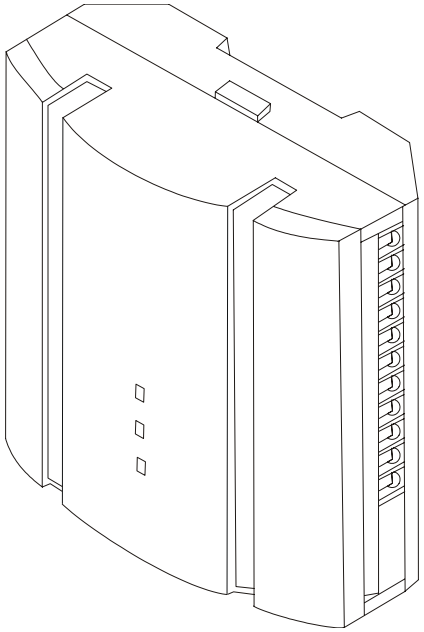
iWorX DXU-2 Application Manual

DXU-2



The DXU-2 package unit controller is a stand-alone microprocessor based controller for single zone DX package units with an economizer. The application includes packaged rooftop DX units with up to two stages of heating, four stages of cooling, and an economizer.

Overview

Digital inputs are provided for fan status, mixed air low limit indication, smoke detector, and filter status. Analog inputs are provided for mixed air temperature, return air humidity and supply air temperature. A two-wire serial interface is provided for the thermostat. The controller incorporates digital outputs in the form of triacs for fan start/stop, two heating stages, four cooling stages, and a two-position economizer. Instead of two heating stages, the unit can control a floating point heating valve. In addition, an analog output is provided to control a modulated economizer if required.

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

Features

- Four stages of cooling
- Two stages of heating, or a floating point heating valve
- Modulated or two-position economizer
- Economizer enabled based on enthalpy or dry bulb calculations
- Minimum cycle timer
- Runtime accumulation for heating, cooling and fan
- Local backup schedule
- Individual temperature setpoints for occupied/unoccupied heat and cool
- Time proportioned control of the staged outputs to reduce cycling
- Proportional + Integral control of the modulated economizer
- LonWorks interface to building automation systems
- Mixed air low limit protection
- Filter status input
- Smoke detection input
- Thermostat with space temp, setpoint adjust, fan override, occupancy override
- Fan control energized on call for heating or cooling
- Automatic heat/cool changeover
- Remote sensor capabilities
- Automatic configuration with the LCI
- Alarm/Event reporting

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Purpose of This Guide

The *iWorX DXU-2 Application Manual* provides application information for the DXU-2 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
563027101	PROFILE DXU Series Installation Instructions	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides instructions for setting up and using the iWorX DXU-2-1 and DXU-2-2 Controllers.
563013401	PROFILE LCI User's Guide	– Application Engineers – Installers – Service Personnel – Start-up Technicians – End user	Provides instructions for setting up and using the iWorX Local Control Interface.
563016101	PROFILE DTM Series General Instructions	– Application Engineers – Installers – Service Personnel – Start-up Technicians	Provides step-by-step installation and checkout procedures for iWorX Digital Thermostat Modules. Also contains instructions for sensor operation.
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.		

Application Description

The controller maintains the temperature of a space to a user-defined setpoint. Figure 1 and Figure 2 illustrate typical controller applications. The control is achieved by controlling the economizer position and sequencing the heating and cooling stages based on the current space requirements.

Figure 1: Single Zone DXU-2 with Modulated Economizer

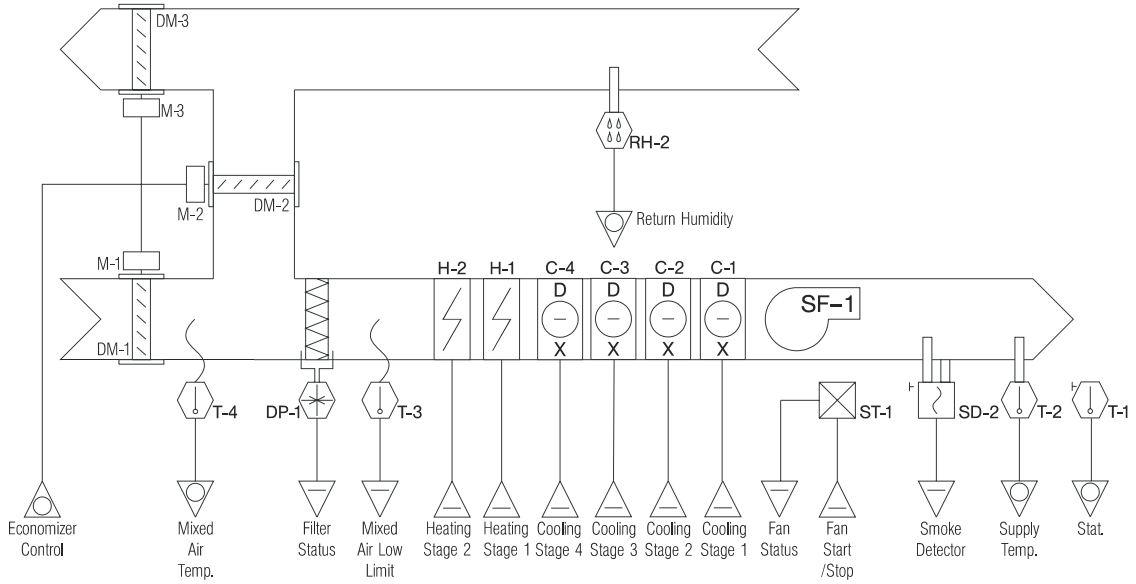
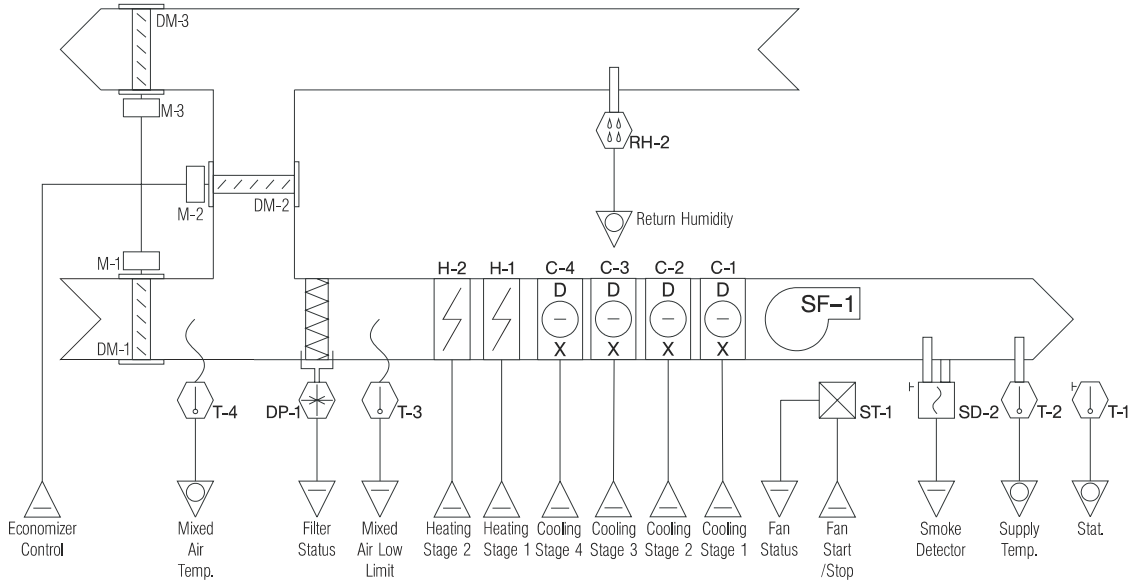


Figure 2: Single Zone DXU-2 with Two Position Economizer



The controller controls the starting and stopping of the supply air fan. The fan is energized when there is a need for heating or cooling. During the occupied periods, the fan can be configured to run continuously. The fan can be overridden from the local thermostat. If overridden, the fan runs continuously.

The enthalpies of the outside and inside air are calculated periodically. A comparison is performed to determine if “free cooling” is available. If “free cooling” is available, the economizer is enabled. Free cooling can also be enabled based on a dry-bulb comparison of the outdoor air temperature and indoor temperature. The system can use either a two position or modulated economizer. If a two position economizer is employed, it is energized when there is a call for cooling. It is used as the first stage of cooling to take advantage of the energy savings. The two-position economizer output is off when the economizer feature is disabled.

If a modulated economizer is employed, when “free cooling” is available, the modulated economizer position is calculated by a Proportional + Integral (P+I) control loop. The control is based on the mixed air temperature and setpoint. As the temperature increases above the mixed air setpoint, the economizer valve is modulated open. The economizer is modulated closed as the temperature decreases below the mixed air setpoint. The economizer is modulated to its minimum position when the economizer is disabled. The economizer can optionally be disabled during unoccupied periods.

Heating is accomplished either through control of up to two stages of electric heating, or through control of one floating point heating valve. Cooling is accomplished through control of up to four stages of cooling.

The heating and cooling stages are sequenced with a time-proportioned control algorithm to minimize excessive cycling. The sequencing is based on the measured space temperature and the heating and cooling setpoints. The heating and cooling setpoints define a desired temperature range for occupied operation. When unoccupied mode is entered, the heating setpoint is set back and the cooling setpoint is setup by a user-defined amount. The cooling stages are interlocked with the economizer control. If the two position economizer is employed, the stages sequence on after the economizer.

Each controller interfaces to a local thermostat. The thermostat includes a space temperature sensor, temperature setpoint adjustment, occupancy override, and a fan auto/on selection (depending on the model).

The controller operates in one of two states: occupied or unoccupied. The LCI determines the active operating mode. The controller maintains the comfort level to a user-defined setpoint during the occupied period. The controller uses setup and setback values during the unoccupied period to maintain the space temperature. An optional backup schedule is provided for cases when the LCI is not available.

A digital input is provided to monitor the status of the supply air fan. If the fan is energized and no air flow is detected after 30 seconds, the controller turns off all stages of heating and cooling along with the supply air fan. The controller returns to normal operation after it is reset. An alarm is reported to the LCI when this condition exists.

The controller monitors a digital input to determine the presence of smoke. When the input indicates smoke, the controller immediately turns off the supply air fan and all stages of heating and cooling. The controller returns to normal operation after it is reset. An alarm is reported to the LCI when smoke is detected.

A digital input is provided on the controller to monitor the status of the air filter. An external pressure switch is wired to the input to determine when the filter becomes dirty. An alarm is reported to the LCI when this condition exists.

Mixed air low limit protection is provided through a digital input. If a low limit condition exists, the controller turns off all stages of heating and cooling along with the supply air fan. An alarm is reported to the LCI when this condition exists. The controller returns to normal operation after it is reset. Following the reset, there is a 10 minute delay before the mixed air low limit is checked again.

The controller monitors the runtime of the cooling stages, heating stages, and fan. When any one of the runtimes exceeds a programmable limit, a maintenance alarm is reported to the LCI.

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

Sequence of Operation

This section describes the detailed sequence of operation for the controller control algorithms.

Setpoints

The heating and cooling setpoint for both occupied and unoccupied periods are programmable values. The space setpoint is a calculated value based on the programmed heating setpoint, cooling setpoint and current operating mode (i.e. occupied or unoccupied).

The space setpoint is derived by first calculating the *zero energy band (zeb)* for the current operating mode.

Occupied Mode

$$ZebOcc = OccupiedCoolSp - OccupiedHeatSp$$

Unoccupied Mode

$$ZeUnocc = UnoccupiedCoolSp - UnoccupiedHeatSp$$

The space setpoint is calculated from the zero energy band and the heating setpoint.

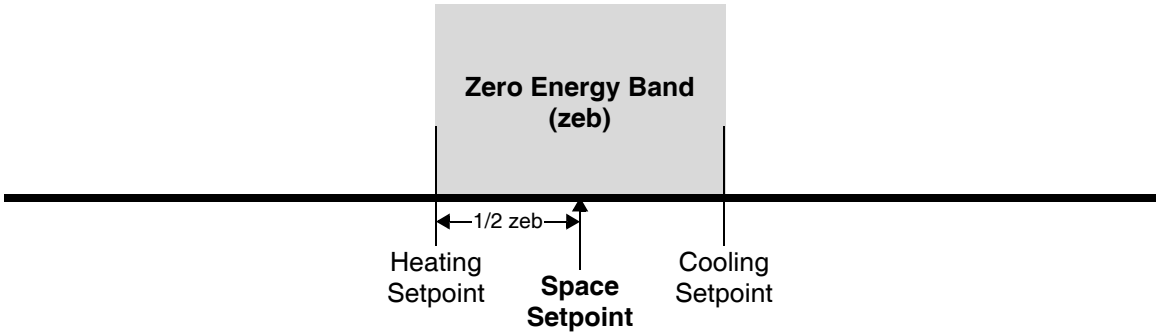
Occupied Mode

$$SpaceSP = OccupiedHeatsp + \frac{ZebOcc}{2}$$

Unoccupied Mode

$$SpaceSp = UnoccupiedHeatSp + \frac{ZebUnocc}{2}$$

Figure 3: Space Setpoint Calculation.



The effective setpoint is a calculated value based on the space setpoint and the thermostat setpoint offset value. The setpoint offset is used to increase or decrease the space setpoint from the local thermostat. The offset value is limited to plus or minus the programmed setpoint adjustment.

The setpoint offset also affects the calculated heating and calculated cooling setpoints by an equal amount. The setpoint offset only applies in the occupied mode of operation. It has no affect in the unoccupied mode. Note that the actual programmed heating and cooling setpoints are not changed. The offset is simply added to the programmed setpoints to derive the calculated values.

Occupied Mode

$$CalcCoolingSp = OccupiedCoolingSp \pm SpOffset$$

$$CalcHeatingSp = OccupiedHeatingSp \pm SpOffset$$

$$EffectiveSp = SpaceSp \pm SpOffset$$

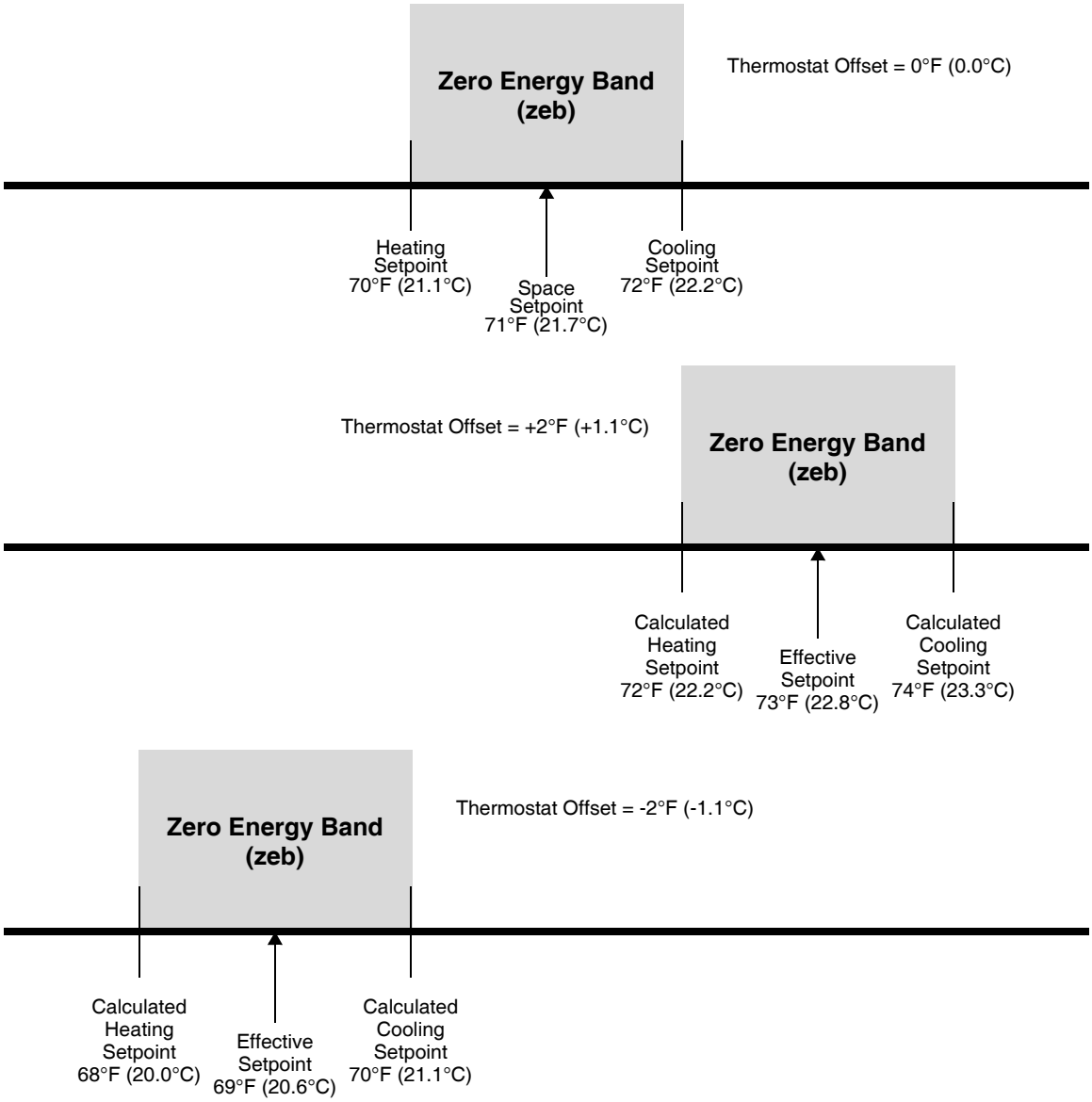
Unoccupied Mode

$CalcCoolingSp = UnoccupiedCoolingSp$

$CalcHeatingSp = UnoccupiedHeatingSp$

$EffectiveSp = SpaceSp$

Figure 4: Setpoint Adjustment



Heating Sequence

The controller provides support for either two stages of electric heating or or one floating point heating valve. You can specify which type of heat you are using through configuration parameters.

Heating Stages

The controller sequences the electric heating stages based on the space temperature and the calculated heating setpoint. When the space temperature drops below the heating setpoint minus the heating control band for a predefined time-period, a stage is turned on. If the space temperature remains below the heating control band for an additional time-period, the next available stage is turned on. This cycle continues until all available stages have been energized.

After the space temperature has risen above the heating setpoint for a predefined period of time, the last energized stage is turned off. (Note that the last stage that was turned on is the first one to be turned off.) If the space temperature remains above the heating setpoint for an additional time-period, the next previous stage is turned off. This cycle continues until all stages have been de-energized.

When the space temperature rises above the space setpoint, all of the electric heating stages turns off.

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

Figure 5: Heat Sequence - Occupied Mode

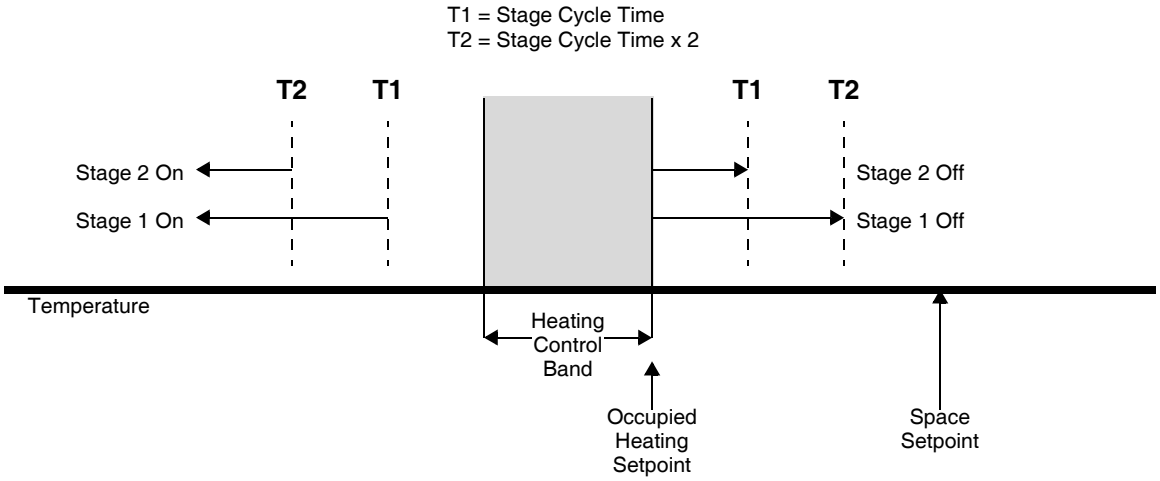
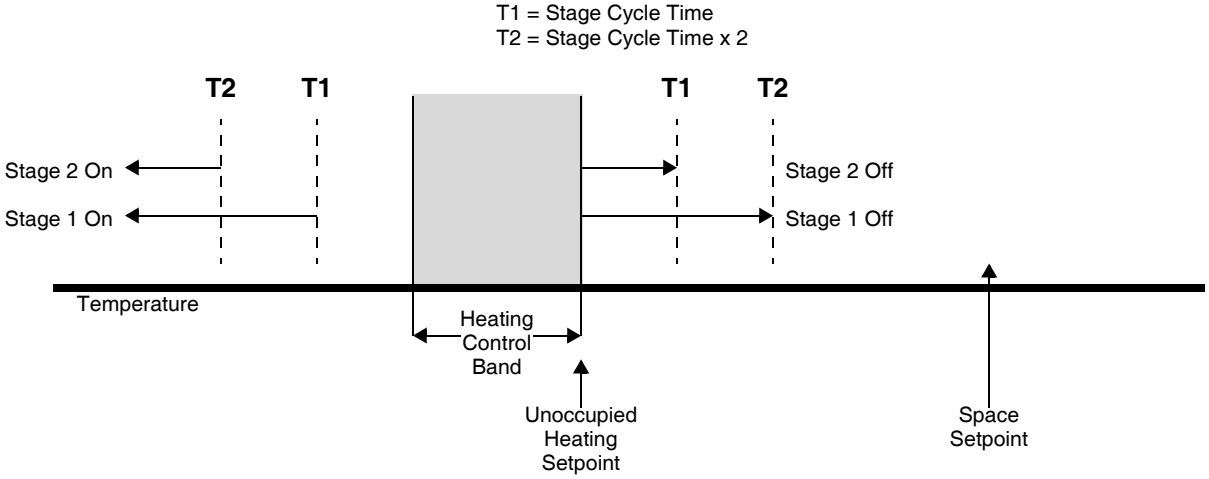


Figure 6: Heat Sequence – Unoccupied Mode



Heating with Floating Point Control

The heating stage outputs can be configured for floating point control of a heating valve. Floating point control is enabled when *Heating Stages* is set to zero and *Heating Valve Travel Time* is non-zero. The H1 output is the valve open signal and the H2 output is the valve close signal.

After a reset, the floating point valve is calibrated by closing the valve for a period of the travel time. This ensures that the valve is fully closed. When the valve is at its calculated 0% or 100% position, the valve is overdriven for 30 seconds to ensure that the valve is fully closed or open.

The floating point control is similar to the heating staging algorithm. If the space temperature is below the heating setpoint, the valve is driven open. When the space temperature is above the heating setpoint, the valve is driven close. There is a +/- 1 °F (0.55 °C) deadband around the setpoint to prevent the valve from dithering. During mixed air low limit alarms, the heating valve is driven to 100%.

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

Cooling Sequence

The controller sequences the cooling compressor stages based on the space temperature and the calculated cooling setpoint. When the space temperature rises above the cooling setpoint plus the cooling control band for a predefined time-period, a stage is turned on. If the space temperature remains above the cooling control band for an additional time-period, the next stage is turned on. This cycle continues until all stages have been energized.

In order to provide maximum energy savings, the cooling stages are interlocked with the economizer. When the economizer is enabled, the cooling stages are prevented from energizing before the economizer has reached its maximum position.

After the space temperature has dropped below the cooling setpoint for a predefined time-period, the last-energized stage is turned off. (Note that the last stage that was turned on is the first one to be turned off.) If the space temperature remains below the cooling setpoint for an additional time-period, the next previous stage is turned off. This cycle continues until all stages have been de-energized.

When the space temperature drops below the space setpoint, all of the cooling stages turns off.

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

Figure 7: Cooling Sequence - Occupied Mode

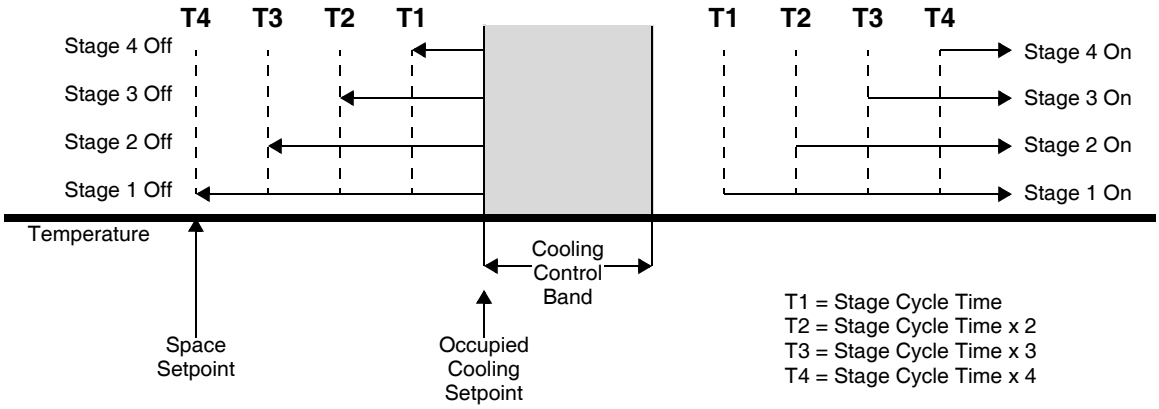
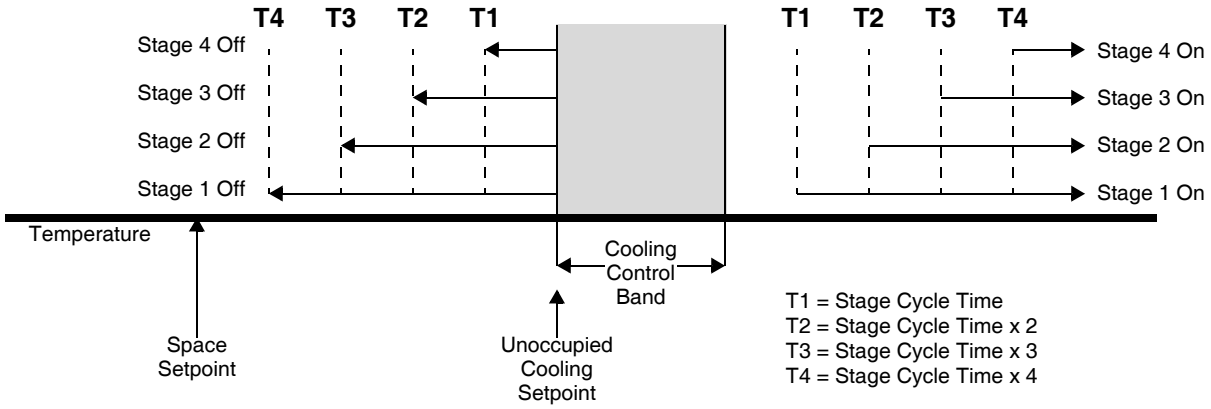


Figure 8: Cooling Sequence – Unoccupied Mode



Economizer Operation

The controller provides support for either two-position or modulated economizer types. You can specify which type of economizer you are using through a configuration parameter. Both economizer types are enabled based on the availability of “free cooling” from the outdoor air. Free cooling can be determined by dry bulb or enthalpy comparisons. In order to provide maximum energy savings, the cooling stages are interlocked with the economizer.

Dry Bulb Comparisons

Free cooling can be determined based on a comparison of outdoor air temperature and indoor air temperature. When the outdoor air temperature is a programmable amount below the indoor air temperature, free cooling is enabled. When the outdoor air temperature rises above the indoor temperature, free cooling is disabled.

Enthalpy Comparison

An enthalpy calculation is performed periodically to determine if “free cooling” is available from the outside air. The outside enthalpy is calculated based on the outside air temperature and humidity. The outside temperature and humidity are measured by an external device (such as an ASM) on the network and sent to the controller. The same calculation is performed on the inside air based on the space temperature and return air humidity. The inside enthalpy minus the outside enthalpy must be greater than the Free Cooling Setpoint in order for the economizer to be used for free cooling.

Optionally, an external device can measure the indoor air humidity globally. In this case, a return air humidity sensor would not be required at each DXU-2.

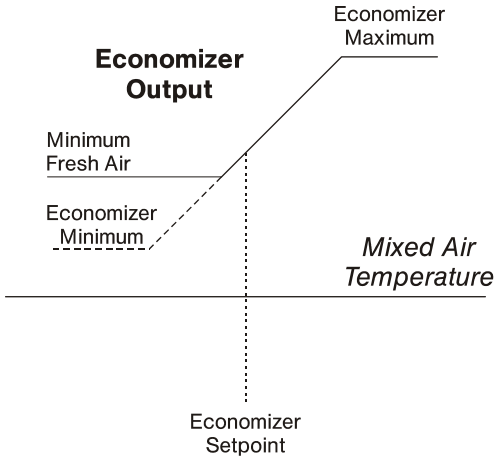
Two-position Economizer Control

If present, the two-position economizer is enabled when there is “free cooling” available as determined by the enthalpy calculations. When the economizer is enabled, the economizer triac output is energized. When the economizer is disabled, the economizer output is de-energized. A configuration parameter is available to optionally disable the economizer during unoccupied periods.

Modulated Economizer Control

If present, the modulated economizer is enabled when there is “free cooling” available as determined by the enthalpy calculations.

Figure 9: Economizer Control.



When the economizer is enabled, a Proportional + Integral (P+I) control loop modulates the economizer output position to maintain a constant mixed air temperature

The Proportional + Integral (P+I) control loop is based on the mixed air temperature setpoint and economizer setpoint. As the temperature increases above the economizer setpoint, the economizer is modulated open. The economizer is modulated closed as the temperature decreases below the economizer setpoint.

To prevent the integral component from becoming too large, there is anti-wind up reset protection. This protection clamps the integral value when all of the components add up to more than 100% or less than 0%. The following equations are used for P+I control:

$$K_p = ProportionalGain$$

$$K_i = IntegralGain$$

$$Error = MixedAirTemp - EconSp$$

$$I = I + (K_i \times Error)$$

$$(EconPosition = (K_p \times (Error + I))) + 50.00\%$$

When the economizer is disabled, it modulates to the minimum position. A configuration parameter is available to optionally disable the economizer during unoccupied periods.

Fan Operation

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

Depending on the model of thermostat, you may be able to override the fan from the local thermostat. When the fan selection is set to *Auto*, the fan operates as described above. If the fan selection is set to *On*, the fan is constantly on.

Fan Proof

When there is a call for heating or cooling, the fan output is energized. A fan status input is provided for monitoring the operation of the fan. When the fan is initially turned on, there is a 30 second delay before the fan status is checked. If at any time after the delay, the fan status indicates the fan is not running, a fan failure condition is generated. The heating and cooling stages are interlocked with the fan. When a fan failure condition exists, the heating stages, cooling stages and the fan immediately turns off. The controller must be reset to clear this condition.

Note: If you are not providing a fan status switch, the input must be jumpered to the adjacent common. After a fan failure, the controller's status LED goes solid red. To return the controller to normal operation after the failure condition is resolved, you must reset the controller by removing and reapplying power or by using the controller reset feature on the LCI. (See *PROFILE LCI User's Guide* for details.)

Smoke Detection

A smoke detector input is provided. If the smoke detector indicates smoke is present, all of the stages and the fan turn off. The controller returns to normal operation after a reset.

Mixed Air Low Limit Detection

An input is provided for a mixed air low limit detection device. If a low limit condition is detected, all of the stages and the fan turn off. The controller returns to normal operation after a neuron reset. (After the DXU-2 switches from unoccupied mode to occupied mode, there is a ten minute delay before it reports Mixed Air Low Limit alarms.)

Filter Status

The filter status input is monitored to determine if the filter is operating properly. The input is used to indicate that maintenance is required on the filter. The controller application is not shutdown due to a filter alarm.

Thermostat

The space temperature value, setpoint adjustment, fan auto/on status (depending on the thermostat model), and occupancy override request are monitored by the thermostat and sent to the controller.

The controller automatically detects a failure of the thermostat. When the thermostat fails, the cooling stages, heating stages, economizer, and fan are turned off and control is disabled.

Note: Unless another host controller overrides the space temperature through the LCI, the thermostat must be connected. The status LED on the controller turns solid red if the thermostat is not connected and no other controller is providing temperature data. Once the DXU-2 begins receiving temperature data, the status LED turns green indicating normal operation.

Local Backup Schedule

The LCI normally determines the operating mode. You can define a local backup schedule for situations when the LCI is not available. When the controller detects that the LCI is not available (after 10 minutes without communication), it resorts to the local backup schedule that you have configured. If the local backup schedule is disabled, the controller defaults to occupied mode.

You configure the occupied and unoccupied times that are used in determining the current operating mode of the controller when it is running the backup schedule. By default, both the unoccupied and occupied time is set to zero, which disables the local backup schedule. This causes the controller to default to the occupied mode of operation if it cannot communicate with the LCI.

Runtime Accumulations

The total runtime is accumulated for the heating, cooling, and fan outputs. The runtimes can be used to indicate that maintenance is required on the equipment controlled by these outputs. The runtime can be reset by an operator or maintenance person once servicing has been performed.

Alarms and Events

The controller detects certain alarm conditions and sends them to the LCI. Before this can occur, you must use the LCI to configure the controller.

Digital Input Alarms

The controller monitors the status of the digital inputs and generates alarms for the following events:

- Fan failure (Fan Failed Alarm)
- Smoke detect (Smoke Detected Alarm)
- Mixed air low limit condition (Low Limit Alarm)
- Dirty filter (Dirty Filter Alarm)

Thermostat Failure

The controller automatically detects the presence of the local thermostat and monitors its status. If the thermostat fails to communicate with the controller, a Thermostat Failed Alarm is generated and the controller's status LED turns red. If the space temperature is overridden by a host controller, this alarm is disabled.

Maintenance Alarm

The controller provides programmable run limits for generating runtime Maintenance Alarms. When any of the cooling, heating, or fan runtime limits are exceeded, a Maintenance Alarm is sent to the LCI.

Space Temperature Alarms

The controller generates high and low limit alarms for the space temperature. You can configure a programmable space temperature alarm limit offset. The temperature limits are calculated based on the control setpoints, alarm limit offset, and control band.

$$HighLimit = CalcCoolingSp + AlarmLimitOffset + CoolBand$$

$$LowLimit = CalcHeatingSp - AlarmLimitOffset - HeatBand$$

When the measured space temperature exceeds the high limit, a high limit alarm (Space Temperature High Limit Alarm) is generated. When the space temperature drops below the low limit, a low limit alarm is generated (Space Temperature Low Limit Alarm). A return to normal alarm is generated when the space temperature is between the high and low limit (Space Temperature Return to Normal).

When the controller switches between the unoccupied and occupied modes of operation, no space temperature alarms are reported for 30 minutes following the switch. This helps eliminate nuisance alarms.

Automatic Configuration

The DXU-2 and iWorX Local Control Interface (LCI) use a self-configuring network management scheme requiring no external tools, binding, or LONWORKS knowledge. The LCI recognizes and configures the DXU-2 when the controller's service pin is pressed. The controller's status light flashes green until the controller is configured, and will be 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 DXU-2 with LNS or other LONWORKS tools if they wish.

The LCI also provides network supervision of the DXU-2. The LCI periodically sends a "ping" message to the DXU-2, which elicits a response. If the response fails, an alarm is displayed on the LCI. The LCI also uses the "ping" message to refresh the occupancy mode and other system wide data.

DXU-2 Configuration

Once the DXU-2 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 DXU-2, and the meanings and suggested values for controller parameters. For more information on using the LCI, see the *PROFILE LCI User's Guide.*

Change Setpoint

This screen displays the current setpoint. Press **`Set Temp`** to manually override active the effective setpoint.

Setup

Heating / Cooling Settings

This screen displays the heating and cooling setpoints used by the DXU-2 controller. Use the up and down arrow keys to select a value to change, then use **–** or **+** to increase or decrease the value (or utilize use keys to directly enter the desired value). Press **`Save`** to save your changes or **`Back`** to return to the Setup screen.

Table 1: DXU-2 Heating and Cooling Settings

Setpoint	Range	Default	Description
Unoccupied Heating	50 to 95 °F (10 to 35 °C)	60.0°F (15.5 °C)	Heating setpoint for unoccupied time periods.
Occupied Heating	50 to 95 °F (10 to 35 °C)	70.0°F (21.1 °C)	Heating setpoint for occupied time periods.
Occupied Cooling	50 to 95 °F (10 to 35 °C)	72.0°F (22.2 °C)	Cooling setpoint for occupied time periods.
Unoccupied Cooling	50 to 95 °F (10 to 35 °C)	82.0°F (27.7 °C)	Cooling setpoint for unoccupied time periods.
Stage Control Band	0 to 10 °F (0 to 5.56 °C)	0.0 ° (Disabled)	Value used to modify the calculated heating and cooling setpoints to form the temperature range in which local heating or cooling is enabled.
Stage Time	0 to 255 minutes	5 minutes	The rate at which stages are sequenced, or the full stroke time of the valve.
Heating Stages	0 to 2	2	Number of heating stages controlled. Set to zero to disable heating or enable floating point heating valve control.
Cooling Stages	0 to 4	4	Number of cooling stages controlled. Zero disables cooling.
Fan Type	Auto, On	Auto	Set to "On" to enable continuous operation during occupied mode. Otherwise, fan switches on and off automatically according to the control algorithm,

Economizer Settings

Displays DXU-2 setpoints that specifically relate to economizer operation.

Table 2: DXU-2 Economizer Settings

Setting	Range	Default	Description
Economizer Setpoint	40.00 to 70.00 °F (4.44 to 21.11 °C)	55.00 °F (12.78 °C)	Setpoint used fro controlling the modulated economizer.
Economizer Minimum Output	0.0 to 10.0 Volts	0.0 Volts	Minimum output voltage for the modulated economizer.
Economizer Maximum Output	0.0 to 10.0 Volts	10.0 Volts	Maximum output voltage for the modulated economizer.
Economizer Type	Disabled, 2 State Unoccupied On, 2 State Unoccupied Off, Modulated Unocc. On, Modulated Unocc. Off,	Disabled	If using an economizer, set this field to a value that describes the type of economizer and whether it should be enabled during unoccupied periods.
Economizer Proportional Gain	0.00 to 100.00% per °F	25.00%	Proportional gain of the economizer's P+I control loop.
Economizer Integral Gain	0.00 to 100.00%	0.05%	Integral gain of the economizer's P+I control loop.
Minimum Fresh Air	0.00 to 100.00%	0.00%	Minimum fresh air position for the modulated economizer.
Free Cool Setpoint	0.0 to 60.0 BTU/lb. (0.0 to 139.6 kjoule/kg)	5.0 BTU/lb. (11.6 kjoule/kg)	Difference between inside enthalpy and outside enthalpy that enables or disables the economizer.[a]

a. This value is only used for "Return Air Humidity Sensor" and "Global Indoor Humidity Sensor" free cooling types.

Heating and Cooling Factors

These buttons enable you to configure the LCI's non-adaptive optimum start (OS) feature to enable morning warm-up and cool down. The OS feature modifies the scheduling of the controller to account for the heating and cooling factor of the system. Set these values to the number of degrees per minute that your system is capable of modifying the indoor air temperature. To disable this feature, set these values to zero.

List All Settings

Displays all of the DXU-2's setpoints and editable settings and provides access to edit all DXU-2 parameters from a single screen.

Table 3: All DXU-2 Settings

Setting	Range	Default	Description
Occup. Temperature Setpoints			
– Occupied Cooling	50 to 95 °F (10 to 35 °C)	72.0°F (22.2 °C)	Cooling setpoint for occupied time periods.
– Unoccupied Cooling	50 to 95 °F (10 to 35 °C)	82.0°F (27.7 °C)	Cooling setpoint for unoccupied time periods.
– Occupied Heating	50 to 95 °F (10 to 35 °C)	70.0°F (21.1 °C)	Heating setpoint for occupied time periods.
– Unoccupied Heating	50 to 95 °F (10 to 35 °C)	60.0°F (15.5 °C)	Heating setpoint for unoccupied time periods.
Space Temperature Limit	0.00 to 15.00 °F (0.00 to 8.33 °C)	5.00 °F (2.78 °C)	Degrees below the heating setpoint or above the cooling setpoint to trigger a low limit or high limit alarm. Zero disables the alarm.

Table 3: All DXU-2 Settings (Continued)

Setting	Range	Default	Description
Heating Stages	0 to 2	2	Number of heating stages controlled. Set to zero to disable heating or enable floating point heating valve control.
Cooling Stages	0 to 4	4	Number of cooling stages controlled. Zero disables cooling.
Stage Control Band	0 to 10 °F (0 to 5.56 °C)	0.0 ° (Disabled)	Value used to modify the calculated heating and cooling setpoints to form the temperature range in which local heating or cooling is enabled.
Stage Time	0 to 255 minutes	5 minutes	The rate at which stages are sequenced, or the full stroke time of the valve.
Fan Type	Auto, On	Auto	Set to “On” to enable continuous operation during occupied mode. Otherwise, fan switches on and off automatically according to the control algorithm,
Setpoint Adjust	0 °F to 10 °F (0 °C to 5.6 °C)	5 °F (2.8 °C)	Allowed range of the setpoint adjustment.
Occ. Extend Time	0 to 1000 minutes	60 minutes	Allowable occupancy extension time.
Economizer Type	Disabled, 2 State Unoccupied On, 2 State Unoccupied Off, Modulated Unocc. On, Modulated Unocc. Off,	Disabled	If using an economizer, set this field to a value that describes the type of economizer and whether it should be enabled during unoccupied periods.
Economizer Setpoint	40.00 to 70.00 °F (4.44 to 21.11 °C)	55.00 °F (12.78 °C)	Setpoint used for controlling the modulated economizer.
Economizer Proportional Gain	0.00 to 100.00% per °F	25.00%	Proportional gain of the economizer’s P+I control loop.
Economizer Integral Gain	0.00 to 100.00%	0.05%	Integral gain of the economizer’s P+I control loop.
Minimum Fresh Air	0.00 to 100.00%	0.00%	Minimum fresh air position for the modulated economizer.
Free Cool Setpoint	0.0 to 60.0 BTU/lb. (0.0 to 139.6 kjoule/kg)	5.0 BTU/lb. (11.6 kjoule/kg)	Difference between inside enthalpy and outside enthalpy that enables or disables the economizer.[a]
Economizer Minimum Output	0.0 to 10.0 Volts	0.0 Volts	Minimum output voltage for the modulated economizer.
Economizer Maximum Output	0.0 to 10.0 Volts	10.0 Volts	Maximum output voltage for the modulated economizer.
Fan Runtime Limit	0 to 65535 hours	1000 hours	Runtime limit for fan after which a maintenance alarm is generated.
Cooling Runtime Limit	0 to 65535 hours	1000 hours	Runtime limit for cooling after which a maintenance alarm is generated.
Heating Runtime Limit	0 to 65535 hours	1000 hours	Runtime limit for heating after which a maintenance alarm is generated.

Table 3: All DXU-2 Settings (Continued)

Setting	Range	Default	Description
Occupied Time			
– Hours	0 to 23	0	Time to begin occupied period for the local backup schedule.
– Minutes	0 to 59	0	
Unoccupied Time			
– Hours	0 to 23	0	Time to end occupied period for the local backup schedule.
– Minutes	0 to 59	0	
Free Cool Type	Return Air Humidity Sensor, Global Indoor Humidity Sensor, Dry Bulb Temperature Comparison	Return Air Humidity Sensor	Type of free cooling comparison to perform.
Economizer Drybulb Setpoint	0.0 to 20.0 °F (0.0 to 11.1 °C)	5 °F (2.78 °C)	Difference between zone temperature and outside temperature that enables of disables the economizer.[b]
Heat Travel Time	0 to 600 seconds	0 seconds	Total time it takes for the floating point heating valve to travel from fully closed to fully open.[c]

a. This value is only used for “Return Air Humidity Sensor” and “Global Indoor Humidity Sensor” free cooling types.
b. This value is only used for “Dry Bulb Temperature Comparison” free cooling.
c. This value is only used if “Heating Stages” is set to zero.

Inputs

The Inputs screen displays the current values of the DXU-2’s inputs. These values cannot be changed.

Table 4: DXU-2 Inputs

Setting	Range	Description
Space Temperature	-22 to 122 °F (-30 to 50 °C)	The space temperature reported by the digital thermostat module.
Supply Air Temperature	-22 to 122 °F (-30 to 50 °C)	Temperature reported by the SAT sensor.
Return Air Humidity	0.00 to 100.00%	Humidity reported by the RAH sensor.
Mixed Air Temperature	-22 to 122 °F (-30 to 50 °C)	Temperature reported by the MAT sensor.
Fan Status	Off, On	Status of the fan proof switch (FNP)
Low Limit	Normal, Freeze	Status of the mixed air low limit indication switch (MLL).
Filter Status	Normal, Dirty	Status of the filter switch (FIL).
Smoke Detector	Normal, Smoke	Status of the smoke detector (SMK).
Inside Enthalpy	0.0 to 60.0 BTU/lb. (0.0 to 139.6 kjoule/kg)	Calculated inside air enthalpy.
Outside Enthalpy	0.0 to 60.0 BTU/lb. (0.0 to 139.6 kjoule/kg)	Calculated outside air enthalpy.

Outputs

This screen displays the current values of the DXU-2's outputs. These values cannot be changed.

Table 5: DXU-2 Outputs

Setting	Range	Description
Heat Output	0.00% to 100.00%	Heat output currently being supplied to the space.
Cool Output	0.00% to 100.00%	Current status of the cooling outputs.
Fan Output	0.00% or 100.00%	Current status of the fan outputs.
Economizer Output	0.00% or 100.00%	Current status of the economizer output.

Runtimes/Limits

This screen shows all runtime totals and runtime limits for the DXU-2. To reset a runtime total to zero, use the up and down arrows to highlight the value, and then press **`Reset`**. To change a value, highlight it and press **`Select`**.

Table 6: DXU-2 Runtimes/Limits

Setting	Range	Default	Description
Fan Runtime	0 to 65535 hours	N/A	Current fan runtime.
Fan Runtime Limit	0 to 65535 hours	1000 hours	Runtime limit for fan after which a maintenance alarm is generated.
Cooling Runtime	0 to 65535 hours	N/A	Current cooling runtime.
Cooling Runtime Limit	0 to 65535 hours	1000 hours	Runtime limit for cooling after which a maintenance alarm is generated.
Heating Runtime	0 to 65535 hours	N/A	Current heating runtime.
Heating Runtime Limit	0 to 65535 hours	1000 hours	Runtime limit for heating after which a maintenance alarm is generated.

Troubleshooting

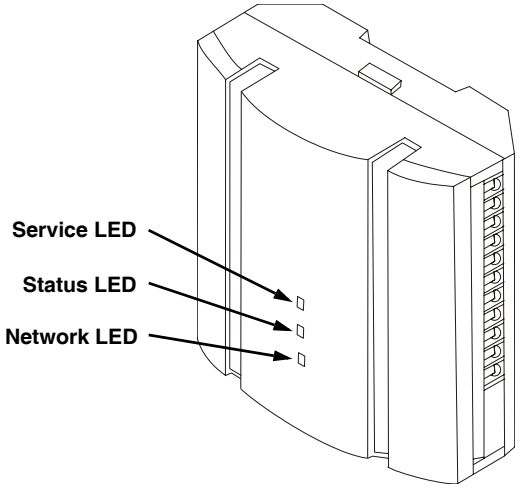
Diagnostic LEDs

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 7: 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
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 10: DXU-2 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).

Fan cycles on for 30 seconds and then turns off.

The controller requires the fan status input to be shorted, normally closed, for proper operation. Ensure that your air flow sensor is working and properly wired to the controller. If you are not using an air flow sensor you must place a jumper between the fan status input and the adjacent common terminal.

The fan will not cycle on after the input has been jumpered or the air flow sensor connected.

If the fan was previously in a fan fault condition, the controller must be reset before proper operation can be restored.

How do I reset the controller?

The controller can be reset by the LCI, or you can cycle power to the controller. Refer to the LCI documentation for more information on resetting the controller using the LCI.

The fan will not cycle on.

There are several reasons the fan may not cycle on, and all should be checked.

1. Are all digital inputs on the controller (except for the fan status input) normally open and wired accordingly?
2. Is the controller in an occupied mode?
3. Has the controller been overridden by the LCI?
4. Is the smoke detector or mixed air low limit indicator (freeze stat) tripped? If so, correct the problem and the controller will automatically start; no reset is necessary.
5. Is the thermostat connected?

The fan and heat/cool pilot relays will not come on even though the LCI indicates it is on.

Ensure that the controller and output pilot relay have been powered with 24 VAC and the output has been correctly wired to the coil of the pilot relay. Also ensure that the pilot relay has a 24 VAC coil.

The 10K thermistor reading is at its maximum or minimum.

The input is either shorted or open.

The economizer damper fails to open.

1. Was the LCI used to select an economizer type other than ‘None’?
2. Is the difference between indoor and outdoor enthalpy greater than the economizer setpoint?
3. If “global humidity” is selected, make sure that the ASM is reading a valid humidity and providing it to the network.