iWorx by Taco Electronic Solutions

Application Guide

505-035

HPU3 Water Source Heat Pump Controller

Self-Contained Interoperable Controller Model UCP-1 for Software Version 2

SUPERSEDES: December 15, 2014

EFFECTIVE: June 30, 2015

Plant ID: 001-4056

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HPU3

The HPU3 heat pump controller is a stand-alone microprocessor-based controller for liquid source heat pump units. The application includes liquid source heat pump units with two-stage compressor, reversing valve, fan, dehumidification (internal and external), humidification, and auxiliary (emergency) heat.

Overview

The HPU3 incorporates digital outputs in the form of triacs for digital fan fan start/stop, two compressor stages, dehumidification enable, humidification enable, reheat enable, auxiliary heat enable, and a reversing valve. An analog output for modulated fan control is also provided. Digital inputs are provided to monitor equipment status and high and low pressure alarms. A two-wire serial interface is provided for the thermostat. Analog inputs are available for optional space temperature, power transducer, supply air temperature, and supply air humidity.

The controller is based on LonWorks® networking technology. The controller can be networked to a higher-level control system for monitoring and control applications.

Features

- Two stage compressor heating/cooling control
- Reversing valve control
- Auxiliary (Emergency) Heat enable
- Dehumidification with Reheat, both internal and external
- Humidification with SAT monitoring
- Local backup schedule
- Individual temperature setpoints for occupied/unoccupied heat and cool
- LonWorks interface to building automation systems
- Equipment status input for additional safety interlocks
- High and Low Pressure Alarm inputs
- Thermostat with space temperature, humidity, temperature setpoint adjust, fan override, occupancy override
- Fan control energized on call for heating or cooling
- Automatic heat/cool changeover
- Global unit enable for main plant synchronization
- Remote sensor capabilities
- Automatic configuration with the LCI
- Real Time Clock
- Alarm/Event reporting

PURPOSE OF THIS GUIDE

The *iWorx® HPU3 Application Guide* provides application information for the HPU3 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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APPLICABLE DOCUMENTATION

See the table below for additional documentation that may be applicable to this controller.

Description	Audience	Purpose
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® LHP2 Application Guide, Document No. 505-024	– Application Engineers – Installers – Service Personnel – Start-up Technicians – End user	These controllers may operate in conjunction with the LHP2. Application manuals provide specific application information about these controllers, including sequence of operation and configuration information.
iWorx® CCU2 Application Guide, Document No. 505-022	– Application Engineers – Installers – Service Personnel – Start-up Technicians – End user	These controllers may operate in conjunction with the CCU2. Application manuals provide specific application information about these controllers, including sequence of operation and configuration information.
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. See also: www.echelon.com/support/documentation/manuals/transceivers.	

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INSTALLATION INSTRUCTIONS

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 HPU3 module which supports a liquid source heat pump.

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.

If the equipment is to be installed outside, it must be 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 are connected to the equipment.

Selecting a Power Source

This equipment requires a UL recognized Class 2 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 sensor power supplies 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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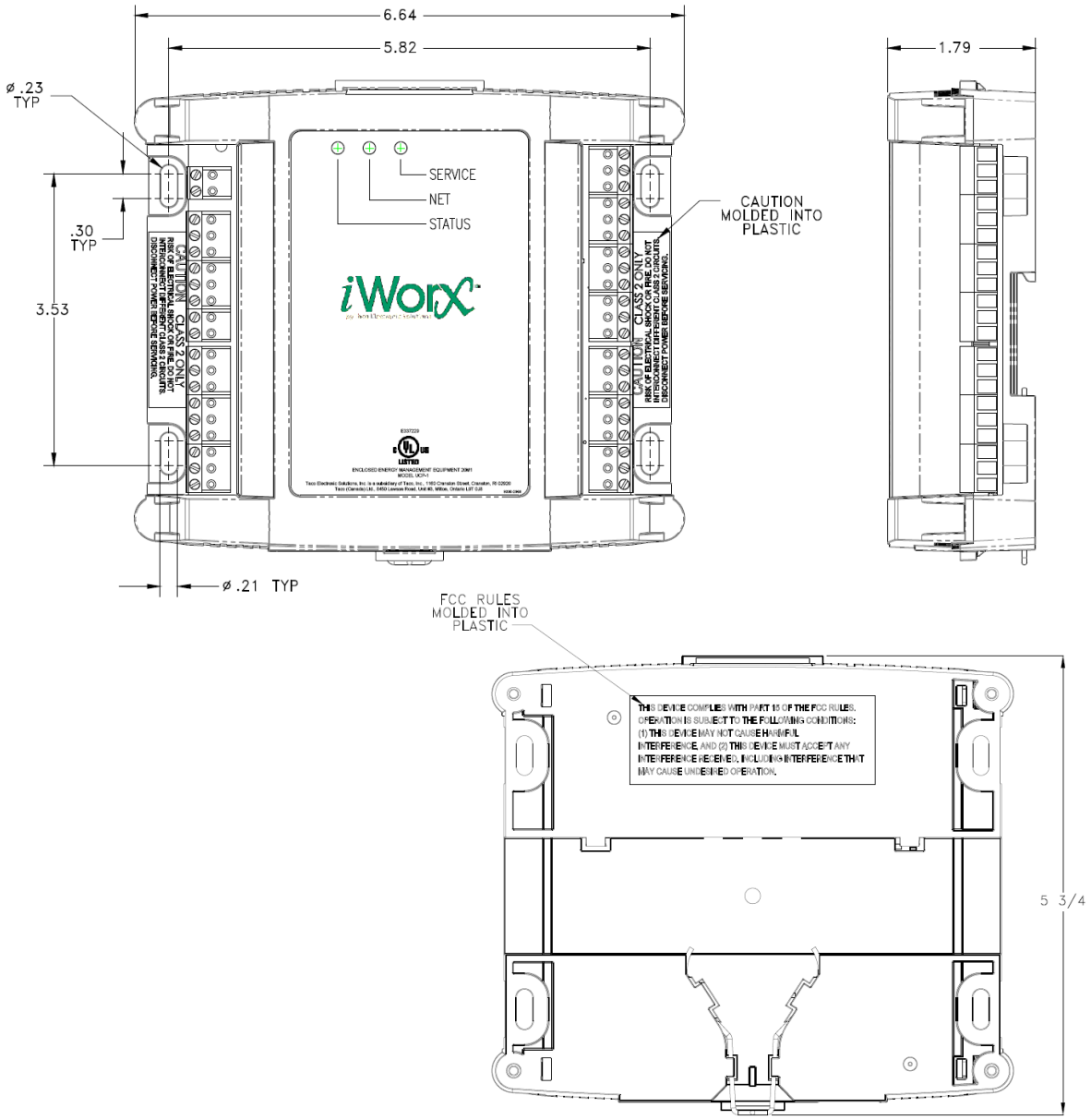
Figure 1: Mounting Dimensions



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

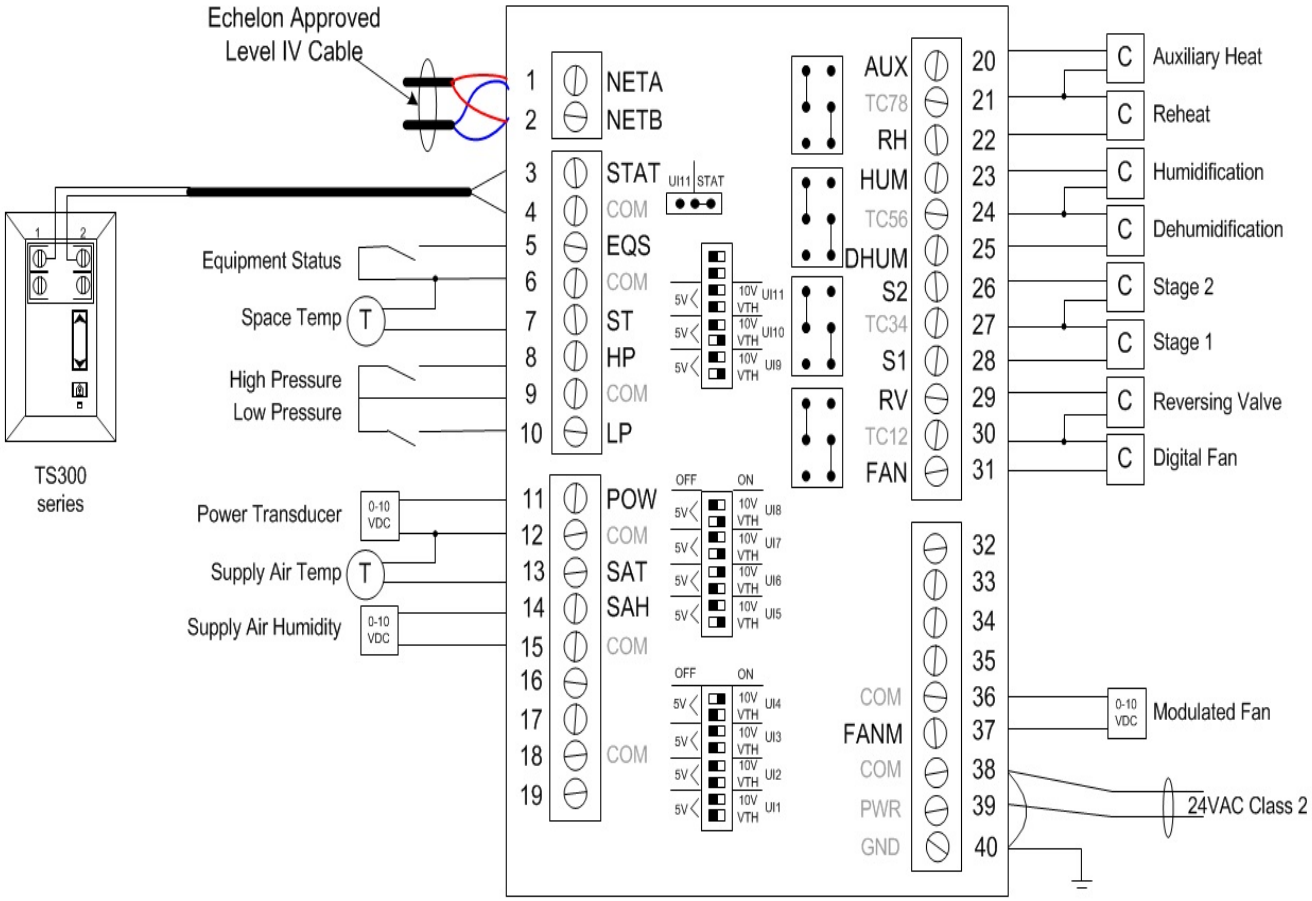
The ground terminal (T40) must be securely connected to earth ground. Failure to properly ground this equipment will result in improper operation. Improper grounding may also increase the risk of electrical shock and may increase the possibility of interference with radio/TV reception.

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, and 12 are connected internally on all HPU3 controllers. Disconnect **ALL** power sources when installing or servicing this equipment to prevent electrical shock or equipment damage.

Figure 2: HPU3 Wiring Example - Power Sourcing



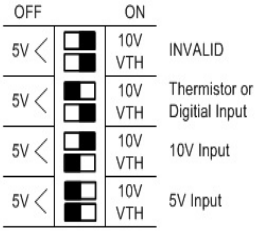
Symbols

T 10 K ohm Precon Type III thermistor

C 24VAC pilot relay or contactor coil

0-10 VDC 0-10 VDC signal

DIP Switches



Output Jumper Positions

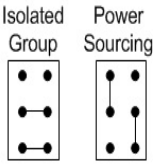


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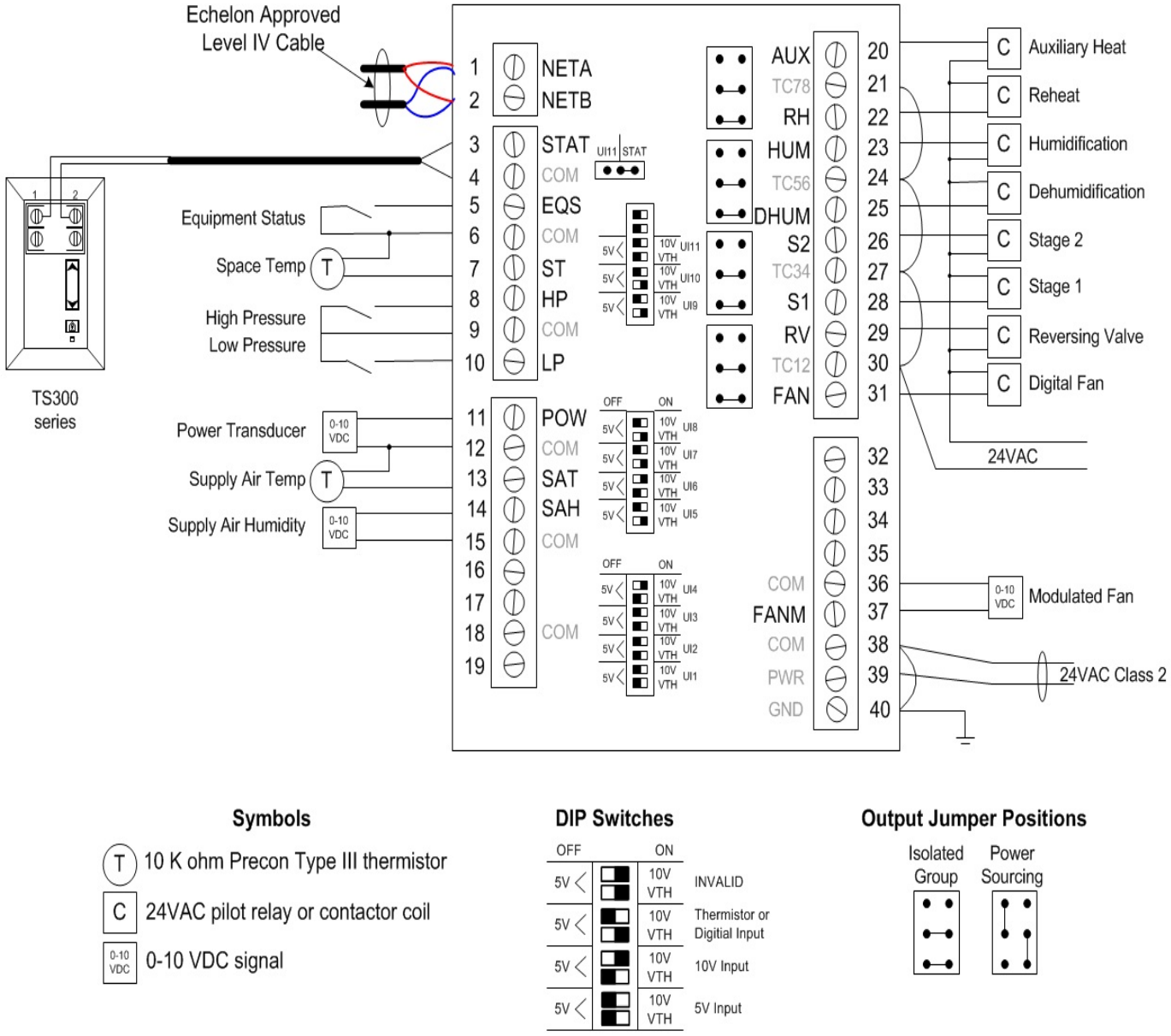
Figure 3: HPU3 Wiring Example - Power Isolated



Symbols

T 10 K ohm Precon Type III thermistor

C 24VAC pilot relay or contactor coil

0-10 VDC 0-10 VDC signal

DIP Switches

Output Jumper Positions

Connecting Input Devices

Thermostat (STAT)

To connect the heat pump thermostat or an RH (humidity) sensor to the unit, attach one wire from the thermostat or sensor to STAT (T3) and the other wire to the adjacent common (T4).

Equipment Status (EQS)

To connect the equipment switch to the digital input, attach one wire of the contact to EQS (T5) and the other wire to the adjacent common (T6). This must be a dry contact switch.

Low Pressure Alarm (LP)

To connect the Low Pressure alarm to the digital input, attach one wire of the contact to LP (T10) and the other wire to the adjacent common (T9). This must be a dry contact switch.

High Pressure Alarm (HP)

To connect the High Pressure alarm to the digital input, attach one wire of the contact to HP(T8) and the other wire to the adjacent common (T9). This must be a dry contact switch.

Heat Pump Power Transducer (POW, optional)

To connect the power transducer to the unit, connect the positive wire from the sensor to POW (T11) and the other wire to the adjacent common (T12). The sensor must be provided and configured by Taco. It is required if the HPU3 needs to report energy usage to a GHP1 for COP calculations.

Supply Air Humidity (SAH)

To connect a humidity sensor to the unit, connect one wire from the sensor to SAH (T14) and the other wire to the adjacent common (T15). This is required when humidifying to prevent saturating the air duct.

Space Temperature / Space Humidity (ST, optional)

To connect a thermistor (Precon III) or a humdity sensor to the analog input, attach one wire of the sensor to ST (T7) and the other wire to the adjacent common (T6). The thermistor or humidity sensor can be used if no TS300 series thermostat is being used.

Supply Air Temperature (SAT, optional)

To connect a thermistor (Precon III) to the analog input, attach one wire of the sensor to ST (T13) and the other wire to the adjacent common (T12).

Connecting Output Devices

Stage 1 & Stage 2 (S1, S2)

The outputs for the stages must be connected to 24 VAC pilot relays if the loads are greater than 1 Amp for each pump. If the loads are less than 1 Amp, connect stage 1 to S1 (T28) and adjacent COM (T27), and connect stage 2 to S2 (T26) and adjacent COM (T27).

Reversing Valve (RV)

The output for the reversing valve must be connected to a 24 VAC pilot relays if the load is greater than 1 Amp. If the load is less than 1 Amp, connect the reversing valve input to RV (T29) and adjacent COM (T30).

Digital Fan (FAN)

The output for the fan must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. If the load is less than 1 Amp, connect the fan input to FAN (T31) and adjacent COM (T30).

Dehumidification (DHUM)

The dehumidification mode output must be connected to a 24 VAC pilot relays if the load is greater than 1 Amp. If the load is less than 1 Amp, connect the fan input to DHUM (T25) and adjacent COM (T24).

Humidification (HUM)

The humidification output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. If the load is less than 1 Amp, connect the external humidification signal to HUM (T23) and the adjacent COM (T24).

Reheat Valve (RH)

The reheat valve output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. If the load is less than 1 Amp, connect the reheat valve to RH (T22) and the adjacent COM (T21).

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Auxiliary Heat (AUX)

The auxiliary heat output must be connected to a 24 VAC pilot relay if the load is greater than 1 Amp. If the load is less than 1 Amp, connect the auxiliary heat output to AUX (T20) and the adjacent COM (T21).

Modulated Fan (FANM)

The modulated fan output can be set to 0-10 V max through the control logic. Connect the positive wire from the fan to FANM (T37) and the other wire to COM (T36).

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

Stat

- Precon Type III 10K thermistor, or
- 12 Volt nominal, internally limited to 0.04 A (SLink)

Supply Air Temp

- Precon Type III 10K thermistor

Heat Pump Power Transducer

- 0 to 10 Volts DC

Equipment Status, High Pressure Alarm, Low Pressure Alarm

- Dry Contact
- Configurable as Disabled, Normally Open, or Normally Closed
- 5 Volts DC Max

Outputs

Stage 1, Stage 2, Reversing Valve, Fan, and Dehumidification

- 24 Volts AC

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

Modulated Fan (analog output)

- 0-10 Volt
- 2K Ohm Minimum Load
- 8 Bit Resolution

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)

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- Humidity: 0 to 90%, non-condensing

Agency Listings

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

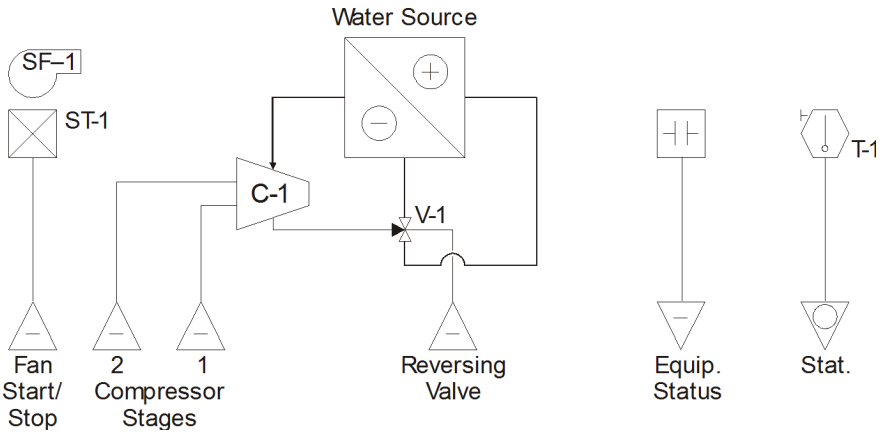
Agency Compliances

- FCC Part 15 Class A

APPLICATION DESCRIPTION

The controller maintains the temperature of a space to a defined setpoint. The figure below illustrates a typical controller application. The control is achieved by sequencing the reversing valve and compressor stages of a liquid source heat pump based on the current space requirements.

Figure 4: HPU3 Application



The controller controls the starting and stopping of the supply air fan. If the unit enable input indicates plant synchronization, the fan is energized when there is call for heating or cooling. During the occupied periods, the fan can be configured to run continuously. The fan can be overridden from the local thermostat. If overridden, the fan will run continuously.

When the temperature increases above the cooling setpoint, the reversing valve cycles to the cooling position. The compressor stages are sequenced on with a time proportioned control algorithm to minimize excessive cycling. As the temperature decreases below the cooling setpoint, the compressor stages are sequenced off. When the unoccupied mode is entered, the cooling setpoint is set up to a separate cooling setpoint for unoccupied mode.

When the temperature decreases below the heating setpoint, the reversing valve cycles to the heating position. The compressor stages are sequenced on with a time proportioned control algorithm to minimize excessive cycling. As the temperature increases above the heating setpoint, the compressor stages are sequenced off. When the unoccupied mode is entered, the heating setpoint is set back to a separate heating setpoint for unoccupied mode.

Each controller interfaces to a local thermostat. The thermostat includes a space temperature sensor, space humidity sensor, temperature setpoint adjustment, occupancy override, and a fan auto/on selection (depending on the model).

The controller operates in one of two states: occupied or unoccupied. The LCI determines the active operating mode. The controller maintains the comfort level to a user-defined setpoint during the occupied period, and uses setup and setback values during the unoccupied period to maintain the space temperature. An optional backup schedule is provided for cases when the LCI is not available.

Three digital inputs are provided to monitor the status of the equipment within the unit. An external contact may be wired to these input to provide additional equipment safety interlocks. When the contact closes, the controller shuts the unit down. An alarm is reported to the LCI when this condition exists. For more detail on response and recovery to the digital alarms, see the appropriate sections under “Sequence of Operation.”

The HPU3 can be synchronized to the main plant water supply through its global unit enable feature. The status of the supply water flow is measured by an external device, and provided to the controller over the network.

The controller monitors the runtime of the fan. When the runtime exceeds a programmable limit, a maintenance alarm is reported to the LCI.

When the space temperature exceeds a programmable limit, a high limit alarm is reported to the LCI. 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 return to normal alarm is reported to the LCI.

When the zone humidity rises above the humidity setpoint, dehumidification is enabled by activating the dehumidification output (external dehumidification), and optionally, the cooling stages (internal dehumidification). Dehumidification is disabled when zone air humidity drops below the setpoint by 3%.

An analog output is available to modulate a variable speed fan to maintain a consistent Supply Air Temperature. This output is governed by a P+I loop with a thermistor based sensor to monitor the Supply Air Temperature.

SEQUENCE OF OPERATION

This section describes the detailed sequence of operation for the controller control algorithms.

Setpoints

The heating and cooling setpoint for both occupied and unoccupied periods are programmable values. The space setpoint is a calculated value based on the programmed heating setpoint, cooling setpoint and current operating mode (i.e. occupied or unoccupied).

The space setpoint is derived by first calculating the zero energy band (ZEB) for the current operating mode.

Occupied Mode

$$ZebOcc = OccupiedCoolSp - OccupiedHeatSp$$

Unoccupied Mode

$$ZebUnocc = UnoccupiedCoolSp - UnoccupiedHeatSp$$

Next, the space setpoint is calculated from the zero energy band and the heating setpoint.

Occupied Mode

$$SpaceSp = OccupiedHeatSp + \frac{ZebOcc}{2}$$

Unoccupied Mode

$$SpaceSp = UnoccupiedHeatSp + \frac{ZebUnocc}{2}$$

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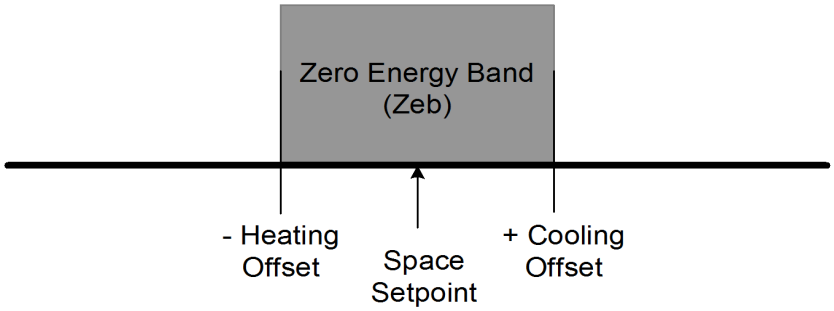
Figure 5: Space Setpoint Calculation.



The effective setpoint is a calculated value based on the space setpoint and the thermostat setpoint offset value. The setpoint offset is used to increase or decrease the space setpoint from the local thermostat. The offset value is limited to plus or minus the programmed setpoint adjustment.

The setpoint offset also affects the calculated heating and calculated cooling setpoints by an equal amount. The setpoint offset only applies in the occupied mode of operation; it has no affect in the unoccupied mode. Note that the actual programmed heating and cooling setpoints are not changed. The offset is added to the programmed setpoints to derive the calculated values.

Occupied Mode

$$CalcCoolingSp = OccupiedCoolingSp \pm SpOffset$$

$$CalcHeatingSp = OccupiedHeatingSp \pm SpOffset$$

$$EffectiveSp = SpaceSp \pm SpOffset$$

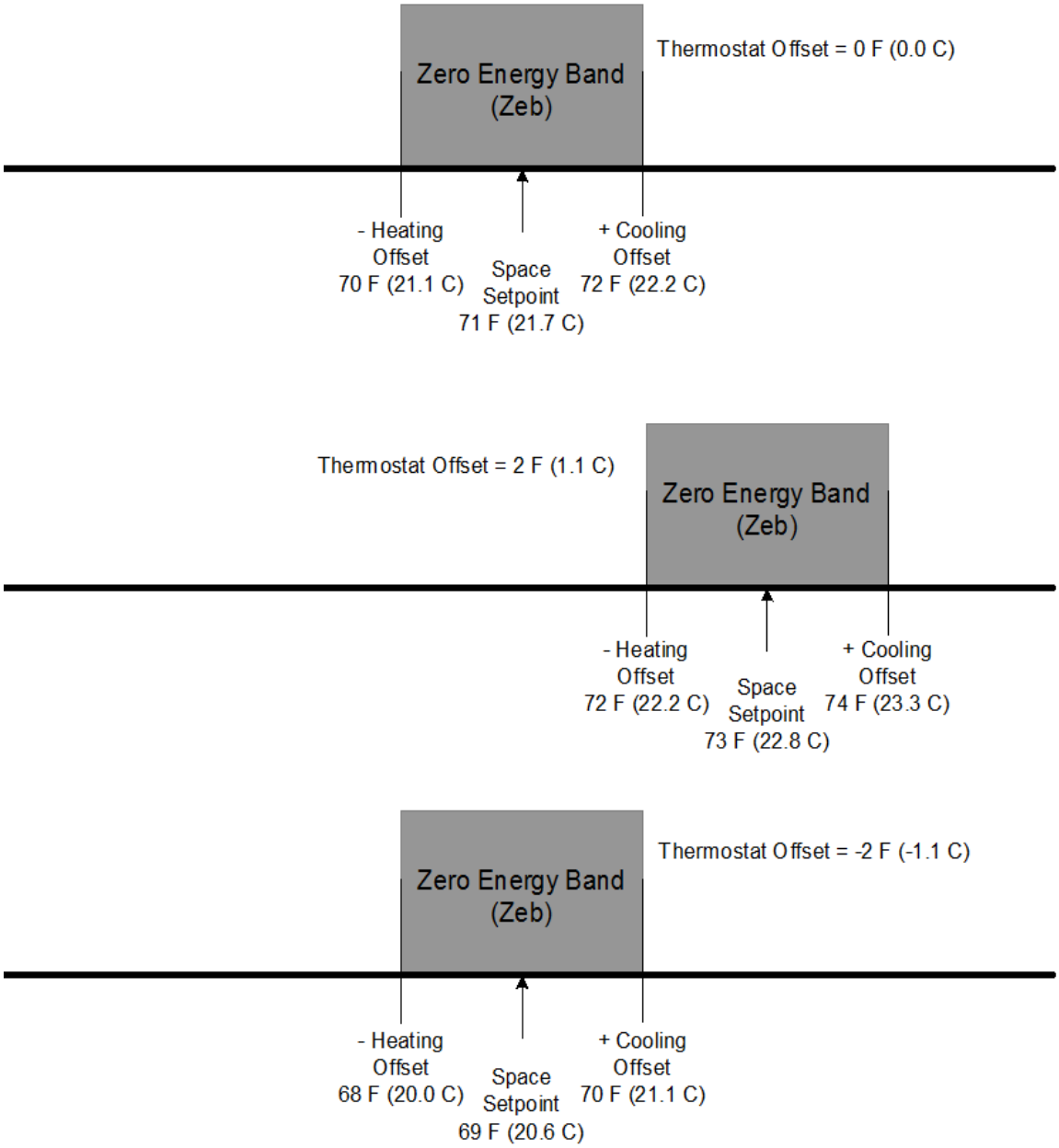
Unoccupied Mode

$$CalcCoolingSp = UnoccupiedCoolingSp \pm SpOffset$$

$$CalcHeatingSp = UnoccupiedHeatingSp \pm SpOffset$$

$$EffectiveSp = SpaceSp$$

Figure 6: Setpoint Adjustment



Heating Sequence

The reversing valve and compressor stages are sequenced based on the space temperature and the calculated heating setpoint. When the space temperature drops below the calculated heating setpoint, the reversing valve is cycled to the heating position. When the space temperature drops below the calculated heating setpoint minus the heating control band for a predefined time period, a compressor stage is turned on. If the space temperature remains below the heating control band for an additional time period, the next available stage is turned on. This cycle continues until all available stages have been energized.

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After the space temperature has risen above the heating setpoint for a predefined time-period, the last-energized stage is turned off. (Note that the last stage that was turned on will be the first one to be turned off.) If the space temperature remains above the heating setpoint for an additional time-period, the next previous stage will be turned off. This cycle continues until all stages have been de-energized.

The configurable value "stage time" determines the duration of the stage. An absolute minimum stage ON time of 2 minutes, and an absolute minimum stage OFF time of 5 minutes are enforced when the space temperature is less than the space setpoint. If the temperature rises above the space setpoint then the minimum on and off times are ignored.

When the space temperature rises above the space setpoint, all of the compressor stages turn off immediately; the stage time and minimum on time are ignored.

During unoccupied periods, the heating setpoint is adjusted downwards through a separate unoccupied heating set-point.

Figure 7: Heat Sequence - Occupied Mode

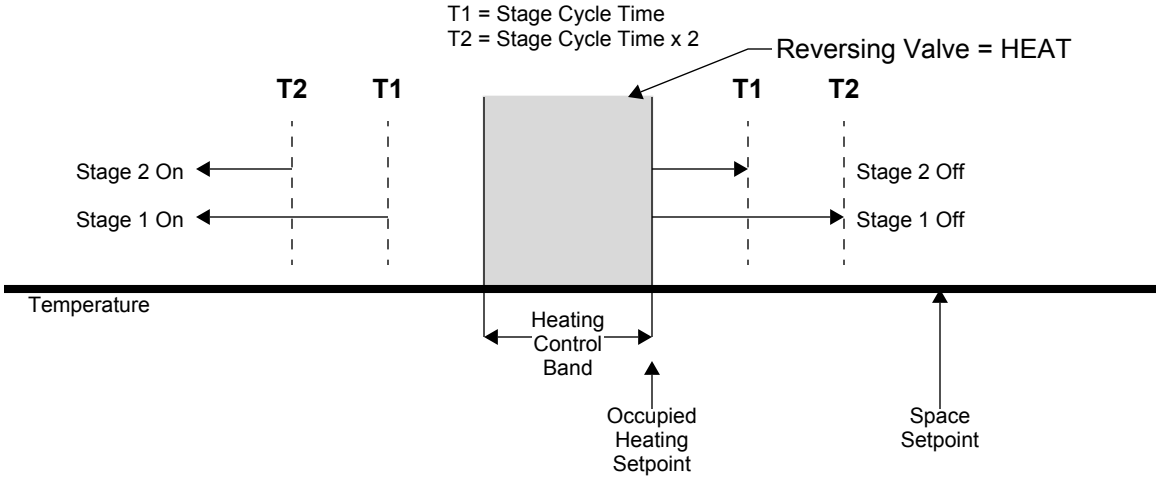
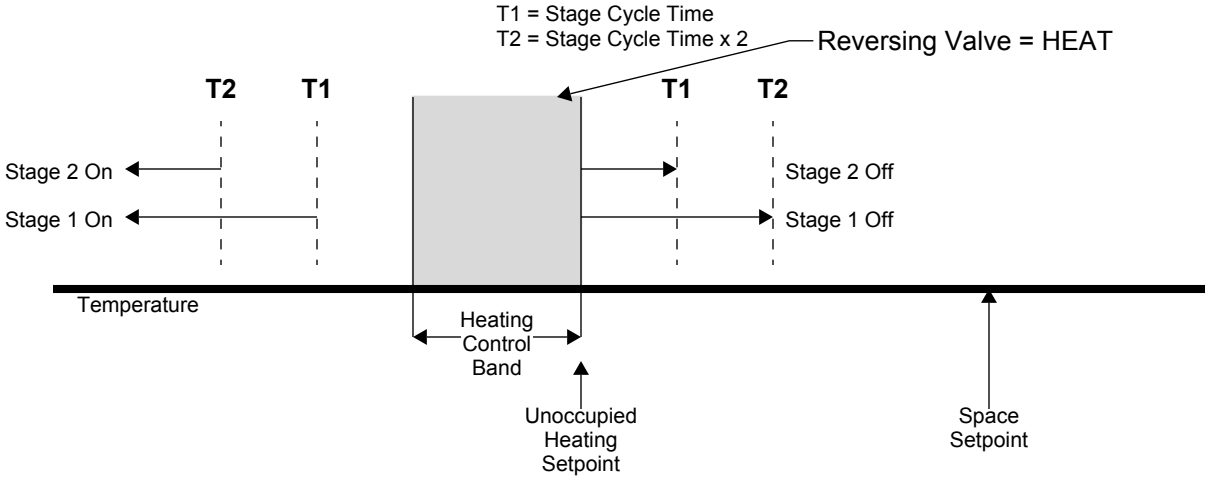


Figure 8: Heat Sequences – Unoccupied Mode



Cooling Sequence

The reversing valve and compressor stages are sequenced based on the space temperature and the calculated cooling setpoint. When the space temperature rises above the calculated cooling setpoint, the reversing valve is cycled to the cooling position. When the space temperature rises above the calculated cooling setpoint plus the cooling control band for a predefined time period, a compressor stage is turned on. If the space temperature remains above the cooling control band for an additional time period, the next available stage will be turned on. This cycle continues until all available stages have been energized.

After the space temperature has dropped below the cooling setpoint for a predefined time period, the last-energized stage is turned off. (Note that the last stage that was turned on will be the first one to be turned off.) If the space temperature remains below the cooling setpoint for an additional time-period, the next previous stage will be turned off. This cycle continues until all stages have been de-energized.

The configurable value "stage time" determines the duration of the stage. An absolute minimum stage ON time of 2 minutes, and an absolute minimum stage OFF time of 5 minutes are enforced when the space temperature is more than the space setpoint. If the temperature falls below the space setpoint then the minimum on and off times are ignored.

When the space temperature drops below the space setpoint, all of the compressor stages turn off immediately; the stage time and minimum on time are ignored.

During unoccupied periods, the cooling setpoint is adjusted upwards through a separate unoccupied cooling setpoint.

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Figure 9: Cooling Sequence - Occupied Mode

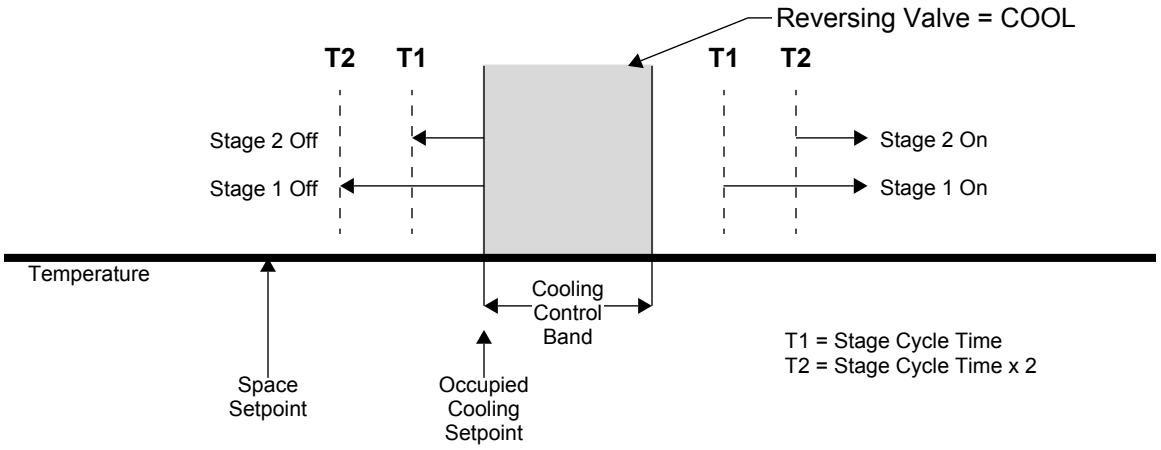
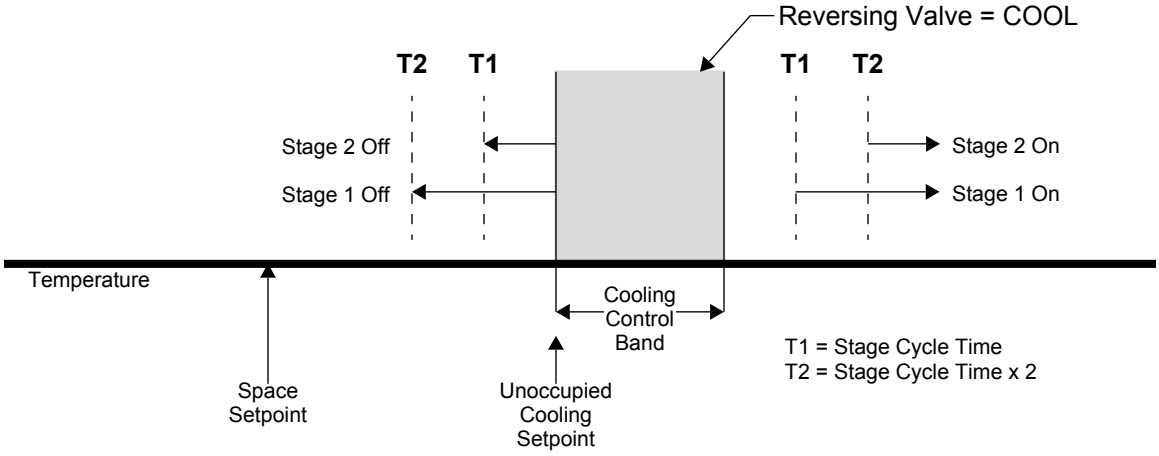


Figure 10: Cooling Sequence – Unoccupied Mode



Commissioning

The controller has a Commissioning screen that allows any of the controller's outputs to be manually configured to any valid value. The Commissioning screen is the last choice in the *All Settings* menu.

From the Commissioning screen, the following outputs can be configured:

- Modulated Fan
- Digital Fan
- Reversing Valve (independent of Valve Type configuration)
- Compressor Stage 1
- Compressor Stage 2
- Dehumidification
- Humidification
- Reheat
- Auxiliary Heat

To enable Commissioning, configure the *Enabled* parameter in the Commissioning screen to “Yes.” Note that when commissioning is enabled, all values are overridden.

To disable Commissioning, configure the *Enabled* parameter in the Commissioning screen to “No.”

Fan Operation

The *Fan Type* is configured for either “Auto” or “On.” This setting determines the fan operation when the *Occupancy Mode* is “Occupied.” This configuration applies to both the digital and modulated fan outputs.

When the *Fan Type* is “Auto,” and the *Occupancy Mode* is “Occupied,” the fans are energized when there is a call for heating or cooling and de-energized when there is no demand for heating or cooling. (i.e. when the space temperature is in the zero energy band - between the heating and cooling setpoints).

When the *Fan Type* is "On," and the *Occupancy Mode* is “Occupied,” the fans are always energized regardless of heating or cooling demand; the modulated fan output is a minimum of 33%; when there is a heating or cooling demand, the modulated fan may increase in speed to satisfy the demand.

Some thermostats allow the fan operation to be overridden. When a thermostat with a single speed fan override is used, the fan override energizes the digital fan and the modulated fan output is 100%. When a thermostat with a three speed fan override is used, all fan speed overrides energize the digital fan and the modulated fan output is 33%, 67% or 100% corresponding to fan speed 1, 2 and 3.

When the *Occupancy Mode* is “Unoccupied,” the fans operate as they would when the *Fan Type* is “Auto.”

Dehumidification with Reheat

The controller may be configured for either “External” *Dehumidification Mode* or “Internal” *Dehumidification Mode*. “External” *Dehumidification Mode* triggers dehumidification equipment using the DHUM digital output. In addition, “Internal” *Dehumidification Mode* controls the reversing valve and compressor stages. The fan purges for two minutes both before and after dehumidification occurs.

Dehumidification begins when the *Space Humidity* rises above the configured dehumidification setpoint, and stops when the *Space Humidity* falls three percent below the dehumidification setpoint. The Reheat (RH) digital output may energize during dehumidification.

Both dehumidification and reheat have valid temperature operating ranges. The valid dehumidification range is defined as the configurable *Shutoff Limit* below the *Cooling Setpoint*. Reheat only occurs when dehumidifying and the space temperature is below the cooling setpoint. Note that the dehumidification range and reheat range are subject to a hysteresis to prevent rapid cycling.

To enable dehumidification, configure the *Dehumidification Type* as either “Always” or “Occupied,” configure the *Setpoint* to a non-zero value (percent), configure the *Shutoff Limit* (°F), and configure the *Dehumidification Mode* to either “External” or “Internal.” Configuration is not required for *Reheat*.

To disable dehumidification and reheat, configure the *Dehumidification Setpoint* to zero. This action disables all dehumidification and reheat regardless of other configured values.

Auxiliary Heat

When the Outdoor Temperature is provided by either an ASM or CSM controller, Auxiliary Heating is enabled. When the Outdoor Temperature falls below the configured auxiliary heat setpoint, the auxiliary heat digital output (AUX) is energized and the compressor stages are turned off. When the Outdoor Temperature rises above the auxiliary heat setpoint plus the configured temperature offset, the auxiliary heat output is deenergized and normal compressor operation continues.

To enable auxiliary heat, insure that there is an ASM or CSM controller on the same network as the HPU3. No other action is necessary.

To disable auxiliary heat without removing the ASM or CSM controllers from the network, configure the auxiliary heat setpoint to a value well below any possible outdoor air temperature. The auxiliary heat setpoint may be configured as low as -459.7°F (absolute zero).

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Global Unit Enable

The controller can be synchronized to the main plant water supply through its global unit enable feature (located on the ASM2 controller). The status of the supply water flow is measured by an external device, and provided to the HPU3 over the network. The controller waits in shutdown mode until water flow is detected.

Humidification

A digital output for humidification (HUM) is provided for adding humidity to the space. When the Space Humidity falls below the configured *Space RH Setpoint*, the humidification output is energized. Humidification output remains energized until the Space Humidity rises three percent above the configured setpoint. Humidification may be configured to operate when Occupied or Always.

If the humidity in the supply duct rises above the configurable *Supply RH Limit*, humidification output is deenergized regardless of the space humidification requirements.

The fan is used to purge the supply duct before and after the humidification output is energized for a configurable amount of time.

To enable humidification, sensors for Supply Air Humidity (SAH) and Space Humidity must be present. Space Humidity may be obtained from an SLink thermostat, or alternatively, from a separate humidity sensor connected to the STAT input (such as when temperature is provided from a BZU3 thermostat that does not provide humidity - see "Hydronic Zone Interaction"). The STAT input is configured in the *Thermostat* configuration screen.

To disable humidification, configure either *Space RH Setpoint* or *Supply RH Limit* to zero percent. If either (or both) of these are configured to zero percent, humidification is not enabled.

Thermostat

Space temperature, current humidity, setpoint adjustment, fan auto/on status (depending on the thermostat model), and occupancy override request are monitored by the thermostat and sent to the controller.

The controller automatically detects a failure of the thermostat. When the thermostat fails, the compressor stages turn off, the fan turns off, and control is disabled.

Note: The thermostat must be connected. The status LED on the controller turns solid red if the thermostat is not connected. Once the thermostat is connected, the status LED turns green indicating normal operation. Alternatively, the thermostat input (STAT) may be used for an RH sensor for Space Humidity, if the controller is also configured as part of a hydronic zone - see "Hydronic Zone Interaction".

Local Backup Schedule

The LCI normally determines the operating mode. A local backup schedule can be defined for situations when the LCI is not available. When the controller detects that the LCI is not available (after 10 minutes without communication), it resorts to the configured local backup schedule. If the local backup schedule is disabled, the controller defaults to occupied mode.

The configured occupied and unoccupied times are used in determining the current operating mode of the controller when it is running the backup schedule. By default, both the unoccupied and occupied time are set to zero, which disables the local backup schedule. This causes the controller to default to the occupied mode of operation if it cannot communicate with the LCI.

Runtime Accumulation

The total runtime is accumulated for the compressor and fan outputs. The runtimes can be used to indicate that maintenance is required on the equipment controlled by these outputs. The runtime can be reset by an operator or maintenance person once servicing has been performed.

Reversing Valve

The reversing valve action can be set to “Energize on Heat” or “Energize on Cool.” The reversing valve default setting is to “Energize on Heat.” This setting can be changed in the All Settings configuration area.

Supply Air Temperature Fan Modulated Output

The calculated Supply Air Temperature (SAT) Setpoint is dependent on whether the HPU3 is in heating or cooling operation. When the HPU3 is in heating mode, the SAT setpoint is the SAT heating setpoint. When the HPU3 is in cooling mode, the SAT setpoint is the SAT cooling setpoint. If present, the SAT output is active whenever the Heat Pump Fan is energized. The output is modulated by a P+I control loop based on the SAT setpoint and the SAT input. The P+I control loop modulates the output to maintain a constant SAT.

When the HPU3 is in cooling mode, as the SAT increases above the SAT setpoint, the SAT output is modulated higher. The SAT output is modulated lower as the temperature decreases below the SAT setpoint.

When the HPU3 is in heating mode, as the SAT decreases below the SAT setpoint, the SAT output is modulated higher. The SAT output is modulated higher as the temperature increases above the SAT setpoint.

Alarms and Events

The controller will detect certain alarm conditions and send them to the LCI. Before this can occur, the user must use the LCI to configure the controller.

Pressure Alarms

High and low pressure alarm inputs are monitored to determine if a pressure alarm condition exists in the heat pump. The pressure alarms may be configured for normally open (active when shorted to ground) or normally closed (active when open).

When a pressure alarm input becomes active, a (high or low) pressure alarm message is sent to the LCI and the heat pump outputs are disabled. When the pressure alarm clears, normal heat pump output is resumed.

If the pressure alarm input becomes active again within two hours, or if the pressure alarm remains active for two hours without clearing, all the controller's outputs are disabled and the controller's status LED turns red. A hard reset is required before the controller resumes operation again.

Thermostat Failure

The controller automatically detects the presence of the local thermostat and monitors its status. If the thermostat fails to communicate with the controller, a Thermostat Failed Alarm is generated and the controller’s status LED turns red.

Maintenance Alarm

The controller provides programmable run limits for generating a runtime Maintenance Alarm. When any of the cooling, heating, or fan runtime limits are exceeded, a maintenance alarm is sent to the LCI.

Space Temperature Alarms

The controller generates high and low limit alarms for the space temperature. The user can configure a programmable space temperature alarm limit offset. The temperature limits are calculated based on the control setpoints, alarm limit offset, and control band.

When the measured space temperature exceeds the high limit, a high limit alarm (Space Temperature High Limit Alarm) is generated. When the space temperature drops below the low limit, a low limit alarm is generated (Space Temperature Low Limit Alarm). A return to normal alarm is generated when the space temperature is between the high and low limit (Space Temperature Return to Normal).

To help eliminate nuisance alarms when the controller switches between the unoccupied and occupied modes of operation, space temperature alarms are not reported for 30 minutes following the switch.

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Hydronic Zone Interaction

To configure the controller to be part of a hydronic zone, associate the controller with a BZU3 from the BZU3 controller's configuration screens. Refer to the BZU3 Application Guide for details on this procedure.

The HPU3 controller initiates network communication with the associated BZU3 Zone controller, which replies with the following zone parameters to the HPU3. These zone parameters take precedence over the HPU3 calculated parameters:

- Space Temperature
- Occupied Setpoint
- Unoccupied Setpoint
- HVAC mode
- Fan mode
- Occupied state

When the HPU3 is configured to be part of a hydronic zone, the Space humidity may be obtained from either a separate RH sensor or an SLink thermostat; either of these are connected to the STAT input and configured from the Thermostat configuration screen.

Automatic Configuration

The HPU3 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 HPU3 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 HPU3 with LNS or other LONWORKS tools if they wish.

The LCI also provides network supervision of the HPU3. The LCI periodically sends a "ping" message to the HPU3, 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.

Communication with Associated Controllers

In addition to Hydronic Zone interaction with the BZU3, the HPU3 is capapable of communicating with any LHP, GHP and CCU controllers on the network to share demand and power usage data. These associations are configured from the main controller screens of the other controllers.

Please refer to the iWorx® *LCI Application Guide*, iWorx® *GHP1 Application Guide* or iWorx® *LHP2 Application Guide* for a detailed description of how to associate the HPU3 and these other controllers.

CONTROLLER IDENTIFICATION

To register the controller with the LCI, press the service pin on the controller once it is properly installed and the LCI is active on the network.

Once the HPU3 is properly installed and recognized by the LCI, the LCI can be used to configure the settings of the controller. This section describes the commands available on the LCI for configuration of the HPU3, and the meanings and default values for controller parameters. For more information on using the LCI, see the *iWorx® LCI Application Guide.*

Network Inputs

The HPU3 allows a network manager to modify the Network Input Variables for the purpose of overriding configuration, operation, inputs and outputs of the controller. Values written to the Network Input Variables have priority over normal controller operation.

Note that Network Input Variables that directly affect controller outputs are ignored when commissioning is enabled. Outputs set in the Commissioning screen when it's enabled have absolute precedence.

- *nviSpaceTemp* overrides the space temperature as obtained from the thermostat, sensor or ASM controller and is used by the controller for temperature control. Values written to this variable will appear in the controller's output of the space temperature on the LCI.
- *nviSpaceRh* overrides the space humidity as obtained from the thremostat, sensor or ASM controller and is used by the controller for humidity control. Values written to this variable will appear in the controller's output of the space humidity on the LCI.
- *nviSupplyTemp* overrides the supply temperature as obtained from sensor input and is used by the controller for supply air temperature control. Values written to this variable will appear in the controller's output of the supply air temperature on the LCI.
- *nviSupplyRh* overrides the supply humidity as obtained from sensor input and is used by the controller humidification to insure that the supply humidity does not go beyond the Supply RH Limit.
- *nviSetpoint* overrides the setpoint as obtained from the thremostat (SLink or BZU), LCI or a pre-configured backup schedule.
- *nviOccCmd* overrides the occupancy as obtained from the thermostat or LCI schedule.Values written to this cariable are reflected in the controller's output of the Occupancy mode. Note that this does NOT override the occupancy sensor; the occupancy sensor (OCC) is 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 is 1 then the runtimes are reset.
- *nviSysTime* is a time stamp to set the date and time. Writing to this variable changes the time on the controller and affects all time-related functions.
- *nviUnitEnable* overrides the global unit enable signal. Unless the unit enable signal is ST_ON (4), the compressor stages are not allowed to energize.
- *nviOutOverride* is a structure that overrides the hardware digital and analog outputs of the HPU3. These values allow the network controller to directly control the analog and digital outputs of the controller. These values have priority over other normal output control except for commissioning mode; commissioning mode has absolute priority over outputs on the controller.

Note: The HPU3 makes no attempt to interpret the outputs; assigning meaningless outputs may have unpredictable results.

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Network Variable Inputs (NVIs)

Internal Variable Name	Format	Range	Description
nviSpaceTemp	SNVT_temp_p	-29 to 230°F (-34 to 110°C) 32767 = no effect	Space temperature
nviSpaceRh	SNVT_lev_percent	0 to 100 percent 32767 = no effect	Space relative humidity
nviSupplyTemp	SNVT_temp_p	-29 to 230°F (-34 to 110°C) 32767 = no effect	Supply air temperature
nviSupplyRh	SNVT_lev_percent	0 to 100 percent 32767 = no effect	Supply air humidity
nviSetpoint	SNVT_temp_p	-29 to 230°F (-33 to 210°C)	Setpoint
nviOccCmd	SNVT_occupancy	0=Occupied 1=Unoccupied 2=Bypass 3-Standby	Occupancy mode
nviResetRuntime	SNVT_lev_disc	0=no reset 1=reset runtimes	Resets fan, heating, and cooling runtimes
nviSysTime	SNVT_time_stamp	Date/Time	System time
nviUnitEnable	unsigned byte	0 = Off 4 = On -1= no effect	Unit enable
nviOutOverride	Structure	Structure	Output override

Output Override Structure (NVI)

Name	Type/Range	Default	Description
digOut[8]	Unsigned Byte: 0=OFF 1=ON -1=no effect	-1 -1 -1 -1 -1 -1 -1 -1	digOut[0] = TO1 (pin 31) FAN digOut[1] = TO2 (pin 29) RV digOut[2] = TO3 (pin 28) S1 digOut[3] = TO4 (pin 26) S2 digOut[4] = TO5 (pin 25) DHUM digOut[5] = TO6 (pin 23) HUM digOut[6] = TO7 (pin 22) RH digOut[7] = TO8 (pin 20) AUX
aOut[4]	SNVT_lev_percent: 0% to 100% 32767=no effect	32767 32767 32767 32767	aOut[0] = AO 0 (pin 37) FANM aOut[1] = AO 1 (pin 35) not used aOut[2] = AO 2 (pin 34) not used aOut[3] = AO 3 (pin 32) not used
fpOut[4]	SNVT_lev_percent: 0% to 100% 32767=no effect	32767 32767 32767 32767	fpOut[0] = not used fpOut[1] = not used fpOut[2] = not used fpOut[3] = not used

Inputs

The Inputs screen displays the current values of the HPU3's inputs. These values cannot be configured from the LCI.

Name	Range	Description
Outside Temp	-30 to 230 °F (-34.4 to 110 °C)	Outside air temperature as reported by the networked ASM or CSM controller
Space Temperature	-22 °F to 122 °F (-30 °C to 50 °C)	Space Temperature
Space Humidity	0 to 100%	Space Humidity
Supply Air Temp	-22 °F to 122 °F (-30 °C to 50 °C)	Supply Air Temperature
Supply Air Humidity	-22 °F to 122 °F (-30 °C to 50 °C)	Supply Air Humidity
Inst Power	0 to 3.4E38 Watts	Instantaneous Power
Input Status	Structure as described in a following table	Status of the inputs

Input Status

Name	Range	Description
Equipment Status	Normal, Alarm	Status of the Equipment Status input (EQS)
High Pressure Status	Normal, Alarm	Status of the High Pressure Alarm input (HP)
Low Pressure Status	Normal, Alarm	Status of the Low Pressure Alarm input (LP)

Outputs

The Outputs screen displays the current values of the HPU3's outputs. These values cannot be changed.

Name	Range	Description
Unit Status	Structure as defined in a table below	Status of the unit
Output Status	Structure as defined in a table below	Status of the outputs

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Unit Status

Name	Range	Description
Mode	Off, Auto, Heat, Cool, Fan, Emergency Heat	Current operating mode.
Heat Output	0 to 100%	Proportion of heating capacity used.
Cool Output	0 to 100%	Proportion of cooling capacity used.
Fan Output	0 to 100%	Modulated Fan Output (FANM)
In Alarm?	No, Yes	Alarm Indication

Output Status

Name	Range	Description
Digital Fan	Off, On	Status of the digital Fan output (FAN)
Reversing Valve	Off, On	Status of the Reversing Valve (RV)
Stage 1	Off, On	Status of Stage 1 output (S1)
Stage 2	Off, On	Status of Stage 2 output (S2)
Dehumidify	Off, On	Status of Dehumidification output (DHUM)
Humidify	Off, On	Status of Humidification output (HUM)
Reheat	Off, On	Status of reheat output (RH)
Auxiliary Heat	Off, On	State of auxiliary heat output (AUX)

Configuration

This section describes the settings that can be modified.

All Settings

This screen displays all of the controller's settings and provides access to edit all parameters from a single screen. Parameters are described in individual tables below.

Setting	Range	Default	Description
Thermostat	Structure	N/A	Thermostat Settings
Setpoints	Structure	N/A	Setpoint Settings
SAT Setpoints	Structure	N/A	Supply Air Temperature settings
Compressor Stages	Structure	N/A	Compressor Stage Settings
Fan Type	Auto, On	Auto	Type of Fan operation
Auxiliary Heat	Structure	N/A	Auxiliary Heat settings
Dehumidification	Structure	N/A	Dehumidification settings
Humidification	Structure	N/A	Humdification settings
Modulated Fan	Structure	N/A	Modulated Fan settings
Status Inputs	Structure	N/A	Enable status inputs
Power Scale	100 to 10,000 Watts full scale		Power corresponding to 10VDC at POW input
Reversing Valve	Energize on Heat Energize on Cool	Energize on Heat	Reversing Valve settings
Fan Runtime Limit	0 to 65,535 hours	1000 hours	Runtime limit for Fan
Comp. Runtime Limit	0 to 65,535 hours	1000 hours	Runtime limit for the compressor stages

Setting	Range	Default	Description
Backup Occ. Time	Structure	N/A	Hour and minute to begin the occupied period for the local backup schedule.
Backup Unocc. Time	Structure	N/A	Hour and minute to begin the unoccupied period for the local backup schedule.
Commissioning	Structure	N/A	Commissioning mode settings

Thermostat

This screen displays HPU3 settings related to this topic and allows access to all of these settings from a single screen.

Setting	Range	Default	Description
Type	SLink, Used for RH, Not Used	SLink	– SLink - Temp and RH from SLink thermostat – Used for RH - Temp from Precon II in ST (UI 9) and RH from sensor in UI 11 – Not Used - Temp and RH not available – Note that association with BZU overrides Temp
Occupancy Extension	0 to 1000 minutes	60 min	Allowable occupancy extension time.
Alarm Temp Offset	0 to 10.0 °F (0 to 5.56 °C)	5 °F (2.8 °C)	Degrees below the heating setpoint or above the cooling setpoint to trigger a low limit or high limit alarm. Zero disables the alarm.
Temperature Offset	-10.0 to 10.0 °F (-5.56 to +5.56 °C)	0 °F (0 °C)	The amount of offset applied to a Precon Type II or Type III sensor.
Accumulated Ext Occ	0 to 1000 min	0 min	Number of minutes the controller has been overridden from the thermostat.

Setpoints

This screen displays HPU3 settings related to this topic and allows access to all of these settings from a single screen.

Setting	Range	Default	Description
Setpoint	50 to 95 °F (10 to 35 °C)	71 °F (21.7 °C)	Setpoint
Cooling Offset	0 to 10.0 °F (0 to 5.56 °C)	1 °F (0.6 °C)	Occupied cooling setpoint offset.
Heating Offset	0 to 10.0 °F (0 to 5.56 °C)	1 °F (0.6 °C)	Occupied heating setpoint offset.
SP Adjust Limit	0 to 10.0 °F (0 to 5.56 °C)	2 °F (1.2 °C)	Allowed range of the setpoint adjustment on a TS300 Series thermostat.
Unocc Cooling	50 to 95 °F (10 to 35 °C)	82 °F (27.8 °C)	Unoccupied cooling setpoint.
Unocc Heating	50 to 95 °F (10 to 35 °C)	60 °F (15.6 °C)	Unoccupied heating setpoint.

SAT Setpoints

This screen displays all the SAT Setpoint settings and provides access to edit these parameters from a single screen.

Setting	Range	Default	Description
Cooling Setpoint	40 to 80°F (4.4 to 26.7°C)	55 °F (12.8°C)	Specifies the target Supply Air Temperature
Heating Setpoint	60 to 100°F (15.5 to 37.8°C)	85 °F (29.4°C)	Specifies the target Supply Air Temperature

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Compressor Stages

This screen displays HPU3 settings related to this topic and allows access to all of these settings from a single screen.

Setting	Range	Default	Description
Stages	1 to 2	2	Number of compressor stages.
Control Band	0 to 10.0 °F (0 to 5.56 °C)	1 °F (0.6 °C)	Heating and cooling stage control band.
Stage Time	0 to 255 minutes	5 minutes	Compressor control cycle timer.

Auxiliary Heat

This screen displays HPU3 settings related to this topic and allows access to all of these settings from a single screen.

Setting	Range	Default	Description
Setpoint	-459 to 621 °F (-273 to 327 °C)	20.0 °F (-6.7 °C)	The outside air temperature (OAT) that triggers auxiliary heating.
Temperature Offset	-10 to 10.0 °F (-5.56 to 5.56 °C)	2.0 °F (1.1 °C)	The temperatre offset above the setpoint when auxiliary heating ends.

Dehumidification

This screen displays all the dehumidification settings and provides access to edit these parameters from a single screen.

Setting	Range	Default	Description
Type	Normal Occupied, Normal Always	Normal Occupied	Available dehumidification types
Setpoint	0.00% to 100.00%	0% (disabled)	Humidity Setpoint
Shutoff Offset	0 to 10°F (0 to 5.56°C)	2.0°F (1.1°C)	Heating Setpoint offset to shut off dehumidification
Mode	External, Internal	External	Internal = use compressor staging (S1, S2) and dehumidify output (DHUM) to dehumidify. External = dehumidify output (DHUM) only.

Humidification

This screen displays all the humidification settings and provides access to edit these parameters from a single screen.

Setting	Range	Default	Description
Type	Occupied Always Enabled	Occupied	Type of humidification
Space RH Setpoint	0.00% to 100.00%	0% (disabled)	Humidity Setpoint
Supply RH Limit	0.00% to 100.00%	80%	Maximum allowed SAH
Purge Time	0 to 65535 seconds	120 seconds	Purge time before and after humidification

Modulated Fan

This screen displays all the Mod Fan settings and provides access to edit these parameters from a single screen.

Setting	Range	Default	Description
Kp	0.0% to 100.0%	5.0%	Proportional band control constant

Setting	Range	Default	Description
Ki	0.0% to 100.0%	0.05%	Integral control constant
Out Min	0 to 10 Volts	0.0V	Minimum output voltage for modulated fan operation.
Out Max	0 to 10 Volts	0.0V	Maximum output voltage for modulated fan operation. If set to 0, fan modulation is disabled.

Status Inputs

This screen allows the user to define the status inputs as either Normally Open or Normally closed or Disabled. Provides access to edit these parameters from a single screen.

Setting	Range	Default	Description
Equip Status Polarity	Disabled, Normally Open, Normally Closed	Disabled	Enable equipment status
High Press Alm Polarity	Disabled, Normally Open, Normally Closed	Disabled	Enable high pressure status input
Low Press Alm Polarity	Disabled, Normally Open, Normally Closed	Disabled	Enable low pressure status input

Backup Occ / Unocc Time

This screen displays all the backup schedule settings and provides access to edit these parameters from a single screen. Backup times are based on a 24 hour clock.

Setting	Range	Default	Description
Hours	0 to 23	0	Hour to start occupied/unoccupied times.
Minutes	0 to 59	0	Minute to start occupied/unoccupied times.

Commissioning

Allows the user to specify the commissioning override values.

Setting	Range	Default	Description
Enabled	No, Yes	No	Enables commissioning mode
Modulated Fan	0 to 100%	0%	Set Modulated Fan Output (MFAN)
Digital Fan	Off, On	Off	Set Digital Fan Output (FAN)
Reversing Valve	Off, On	Off	Set Reversing Valve Output (RV)
Compressor Stage 1	Off, On	Off	Set Compressor Stage 1 Output (S1)
Compressor Stage 2	Off, On	Off	Set Compressor Stage 2 Output (S2)
Dehumidification	Off, On	Off	Set Dehumidification Output (DHUM)
Humidification	Off, On	Off	Set Humidification Output (HUM)
Reheat	Off, On	Off	Set Reheat Output (RH)
Auxiliary Heat	Off, On	Off	Set Auxiliary Heat Output (AUX)

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Alarms

The table below describes the alarms that the user may encounter and how to reset them.

Alarm	Range	Alarm Trigger	Alarm Reset
Equipment Failure	Normal, Alarm	Occurs when the controller detects that the equipment status input contact has faulted.	The cause of the emergency condition must be resolved.
Thermostat Failure	Normal, Alarm	Occurs when the thermostat is unable to communicate to the controller	Automatic when thermostat connected to the controller.
Space Temp	Normal, Alarm	Occurs when the space temperature exceeds the specified high limit or drops below the specified low limit.	Automatic when space temperature returns within its normal range.
Maintenance	Normal, Alarm	Occurs when the fan, heating, or cooling operating hours have exceeded their Runtime limit.	To clear the alarm, a user must enter a new value for the alarm limit or reset the accumulated runtimes to zero.
High Pressure	Normal, Soft Alarm, Hard Alarm	Occurs when the High Pressure Alarm input is faulted. Alarm is 'Hard' if more than one alarm happens within 120 minutes. 'Soft' if no previous High Pressure alarms in the last 120 minutes.	Soft Alarm is cleared as soon as Low Pressure Input is no longer faulted. Hard Alarm requires Controller Reset.
Low Pressure	Normal, Soft Alarm, Hard Alarm	Occurs when the Low Pressure Alarm input is faulted. Alarm is 'Hard' if more than one alarm happens within 120 minutes. 'Soft' if no previous High Pressure alarms in the last 120 minutes.	Soft Alarm is cleared as soon as Low Pressure Input is no longer faulted. Hard Alarm requires Controller Reset.

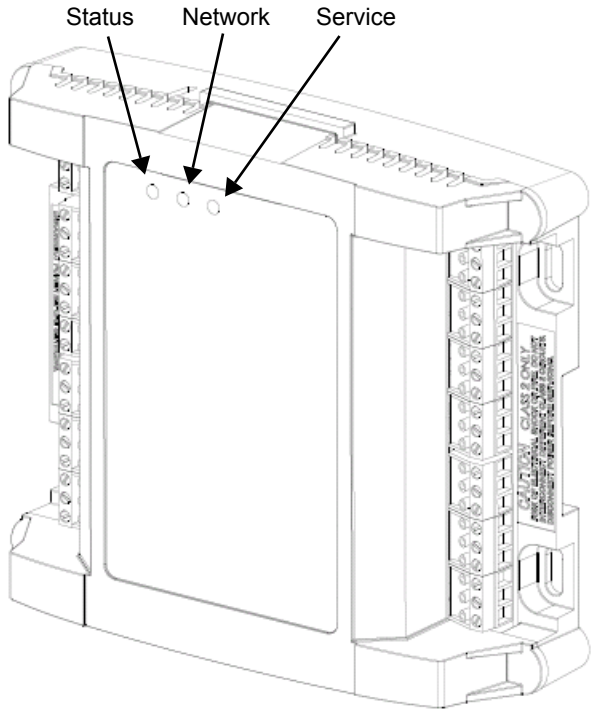
TROUBLESHOOTING

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 11: HPU3 Controller LEDs



Troubleshooting Tips

The table below provides solution to some common problems you may encounter.

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.
The fan will not cycle on after the equipment status input alarm has been resolved	If the controller was previously in an equipment status fault condition, the controller must be reset before proper operation can be restored.
The fan and staged pilot relays 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.
The Space Temperature or Supply Air Temperature thermistor reading is at its maximum or minimum.	The input is either shorted or open.
The staged outputs will not come on even though the space requires conditioned air.	Is there water flow in the system? Verify the associated CCU2 or LHP2 controller are operating and the HPU3 is a member of the controller. If there is no CCU2 or LHP2 connected, then the Unit Enable input of the ASM2 must detect water flow (On).

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Problem	Solution
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.
How do I associate my HPU3 controllers with the LHP2?	Use the LHP2's grouping mechanism, specifically *Members* on the LHP2 HVAC Setup screen of the LCI. Only HPU3s may be associated with the LHP2.
Under what conditions does the HPU3 require a reset for normal operation.	There are two conditions that require a reset: – Equipment failure and hard pressure failure (alarm)

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:

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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