

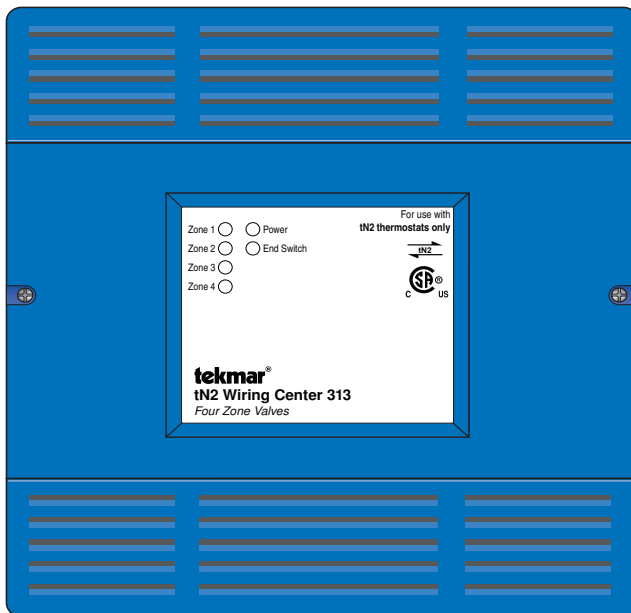


tekmar® Installation & Operation Manual

tN2 Wiring Center 313

Introduction

The tekmarNet®2 Wiring Center 313 is designed to operate up to four zone valves in a hydronic heating system. It can be mounted in the mechanical room or near a remote zone manifold, providing a convenient location to wire both thermostats and zone valves while only requiring two wires to be run back to the mechanical room. When combined with tekmarNet®2 Thermostats, all devices communicate to provide a synchronized end switch that reduces cycling of equipment.



Features

- Four 24 V (ac) powered zone outputs
- For use with tekmarNet®2 Thermostats
- Supports two-stage tekmarNet®2 Thermostats
- tN4 expansion terminals
- Isolated end switch
- 115 V (ac) zone group pump output
- Outdoor sensor input
- External diagnostic LEDs
- CSA C US Certified for use in USA and Canada

Benefits

- Simple, convenient wiring location
- Compact enclosure for flexible installation
- Reduce equipment cycling through the use of tekmarNet®2 Thermostats

Note

- Not for use with tekmarNet®4 Thermostats

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Getting Started

Congratulations on the purchase of your new tekmarNet® Wiring Center!

This manual covers the complete installation, programming and sequence of operation for this control. You will also find instruction on testing, commissioning, and troubleshooting the control and system that it operates.

Installation

Caution

Improper installation and operation of this control could result in damage to the equipment and possibly even personal injury or death. It is your responsibility to ensure that this control is safely installed according to all applicable codes and standards. This electronic 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. Do not attempt to service the control. Refer to qualified personnel for servicing. There are no user serviceable parts. Attempting to do so voids warranty and could result in damage to the equipment and possibly even personal injury or death.

Radio Frequency Interference

The installer must ensure that this control and its wiring are isolated and/or shielded from strong sources of electromagnetic noise. Conversely, this Class B digital apparatus complies with Part 15 of the FCC Rules and meets all requirements of the Canadian Interference-Causing Equipment Regulations. However, if this control does cause harmful interference to radio or television reception, which is determined by turning the control off and on, the user is encouraged to try

to correct the interference by re-orientating or relocating the receiving antenna, relocating the receiver with respect to this control, and/or connecting the control to a different circuit from that to which the receiver is connected.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Preparation

Tools Required

- tekmar or jeweller screwdriver
- Phillips head screwdriver
- Needle-nose pliers
- Wire stripper

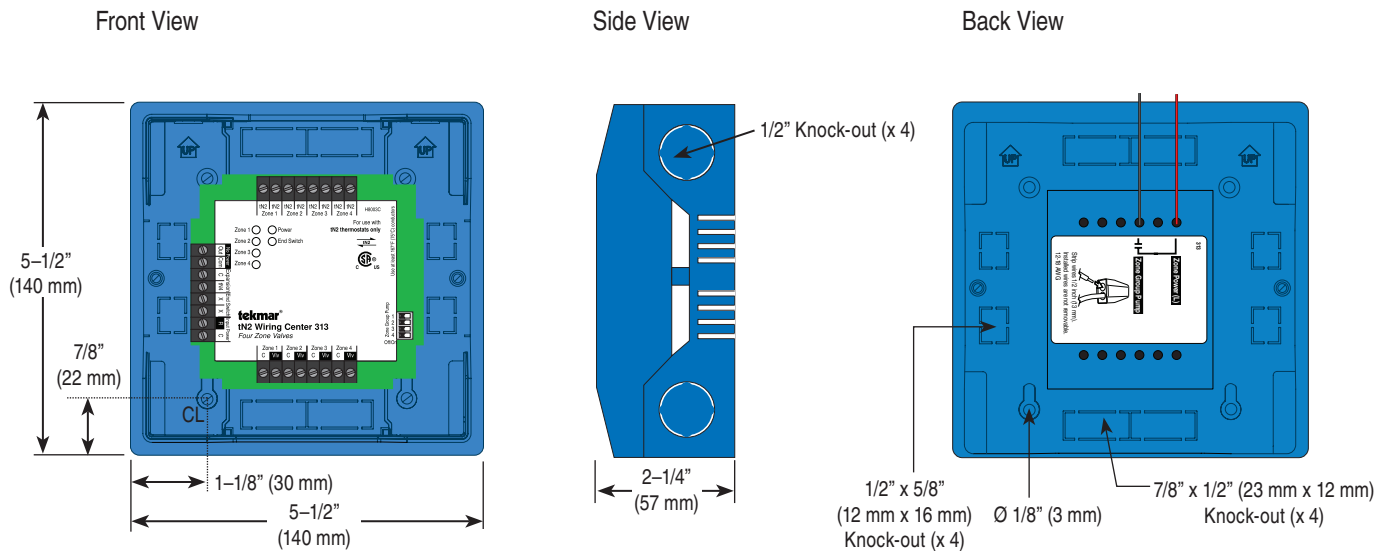
Materials Required

- (2) #10 x 1" wood screws
- (2) wire nuts
- 18 AWG LVT solid wire (low voltage connections)
- 14 AWG solid wire (line voltage connections)
- tekmar 009 (24 V (ac) transformer)
- Cable or conduit connectors

Power Required

- 120 V (ac), 1-phase, 15 A service from circuit breaker panel
- Power disconnect (optional)

Physical Dimensions



Installation Location

- When choosing the location for the control, consider the following:
- Keep dry. Avoid potential leakage onto the control. RH \leq 90% to 122°F (50°C) in a non-condensing environment.
- Do not expose to operating temperatures beyond 32-122°F (0-50°C).
- Provide adequate ventilation.
- Keep away from equipment, appliances or other sources of electrical interference.
- Locate the control near zone valves if possible.
- Provide easy access for wiring and viewing the control.
- Mount approximately 5 ft. (1.5 m) off the finished floor.
- Install to wall using #10 x 1" wood screws. Wall anchors are recommended when mounting to sheet rock, wall-board or masonry.

Rough-In Wiring

Line Voltage Wiring

In most cases, the control can be mounted directly to a wall without the need for any line voltage connections.

As an option, the control may be mounted to a 4" x 4" electrical junction box so that the high voltage electrical connections for the transformer are safely contained.

For ease of service, the circuit breaker or power disconnect should be located in reasonably close proximity to the equipment.

All line voltage wire connections are recommended to be pulled inside a flexible or solid conduit. Always follow proper wiring practices, building and electrical codes for your jurisdiction.

Each cable must be pulled to the electrical junction box. It is recommended to label each cable for easy identification. All line voltage wires should be stripped to a length of 1/2" (13 mm).

Pull a three conductor 14 AWG cable for the following equipment:

- Circuit Breaker or Power Disconnect (if applicable)
- Zone Group Pump (if applicable)

Low Voltage Wiring

Each cable must be pulled from the equipment to the control's plastic enclosure. All low voltage wiring connections enter the enclosure through conduit knockouts on the sides, or through the square knockouts on the rear. It is recommended to label each cable for easy identification. All low voltage wires are to be stripped to a length of 3/8" (9 mm) to ensure proper connection to the control.

Pull two conductor 18 AWG LVT cable, up to 500 feet (150 m) for the following equipment:

- tekmarNet[®]2 Thermostats
- tekmarNet[®]2 House Control (if applicable)

- 24 V (ac) Power
- Zone Valves
- Boiler T-T (If using End Switch)
- Outdoor Sensor 070 (if applicable)

Pull three conductor 18 AWG LVT cable for the following equipment:

- tekmarNet[®]4 Accessories (User Switch, Timer)

Sizing the Transformer

The control requires an external transformer. A tekmar Transformer 009 (or 009K which includes a 4"x 4" electrical box) can supply up to 40 VA, and includes an in-line fuse to protect the transformer and control.

In order to correctly size the external transformer, all loads connected to the control must be taken into account.

When adding up the loads, consider the following:

- Thermostats 527, 528, 529, and 530 draw approximately 1.3 VA each.
- Each zone valve must be sized for peak load. This can be obtained by multiplying the peak current draw (in Amps) by 24 V (ac).

The total power capacity of the power supply should be larger than the total load of all the devices connected to the control. This total load must not exceed 99 VA. Multiple tekmar Transformer 009's can be wired together to increase total VA capacity.

The following chart is provided to simplify transformer sizing:

| Zone | 1 | 2 | 3 | 4 | |
|-----------------|---------|---------|---------|---------|-------------------|
| Thermostat Load | | | | | |
| Zone Valve Load | | | | | |
| Total Zone Load | _____ + | _____ + | _____ + | _____ + | Control Load (VA) |
| | | | | | 3 |

= Transformer must exceed:
_____ VA

Control Wiring

Line Voltage Wiring

CAUTION: TURN ALL POWER OFF BEFORE PERFORMING ANY WIRING.

Wire the Grounds

- Connect the power supply ground and zone group pump ground to the electrical box as shown in Figure 1.

Wire the Neutrals (N)

- Connect the 115 V (ac) neutral (N) and zone group pump neutral wires to the 115 V (ac) side of the transformer. Use a wire nut or approved connector. See Figure 1.

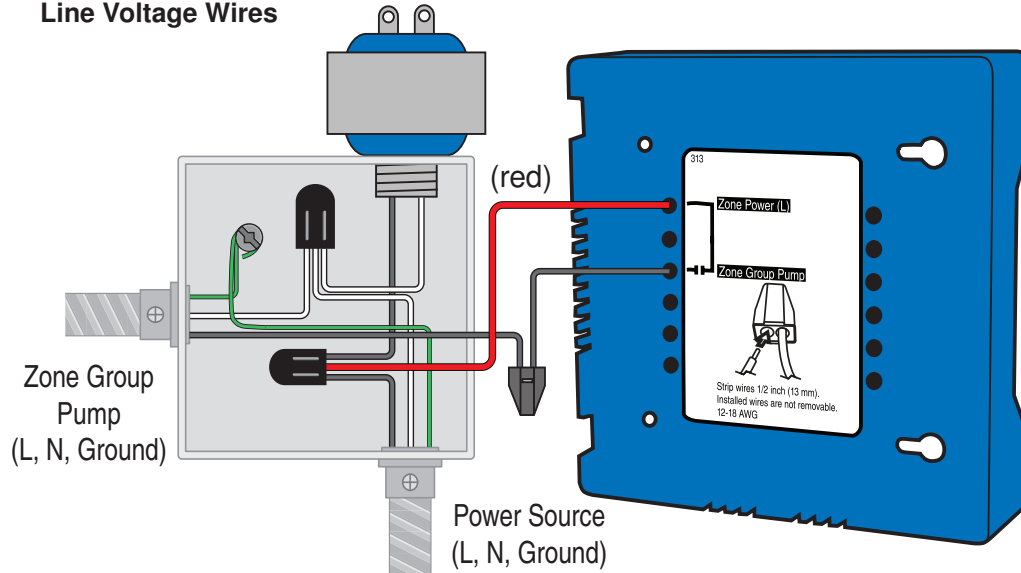
Wire the Power (L)

- Connect the 115 V (ac) line voltage (L) wire to the 115 V (ac) side of the transformer and to the Power L wire (red) of the zone group pump relay. Use a wire nut or approved connector. See Figure 1.

Wire the Zone Group Pump (L)

- Connect the 115 V (ac) line voltage (L) wire from the zone group pump to the Zone Group Pump push-in wire connector. See Figure 1.
- If the zone group pump is not used then cut the rear red and black wires where they exit the enclosure.

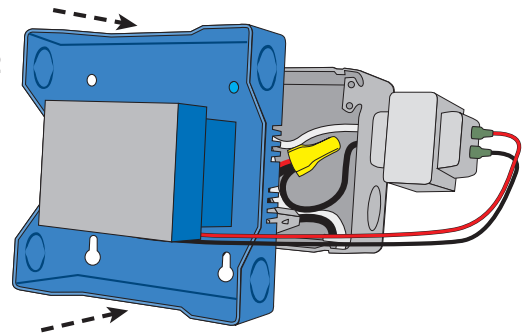
Figure 1 - Connect Line Voltage Wires



Install The Enclosure

- The enclosure may be mounted directly to a wall or to an electrical junction box.
- Ensure that the high voltage wires are neatly tucked inside the electrical junction box.
- Using 2 of the 4 holes in the back of the enclosure, securely fasten it to the electrical junction box with 2 #10 screws as shown in Figure 2.

Figure 2



Low Voltage Wiring

External Power Supply

It is strongly recommended that a transformer with an in-line fuse be used in order to protect the transformer from high currents. The tekmar Transformer 009 includes a fuse.

- Connect the 24 V (ac) leads from the transformer to the C and R terminals marked "Input Power" on the 313.

tekmarNet®2 Thermostats

The 313 is designed to operate with tekmarNet®2 Thermostats. They provide the heating and cooling control for each zone, and communicate with any other tekmarNet® device on the system.

- Connect the tN2 terminals from each thermostat to the corresponding tN2 terminals for each zone on the 313.

Zone Valves

- Wire the zone valves to the C and Vlv terminals on the 313.
- End switches on zone valves are not required when using the 313.

tN4 Expansion Terminals

The 313 uses the Expansion tN4 and C terminals to communicate with additional Wiring Centers, House Controls, and other tekmarNet® devices.

- Connect the tN4 and C Expansion terminals on the 313 to the corresponding tN4 and C Expansion terminals of the additional external device.

Wiring the End Switch

The 313 can operate a single on-off boiler or provide a demand to a tekmar control.

- Connect the X X End Switch terminals on the 313 to the T-T (or R-W) terminals on the boiler.
- If required, use the X X End Switch terminals to switch 24 V (ac) to power a demand on a tekmar outdoor reset control.

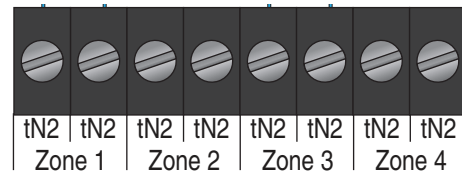
Wiring the Outdoor Sensor

The 313 has an optional outdoor sensor input.

- Wire the outdoor sensor to the Out and Com terminals on the 313.
- The outdoor temperature will be displayed on all thermostats connected to the 313.

Two-Stage tekmarNet®2 Thermostat Wiring

A two stage thermostat is automatically detected when connected to Zone 1 or Zone 3. If there is no tN2 thermostat connected to Zone 2 or Zone 4, these outputs will automatically operate the heating equipment for second stage heat.



| Two-Stage Terminal Designation | | | |
|--------------------------------|---------|---------|---------|
| Zone 1 | | Zone 3 | |
| Stage 1 | Stage 2 | Stage 1 | Stage 2 |

Testing the Control Wiring

Testing the Power

If the control Power light does not turn on, check the Input Power wiring terminals using an electrical multimeter. The voltage should measure between 21.6 to 26.4 V (ac). If the voltage is below this range, measure the line voltage side of the transformer. The voltage should measure between 103.5 to 126.5 V (ac).

Testing the Thermostats

If the thermostat display turns on, this indicates that the thermostat is operating correctly and there are no electrical issues. In the event that the display is off, or the display is cycling on and off, follow this procedure.

1. Remove the tN2 wires from the thermostat.
2. Use an electrical meter to measure DC voltage between the tN2 terminals.

If the DC voltage is 0 V (dc) for 20 seconds, then there is an open or short circuit in the tN2 wires. If the DC voltage is 0 V (dc) for 10 seconds and then is 23 to 24 V (dc) for 5 seconds, this indicates the wiring is correct.

3. Connect the thermostat to the tN2 wires from a zone on a House Control, Wiring Center, or Zone Manager.
4. If the thermostat display is off, or is cycling on and off, move the thermostat to the next available zone on the House Control, Wiring Center, or Zone Manager.

If the thermostat display remains permanently on, there may be a fault with the previously tried zone on the House Control, Wiring Center, or Zone Manager.

If the thermostat display continues to be off, or is cycling on and off, there may be a fault on the thermostat.

If a fault is suspected, contact your tekmar sales representative for assistance.

Testing the Zone Output

1. Use an electrical test meter to measure the (ac) voltage between the C and the Vlv terminals for each zone valve output.
 - Lower the thermostat temperature setting. When the zone LED is off, the reading should be 0 V (ac) and the valve should be closed.
 - Raise the thermostat temperature setting. When the zone LED is on, the reading should be 24 V (ac) + / - 10% and the valve should be open.

Note: If power to the zone valve is present but the zone valve does not operate properly, refer to any troubleshooting information supplied by the zone valve manufacturer.

Testing tekmarNet®4 Expansion

To test the tN4 Network, check the wires for continuity and shorts.

1. Disconnect the two tN4 expansion wires (tN4 and C) at one end and twist them together.
2. Go to the other end of the wires and disconnect them.
3. Using an electrical test meter, check for continuity. Resistance should read 0 ohms, or continuity should produce a tone. If not, this indicates that there are damaged wires connecting the tN4 control to the 313. Repair or replace the wires as necessary.
4. Go back to the original end of the wires and, using a wire nut, cap each expansion wire individually so that these ends cannot touch another conductor.
5. Go to the other end of the wires and again, test for shorts. Resistance should be infinite, or O.L. and there should be no tone. If tone exists or less than 50 000 ohms is found, then the wires are not insulated from one another. This is generating a short on the wires connecting the tN4 control to the 313.
6. Replace the damaged wires, test, and reconnect them to their proper terminals.

Testing The End Switch / Zone Group Pump

If the tN4 expansion terminals are not used to connect the 313 to the system, the end switch may be used.

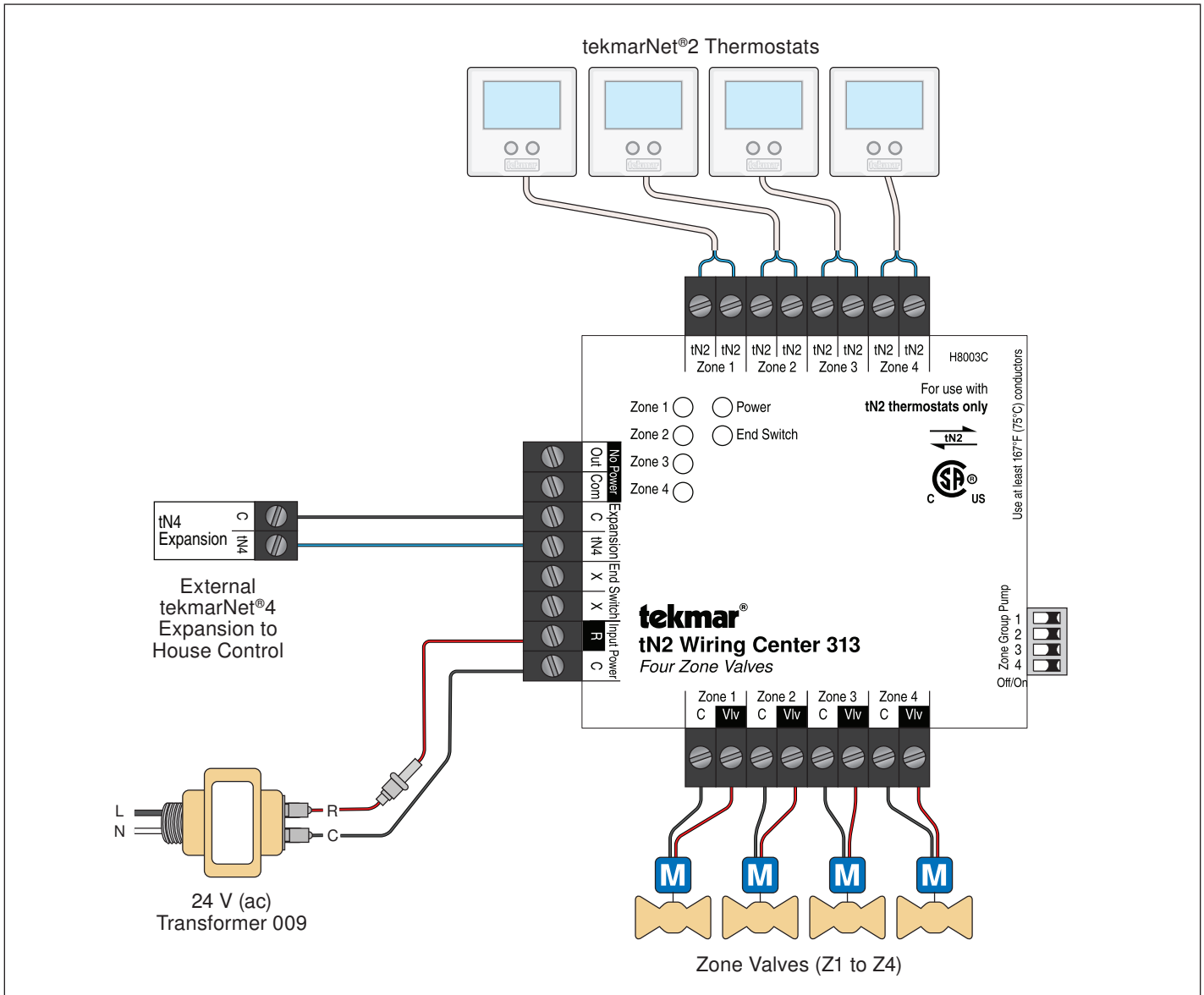
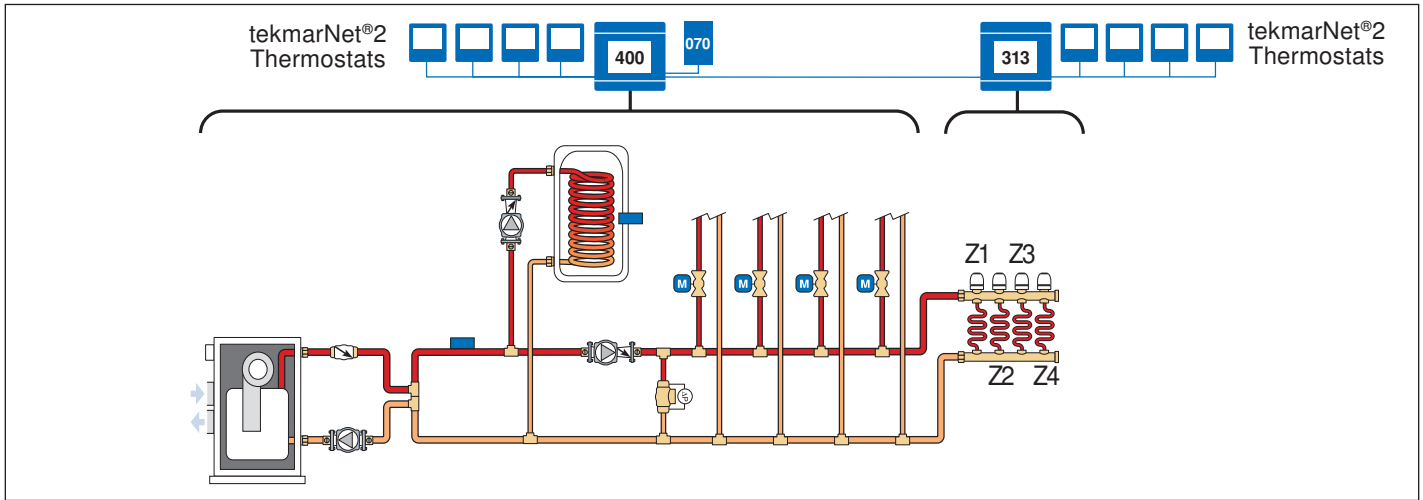
1. Remove the wires from the end switch terminals.
2. Use an electrical test meter to measure continuity across the XX end switch terminals on the 313.
 - When the end switch LED is off, no continuity should be present (no tone).
 - When the end switch LED is on, continuity should be present (tone).
3. Use an electrical test meter to measure voltage across the zone group pump hot switch leg and neutral.
 - When the end switch LED is off, the voltage should be 0 V (ac).
 - When the end switch LED is on, the voltage should be between 103.5 to 126.5 V (ac).

Applications

tekmarNet®4 Expansion to House Control

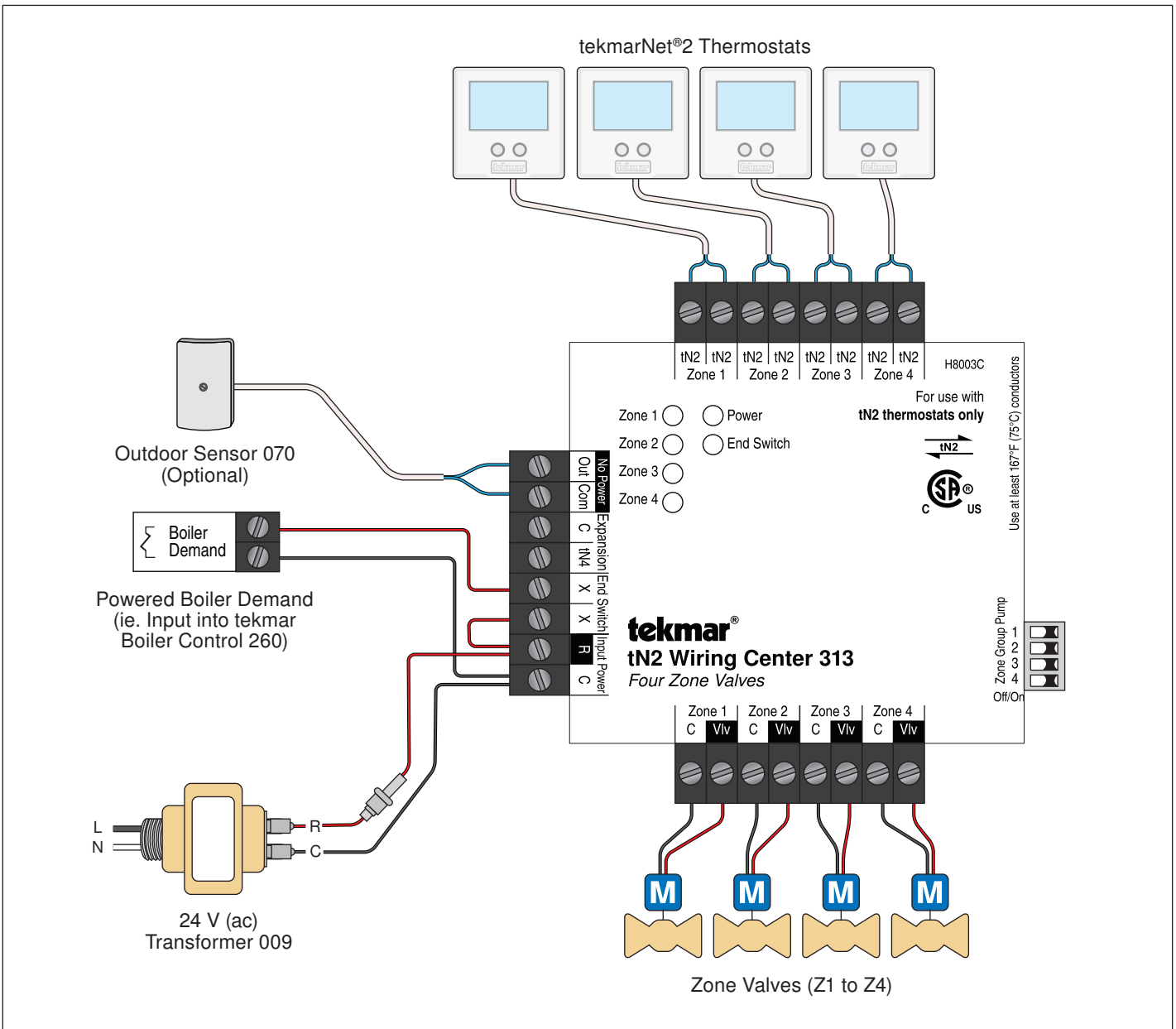
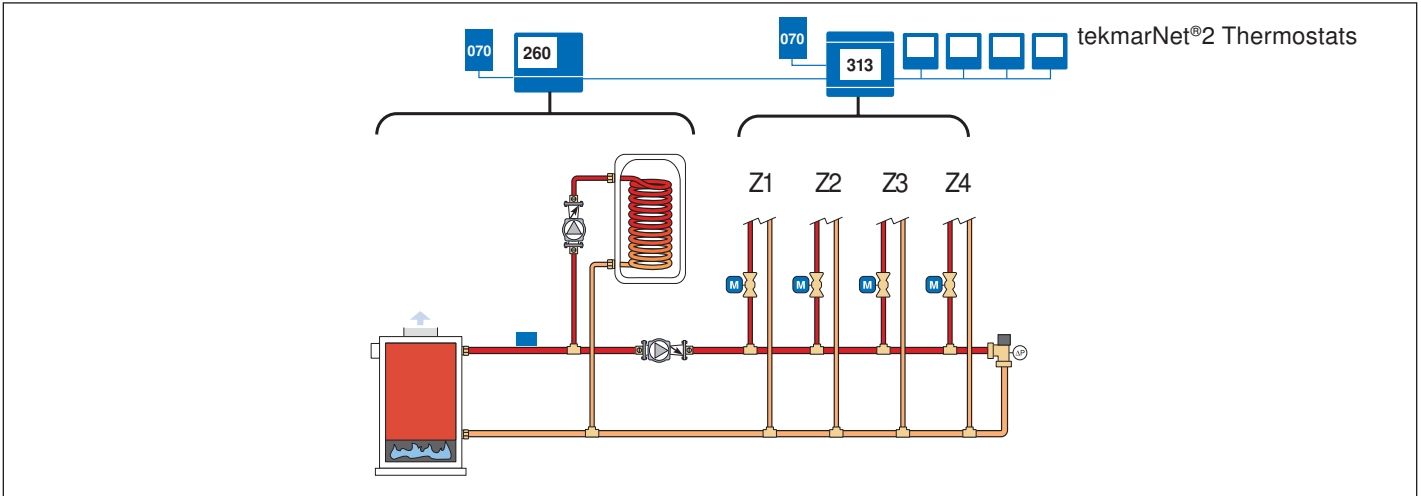
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Description: tN2 Wiring Center 313, four tekmarNet®2 Thermostats, and four zone valves wired into a tekmar tN2 House Control 400 which controls the boiler, primary pump and DHW pump.



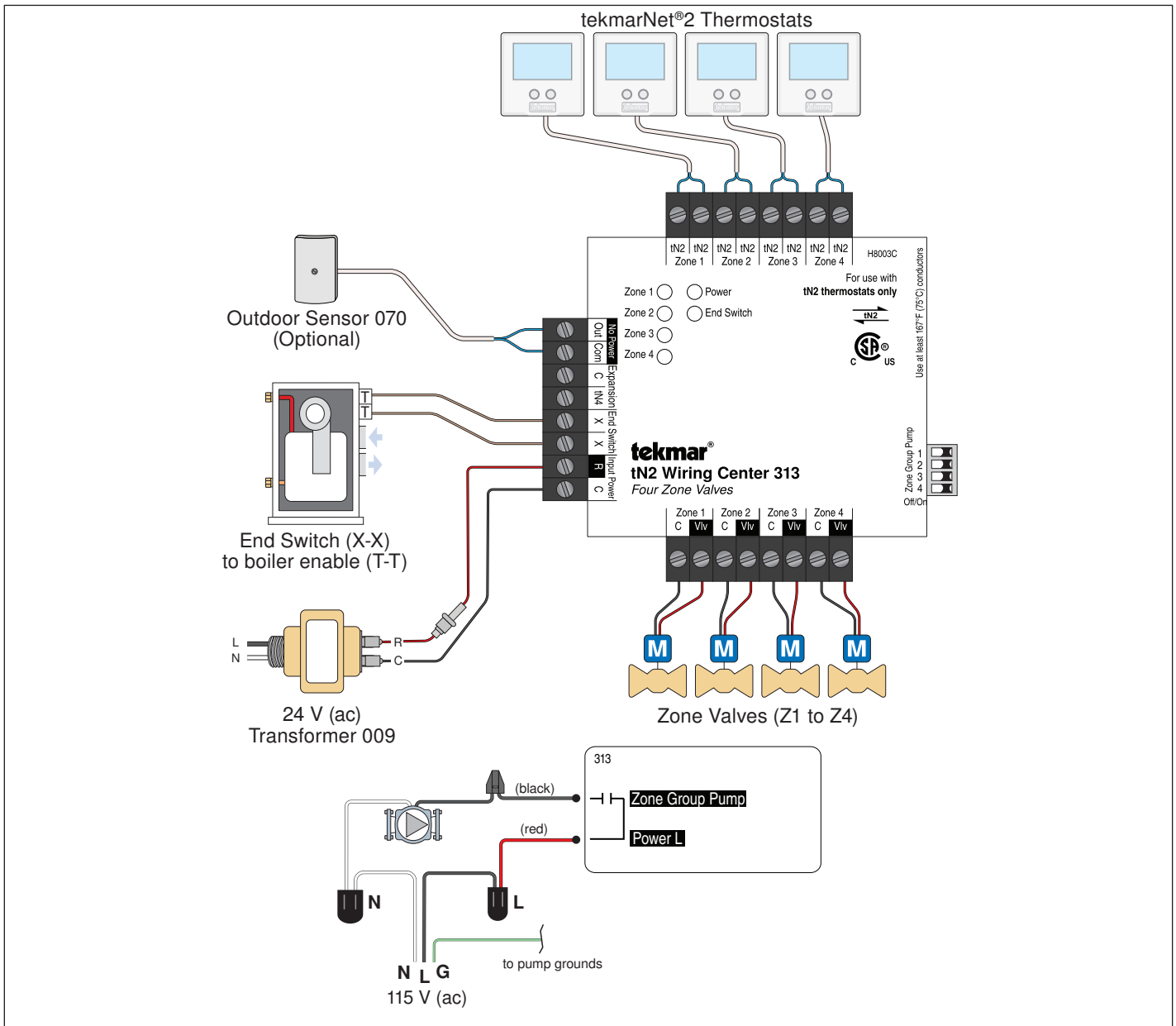
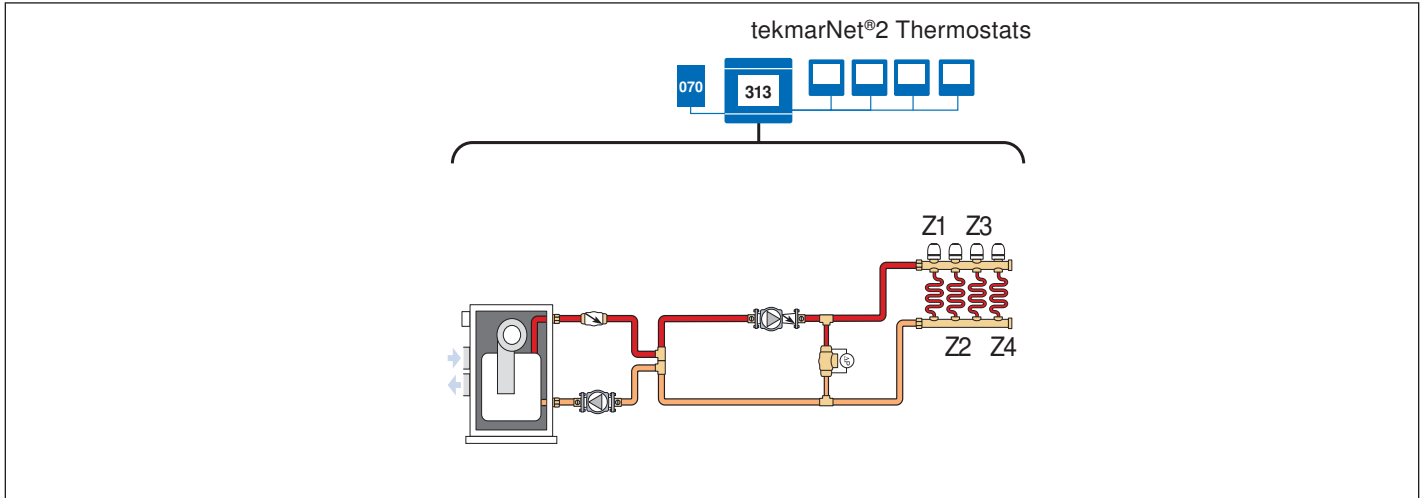
End Switch (X-X) To Powered Boiler Demand

Description: tN2 Wiring Center 313, four tekmarNet®2 Thermostats, and four zone valves wired into a powered boiler demand input on a device such as a tekmar Boiler Control 260 which controls the primary pump and DHW pump.









End Switch (X-X) To Boiler Enable (T-T)

Description: tN2 Wiring Center 313, four tekmarNet®2 Thermostats, and four zone valves wired into the T-T terminals on the boiler to give an enable. The pump is controlled by the Zone Group Pump output on the 313.

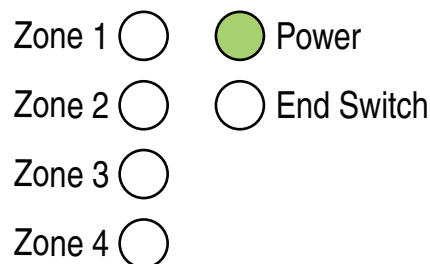


User Interface

LEDs

| | |
|---|---|
|  | ZONE 1 The zone 1 thermostat is calling for heat and the 24 V (ac) output is energized. |
|  | ZONE 2 The zone 2 thermostat is calling for heat and the 24 V (ac) output is energized. |
|  | ZONE 3 The zone 3 thermostat is calling for heat and the 24 V (ac) output is energized. |
|  | ZONE 4 The zone 4 thermostat is calling for heat and the 24 V (ac) output is energized. |
|  | POWER 24 V (ac) is being applied to the Wiring Center to provide it with power. |
|  | END SWITCH At least one of the zone thermostats are calling for heat and the end switch relay output is closed. |

Wiring Center 313

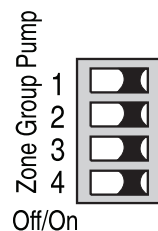


Zone LED Flashing

The zone has an open or short circuit and communication to the thermostat on the zone has been interrupted. Check the wiring between the thermostat and the Wiring Center for open or short circuits. If the thermostat was intentionally removed, power the Wiring Center off for 10 seconds.

DIP Switches

Each zone has a corresponding zone group pump DIP switch. Set the switch to On to operate the zone group pump output whenever that zone calls for heat. When the DIP switch is set to off, the zone group pump will not operate when that zone calls for heat.



Sequence of Operation

tekmarNet® System

Section A

tekmarNet® is a family of products that use communication to operate the HVAC system in a comfortable and efficient manner. The Wiring Center is a zoning component in a tekmarNet® system and requires tekmarNet®2 (tN2) Thermostats to be directly connected to it.

The tekmarNet®4 (tN4) Expansion terminals can link the Wiring Center with other tekmarNet® components:

- House Controls 400, 401, 402, 403 - Provides boiler and DHW control

- Reset Modules 420, 421, 422, 423
- Boiler Controls 274, 275
- Wiring Centers 313, 314, 315, 316 - Add additional zones
- tN4 Thermostats - Add thermostats
- tN4 Timer 033 - Adds 4 programmable schedules
- tN4 User Switch 479 - Provides a system override for vacations and holidays
- tN4 Setpoint Control 161, 162 - Control hot tubs, pools and more

Relay Outputs

End Switch Operation

The End Switch relay ('XX') closes and the end switch LED turns on. The switch remains closed as long as any zone is calling for heat. This can provide a boiler demand to a tekmar reset control, or provide a boiler enable to a boiler's TT terminals.

If the Wiring Center is connected to a tN4 bus, all communication messages will pass through the 313's tN4 expansion connection. tN4 messages are required in order to create a boiler demand on a device such as a tekmar House Control 400.

24 V (ac) Zone Relay Operation

When a thermostat calls for heat, it sends a message to the Wiring Center and the corresponding zone LED turns on. Power is then supplied to the appropriate zone output as indicated by the LED.

Zone Group Pump Operation

The zone group pump remains on when any zone is calling for heat and the corresponding DIP switch is set to ON. When using thermal actuated zone valves, a 3 minute time delay can be set on the thermostat to allow the zone valve to fully open before the zone group pump is activated.

Energy Saving Features

Section C

Network Schedules

Adding a schedule to a tekmarNet® system is both easy and valuable. A Timer 033 provides scheduling with up to 4 events per day for every tekmarNet® Thermostat. Turning down the room temperatures when they are unoccupied reduces boiler on-time and energy consumption which helps save money and the environment.

One-Touch Economy

A User Switch 479 allows for one-touch overrides of the system. For example, if leaving the building for vacation, simply press the "Away" button and all the thermostats will immediately operate at a lower temperature, instead of having to walk around the building lowering the heating temperature setting and raising the cooling temperature setting on each thermostat.

Zone Synchronization

The Wiring Center includes an energy saving feature called Zone Synchronization. In typical zoned systems, the thermostats operate on a stand-alone basis. This means that a zone turns on and off as required without any regard for other zones. The net effect is random operation of the zones causing short cycling of the heat source. tekmarNet® thermostats communicate to ensure that their cycles are synchronized. Energy is saved by ensuring zones requiring heat operate on the same cycle, therefore reducing short cycling of the boiler.

Troubleshooting

Frequently Asked Questions

| Symptom | Look For... | Corrective Action |
|---------------------------|--------------------|--|
| Power LED is off | Power to control | Use electrical meter to measure 24 V (ac) voltage on input power R and C terminals. |
| No central heating | Zone LEDs | If there are no green Zone LEDs, there are no thermostats calling for heat. |
| | System in AWAY | During AWAY, the thermostats operate at a lower temperature. Locate a 'User Switch' and set to Normal to resume heating. |
| Single zone over heating | LED shows zone on | Thermostats have a differential of +/- 1.5°F (0.8°C) of the temperature setting. Due to the display rounding numbers up, heating can appear on when the temperature is 2°F (1°C) above the setting. This is normal operation. |
| | LED shows zone off | Ensure zone valve terminals measure 0 V (ac). Measuring 0 V (ac) indicates mechanical zone valve may have failed in the open position. Measuring 24 V (ac) indicates control relay may have failed. |
| Single zone under heating | LED shows zone on | Ensure zone valve terminals measure 24 V (ac). Measuring 24 V (ac) indicates mechanical zone valve may have failed in the closed position. Measuring 0 V (ac) indicates control relay may have failed. |
| | LED shows zone off | Check the thermostat to see if it is calling for heat (H1 displayed on the screen). |
| | Zone LED flashing | The zone has an open or short circuit and communication to the thermostat on the zone has been interrupted. Check the wiring between the thermostat and the Wiring Center for open or short circuits. If the thermostat was intentionally removed, power the Wiring Center off for 10 seconds. |

Technical Data

| tN2 Wiring Center 313 <i>Four Zone Valves</i> | |
|---|---|
| Literature | D313, Q313, C313 |
| Control | Microprocessor control. This is not a safety (limit) control. |
| Packaged weight | 1.4 lbs (630 g) |
| Dimensions | 5.5" H x 5.5" W x 2.25" D (140 x 140 x 57 mm) |
| Enclosure | Blue PC+ABS plastic, NEMA type 1 |
| Approvals | CSA C US, meets class B: ICES & FCC Part 15 |
| Ambient conditions | Indoor use only, 32 to 122°F (0 to 50°C), RH ≤ 90% Non-condensing |
| Power supply | 24 V (ac) ±10% 60 Hz, 3 VA min, 99 VA max, Class 2 |
| Zone valve load | 24 V (ac) 2 A, maximum combined current (zones 1 to 4): 4 A |
| End switch relay | 24 V (ac) 2 A |
| Zone group pump relay | 115 V (ac) 5 A |
| Sensors | NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) β=3892 |
| –Included | None |
| –Optional | Outdoor Sensor 070 |
| 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 and acknowledges that it has read and 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 and materials if the Product is installed and used in compliance with tekmar's instructions, ordinary wear and 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 and labor provided by tekmar to repair defects in materials and/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, and such repair, exchange or credit shall be the sole remedy available from tekmar, and, 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 and expenses being subject to Purchaser's agreement and 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 and obligation. Purchaser shall indemnify and hold tekmar harmless from and against any and all claims, liabilities and 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 and/or the local codes and 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 AND FITNESS FOR A PARTICULAR PURPOSE, DURABILITY OR DESCRIPTION OF THE PRODUCT, ITS NON-INFRINGEMENT OF ANY RELEVANT PATENTS OR TRADEMARKS, AND 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 and other contact information regarding the appropriate Representative.



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