iWorx by Taco Electronic Solutions

Application Guide

505-038

BZU3 Hydronic Zone Controller

Self-Contained Interoperable Controller Model UCP-1

SUPERSEDES: December 17, 2012 EFFECTIVE: March 9, 2016

Plant ID: 001-4070

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BZU3

The BZU3 is a self-contained microprocessor-based controller for up to 4 radiant heating zones.

Overview

The BZU3 is a hydronic heating zone controller capable of regulating floor and space temperature for up to four zones. Each zone has two analog inputs: one for floor temperature and one for space temperature. Temperature inputs are standard Precon III thermistors, but are also compatible with the TS20X-series thermostat so that each zone's setpoint may be overridden by the user. One zone may also be designated the master zone in the Zone Settings menu, and thus provides heat/cool and fan on/off/auto information to the BZU3 and associated DXU3 or DXU4. There is also an Outside Air Temperature input which may be used with a Precon III thermistor. Each zone has a digital output and a modulating output suitable for valves or circulators. There are also digital outputs for two Group Circulators, one Primary Circulator and Heat Demand.

The controller is based on LONWORKS® networking technology. The controller communicates with the BLM, DXU, and HPM series controllers over the network. The controller can also be networked to a higher-level control system for monitoring and control applications.

Features

- Control of up to four heating zones with individual sensor inputs and isolated outputs
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- Individual temperature setpoints for occupied heating of each zone
- Common temperature setpoint for unoccupied heating
- Proportional plus integral (P+I) control
- Heat Demand output for a common pump or non-networked heat source
- Heat Demand communicated to a BLM series boiler controller or HPM heat pump master controller
- Outdoor Air Cutoff temperature
- TS20X thermostat information communicated to DXU controllers
- Automatic configuration with a Local Control Interface (LCI) touchscreen
- Alarm/Event Reporting

PURPOSE OF THIS GUIDE

The *iWorx® BZU3 Application Guide* provides application information for the BZU3 Controller.

The reader should understand basic HVAC concepts, intelligent environmental control automation, and basic LONWORKS networking and communications. This Application Manual is written for:

- Users who engineer control logic
- Users who set up hardware configuration
- Users who change hardware or control logic
- Technicians and field engineers

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iWorx® products shall only be used for the applications identified in the product specifications and for no other purposes. For example, iWorx® products are not intended for use to support fire suppression systems, life support systems, critical care applications, commercial aviation, nuclear facilities or any other applications where product failure could lead to injury to person, loss of life, or catastrophic property damage and should not be used for such purposes.

Taco Electronic Solutions, Inc. will not be responsible for any product or part not installed or operated in conformity with the Document and instructions or which has been subject to accident, disaster, neglect, misuse, misapplication, inadequate operating environment, repair, attempted repair, modification or alteration, or other abuse. For further information, please refer to the last page of this Document for the company's Limited Warranty Statement, which is also issued with the product or available at www.taco-hvac.com.

APPLICABLE DOCUMENTATION

Part Number	Audience	Purpose
iWorx® BZU3 Application Guide, Document No. 505-038 (this document)	– Application Engineers – Wholesalers – Contractors	Provides specific application information about the BLM series, including sequence of operation and configuration information.
iWorx® LCI Application Guide, Document No. 505-002	– Application Engineers – Installers – Service Personnel – Start-up Technicians – End user	Provides instructions for setting up and using the iWorx® Local Control Interface.
iWorX DXU3 Application Guide, Document No. 505-004 *iWorX DXU4 Application Guide*, Document No. 505-005	– Application Engineers – Installers – Service Personnel – Start-up Technicians – End user	Provides specific application information about the DXU series, including sequence of operation and configuration information.
iWorX BLMC Application Guide, Document No. 505-001	– Application Engineers – Installers – Service Personnel – Start-up Technicians – End user	Provides specific application information about the BLMC series, including sequence of operation and configuration information.
iWorX HPM1 Application Guide, Document No. 505-004	– Application Engineers – Installers – Service Personnel – Start-up Technicians – End user	Provides specific application information about the DXU series, including sequence of operation and configuration information.
iWorX TS200 Series Installation Guide, Document No. 502-016	– Application Engineers – Installers – Service Personnel – Start-up Technicians – End user	Provides specific information about the TS200 series thermostats, including installation and usage instructions.
http://www.iWorxWizard.com	– Application Engineers – Wholesalers – Contractors	An on-line configuration and submittal package generator based on user input. Automatically generates bill of materials, sequence of operations, flow diagrams, wiring diagrams, points and specifications.
Additional Documentation	*LonWorks FTT-10A Free Topology Transceiver User's Guide,* published by Echelon Corporation. It provides specifications and user instructions for the FTT-10A Free Topology Transceiver.	

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INSTALLATION GUIDE

General

CAUTION: This symbol is intended to alert the user to the presence of important installation and maintenance (servicing) instructions in the literature accompanying the equipment.

CAUTION: Risk of explosion if battery is replaced by an incorrect type. Contains lithium type battery; dispose of properly.

WARNING: Electrical shock hazard. Disconnect **ALL** power sources when installing or servicing this equipment to prevent electrical shock or equipment damage.

Make all wiring connections in accordance with these instructions and in accordance with pertinent national and local electrical codes. Use only copper conductors that are suitable for 167 °F (75 °C).

Static Electricity

Static charges produce voltages that can damage this equipment. Follow these static electricity precautions when handling this equipment.

- Work in a static free area.
- Touch a known, securely grounded object to discharge any charge you may have accumulated.
- Use a wrist strap when handling printed circuit boards. The strap must be secured to earth ground.

FCC Compliance

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. This equipment can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to a power source different from that to which the receiver is connected.
- Consult the equipment supplier or an experienced radio/TV technician for help.

You are cautioned that any changes or modifications to this equipment not expressly approved in these instructions could void your authority to operate this equipment in the United States.

BEFORE INSTALLING

About this Document

The instructions in this manual are for the BZU3 module, which supports up to four radiant heating zones.

Inspecting the Equipment

Inspect the shipping carton for damage. If damaged, notify the carrier immediately. Inspect the equipment for damage. Return damaged equipment to the supplier.

What is Not Included with this Equipment

- A power source for the equipment electronics and peripheral devices.
- Tools necessary to install, troubleshoot and service the equipment.
- The screws or DIN rail needed to mount the device.
- Peripheral devices, such as sensors, actuators, etc.

- Cabling, cabling raceway, and fittings necessary to connect this equipment to the power source, FTT-10A network and peripheral devices.

Equipment Location

Abide by all warnings regarding equipment location provided earlier in this document.

Optimally, the equipment should be installed within a secure enclosure.

The equipment must be installed indoors unless contained within a protective enclosure. The enclosure must maintain internal temperature and humidity within the ranges specified for this equipment.

The equipment must be installed within 500 feet of all input peripherals (smoke detectors, sensors, etc.) that will be connected to the equipment. It must be within 200 feet of any connected thermostats.

Selecting a Power Source

This equipment requires a UL recognized external power source (not supplied) to operate. The controller power input requires a voltage of 24 Volts AC.

To calculate power source current requirements, add the power consumption of all peripheral devices to that of the controller.

The controller and triac output loads can use the same power source. If both are using the same power source, the loads must have EMF protection. This protection can be integral to the load, or installed in the 24 VAC wiring across the load's coil.

To provide necessary RFI and transient protection, the controller's ground (GND) pin (T40) must be connected to earth ground or the earth ground of the packaged unit's enclosure ground. Failure to properly ground the controller may cause it to exceed FCC limits. Excessive noise could also produce inaccurate sensor data. The power source must be capable of operating with this connection to ground.

INSTALLATION

Warning: Electrical shock hazard. To prevent electrical shock or equipment damage, disconnect **ALL** power sources to controllers and loads before installing or servicing this equipment or modifying any wiring.

Mounting the Device

1. Select a mounting location. Enclosure mounting is recommended.
2. Hold the controller on the panel you wish to mount it on. With a marker or pencil mark the mounting locations on the panel.
3. Using a small drill bit pre-drill the mounting holes.
4. Using two #6 pan head screws, mount the controller to the panel.
5. Wire the controller (See Routing Cabling to the Device).

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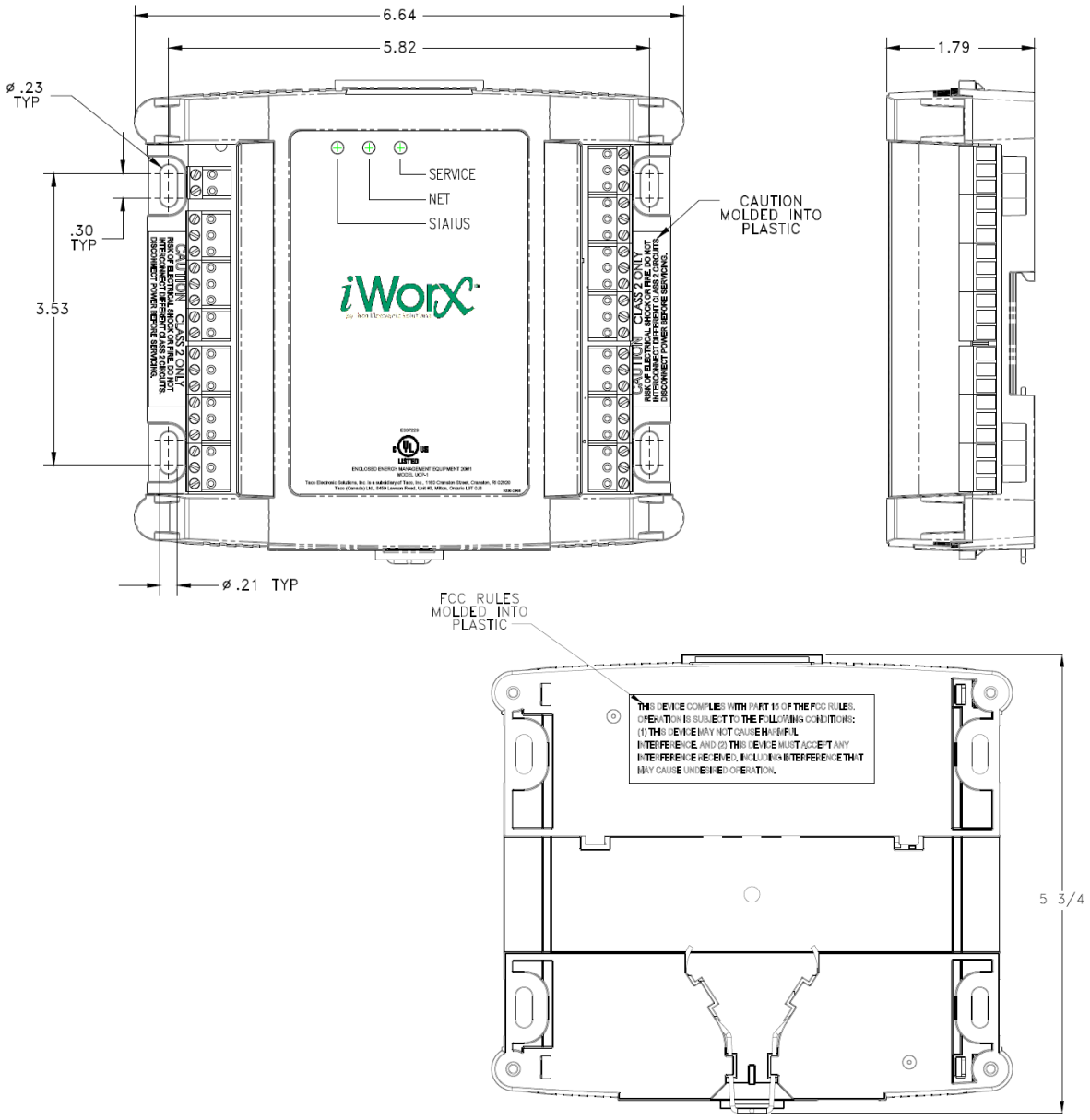
Figure 1: Mounting Dimensions



Routing Cabling to the Device

Cabling used to connect the power source and cabling used to connect the FTT-10A network must remain separated within the control enclosure and wiring conduit.

Grounding the Device

The ground terminal (T40) must be securely connected to earth ground. Failure to properly ground this equipment will result in improper operation. Improper grounding may also increase the risk of electrical shock and may increase the possibility of interference with radio/TV reception.

For best performance, connect the power supply common terminal (T38) to the same external point as the ground terminal (T40).

WIRING INFORMATION

WARNING: Terminals 6, 9, 12, 15, 18 and 38 are connected internally on all BZU3 controllers. Disconnect **ALL** power sources when installing or servicing this equipment to prevent electrical shock or equipment damage.

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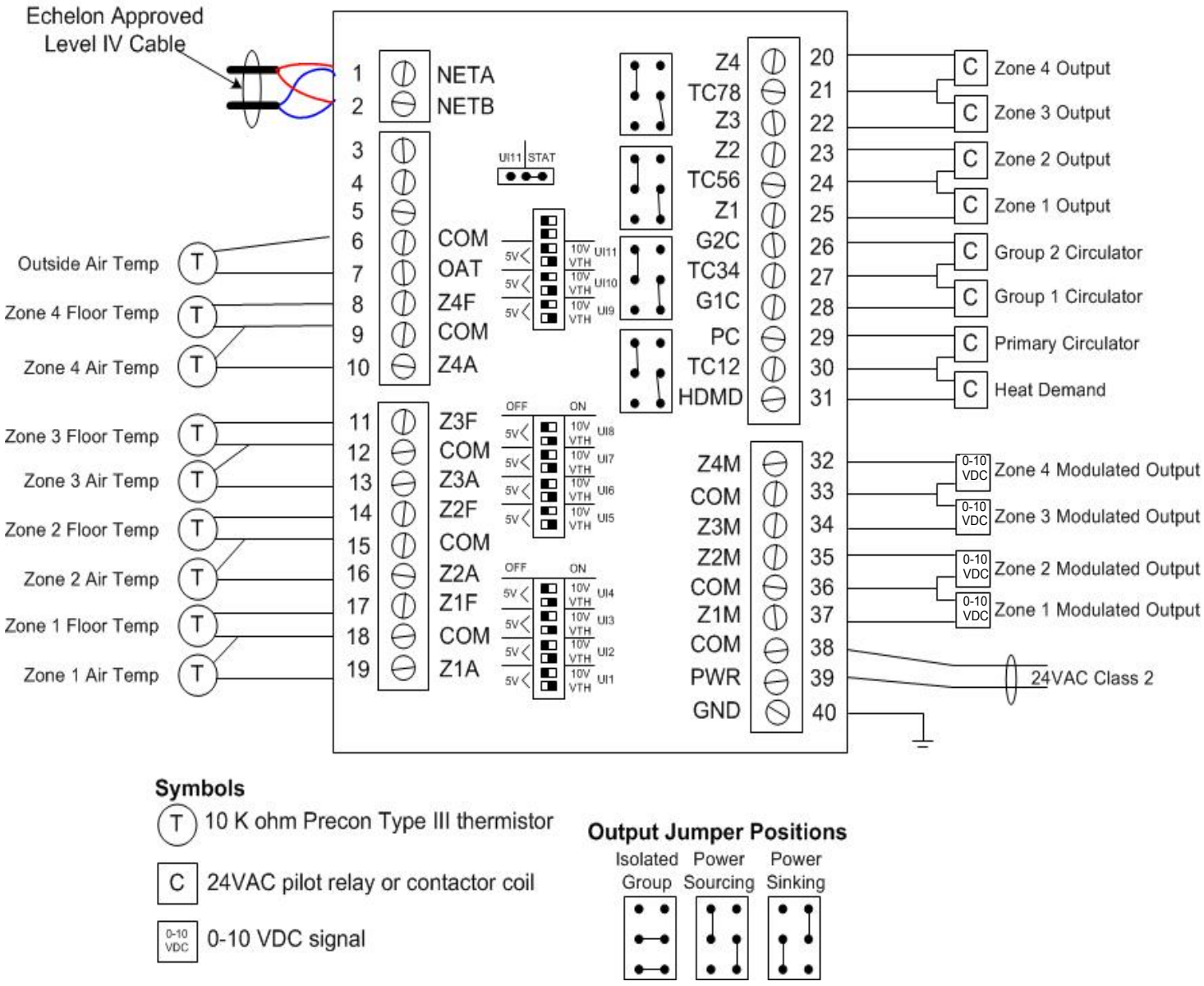
Figure 2: BZU3 - Power Sourcing



Symbols

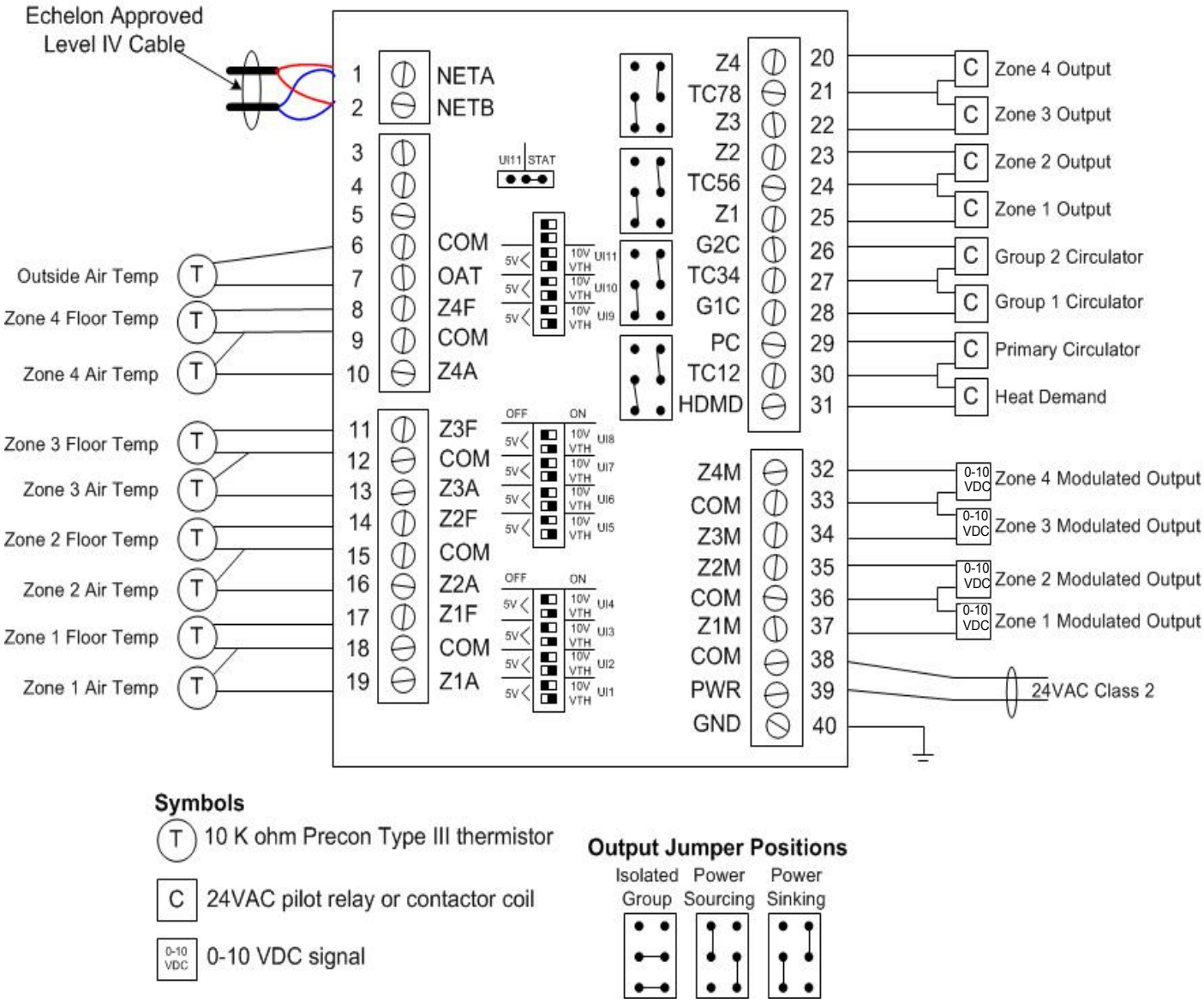
T 10 K ohm Precon Type III thermistor

C 24VAC pilot relay or contactor coil

0-10 VDC 0-10 VDC signal

Output Jumper Positions

Figure 3: BZU3 Power Sinking



Symbols

T 10 K ohm Precon Type III thermistor

C 24VAC pilot relay or contactor coil

0-10 VDC 0-10 VDC signal

Output Jumper Positions

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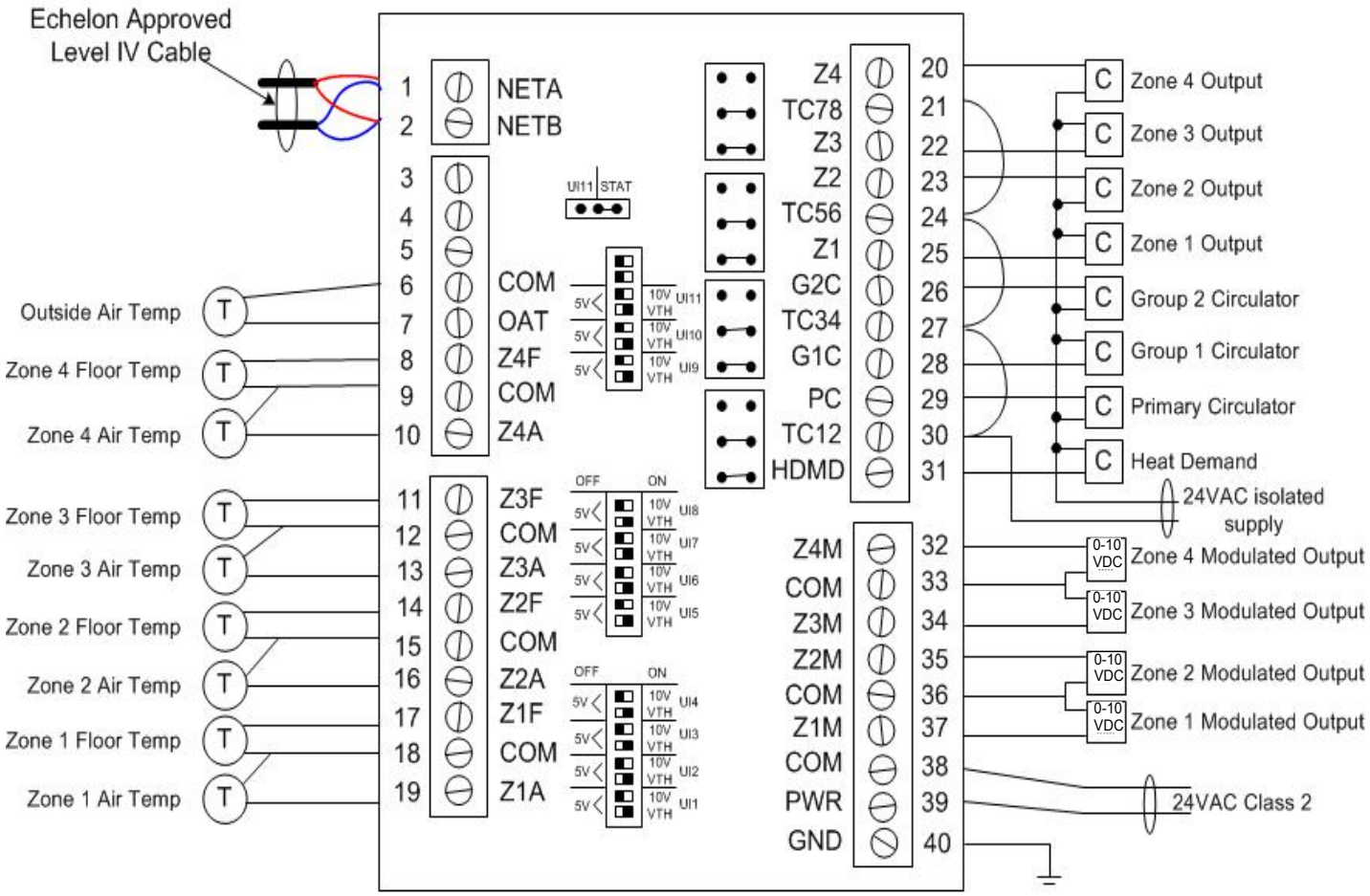
Figure 4: BZU3 Power Isolated



Symbols

T 10 K ohm Precon Type III thermistor

C 24VAC pilot relay or contactor coil

0-10 VDC 0-10 VDC signal

Output Jumper Positions

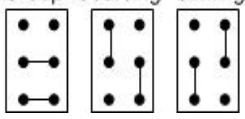
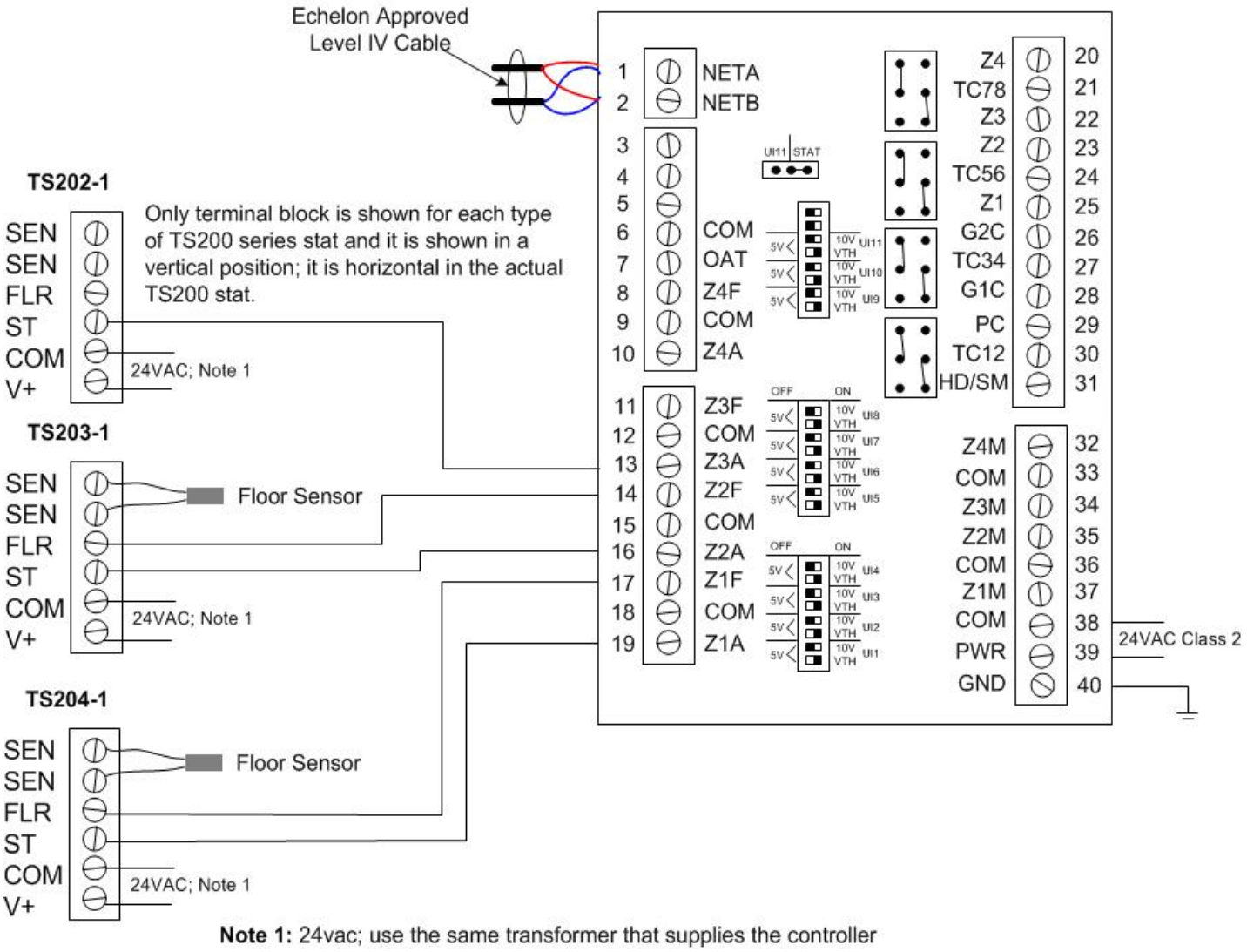


Figure 5: BZU3 with TS200-series Thermostats



Note 1: 24vac; use the same transformer that supplies the controller

Connecting Input Devices

Zone 1 Air Temperature (Z1A)

This input can use a Precon II/III thermistor or a Taco TS200-series thermostat. To connect a thermistor, attach one wire to the Z1A (T19) input and the other the adjacent COM (T18). To connect a TS200, make sure the thermostat has the proper ground connection and connect the Space Temperature terminal to Z1A (T19).

Zone 1 Floor Temperature (Z1F)

This input can use a Precon II/III thermistor or a Taco TS200-series thermostat. To connect a thermistor attach one wire to the Z1F (T17) input and the other the adjacent COM (T18). To connect a TS200, make sure the thermostat has the proper ground connection and connect the Floor Temperature terminal to Z1F (T17).

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Zone 2 Air Temperature (Z2A)

This input can use a Precon II/III thermistor or a Taco TS200-series thermostat. To connect a thermistor attach one wire to the Z2A (T16) input and the other the adjacent COM (T15). To connect a TS200, make sure the thermostat has the proper ground connection and connect the Space Temperature terminal to Z2A (T16).

Zone 2 Floor Temperature (Z2F)

This input can use a Precon II/III thermistor or a Taco TS200-series thermostat. To connect a thermistor attach one wire to the Z2F (T14) input and the other the adjacent COM (T15). To connect a TS200, make sure the thermostat has the proper ground connection and connect the Floor Temperature terminal to Z2F (T14).

Zone 3 Air Temperature (Z3A)

This input can use a Precon II/III thermistor or a Taco TS200-series thermostat. To connect a thermistor attach one wire to the Z3A (T13) input and the other the adjacent COM (T12). To connect a TS200, make sure the thermostat has the proper ground connection and connect the Space Temperature terminal to Z3A (T13).

Zone 3 Floor Temperature (Z3F)

This input can use a Precon II/III thermistor or a Taco TS200-series thermostat. To connect a thermistor attach one wire to the Z3F (T11) input and the other the adjacent COM (T12). To connect a TS200, make sure the thermostat has the proper ground connection and connect the Floor Temperature terminal to Z3F (T11).

Zone 4 Air Temperature (Z4A)

This input can use a Precon II/III thermistor or a Taco TS200-series thermostat. To connect a thermistor attach one wire to the Z4A (T10) input and the other the adjacent COM (T9). To connect a TS200, make sure the thermostat has the proper ground connection and connect the Space Temperature terminal to Z4A (T10).

Zone 4 Floor Temperature (Z4F)

This input can use a Precon II/III thermistor or a Taco TS200-series thermostat. To connect a thermistor attach one wire to the Z4F (T8) input and the other the adjacent COM (T9). To connect a TS200, make sure the thermostat has the proper ground connection and connect the Floor Temperature terminal to Z4F (T8).

Outdoor Air Temperature (OAT)

This input uses a Precon III thermistor. To connect a thermistor, attach one wire to the OAT (T7) input and the other the adjacent COM (T6). Once connected, remove the controller's cover and move the jumper W15 from *Stat* to *UI11*. Remember to place the UI11 dip switch in the thermistor positions (Right / Left [from the bottom]). If no ASM2 is present on the network, the OAT sensor connected to the BZU3 is used.

Connecting Output Devices

Zone 1 Modulating Output (Z1M)

The modulated Zone 1 output is set to 0-10 V max through the control logic. Connect the positive wire from the valve or circulator control input to Z1M (T37) and the other wire to COM (T36).

Zone 2 Modulating Output (Z2M)

The modulated Zone 2 output is set to 0-10 V max through the control logic. Connect the positive wire from the valve or circulator control input to Z2M (T35) and the other wire to COM (T36).

Zone 3 Modulating Output (Z3M)

The modulated Zone 3 output is set to 0-10 V max through the control logic. Connect the positive wire from the valve or circulator control input to Z3M (T34) and the other wire to COM (T33).

Zone 4 Modulating Output (Z4M)

The modulated Zone 4 output is set to 0-10 V max through the control logic. Connect the positive wire from the valve or circulator control input to Z4M (T32) and the other wire to COM (T33).

Heat Demand Circulator (HDMD)

The Heat Demand Circulator output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. See preceding figures for details. If the load is less than 1 Amp, connect it to HDMD (T31) and TC12 (T30).

Primary Circulator (PC)

The Primary Circulator output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. See preceding figures for details. If the load is less than 1 Amp, connect it to PC (T29) and TC12 (T30).

Group 1 Circulator (G1C)

The Group 1 Circulator output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. See preceding figures for details. If the load is less than 1 Amp, connect it to G1C (T28) and TC34 (T27).

Group 2 Circulator (G2C)

The Group 2 Circulator output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. See preceding figures for details. If the load is less than 1 Amp, connect it to G2C (T26) and TC34 (T27).

Zone 1 Out (Z1)

The Zone 1 output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. See preceding figures for details. If the load is less than 1 Amp, connect it to Z1 (T25) and TC56 (T24).

Zone 2 Out (Z2)

The Zone 2 output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. See preceding figures for details. If the load is less than 1 Amp, connect it to Z2 (T23) and TC56 (T24).

Zone 3 Out (Z3)

The Zone 3 output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. See preceding figures for details. If the load is less than 1 Amp, connect it to Z3 (T22) and TC78 (T21).

Zone 4 Out (Z4)

The Zone 4 output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. See preceding figures for details. If the load is less than 1 Amp, connect it to Z4 (T20) and TC78 (T21).

Other Connections

Network (LON)

Network wiring must be twisted pair. One network wire must be connected to terminal NETA (T1) and the other network wire must be connected to terminal NETB (T2). Polarity is not an issue since an FTT-10A network is used for communications.

Power (PWR)

Connect one output wire from a 24 VAC power supply to PWR (T39) and the other output wire from the power supply to the adjacent common terminal (T38). T38 must be connected to earth ground.

Ground (GND)

Terminal GND (T40) must be connected to earth ground. Failure to properly ground this equipment will result in improper operation. Improper grounding may also increase the risk of electrical shock, and may increase the possibility of interference with radio and TV reception.

SPECIFICATIONS

Electrical

Inputs

- Cabling: twisted shielded pair, 18 AWG recommended—500 feet max. (152 meters)
- Resolution: 10 bit

Zone 1/2/3/4 Air Temperature, Zone 1/2/3/4 Floor Temperature

- Precon Type III 10K thermistor or TS200-series

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Outdoor Air Temperature

- Precon Type III 10K thermistor

Outputs

Zone 1/2/3/4 Modulating Output

- 0-10 VDC

Heat Demand Circulator, Primary/Group 1/Group 2 Circulator, Zone 1/2/3/4 Out

- 24 VAC
- 1A @ 50C, 0.5A @ 60C, limited by the Class 2 supply rating

Power

Power Requirements

- 24VAC (20VAC to 28VAC), requires an external Class 2 supply

Power Consumption

- 7.2W with no external loads, maximum limited by the class 2 supply rating

Recommended Sensor Wire

Cable Type	Pairs	Details	Taco Catalog No.
18AWG	1	Stranded Twisted Shielded Pair, Plenum	WIR-018

FTT-10A Network

- Speed: 78KBPS
- 42.4 Volts DC max
- Cabling: Maximum node-to-node distance: 1312 feet (400 meters)
- Maximum total distance: 1640 feet (500 meters)

Cable Type	Pairs	Details	Taco Catalog No.
Level 4 22AWG (0.65mm)	1	Unshielded, Plenum, U.L. Type CMP	WIR-022

For detailed specifications, refer to the *FTT-10A Free-Topology Transceiver User's Guide* published by Echelon Corporation (www.echelon.com/support/documentation/manuals/transceivers).

Mechanical

Housing

- Dimensions: 5.55" (141mm) high, 6.54" (166 mm) wide, 1.75" deep (44 mm)
- ABS

Weight

- Controller Weight: 0.70 pounds (0.32 kilograms)
- Shipping Weight: 1.0 pounds (0.46 kilograms)

Electronics

- Processor: 3150 Neuron 10 MHz
- Flash: 48 Kilobytes
- SRAM: 8 Kilobytes
- Termination: 0.197" (5.0 mm) Pluggable Terminal Blocks, 14-22 AWG

Environmental

- Temperature: 32 °F to 140 °F (0 °C to 60 °C)

- Humidity: 0 to 90%, non-condensing

Agency Listings

- UL Listed for US and Canada, Energy Management Equipment PAZX and PAZX7.

Agency Compliances

- FCC Part 15 Class A

APPLICATION DESCRIPTION

The iWorx® BZU3 is a self-contained interoperable controller for zoning in a hydronic system. The BZU3 maintains the temperature of up to four zones by operating valves and circulators in cooperation with a BLM boiler controller or HPM heat pump controller. It may also be used as a stand-alone zone controller with a non-networked heat source, or to activate cooling if used in conjunction with a DXU controller.

The temperature of each zone's slab is controlled independently. Separate occupied temperature setpoints are set for each zone, and an unoccupied temperature setpoint is common to all zones. Occupancy is determined by the associated LCI group or may be set to occupied for the individual zones.

An air temperature sensor and slab temperature sensor are monitored in each zone. The analog outputs for each zone are operated based on a proportional plus integral (P+I) control loop. The heat demand output is turned on when any zone demand output is on. Group circulators are activated when a zone that they are associated with has heat demand.

The "zones" may be indoor spaces with room temperature sensors, floor sensors, or other radiant panels with embedded or surface sensors.

The BZU3 may be set to communicate its heat demand to the BLM or HPM, which provides the appropriate supply temperatures. The BZU3 may be configured for a secondary loop supply, which uses the injection functions of the BLM, or it may be set to use only the primary loop as a supply.

The BZU3 may be set to communicate its cooling demand to a DXU, which then activates a chiller or other cooling unit. When the master sensor that it is following determines that cooling is required, all heating is deactivated by the controller.

The commissioning switch displayed on the LCI can be set to turn on all outputs simultaneously for test purposes.

The zone valve outputs are capable of actuating 2-wire zone valves with up to 1.0 A current draw.

0-10V modulating outputs are provided for each zone to support modulating valves or circulators.

SEQUENCE OF OPERATION

This section describes the detailed sequence of operation for the BZU3 control strategy. The italicized terms refer to the settings available on the LCI. (See “Controller Identification” on page 20.)

Operational Modes

There are three types of radiant zone operation:

Space Temperature Mode

In this mode, zone temperature is sensed by a room air temperature sensor. Heating is activated (or modulated) to maintain the Space Temperature Setpoint. Floor sensor is ignored.

Floor Temperature Mode

In this mode, floor temperature is sensed by a floor temperature sensor. Heating is activated (or modulated) to maintain the Floor Temperature Setpoint. Space Temperature is ignored.

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Space with Floor Mode

In this mode, the BZU3 attempts to maintain both the space and floor temperatures. As a safety measure, the output is overridden to “off” when the floor temperature rises above the floor temperature max or the space temperature rises above the space temperature max.

Occupancy

The occupancy of all four zones is determined by the group occupancy status communicated from the LCI. At the LCI group level, the occupancy may be scheduled or manually set to the occupied state. When in the unoccupied state, each zone is controlled to the common *Unoccupied Setpoint*. When occupied, each zone is controlled to its individual Zone 1/2/3/4 *Occupied Setpoint*.

Zone Output Operation

The four zone outputs may be used for zone valves or other 24 VAC-actuated heat sources. If not disabled by the outdoor limits, the outputs for each zone are operated to maintain the zone setpoints established above. The outputs are hysteretically controlled by comparing each zone temperature (Zone 1/2/3/4 Temperature) with the respective setpoints (Zone 1/2/3/4 Setpoint), or by a PI loop modulated output.

The status of each output is displayed on the LCI (Zone 1/2/3/4 Output).

At the BZU3 zone level, each zone may be individually set to “On” by turning on the Zone 1/2/3/4 Override switch.

Primary and Group Circulators

The primary circulator output is an on/off output that energizes whenever any of the four zone outputs are turned on. Group Circulator outputs turn on whenever their associated zones are active. See *Zone X Configuration* for more info.

Gain Control

The analog outputs are modulated by a Proportional + Integral (P+I) control loop based on the heating loop setpoint and the space temperature. The P+I control loop modulates the valve to maintain a constant space temperature. As the temperature decreases below the heating loop setpoint, the heating valve is modulated open. The heating valve is modulated closed as the temperature increases above the heating loop setpoint. When unoccupied mode is entered, the heating loop setpoint is set back through a separate unoccupied heating setpoint.

To prevent the integral component from becoming too large, there is anti-wind up reset protection. This protection clamps the integral value when all of the components add up to more than 100% or less than 0%. The following equations are used for P+I control:

$K_p = Proportional\ Gain$

$K_i = Integral\ Gain$

$Error = HeatingLoopSp - SpaceTemp$

$I = I + (K_i \times Error)$

$HeatPosition = (K_p \times Error) + I$

Demand Outputs & BLM Communication

When any of the zone outputs are turned on, the *Heat Demand* output is turned on. This may be used to operate a supply pump for the zone circuits or to signal a heat demand to a non-networked boiler control or other heat source. If the BZU3 *Heat Demand* setting is on, then the status of this output is communicated to the BLM as a primary loop demand.

The greatest of the four zone demands is displayed as the *Maximum Zone Demand*. If the BZU3 *Zone Demand* setting is on, this maximum value is communicated to the BLM as a sub-zone demand for the secondary loop. If the outdoor temperature is below the OAT heating cutoff of the BLM, the BLM zone pump is operated and the injection output is controlled to provide the appropriate outdoor reset temperature in the secondary loop. The boilers and primary pump are operated as needed to meet the injection demand.

If the BZU3 zones are on the secondary loop of the BLM, only the BZU3 *Zone Demand* setting needs to be on, since the demand for the boiler is dictated by the injection requirements. This method fires the boiler only as needed. However, both BLM settings, the *Heat Demand* and the *Zone Demand* may be turned on. The effect of this is to create a demand for the boiler whenever a BZU3 zone is calling. This serves to keep the boiler in a standby mode that could reduce cycling as the demand from the secondary loop varies.

Additional Features

Commissioning Switch

In addition to the individual zone commissioning switches, a single switch setting can be adjusted at the LCI. By setting *Commissioning* to "On," all eight digital outputs are turned on simultaneously.

Alarm Monitoring

The controller detects certain conditions and sends them to the LCI as alarms. These alarms are displayed and recorded for later access, but do not alter the system operation.

Temperature Sensor Alarm

If the analog input from a thermistor is outside of the expected range of the thermistor (-60 °F to 230 °F [-51 °C to 110 °C]), this alarm is sent to the LCI. An alarm of this type is most likely due to a wiring fault causing the input to be shorted or open. An open sensor results in a reading of -60 °F (-51 °C), while a short appears as 230 °F (110 °C).

Space High Temperature Alarm

When the space temperature exceeds a programmable limit a high limit alarm is reported to the LCI. When the space temperature returns to the proper range a space temperature normal notice is reported to the LCI.

Space Low Temperature Alarm

When the space temperature drops below a programmable limit a low limit alarm is reported to the LCI. When the space temperature returns to the proper range a space temperature normal notice is reported to the LCI.

Floor High Temperature Alarm

When the floor temperature exceeds a programmable limit a high limit alarm is reported to the LCI. When the floor temperature returns to the proper range a floor temperature normal notice is reported to the LCI.

Floor Low Temperature Alarm

When the floor temperature drops below a programmable limit a low limit alarm is reported to the LCI. When the space temperature returns to the proper range a floor temperature normal notice is reported to the LCI.

Communication with Associated Devices

The controller is capable of communicating and sharing information with other controllers on the network.

Communication with DXU

The communication between DXU and BZU3 gets configured by the LCI2. In the individual controller screen for the BZU, a **`Members`** button is displayed and can be pressed to make an association between a DXU and a BZU3. This can only be a one-to-one association, where the DXU acts as the master and the BZU3 acts as a slave.

During the association process, the DXU receives a configuration message from the LCI2 containing the neuron ID for the BZU3. Once associated, the DXU starts sending messages to the BZU3 and receives messages from the BZU3 in exchange.

Communication with BLM

When associated with the BLM series controllers, the BZU3 communicates a demand for hot water. For a demand to be received at the BLM series controller, the BZU3 must be associated with the BLM and have the *Heat Demand* or *Zone Demand* configuration parameter enabled.

Communication With HPM

When associated with the HPM1 water to water heat pump controller, the BZU3 communicates a demand for hot water. For a demand to be received at the HPM1 controller, the BZU3 must be associated with the HPM1.

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Automatic Configuration

The BZU3 and iWorx® Local Control Interface (LCI) use a self-configuring network management scheme requiring no external tools, binding, or LONWORKS knowledge. The LCI recognizes and configures the BZU3 when the controller's service pin is pressed. The controller's status light flashes green until the controller is configured, and is solid green after the controller is configured. Once the service pin has been pressed, no further action is required by the user; the controller is fully accessible to the LCI. Users may bind to SNVTs on the BZU3 with LNS or other LONWORKS tools *after* the BZU3 has been inserted into the LCI2 network.

The LCI also provides network supervision of the BZU3. The LCI periodically sends a "ping" message to the BZU3, which elicits a response. If the response fails, an alarm is displayed on the LCI. The LCI also uses the "ping" message to refresh the occupancy mode and other system wide data.

CONTROLLER IDENTIFICATION

Once the BZU3 is properly installed and recognized by the LCI, the LCI touchscreen is used to configure the settings of the controller and to monitor the Inputs, Outputs and Alarms. This section describes the commands available on the LCI for monitoring/configuration of the BZU3, and the meanings and suggested values for controller parameters. For more information on using the LCI, see the *iWorX LCI User's Guide.*

Network Inputs

The BZU3 allows a network manager to write to Network Input Variables for the purpose of overriding the configuration, operation and outputs of the BZU3. The variables are listed below and in Table 1 on page 20.

Values written to NVIs have absolute priority over any other controller operation.

- *nviOccCmd* overrides the occupancy as obtained from the thermostat. Writing to this variable will also be reflected in the controller's output of the occupancy mode. Note that this is NOT the occupancy sensor. The occupancy sensor hardware input (OCC) will still be displayed on the LCI based on its configuration.
- *nviResetRuntime* is a command to reset the fan, heating and cooling runtimes. If the value sent is 0, then no reset occurs; if the value sent is 1, then the runtimes are reset.
- *nviSysTime* is a time stamp to set the date and time. Writing to this variable will change the time on the device and will affect all time-related functions such as schedules.
- *nviOutOverride* is a structure defined in Table 2 on page 21 that overrides the hardware digital and analog outputs on the BZU3. These values allow the network controller to directly control the analog and digital outputs of the board. Additionally, the two floating setpoint outputs may be set directly.

  NOTE: the BZU3 makes no attempt to interpret the outputs; assigning meaningless outputs (such as setting a digital output in both the digOut array and the fpOut array, or assigning values to Z1 and Z2 but leaving Z3 and Z4 as 0xFF) will have unpredictable results.

Table 1: Network Variable Inputs (NVIs)

Internal Variable Name	Format	Range	Description
nviOccCmd	SNVT_occupancy	0=Occupied 1=Unoccupied 2=Bypass 3=Standby -1=Nul	Occupancy Command
nviResetRuntime	SNVT_lev_disc	0=no reset 1=reset runtimes	Resets fan, heating, and cooling runtimes
nviSysTime	SNVT_time_stamp	Date/Time	System time
nviOutOverride	See Table 4	Structure	Output override
nviZoneTempOvrd	SNVT_temp_p[4]	SNVT_temp_p[4]	Zone Temperature Input Overrides.
nviFloorTempOvrd	SNVT_temp_p[4]	SNVT_temp_p[4]	Floor Temperature Input Overrides.

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Table 2: Output Override Structure (NVI)

Setting	Type/Range	Default	Description
digOut[8]	Unsigned Byte: 0=OFF 1=ON 0xFF=no override	0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0xFF	digOut[0] = TO1 (pin 31) HDMD digOut[1] = TO2 (pin 29) PC digOut[2] = TO3 (pin 28) G1C digOut[3] = TO4 (pin 26) G2C digOut[4] = TO5 (pin 25) Z1 digOut[5] = TO6 (pin 23) Z2 digOut[6] = TO7 (pin 22) Z3 digOut[7] = TO8 (pin 20) Z4
aOut[4]	SNVT_lev_percent: 0% to 100% 32767=no override	32767 32767 32767 32767	aOut[0] = AO 0 (pin 37) Z1M aOut[1] = AO 1 (pin 35) Z2M aOut[2] = AO 2 (pin 34) Z3M aOut[3] = AO 3 (pin 32) Z4M
fpOut[4]	SNVT_lev_percent: 0% to 100% 32767=no override	32767 32767 32767 32767	fpOut[0] = unassigned fpOut[1] = unassigned fpOut[2] = unassigned fpOut[3] = unassigned

Inputs

This screen list all the inputs on the BZU3. These values cannot be changed.

Setting	Range	Description
Outside Temp	-29 to 230 °F (-33 to 110 °C)	OAT as reported from the ASM2 controller on the network
Zone 1 Space	-60 to 230 °F (-51 to 110 °C)	Measured temperature of each slab zone. -60°F relates to an open sensor 230°F relates to a shorted sensor
Zone 2 Space		
Zone 3 Space		
Zone 4 Space		
Zone 1 Floor	-60 to 230 °F (-51 to 110 °C)	Measured temperature of each slab zone. -60°F relates to an open sensor 230°F relates to a shorted sensor
Zone 2 Floor		
Zone 3 Floor		
Zone 4 Floor		
Occupancy	Occ, Unocc	Occupancy status of the zone according to schedule or override.
Outdoor Temp (Local)	-29 to 230 °F (-33 to 110 °C)	OAT as reported from the controller
SMLT Heater Temp	-29 to 230 °F (-33 to 110 °C)	Temperature of heating element in five-wire SMLT Sensor

Outputs

This screen list all the outputs of the BZU3. These values cannot be changed.

Setting	Range	Description
SMLT Heat	Off, On	Status of the pump output.
Primary Pump		
Group 1 Pump		
Group 2 Pump		
Zone 1 Pump		
Zone 2 Pump		
Zone 3 Pump		
Zone 4 Pump		
Zone 1 Out	0.00% to 100.00%	Status of the zone outputs.
Zone 2 Out		
Zone 3 Out		
Zone 4 Out		
Zone 1 Setpoint	-23 to 203 °F (-30.5 to 95 °C)	Current setpoint for each zone.
Zone 2 Setpoint		
Zone 3 Setpoint		
Zone 4 Setpoint		
Runtimes Z1, Z2, Z3, Z4, G1, G2, P	0 to 65535 hours	Actual number of run hours for the output
Day of Week	Monday - Sunday	Current day of the week

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Configuration

All Settings

This screen lists adjustments that system managers may modify periodically during normal operation. Some parameters with a Range value of “Structure” are described in individual tables that follow.

Setting	Range	Default	Description
Commissioning	Off, On	Off	Overrides all Outputs when “On,” normal operation when “Off”
Zone 1 Config	Structure	N/A	Zone Configuration Properties
Zone 2 Config	Structure	N/A	Zone Configuration Properties
Zone 3 Config	Structure	N/A	Zone Configuration Properties
Zone 4 Config	Structure	N/A	Zone Configuration Properties
Zone 1 Temp Settings	Structure	N/A	Settings related to this zone’s temperature setpoints
Zone 2 Temp Settings	Structure	N/A	Settings related to this zone’s temperature setpoints
Zone 3 Temp Settings	Structure	N/A	Settings related to this zone’s temperature setpoints
Zone 4 Temp Settings	Structure	N/A	Settings related to this zone’s temperature setpoints
Zone 1 Mod	Structure	N/A	Zone configuration for Modulated Output
Zone 2 Mod	Structure	N/A	Zone configuration for Modulated Output
Zone 3 Mod	Structure	N/A	Zone configuration for Modulated Output
Zone 4 Mod	Structure	N/A	Zone configuration for Modulated Output
Unoccupied SP	32 to 80.6 °F (0 to 27 °C)	69 °F (20.5 °C)	Unoccupied zone setpoint for all of the zones (set by LCI)
Demand Type	Lowest Temp, Average, Master Zone	Lowest Temp	Type of Demand to send to DXU/BLM. Lowest Temp - The demand of the zone with the lowest space/floor temperature is sent to the master controller. Average - The average demand from all zones is sent to the master controller. Master - The demand from the master zone is sent to the master controller.
Master Zone	1, 2, 3, 4	1	Specifies which zone is the master zone
OAT Heat Cutoff	32 to 80.6 °F (0 to 27 °C)	69.0 °F (20.0 °C)	Warm weather shutdown
Zone 1 Name	Alpha-numeric string - max 17 characters	“Zone 1”	Zone naming override. This name appears for the individual zone setting in the LCI.
Zone 2 Name	Alpha-numeric string - max 17 characters	“Zone 2”	Zone naming override. This name appears for the individual zone setting in the LCI.
Zone 3 Name	Alpha-numeric string - max 17 characters	“Zone 3”	Zone naming override. This name appears for the individual zone setting in the LCI.
Zone 4 Name	Alpha-numeric string - max 17 characters	“Zone 4”	Zone naming override. This name appears for the individual zone setting in the LCI.
Day Of Week	Monday - Sunday	Monday	Current day of the week
WDay Occ Time	Structure	N/A	Time to begin occupied period for the local backup schedule on weekdays.

Setting	Range	Default	Description
WDay Unocc Time	Structure	N/A	Time to begin unoccupied period for the local backup schedule on weekdays.
WEnd Occ Time	Structure	N/A	Time to begin occupied period for the local backup schedule on weekends.
WEnd Unocc Time	Structure	N/A	Time to begin unoccupied period for the local backup schedule on weekends.
BLMR Mixing Loop	Loop 1, Loop 2	Loop 1	Loop on BLM that this BZU3 uses
Heat Demand	Off, On	Off	If set to "On", the heat demand is communicated to the BLM as a demand for the reset temperature from the primary loop.
Zone Demand	Off, On	Off	If set to "On," the max zone demand is communicated to the BLM as a subzone demand for the injection pump (secondary loop).
Runtime Limits	Structure	N/A	Setting for output runtime limits.
Global Types	Dry Contact, Five Wire	Dry Contact	Describes type of Global Snow Melt Sensor. Can be Dry Contact type or five-wire type with unregulated heating element (requires wiring connections to SHT and HT).

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Zone 1 - 4 Config

Setting	Range	Default	Description
Zone Output Type	Digital, Analog	Digital	Zone uses modulating or digital output
Group	No Grouping, Group 1, Group 2	No Grouping	Describes which group circulator is triggered by activiation of this zone
Commissioning	On, Off	Off	Individual Commissioning for this zone

Zone 1 - 4 Temp Settings

Setting	Range	Default	Description
Stat Type	Precon III, Precon II, TS200 Series, Not Used	TS200 Series	Type of temperature sensor used for this zone
Radiant Mode	Space Mode, Floor Mode, Space with Floor Mode	Space with Floor Mode	Describes the inputs used to govern the behavior of the zone
Zone Occ SP	23 to 203 °F (-5.0 to 95 °C)	69.0 °F (20.0 °C)	Setpoint for zone space while Occupied
Floor Occ Temp Min	-59 to 203 °F (-50.6 to 95 °C)	69.0 °F (20.0 °C)	Setpoint for zone floor while Occupied
Floor UnOcc Temp Min	-59 to 203 °F (-50.6 to 95 °C)	69.0 °F (20.0 °C)	Setpoint for zone floor while not Occupied
Floor Temp Max	-59 to 203 °F (-50.6 to 95 °C)	85.0 °F (29.4 °C)	Maximum allowable floor temperature
Space Temp Max	-59 to 203 °F (-50.6 to 95 °C)	85.0 °F (29.4 °C)	Maximum allowable space temp during Floor Mode or Space with Floor Mode operation

Zone 1 - 4 Mod

Setting	Range	Default	Description
Gain	-4 to +5	0	Gain for zone response
On	0 to 100%	30.0%	Initial Output when zone activates
Ramp Up	0 to 20%	1.0%	Limit on zone ramp up
Ramp Down	0 to 20%	0.5%	Limit on zone ramp down
Out Min	0 to 10V	0.5 V	Minimum Voltage Out
Out Max	0 to 10V	10.0 V	Maximum Voltage Out

Runtime Limits

Setting	Range	Default	Description
Z1	0 to 65535 hours	1000	Limit at which a unit maintenance alarm is generated.
Z2	0 to 65535 hours	1000	Limit at which a unit maintenance alarm is generated.
Z3	0 to 65535 hours	1000	Limit at which a unit maintenance alarm is generated.
Z4	0 to 65535 hours	1000	Limit at which a unit maintenance alarm is generated.
G1	0 to 65535 hours	1000	Limit at which a unit maintenance alarm is generated.
G2	0 to 65535 hours	1000	Limit at which a unit maintenance alarm is generated.
P	0 to 65535 hours	1000	Limit at which a unit maintenance alarm is generated.

WDay Occ/UnOcc Time & WEnd Occ/UnOcc Time

Setting	Range	Default	Description
Hours	0-23	0	Military time for the hour of the day when the occupied or unoccupied state starts
Minutes	0-59	0	Minute, when occupied or unoccupied state starts

Space Temp Limits

Setting	Range	Default	Description
High Temp Alarm	-23 to 203 °F (-30.5 to 95 °C)	80.0 °F (26.7 °C)	High temperature alarm threshold
Low Temp Alarm		42.0 °F (5.6 °C)	Low temperature alarm threshold
High Floor Alarm		110.0 °F (43.3 °C)	High floor temperature alarm threshold
Low Floor Alarm		32.0 °F (0 °C)	Low floor temperature alarm threshold

Alarms

Alarm	Range	Alarm Trigger	Alarm Reset
Temperature Sensor Alarm	Normal, Alarm	Any one of the attached Sensors is Open or Short	Sensor Reading is within the specified Sensor range or faulty sensor gets replaced
Unit Maintenance Alarm	Normal, Alarm	Any of the output runtimes exceeds the specified limit.	Runtimes are reset.
Space Temperature Alarm	Normal, Alarm	Any one of the Zone Temperature readings is: above Space Occ Setp +1.5°F or below Space Unocc Setp -1.5°F	The Zone Temperature reading of the Zone in Alarm is: below Space Occ Setp -1.5°F or above Space Unocc Setp +1.5°F *
Plant Alarm	Normal, Alarm	The contact for the Plant Alarm Input closes	The contact for the Plant Alarm Input opens
Thermostat Alarm	Normal, Alarm	The BZU3's TS20X sensor is delivering faulty temperature values or has lost communication	Reset the BZU3 to clear this alarm

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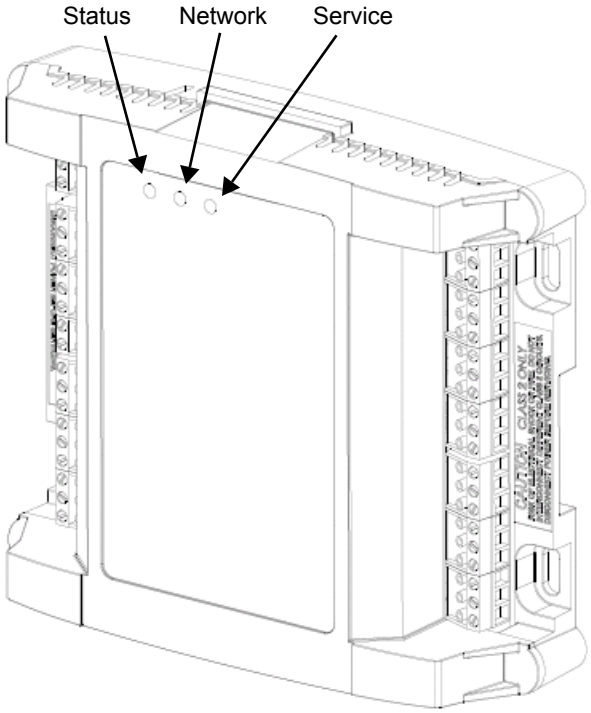
TROUBLESHOOTING

Diagnostic LEDs

The controller has 3 LED indicators. These indicators can aid in troubleshooting equipment operation problems. The following table lists the functions of the controller's LEDs in the order they appear from left to right on the unit.

LED	Indication
Status	– Solid green when running and configured by an LCI (networking) – Flashing green when running and NOT configured by an LCI (stand-alone) – Solid red when a fault condition exists (control shut down) – Blinking Red - the controller has a device failure – Solid Amber - The controller has not received a LCI ping message in over 10 minutes and is part of a network.
Network	– Yellow while the controller is transmitting data onto the FTT-10A network – Green when there is network activity – Off when there is no network activity
Service	– Illuminated when the service pin is depressed or when a controller gets configured by the LCI.

Figure 6: BZU3 Controller LEDs



Troubleshooting Tips

Problem	Solution
Controller is not running and Status LED is not illuminated.	No power to controller. Verify the voltage on the controller's power connector (24 VAC).
How do I reset the controller?	The controller can be reset by the LCI, or you can cycle power to the controller. Refer to the LCI documentation for more information on resetting the controller using the LCI.
A zone pilot relay will not come on even though the LCI indicates it is on.	Ensure that the controller and output pilot relay have been powered with 24 VAC and the output has been correctly wired to the coil of the pilot relay. Also ensure that the pilot relay has a 24 VAC coil. Ensure that the output jumpers are in the right position for this application (isolated group, power sourcing or power sinking).
The 10K thermistor reading is out of range.	The input is either shorted or open, or the dip switches are not set. Make sure the appropriate dip switch for this input is in the VTH "On" and 5V "Off" position.
Thermistor readings fluctuate rapidly, sometimes by several degrees.	The controller is not properly grounded. The controller's ground (GND) pin (T40) must be connected to earth ground. Also ensure that the controller's digital inputs are dry contacts and that no voltage is being applied or switched to the inputs.
Controller is not running and Status LED is not illuminated.	No power to controller. Verify the voltage on the controller's power connector (24 VAC).
Why is my space cold in the morning? The setpoint is at 70 °F but the room is still at the Unoccupied Temperature.	When a radiant zone enters the occupied mode after a night setback, the room needs to heat up and this takes longer than a conventional forced air heating. To avoid situations like that, schedule your occupied time 30 min (or the desired warm-up time for your individual situation) before you get up or expect the temperature to have reached the comfort point.
What should I do with unused inputs?	If only one input to a zone is used, the *Radiant Mode* setting must be "Space Mode" or "Floor Mode." The installer may want to place dummy 10K resistors across unused inputs to prevent confusion from aberrant readings.

Getting Help

Components within an iWorx® controller, sensor, or power supply cannot be field repaired. If there is a problem with a unit, follow the steps below before contacting your local TES representative or TES technical service.

1. Make sure controllers, sensors, and power supplies are connected and communicating to desired devices.
2. Record precise hardware setup indicating the following:

   Version numbers of application software.

   Device and/or firmware version number.

   A complete description of difficulties encountered.

Notes:

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LIMITED WARRANTY STATEMENT

Taco Electronic Solutions, Inc. (TES) will repair or replace without charge (at the company's option) any product or part which is proven defective under normal use within one (1) year from the date of start-up or one (1) year and six (6) months from date of shipment (whichever occurs first).

In order to obtain service under this warranty, it is the responsibility of the purchaser to promptly notify the local TES stocking distributor or TES in writing and promptly deliver the subject product or part, delivery prepaid, to the stocking distributor. For assistance on warranty returns, the purchaser may either contact the local TES stocking distributor or TES. If the subject product or part contains no defect as covered in this warranty, the purchaser will be billed for parts and labor charges in effect at time of factory examination and repair.

Any TES product or part not installed or operated in conformity with TES instructions or which has been subject to accident, disaster, neglect, misuse, misapplication, inadequate operating environment, repair, attempted repair, modification or alteration, or other abuse, will not be covered by this warranty.

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If in doubt as to whether a particular product is suitable for use with a TES product or part, or for any application restrictions, consult the applicable TES instruction sheets or in the U.S. contact TES at 401-942-8000 and in Canada contact Taco (Canada) Limited at 905-564-9422.

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