iWorx by Taco Electronic Solutions

Application Guide

505-053

Universal Exhaust Fan Controller - 3 Zones

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

SUPERSEDES: March 4, 2016

EFFECTIVE: April 1, 2016

Plant ID: 001-4260

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XFC1

The XFC1 Universal Exhaust Fan Controller is a stand-alone microprocessor-based controller for supply and exhaust fan control. The application may require fan control for static pressure, temperature, air quality or ON/OFF control. The fan may be two-state or modulated.

Overview

The Exhaust Fan Controller (XFC) is designed to turn fans on and off and/or modulate them based on a predetermined occupancy schedule, demand input, and input from static pressure, temperature, and/or Air Quality sensors.

In addition to the Smoke Detection and Demand Inputs that are common to all zones, each of the three (3) zones has the following inputs and outputs:

- One digital input for fan status
- One analog input for pressure, temperature or air quality (CO, CO2 or NO2)
- One additional analog input for air quality (CO, CO2 or NO2)
- One digital output for ON-OFF fan control or fan enable
- One analog output for modulated fan control

Features

- Flexible configuration for three independent fan control zones
- Each zone supports multiple control strategies:
    - Static Pressure control with optional Air Quality input
    - Temperature control with optional Air Quality input
    - Air Quality control with two independent air quality inputs
    - Demand (ON-OFF) control with two independent air quality inputs
    - Occupied (ON-OFF) control with two independent air quality inputs
- Air Quality supports detection of CO, CO2, NO2
- All Sensors configured to operate Always, when Occupied or when Demand Input is ON
- Support for both Digital and Modulated Fans
- Support for both Supply and Exhaust Fan positions
- Individual Zone Reset
- Alarm/Event reporting for:
    - Smoke Detection
    - Fan Proof
    - Air Quality
    - High and Low Pressure
    - High and Low Temperature
    - Runtime Maintenance
- Local backup schedule with separate weekend and weekday schedules
- Commissioning mode for direct control
- LonWorks interface to building automation systems and host products
- Automatic configuration with the LCI
- Datapoints exposed through network variables

PURPOSE OF THIS GUIDE

The *iWorx® XFC1 Application Guide* provides application information for the Exhaust Fan Controller.

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

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

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APPLICABLE DOCUMENTATION

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

Description	Audience	Purpose
iWorx® LCI Application Guide, Document No. 505-002	– Application Engineers – Installers – Service Personnel – Start-up Technicians – End user	Provides instructions for setting up and using the iWorx® Local Control Interface.
http://www.iWorxWizard.com	– Application Engineers – Wholesalers – Contractors	An on-line configuration and submittal package generator based on user input. Automatically generates bill of materials, sequence of operations, flow diagrams, wiring diagrams, points and specifications.
Additional Documentation	*LonWorks FTT-10A Free Topology Transceiver User's Guide,* published by Echelon Corporation. It provides specifications and user instructions for the FTT-10A Free Topology Transceiver. See also: www.echelon.com/support/documentation/manuals/transceivers.	

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INSTALLATION INSTRUCTIONS

General

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

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

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

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

Static Electricity

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

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

FCC Compliance

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

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

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

BEFORE INSTALLING

About this Document

The instructions in this manual are for the XFC1 module which supports an Exhaust Fan Controller.

Inspecting the Equipment

Inspect the shipping carton for damage. If damaged, notify the carrier immediately. Inspect the equipment for damage. Return damaged equipment to the supplier.

What is Not Included with this Equipment

- A power source for the equipment electronics and peripheral devices.
- Tools necessary to install, troubleshoot and service the equipment.
- The screws or DIN rail needed to mount the device.
- Peripheral devices, such as sensors, actuators, etc.
- Cabling, cabling raceway, and fittings necessary to connect this equipment to the power source, FTT-10A network and peripheral devices.

Equipment Location

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

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

If the equipment is to be installed outside, it must be contained within a protective enclosure. The enclosure must maintain internal temperature and humidity within the ranges specified for this equipment.

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

Selecting a Power Source

This equipment requires a UL recognized Class 2 external power source (not supplied) to operate. The controller power input requires a voltage of 24 Volts AC.

To calculate power source current requirements, add the power consumption of all peripheral devices to that of the controller.

The controller and sensor power supplies can use the same power source. If both are using the same power source, the loads must have EMF protection. This protection can be integral to the load, or installed in the 24 VAC wiring across the load's coil.

To provide necessary RFI and transient protection, the controller's ground (GND) pin (T40) must be connected to earth ground or the earth ground of the packaged unit's enclosure ground. Failure to properly ground the controller may cause it to exceed FCC limits. Excessive noise could also produce inaccurate sensor data. The power source must be capable of operating with this connection to ground.

INSTALLATION

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

Mounting the Device

1. Select a mounting location. Enclosure mounting is recommended.
2. Hold the controller on the panel you wish to mount it on. With a marker or pencil mark the mounting locations on the panel.
3. Using a small drill bit pre-drill the mounting holes.
4. Using two #6 pan head screws, mount the controller to the panel.
5. Wire the controller (See Routing Cabling to the Device).

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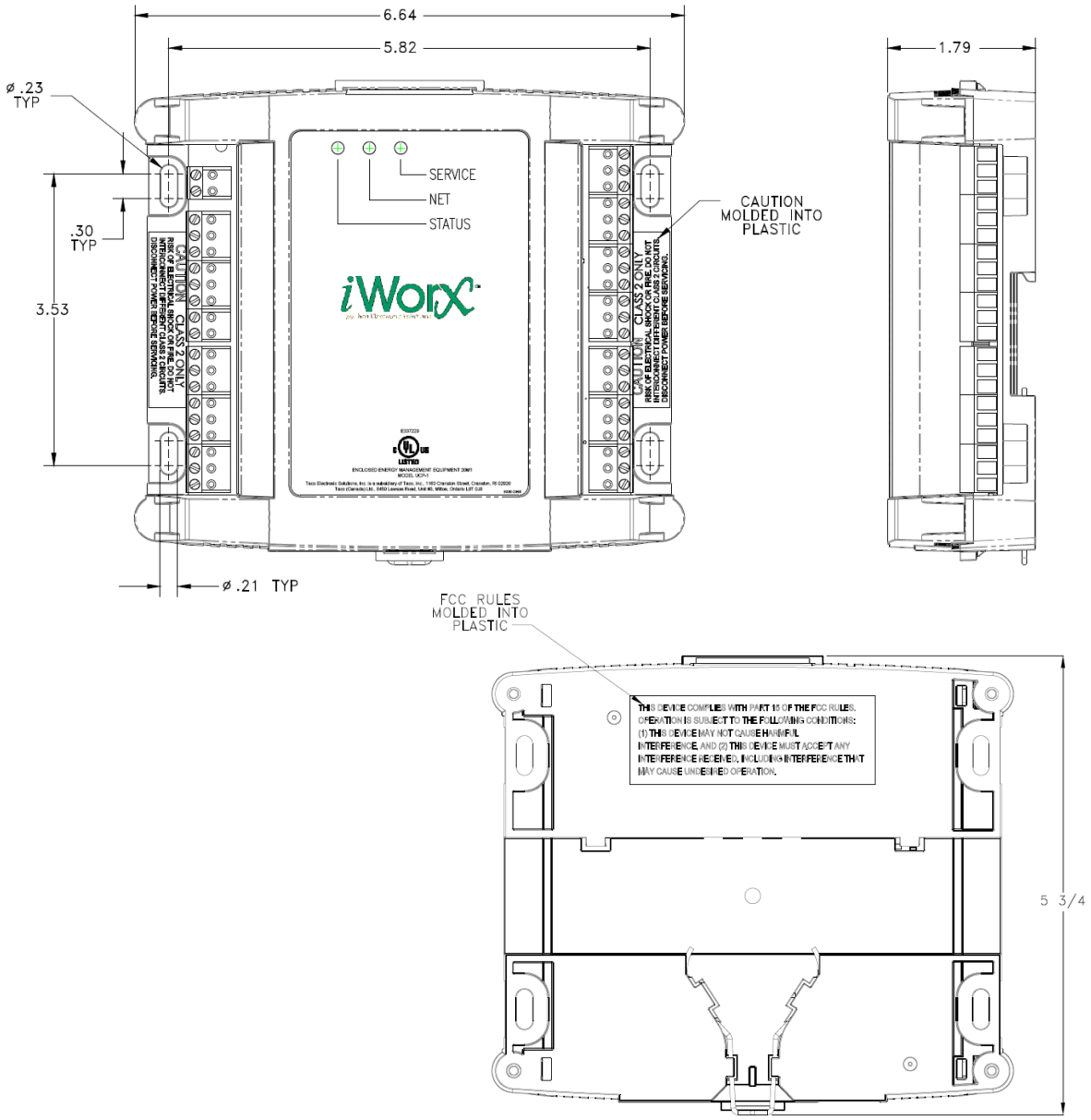
Figure 1: Mounting Dimensions



Routing Cabling to the Device

Cabling used to connect the power source and cabling used to connect the FTT-10A network must remain separated within the control enclosure and wiring conduit.

Grounding the Device

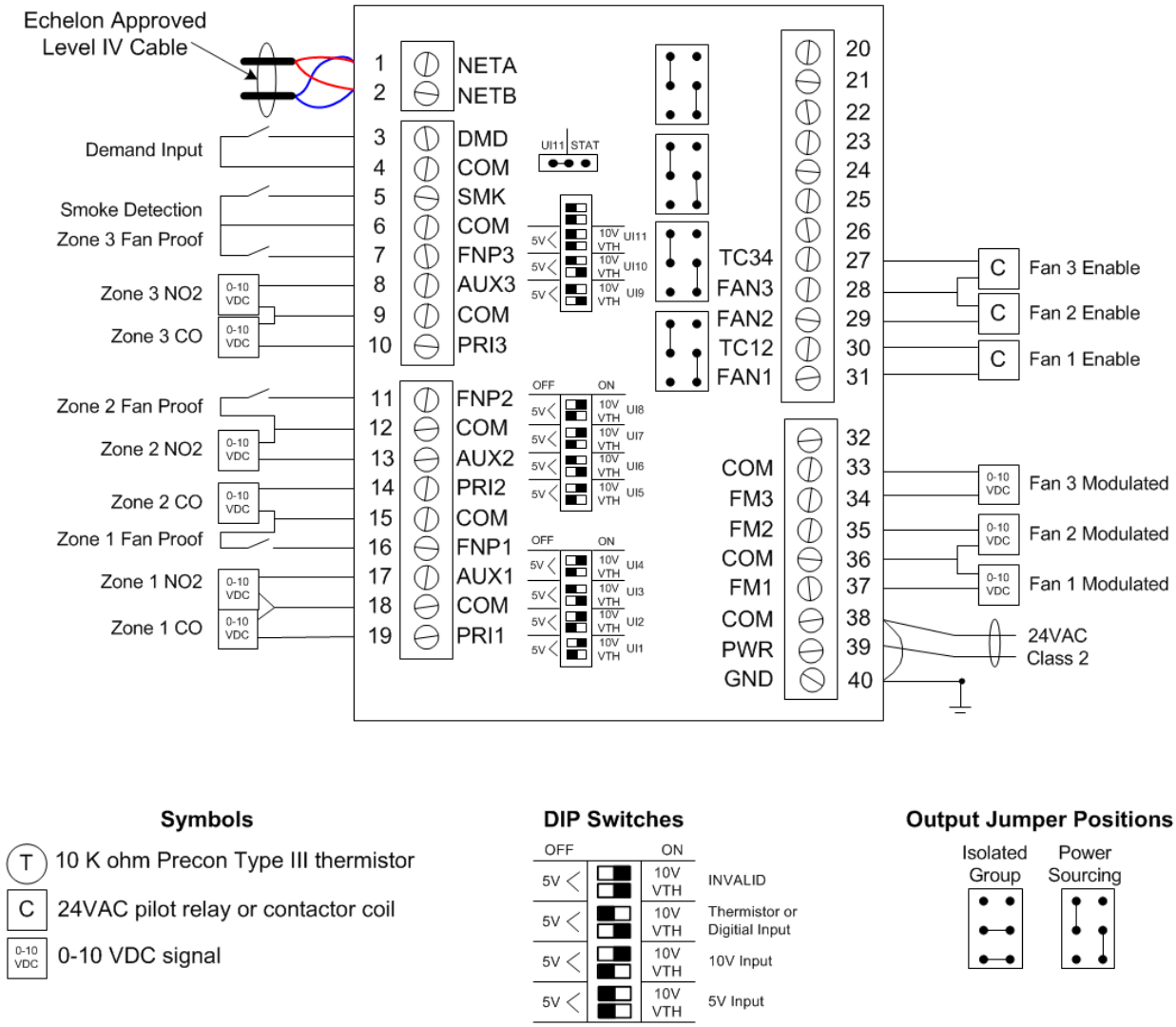
The ground terminal (T40) must be securely connected to earth ground. Failure to properly ground this equipment will result in improper operation. Improper grounding may also increase the risk of electrical shock and may increase the possibility of interference with radio/TV reception.

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

WIRING INFORMATION

WARNING: Terminals 6, 9, 12, 15 and 18 are connected internally on XFC1 controllers. Disconnect **ALL** power sources when installing or servicing this equipment to prevent electrical shock or equipment damage.

Figure 2: XFC1 Configured for Occupancy with CO and NO2 Override - Power Sourcing



Symbols

- T — 10 K ohm Precon Type III thermistor
- C — 24VAC pilot relay or contactor coil
- 0-10 VDC — 0-10 VDC signal

DIP Switches

Output Jumper Positions

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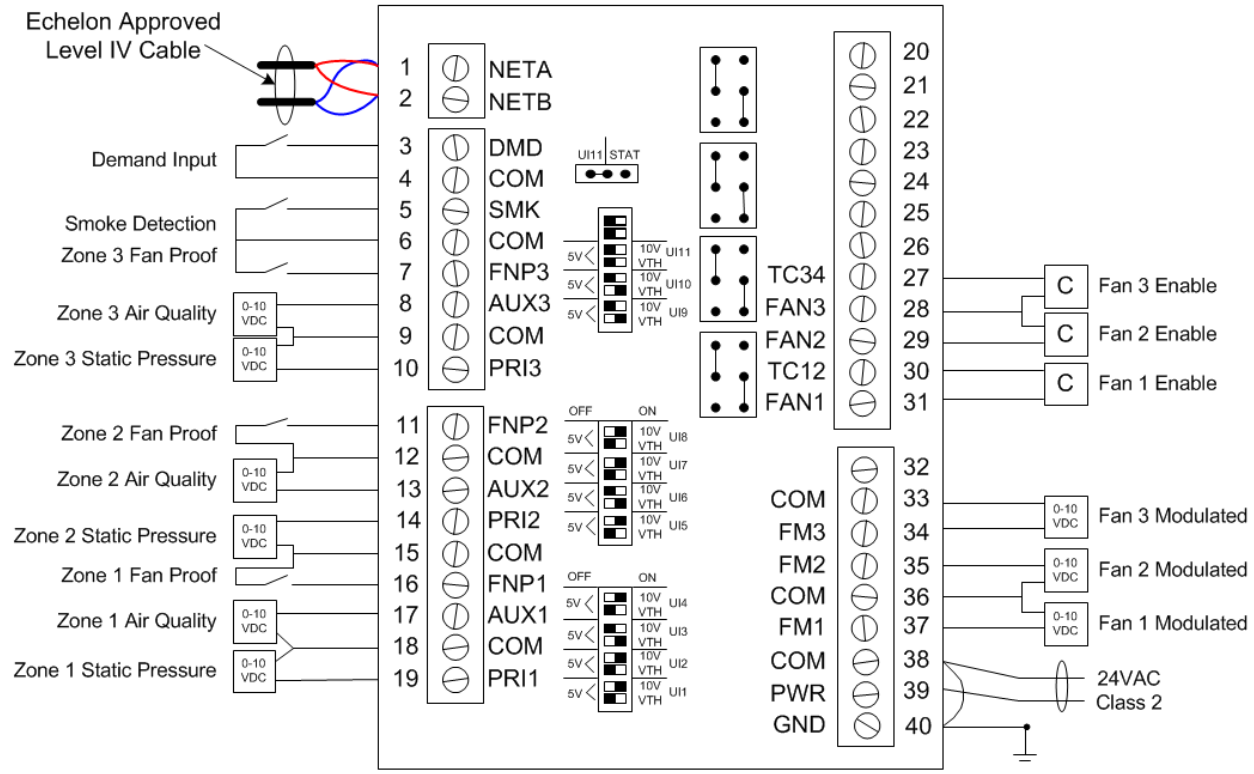
Figure 3: XFC1 Configured for Static Pressure and Air Quality Override - Power Sourcing



Symbols

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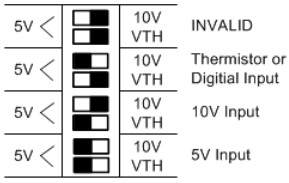
C 24VAC pilot relay or contactor coil

0-10 VDC 0-10 VDC signal

DIP Switches



Output Jumper Positions

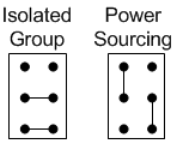
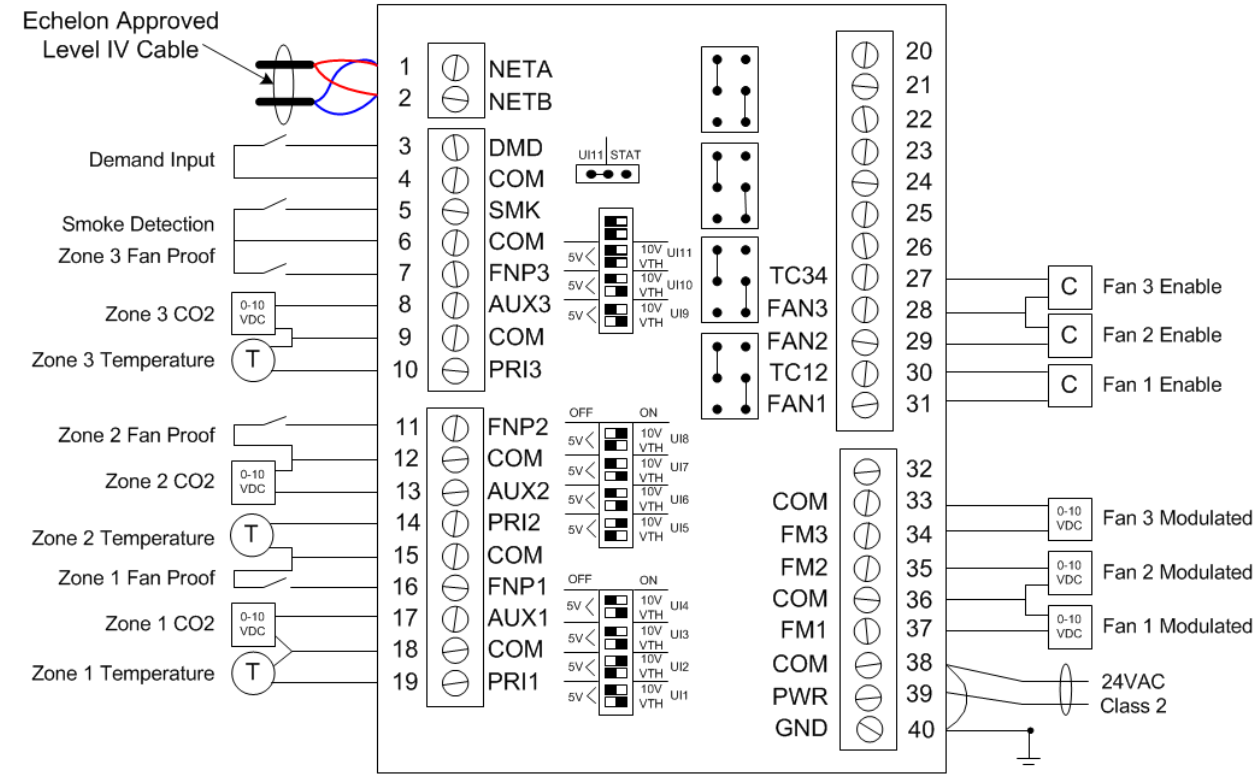


Figure 4: XFC1 Configured for Temperature and Air Quality Override - Power Sourcing



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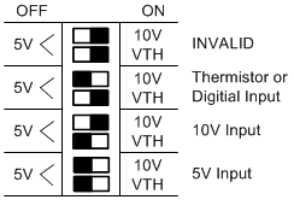
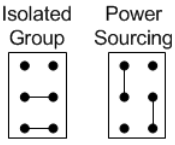


Output Jumper Positions



Connecting Input Devices

Demand Input (DMD)

This is a digital, dry contact style input. To connect the demand input sensor to the controller, connect one wire from the demand to DMD (T3) and the other wire to the adjacent common (T4).

Smoke Detection (SMK)

This is a digital, dry contact style input. To connect the smoke sensor to the controller, connect one wire from the sensor to SMK (T5) and the other wire to the adjacent common (T6).

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Temperature Input (PRI1, PRI2, PRI3)

Each zone's priority input may be used for Precon III temperature sensor input. To connect the Precon III temperature sensor to the controller, connect one wire from the sensor to the PRI1, PRI2 or PRI3 input (T19, T14 or T10) and the other wire to the adjacent common (T18, T15 or T9).

Pressure Input (PRI1, PRI2, PRI3)

Each zone's priority input may be used for 0-10V pressure sensor input. To connect the 0-10V pressure sensor to the controller, connect the positive wire from the sensor to the PRI1, PRI2 or PRI3 input (T19, T14 or T10) and the other wire to the adjacent common (T18, T15 or T9).

Air Quality Input (PRI1, PRI2, PRI3, AUX1, AUX2, AUX3)

Each zone's priority and auxiliary inputs may be used for 0-10V air quality sensor input. The air quality sensor may be designed to detect any air quality contaniment such as CO2, NO2 and CO. To connect the 0-10V air quality sensor input sensor to the controller, connect the positive wire from the sensor to the PRI1, PRI2, PRI3, AUX1, AUX2 or AUX3 input (T19, T14, T10, T17, T13 or T8) and the other wire to the adjacent common (T18, T15, T9, T18, T12 or T9).

Fan Proof Input (FNP1, FNP2, FNP3)

Each zone's priority input must be used for fan proof sensor input. To connect the fan proof sensor to the controller, connect one wire from the sensor to the FNP1, FNP2 or FNP3 input (T16, T11 or T7) and the other wire to the adjacent common (T15, T12 or T6). To use a zone with no fan proof input, connect the FAN input directly to the adjacent common.

Connecting Output Devices

Digital Fan Enable (FAN1, FAN2, FAN3)

The fan enable must be connected to a 24 VAC pilot relay if the load is greater than 1 ampere. If the load is less than 1 ampere, connect the fan enable to FAN1, FAN2 or FAN 3 (T31, T29, T28) and the adjacent common (T30 or T27).

Modulated Fan (FM1, FM2, FM3)

The modulated fan output is set from 0 to 10V through the control logic. Connect the positive wire from the fan actuator to FM1, FM2 or FM3 (T37, T35, T34) and the other wire to the adjacent common (T36 or T33).

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

Smoke Detection, Demand: Dry Contact, Normally Open, 5 Volts DC Max

Temperature: Precon Type III 10K Thermistor

Pressure Sensor, Air Quality Sensor: 0-10 Volts DC

Fan Proof Sensor: Dry Contact, Normally Open, 5 Volts DC Max

Electrical Outputs

Fan Modulation: 0-10 Volts DC, 2K Ohm minimum

Digital Fan Enable: 24 Volts AC, 1 Amp at 50 °C, 0.5 Amps at 60 °C, limited by Class 2 supply

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

Recommended Sensor Wire

Maximum Length: 500 feet (152 meters)

Cable Type	Pairs	Details	Taco Catalog No.
18AWG	1	Stranded Twisted Shielded Pair, Plenum	WIR-018

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)

Cable Type	Pairs	Details	Taco Catalog No.
Level 4 22AWG (0.65mm)	1	Unshielded, Plenum, U.L. Type CMP	WIR-022

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

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

FCC Part 15 Class A compliant

SEQUENCE OF OPERATION

The controller uses a flexible configuration scheme to support three independent fan zones configured for one of the following fan control strategies:

Occupancy (ON-OFF)	Fan speed is based on occupancy and two air quality sensors. Fan speed is a configured constant rate.
Demand (ON-OFF)	Fan speed is based on the demand input and two air quality sensors. Fan speed is a configured constant rate.
Air Quality	Fan speed is based on occupancy or demand and two air quality sensors. Fan speed is a configured constant rate.
Temperature	Fan speed is modulated based on temperature read on the primary sensor. The auxiliary sensor may optionally be used for air quality.
Pressure	Fan speed is modulated based on pressure read on the primary sensor. The auxiliary sensor may optionally be used for air quality.

Each independent fan zone implements its control strategy using the occupancy state, the demand input and the input from none, one or two sensors. When a zone uses both sensors and the fan speeds determined from them differ, the highest fan speed is used.

Sensors are configured as “Disabled,” enabled when “Occupied,” enabled on “DMD Input,” or “Always” enabled. When a sensor is not used, it must be configured to “Disabled”:

Disabled	Ignore sensor input
Occupied	Enable sensor input when the controller is occupied.
DMD Input	Enable sensor when the demand input is ON.
Always	Always enable sensor input regardless of the occupied or demand states.

Air Quality Inputs

Temperature and Pressure control strategies have one sensor (AUX) available for air quality; Demand, Occupancy and Air Quality control strategies have two sensors (PRI, AUX) available for air quality.

If the contaminant level rises above the configured *Fan Purge Setpoint*, the fan runs immediately at the configured *Air Quality PURGE* speed. The fan stays at that speed until the contaminant level falls below the configured *Control Hysteresis*. If the contaminant level rises above the configured *Alarm Setpoint*, an alarm is sent to the LCI.

Having two air quality setpoints for each sensor (Fan *Purge Setpoint*, and *Alarm Setpoint*) allows the controller to attempt to clear the air of contaminants before sending alarms that could potentially become a nuisance. To take advantage of the dual setpoints, configure the zone's *Fan Purge Setpoint* to a lower value than the *Alarm Setpoint*.

Note that air quality monitoring is only performed when the sensor is enabled. When multiple sensors are independently monitoring contaminant levels, the fan runs at the highest fan speed based on the two sensors.

Air quality sensor voltage and PPM ranges are configured values. The only restriction on air quality sensors are the maximum of 6,553 ppm, and the resolution of 0.1 ppm. This is sufficient for most CO2, CO and NO2 air quality applications.

Air Quality Control Strategy

Both sensors are available for air quality monitoring with the Air Quality control strategy. Unused sensors must be configured to “Disabled.”

For each sensor in the zone, a constant fan speed is determined based on the air quality and either the occupancy state or demand input. The constant fan speed is the configured *Air Quality PURGE Speed*, the *Continuous ON Speed*, or *OFF* (configured *Minimum Voltage*); the highest fan speed from the two sensors is the final fan speed.

Fan speed determined from each sensor is:

- OFF when the sensor is disabled
- *Continuous ON Speed* when the sensor is enabled
- *Air Quality PURGE Speed* when the contaminant level is above the purge setpoint and the sensor is enabled

The Air Quality control strategy is summarized in the following table:

Table 1: Air Quality Control Strategy

Sensor Configuration	Demand/Occupancy	Air Quality	Resulting Fan Speed
DMD Input / Occupied	Off / Unoccupied	*below* purge setpoint	OFF (Min Voltage)
		above purge setpoint	OFF (Min Voltage)
	On / Occupied	*below* purge setpoint	Continuous ON Speed
		above purge setpoint	Air Quality PURGE Speed
Always	-	*below* purge setpoint	Continuous ON Speed
		above purge setpoint	Air Quality PURGE Speed

Note that the primary and auxiliary sensors are configured independently allowing the two sensors to monitor contaminant levels at different times.

Demand and Occupancy Control Strategies

The Demand control strategy uses the demand input to determine the fan speed; the Occupancy control strategy uses the controller's occupancy state to determine the fan speed. This is the only difference between these two control strategies.

As with the Air Quality control strategy, both sensors are available for air quality monitoring and unused sensors must be configured to *Disabled*.

A constant fan speed is determined based on the air quality and either the occupancy state or demand input. The constant fan speed is the configured Air Quality PURGE Speed, the Continuous ON Speed, or OFF (configured Minimum Voltage); the highest fan speed from the two sensors is the final fan speed.

Fan speed determined from each sensor is:

- OFF when the Demand Input is Off (or the Occupancy state is Unoccupied)
- *Continuous ON* speed when the Demand Input is On (or the Occupancy state is Occupied)
- *Air Quality PURGE* speed when the contaminant level is above the purge setpoint and the sensor is enabled.

The Demand and Occupancy control strategies are summarized in the following table:

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Table 2: Demand or Occupancy Control Strategy

Sensor Configuration	Demand/Occupancy	Air Quality	Resulting Fan Speed
DMD Input / Occupied	Off / Unoccupied	*below* purge setpoint	OFF (Min Voltage)
		above purge setpoint	OFF (Min Voltage)
	On / Occupied	*below* purge setpoint	Continuous ON Speed
		above purge setpoint	Air Quality PURGE Speed
Always	Off / Unoccupied	*below* purge setpoint	OFF (Min Voltage)
		above purge setpoint	Air Quality PURGE Speed
	On / Occupied	*below* purge setpoint	Continuous ON Speed
		above purge setpoint	Air Quality PURGE Speed

Note that when the sensor is configured as Always and the Demand is Off (or the Occupancy state is Unoccupied), the fan remains OFF (Min Voltage) as long as the contaminant level is below the purge setpoint. This contrasts with all other strategies including the Air Quality control strategy described previously.

Note also that the primary and auxiliary sensors are configured independently allowing sensors to monitor air quality at different times.

Static Pressure Control Strategy

The Static Pressure control strategy uses the primary sensor for static pressure control and the auxiliary sensor for optional air quality monitoring. Each sensor determines a fan speed; the highest fan speed is the final fan speed. If the auxiliary sensor is not used, it must be configured to “Disabled.”

High and *Low Pressure Alarm Offset* values are configured. These values represent a change in pressure from the configured *Setpoint*. When the pressure exceeds an alarm offset, an alarm is sent to the LCI. The High Pressure alarm is configured with *High Pressure Action* to either stop the fan or allow the fan to continue running when the pressure exceeds the *High Pressure Alarm Offset*. The configured *Alarm Delay* delays the sending of alarms and possible stopping of the fan.

Note that the low pressure alarm is cleared when pressure returns back above the *Low Pressure Alarm Offset*; however, the high pressure condition does not clear automatically. To clear the high pressure alarm condition and allow the fan to run again, the *Reset Zone* setting in the Zone Cfg configuration page must be set to "Yes" and saved. This action does not affect the other two zones. This condition is also cleared when the controller is reset; however, resetting the controller resets all three zones. The ability to reset an individual zone is unique to the XFC1 controller.

The fan speed determined from the primary sensor input is a modulated value that is increased or decreased by incremental amounts (steps) to achieve the static pressure setpoint. The configured *Control Hysteresis* defines two bands around the static pressure setpoint:

- The wide band - this is the configured *Control Hysteresis*.
- The narrow band - this is 75% of the wide band.

The primary sensor fan speed is modulated until the static pressure is within the narrow band. The fan speed is held constant until the static pressure falls outside the wide band, which causes the fan speed to be modulated again until the static pressure is within the narrow band again.

If the auxiliary sensor is disabled or is enabled and the contaminant level is below the setpoint, the auxiliary sensor has no effect on the fan speed; if the auxiliary sensor is enabled and detects that the contaminant level is above the setpoint, the fan speed is set to the *Air Quality PURGE Speed*.

The fan is:

- *OFF* when the primary sensor is not enabled.
- *Modulated* to maintain the static pressure to setpoint when the primary sensor is enabled.

- *Air Quality PURGE Speed* when the contaminant level is above the purge setpoint and the auxiliary sensor is enabled.

Note that the primary and auxiliary sensors are configured independently allowing the static pressure to be controlled independently from air quality monitoring.

Fan speeds determined from the primary and auxiliary sensors are combined to generate a single fan speed. The effect of each sensor on the fan speed is summarized in the following tables:

Table 3: Static Pressure Control Strategy - Primary Sensor

Sensor Configuration	Demand/Occupancy	Resulting Fan Speed
DMD Input / Occupied	Off / Unoccupied	OFF (Min Voltage)
	On / Occupied	Modulated based on pressure
Always	-	Modulated based on pressure

Table 4: Static Pressure Control Strategy - Auxiliary Sensor

Sensor Configuration	Demand/Occupancy	Air Quality	Resulting Fan Speed
DMD Input / Occupied	Off / Unoccupied	*below* purge setpoint	No effect
		above purge setpoint	No effect
	On / Occupied	*below* purge setpoint	No effect
		above purge setpoint	Air Quality PURGE Speed
Always	-	*below* purge setpoint	No effect
		above purge setpoint	Air Quality PURGE Speed

Temperature Control Strategy

The Temperature control strategy uses the primary sensor for temperature control and the auxiliary sensor for air quality monitoring. Each sensor determines a fan speed; the highest fan speed is the final fan speed. If the auxiliary sensor is not used, it must be configured to “Disabled.”

High and *Low Temperature Alarm Offset* values are configured. These values represent a change in temperature from the configured *Setpoint*. When the temperature exceeds an alarm offset, an alarm is sent to the LCI. The configured *Alarm Delay* delays the sending of alarms.

The fan speed determined from the primary sensor input is the result of a PI algorithm (see ”PI Algorithm Used In Temperature Control” below).

If the auxiliary sensor is disabled or is enabled and the contaminant level is below the setpoint, the auxiliary sensor has no effect on the fan speed; if the auxiliary sensor is enabled and detects that the contaminant level is above the setpoint, the fan speed is set to the *Air Quality PURGE Speed*.

The fan is:

- OFF when the primary sensor is not enabled.
- *Modulated* to maintain the temperature to setpoint when the primary sensor is enabled.
- *Air Quality PURGE Speed* when the contaminant level is above the purge setpoint and the auxiliary sensor is enabled.

Note that the primary and auxiliary sensors are configured independently allowing the temperature to be controlled independently from air quality monitoring.

Fan speeds determined from the primary and auxiliary sensors are combined to generate a single fan speed. The effect of each sensor on the fan speed is summarized in the following tables:

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Table 5: Temperature Control Strategy - Primary Sensor

Sensor Configuration	Demand/Occupancy	Resulting Fan Speed
DMD Input / Occupied	Off / Unoccupied	OFF (Min Voltage)
	On / Occupied	Modulated based on temperature
Always	-	Modulated based on temperature

Table 6: Temperature Control Strategy - Auxiliary Sensor

Sensor Configuration	Demand/Occupancy	Air Quality	Resulting Fan Speed
DMD Input / Occupied	Off / Unoccupied	*below* purge setpoint	No effect
		above purge setpoint	No effect
	On / Occupied	*below* purge setpoint	No effect
		above purge setpoint	Air Quality PURGE Speed
Always	-	*below* purge setpoint	No effect
		above purge setpoint	Air Quality PURGE Speed

PI Algorithm Used In Temperature Control

Temperature is controlled using a Proportional + Integral (PI) algorithm. The PI aglorithm uses Temperature read from the primary sensor, the configured values *Setpoint*, *Kp* and *Ki* and the internal values Error, iSum, ProportionalComponent and IntegralComponent. The algorithm produces FanOutput which is a value from 0 to 100 percent.

Each second, the PI algorithm:

- Calculates Error in °C. When the temperature mode is heating, Error is Temperature minus Setpoint; when cooling, Error is Setpoint minus Temperature:

  $Error(°C) = (Temperature - Setpoint)$ or $(Setpoint - Temperature)$

- Adds Error to iSum. (There is also an anti-windup feature to prevent iSum from getting too large):

  $iSum = iSum + Error$

- Calculates ProportionalComponent and IntegralComponent:

  $ProportionalComponent = Error \times Kp$ (limited to 100%)

  $IntegralComponent = iSum \times Ki$

- Calculates FanOutput by combining the components:

  $FanOutput(\%) = ProportionalComponent + IntegralComponent$

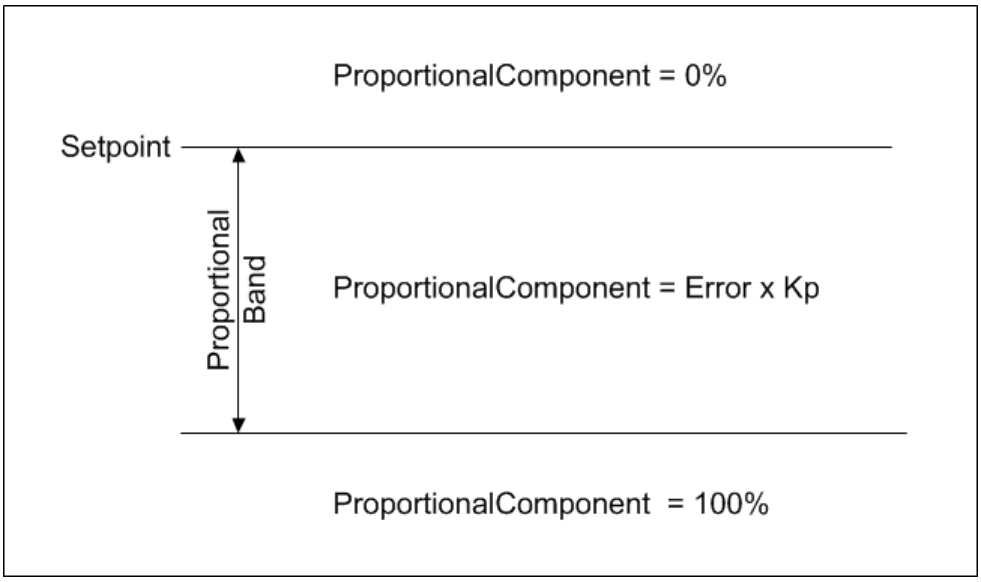
Configuring Kp

When choosing a value for *Kp*, it is helpful to understand the *proportional band*. The proportional band is the temperature region in which the output is modulated. It is also the inverse of Kp:

$$Proportional\ Band = 100\% / Kp$$

When the temperature is outside the proportional band, the proportional component of the output is either 0% or 100%. When the temperature is within the proportional band, the proportional component is a proportion (*Kp*) of the Error. When the temperature reaches the setpoint, the proportional component is zero.

Figure 5: Relationship of Kp and the Proportional Band



Example: To guarantee that the fan operates in a heating loop, at 100% output until the temperature rises to within 2 °C of setpoint, configure Kp to 50:

Kp = 100/2 = 50

Proportional Band = 100%/50 = 2

Configuring Ki

The integral component of FanOutput is the smaller component of the PI algorithm output, however it continues to increase in size if the output from the proportional component is insufficient to bring the temperature to the setpoint.

The integral component is the accumulated sum of the error multiplied by Ki where Ki is the amount per degree Celcius that the output increases each second that the temperature remains below setpoint. If the temperature stays at 2 °C below setpoint then each second, the integral component is increased by Ki x 2.

This value should remain small in comparison to Kp. It may be helpful to think of Ki in terms of increase in fan speed per minute (Ki times 60): if Ki is 0.2 and the temperature stays at 1°C below setpoint then the fan speed increases by 12% each minute (0.2 percent per second x 60 seconds per minute).

Fan Operation

Each zone has one analog (0-10V) fan modulation (FM) output and one digital (ON/OFF) fan output (FAN). Each zone also has one fan proof input (FNP).

Each of the control strategies controls the analog and digital fan outputs for one zone. When the analog fan output has a value other than the configured *Min Voltage*, the digital fan output is on. When the analog fan output is *Min Voltage*, the digital fan output is off. The digital fan output may be used alone to control an ON/OFF fan, used to enable an analog fan, or ignored.

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The fan status input is provided for monitoring the operation of the fan. If the fan status indicates that the fan is not running when the fan outputs are on, a fan failure condition is created. The configurable *Fan Proof Alarm Delay* allows the fan failure alarm and action to be delayed.

On Fan Proof Failure is configured to either “Stop Fan” or “Continue Running.” In the “Stop Fan” configuration, the fan is only allowed to continue for a configurable amount of time (*Fan Proof Alarm Delay*) before the modulated fan output is driven to *Min Voltage*, the digital fan output is turned off and an alarm is sent to the LCI. When configured to “Continue Running,” the fan outputs continues to run as before the alarm but the alarm is still sent to the LCI.

The fan failure condition does not clear automatically. To clear this condition and allow the fan to run again, configure the *Reset Zone* setting in the *Zone Cfg* configuration page to “Yes.” This does not affect the other two zones. The fan failure condition is also cleared when the controller is reset, however resetting the controller resets all three zones. The ability to reset an individual zone is unique to the XFC1 controller; other controllers require the entire controller to be reset to clear a fan failure.

If fan proof failure detection is not used, the fan proof input (FNP) must be jumpered to the adjacent common. See the "Connecting Devices" section. If the fan proof input is not connected, the controller does not operate properly.

Note: When *On Fan Proof Failure* is configured to “Stop Fan,” the only action taken by the controller on a fan proof failure to stop the fan is to provide *Min Voltage* on the analog fan output and turn off the digital fan output. There is no brake applied to the fan. And if *Min Voltage* is 2V, the modulated fan output is 2 Volts, not zero Volts.

Note: The temperature control strategy has a configuration setting for *Min Fan Speed*. *Min Fan Speed* is the baseline of the modulated output range. Do not use *Min Voltage* for this purpose as *Min Voltage* is used by the controller to stop the fan. For example: if *Min Voltage* = 0V and *Min Fan Speed* = 20%, the modulated fan output ranges between 2 and 10 Volts. When turning the fan off, the modulated fan output drops to zero Volts.

Smoke Detection

A digital smoke detector input is provided. If the smoke detector indicates that smoke is present, all of the fan outputs for all zones shut off and a smoke alarm is sent to the LCI. The response to smoke detection is immediate; there is no delay in shutting off the fans or sending the alarm to the LCI. To clear this error and allow all three zones to operate again, the controller must be reset from the LCI or power cycled.

Realtime Clock (RTC)

The realtime clock is synchronized with the LCI each day at midnight. The controller uses the realtime clock in conjunction with its local backup schedule during periods when the LCI is not available.

Local Backup Schedules

The LCI normally determines the occupied mode (occupied or unoccupied). Local backup schedules may be configured for week days and weekend days for use when the LCI is not available. Backup schedules are used if communications with the LCI is lost for more than ten (10) minutes. If comminications with the LCI is lost and the backup schedules have not been configured, the controller operates in the occupied mode.

Runtime Accumulation

Total runtime is accumulated for each of the three zones. Runtimes are used to indicate that maintenance is required on the equipment. Runtimes are displayed on the *Outputs* page and are reset from the controller's main page. Runtime Limits are configured from the *Runtime Limits* configuration page. When a zone's runtime reaches the Runtime Limit, a Maintenance Alarm is sent to the LCI.

Runtimes are not reset by zone reset, controller reset or power failures.

Automatic Configuration

The XFC1 and iWorx® Local Control Interfdace (LCI) use a self-configuring network management scheme requiring no external tools, binding or LonWorks knowledge. The LCI recognizes and configures the XFC1 when the controller's service pin is pressed. The controller's status light flashes green until the controller's LON communications 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 XFC1 with LNS or other LonWorks tools if they wish.

The LCI also provides network supervision of the XFC1. The LCI periodically sends a ping message to the XFC1, 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 , system time and other system wide data.

Commissioning

A Commissioning settings page is provided for manual override of outputs during the commissioning process. The commissioning page has settings for each digital and analog fan plus one global *Enable* that must be set to “Yes” for commissioning to function.

Digital fans are configured to either “On” or “Off.” Analog fans are configured to a voltage output (0-10V); the configured *Min Voltage* and *Max Voltage* are ignored while commissioning is enabled.

A common mistake is to leave the commissioning mode *Enable* set to “Yes” which prevents all zones from operating in their configured control strategy.

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CONTROLLER IDENTIFICATION

The controller must be configured by the LCI to set the controller's schedules, change its setpoints, etc. To allow the LCI to identify the XFC1, the controller's service pin must be pressed after the controller is installed and the LCI is active on the network. The controller's status light flashes green until it is configured, and is solid green after it is configured.

Once the XFC1 is properly installed and recognized by the Local Control Interface (LCI), the LCI is used to communicate with the controller. This section describes the network input variables that are used by other networking devices to override parameters on the controller, the *Inputs* and *Outputs* that are displayed on the LCI, the *Configuration Settings* available on the LCI and the *Alarms* generated by the controller and displayed on the LCI.

Network Inputs

The XFC1 exposes Network Variable Inputs (NVI's) for the purpose of overriding the configuration, operation, inputs and outputs of the controller. The exposed variables are listed below. Note that NVI's are accessed over the LON network, not through the LCI.

Values written to NVIs have absolute priority over any other controller operation.

Network Variable Inputs (NVIs)

Internal Variable Name	Format	Range	Description
nviResetRuntime	SNVT_lev_disc	0 or 1	A value of 0 does nothing A value of 1 resets runtimes for all zones
nviSysTime	SNVT_time_stamp	Date/Time	Resets the date and time in the RTC used by the controller
nviOccCmd	SNVT_occupancy	-1=Nul 0=Occupied 1=Unoccupied 2=Bypass	-1 is ignored, no override 0 and 2 are interpreted as occupied All other values including 1 are interpreted as unoccupied
nviDmdCmd	Unsigned Byte	0 = Off 1 = On 255 = no override	Overrides demand input (DMD)
nviOutOverride	Output Override	Structure See Below	Overides controller outputs
nviZone1	Zone Input	Structure See Below	Overrides zone 1 inputs
nviZone2	Zone Input	Structure See Below	Overrides zone 2 inputs
nviZone3	Zone Input	Structure See Below	Overrides zone 3 inputs

Output Override Structure (NVI)

Name	Type/Range	Default	Description
digOut[8]	Unsigned Byte: 0=OFF 1=ON 255=no override	255 255 255 255 255 255 255 255	digOut[0] = TO1 (pin 31) FAN 1 digOut[1] = TO2 (pin 29) FAN 2 digOut[2] = TO3 (pin 28) FAN 3 digOut[3] = TO4 (pin 26) Unused digOut[4] = TO5 (pin 25) Unused digOut[5] = TO6 (pin 23) Unused digOut[6] = TO7 (pin 22) Unused digOut[7] = TO8 (pin 20) Unused
aOut[4]	SNVT_lev_percent: 0% to 100% 32767=no override	32767 32767 32767 32767	aOut[0] = AO 0 (pin 37) FM1 aOut[1] = AO 1 (pin 35) FM2 aOut[2] = AO 2 (pin 34) FM3 aOut[3] = AO 3 (pin 32) Unused
fpOut[4]	SNVT_lev_percent: 0% to 100% 32767=no override	32767 32767 32767 32767	These values are ignored by this controller

Zone Input Structure for Overriding Inputs

Name	Type/Range	Default	Description
FanStat	Unsigned Byte 255 =unassigned 0 = Fan Proof=FALSE 1 = Fan Proof=TRUE	255	Simulated Fan Status Input
Press	SNVT_press_p 65535 = unassigned	65535	Simulated pressure in Pascals (Pascals = WC x 249.091)
Temp	SNVT_temp_p 32767 = unassigned	32767	Simulated temperature in deg Celcius x 100 SNVT_temp_p = (°F - 32) x 500/9
PriPpm	Unsigned long 32767 = unassigned	0	Simulated PPM from primary sensor times 10 PriPpm = PPM x 10
AuxPpm	Unsigned long 32767 = unassigned	0	Simulated PPM from primary sensor times 10 AuxPpm = PPM x 10

Inputs

The LCI displays the controller inputs on the *Inputs* page. Most, but not all of these inputs originate on the controller hardware inputs. *Outside Temp*, *Day of the Week* and *Occupancy State* are sent from the LCI; if communications with the LCI is lost, *Occupancy State* and *Day of the Week* are calculated from the realtime clock (RTC) on the controller.

To display the Inputs page, select the *Controllers* button on the *Home* page, select the controller from the controller list, then select *Inputs* from the controller's main page.

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Inputs Page

Name	Range	Description
Outside Temp	-29 to 230°F (-34 to 110°C)	Outside temperature as received from the ASM2 controller.
Day of the Week	Not Set, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday	Day of the week from the realtime clock (RTC)
Occupancy State	Occupied Unoccupied	Occupancy mode of the controller
Demand State	Off, On	Status of Demand Input (DMD)
Smoke Detected	No, Yes	Smoke Detection status
Zone 1 Inputs	Zone Input structure	Inputs from zone 1
Zone 2 Inputs	Zone Input structure	Inputs from zone 2
Zone 3 Inputs	Zone Input structure	Inputs from zone 3

Zone Input Structure for Displaying Inputs

Name	Range	Description
Fan Status	Off or On	Fan Status as read from the fan proof input
Static Pressure	-10.0WC to +10.0WC	Static Pressure - valid only in Static Pressure control strategy, displays 0 WC in other control strategies
Temperature	-29°F to 230°F (-33.9°F to 110°C)	Temperature - valid only in Temperature control strategy, displays 621.8°F in other control strategies
Primary Air Quality	0.0ppm to 6553.5ppm	Air Quality sensor reading on primary input - valid only in Air Quality and Occupancy (ON-OFF) control strategies, displays 0.0ppm in other control strategies
Auxiliary Air Quality	0.0ppm to 6553.5ppm	Air Quality sensor reading on auxiliary input

Outputs

The Outputs screen lists the outputs of the XFC1 and shows their current values. None of these values can be changed from this page.

The LCI displays the controller outputs on the *Outputs* page. These outputs are originated by the controller algorithms. *Modulated Fan* and *Digital Fan* indicate the values on the zone's analog and digital output hardware.

To display the *Outputs* page, select the *Controllers* button on the Home page, select the controller from the controller list, then select *Outputs* from the controller's main page.

Outputs

Name	Range	Description
Summary	Summary structure	Brief summary of the three zones' states *
Zone 1 Outputs	Outputs structure	Zone 1 outputs
Zone 2 Outputs	Outputs structure	Zone 2 outputs
Zone 3 Outputs	Outputs structure	Zone 3 outputs

* In addition to the *Outputs* page, this same Summary is also displayed on the LCI in the controller list.

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Summary Structure

Name	Range	Description
Zone 1	Disabled Unoccupied Fan OFF Air Quality is Ok Air Quality PURGE Occupied Fan ON Increasing Fan Speed Decreasing Fan Speed Steady Fan Speed Heating PI Control Cooling PI Control Demand Fan ON Demand Fan OFF Sensor Config Error Commissioning	Brief summary of a zone's state - This summary also appears next to the controller name in the controller list on the LCI.
Zone 2	Disabled Unoccupied Fan OFF Air Quality is Ok Air Quality PURGE Occupied Fan ON Increasing Fan Speed Decreasing Fan Speed Steady Fan Speed Heating PI Control Cooling PI Control Demand Fan ON Demand Fan OFF Sensor Config Error Commissioning	Brief summary of a zone's state - This summary also appears next to the controller name in the controller list on the LCI.
Zone 3	Disabled Unoccupied Fan OFF Air Quality is Ok Air Quality PURGE Occupied Fan ON Increasing Fan Speed Decreasing Fan Speed Steady Fan Speed Heating PI Control Cooling PI Control Demand Fan ON Demand Fan OFF Sensor Config Error Commissioning	Brief summary of a zone's state - This summary also appears next to the controller name in the controller list on the LCI.

Zone Outputs Structure

Name	Range	Description
Alarm State	No Alarm SMOKE Detected FAN PROOF Failure AIR QUALITY In Alarm PRESSURE LOW PRESSURE HIGH TEMPERATURE LOW TEMPERATURE HIGH Maintenance Required Fan & Air Quality Fan & Maintenance Air Qual & Maintenance Fan & Air Qual & Maint	Brief summary of a zone's alarm state
Modulated Fan	0 to 100%	Modulated Fan Output
Digital Fan	Off or On	Digital Fan Output
Fan Runtime	0 to 65535 Hr (7.5 years)	Fan Runtime

Configuration

This screen lists all possible settings on the XFC1. Some of the settings are structures themselves and will be described in detail in the tables below.

All Settings Page

The LCI *All Settings* page is for configuring the XFC1 controller; all controller configuration is done from this page, except for resetting the runtimes which is done from the controller's main page.

To display the controller's *Main* page, select the *Controllers* button on the *Home* page, then select the controller from the controller list.

To display the *All Settings* page, select the *Controllers* button on the Home page, select the controller from the controller list, then select *All Settings* from the controller's main page.

Setting	Range	Default	Description
Zone 1 Name	Alpha-numeric string 16 character max	Zone 1	Zone name override. This name replaces "Zone 1" on LCI display screen.
Zone 1 Cfg	Zone Cfg structure		Zone 1 main configuration
Zone 1 Fan Cfg	Fan Cfg structure		Zone 1 fan configuration
Zone 1 Temp Cfg	Temp Cfg structure		Zone 1 temperature configuration
Zone 1 Press Cfg	Pressure Cfg structure		Zone 1 pressure configuration
Zone 1 Pri AQ Cfg	Air Quality Cfg structure		Zone 1 primary AQ configuration
Zone 1 Aux AQ Cfg	Air Quality Cfg structure		Zone 1 auxiliary AQ configuration
Zone 2 Name	Alpha-numeric string 16 character max	Zone 2	Zone name override. This name replaces "Zone 2" on LCI display screen.
Zone 2 Cfg	Zone Cfg structure		Zone 2 main configuration
Zone 2 Fan Cfg	Fan Cfg structure		Zone 2 fan configuration
Zone 2 Temp Cfg	Temp Cfg structure		Zone 2 temperature configuration
Zone 2 Press Cfg	Pressure Cfg structure		Zone 2 pressure configuration

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Zone 2 Pri AQ Cfg	Air Quality Cfg structure		Zone 2 primary AQ configuration
Zone 2 Aux AQ Cfg	Air Quality Cfg structure		Zone 2 auxiliary AQ configuration
Zone 3 Name	Alpha-numeric string 16 character max	Zone 3	Zone name override. This name replaces "Zone 3" on LCI display screen.
Zone 3 Cfg	Zone Cfg structure		Zone 3 main configuration
Zone 3 Fan Cfg	Fan Cfg structure		Zone 3 fan configuration
Zone 3 Temp Cfg	Temp Cfg structure		Zone 3 temperature configuration
Zone 3 Press Cfg	Pressure Cfg structure		Zone 3 pressure configuration
Zone 3 Pri AQ Cfg	Air Quality Cfg structure		Zone 3 primary AQ configuration
Zone 3 Aux AQ Cfg	Air Quality Cfg structure		Zone 3 auxiliary AQ configuration
Runtime Limits	Runtime Limits structure		Runtime limits that define when maintenance alarm is sent to LCI
Day of the Week	Not Set, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday	Not Set	Day of the Week
Weekday Occ	Time of Day structure		Backup weekday occupancy time
Weekday Unocc	Time of Day structure		Backup weekday unocc time
Weekend Occ	Time of Day structure		Backup weekend occupancy time
Weekend Unocc	Time of Day structure		Backup weekend unocc time
Commissioning	Commissioning structure		Commissioning mode interface

Zone Cfg Structure

This screen displays settings related to Zone configuration and allows access to all of these settings from a single screen.

Setting	Range	Default	Description
Control Strategy	Disabled, Air Quality, Occupancy (ON-OFF), Demand (ON-OFF), Static Pressure, Temperature	Disabled	The control strategy used for the fan in this zone
Primary Sensor Enable	Disabled, Occupied, DMD Input, Always	Occupied	When is the primary sensor operational
Auxiliary Sensor Enable	Disabled, Occupied, DMD Input, Always	Occupied	When is the auxiliary sensor operational
Reset Zone	No, Yes	No	Reset this zone

Fan Cfg Structure

This screen displays settings related to Fan configuration and allows access to all of these settings from a single screen.

Setting	Range	Default	Description
Min Voltage	0.0 to 10.0 V	0.0 V	Minimum Fan Voltage
Max Voltage	0.0 to 10.0 V	10.0 V	Maximum Fan Voltage
On Fan Proof Failure	Stop Fan, Continue Running	Stop Fan	Action taken when there is a fan proof failure
Fan Proof Alarm Delay	0 to 300 Sec	30 Sec	Time to wait before taking action on a fan proof failure
Continuous ON Speed	0 t0 100%	50%	Fan speed used in Occupied (ON-OFF) and Air Quality Control Strategies
Air Quality PURGE Speed	0 to 100%	100%	Fan speed used in Air Quality control strategy or other strategies for Air Quality Override

Temp Config Structure

This screen displays settings related to Temperature Configuration.

Setting	Range	Default	Description
Sensor Offset	-10°F to +10°F (-5.6°C to 5.6°C)	0.0°F (0.0°C)	Sensor Offset
Setpoint	50.0°F to 95.0°F (10.0°C to 35.0°C)	71°F (21.7°C)	Temperature Setpoint
Min Fan Speed	0.0% to 100.0%	0.0%	Minimum Fan Modulation Range
Max Fan Speed Increase	0.1% to 100.0%	5%	Maximum allowed fan speed increase (percent per second)
Temperature Mode	Heat, Cool	Cool	Temperature Mode
Kp	0 to 1,000	10.000	Kp Proportional Control Constant
Ki	0 to 1,000	0.2	Ki Integral Control Constant
Low Temp Alarm Offset	-10°F to +10°F (-5.6°C to 5.6°C)	10°F (5.67°C)	Low Temperature Alarm Offset
High Temp Alarm Offset	-10°F to +10°F (-5.6°C to 5.6°C)	10°F (5.67°C)	High Temperature Alarm Offset
Alarm Delay	0 to 300 Sec	30 Sec	Alarm Delay

Pressure Config Structure

This screen displays settings related to Pressure Configuration.

Setting	Range	Default	Description
Min Sensor Voltage	0.0 to 10.0 V	0.0 V	Minimum Sensor Voltage Range
Max Sensor Voltage	0.0 to 10.0 V	10.0 V	Maximum Sensor Voltage Range
Min Sensor Pressure	-10.00 to +10.00 WC	0.00 WC	Minimum Sensor Pressure Range
Max Sensor Pressure	-10.00 to +10.00 WC	5.00 WC	Maximum Sensor Pressure Range
Fan Position	Exhaust, Supply	Exhaust	Fan Position
Setpoint	-10.00 to +10.00 WC	3.00	Static Pressure Setpoint
Control Hysteresis	0.00 to 5.00 WC	0.1 WC	Control Hysteresis

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Setting	Range	Default	Description
Step Size	0.1 to 100.0%	1.0%	Fan Speed Change per Second
Low Pressure Alarm Offset	-10.00 to +10.00 WC	1.00 WC	Low Pressure Alarm Offset
High Pressure Alarm Offset	-10.00 to +10.00 WC	1.00 WC	High Pressure Alarm Offset
Alarm Delay	0 to 300 Sec	30 Sec	Alarm Delay
High Pressure Alarm Action	Stop Fan, Continue Running	Stop Fan	Action taken when there is a high pressure alarm

Air Quality Config Structure

This screen displays settings related to Air Quality Configuration.

Setting	Range	Default	Description
Min Sensor Voltage	0.0 to 10.0 V	0.0 V	Minimum Voltage Range
Max Sensor Voltage	0.0 to 10.0 V	10.0 V	Maximum Voltage Range
Min Sensor PPM	0.0 to 6553.5 PPM	0.0 PPM	Minimum PPM Range
Max Sensor PPM	0.0 to 6553.5 PPM	2000.0 PPM	Maximum PPM Range
Sensor Offset	0.0 to 6553.5 PPM	0.0 PPM	Sensor Offset
Control Hysteresis	0.0 to 6553.5 PPM	10.0 PPM	Control Hysteresis
Fan Purge Setpoint	0.0 to 6553.5 PPM	600.0 PPM	Fan Purge Setpoint
Alarm Setpoint	0.0 to 6553.5 PPM	1200.0 PPM	Alarm Setpoint

Runtime Limits Structure

This screen displays settings related to Runtime Limits.

Setting	Range	Default	Description
Zone 1	0 to 65535 Hr (7.5years)	10,000	Zone 1 runtime
Zone 2	0 to 65535 Hr (7.5years)	10,000	Zone 2 runtime
Zone 3	0 to 65535 Hr (7.5years)	10,000	Zone 3 runtime

Time of Day Structure

This screen displays settings related to time of day.

Setting	Range	Default	Description
Hours	0 to 23	0	Hour of the Day
Minutes	0 to 59	0	Minute of the Hour

Commissioning Structure

This screen displays settings related to commissioning.

Setting	Range	Default	Description
Enable	No, Yes	No	Enable Commissioning (all zones)
Zone 1 Digital Fan	Off, On	Off	Digital Fan Output State
Zone 1 Mod Fan Voltage	0.0 to 10.0 V	0.0 V	Modulated Fan Output voltage
Zone 2 Digital Fan	Off, On	Off	Digital Fan Output State

Setting	Range	Default	Description
Zone 2 Mod Fan Voltage	0.0 to 10.0 V	0.0 V	Modulated Fan Output voltage
Zone 3 Digital Fan	Off, On	Off	Digital Fan Output State
Zone 3 Mod Fan Voltage	0.0 to 10.0 V	0.0 V	Modulated Fan Output voltage

Alarms

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

The XFC1 supports three zone specific alarms (Fan Proof, Air Quality and Maintenance) and one controller-wide alarm (Smoke Detected).

To display the *Alarms* page, select the *Controllers* button on the *Home* page, select the controller from the controller list, then select *Alarms* from the controller's main page.

Alarm	Trigger	Reset
Smoke Detected	Smoke is detected on SMK Input	Controller must be reset
Zone Fan Proof Failure	Fan proof is off for Fan Proof Alarm Delay	Use the Reset Zone setting on the Zone Cfg page to reset one zone or reset the controller to reset all zones
Zone Air Quality	Air Quality ppm rises above Alarm Setpoint	Automatically resets when Air Quality ppm falls below Alarm Setpoint minus Control Hysteresis
Zone Maintenance	Runtime hours exceeded	Alarm does not clear but runtime hours may be reset on the LCI using the Reset Runtimes button on the Controller's main page
Zone Temp Low	Zone temperature exceeds zone low temp alarm offset	Automatically resets when zone temperature rises above zone low temp alarm offset plus 0.5?F
Zone Temp High	Zone temperature exceeds zone high temp alarm offset	Automatically resets when zone temperature falls below zone high temp alarm offset minus 0.5?F
Zone Pressure Low	Zone pressure exceeds zone low pressure alarm offset	Automatically resets when zone pressure rises above zone low pressure alarm offset plus the control hysteresis
Zone Pressure High	Zone pressure exceeds zone high pressure alarm offset	Use the Reset Zone setting on the Zone Cfg page to reset one zone or reset the controller to reset all zones

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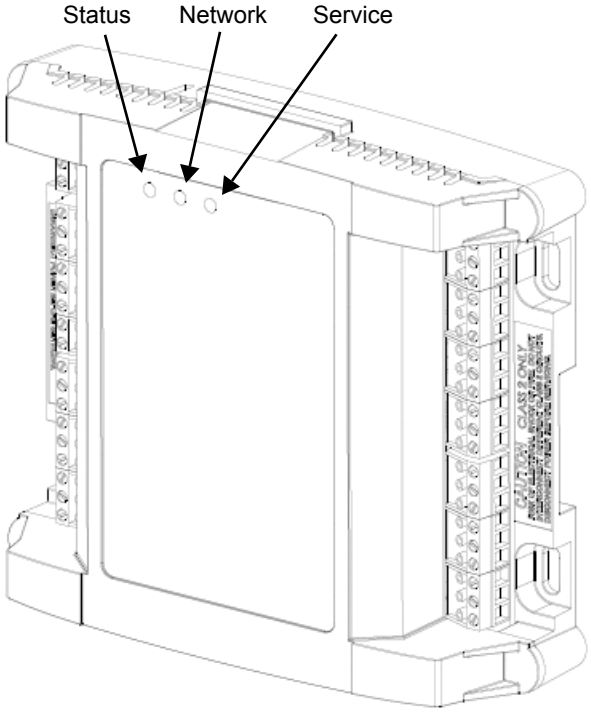
TROUBLESHOOTING

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 6: XFC1 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.
Can my iWorx® system contain multiple XFC1 controllers?	Yes, provided that you do not exceed the maximum number of controllers that can be handled by the Local Control Interface (LCI).
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.

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.

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.

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