iWorx by Taco Electronic Solutions

Application Guide

505-025

HPU2 Water Source Heat Pump Controller

Self-Contained Interoperable Controller Model UCP-1

SUPERSEDES: December 19, 2014 EFFECTIVE: July 9, 2015

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HPU2

The HPU2 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 and fan.

Overview

A digital input is provided to monitor equipment status. A two-wire serial interface is provided for the thermostat. The HPU2 incorporates digital outputs in the form of triacs for fan start/stop, two compressor stages, and a reversing valve.

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
- 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
- Thermostat with space 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® HPU2 Application Guide* provides application information for the HPU2 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

REPRESENTATIONS AND WARRANTIES

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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.	

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).

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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 HPU2 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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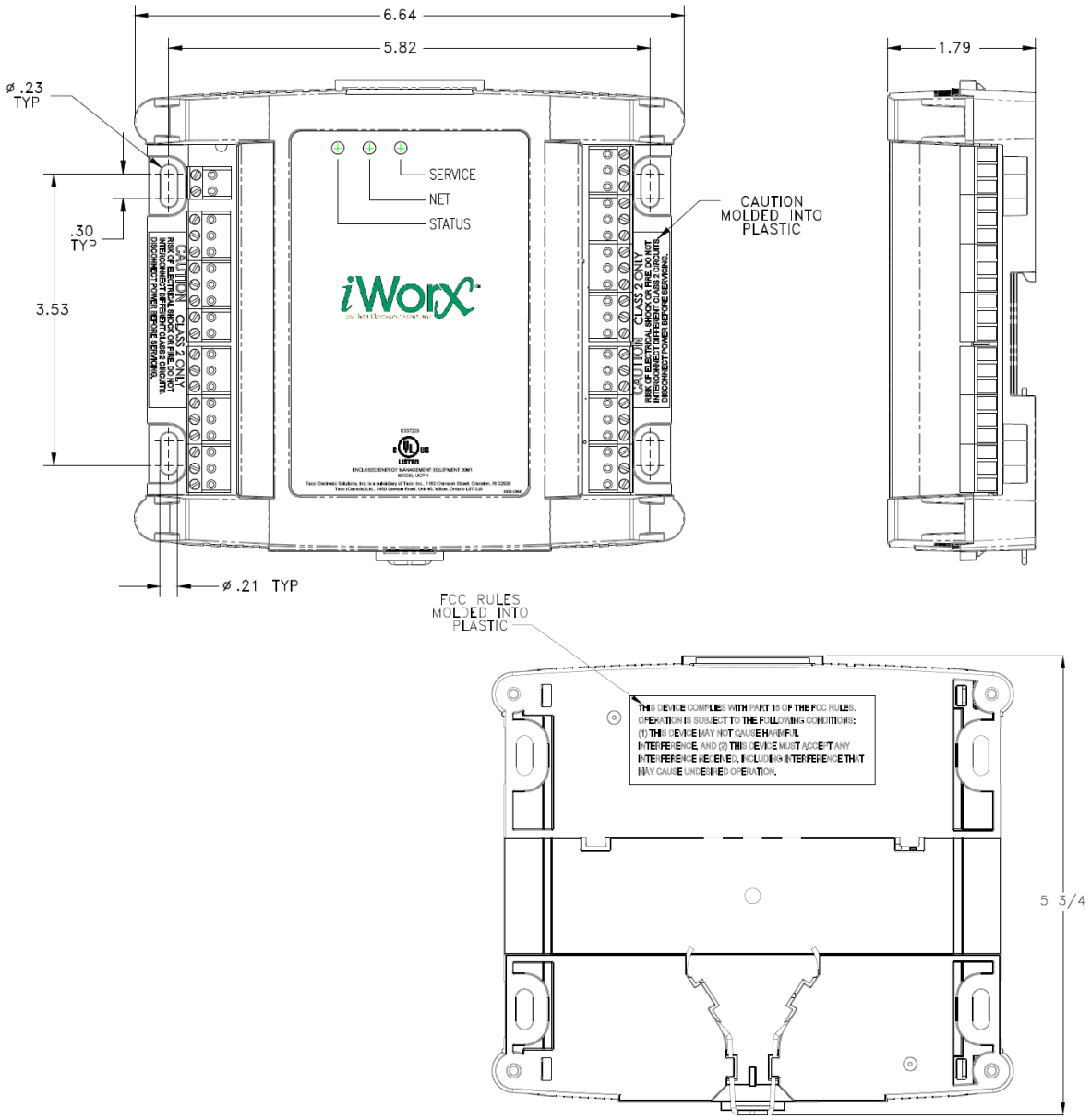
Figure 1: Mounting Dimensions



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

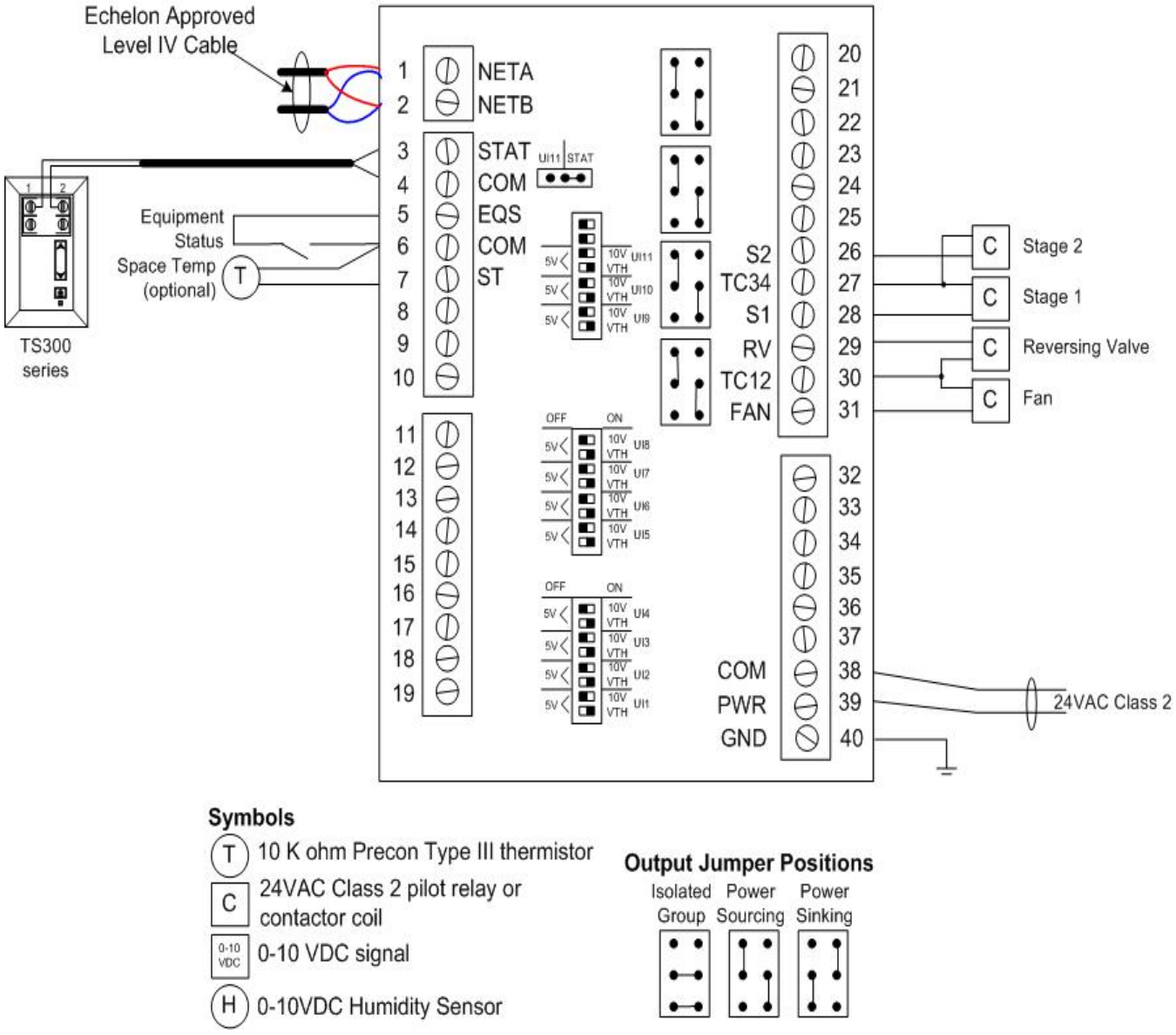
The ground terminal (T40) must be securely connected to earth ground. Failure to properly ground this equipment will result in improper operation. Improper grounding may also increase the risk of electrical shock and may increase the possibility of interference with radio/TV reception.

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

WIRING INFORMATION

WARNING: Terminals 4 and 6 are connected internally on all HPU2 controllers. Disconnect **ALL** power sources when installing or servicing this equipment to prevent electrical shock or equipment damage.

Figure 2: HPU2 Wiring Example - Power Sourcing



Symbols

- (T) 10 K ohm Precon Type III thermistor
- [C] 24VAC Class 2 pilot relay or contactor coil
- [0-10 VDC] 0-10 VDC signal
- (H) 0-10VDC Humidity Sensor

Output Jumper Positions

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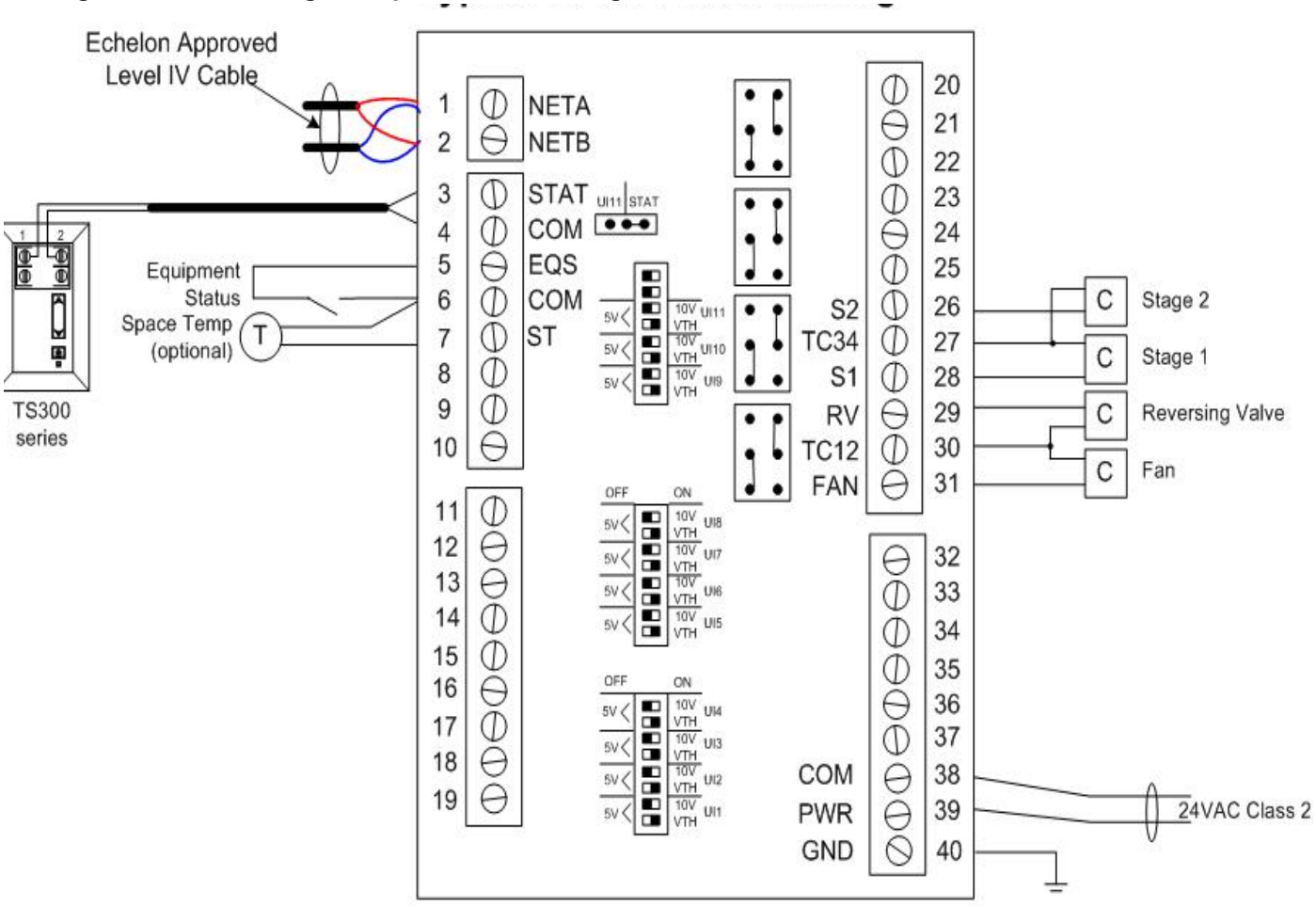
Figure 3: HPU2 Wiring Example - Power Sinking



Symbols

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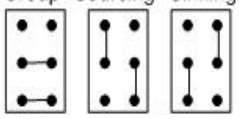
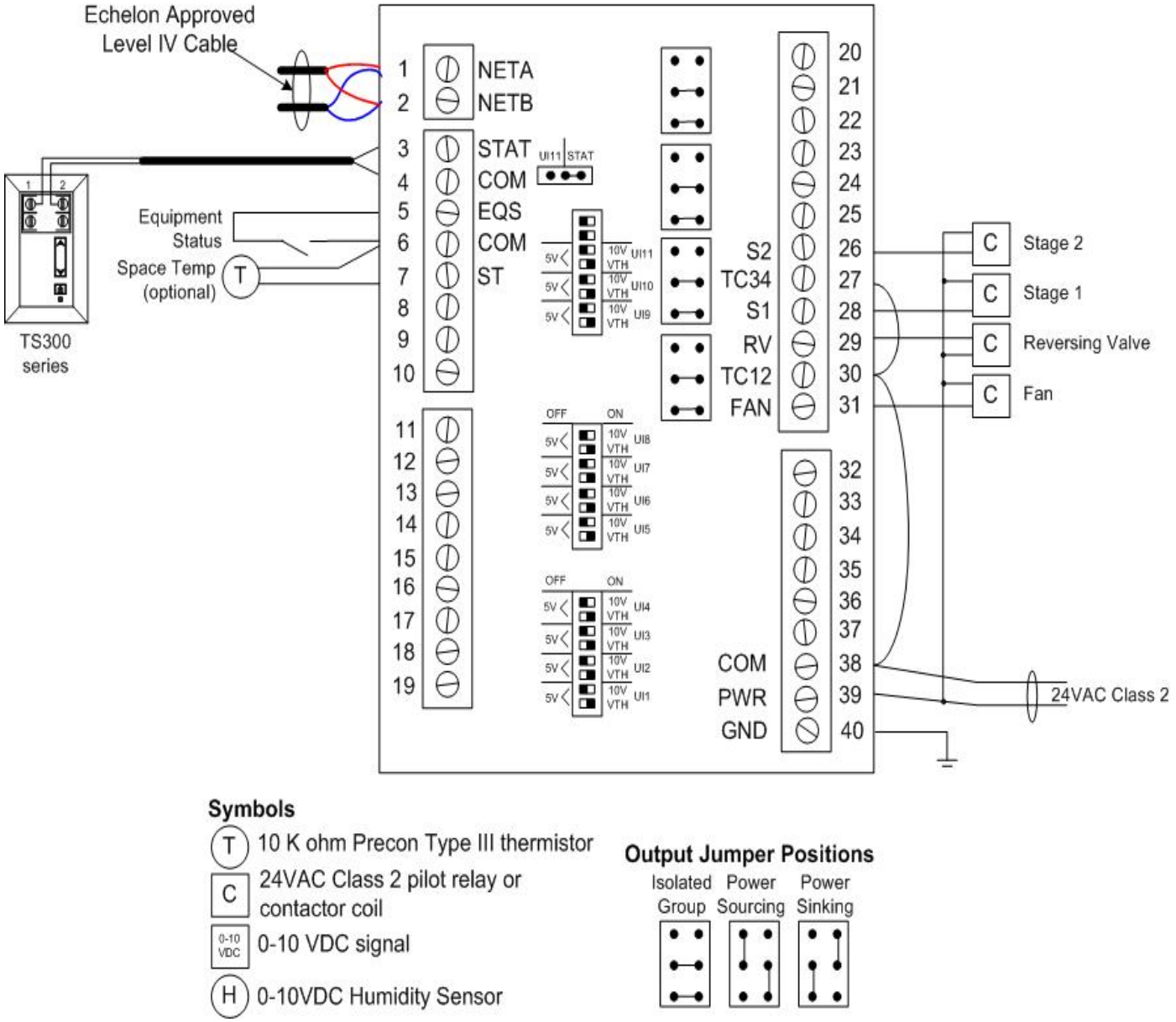


Figure 4: HPU2 Wiring Example - Power Isolated



Connecting Input Devices

Thermostat (STAT)

To connect the heat pump thermostat to the unit, attach one wire from the thermostat 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).

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Space Temperature (ST, optional)

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

Connecting Output Devices

Stage 1 & Stage 2 (S1, S2)

The outputs for the stages must be connected to 24 VAC pilot relays if the load is greater than 1 Amp for each pump. If the load is less than 1 Amp, connect stage 1 to S1 (T28) and adjacent TC34 (T27), and connect stage 2 to S2 (T26) and adjacent TC34 (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 TC12 (T30).

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 TC12 (T30).

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

- iWorx® TS300 Series

Equipment Status

- Dry Contact
- Normally Open

- 5 Volts DC Max

Space Temp (optional)

- Precon Type II or Type III 10K thermistor

Outputs

Stage 1, Stage 2, Reversing Valve, and Fan

- 24 Volts AC
- 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
- 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

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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.

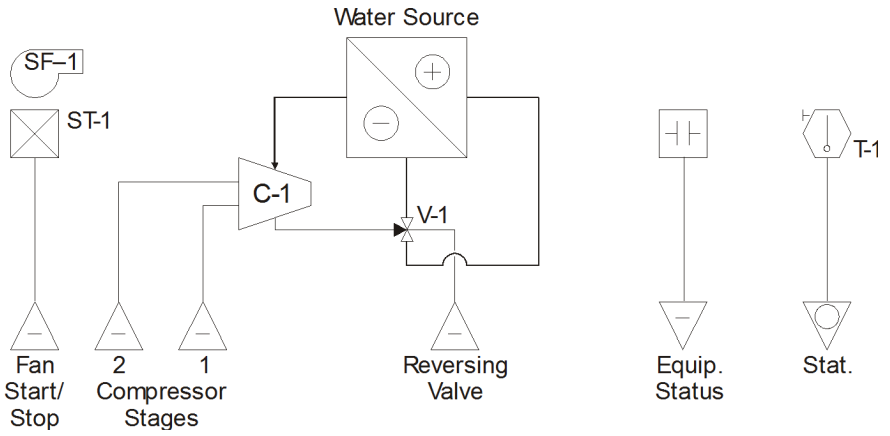
Agency Compliances

- FCC Part 15 Class A

APPLICATION DESCRIPTION

The 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 5: HPU2 Application



The controller controls the starting and stopping of the supply air fan. If the unit enable input indicates plant synchronization, the fan will be 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, 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.

A digital input is provided to monitor the status of the equipment within the unit. An external contact may be wired to the input to provide additional equipment safety interlocks. When the contact closes, the controller shuts the unit down. An alarm will be reported to the LCI when this condition exists.

The HPU2 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 will be reported to the LCI.

When the space temperature exceeds a programmable limit, a high limit alarm will be reported to the LCI. When the space temperature drops below a programmable limit, a low limit alarm will be reported to the LCI. When the space temperature returns to the proper range, a return to normal alarm will be reported to the LCI.

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 programmed value. The heating setpoint, and cooling setpoint are calculated from the space setpoint and heating and cooling offsets and the current operating mode (i.e. occupied or unoccupied).

The space setpoint is displayed in the thermostat and the LCI's controllers list.

The zero energy band is calculated as follows:

Occupied Mode

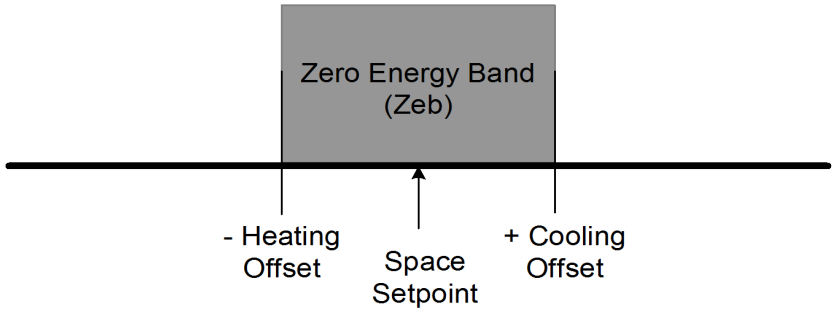
$$ZebOcc = (SpaceSetpoint - Heatoffset) - (SpaceSetpoint + CoolOffset)$$

Unoccupied Mode

$$CalcHeatSp = UnoccupiedHeatSp$$

$$CalcCoolSp = UnoccupiedCoolSp$$

Figure 6: Space Setpoint Calculation.



The effective setpoint is a calculated value based on the space setpoint and the thermostat's *user setpoint adjustment*. The *user setpoint adjustment* is used to increase or decrease the space setpoint from the local thermostat. The *user setpoint adjustment* is limited to plus or minus the programmed *setpoint adjust limit*.

The *user setpoint adjustment* also affects the calculated heating and calculated cooling setpoints by an equal amount. The *user setpoint adjustment* and the *setpoint adjust limit* apply only in the occupied mode of operation; they have no affect in the unoccupied mode. Note that the actual programmed setpoint, heating and cooling offsets are not changed. The thermostat's *user setpoint adjustment* is added to the programmed setpoints to derive the calculated values.

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Occupied Mode

$$CalcCoolingSp = SpaceSp + CoolOffset \pm UserSpAdjust$$

$$CalcHeatingSp = SpaceSp - HeatOffset \pm UserSpAdjust$$

$$EffectiveSp = SpaceSp \pm SpOffset$$

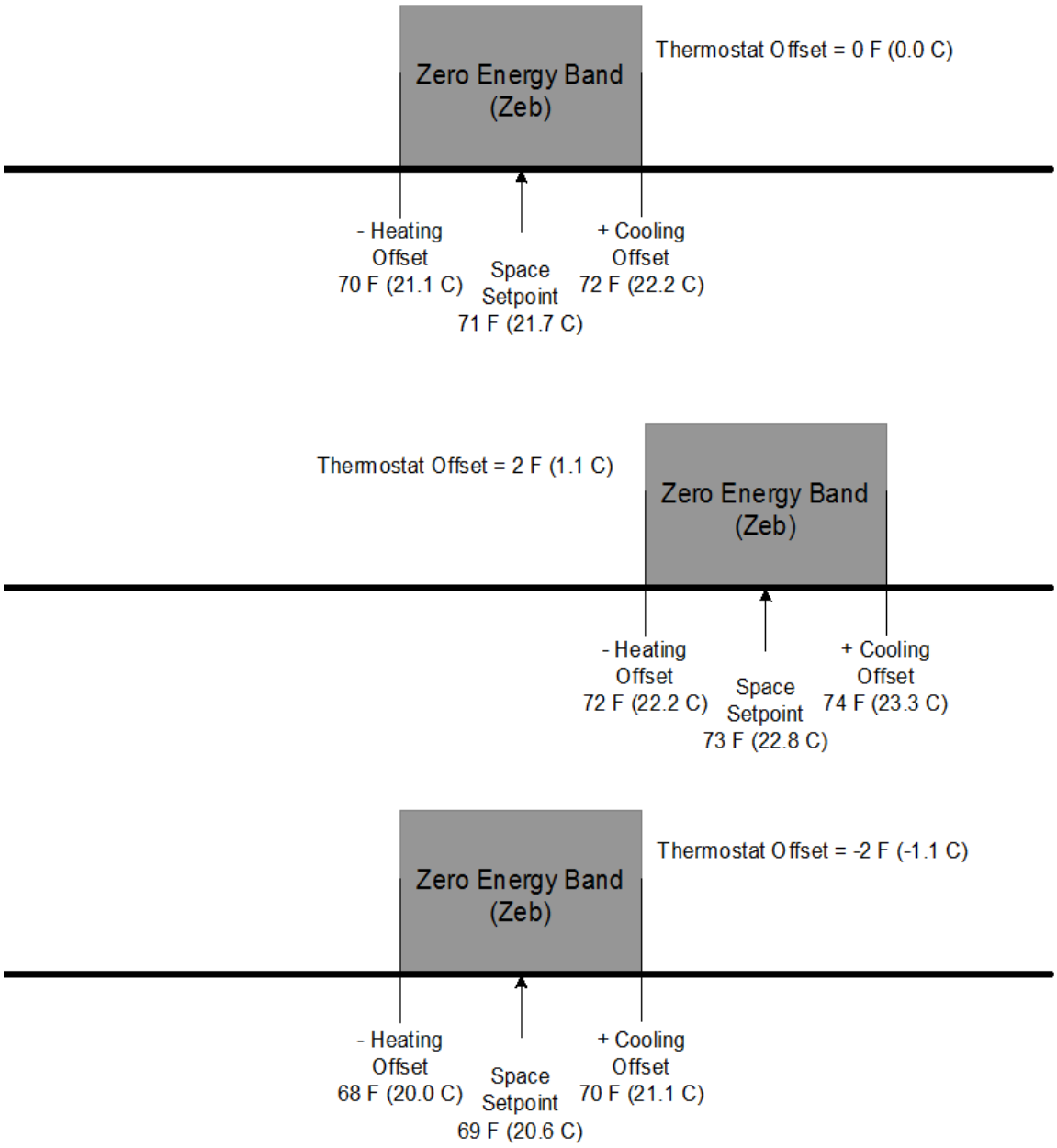
Unoccupied Mode

$$CalcCoolingSp = UnoccupiedCoolingSp$$

$$CalcHeatingSp = UnoccupiedHeatingSp$$

$$EffectiveSp = SpaceSp$$

Figure 7: 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 minus the heating control band for a predefined time-period, the reversing valve is cycled to the heating position and 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 will be turned on. This cycle continues until all available stages have been energized.

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. However, an absolute minimum stage ON time of 2 minutes, and an absolute minimum stage OFF time of 5 minutes are enforced.

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

Figure 8: Heat Sequence - Occupied Mode

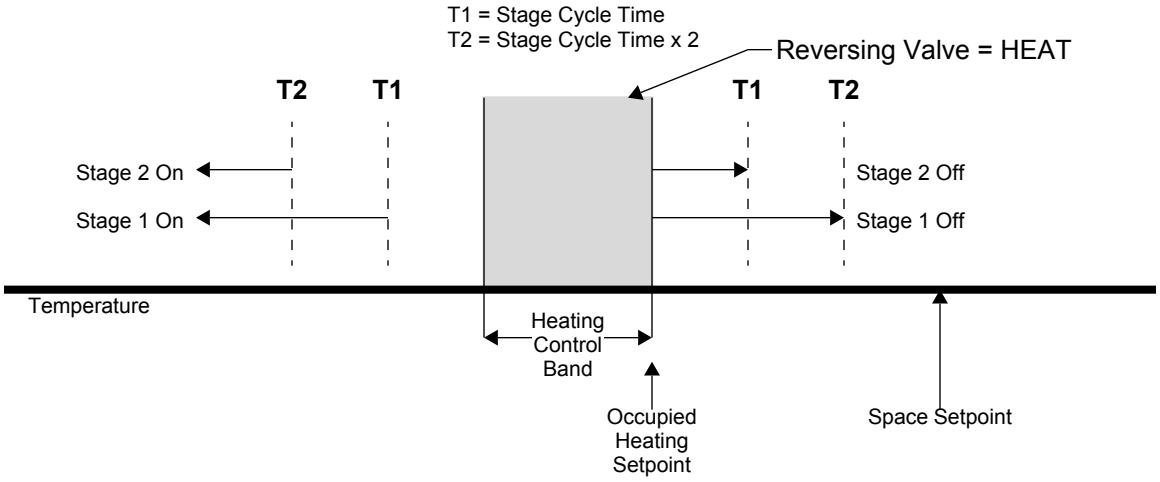
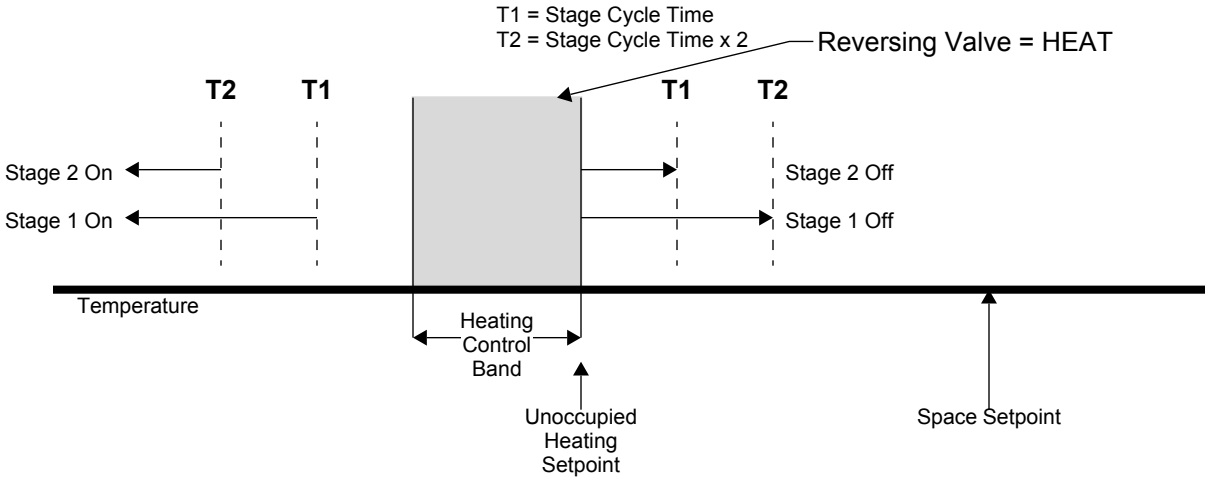


Figure 9: Heat Sequences – Unoccupied Mode



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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 plus the cooling control band for a predefined time-period, the reversing valve is cycled to the cooling position and 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. However, an absolute minimum stage ON time of 2 minutes, and an absolute minimum stage OFF time of 5 minutes are enforced.

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

Figure 10: Cooling Sequence - Occupied Mode

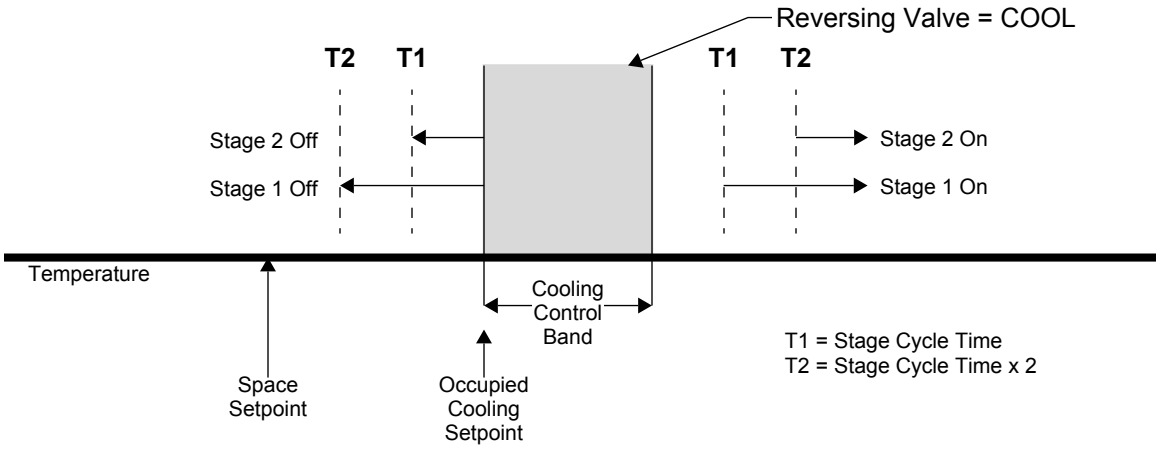
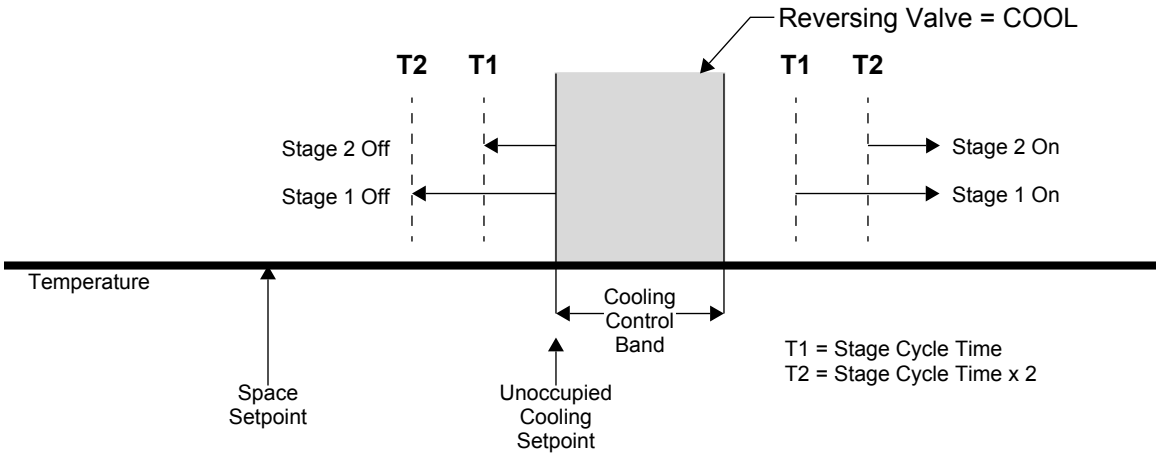


Figure 11: Cooling Sequence – Unoccupied Mode



Fan Operation

During occupied periods, the user can set the fan to always run or to cycle off when the space temperature is within the zero energy band. The zero energy band is defined as the temperature range between the cooling and heating set-points. The fan is interlocked with the cooling and heating stages. If there is a call for heating or cooling the fan will energize immediately. During the unoccupied period, the fan will always cycle off when the space temperature is within the zero energy band.

The user can override the fan from the local thermostat (depending on the model). When the fan selection is set to *Auto*, the fan operates as described above. If the fan selection is set to *On*, the fan will be on constantly.

Equipment Status

An equipment status input is monitored to determine if the fan coil equipment is operating properly. When the fan is initially turned on, there is a 30 second delay before the equipment status is checked. If the contact closes after the delay, indicating equipment failure, the compressor stages will turn off and the fan will turn off. The status LED on the controller will turn solid red. The controller must be reset to clear this condition.

Global Unit Enable

The controller 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 HPU2 over the network. The controller waits in shutdown mode until water flow is detected.

Thermostat

Space temperature, 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 will automatically detect a failure of the thermostat. When the thermostat fails, the compressor stages will turn off, the fan will turn off, and control will be disabled.

Note: The thermostat must be connected. The status LED on the controller will turn solid red if the thermostat is not connected. Once the thermostat is connected, the status LED will turn green indicating normal operation.

Note: The *Space Temperature* can also be acquired by a Precon II or III sensor. The *Thermostat - Type* setting must be set to *Precon II* or *Precon III*.

Real Time Clock (RTC)

The RTC will be set or synced by the LCI each day at midnight. The controller will utilize the RTC in conjunction with its local backup schedule during periods when the LCI is not available.

Local Backup Schedule

The LCI normally determines the operating mode. The user can define a local backup schedule 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 local backup schedule that the user has configured. If the local backup schedule is disabled, the controller defaults to occupied mode.

The user configures the *occupied* and *unoccupied* times that 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 will be 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.

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Runtime Accumulation

The total runtime is accumulated for the heating, cooling, 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.

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.

Digital Input Alarm

The controller monitors the status of the equipment status digital input and generates an Equipment Status Alarm if detected.

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 will be generated and the controller's status LED will turn 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.

$$HighLimit = CalcCoolingSp + AlarmLimitOffset + CoolBand$$

$$LowLimit = CalcHeatingSp - AlarmLimitOffset - HeatBand$$

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.

Automatic Configuration

The HPU2 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 HPU2 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 HPU2 with LNS or other LONWORKS tools if they wish.

The LCI also provides network supervision of the HPU2. The LCI periodically sends a "ping" message to the HPU2, 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.

Hydronic Zone Interaction

The controller can be configured to be part of a hydronic zone. Although the controller acts as master on the network and initiates network communication to the associated BZU Zone controller, it receives various information from the BZU and gets configured in the BZU controller screen.

For a residential environment, the BZU and its attached Thermostats allow certain user interactions that are communicated to the controller. The BZU input takes precedence over the internal controller calculation. The following variables can be set by the BZU:

- Occupied Setpoint
- Unoccupied Setpoint
- HVAC-Mode
- Fan-Mode

Occupied Setpoint

The Occupied Setpoint is determined by the BZU and depends on the BZU configuration. It can be in three modes:

- Master
- Average
- Lowest

The Controller does not need to know the specific BZU settings and takes the Occupied Setpoint.

Unoccupied Setpoint

The Unoccupied Setpoint is communicated from the BZU; there is one setting for all zones.

HVAC-Mode

The HVAC mode can be:

- Heat
- Off
- Cool
- Auto

The format of the HVAC mode is a SNVT_hvac_mode enumeration.

Fan-Mode

The FAN mode can be:

- On
- Auto

In the “On” mode, the fan is overridden to "on" by the BZU. The BZU setting takes precedence over local DXU4 settings. In the “Auto” mode, the DXU4 follows any of its internal settings which can be *Auto*, *Auto no Heat*, or *Auto Radiant*.

Communication with Associated Controllers

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

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Communication with a BZU

The communication between a HPU2 and a BZU is configured by the LCI. The individual controller screen for the BZU displays a *Members* button which creates an association between a HPU2 and a BZU. This can only be a one-to-one association, where the BZU acts as the master and the HPU2 acts as a slave. During the association process, the BZU receives a notice from the HPU2. Once associated, the BZU exchanges messages with the HPU2. When communication is lost between the HPU2 and the BZU, the BZU attempts to contact the HPU2 every 5 minutes. During this time, the HPU2 reacts as if the thermostat doesn't respond.

Communication with LHP2, CCU2

The communication between a HPU2 and associated controllers is configured by the LCI2. The HPU2 can only be associated in the corresponding master controller, which could be a CCU-type or LHP-type controller.

Please refer to the *iWorx® LCI Application Guide* or *iWorx® LHP Application Guide* for a detailed description of how to associate HPU2 and a suitable master controller.

CONTROLLER IDENTIFICATION

Once the HPU2 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 HPU2, and the meanings and default values for controller parameters. For more information on using the LCI, see the *iWorx® LCI Application Guide.*

Inputs

The Inputs screen displays the current values of the HPU2's inputs. These values cannot be changed.

Input	Range	Description
Outside Temp	-30 to 230 °F (-34.4 to 110 °C)	The outside air temperature as reported by the networked ASM2.
Space Temperature	-22 °F to 122 °F (-30 °C to 50 °C)	Space temperature reading
Equipment Status	Normal, Alarm	Status of the Equipment Status input
Occupancy Mode	Occ, Unocc, Bypass, Auto	Current occupancy mode.

Outputs

The Outputs screen displays the current values of the HPU2's outputs. These values cannot be changed.

Output	Range	Description
Mode	Auto, Heat, Cool, Off, Fan	Current operating mode.
Heat Output	0 to 100%	Capacity of heating used.
Cool Output	0 to 100%	Capacity of cooling used.
Fan Output	0 to 100%	Off=0%, On=100%
In Alarm?	No, Yes	Alarm Indication

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. Some parameters (defaulted as Structure) will be described in individual tables below.

Setting	Range	Default	Description
Thermostat	Structure	N/A	Thermostat Settings
Setpoints	Structure	N/A	Setpoint Settings
Comp. Stages	Structure	N/A	Compressor Stage Settings
Fan Type	Auto, On	Auto	Type of fan operation
Fan Runtime Limit	0 to 65,535 hours	1000 hours	Runtime limit for heating
Comp. Runtime Limit	0 to 65,535 hours	1000 hours	Runtime limit for the compressor stages
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.
Rev. Valve Action	Energize on Heat, Energize on Cool	Energize on Heat	Reverse Valve Action Settings Energize on Cool; Cool=1, Heat=0 Energize on Heat; Cool=0; Heat=1

Thermostat

This screen displays HPU2 settings related to this topic and allows access to all of these settings from a single screen.

Setting	Range	Default	Description
Type	Slink, Precon-II, Precon-III, Not Used	Slink	Type of Thermostat
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 HPU2 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.

Compressor Stages

This screen displays HPU2 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.

Backup Occ Time / 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
Hour	0 to 23	0	Hour to start occupied/unoccupied times.
Minute	0 to 59	0	Minute to start occupied/unoccupied times.

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 equipment input detects that the equipment input contact closes.	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.

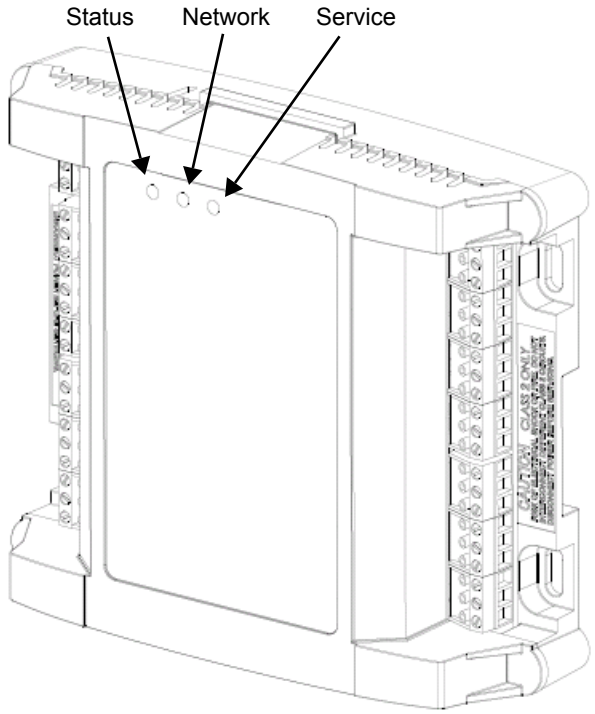
TROUBLESHOOTING

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 12: HPU2 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 a fan fault condition, the controller must be reset before proper operation can be restored.

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Problem	Solution
The fan and heat/cool 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 10K thermistor reading is at its maximum or minimum.	The input is either shorted or open.
The Heat or Cool 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 HPU2 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).
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 HPU2 controllers with the LHP2?	Use the LHP2's grouping mechanism, specifically *Members* on the LHP2 HVAC Setup screen of the LCI. Only HPU2s may be associated with the LHP2.
What is **Save** for in the *Members* screen and when do I press it?	This button stores network information into the LHP2 about the controllers in its group. Press this button when you have made any changes to the grouping.
What iWorX controllers can be part of a LHP2's group?	Only HPU2 controllers can be part of the LHP2's group and demand cooling or heating from it.
Under what conditions does the HPU2 require a reset for normal operation.	There is one condition that requires a reset: – Equipment failure

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.

TES reserves the right to provide replacement products and parts which are substantially similar in design and functionally equivalent to the defective product or part. TES reserves the right to make changes in details of design, construction, or arrangement of materials of its products without notification.

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Printed in the USA