

Installation, Operation and Maintenance Manual

Smart Mix Expansion 295



⚠ WARNING



**THINK
SAFETY
FIRST**

Please read carefully before proceeding with installation. Your failure to follow any attached instructions or operating parameters may lead to the product's failure.
Keep this Manual for future reference.

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Important Safety Information

WARNING

It is your responsibility to ensure that this control is safely installed according to all applicable codes and standards. tekmar® is not responsible for damages resulting from improper installation and/or maintenance.

To avoid serious personal injury and damage to the equipment:



- Read Manual and all product labels BEFORE using the equipment. Do not use unless you know the safe and proper operation of this equipment.
- Keep this Manual available for easy access by all users.
- Replacement Manuals are available at tekmarControls.com



This is a safety-alert symbol. The safety alert symbol is shown alone or used with a signal word (DANGER, WARNING, or CAUTION), a pictorial and/or a safety message to identify hazards.

When you see this symbol alone or with a signal word on your equipment or in this Manual, be alert to the potential for death or serious personal injury.



This pictorial alerts you to electricity, electrocution, and shock hazards.



Double insulated.

WARNING

This symbol identifies hazards which, if not avoided, could result in death or serious injury.

CAUTION

This symbol identifies hazards which, if not avoided, could result in minor or moderate injury.

NOTICE

This symbol identifies practices, actions, or failure to act which could result in property damage or damage to the equipment.

WARNING

- It is the installer's responsibility to ensure that this control is safely installed according to all applicable codes and standards.
- Improper installation and operation of this control could result in damage to the equipment and possibly even personal injury or death.
- This control is not intended for use as a primary limit control. Other controls that are intended and certified as safety limits must be placed into the control circuit.

NOTICE

Do not attempt to service the control. There are no user serviceable parts inside the control. Attempting to do so voids warranty.

Radio Frequency Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device complies with part 15 of the FCC Rules and with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The antenna used for this radio must be properly installed and maintained and must provide a separation distance of at least 7.9 inches (20 cm) from all persons.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et

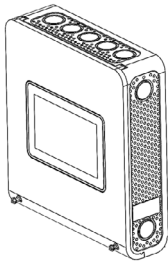
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Installation

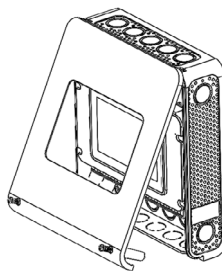
Installation Location

When choosing the location for the control, consider the following:

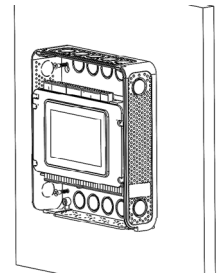
- Keep dry. Avoid potential leakage onto the control.
RH $\leq$ 90% to 104°F (40°C).
Non-condensing environment.
- Do not expose to operating temperatures beyond 32-104°F (0-40°C)
- Provide adequate ventilation.
- Keep away from equipment, appliances or other sources of electrical interference.
- Provide easy access for wiring, viewing, and adjusting the display screen.
- Mount approximately 5 ft. (1.5 m) off the finished floor.
- Locate the control near pumps and/or zone valves if possible.
- Provide a solid backing to mount the enclosure to. For example: plywood, studs, etc
- Use the conduit knockouts provided on the upper, lower, back and sides of the enclosure.



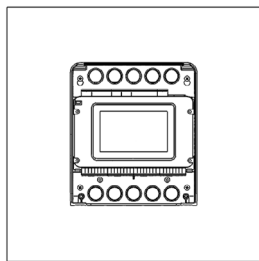
Use a Phillips screwdriver to loosen the two screws on the cover.



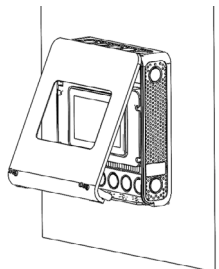
Pull the front cover towards you. The top of the cover will pivot on a hinge. Remove the cover by releasing the pivot hooks on the underside of the control.



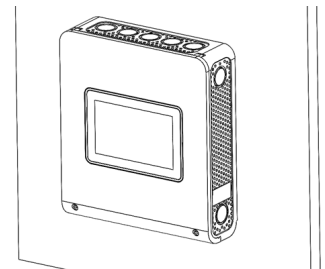
Mount the enclosure to a wall using #6 wood screws in the four mounting holes. Use screw anchors if drilling into masonry.



Use the 24 knock-outs to install connecting conduits and cabling to the control.



To install the cover, hook the top of the cover to the enclosure, then pivot the bottom to shut.



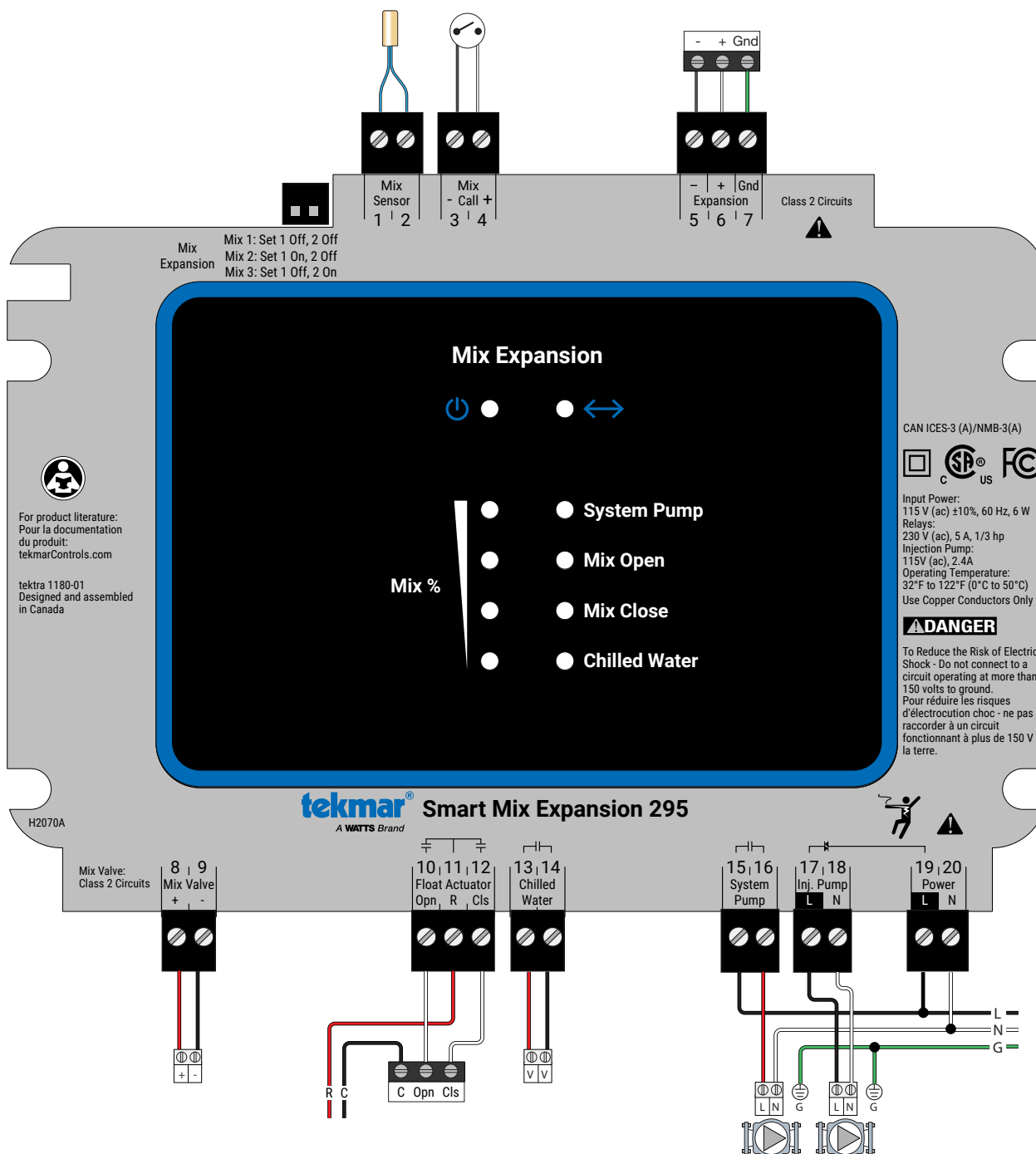
Use a Phillips screwdriver to fasten the two bottom screws.

Wiring Schematic

This section provides a wiring schematic for the control.

⚠ WARNING

- Before wiring, ensure all power is turned off and take all necessary precautions.
- Sensor wiring may be extended to a total length of 500 feet (152 m) using 18 AWG solid conductor wire.
- Strip all wiring to a length of $\frac{3}{8}$ in. or 10 mm for all terminals.
- A circuit breaker or power disconnect that provides power to the control should be located nearby and clearly labeled.
- Refer to the current and voltage ratings at the back of this brochure before connecting devices to this control.
- Only qualified personnel should install or service the control.



Wiring Instructions

This section explains how to wire individual devices to the Smart Mix Expansion 295.

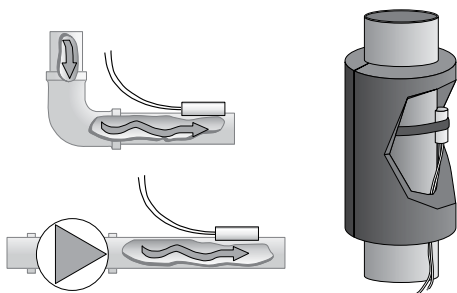
Mounting the Universal Sensors

These sensors are designed to mount on a pipe or in a temperature immersion well.

The Universal Sensor should be placed downstream of a pump or after an elbow or similar fitting. This is especially important if large diameter pipes are used as the thermal stratification within the pipe can result in erroneous sensor readings. Proper sensor location requires that the fluid is thoroughly mixed within the pipe before it reaches the sensor.

Strapped to Pipe

The Universal Sensor can be strapped directly to the pipe using the cable tie provided. Insulation should be placed around the sensor to reduce the effect of air currents on the sensor measurement.



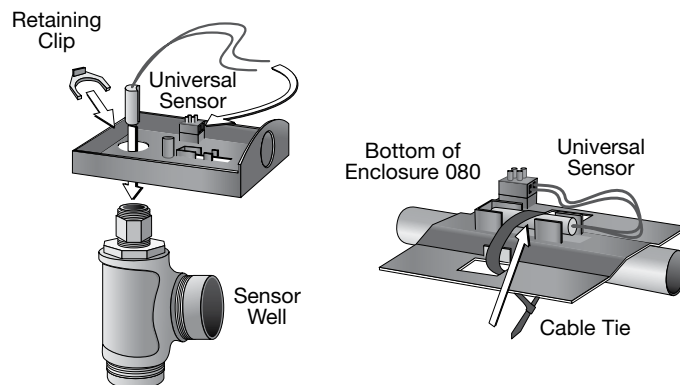
Immersion Well

If a Universal Sensor is mounted onto 1" diameter L type copper pipe, there is approximately an 8 second delay between a sudden change in water temperature and the time the sensor measures the temperature change. This delay increases considerably when mild steel (black iron) pipe is used. In general, it is recommended that a temperature well be used for steel pipe of diameter greater than 1 1/4". Temperature wells are also recommended when large diameter pipes are used and fluid

stratification is present. If the well is not a snug fit on the sensor tube, use the heat transfer paste. Apply paste to the sides of the sensor and place a pea-sized globule on the sensor tip. Push the sensor into the well and when it bottoms out, press firmly. The paste will be forced up the sides of the well.

Conduit Connection

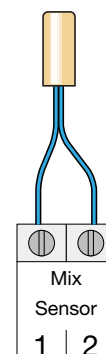
The Universal Sensor and Universal Sensor Enclosure 080 (sold separately) are specifically designed to mount onto a 3/8" ID temperature well that is supplied with an end groove. To install the well, plumb a 'tee' into the pipe and fix the well into the 'tee'. The 080 enclosure has a 7/8" back knockout that must be removed and fitted over the temperature well. The Universal Sensor is then inserted into the well and the retaining clip supplied with the enclosure is snapped onto the well end groove. If the well has a threaded end, the installer must supply a standard threaded conduit retaining ring. The two wires from the sensor are connected to the terminal block provided in the enclosure. The other side of the terminal block is used to connect the wires from the control.



Mix Sensor (Terminals 1, 2)

The included Universal Sensor 082 can measure the mix supply temperature downstream of the mixing valve or variable speed injection loop tees.

- Connect the wires to the mix sensor terminals 1 and 2.



Testing the Sensor Wiring

A good quality test meter capable of measuring up to 5,000 k Ω (1 k Ω = 1000 Ω) is required to measure the sensor resistance. In addition to this, the actual temperature must be measured with either a good quality digital thermometer, or if a thermometer is not available, a second sensor can be placed alongside the one to be tested and the readings compared.

First measure the temperature using the thermometer and then measure the resistance of the sensor at the control. The wires from the sensor must not be connected to the control while the test is performed. Using the chart below, estimate the

temperature measured by the sensor. The sensor and thermometer readings should be close. If the test meter reads a very high resistance, there may be a broken wire, a poor wiring connection or a defective sensor. If the resistance is very low, the wiring may be shorted, there may be moisture in the sensor or the sensor may be defective. To test for a defective sensor, measure the resistance directly at the sensor location.

Do not apply voltage to a sensor at any time as damage to the sensor may result.

Call customer support if you need assistance with technical details.

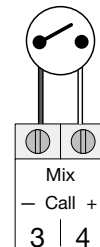
TEMPERATURE		RESISTANCE	TEMPERATURE		RESISTANCE	TEMPERATURE		RESISTANCE	TEMPERATURE		RESISTANCE
°F	°C	Ω	°F	°C	Ω	°F	°C	Ω	°F	°C	Ω
-50	-46	490,813	20	-7	46,218	90	32	7,334	160	71	1,689
-45	-43	405,710	25	-4	39,913	95	35	6,532	165	74	1,538
-40	-40	336,606	30	-1	34,558	100	38	5,828	170	77	1,403
-35	-37	280,279	35	2	29,996	105	41	5,210	175	79	1,281
-30	-34	234,196	40	4	26,099	110	43	4,665	180	82	1,172
-25	-32	196,358	45	7	22,763	115	46	4,184	185	85	1,073
-20	-29	165,180	50	10	19,900	120	49	3,760	190	88	983
-15	-26	139,403	55	13	17,436	125	52	3,383	195	91	903
-10	-23	118,018	60	16	15,311	130	54	3,050	200	93	829
-5	-21	100,221	65	18	13,474	135	57	2,754	205	96	763
0	-18	85,362	70	21	11,883	140	60	2,490	210	99	703
5	-15	72,918	75	24	10,501	145	63	2,255	215	102	648
10	-12	62,465	80	27	9,299	150	66	2,045	220	104	598
15	-9	53,658	85	29	8,250	155	68	1,857	225	107	553

Mix Call (Terminals 3, 4)

A mix call is required whenever a zone running off the mixing loop requires heating. The heat call can be a dry contact or up to 24 V (ac).

- Connect the Mix Call terminals 3 and 4 to a switched heat demand.
- Typical heat calls are from a switching relay, zone valve control or thermostat.

Mix cooling calls can only be triggered using tekmarNet thermostats connected to the tekmarNet mix bus.

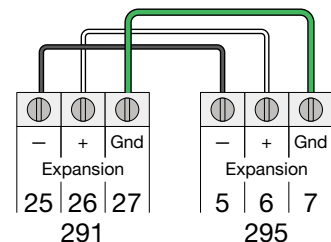


Expansion Modules (Terminals 5, 6, 7)

The Smart Heat Pump Control 291 operates up to 3 mixing temperatures by expanding the system with up to 3 Smart Mix Expansion 295.

The control connects to the expansion through a wired three-wire connection. The maximum bus cable length is 100 feet (30 m) using 18 AWG solid conductor cable.

- Connect terminal 25 (-) of the 291 to the expansion terminal 5 (-).
- Connect terminal 26 (+) of the 291 to the expansion terminal 6 (+).
- Connect terminal 27 (Gnd) of the 291 to the expansion terminal 7 (Gnd).

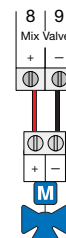


Mixing Valves (Terminals 8, 9)

An analog 0-10 V (dc) or 4-20 mA signal can be provided by the modulating output on the 295. The analog signal can be used to operate an actuator mounted to a mixing valve or a variable frequency drive (VFD) which in turn operates a pump.

- Connect terminal 8 (+) to the (+) of the mixing device.
- Connect terminal 9 (-) to the (-) of the mixing device.

A visual indication of the analog output is displayed by the Mix % LEDs on the user interface.

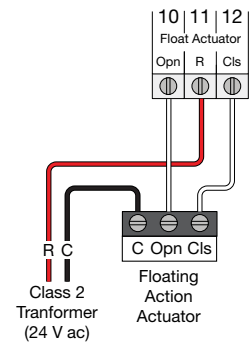


Floating Actuator Mixing (Terminals 10, 11, 12)

A floating action actuator motor can be connected to the 295 on the Opn and Cls terminals. The module pulses the actuator motor with 24 V (ac) to open or close the valve in order to maintain the correct supply water temperature at the mix supply sensor when there is a requirement for mixing. The mixing valve that the actuator is connected to can be either a 2-way, 3-way or 4-way valve.

- Connect terminal 10 (Opn) to the (Opn) of the mixing device.
- Connect terminal 11 (R) to the (R) of the mixing device.
- Connect terminal 12 (Cls) to the (Cls) of the mixing device.

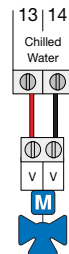
A visual indication of the analog output is displayed by the Mix % LEDs on the user interface.



Diverting Valve (Terminals 13, 14)

The Smart Mix Expansion 295 supports switching between receiving supply water from the hot or cold tank of a 4-pipe heat pump system. This allows the distribution system such as a 2-pipe fan coil or a radiant floor manifold to switch between heating and cooling. Either two sets of 3-way valves can be installed or tekmar offers pre-assembled 6-way diverting valves.

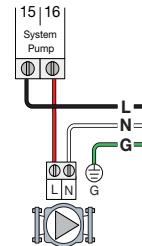
- Connect terminals 13 and 14 to the diverting valve(s).



System Pump (Terminals 15, 16)

The system pump operates whenever a heat or cool call is received and there is no special status such as warm weather shut down or cold weather shut down.

- Connect terminal 15 to 115 V ac line wire (L).
- Connect terminal 16 115 V wire (L) to the (L) of the system pump.

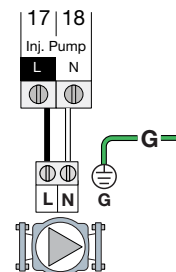


Injection Mixing Pump (Terminals 17, 18)

A standard wet rotor circulator can be connected to the variable speed output. The control increases or decreases the power output to the circulator when there is a requirement for mixing. The circulator speed varies to maintain the correct mixed supply water temperature at the mix supply sensor. For correct sizing and piping of the variable speed injection circulator, refer to essay E 021.

- Connect terminal 17 115 V ac line wire (L) to the (L) of the mixing device.
- Connect terminal 18 neutral wire (N) to the (N) of the mixing device.

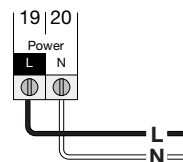
A visual indication of the analog output is displayed by the Mix % LEDs on the user interface.



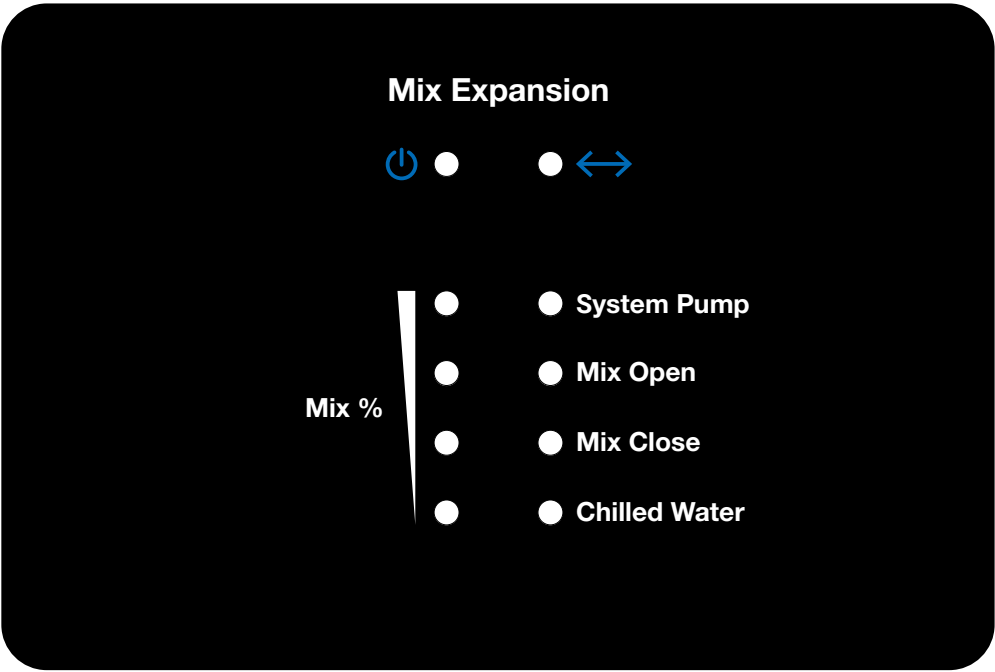
Input Power (Terminals 19, 20)

Provide a 15 Amp circuit for the input power.

- Connect the 115 V (ac) line wire (L) to terminal 19.
- Connect the neutral wire (N) to terminal 20.



User Interface



Status Icons

	POWER LED is on when powered.		COMMUNICATION LED is on when communicating to the 291.
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System Outputs

Status

Item	Description
System Pump	The LED is illuminated when the system pump is running.
Mix Open	The LED is illuminated when the mixing valve is open.
Mix Close	The LED is illuminated when the mixing valve is closed.
Chilled Water	The LED is illuminated when the diverting valve is open and sending water from the chilled water tank.

System Outputs

Mix Percentage

The mix percentage is available when doing variable speed injection mixing.

Mix % LEDs	Mix Percentage
4 LED On	76 to 100
3 LED On	51 to 75
2 LED On	26 to 50
1 LED On	1 to 25
0 LED On	0

Dip Switch Settings

There are two DIP switches located on the top left side of the control. The DIP switch positions determine the Mix number (1, 2, or 3) on the Smart Heat Pump Control 291

Mix Number	DIP Switch 1	DIP Switch 2
Mix 1	Off	Off
Mix 2	Off	On
Mix 3	On	Off

Sequence of Operation

The Smart Mix Expansion 295 has a mix call and a mix supply sensor. This information is sent to the Smart Heat Pump Control 291 using the expansion communication bus. The Smart Heat Pump Control 291 uses its settings to calculate a mix target and sends information to the Smart Mix Expansion 295 to operate the mixing valve position, the variable speed injection pump speed and the mix system pump. When there is a tekmarNet cooling call, the diverting valve output is closed to switch the mix loop from heating to cooling operation.

Troubleshooting

Symptom	Description
Power LED Off	Using an electrical meter, check that the supply voltage is between 103.5 and 126.5 V (ac). If the supply voltage is correct and the Power LED remains off the control may be faulty.
Communication LED Off	Check that the mix expansion on wiring terminals 4, 5, and 6 are connected using 3-conductor 18 AWG LVT wire if connections are less than 100 feet (30 m). Connections exceeding 100 feet (30 m) or installed in high radio-frequency environments should use 3-conductor, 22 AWG shielded-twisted pair. The mix expansion wiring is polarity sensitive so it is important to check that the wire color codes are in the correct terminal locations.

Technical Data

Literature	IOM-T-295, ES-T-295
Packaged Weight	2.4 lbs. (1.10 kg)
Dimensions	9" H x 8" W x 2 3/8" D (229 x 203 x 60 mm)
Enclosure	Blue ABS plastic, NEMA type 1
Approvals	CSA C US, FCC Part 15B, CAN ICES-3 (B)/NMB-3(B)
Ambient Condition	Indoor use only, 32 to 122°F (0 to 50°C), <90% RH non-condensing, Installation Category II, Pollution Degree 2
Power Supply	115 V (ac)±10%, 60 Hz, 6W
Relays	230 V (ac), 5 A, 1/3 hp
Variable Pump	115V (ac), 2.4A
Modulating Output	0-10 V (dc) 500 Ω minimum load impedance or 4-20 mA 1 kΩ max load impedance
Calls	24V (ac) or Short
Warranty	Limited 3 Year

Limited Warranty and Product Return Procedure

Limited Warranty *The liability of tekmar under this warranty is limited. The Purchaser, by taking receipt of any tekmar product ("Product"), acknowledges the terms of the Limited Warranty in effect at the time of such Product sale & acknowledges that it has read & understands same.*

The tekmar Limited Warranty to the Purchaser on the Products sold hereunder is a manufacturer's pass-through warranty which the Purchaser is authorized to pass through to its customers. Under the Limited Warranty, each tekmar Product is warranted against defects in workmanship & materials if the Product is installed & used in compliance with tekmar's instructions, ordinary wear & tear excepted. The pass-through warranty period is for a period of twenty-four (24) months from the production date if the Product is not installed during that period, or twelve (12) months from the documented date of installation if installed within twenty-four (24) months from the production date.

The liability of tekmar under the Limited Warranty shall be limited to, at tekmar's sole discretion: the cost of parts & labor provided by tekmar to repair defects in materials &/or workmanship of the defective product; or to the exchange of the defective product for a warranty replacement product; or to the granting of credit limited to the original cost of the defective product, & such repair, exchange or credit shall be the sole remedy available from tekmar, &, without limiting the foregoing in any way, tekmar is not responsible, in contract, tort or strict product liability, for any other losses, costs, expenses, inconveniences, or damages, whether direct, indirect, special, secondary, incidental or consequential, arising from ownership or use of the product, or from defects in workmanship or materials, including any liability for fundamental breach of contract.

The pass-through Limited Warranty applies only to those defective Products returned to tekmar during the warranty period. This Limited Warranty does not cover the cost of the parts or labor to remove or transport the defective Product, or to reinstall the repaired or replacement Product, all such costs & expenses being subject to Purchaser's agreement & warranty with its customers.

Any representations or warranties about the Products made by Purchaser to its customers which are different from or in excess of the tekmar Limited Warranty are the Purchaser's sole responsibility & obligation. Purchaser shall indemnify & hold tekmar harmless from & against any & all claims, liabilities & damages of any kind or nature which arise out of or are related to any such representations or warranties by Purchaser to its customers.

The pass-through Limited Warranty does not apply if the returned Product has been damaged by negligence by persons other than tekmar, accident, fire, Act of God, abuse or misuse; or has been damaged by modifications, alterations or attachments made subsequent to purchase which have not been authorized by tekmar; or if the Product was not installed in compliance with tekmar's instructions &/or the local codes & ordinances; or if due to defective installation of the Product; or if the Product was not used in compliance with tekmar's instructions.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH THE GOVERNING LAW ALLOWS PARTIES TO CONTRACTUALLY EXCLUDE, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY & FITNESS FOR A PARTICULAR PURPOSE, DURABILITY OR DESCRIPTION OF THE PRODUCT, ITS NON-INFRINGEMENT OF ANY RELEVANT PATENTS OR TRADEMARKS, & ITS COMPLIANCE WITH OR NON-VIOLATION OF ANY APPLICABLE ENVIRONMENTAL, HEALTH OR SAFETY LEGISLATION; THE TERM OF ANY OTHER WARRANTY NOT HEREBY CONTRACTUALLY EXCLUDED IS LIMITED SUCH THAT IT SHALL NOT EXTEND BEYOND TWENTY-FOUR (24) MONTHS FROM THE PRODUCTION DATE, TO THE EXTENT THAT SUCH LIMITATION IS ALLOWED BY THE GOVERNING LAW.

Product Warranty Return Procedure All Products that are believed to have defects in workmanship or materials must be returned, together with a written description of the defect, to the tekmar Representative assigned to the territory in which such Product is located. If tekmar receives an inquiry from someone other than a tekmar Representative, including an inquiry from Purchaser (if not a tekmar Representative) or Purchaser's customers, regarding a potential warranty claim, tekmar's sole obligation shall be to provide the address & other contact information regarding the appropriate Representative.



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