

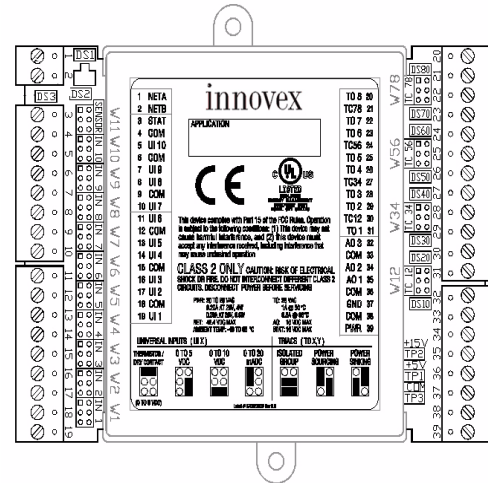
BTU-3

The BTU-3 BTU metering unit is a microprocessor based controller for metering up to three zones.

Overview

Analog inputs are provided for the supply water temperature, return water temperature and the flow for up to three zones.

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 BTU's per day and in total for up to three zones
- Accumulation of Volume per day and in total for up to three zones
- 31 day logs for Energy consumption and Flow for up to three zones
- Renaming of zones/consumers up to 7 Characters
- Pipe sizes of 1/4", 1/2", 3/4" and 1" (up to 55GPM)
- Configurable for different Flow Meter sizes
- Configurable for different Water-Glycol ratios
- Configurable for different Return Temperature sensor types (RTD, VFS or Precon)
- Configurable for BTU and Flow as well as Flow measuring only for DHW applications
- Each zone has it's own settings, and one controller can accomodate different pipe sizes, flow rates and return temerature sensors.
- LonWorks® interface to building automation systems and host products
- Automatic configuration with a Local Control Interface (LCI) touchscreen



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Purpose of This Guide

The *iWorX BTU-3 User Manual* provides application information for the BTU-3 Controller.

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

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

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Applicable Documentation

Part Number	Description	Audience	Purpose
iWorX-LCI2-USR-100	iWorX LCI User's Guide	<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>VFS Series</i>	VFS Sensor Data Sheet	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel 	Provides instructions for setting up and using the VFS Sensor series
<i>RPS Series</i>	RPS Sensor Data Sheet	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel 	Provides instructions for setting up and using the RPS Sensor series
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.		

Precautions

General



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



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 static charge you may have accumulated.
- Use a wrist strap when handling printed circuit boards. The wrist strap must be secured to earth ground.

Location

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.

This equipment is suitable for both indoor and outdoor use. 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 185 °F (85 °C) or fall below -40 °F (-40 °C) and relative humidity does not exceed 90%, non-condensing.

For Installation in the United States

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.

For Installation in the European Community

This equipment meets the requirements of the European Community Directives for Electromagnetic Compatibility (EMC Directive 89/336/EE).

Before Installing

About this Document

The instructions in this document are for the BTU-3 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 flow meters, sensors, actuators, etc.
- Cabling, cabling raceway, and fittings necessary to connect this equipment to the power source, FTT-10A network and peripheral devices.

Equipment Location



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

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

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

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

Selecting a Power Source

This equipment requires a UL recognized or CE marked (as appropriate) 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.

To provide necessary RFI and transient protection, the controller's ground (GND) pin (T37) must be connected to earth ground. Failure to properly ground the controller may cause it to exceed FCC & CE limits. Excessive noise could also produce inaccurate sensor data. The power source must be capable of operating with this connection to ground.

Installation

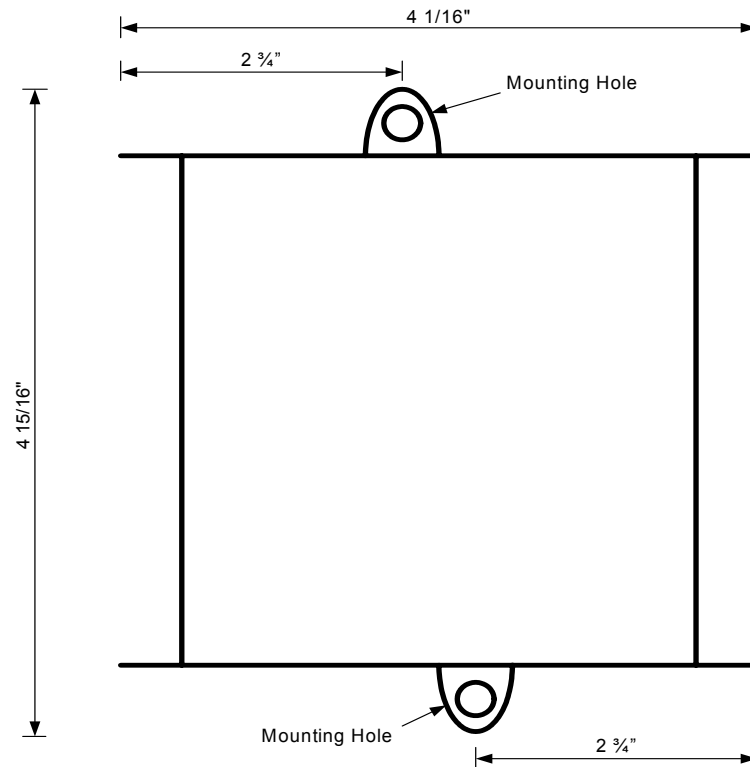


Warning: Electrical shock hazard. To prevent electrical shock or equipment damage, disconnect **ALL** power sources to controllers before installing or servicing this equipment or modifying any wiring.

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 (T37) 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.



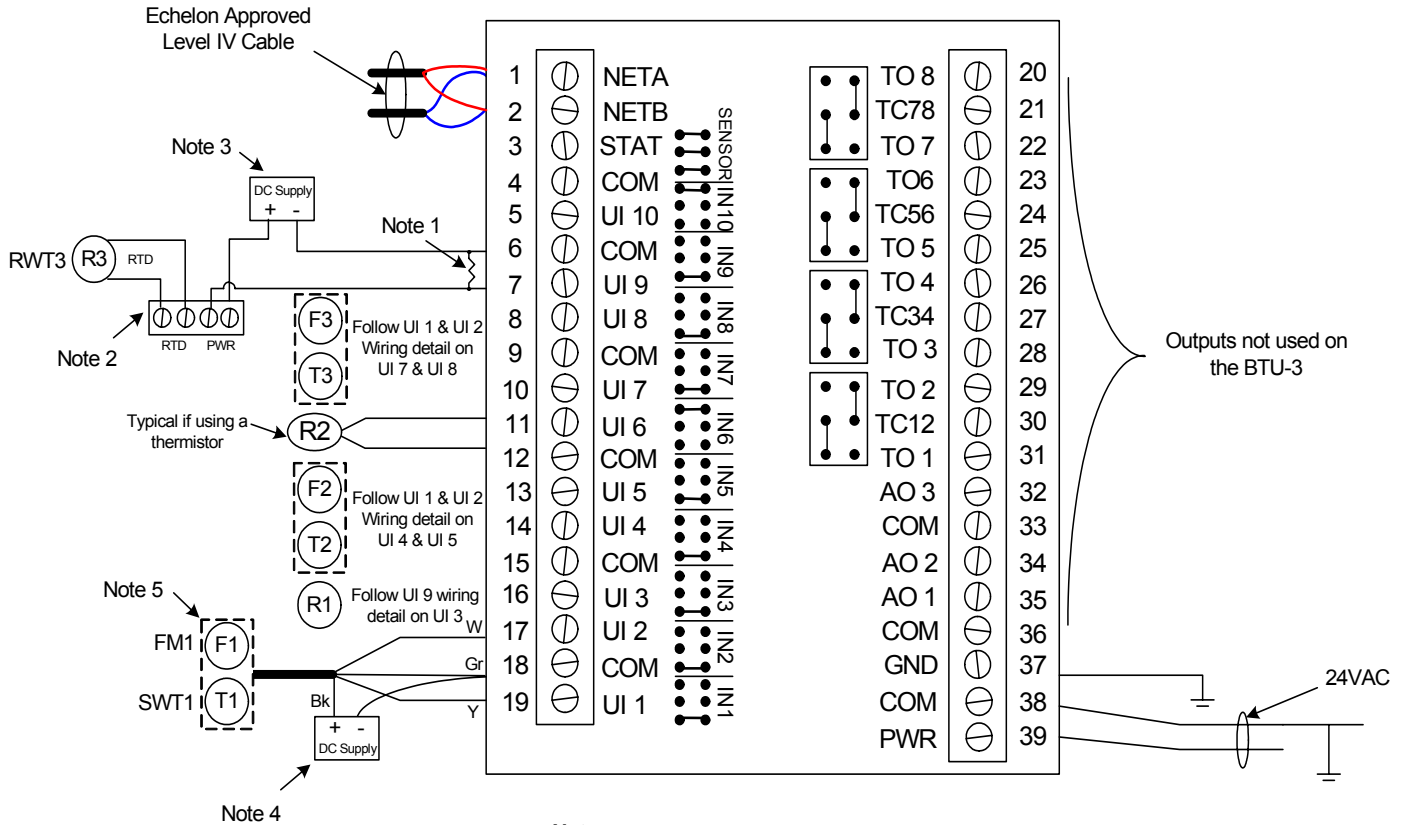
For best performance, connect the power supply common terminal (T38) to the same external point as the ground terminal (T37).

Wiring Information



WARNING: Terminals 4,6,9,12,15 and 18 are connected internally on all BTU-3 controllers. Disconnect **ALL** power sources when installing or servicing this equipment to prevent electrical shock or equipment damage.

BTU-3 Wiring Details

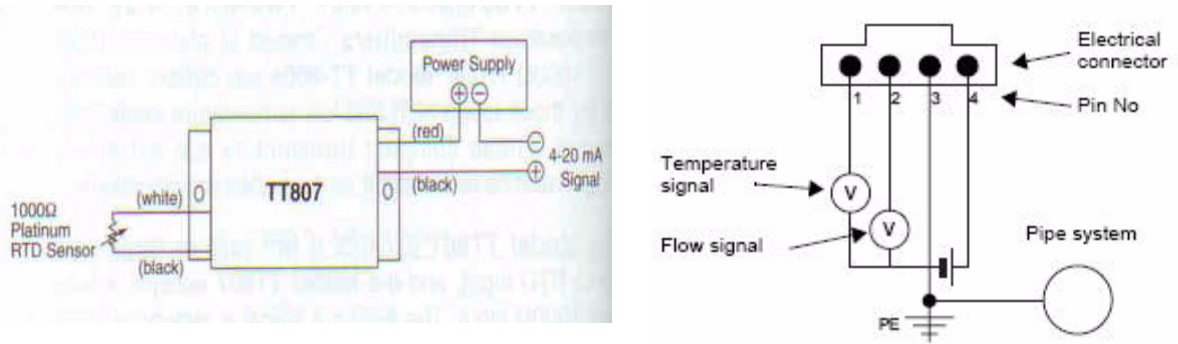


- Notes:**
1. Install a precision 500 ohm resistor across input
 2. Wiring detail for the RTD sensor transmitter
 3. 8.5 to 35 VDC power supply not provided
 4. 5 VDC power supply, +/- 5% not provided
 5. May also be used to measure RWT instead of the RTD sensor transmitter.

Flow Sensors are in Position UI 2, UI 5 and UI 8, Supply Temperature Sensors are in Position UI 1, UI 4 and UI 7.

Jumpers for All Sensors except Thermistors must be in the 0-10V position shown on the label of the controller. Thermistor type return temperature sensors must be jumpered in the Thermistor/Dry Contact position.

Note: The above Figure is an Example, it needs to be customized for the requirements of the job. Positions and wiring of sensors need to be checked carefully.

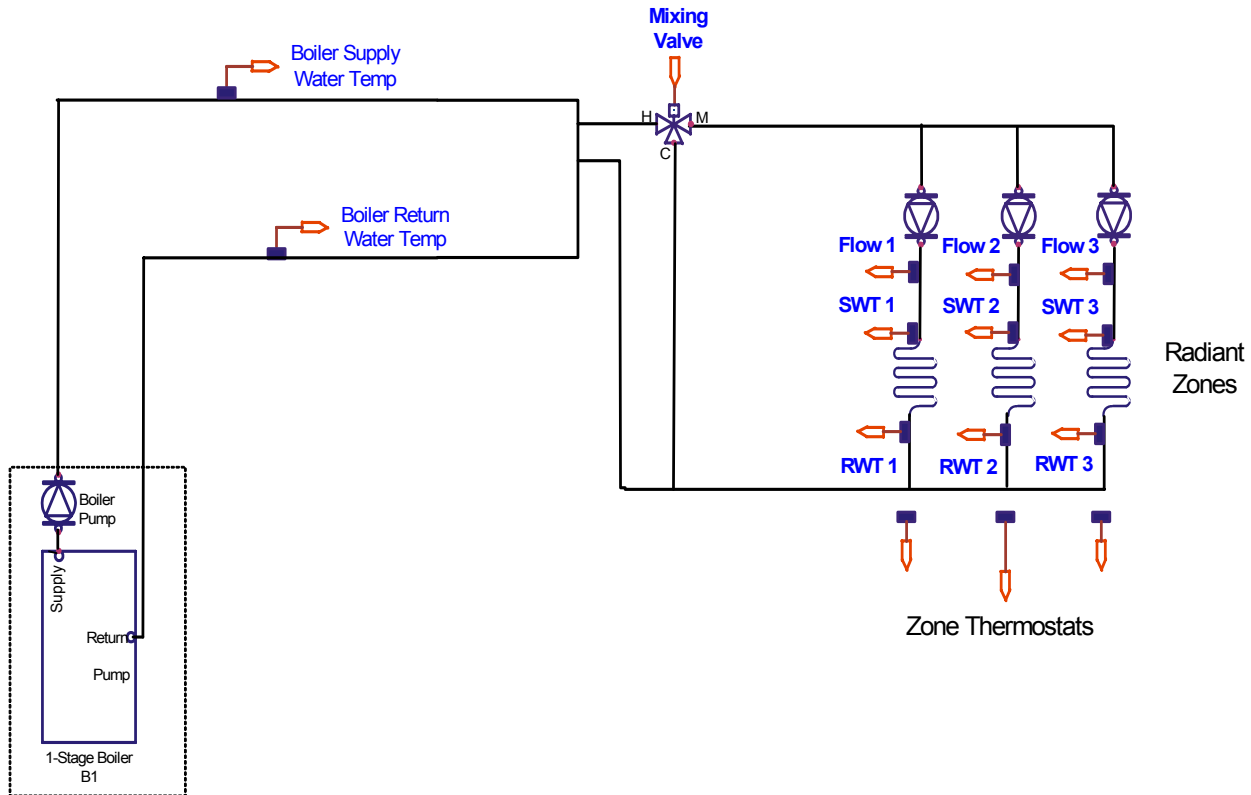


a) (left)RTD Sensor Type TT807: 4-20mA signal must be converted with a high precision resistor. Please check in with technical department about the size of the resistor.

b) (right)VFS/RPS Sensor Type: The Sensor com must be wired into any of the BTU controller coms (Pin 18) as well as the com on the power supply.

Applications

Figure 1: Typical BTU Metering application



Sequence of Operation

This section describes the sequence of operation for the controller.

Supply Water Temperature

The supply water temperature sensor input is for a 0-10 V scaled device. The controller reads the sensor and converts it to a temperature once a second. The converted value is made available for the energy calculation.

Return Water Temperature

The return water temperature sensor input is for a thermistor, RTD sensor or VFS/RPS type sensor. The controller reads the sensor and converts it to a temperature once a second. The converted value is made available for the energy calculation.

Flow

The flow sensor input is a 0 to 10 Volt scaled device. Every second, the controller reads the sensor and converts the reading to a flow measurement. The converted value is made available for the energy calculation.

Electrical Energy Consumption Monitoring

The BTU-3 monitors the supply and return temperature as well as the flow of a radiant sub-system. The values are measured every second and every minute an average is calculated. The system then calculates an energy rate value in BTU/Hr, a volume rate in l/s, a daily total heat consumption and a total heat consumption in BTU, a daily total volume and a total volume in l. The system uses the formula:

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

Where:

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

The heat flow depends on the liquid used in the system as well as the temperature at the time of the measurement.

All the calculated values are accumulated until the end of an interval(day).

Heat consumption and flow are accumulated and logged for 31 consecutive days. The oldest value will be overridden after 31 days have lapsed.

BTU-3 Configuration

Once the BTU-3 is properly installed and recognized by the Local Control Interface (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 BTU-3, and the meanings and suggested values for controllers configuration parameters. For more information on using the LCI, see the *iWorX LCI User's Guide*.

List All Settings

Displays all of the BTU-3's setpoints and editable settings and provides access to edit all BTU-3 parameters from a single screen, some of the parameters are structures and will be described in individual tables below this table..

Table 1: All BTU-3 Settings

Setting	Range	Default	Description
Zone 1 Meter	1-20l/min, 2-40l/min, 5-100l/min, 10-200l/min	5-100l/min	Meter type by minimal and maximum flow
Zone 2 Meter	1-20l/min, 2-40l/min, 5-100l/min, 10-200l/min	5-100l/min	Meter type by minimal and maximum flow
Zone 3 Meter	1-20l/min, 2-40l/min, 5-100l/min, 10-200l/min	5-100l/min	Meter type by minimal and maximum flow
Zone 1 Name		Zone 1	Individual name for the zone
Zone 2 Name		Zone 2	Individual name for the zone
Zone 3 Name		Zone 3	Individual name for the zone
Water-Glycol Ratio	Water, 20 % Ethylene glycol, 30 % Ethylene glycol, 40 % Ethylene glycol, 50 % Ethylene glycol, 20 % Propylene glycol, 30 % Propylene glycol, 40 % Propylene glycol, 50 % Propylene glycol,	Water	Water glycol ratio used in the system
Number of Zones	1-3	1	Number of active zones on this controller.
Zone 1 Sensor	Supply Position, Return Position	Supply Position	Position, where the flow sensor is located
Zone 2 Sensor	Supply Position, Return Position	Supply Position	Position, where the flow sensor is located

Table 1: All BTU-3 Settings (Continued)

Setting	Range	Default	Description
Zone 3 Sensor	Supply Position, Return Position	Supply Position	Position, where the flow sensor is located
Zone 1 Reset	Yes/No	No	Zone counters will be reset
Zone 2 Reset	Yes/No	No	Zone counters will be reset
Zone 3 Reset	Yes/No	No	Zone counters will be reset
Zone 1 Temp	0-5V VFS/RPS, 0-10V RTD, PreconIII PreconII	0-5V VFS/RPS	Type of Temperature Sensor used
Zone 2 Temp	0-5V VFS/RPS, 0-10V RTD, PreconIII PreconII	0-5V VFS/RPS	Type of Temperature Sensor used
Zone 3 Temp	0-5V VFS/RPS, 0-10V RTD, PreconIII PreconII	0-5V VFS/RPS	Type of Temperature Sensor used
Zone 1 RTD Type	30-230DegF	30-230DegF	Supported temperature range for RTD sensor
Zone 2 RTD Type	30-230DegF	30-230DegF	Supported temperature range for RTD sensor
Zone 3 RTD Type	30-230DegF	30-230DegF	Supported temperature range for RTD sensor

Inputs

The Inputs screen displays the current values of the BTU-3's inputs. These values cannot be changed.

Table 2: BTU-3 Inputs

Input	Range	Description
Outside Temp		Networked Outside Air Temperature, if an ASM-2 module is in the network
Zone 1 Supply	32 to 212 °F (0 to 100 °C)	Temperature for Zone 1 reported by the supply temperature sensor.
Zone 2 Supply	32 to 212 °F (0 to 100 °C)	Temperature for Zone 2 reported by the supply temperature sensor.
Zone 3 Supply	32 to 212 °F (0 to 100 °C)	Temperature for Zone 3 reported by the supply temperature sensor.
Zone 1 Return	32 to 212 °F (0 to 100 °C)	Temperature for Zone 1 reported by the return temperature sensor
Zone 2 Return	32 to 212 °F (0 to 100 °C)	Temperature for Zone 2 reported by the return temperature sensor
Zone 3 Return	32 to 212 °F (0 to 100 °C)	Temperature for Zone 3 reported by the return temperature sensor

Outputs

The Outputs screen displays the current values of the BTU-3's calculated values. These values cannot be changed.

Table 3: BTU-3 Outputs

Output	Range	Description
Zone 1 Data	Structure	See table 4 below
Zone 2 Data	Structure	See table 4 below
Zone 3 Data	Structure	See table 4 below
Zone 1 Mode	N/A, Heat, Cool	Displays the mode of the radiant system. N/A means no flow detected. Heat means that the system is in heating mode, cool means, that the system is in cooling mode
Zone 2 Mode	N/A, Heat, Cool	Displays the mode of the radiant system. N/A means no flow detected. Heat means that the system is in heating mode, cool means, that the system is in cooling mode
Zone 3 Mode	N/A, Heat, Cool	Displays the mode of the radiant system. N/A means no flow detected. Heat means that the system is in heating mode, cool means, that the system is in cooling mode
Zone 1 Meterg	BTU and Flow(DHW), Flow (DHW) only	Allows the selection between full BTU metering with BTU and Flow, or metering the flow for DHW for Zone 1
Zone 2 Meterg	BTU and Flow(DHW), Flow (DHW) only	Allows the selection between full BTU metering with BTU and Flow, or metering the flow for DHW for Zone 2
Zone 3 Meterg	BTU and Flow(DHW), Flow (DHW) only	Allows the selection between full BTU metering with BTU and Flow, or metering the flow for DHW for Zone 3

Table 4: Zone Data Structure

Name	Range	Description
Energy Rate	depends on the installed flow sensor	Calculated rate of heat flow . Please see DataSheet for possible ranges
Flow Rate	depends on the installed flow sensor	Flow per minute. Please see DataSheet for possible ranges
Total Vol Day	1E38 l	Total accumulated volume for the current day.
Total Vol	1E38 l	Total accumulated volume
Total Vol [K]	65535 G(l)	Total accumulated volume in Kilo
Total BTU Day	1E38 IBTU	Total accumulated heat consumption for the current day
Total BTU	1E38 IBTU	Total accumulated heat consumption
Total BTU [K]	65535 KBTU	Total accumulated heat consumption in kilo

Troubleshooting

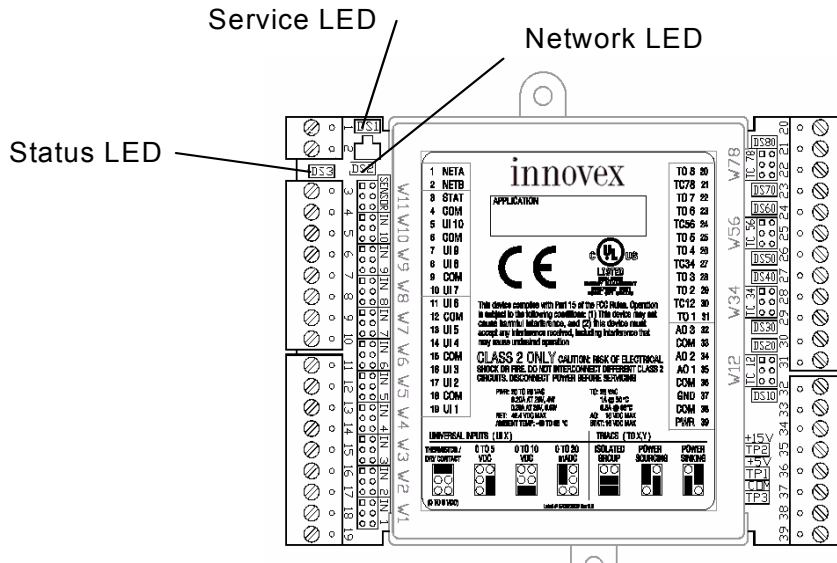
Diagnostic LEDs

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 top to bottom on the unit.

Table 5: Controller LED Indicators.

LED	Indication
Service	– Illuminated when the service pin is pushed
Status	– Solid green when running and configured by an LCI – Flashing green when running and NOT configured by an LCI – Solid red when a fault condition exists – Blinking Red - the controller has a device failure – Solid Amber - The controller has not received a LCI ping message in over 10 mins
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

Figure 2: BTU-3 Controller LEDs



Troubleshooting Tips

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 10K thermistor reading is at its maximum or minimum.

The input is either shorted or open.

The Flow Sensor is not reading values

- Has the proper sensor been selected in the “All Settings” - section?
- Is the cable plugged in and is the Sensor connected to a 5VDC Power supply?
- Is the sensor properly grounded?
- Are the wires connected to the proper input?
- Is the sensor connected to the right zone?
- Is the number of zones set to a value other than 0 in the “All Settings”- section?
- Is the sensor installed in the direction of the flow?
- Is the right sensor for the specific flow installed.
- The sensor is a dual sensor measuring temperature and flow. Is the flow wired into the input for flow and the temperature wired into the temperature input?

Return sensor is not reading values

- Has the proper return sensor type selected in the “All Settings” section?
- Is the sensor connected to the right power supply (sensor type RTD 9-35VDC, sensor type RPS 0-5VDC, sensor type Precon II/III - no power supply)?
- Is the jumper in the position for the selected sensor type.
- Is the sensor properly grounded?

BTU log or Volume Log is not displaying any values

Number of zones must be > 0

BTU log or Volume Log does not update it's values

The old BTU/Volume log must be saved on CF or SD card before a new log can be retrieved. This step is necessary to protect the data from inadvertently being overwritten.

The BTU Metering controller does not sound a beep, when service-pinned in

- Make sure you are following the wiring instructions, the type of wire recommended.
- Do not use different gauge wires.

An online demonstration can be found online at

<http://BTU.innovextechnologies.com>

Please contact konni@innovextechnologies.com for access to the demo.

