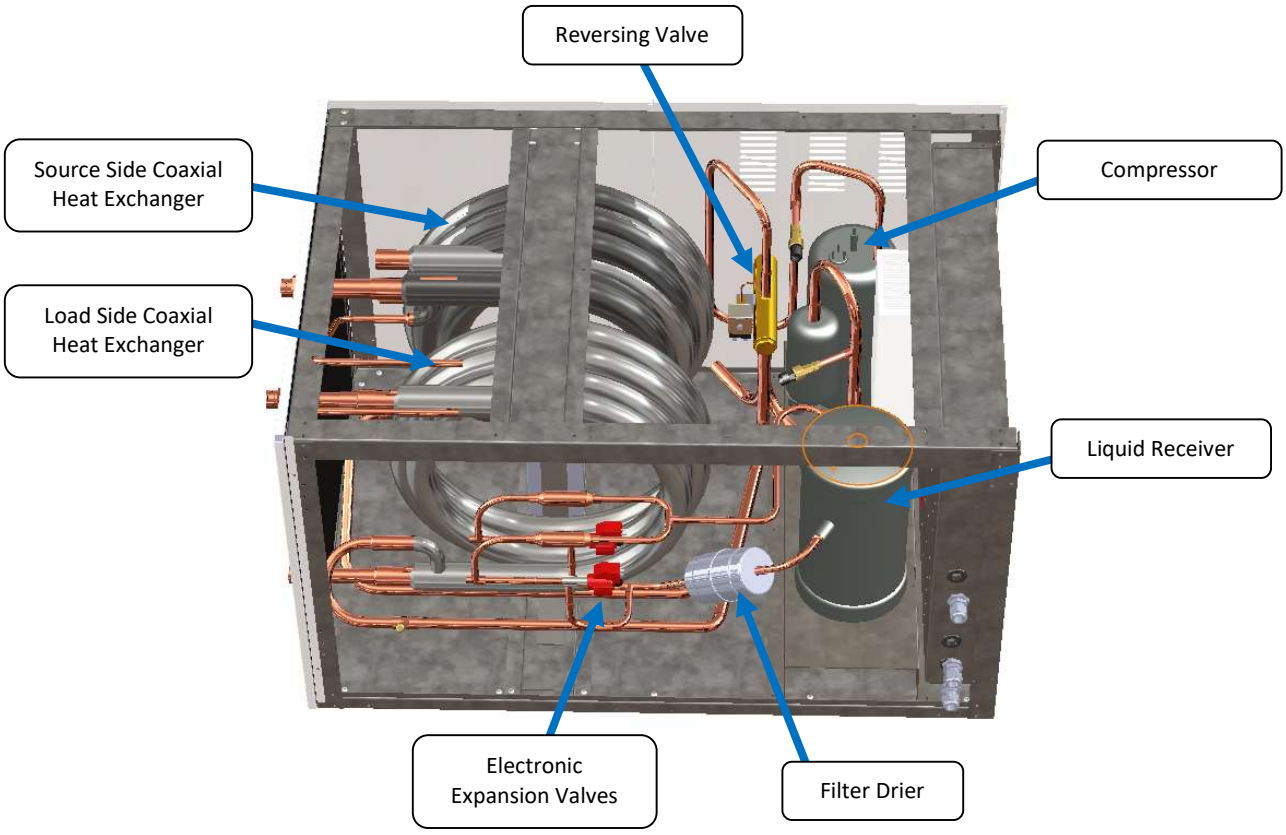
With oversized coaxial heat exchangers, electronic expansion valves and a liquid receiver, the unit has been designed to maximize its efficiency in a wide range of load conditions.



2.1 *ELECTRICAL PANEL COMPONENTS*



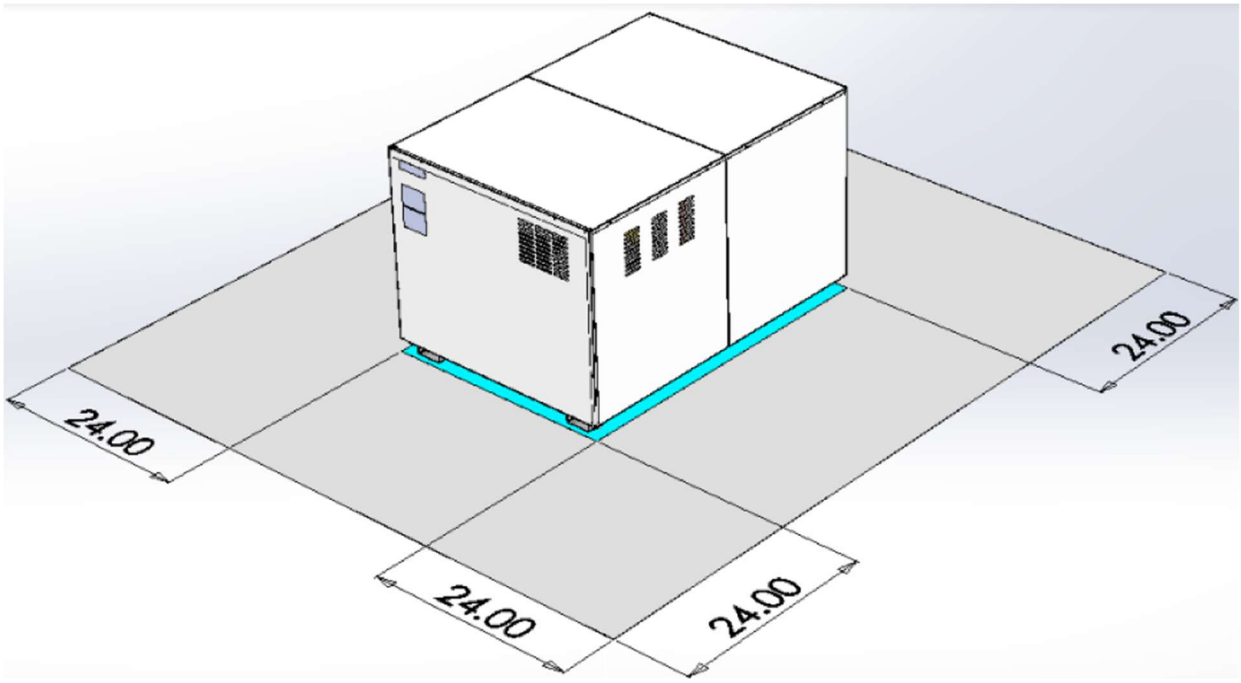
2.2 *MECHANICAL COMPONENTS*



3 MECHANICAL INSTALLATION

3.1 *CLEARANCES*

The unit must be installed in a way to allow easy servicing for the technician. Therefore, a minimal clearance of 24 inches on the electrical panel side is mandatory. Also, it is recommended to have minimal clearances of 24 inches on lateral and back sides. Top side minimal clearance is 12 inches



3.2 *General water installation*

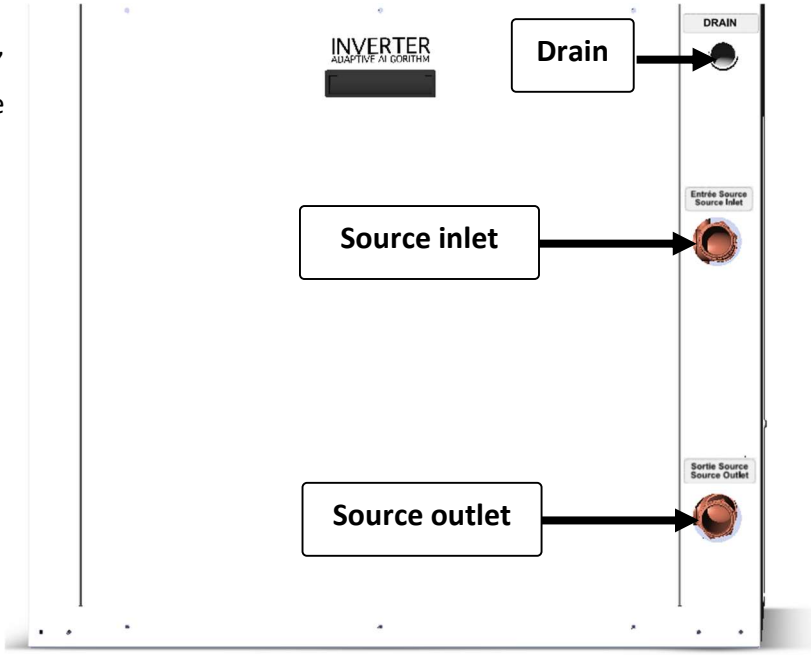
Water connections

The water inlet and outlet connections are 1" male NPT. Teflon tape must be used on each male fitting prior to screw-in the female fittings.

Water circuit flow rate

The proper water flow rate for each unit must be properly calculated. The total pressure-drop of the ground circuit, indoor piping, headers, heat pump exchanger pressure drop, minimum circuit temperature, and antifreeze type.

To assure proper flow, P/T ports should be installed to determine the flow rate. These ports should be located at the supply and return water connections on the unit. The proper flow rate of the circuit cannot be precisely set without measuring the water pressure drop through the source side heat exchanger. ***(P/T ports are not included)***



*** Proper flushing and purging methods and any other procedure associated with this product must be performed by a qualified personal. ***

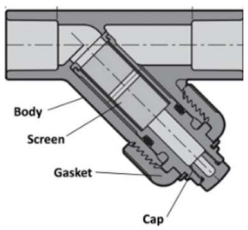
3.3 *BPHE - Brazed plate heat exchanger*

WTA series comes standard with (BPHE) Brazed Plate Heat Exchanger, it's made of stainless-steel plates, brazed with copper or nickel. The brazing process seals the plates together making extremely durable.

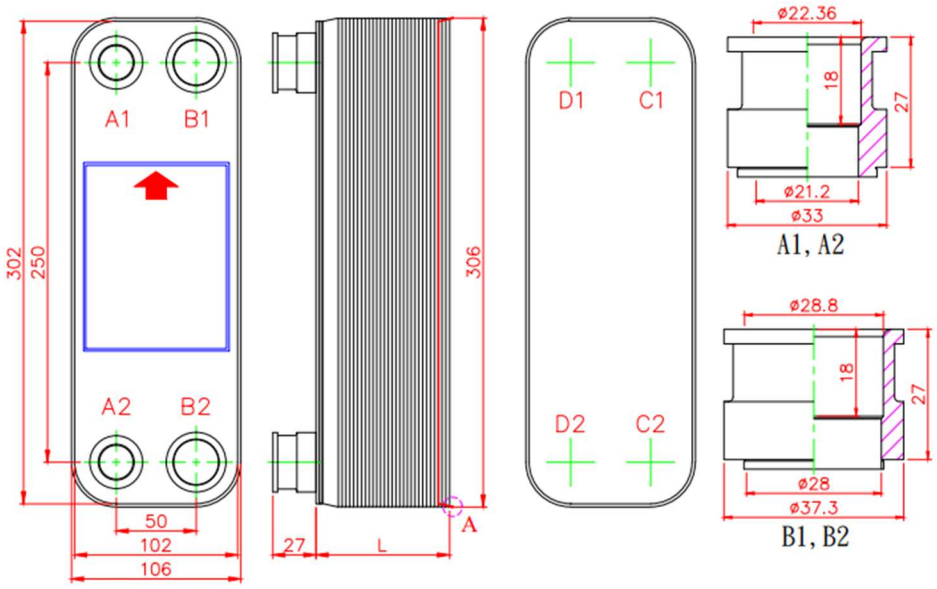
Filters and cleaning

The uses of strainer or filter <1mm, 16 mesh before the inlet water connection are mandatory to filter out dirt or large particles **(Strainer/filter not included).** After the water circuit as been in operation for few hours, strainer or filter should be checked and cleaned and 6-8 month after that it should be recheck and cleaned if necessary. Failure to do so could result in blockage in heat exchanger water circuit due to dirt or large particles which will reduce water flow rate and could cause freezing effect, damage the integrity of the BPHE or heat pump operation malfunction. **(Example of strainer below)**

Y Strainer



BPHE image.



Cleaning solution

If heat exchanger water piping is dirty due to service of water circuit and need to be clean, a weak acid with concentration less than 5% can be used, for example: citric acid, oxalic acid add in a tank. Before re-connecting and restarting the system, flush the heat exchanger water circuit with large amounts of fresh water to purge any remaining acid solution. If the acidity is too high, the copper and stainless steel inside the BPHE may be etched or corroded, which could decrease life span of exchanger**.**

Warning

Seawater, chlorinated water, etc. are not suitable for BPHE because of their corrosive nature on regular stainless steel and copper. Please refer to Water Quality Standard (JRA-GL-02-1994) chart.

Ground water with high levels of sulfuric compound, sulfuric acid, or low PH value, may cause gradual copper corrosion and damage the BPHE in a few years.

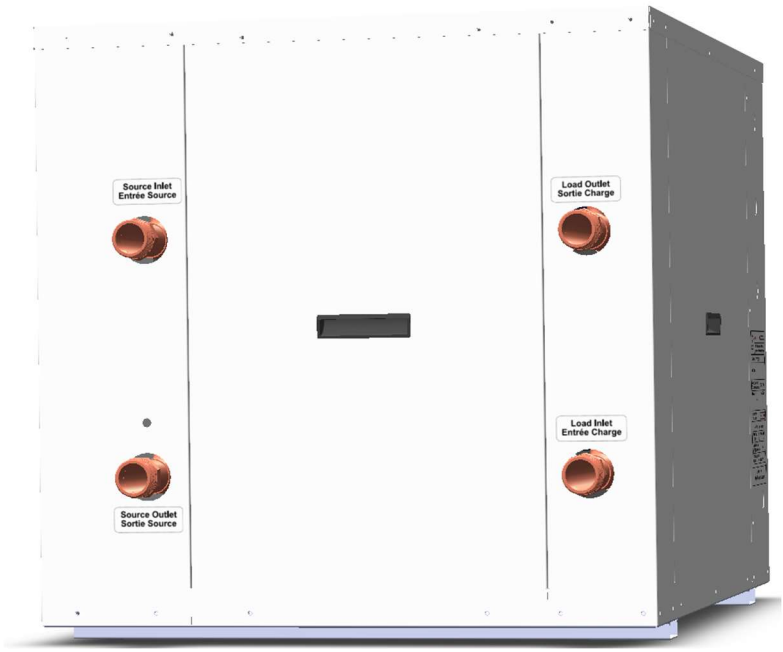
Water Quality Standard (JRA-GL-02-1994)

	ITEM		Cooling Water			Cool Water		Possibility	
			Circuit Water		Direct Pump				
			Close Circuit	Open Circuit	Instant Drain Water	Close Circuit 20°C below	Open Circuit	Corrosion	Scale
Basic Element	PH(25°C)		6.8~7.2	6.8~7.2	6.8~7.2	6.8~7.2	6.8~7.2		●
	EC(25°C)	μS/cm	≤800	≤300	≤400	≤400	≤300	●	●
	(Cl^{-1})	mg/l	≤200	≤50	≤50	≤50	≤50	●	
	(SO_4^{-2})	mg/l	≤200	≤50	≤50	≤50	≤50	●	
	$(PH4.8,CaCO_3)$	mg/l	≤100	≤50	≤50	≤50	≤50		●
	Total $(CaCO_3)$	mg/l	≤200	≤70	≤70	≤70	≤70		●
	Ca $(CaCO_3)$	mg/l	≤150	≤50	≤50	≤50	≤50		●
	SiO_2	mg/l	≤50	≤30	≤30	≤30	≤30		●
Reference Element	Fe	mg/l	≤1.0	≤0.3	≤1.0	≤1.0	≤0.3	●	●
	Cu	mg/l	≤0.3	≤0.1	≤1.0	≤1.0	≤0.1	●	
	S^-	mg/l	N.F	N.F	N.F	N.F	N.F	●	
	NH_4^{-1}	mg/l	≤1.0	≤0.1	≤1.0	≤1.0	≤0.1	●	
	Free Chlorine	mg/l	≤0.3	≤0.3	≤0.3	≤0.3	≤0.3	●	
	CO_3^{-2}	mg/l	≤4.0	≤4.0	≤4.0	≤4.0	≤4.0	●	
	Stability Value		6.0~7.0	-----	-----	-----	-----	●	●

1. The Water Quality for Heat Exchanger should be applied to above standard.
2. When using De-ionized water, pure water, extra pure water, nickel brazed is recommended.
3. If you are concerning about certain elements which are not listed on this chart, please contact our sales representative at sales@kaori.com.tw.

3.4 *WATER CONNECTIONS*

All four water connections are male ¾" NPT. Teflon tape must be used on each male fitting prior to screw-in the installation female fittings and the source side modulating water valve if used.



3.5 *SOURCE SIDE MODULATING WATER VALVE INSTALLATION*

The unit can be equipped with an optional modulating water valve on the source side in the case of a ground source open loop application. The valve will then modulate in order to use as less water as possible as per changing load conditions.

If used, the valve must be installed on the source side water out connection.



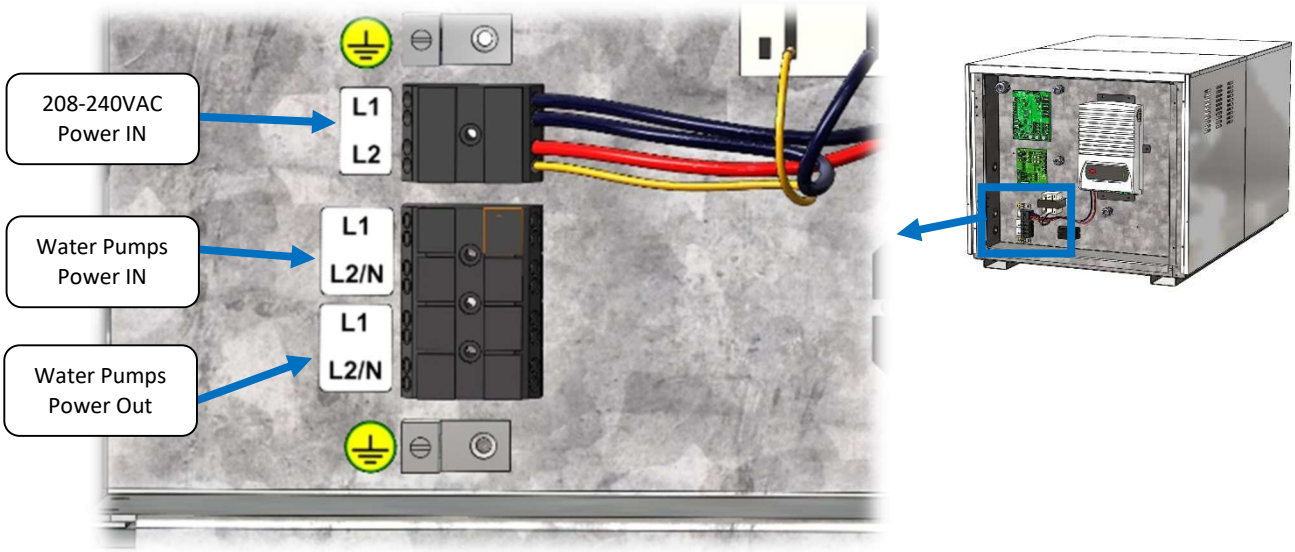
3.6 *OUTDOOR TEMPERATURE SENSOR INSTALLATION*

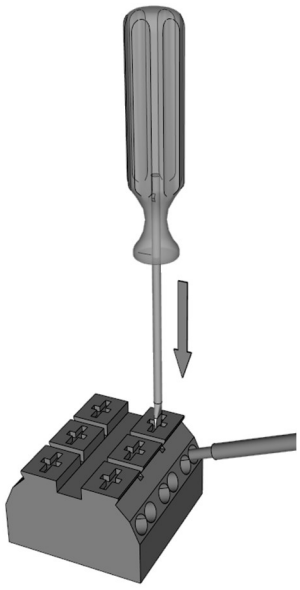
The unit can be equipped with an optional outdoor temperature sensor. The outdoor temperature will then affect the load side water out temperature setpoints for Y1 and Y2 stages. The outdoor temperature sensor option comprises a sensor controller box, the sensor itself and a sensor sunlight shield cover. If not installed, the unit will assume that outdoor temperature is always -10°C (14°F).

The controller box must be installed indoor, near of the outdoor sensor location.

4 POWER CONNECTIONS

ATTENTION: **208-240Vac electrical connections must be made by a qualified electrician and in accordance with local codes.**





Terminal blocks
for supply and distribution

The heat pump cabinet must be connected to a 208-240Vac source protected by a 20-30A circuit breaker according to the code in force in your area. This connection must be made via the terminal block named "Power supply". Also, the power cable must be of appropriate size and in accordance with the code in force in your area.

The 240Vac connection is made via spring-loaded terminal blocks. With a flat screwdriver, press the terminal and insert a wire while continuing to press. Release and the wire is secure. "With the wire band at 11mm (7/16) ".

5 CONTROL CONNECTIONS

5.1 *THERMOSTATS/CONTROLS CONNECTIONS*

The unit features a three-stage control implemented as Y1, Y2 and Y3 terminals on the IO board. In addition, the IO board has an O terminal for reversing valve control. Each of these terminals must be energized with the R potential in order to be considered as active by the control.

Y1 terminal must be connected to the radiant floors' control.

Y2 terminal must be connected to air handler control

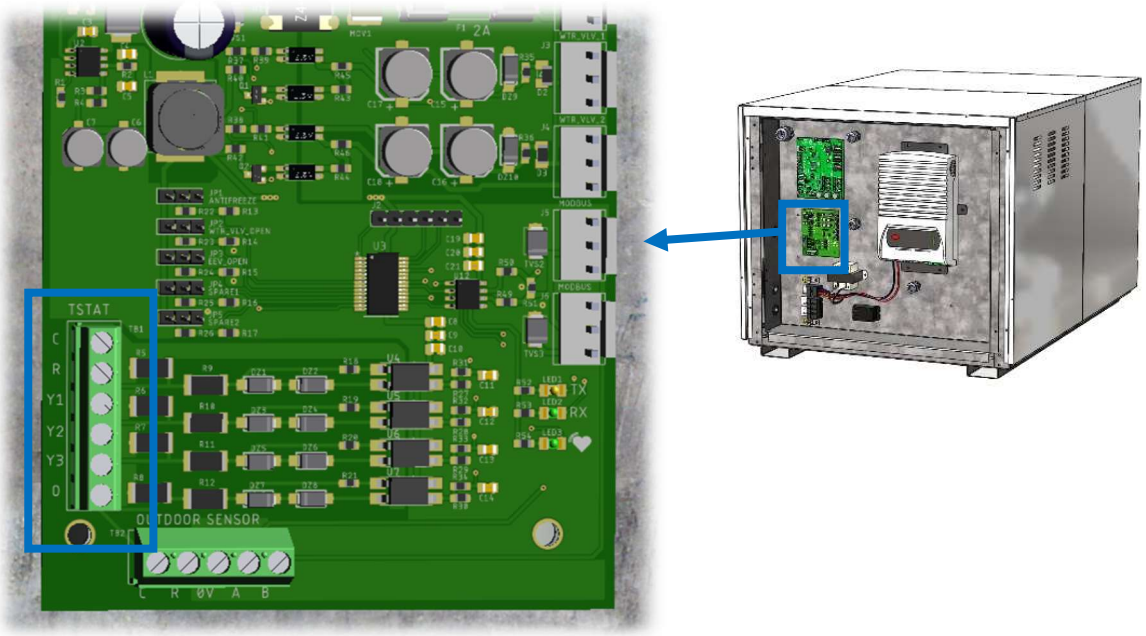
Y3 terminal must be connected to domestic hot water control

O terminal must be connected to the air handler control*

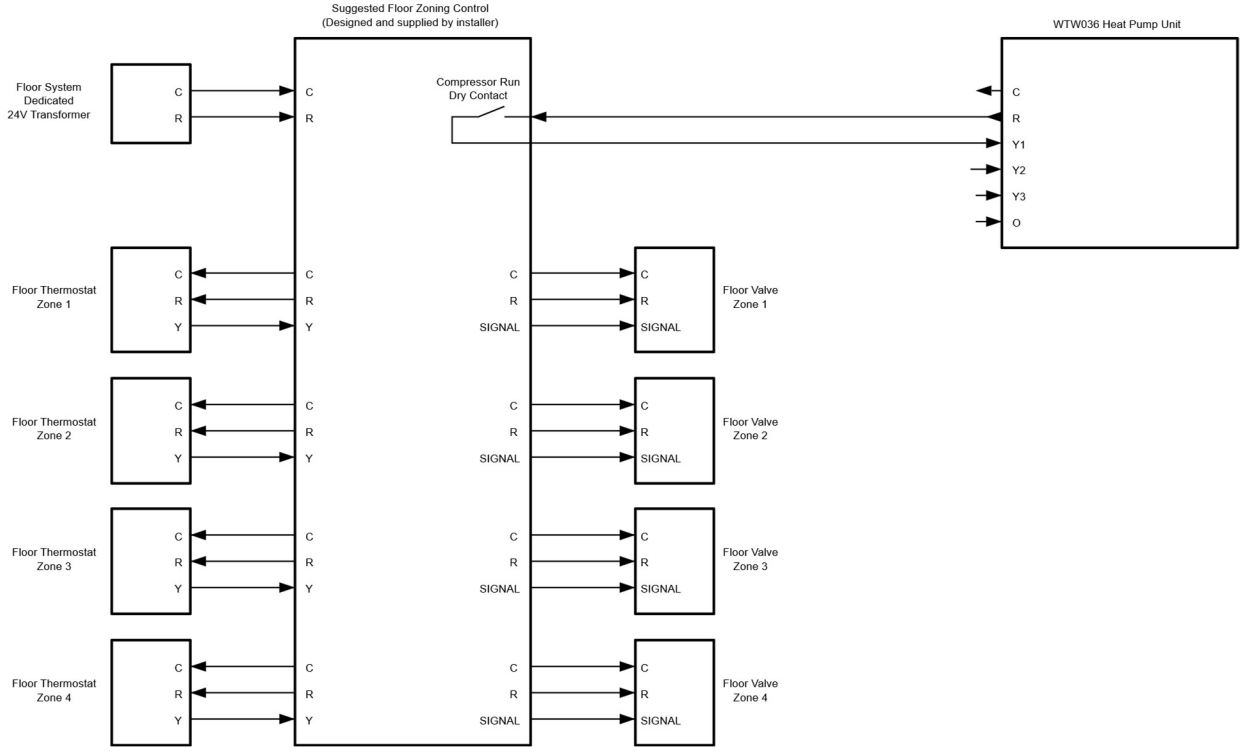
When O terminal is energized from air handler control, water valves for radiant floors and domestic hot water circuits must be closed by the central control.

NOTE: 22-20AWG stranded wire is recommended for all control connections.

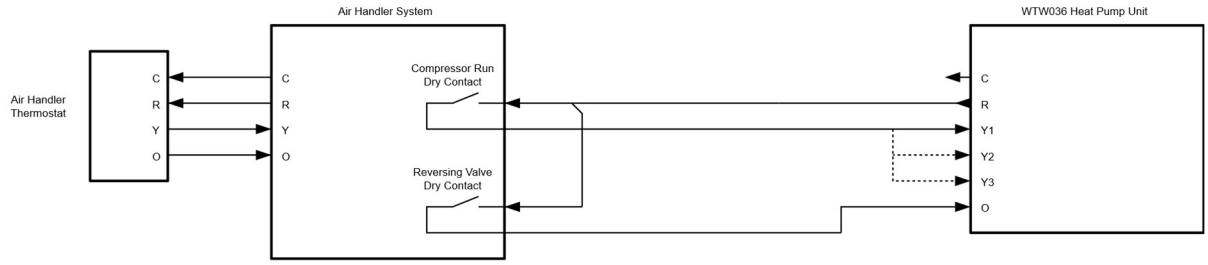
5.1.1 CONTROL TERMINALS LOCATION IN WTW036



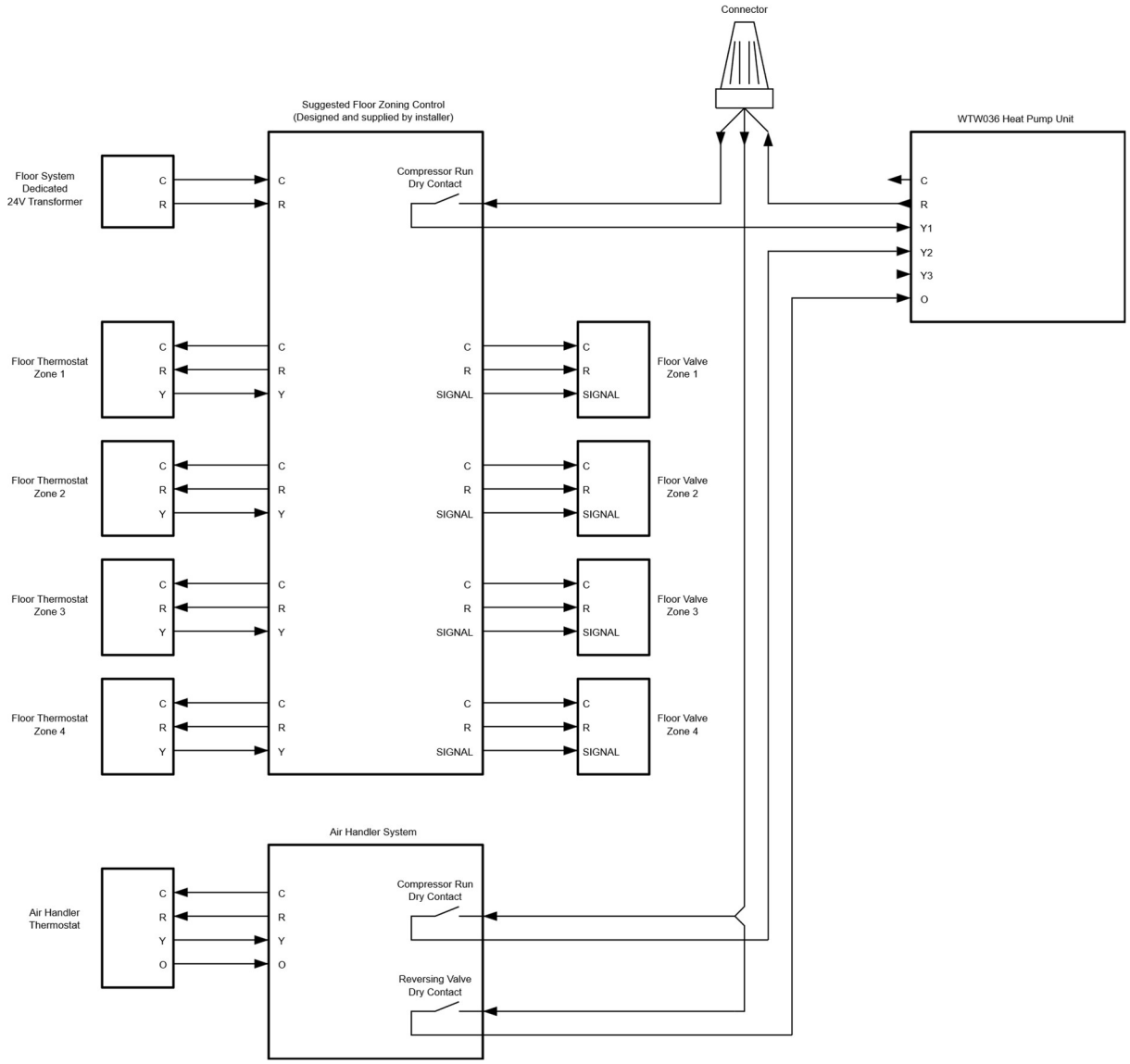
5.1.2 CONTROL CONNECTIONS SCHEMATIC FOR FLOOR SYSTEM ONLY



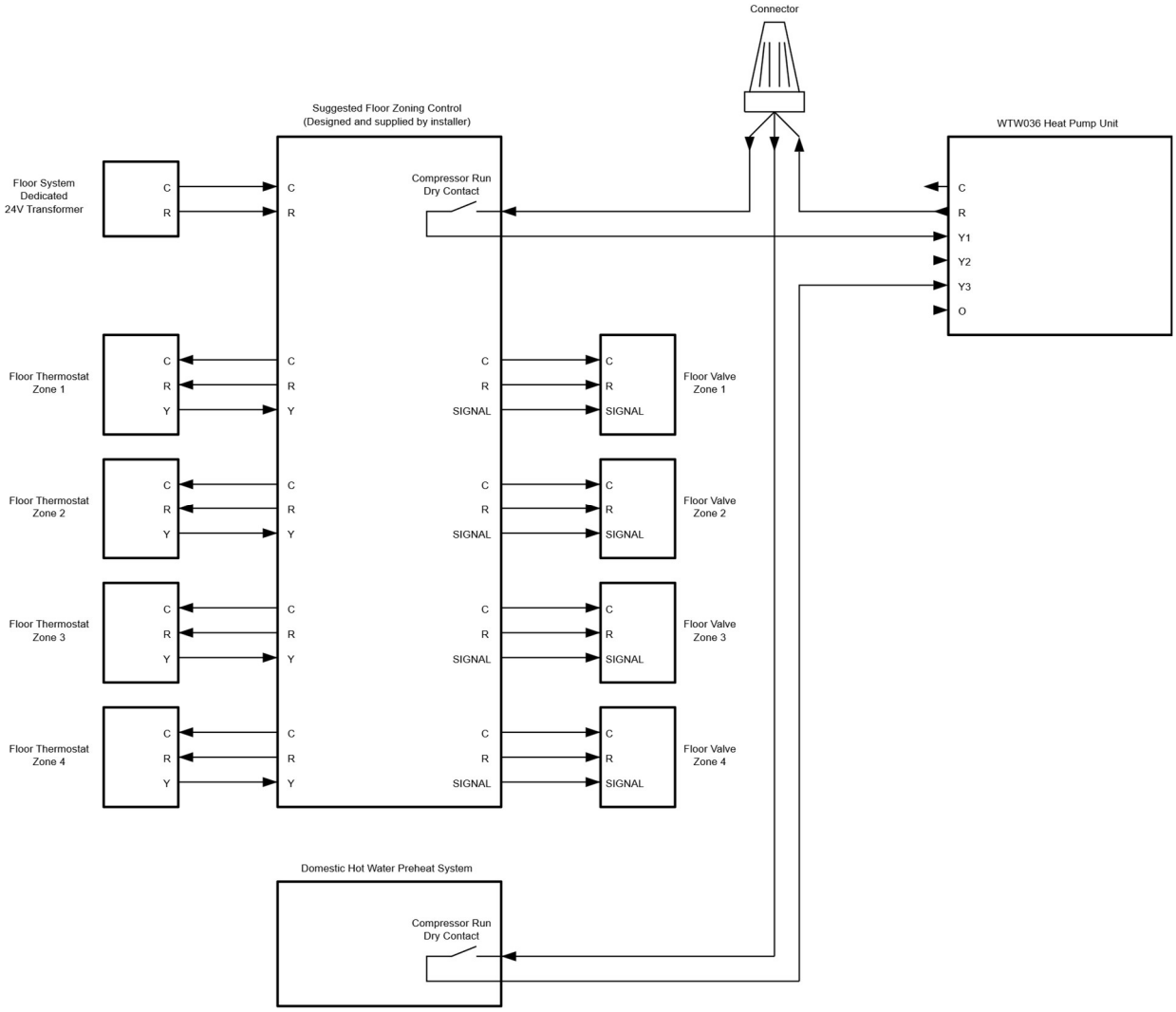
5.1.3 CONTROL CONNECTIONS SCHEMATIC FOR AIR HANDLER ONLY



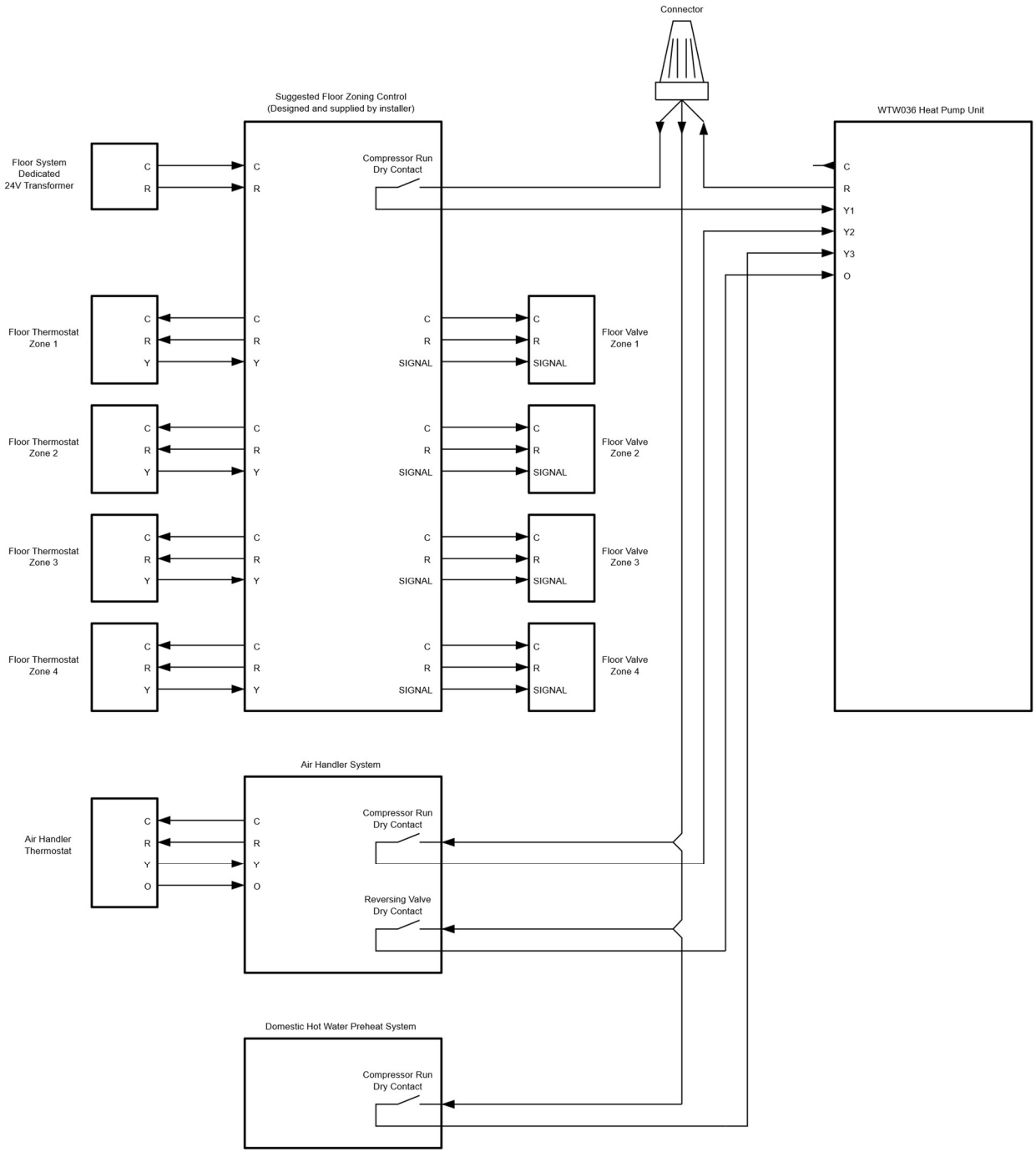
5.1.4 CONTROL CONNECTIONS SCHEMATIC FOR FLOOR SYSTEM + AIR HANDLER



5.1.5 CONTROL CONNECTIONS SCHEMATIC FOR FLOOR SYSTEM + DOMESTIC HOT WATER

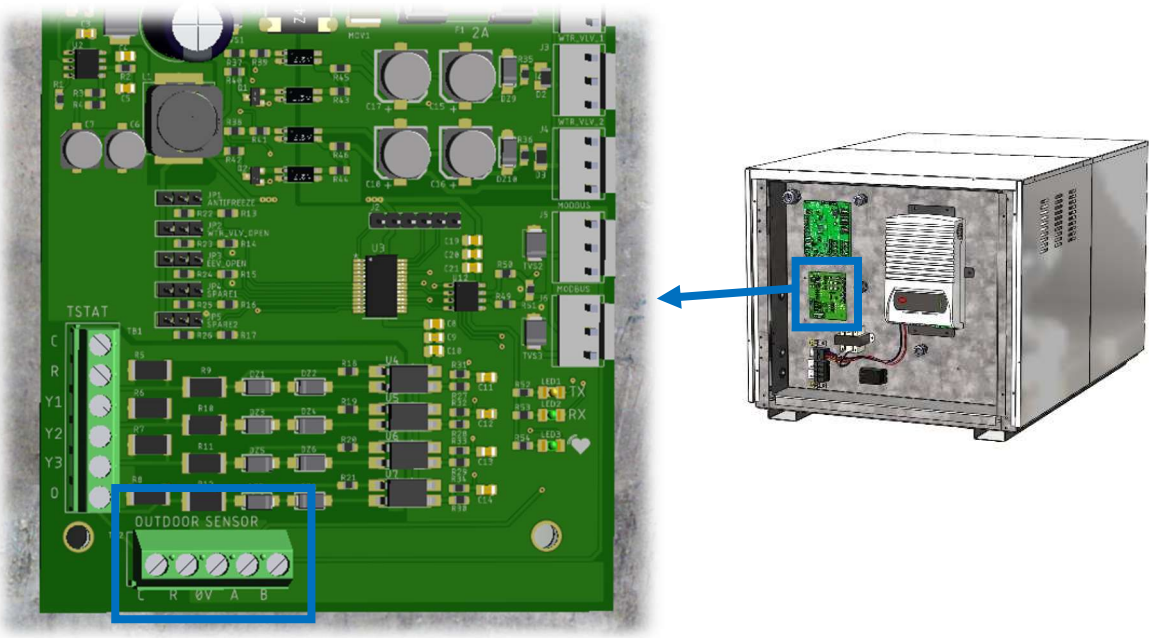


5.1.6 CONTROL CONNECTIONS SCHEMATIC FOR FLOOR SYSTEM + AIR HANDLER + DOMESTIC HOT WATER



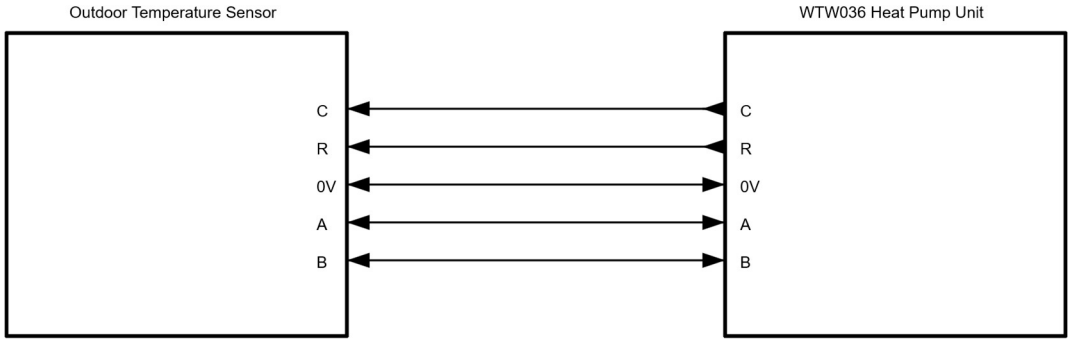
5.2 *OUTDOOR TEMPERATURE SENSOR CONNECTIONS*

5.2.1 OUTDOOR TEMPERATURE SENSOR CONNECTIONS LOCATION IN WTW036



5.2.2 CONTROL CONNECTIONS SCHEMATIC FOR OUTDOOR TEMPERATURE SENSOR

If the optional outdoor temperature sensor is to be used, it must be connected to the unit's I/O board as shown on the following schematic.



6 SYSTEM OPERATION

6.1 *CONTROL INPUTS FUNCTIONS*

Each control input terminal has a specific function. These functions are described below.

Y1 terminal:
If Y1 terminal is energized in heat mode (O terminal not energized), the compressor will modulate to keep the load side water out temperature at setpoint for Y1.
If Y1 terminal is energized in cool mode (O terminal energized), the compressor will modulate to keep the suction pressure at 130psi (low power cooling).

Y2 terminal:
If Y2 terminal is energized in heat mode (O terminal not energized), the compressor will modulate to keep the load side water out temperature at setpoint for Y2.
If Y2 terminal is energized in cool mode (O terminal energized), the compressor will modulate to keep the suction pressure at 120psi (medium power cooling).

Y3 terminal:
If Y3 terminal is energized in heat mode (O terminal not energized), the compressor will modulate to keep the load side water out temperature as high as possible.
If Y3 terminal is energized in cool mode (O terminal energized), the compressor will modulate to keep the suction pressure at 110psi (high power cooling).

O terminal: if O terminal is not energized, the system is in heat mode. If O terminal is energized, the system is in cooling mode.

6.2 *COOLING OR HEATING MODES PRIORITY*

There is no cooling or heating mode priority implemented in the WTW036 control. Cooling is to be used only in air handler applications and priority must be managed by third party control.

6.3 *COMPRESSOR OIL RETURN SEQUENCE*

Since the variable capacity refrigeration system can cope with very low load conditions, it is possible that in low load conditions the refrigeration system's oil remain trapped in certain parts of the refrigeration circuit. To ensure proper oil return to the compressor crankcase, an oil return sequence will trigger if the compressor runs under a certain speed for at least 3 hours.

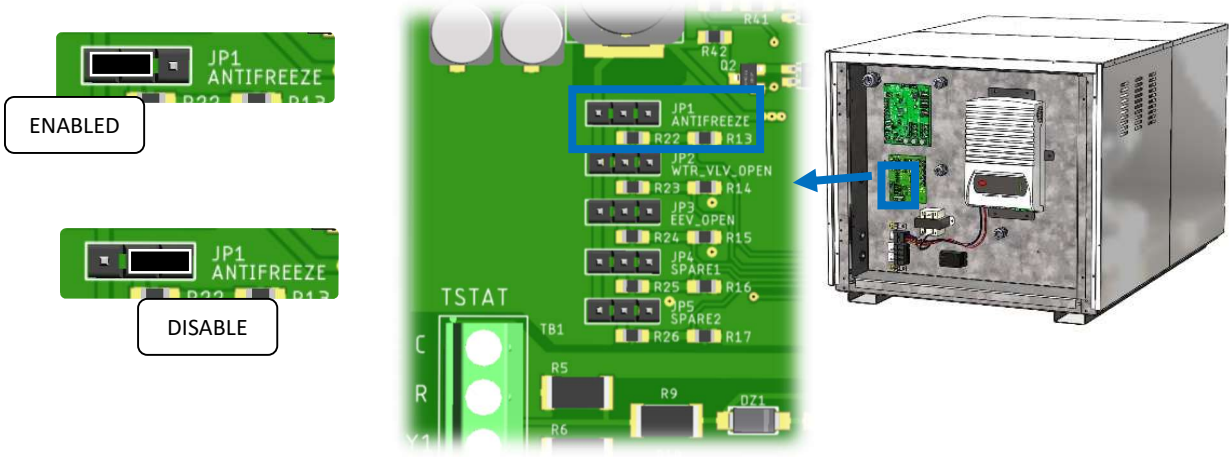
When an oil return sequence starts, the compressor will first turn off for 2 minutes after what it will start back at full speed and going down to controlled mode.

6.4 *FREEZE PROTECTION*

The unit is protected against fluid freezing on both source and load sides. In heat mode, the unit will have two levels of freeze protection on the source side. The first level is protecting the source side coil if pure water is used (not mixed with antifreeze fluid like glycol, ethanol, brine, etc). This protection will force the compressor to minimum speed if the source side water out temperature is lower or equal to 2,0°C (35,6°F).

The second level of protection will stop the compressor if the suction pressure is lower or equal to 30psi for more than 2 minutes.

The first level of protection can be disabled by changing the position of a jumper on the unit's main control board "T5" connector as shown on the following picture.

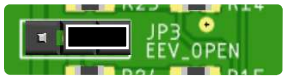


6.5 *FORCE EXPANSION VALVES TO FULLY OPEN*

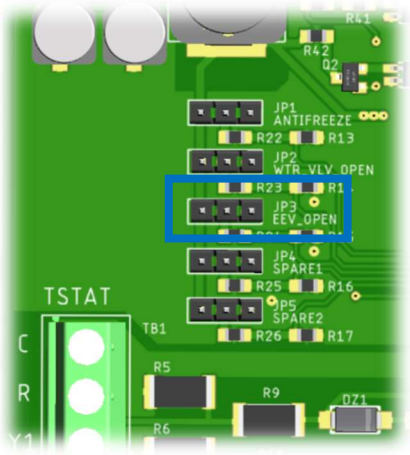
In case the refrigerant in the unit must be recovered, the electronic expansion valves must be forced to fully open position. The EEVs can be forced in open position by changing the position of a jumper on the unit's main control board "T6" connector as shown on the following picture.

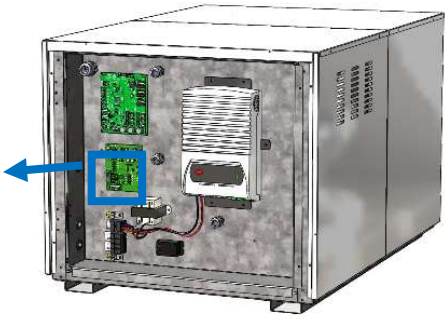


NORMAL



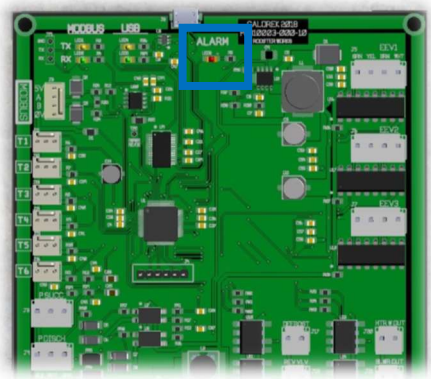
EEVS
OPEN





7 ALARM CODES LED INDICATOR

The unit's main control board features a led indicator dedicated for alarm code indication as shown on the following picture.





7.1 *ALARM CODES DESCRIPTIONS*

If an alarm or error occurs in the unit, the alarm led will flash 2 to 14 times, corresponding to an alarm code. The led will switch on and off in intervals of 0,5 second while displaying the code and then will pause for 3 seconds.

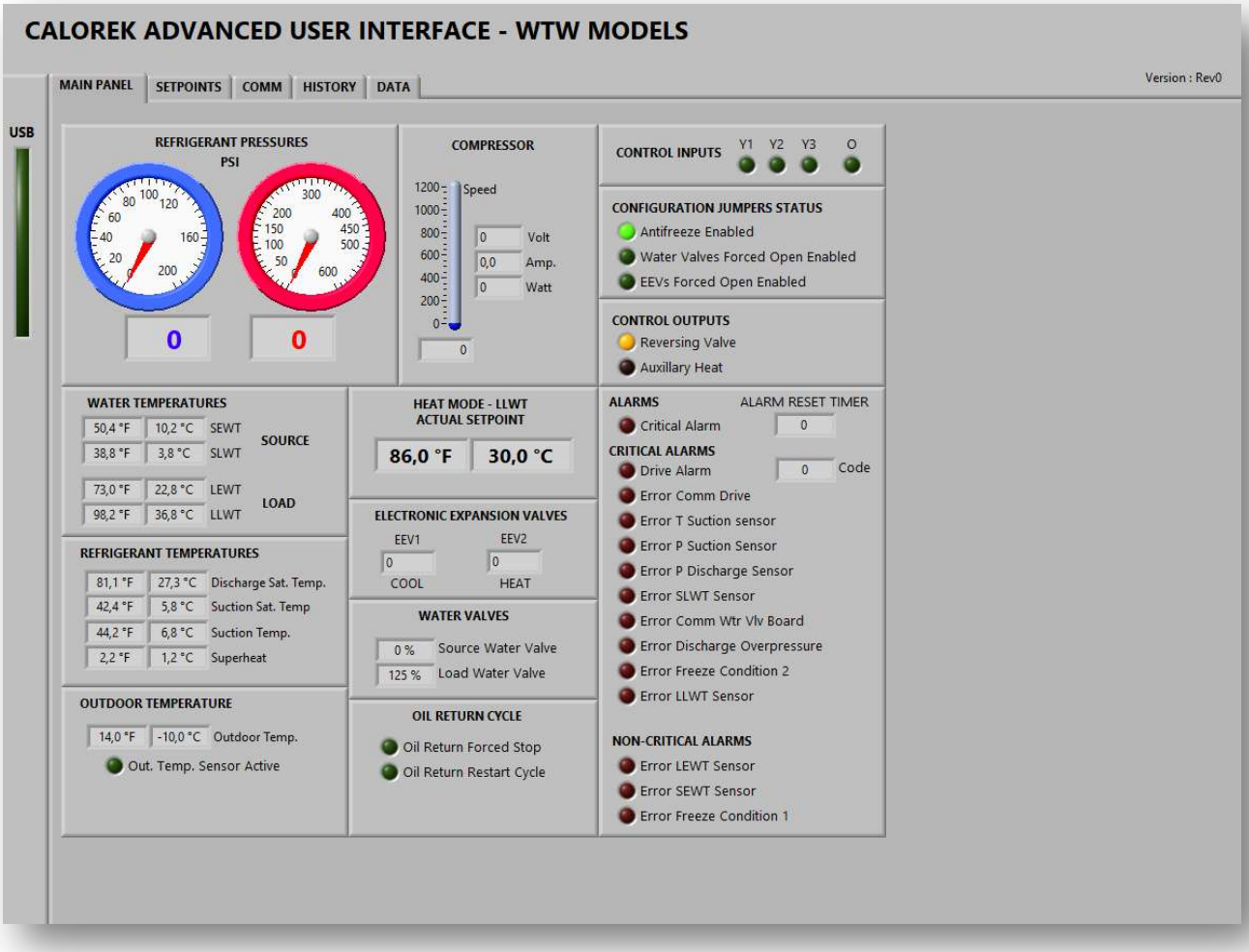
FLASHES	DESCRIPTION
2	COMPRESSOR DRIVE IN ALARM
3	COMPRESSOR DRIVE COMMUNICATION ERROR
4	SUCTION TEMPERATURE SENSOR ERROR
5	DISCHARGE PRESSURE SENSOR ERROR
6	SUCTION PRESSURE SENSOR ERROR
7	SLWT SENSOR ERROR
8	I/O BOARD COMMUNICATION ERROR
9	DISCHARGE OVERPRESSURE ALARM
10	LLWT SENSOR ERROR
11	SEWT SENSOR ERROR
12	LEWT SENSOR ERROR
13	FREEZE ALARM LEVEL 1
14	FREEZE ALARM LEVEL 2

8 GRAPHIC USER INTERFACE (GUI)

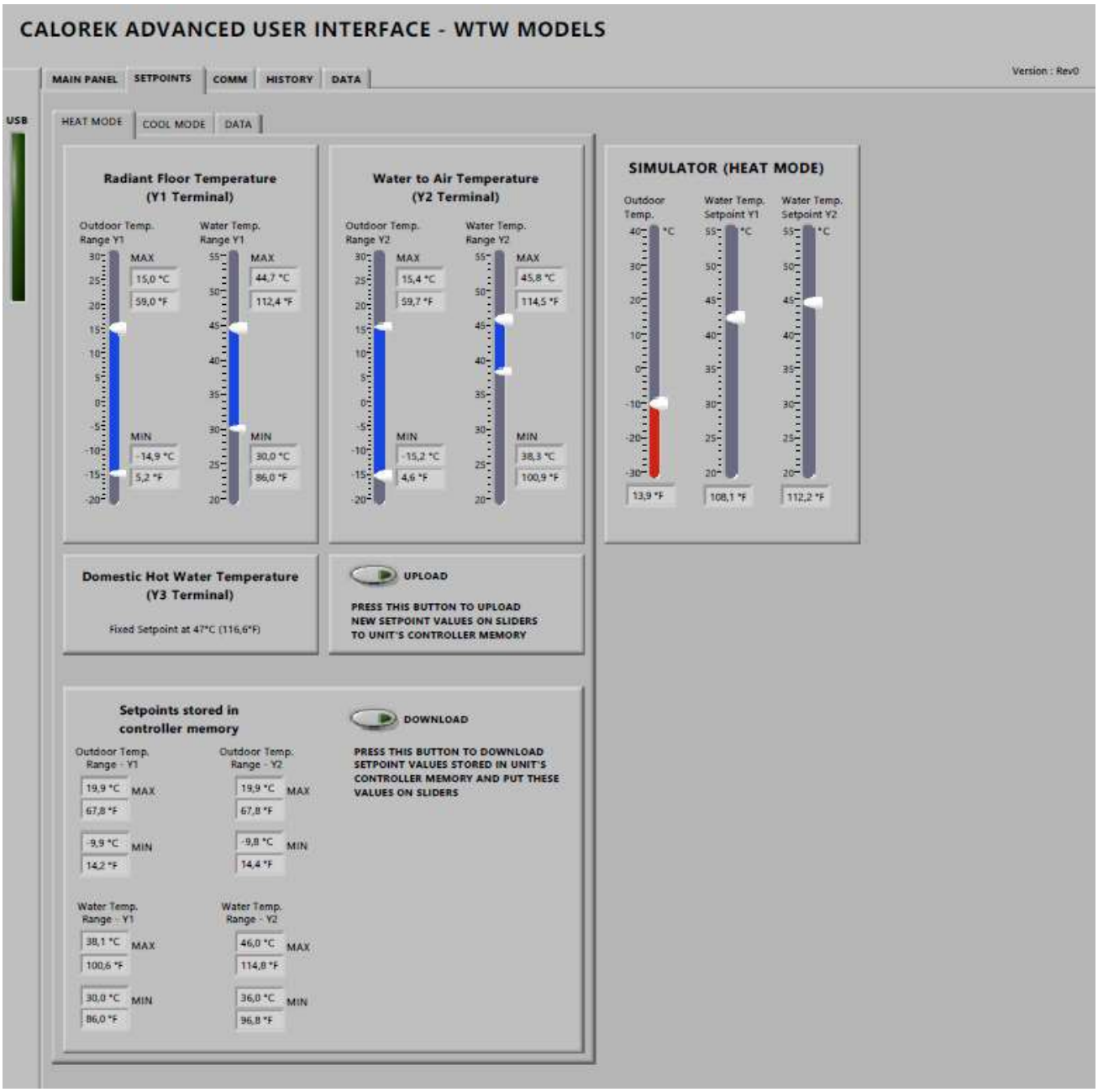
A Graphic User Interface (GUI) is provided on a USB key supplied with each unit. It can be installed on a laptop and allows the technician to see the system variables in real time. The GUI features a section where the water temperature setpoints can be adjusted considering the outdoor temperature readings. If the outdoor temperature sensor is not used, the unit will assume that outdoor temperature is always -10°C (14°F).

8.1 *GUI MAIN PANEL*

The main panel shows real time information on unit's general operating parameters.

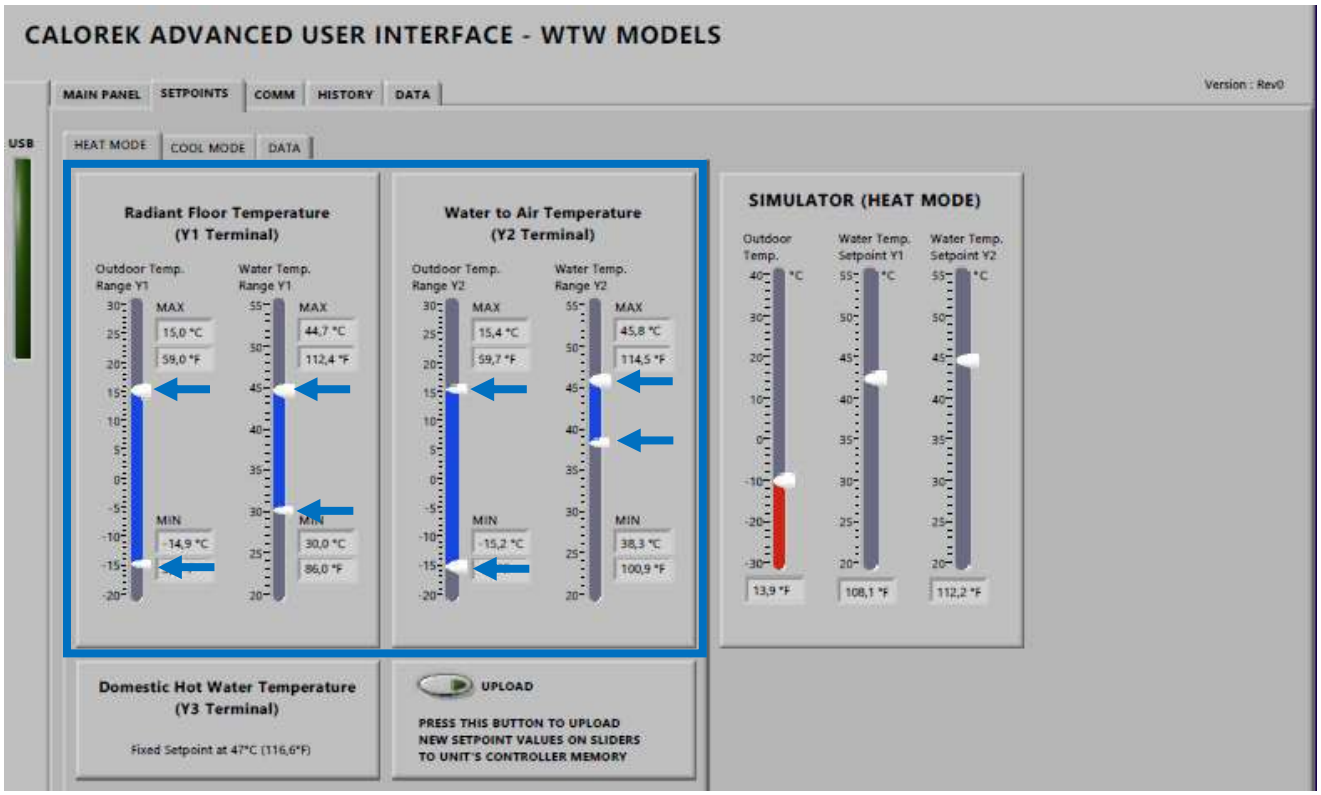


8.2 *GUI SETPOINTS PANEL - HEAT MODE TAB*



8.2.1 SETTING OF Y1 AND Y2 WATER TEMPERATURE SETPOINTS IN HEAT MODE

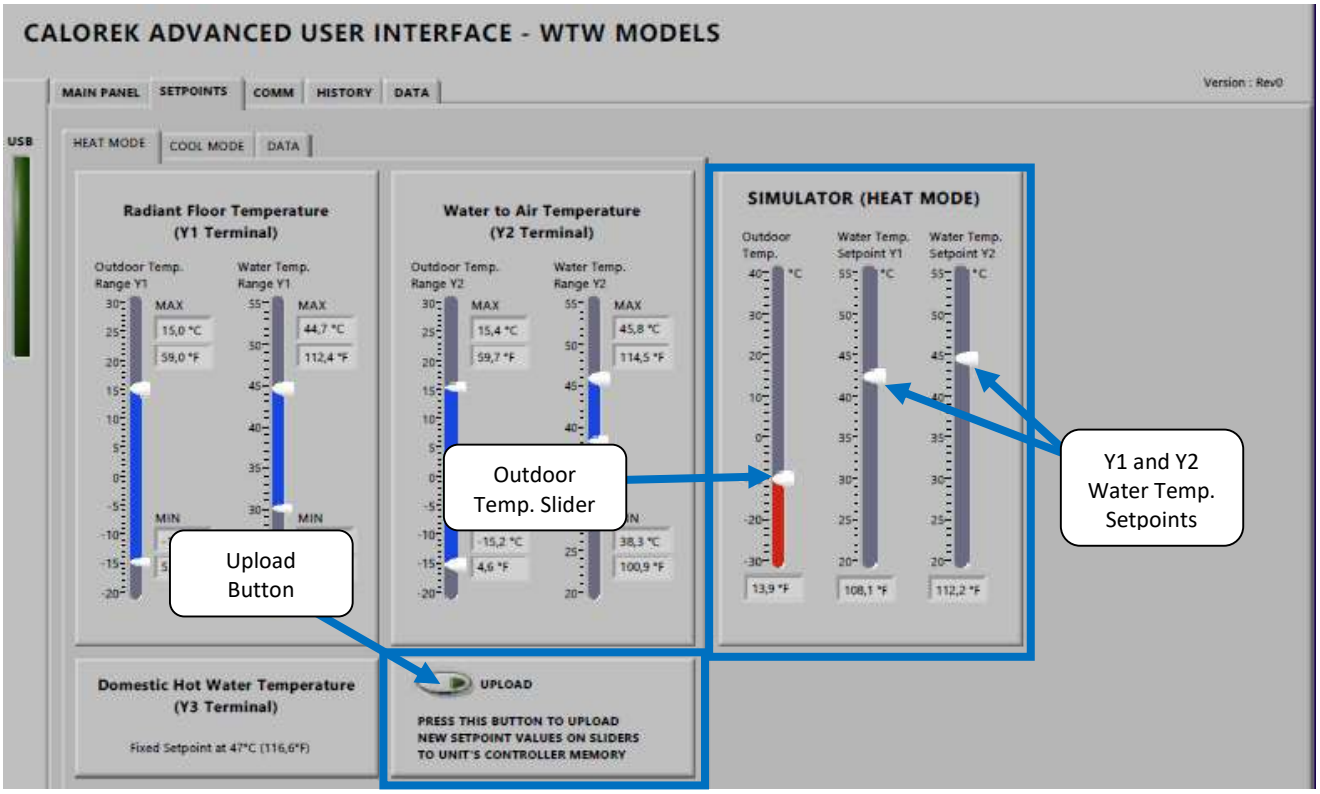
For both Y1 and Y2 terminals in heat mode (O terminal not energized), the installer can adjust the load side water out temperature (LLWT) setpoints ranges as per outdoor temperature range. On the setpoints panel, use the sliders to adjust both the outdoor temperature range and the LLWT range for both Y1 and Y2 terminals.



8.2.2 SIMULATION OF WATER TEMPERATURE SETPOINTS SETTINGS

The simulator shown on picture below allows the technician to simulate what will be the actual LLWT setpoints for both Y1 and Y2 terminals. Use the Outdoor Temp. Slider to move the simulated outdoor temperature. Look at the Y1 and Y2 Water Temp. Setpoints Sliders to see the effect of the moving outdoor temperature on both Y1 and Y2 setpoints.

The simulator is a simple and useful tool for the installer to quickly see the Y1 and Y2 LLWT settings effects before to save it in unit's main control memory.



8.2.3 SETPOINTS UPLOAD TO UNIT'S MAIN CONTROL MEMORY

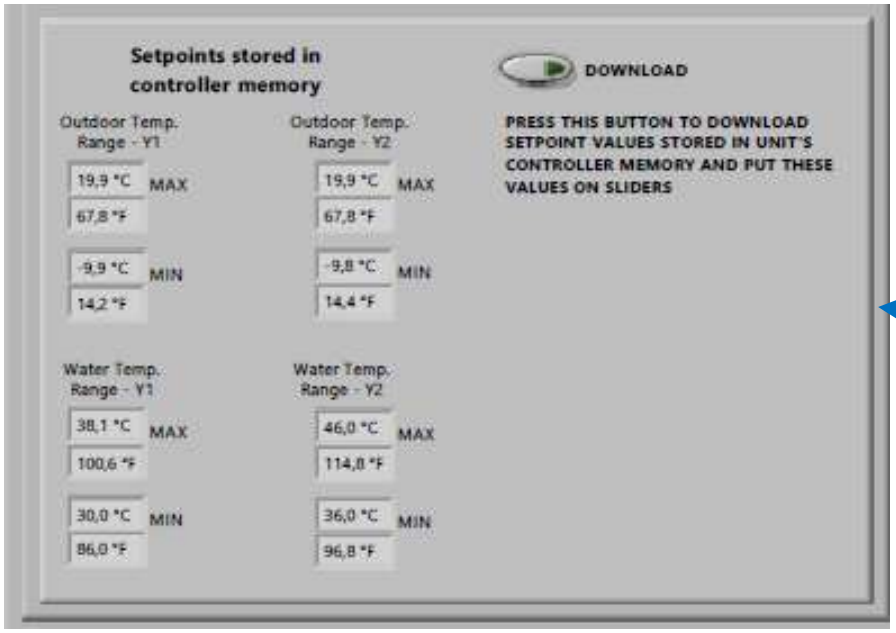
To upload the new settings to the main control memory, push the Upload Button shown on picture above. The new value will then be stored in main control EEPROM, a non-volatile memory.

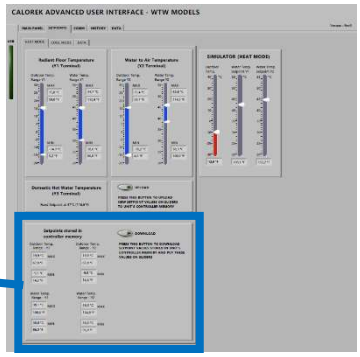
8.2.4 Y3 WATER TEMPERATURE SETPOINT IN HEAT MODE

When in heat mode and Y3 is energized, the unit will try to reach the highest possible water out temperature on the load side (LLWT) by keeping the operation parameters in an acceptable envelope.

8.2.5 DOWNLOAD STORED SETPOINTS TO GUI

When connected to the unit (USB), the GUI will show the heat mode LLWT actual setpoints stored in the control memory. It is possible to download synchronise these values to the GUI LLWT setpoints adjustment sliders.





8.2.6 CONTROL SETPOINTS IN COOL MODE

When O Terminal is energized, the unit is in cool mode and the compressor will modulate in order to maintain suction pressure setpoints. For Y1, Y2 and Y3, the compressor control will run under different suction pressure setpoints. These setpoints are not adjustable by the installer.

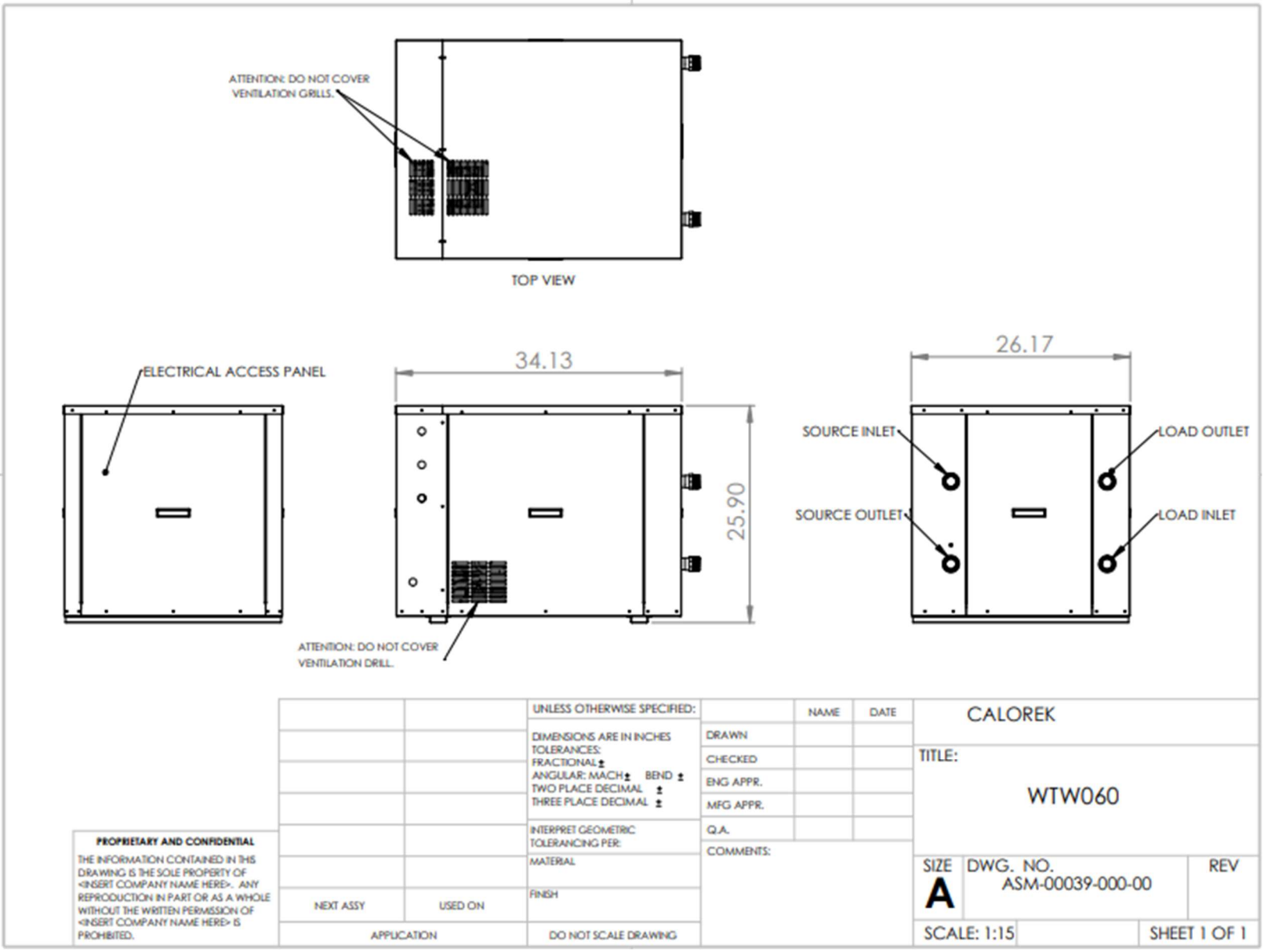
Y1 Setpoint = 130psi suction pressure

Y2 Setpoint = 120psi suction pressure

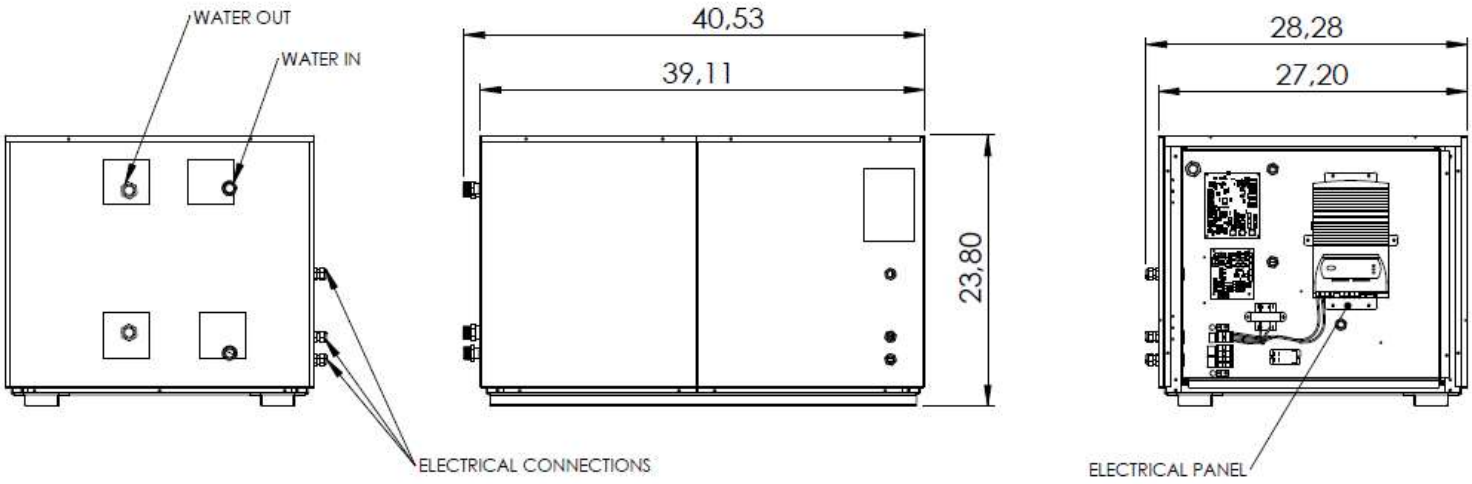
Y3 Setpoint = 110psi suction pressure

9 DIMENSIONAL DRAWINGS

9.1 *WTW060 WATER TO WATER HEAT PUMP UNIT DIMENSIONS*



9.2 *WTW036 WATER TO WATER HEAT PUMP UNIT DIMENSIONS*



		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL	COMMENTS:		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

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CALOREK TECHNOLOGIES

TITLE: WTW036

SIZE	DWG. NO.	REV
A	ASM-00032-000-00	

SCALE: 1:14 | SHEET 1 OF 1