SPECIFICATIONS

Electrical Inputs

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


Pump Flow Proof, Tower Fan Proof, Boiler Flow Proof, Basin Water Level: Dry Contact, Normally Open, 5 Volts DC Max

Electrical Outputs

Boiler1, Boiler2, Circulation Pump 1, Circulation Pump 2, Tower Spray Pump, Tower Fan, Tower Damper, Tower Sump: 24 Volts AC, 1 Amp at 50 °C, 0.5 Amps at 85 °C, limited by the Class 2 Supply rating

Cooling Tower Valve, Cooling Tower VFD Fan: 0-10 Volts DC, 2K Ohm minimum load, 8 bit resolution

Recommended Sensor Wire

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Pairs</th>
<th>Details</th>
<th>Taco Catalog No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18AWG</td>
<td>1</td>
<td>Stranded Twisted Shielded Pair, Plenum</td>
<td>WIR-018</td>
</tr>
</tbody>
</table>

Recommended LON Bus FTT-10A Network Wire

Speed: 78KBPS

Max Volts: 42.4 Volts DC

Cabling: Maximum node-to-node distance: 1312 feet (400 meters); Maximum total distance: 1640 feet (500 meters)

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Pairs</th>
<th>Details</th>
<th>Taco Catalog No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 4 22AWG (0.65mm)</td>
<td>1</td>
<td>Unshielded, Plenum, U.L. Type CMP</td>
<td>WIR-022</td>
</tr>
</tbody>
</table>

Mechanical

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

Controller Weight: 0.70 pounds (0.32 kilograms)

Shipping Weight: 1.0 pounds (0.46 kilograms)

Processor: 3150 Neuron 10 MHz

Flash: 48 Kilobytes
SRAM: 8 Kilobytes
Termination: 0.197" (5.0 mm) Pluggable Terminal Blocks, 14-22 AWG
Temperature: 32 °F to 140 °F (0 °C to 60 °C)
Humidity: 0 to 90%, non-condensing
UL Listed for US and Canada, Energy Management Equipment PAZX and PAZX7
FCC Part 15 Class A compliant

BEFORE INSTALLATION

Equipment Location

Abide by all warnings regarding equipment location provided in this document. This equipment is suitable for indoor use only. Preferably, or as required by National Electrical Code, the unit is intended to be installed within an electrical control enclosure. Operate where ambient temperatures do not exceed 140 °F (60 °C) or fall below 32 °F (0 °C) and relative humidity does not exceed 90%, non-condensing.

If the equipment is to be installed outdoors, it must be contained within a protective enclosure that maintains 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.

Avoid locations where corrosive fumes, excessive moisture, vibration or explosive vapors are present.

Avoid electrical noise interference. Do not install near large contactors, electrical machinery, or welding 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 PRECAUTIONS

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.

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.

**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).

**Power**

**Requires:** 24VAC (20VAC to 28VAC), requires an external Class 2 supply

**Consumes:** 7.2W with no external loads, maximum limited by the Class 2 supply rating
LHP - WATER SOURCE HEAT PUMP LOOP CONTROLLER

**Controlled:** 1 ea. Cooling Tower Fan (On/Off or 0-10 VDC), Tower Sump, Tower Damper, Tower Spray Pump, Cooling Tower Bypass Valve (0-10 VDC), 2 ea. Heat Pump Loop Water Pumps (On/Off), 2 ea. Boilers (On/Off)

**Sensors Required:** Heat Pump Supply Water Temp, Heat Pump Return Water Temp, Supply Water Temp, Return Water Temp

**Setup Instructions**

1. Press **Controllers** from main screen.
2. Select required LHP from controller list and press appropriate controller.
3. Press **All Settings**.
4. Press **Tower Bypass SP**.
   - The **Tower Bypass SP** menu opens.
     a. Specify **Tower Bypass Valve SP** in degrees.
     b. Press **Save**.
5. Press **Tower VFD Fan SP**.
   - The **Tower VFD Fan SP** menu opens.
     a. Specify **Tower VFD Fan SP** (cooling setpoint) in degrees. As the temperature increases above the cooling tower water setpoint, the fan speed increases.
     b. Press **Save**.
8. Press **Tower OAT Low Limit**.

9. The **Tower OAT Low Limit** menu opens.
   a. Specify **Low Limit** in degrees. This value sets the outdoor air temperature below which low limit control of the cooling tower is enabled.
   b. Press **Save**.

10. Press **Tower Bypass Valve**.

11. The **Tower Bypass Valve** menu opens.
    a. Select **Min AO (Output) Voltage** (0-10VDC). 0-2.0VDC is typical.
    b. Select **Max AO (Output) Voltage** (0-10VDC). 10.0VDC is typical.
    c. Press **Save**.
    d. Note: DO NOT change factory KP/KI settings.
        Please review Factory KP/KI Setting White Paper # 508-001.

12. Press **Tower VFD Fan**.

13. The **Tower VFD Fan** menu opens.
    a. Select **Min AO (Output) Voltage** (0-10VDC). 0-2.0VDC is typical.
    b. Select **Max AO (Output) Voltage** (0-10VDC). 10.0VDC is typical.
    c. Press **Save**.
    d. Note: DO NOT change factory KP/KI settings.
        Please review Factory KP/KI Setting White Paper # 508-001.

14. Press **Boiler Timing**.

15. The **Boiler Timing** menu opens.
    a. Select **Min On Time** in minutes.
    b. Select **Min Off Time** in minutes.
    c. Press **Save**.
16. Press **Zone Limit**.

Zone Limit

1. The **Zone Limit** menu opens.
   a. Specify the Number of zones requiring conditioned water before the cooling loop is enabled.
   b. Press **Save**.

18. Press **Circ Pump Mode**.

Circ Pump Mode

19. The **Circ Pump Mode** menu opens.
   a. Select:
      - "On demand" - Runs with call only or
      - "Continuous" - Runs continuously.
   b. Press **Save**.

20. Press **Circ OAT Low Limit**.

Circ OAT Low Limit

21. The **Circ OAT Low Limit** menu opens.
   a. Specify **Circ OAT Low Limit** in degrees. This value is the outdoor air temperature below which low limit control of the circulation pumps is enabled.
   b. Press **Save**.

22. Press **Next 8**.
23. Press **Tower Fan Mode**.

- The **Tower Fan Mode** menu opens.
  a. Select “VFD Fan” or “Stage Fan.”
  b. Press **Save**.

24. Press **Spray Pump Delay**.

- The **Spray Pump Delay** menu opens.
  a. Specify **Spray Pump Delay** in minutes.
  b. Press **Save**.

25. Press **Boiler/Tower Temp Limits**.

- The **Boiler/TowerTemp Limits** menu opens.
  a. Specify **Min Supply Water Temp** in degrees.
  b. Specify **Max Supply Water Temp** in degrees.
  c. Specify **Min Return Water Temp** in degrees.
  d. Specify **Max Return Water Temp** in degrees.
  e. Press **Save**.
31. Press **Heat Pump Limits**.

32. The **Heat Pump Limits** menu opens.
   a. Specify **Min Supply Water Temp** in degrees.
   b. Specify **Max Supply Water Temp** in degrees.
   c. Specify **Min Return Water Temp** in degrees.
   d. Specify **Max Return Water Temp** in degrees.
   e. Press **Save**.

33. Press **Water Temp Limit**.

34. The **Water Temp Limit** menu opens.
   a. Specify **Water Temp Limit** in degrees. This value is the offset subtracted from the minimum water temperature setpoints to form the water temperature low limit alarm setpoint and added to the maximum water temperature setpoints to form the water temperature high limit setpoint.
   b. Press **Save**.

35. Press **Cool Tower Setpoints**.

36. The **Cool Tower Setpoints** menu opens.
   a. Specify **Damper On** in degrees.
   b. Specify **Damper Off** in degrees.
   c. Specify **Spray Pump On** in degrees.
   d. Specify **Spray Pump Off** in degrees.
   e. Specify **Fan On** in degrees.
   f. Specify **Fan Off** in degrees.
   g. Press **Save**.

37. Press **Boiler Setpoints**.

38. The **Boiler Setpoints** menu opens.
   a. Specify **Lead Boiler On** in degrees.
   b. Specify **Lead Boiler Off** in degrees.
   c. Specify **Lag Boiler On** in degrees.
   d. Specify **Lag Boiler Off** in degrees.
   e. Press **Save**.
ASSOCIATING THE LHP2 TO OTHER IWORX® MODULES ON THE NETWORK

If the LHP2 is part of a network with the LCI2, it can be configured to be networked with other controllers. All other controllers utilizing the LHP2 for supply water should be associated.

1. Complete the steps previously detailed.
2. Press **Controllers** from main screen.
3. Select required LHP from controller list and press appropriate controller.
4. Press **HVAC Setup**.

5. Press **Members**.

6. The **Members** menu opens.

7. The LCI identifies all appropriate members within the LCI’s network of controllers.
8. Click on appropriate controller shown in gray (Not associated) to associate to the LHP.
9. A successful association changes to RED and states **MASTER: LHP2** (or LHP controller’s current name).
10. Press **Save**.
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.

<table>
<thead>
<tr>
<th>LED</th>
<th>Indication</th>
</tr>
</thead>
</table>
| 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 1: LHP2 Controller LEDs
## Troubleshooting Tips

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

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller is not running and Status LED is not illuminated.</td>
<td>No power to controller. Verify the voltage on the controller’s power connector (24 VAC).</td>
</tr>
<tr>
<td>Fan cycles on for 30 seconds then turns off.</td>
<td>The controller requires proper connection of the equipment status for proper operation. Ensure that your equipment status is working and properly wired to the controller.</td>
</tr>
<tr>
<td>The fan will not cycle on after the input fault has been corrected.</td>
<td>If the equipment was previously in a equipment status fault condition, the controller must be reset before proper operation can be restored.</td>
</tr>
<tr>
<td>How do I reset the controller?</td>
<td>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.</td>
</tr>
<tr>
<td>The 10K thermistor is reading at either its maximum or minimum.</td>
<td>The input is either shorted or open.</td>
</tr>
<tr>
<td>Can my iWorx® system contain multiple LHP2 controllers?</td>
<td>No, the system can only recognize one.</td>
</tr>
<tr>
<td>Thermistor readings fluctuate rapidly, sometimes by several degrees.</td>
<td>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.</td>
</tr>
<tr>
<td>How do I associate my other controllers with the LHP2?</td>
<td>Use the LHP2’s grouping mechanism, specifically <strong>Members</strong> on the LHP2 HVAC Setup screen of the LCI. Only HPU controllers may be associated with the LHP2.</td>
</tr>
<tr>
<td>What is <strong>Save</strong> for in the <strong>Members</strong> page, and when do I press it?</td>
<td>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 member grouping.</td>
</tr>
<tr>
<td>What controllers can be part of the LHP2’s group?</td>
<td>Only HPU controllers can be part of the LHP2’s group and demand cooling or heating from it.</td>
</tr>
<tr>
<td>Several controllers are requesting cooling or heating, but the circulation pump has not been enabled.</td>
<td>The &quot;Zone Limit&quot; setting may be set higher than the number of zones that are currently requesting cooling or heating. The circulation pump will not be enabled until the number of zones requesting cooling or heating is greater than zone limit. If the number of controllers requesting cooling or heating exceeds the zone limit but the circulation pump is still not enabled, the outside air temperature may be less than the “Outdoor Air Temp low limit.” See the outside air temperature on LCI input screen.</td>
</tr>
<tr>
<td>I only have one circulation pump and/or boiler; how can I disable lead/lag operation?</td>
<td>The lead/lag function is built into the controller and cannot be disabled. However, you can wire both circulation pump outputs in parallel from the controller to the existing pump and the system will operate normally. Do the same for the boiler if the system only has one boiler.</td>
</tr>
<tr>
<td>The cooling tower staging does not follow the setpoints that are defined.</td>
<td>Verify that the tower bypass setpoint is lower than the cooling tower setpoints. Remember, staging will not occur until the tower bypass valve has reached the 100% open position. If staging is turning off before the defined OFF setpoints, the tower bypass valve is most likely not fully open.</td>
</tr>
<tr>
<td>Does the LHP2 require a reset if a single pump fails?</td>
<td>No, only a dual pump failure requires a reset.</td>
</tr>
<tr>
<td>Under what conditions does the LHP2 require a reset for normal operation?</td>
<td>There are four conditions that require a reset:</td>
</tr>
<tr>
<td></td>
<td>– Dual pump failure</td>
</tr>
<tr>
<td></td>
<td>– Tower fan failure</td>
</tr>
<tr>
<td></td>
<td>– Dual boiler failure</td>
</tr>
<tr>
<td></td>
<td>– OAT sensor failure</td>
</tr>
</tbody>
</table>

## Additional Notes

1. To set the fan outputs for reverse action, exchange the minimum and maximum values.
2. To set the valve outputs for reverse action, exchange the minimum and maximum values.
3. To set the fan or valve outputs for reverse action, exchange the minimum and maximum values.
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.
REPRESENTATIONS AND WARRANTIES

This Document is subject to change from time to time at the sole discretion of Taco Electronic Solutions, Inc. All updates to the Document are available at www.taco-hvac.com. When installing this product, it is the reader's responsibility to ensure that the latest version of the Document is being used.

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

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

APPLICABLE DOCUMENTATION

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Audience</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>iWorx® LCI2 Application Guide, Document No. 505-002</td>
<td>Application Engineers, Installers, Service Personnel, Start-up Technicians, End user</td>
<td>Provides instructions for setting up and using the iWorx® Local Control Interface.</td>
</tr>
<tr>
<td>iWorx® LCI3 Application Guide, Document No. 505-050</td>
<td></td>
<td></td>
</tr>
<tr>
<td>iWorx® HPU2 Application Guide, Document No. 505-025</td>
<td>Application Engineers, Installers, Service Personnel, Start-up Technicians, End user</td>
<td>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.</td>
</tr>
<tr>
<td>iWorx® HPU3 Application Guide, Document No. 505-035</td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="http://www.iWorxWizard.com">http://www.iWorxWizard.com</a></td>
<td>Application Engineers, Wholesalers, Contractors</td>
<td>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.</td>
</tr>
</tbody>
</table>

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.

TES products are not intended for use to support fire suppression systems, life support systems, critical care applications, commercial aviation, nuclear facilities or any other applications where product failure could lead to injury to person, loss of life, or catastrophic property damage and should not be sold for such purposes.

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.

TES OFFERS THIS WARRANTY IN LIEU OF ALL OTHER EXPRESS WARRANTIES. ANY WARRANTY IMPLIED BY LAW INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS IS IN EFFECT ONLY FOR THE DURATION OF THE EXPRESS WARRANTY SET FORTH IN THE FIRST PARAGRAPH ABOVE.

THE ABOVE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR STATUTORY, OR ANY OTHER WARRANTY OBLIGATION ON THE PART OF TES.

TES WILL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF ITS PRODUCTS OR ANY INCIDENTAL COSTS OF REMOVING OR REPLACING DEFECTIVE PRODUCTS.

This warranty gives the purchaser specific rights, and the purchaser may have other rights which vary from state to state. Some states do not allow limitations on how long an implied warranty lasts or on the exclusion of incidental or consequential damages, so these limitations or exclusions may not apply to you.