

BTU3 Hydronic Metering Control

Self-Contained Interoperable Controller Model UCP-1 for Software Version 3

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BTU3

The BTU3 Hydronic Metering Control is a microprocessor-based controller used to monitor BTU consumption and water volume usage for up to three zones with an additional two flow inputs for leak detection.

Overview

Analog inputs are provided for the supply water temperature, return water temperature and flow for up to three zones. Analog inputs are also provided for two auxiliary inputs for leak detection. One digital output is used for a Leak Alarm Shutdown signal.

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

Features

- Supply water temperature measurement for up to three zones
- Return water temperature measurement for up to three zones
- Flow for up to three zones
- Calculation of momentary Energy Rate, Flow Rate for up to three zones
- Accumulation of BTUs per day and total BTUs for up to three zones
- Accumulation of Volume per day and total volume for up to three zones
- 31-day logs for Energy consumption and volume for up to three zones
- Configurable leak detection with "Leak Alarm" shutdown signal
- Renaming of zones/consumers up to 17 characters
- Pipe sizes of 1/4", 1/2", 3/4", 1", and 1.25" (up to 105 GPM)
- Configurable for different Flow Meter sizes
- Configurable for different Water-Glycol ratios
- Configurable for Precon-type (recommended) or VTS sensors
- LonWorks® interface to building automation systems and host products
- Automatic configuration with a Local Control Interface (LCI) touchscreen

PURPOSE OF THIS GUIDE

The *iWorx® BTU3 Application Guide* provides application information for the BTU3 Controller.

The reader should understand basic HVAC concepts, intelligent environmental control automation, and basic LON-WORKS networking and communications. This Application Guide 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

Part Number	Audience	Purpose
<i>iWorx® BTU3 Application Guide</i> , Document No. 505-014-3 (this document)	<ul style="list-style-type: none"> – Application Engineers – Wholesalers – Contractors 	Provides specific application information about the BTU series, including sequence of operation and configuration information.
<i>iWorx® LCI Application Guide</i> , Document No. 505-002	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel – Start-up Technicians – End user 	Provides instructions for setting up and using the iWorx® Local Control Interface.
<i>iWorx® VFTS Sensors with BTUPS Regulated Power Supply</i> , Document No. 502-026	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Provides specific installation and usage information for the sensor series that are most often used with the BTU series controllers.
http://www.iWorxWizard.com	<ul style="list-style-type: none"> – 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	<i>LonWorks FTT-10A Free Topology Transceiver User's Guide</i> , published by Echelon Corporation. It provides specifications and user instructions for the FTT-10A Free Topology Transceiver.	

INSTALLATION GUIDE

General



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



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



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

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

Static Electricity

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

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

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference. This equipment can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

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

BEFORE INSTALLING

About this Document

The instructions in this document are for the BTU3 module which provides nine sensor inputs.

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

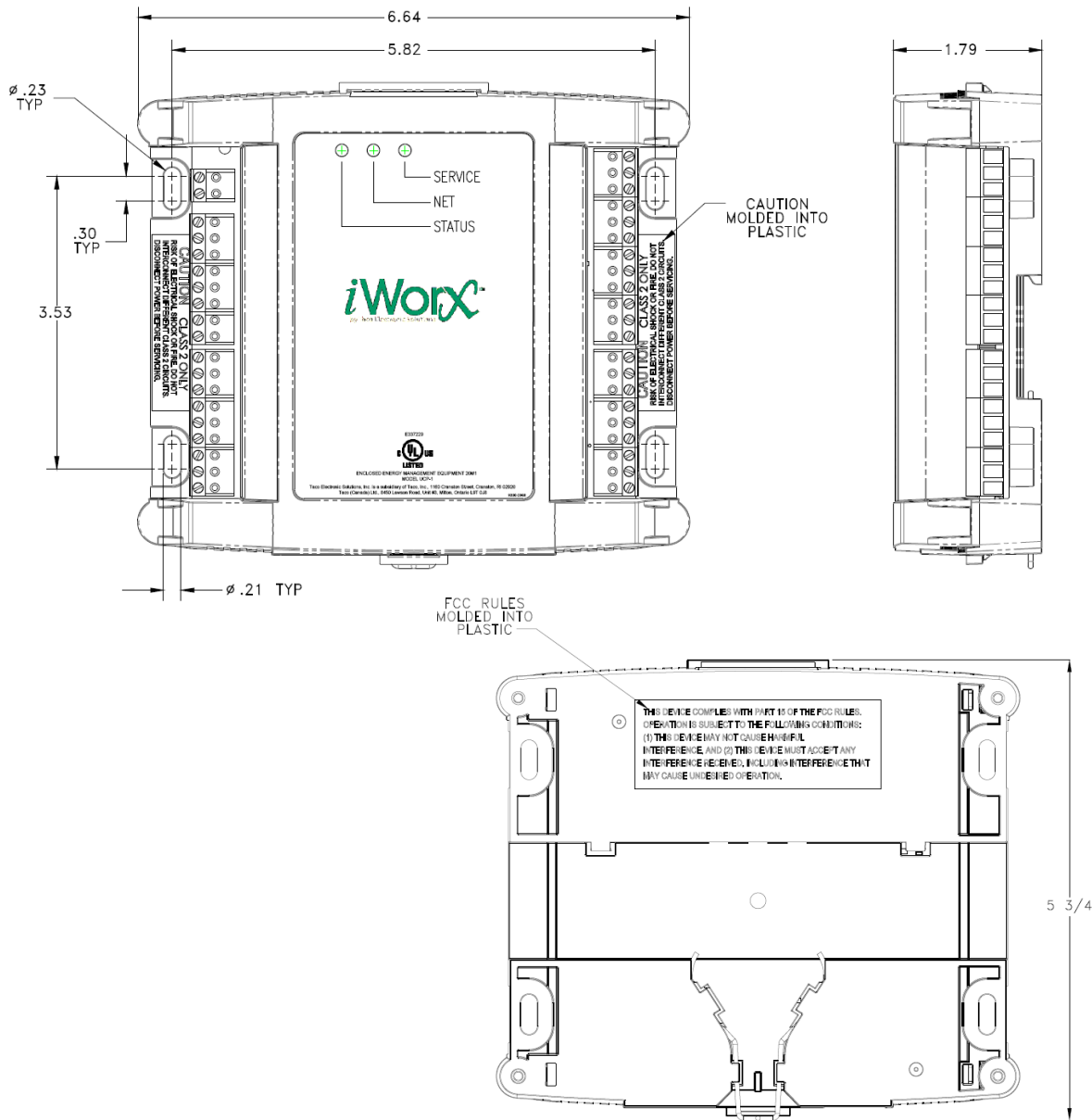


Warning: Electrical shock hazard. To prevent electrical shock or equipment damage, disconnect **ALL** power sources to controllers before installing or servicing this equipment or modifying any wiring.

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).

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).

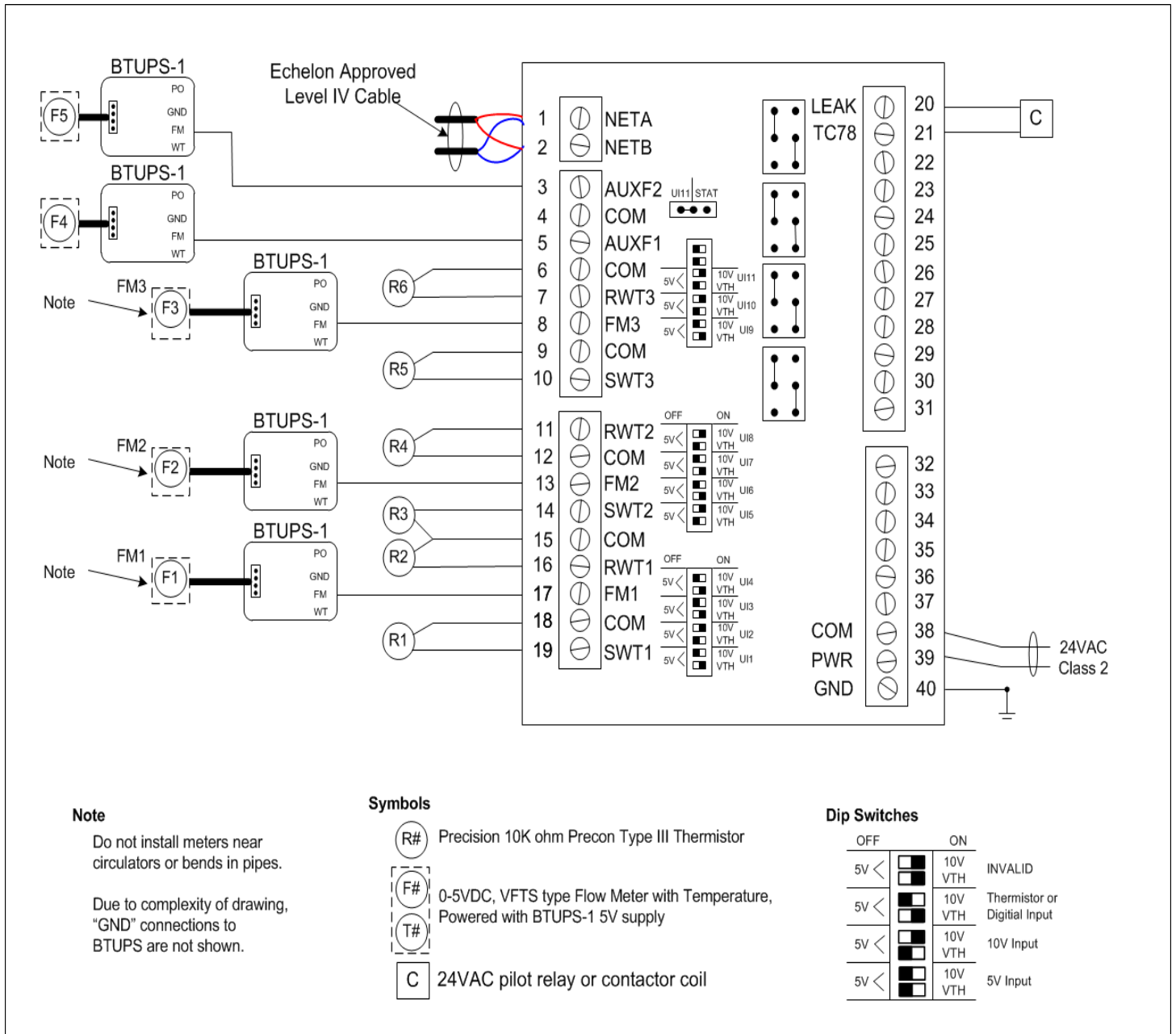
WIRING INFORMATION



WARNING: Terminals 4, 6, 9, 12, 15, 18 and 38 are connected internally on all BTU3 controllers. Disconnect **ALL** power sources when installing or servicing this equipment to prevent electrical shock or equipment damage.

NOTE: Dip switches for inputs used for flow sensors or non-thermistor temperature sensors are configured for 0-10V signals. Dip switches for inputs used for thermistors are configured for dry contact (VTH) signals.

Figure 2: Typical BTU3 with Precon Temperature Sensors and VTS Flow Sensors

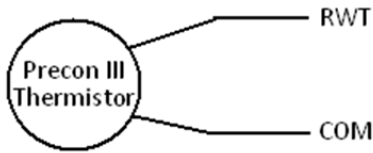


Connecting Input Devices

The figures below demonstrate typical sensor wiring.

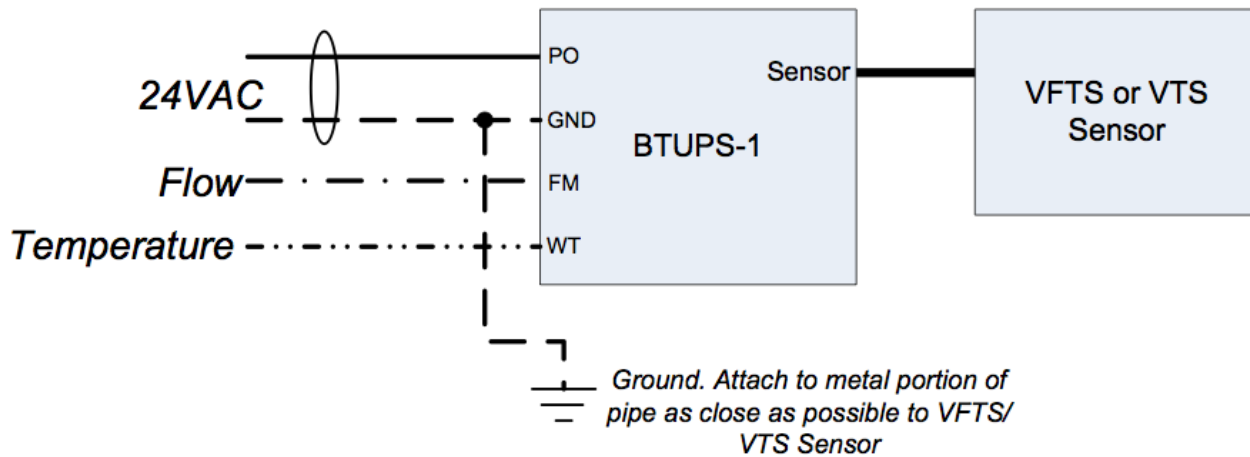
Precon II or III sensors are wired as a standard thermistor. One terminal is connected to a common pin, the other to the RWT input. Jumpers for RWT lines using Precon II or III sensors must be configured for VTH input.

Figure 3: Typical Precon III Sensor Wiring



VTS Sensors are wired in the same manner as VFTS sensor (shown below), except they do not include a flow output.

Figure 4: Typical VFTS Sensor Wiring



RWT

The RWT input is used to measure a zone's Return Water Temperature. It can accept a Precon II or III sensor. Thermistors are recommended for accuracy.

SWT

The SWT input is used to measure a zone's Supply Water Temperature. It can accept a Precon II or III sensor.

FM

The FM input is connected to a Flow Meter. This can be the flow signal of the VFTS sensor or any flow sensor that provides a 0-10V signal.

AUX1F, AUX2F

The AUXF inputs are connected to flow meters. This can be the flow signal of the VFTS sensor or any flow sensor that provides a 0-10V signal. Use identical flow meters for AUX1F and AUX2F.

Connecting Output Devices

LEAK

The LEAK 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 LEAK alarm load to LEAK (T20) and TC78 (T21).

BTUPS INSTALLATION

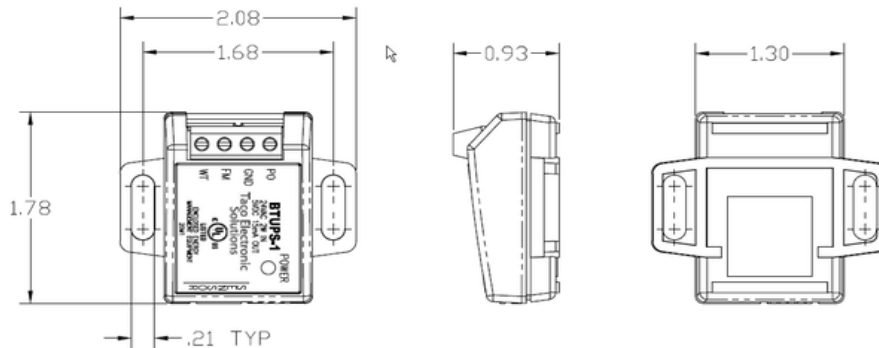


Warning: Electrical shock hazard. To prevent electrical shock or equipment damage, disconnect **ALL** power sources to controllers before installing or servicing this equipment or modifying any wiring.

Mounting the Device

1. Select a mounting location. Enclosure mounting is recommended.
2. Hold the device 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 device to the panel.
5. Wire the device (See Wiring Diagram).

Figure 5: Mounting Dimensions



Grounding the Device



The ground terminal (GND/COM) must be securely connected to a conductive pipe as close as possible to the sensor head. Failure to properly ground this equipment will result in improper operation. Improper grounding may also produce inaccurate sensor data.

VFTS INSTALLATION



It is recommended that wiring for these units not be run in the same conduit as line voltage wiring or with wiring used to supply highly inductive loads such as motors, generators, and coils.

Installing the Device

The device must be installed in the water pipe where the flow and/or temperature will be measured. The device must be installed with the flow arrow properly aligned with the direction of flow. The diagrams below provide device dimensions for the various models.

Piping Configuration



Proper piping configuration is critical for correct and accurate operation of the sensor. Please observe this section carefully and completely.

- The VFTS should be installed with the arrow on the housing pointing in the direction of flow.
- Before entering the VFTS, piping should be free of bends, pumps or obstructions for a length of at least 15 times the diameter of the pipe.
- After exiting the VFTS, piping should be free of bends, pumps or obstructions for a length of at least 5 times the diameter of the pipe.
- The VFTS can be installed in any orientation, so long as the sensor remains completely immersed. The presence of air in the pipe or the sensor housing will result in inaccurate readings.

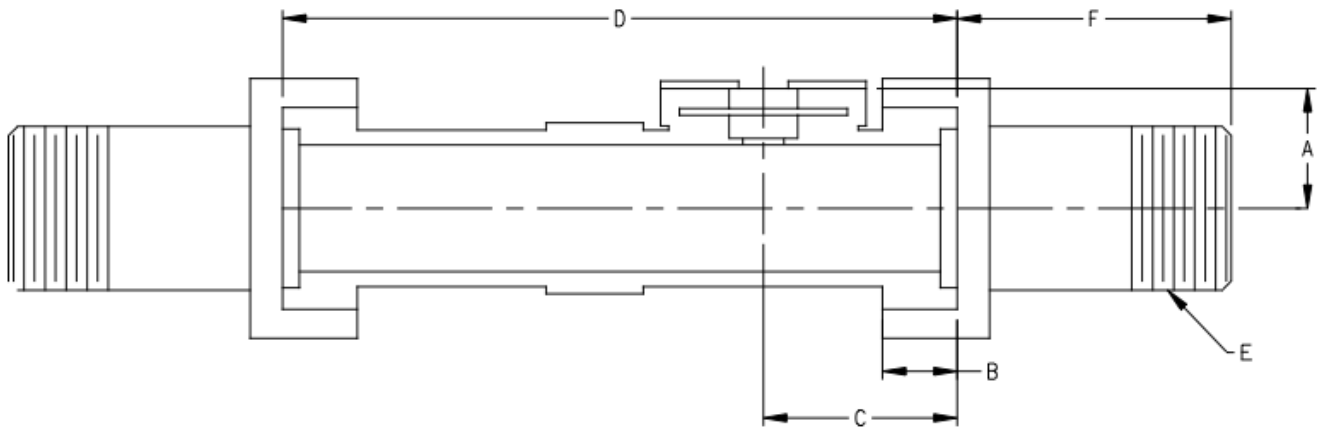
- DO NOT install NPT connections using pipe dope or thread sealant. Use 3 to 4 layers of Teflon tape to seal each joint.

Process Connections

The following process connections are used:

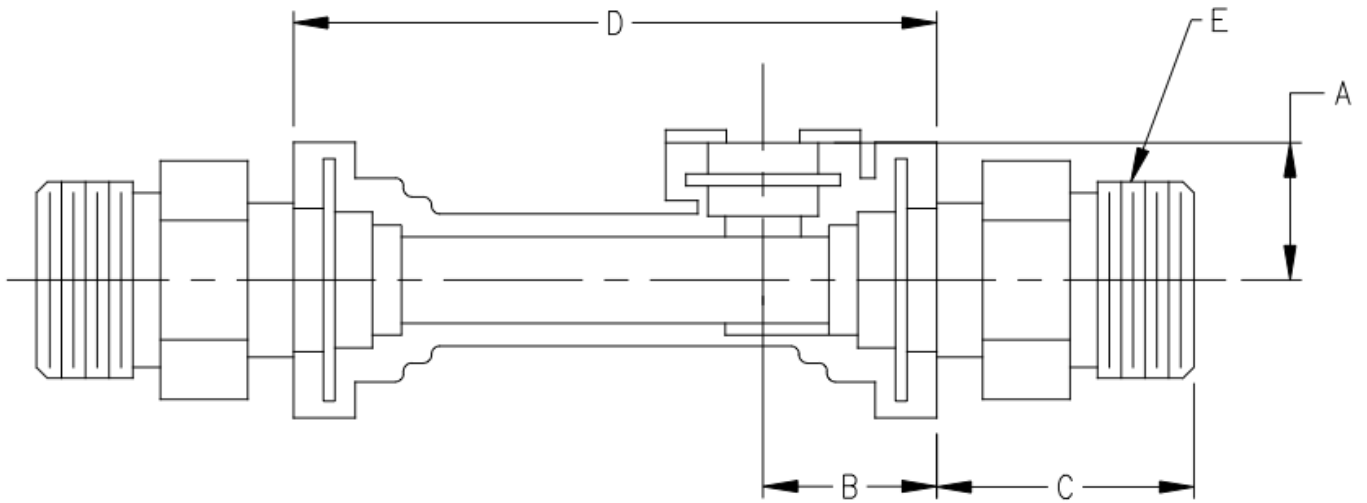
- VFTS5: 1/2" NPT (male) clip lock x 1/2" NPT (male) clip lock
- VFTS10: 3/4" NPT (male) clip lock x 3/4" NPT (male) clip lock
- VFTS26: 3/4" NPT (male) union x 3/4" NPT (male) union
- VFTS52: 1" NPT (male) union x 1" NPT (male) union
- VFTS104: 1 1/4" NPT (male) union X 1 1/4" NPT (male) union
- VTS: Special 1/2 NPT Stainless Steel Pipe Nipple with clip lock

Figure 6: Dimensions - Large Models



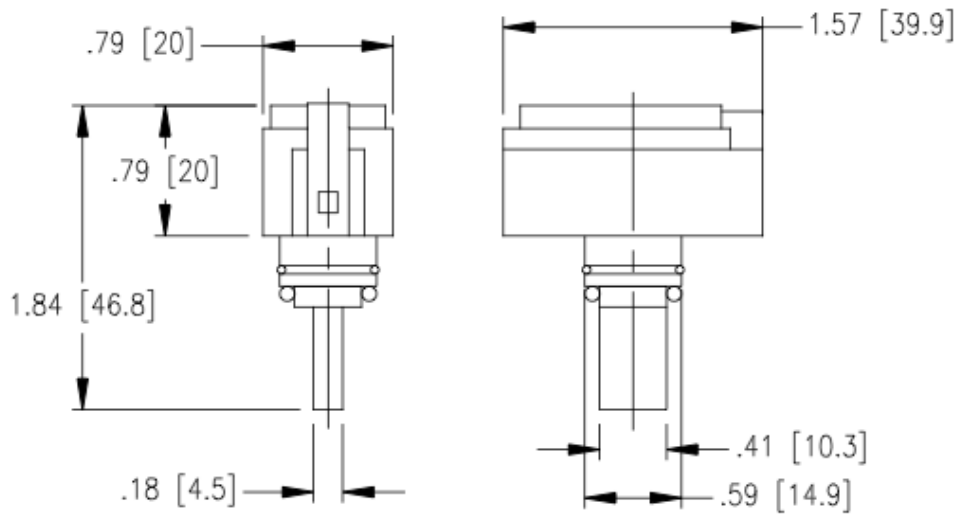
PART NO	A	B	C	D	E	F
VFTS26-1	.83 [21]	.47 [12]	1.44 [36.5]	5.08 [129]	2X 3/4 NPT	
VFTS52-1	.96 [24.5]	.60 [15]	1.56 [39.5]	5.41 [137.5]	2X 1 NPT	2.20[55.88]
VFTS104-1	1.11 [28]	.62 [15.7]	2.34 [59.5]	7.10 [180]	2X 1 1/4 NPT	

Figure 7: Dimensions - Small Models



PART NO	A	B	C	D	E
VFTS5-1	.75 [19]	.95 [24]	1.40 [35.56]	3.50 [88.88]	2X 1/2 NPT
VFTS10-1		1.0 [25.2]			2X 3/4 NPT

Figure 8: Dimensions - Sensor



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

- Sensor cabling: twisted shielded pair, 18 AWG recommended—20 feet max. (6.10 meters)
- Resolution: 10 bit

Supply Water Temperature

- Precon Type II or III 10K Thermistor

Flow for three different zones and two auxiliary flow inputs

- 0-5VDC signal from a VFTS sensor

Return Water Temperature for three different zones

- Precon Type II or III Thermistor, 0-5VDC

Outputs

Leak Detection Alarm

- 24 Volts AC, 1 Amp at 50 C, 0.5 Amps at 60 C, limited by Class 2 supply.

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).

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

Mechanical**Housing**

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

Weight

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

Electronics

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

Environmental

- Temperature: 32 °F to 140 °F (0 °C to 60 °C)
- Humidity: 0 to 90%, non-condensing

Agency Listings

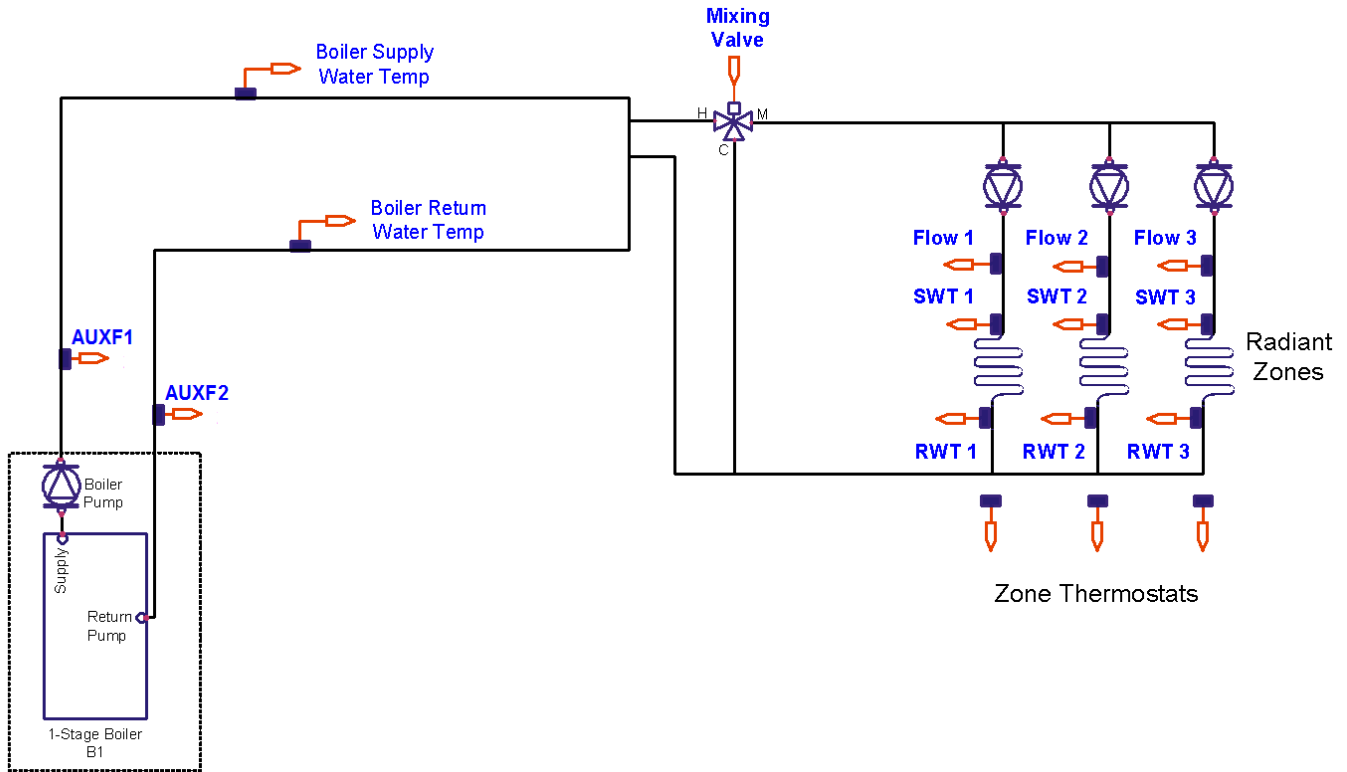
- UL Listed for US and Canada, Energy Management Equipment PAZX and PAZX7.

Agency Compliances

- FCC Part 15 Class A

APPLICATION DESCRIPTION

Figure 9: Typical BTU Metering Application



NOTE: Each flow sensor should ideally be placed at least 15 x (Pipe Diameter) away from any circulator or valve.

SEQUENCE OF OPERATION

This section describes the sequence of operation for the controller.

Energy Monitoring

The BTU3 monitors supply and return temperatures and volumetric flow rates of three zones. From these values, energy and volumetric data are calculated and made available to the LCI to display and log.

The most common and recommended installation option is to install the VFTS sensor in the Supply Water position. For greatest accuracy in temperature measurement and BTU calculations, use Precon sensors for both the supply and return temperature. However, other configurations may be used.

The water temperature sensor inputs are for thermistor or VFTS/VTS type sensors. The controller reads the temperature sensors once per second and makes the temperatures available to the LCI where they are displayed in the controller's Inputs screen.

The flow sensor inputs are scaled voltage inputs from VFTS devices. The controller reads the flow sensors once per second and makes the flow rates available to the LCI where they are displayed in the controller's Inputs screen.

The heat and cool loop temperature and flow sensors are disabled by default. To enable temperature, flow or BTU monitoring, each zones "Zone Type" must be configured in the Heat/Cool Loop Settings configuration screen:

- Temp Only - monitors only the zone temperatures, displayed on LCI Inputs screen each second.
- Flow Only - monitors only the volumetric flow, displayed on LCI Inputs screen each second.
- BTU Zone - monitors both temperature and flow, and calculates BTU energy and volume data each minute.
- Disabled - disables all monitoring for this zone.

BTU energy and volume data that is calculated each minute is displayed on the LCI in the controller's Outputs screen. Each zone has the following data:

- Daily Heating BTUs (BTU)
- Life Heating BTUs (BTU)
- Daily Cooling BTUs (BTU)
- Life Cooling BTUs (BTU)
- Daily Volume (GAL)
- Life Volume (GAL)

Daily BTUs totals and Daily Volume totals are reset to zero each day at midnight; life totals are not. All totals may be manually reset to zero by selecting "Reset Totals" from the configuration page on the LCI.

In addition to acquiring BTU data and making it available to the LCI, the controller may be configured to log the Daily BTUs and Daily Volume data. This logging occurs each day at midnight before the data has been reset to zero. The logged data is stored on the controller until it uploaded to the LCI (manually or automatically).

Each zone has both Heating and Cooling BTUs. The meaning of each depends on the configuration of the zone's "Zone Mode":

Zone Mode	Description
Auto	If the supply temperature is greater than the return temperature (i.e. the zone is heating) then BTUs are added to the Heating BTUs. If the supply temperature is less than the return temperature (i.e. the zone is cooling), BTUs are added to the cooling BTUs.
Heat	If the supply temperature is greater than the return temperature (i.e. the zone is heating) then BTUs are added to the Heating BTUs. If the supply temperature is less than the return temperature, BTUs are subtracted from the heating BTUs.
Cool	If the supply temperature is less than the return temperature (i.e. the zone is cooling) then BTUs are added to the Cooling BTUs. If the supply temperature is greater than the return temperature, BTUs are subtracted from the cooling BTUs.

The BTU3 uses the following formula to calculate the rate of heat energy flow:

$$q = (8.01 \times rho \times cp) \times f \times (\Delta T)$$

Where:

- q = rate of heat flow (Btu/hr)
- rho = density (lb/ft³)
- cp=specific heat (Btu/lb/°F)
- f = flow rate (gpm)
- dT = absolute value of the temperature change of fluid (°F)
- 8.01 = units conversion factor

To retrieve saved logs, select the "Retrieve Logs" button on the controller's screen.

NOTE: If the LCI prompts for the media instead of displaying the logs, select "\CF Card", then select the controller and press the "Retrieve Logs" button again. Perform this procedure the first time each day that the logs are retrieved.

A total of nine logs are displayed as follows:

Log Name	Description of Log Contents
Zone 1 Cool	31 daily totals of Cool loop COOLING BTUs in ascending order by date.
Zone 1 Heat	31 daily totals of Cool loop HEATING BTUs in ascending order by date.
Zone 1 Volume	31 daily totals of Cool Loop Volume in ascending order by date.
Zone 2 Cool	31 daily totals of Cool loop COOLING BTUs in ascending order by date.
Zone 2 Heat	31 daily totals of Cool loop HEATING BTUs in ascending order by date.
Zone 2 Volume	31 daily totals of Cool Loop Volume in ascending order by date.
Zone 3 Cool	– 31 daily totals of Cool loop COOLING BTUs in ascending order by date.
Zone 3 Heat	– 31 daily totals of Cool loop HEATING BTUs in ascending order by date.
Zone 3 Volume	– 31 daily totals of Cool Loop Volume in ascending order by date.

The controller is able to store 31 days of logged data. If the logged data is not manually uploaded after 31 days, the logs are automatically uploaded and saved on the LCI.

Logged data is saved in non-volatile memory on the controller before it is uploaded to the LCI - no data is lost if power is lost to the controller or LCI. If power is lost for more than one day, data for missed days shows a zero value. If power is lost for more than 31 days, logged data that has not been uploaded to the LCI is lost.

All logs uploaded to the LCI (manually or automatically) are available on the CF card.

Leak Detection

Leak detection is provided using two additional flow inputs (or electrical connection to existing flow inputs) to AUX1F and AUX2F.

When the leak alarm is enabled, the controller calculates the difference between the two auxiliary inputs. If this difference is greater than the configured setpoint for the configured amount of time, an alarm is sent to the LCI and the Leak Alarm output is energized.

CONTROLLER IDENTIFICATION

Inputs

The Inputs screen displays the current values of the BTU3's inputs. These values cannot be changed.

Name	Range	Description
Outside Temp	-30 to 230 °F (-34.4 to 110 °C)	Outside Air temperature if an ASM or CSM module is in the network.
Zone 1 Sensor	Structure	See table below.
Zone 2 Sensor	Structure	See table below.
Zone 3 Sensor	Structure	See table below.
Zone 4 Sensor	Structure	See table below.
Zone 5 Sensor	Structure	See table below.

BTU Zone Sensor (Zones 1-3)

Name	Range	Description
Mode	Auto, Heat, Cool	Mode of operation
Supply Temp	-30 to 230 °F (-34.4 to 110 °C)	Supply water temperature. This represents a hardware input.
Return Temp	-30 to 230 °F (-34.4 to 110 °C)	Return water temperature. This represents a hardware input.
Flow Rate	0 to 3.4e38 GPM	Volumetric Flow Rate calculated once per minute.
Energy Rate	0 to 3.4e35 KBTU/Hr	Energy rate calculated once per minute.

Auxiliary Zone Sensor (Zones 4-5)

Name	Range	Description
Total Volume	0 to 3.4e38 G	Volume accumulated since last reset of this zone.
Flow Rate	0 to 3.4e38 GPM	Volumetric Flow Rate.

Outputs

The Outputs screen displays the current values of the BTU3's calculated values. These values cannot be changed.

Output	Range	Description
Zone 1 Data	Structure	See table below
Zone 2 Data	Structure	See table below
Zone 3 Data	Structure	See table below

Zone Data

Name	Range	Description
Daily Heating BTUs	0 to 3.4e35 KBTU	Heating BTUs accumulated since midnight, present day
Life Heating BTUs	0 to 3.4e35 KBTU	Heating BTUs accumulated since last Reset Totals
Daily Cooling BTUs	0 to 3.4e35 KBTU	Cooling BTUs accumulated since midnight, present day
Life Cooling BTUs	0 to 3.4e35 KBTU	Cooling BTUs accumulated since last Reset Totals
Daily Volume	0 to 3.4e38 G	Volume accumulated since midnight, present day
Life Volume	0 to 3.4e38 G	Volume accumulated since last Reset Totals

Configuration

Once the BTU3 is properly installed and recognized by the Local Control Interface (LCI2), the LCI2 can be used to configure the settings of the controller. This section describes the commands available on the LCI2 for configuration of the BTU3, and the meanings and suggested values for controllers configuration parameters. For more information on using the LCI2, see the *iWorX LCI Application Guide*.

All Settings

Displays all of the BTU3's setpoints and editable settings and provides access to edit all BTU3 parameters from a single screen. Some of the parameters are structures and will be described in individual tables below this table..

Name	Range	Default	Description
Zone 1 Config	Structure	N/A	See table below
Zone 2 Config	Structure	N/A	See table below
Zone 3 Config	Structure	N/A	See table below
Zone 4 Meter	Structure	N/A	See table below
Zone 5 Meter	Structure	N/A	See table below
Leak Alarm Config	Structure	N/A	See table below
Zone 1 Name	1-17 characters	"Zone 1"	Customized name for the zone
Zone 2 Name	1-17 characters	"Zone 2"	Customized name for the zone
Zone 3 Name	1-17 characters	"Zone 3"	Customized name for the zone
Zone 4 Name	1-17 characters	"Zone 4"	Customized name for the zone
Zone 5 Name	1-17 characters	"Zone 5"	Customized name for the zone

Zone Settings for Zones 1, 2, 3

Displays all of the BTU3's editable settings for each of the three zones and provides access to edit all the parameters from a single screen.

Setting	Range	Default	Description
Zone Type	BTU Zone Flow Only Temp Only Disabled	Disabled	BTU Zone - Supply, return and flow are used to calculate BTUs. Flow Only - Flow rate is updated on LCI. Temp Only - Temperature is updated on LCI. Disabled - Inputs are not updated on LCI.
Zone Mode	Auto Heat Cool	Heat or Cool	Auto - Heating and Cooling BTUs are shown separately. Heat - Heating BTUs added and cooling BTUs subtracted. Cool - Cooling BTUs added and heating BTUs subtracted. The default is "heat" for heating loop, "cool" for cooling loop
Meter Type	ACC-VFTS 4-1 (DN8) ACC-VFTS 10-1 (DN10) ACC-VFTS 20-1 (DN20) ACC-VFTS 40-1 (DN25) VFTS 1-20 VFTS 2-40 VFTS 5-100 VFTS 10-200 VFTS 20-400 0-10V Flow Meter Disabled	VTFS 1-20	Flow meter sensor type connected to the flow input
Minimum Flow	0.00 to 1,000,000 GPM	4.0 GPM	Minimum Flow Rate when configured for 0-10V Flow Meter
Maximum Flow	0.00 to 1,000,000 GPM ⁴	800.0 GPM	Maximum Flow Rate when configured for 0-10V Flow Meter
Media Ratio	100% Water Ethylen Glycol 20% Ethylen Glycol 30% Ethylen Glycol 40% Ethylen Glycol 45% Ethylen Glycol 50% Propylen Glycol 20% Propylen Glycol 30% Propylen Glycol 40% Propylen Glycol 45% Propylen Glycol 50% TYFOCO_HTL	100% Water	Water or alcohol ratio
Supply Sensor	Precon III Precon II Not used	Precon III	Temperature sensor connected to the supply input

Setting	Range	Default	Description
Return Sensor	Precon III Precon II Not used	Precon III	Temperature sensor connected to the return input
Enable Logging	Off On	Off	Enable BTU and Volume logging - BTU Zone type configuration only
Reset Totals	No Yes	No	Reset daily and life totals for this zone to zero

Meter Settings (for Zones 4, 5)

Name	Range	Default	Description
Meter Type	VTFS 1-20 VTFS 2-40 VTFS 5-100 VTFS 10-200 VTFS 20-400 0-10V Flow Meter Disabled	VTFS 1-20	Flow meter sensor type connected to the flow input
Minimum Flow	0.00 to 1,000,000 GPM	4.0 GPM	Minimum Flow Rate when configured for 0-10V Flow Meter
Maximum Flow	0.00 to 1,000,000 GPM4	800.0 GPM	Maximum Flow Rate when configured for 0-10V Flow Meter

Leak Alarm Config

Name	Range	Default	Description
Enable Alarm	No Yes	No	Enable the Leak Alarm
Flow Difference SP	0 to 3.4e38 GPM	0 GPM	Difference in flow rates that triggers the alarm.
Alarm Delay	1 to 600 Seconds	1 Second	Time delay before alarm is triggered.
Alarm Output	Normally Open, Normally Closed	Normally Open	Leak Alarm Output type
Reset Totals	No Yes	No	Reset the accumulated flow difference and individual flow totals for zones 4 and 5.

Alarms

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

Alarm	Range	Alarm Trigger	Alarm Reset
Leak Detect	Normal, Alarm	AUXF1 differs from AUXF2 by configured amount	Equipment failure must be resolved
Input 1 Short	Normal, Alarm	HW Supply Temp sensor input indicates a short circuit	Equipment failure must be resolved
Input 1 Open	Normal, Alarm	HW Supply Temp sensor input indicates an open circuit	Equipment failure must be resolved
Input 2 Short	Normal, Alarm	HW Flow sensor input indicates a short circuit	Equipment failure must be resolved

Alarm	Range	Alarm Trigger	Alarm Reset
Input 2 Open	Normal, Alarm	HW Flow sensor input indicates an open circuit	Equipment failure must be resolved
Input 3 Short	Normal, Alarm	HW Return Temp sensor input indicates a short circuit	Equipment failure must be resolved
Input 3 Open	Normal, Alarm	HW Return Temp sensor input indicates an open circuit	Equipment failure must be resolved
Input 4 Short	Normal, Alarm	CW Supply Temp sensor input indicates a short circuit	Equipment failure must be resolved
Input 4 Open	Normal, Alarm	CW Supply Temp sensor input indicates an open circuit	Equipment failure must be resolved
Input 5 Short	Normal, Alarm	CW Flow sensor input indicates a short circuit	Equipment failure must be resolved
Input 5 Open	Normal, Alarm	CW Flow sensor input indicates an open circuit	Equipment failure must be resolved
Input 6 Short	Normal, Alarm	CW Return Temp sensor input indicates a short circuit	Equipment failure must be resolved
Input 6 Open	Normal, Alarm	CW Return Temp sensor input indicates an open circuit	Equipment failure must be resolved
Input 7 Short	Normal, Alarm	CW Supply Temp sensor input indicates a short circuit	Equipment failure must be resolved
Input 7 Open	Normal, Alarm	CW Supply Temp sensor input indicates an open circuit	Equipment failure must be resolved
Input 8 Short	Normal, Alarm	CW Flow sensor input indicates a short circuit	Equipment failure must be resolved
Input 8 Open	Normal, Alarm	CW Flow sensor input indicates an open circuit	Equipment failure must be resolved
Input 9 Short	Normal, Alarm	CW Return Temp sensor input indicates a short circuit	Equipment failure must be resolved
Input 9 Open	Normal, Alarm	CW Return Temp sensor input indicates an open circuit	Equipment failure must be resolved
Input 10 Short	Normal, Alarm	CW Flow sensor input indicates a short circuit	Equipment failure must be resolved
Input 10 Open	Normal, Alarm	CW Flow sensor input indicates an open circuit	Equipment failure must be resolved
Input 11 Short	Normal, Alarm	CW Return Temp sensor input indicates a short circuit	Equipment failure must be resolved
Input 11 Open	Normal, Alarm	CW Return Temp sensor input indicates an open circuit	Equipment failure must be resolved

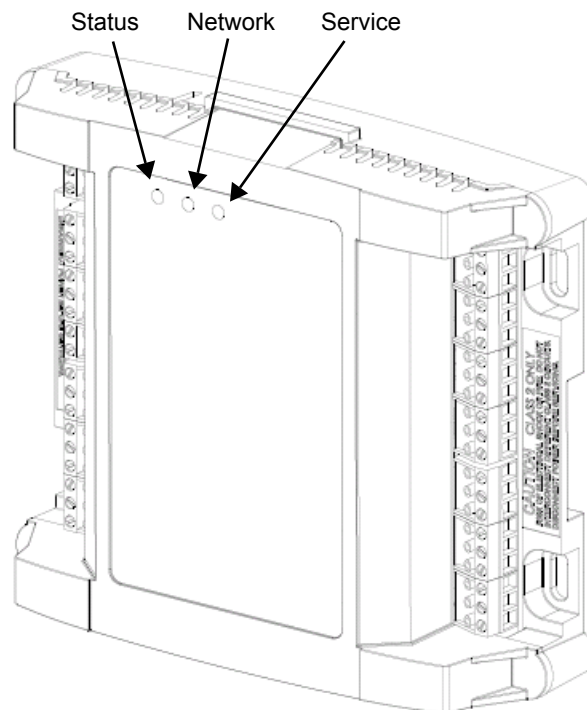
TROUBLESHOOTING

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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Illuminated when the service pin is depressed or when a controller gets configured by the LCI.

Figure 10: BTU3 Controller LEDs



Troubleshooting Tips

This section describes common problems and how to resolve them.

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 RWT or SWT reading is out of range, at minimum, or maximum.	The input is either shorted or open.
The Flow Sensor is not reading values.	<ul style="list-style-type: none"> - Has the proper sensor been selected in the "All Settings" section? - Is the cable from the VFTS plugged into the BTUPS? - Are the FM and WT wires connected to the proper BTU3 inputs? - Are the DIP switches for the FM inputs set for 10V? - Is 24VAC power connected to the BTUPS? (Its LED should be on). - Is the VFTS properly connected to a pipe ground? - Is the <i>Number of Zones</i> value in the "All Settings" section set to a number other than 0?
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.
The Flow Sensor is registering a flow even when there can be no flow in the system.	The VFTS is not properly grounded. If the pipe in which the VFTS is installed is metal, strap one end of a ground wire to the pipe as close as possible to the VFTS. If the pipe is NOT metal, find the nearest metal fitting to the VFTS and strap the ground wire to it. Make sure there is good electrical contact between the metal and the ground wire. The other end of the ground wire should be connected to the GND terminal of the BTUPS.

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.

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

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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.

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