Predator Controller Hardware Family

Description

The LONMARK® certified configurable Predator® Controller provides direct digital control of a variety of mechanical equipment ranging from zone level control of VAV/CV, Heat Pump, Unit Ventilator, and Fan Coil Units to air distribution units to mechanical plants to spare point pick up of miscellaneous zone equipment. The Predator Controller is designed to reside on a LONWORKS® network, providing seamless interaction with all LONMARK products. The Predator Controller offers cost-effective flexibility – by providing various input/output configurations; each designed to meet the individual equipment application requirements.

Features

- Conforms to and is certified to the LONMARK interoperability guidelines, enabling information sharing with other LONMARK products.
- LONMARK-compliant with space comfort functional profile number 8505 for zone level control and the Discharge Air Controller Functional Profile 8610 for air distribution control.
- Field-selectable parameters allow entry and updating of setpoint and control parameters via the TALON® Interface.
- Unique two-piece design, consisting of a plenum-rated Enclosure Cover with Embedded Controller Board and a separate Wiring Base, to protect electronic parts from potential damage during installation.
- Variety of platform configurations for application flexibility.
- Advanced PID control minimizes offset and maintains tighter setpoint control.
- Return to service from power failure without operator intervention.

Single Fan VAV AHU
Chilled Water with Options

Application Data Sheet

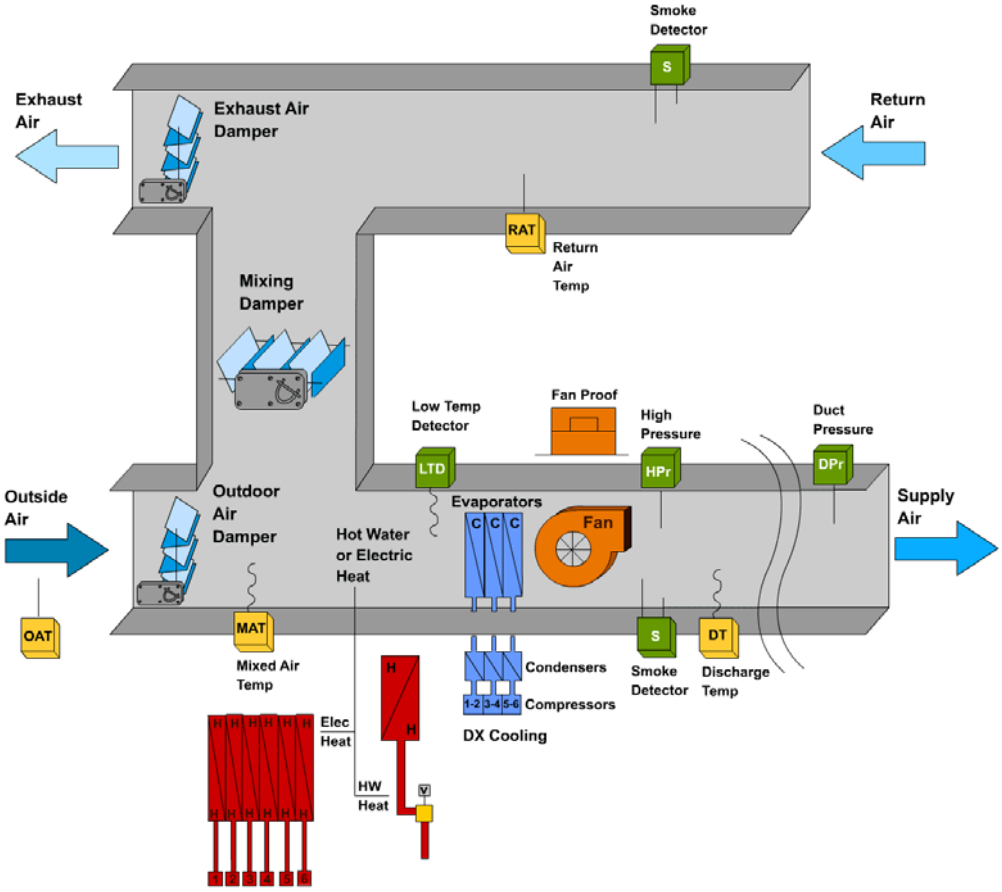


Figure 1. Single Fan CHW VAV AHU with selectable hot water or electric heat with options

Features

- LONMARK compliant with Discharge Air Controller Functional Profile (8610)
- Economizer cycle driven by local dry bulb logic or network override
- Minimum ventilation setting responds to air quality input for demand controlled ventilation
- Multiple options for supply air temperature reset to optimize system performance
- Interoperates with LonMark zone controllers to coordinate occupancy and air conditioning functions
- Adaptive control of outdoor air dampers responds quickly and stably in any season
- PID control minimizes offset and maintains tighter set point control
- Conforms to the LONMARK interoperability guidelines, enabling information sharing with LONMARK products from other vendors.

Sequence of Operation

Occupied Control

General

The supply fan starts slowly and runs throughout the occupied mode. A PID control loop continually adjusts the fan capacity to maintain the duct static pressure at setpoint as loads vary in the zones. The duct pressure setpoint may be an adjustable constant, or may be varied automatically by another node to minimize energy consumption.

Ventilation Control Ventilation (DCV)

During occupied mode, the outdoor air damper opens to the design ventilation setting and stays open. When Demand Controlled Ventilation (DCV) is implemented, the ventilation setting may be automatically adjusted from internally in the Predator or by another node to a value appropriate for the demand. The Predator DCV function is adjustable, while the ventilation demand value comes from another node.

The supply air temperature setpoint may be adjusted manually or varied according to an adjustable built-in reset function.

Discharge Temperature Control

Hot Water Option
When free cooling is available, the heating coil valve, outdoor air damper, and cooling coil valve modulate in sequence to maintain discharge air temperature setpoint. The outdoor air damper does not close beyond the current ventilation setting. When free cooling is unavailable, the outdoor air damper goes to the current ventilation setting; the heating coil valve and cooling coil valve modulate in sequence to maintain discharge air temperature setpoint.

Staged Heat Option
When free cooling is available, the heat stages, outdoors air damper, and cooling coil valve modulate in sequence to maintain discharge air temperature setpoint. The outdoor air damper does not close beyond the current ventilation setting. When free cooling is unavailable, the outdoor air damper goes to the current ventilation setting; the heat stages and cooling coil valve modulate in sequence to maintain discharge air temperature setpoint.

Unoccupied Control

General

During unoccupied periods, the air handler is normally off. The outdoor damper is closed and the cooling valve is closed. The optional hot water coil valve may be forced closed, or it may operate to maintain unit temperature above freezing. Optional staged heat stages are turned off.

The Predator may run the air handler intermittently to provide heating or cooling in response to demand from the associated unoccupied zone controllers.

Unoccupied Cooling Mode

The air handler starts in response to a cool or ***pre-cool*** command from the network or measured zone temperature above the unoccupied setpoint. The Predator modulates the supply fan capacity to maintain measured duct pressure at the duct static pressure setpoint. If free cooling is not available, the outdoor air damper closes fully. Mechanical cooling may be locked out during unoccupied periods.

Unoccupied Heating Mode

The air handler starts in response to a heat or ***warm-up*** command from the network or measured zone temperature below the unoccupied setpoint. The Predator modulates the supply fan capacity to maintain measured duct pressure at the duct static pressure setpoint. The hot water coil or staged heat is operated to maintain the supply air temperature at the heating setpoint. The cooling coil valve and the outdoor air damper are closed.

Safety Shutdown

Low Temperature

If a Low Temperature is detected the OA damper closes and the fan shuts off. The chilled water valve opens fully. The optional hot water coil valve opens fully; optional staged heat is turned off. The system may be configured to re-start automatically after the condition clears, or to remain shut down until a manual reset.

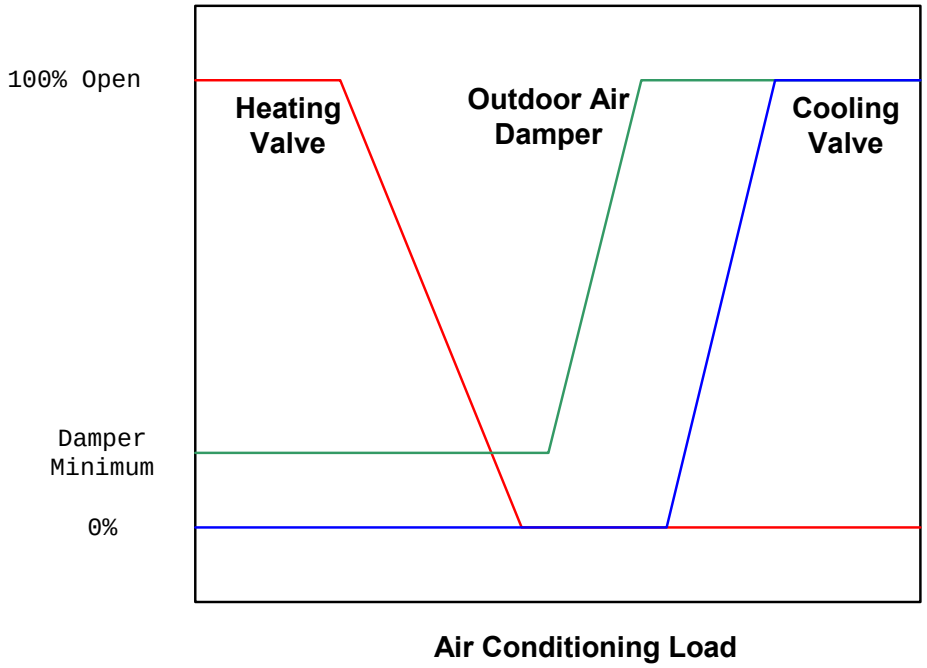
Other Safeties

Any number of other safety devices, such as smoke detectors or a high duct pressure switch, may be applied to shut the unit down. The Predator turns off the fan, closes the OA dampers and closes the coil valves. The Predator indicates an alarm condition over the network, and remains shut down until reset manually.

Off

In this mode, the cooling or heating coil valve and OA damper are closed and the fan is off.

Temperature Control Sequence Diagrams



The Predator sequences heating, cooling and outside air as needed to meet air contidioning load.

Special Features

System Level Occupancy Control

Occupancy for an air handler should be coordinated with occupancy for its respective zones. A site may employ more than one of the following interoperation mechanisms to accomplish system level coordination:

- The Predator Air Handler Controller may drive occupancy of the zones through bound network variables.
- The zone controllers may drive occupancy of the air handler so that it runs to meet their needs.
- Occupancy of the zones and air handler may both be driven in a coordinated way by another LonMark device.

The Predator responds to LonMark occupancy override (nviOccManCmd), allowing a building operator or technician to override the system from any LonMark compatible user interface.

The Predator responds to a LonMark compatible occupancy schedule input (nviOccSchedule). This allows the Predator to utilize the scheduling functions of other devices on the LonTalk Network.

The primary occupancy signal could also come from a time clock, wall switch, or occupancy sensor physically wired to one of the inputs of the Predator. This occupancy signal can then be shared with other controllers via the LonTalk Network.

Duct Pressure Reset

To comply with ASHRAE Standard 90.1, Energy Efficiency for Commercial Buildings, the Predator supports automatic duct pressure reset by accepting a variable setpoint. The dynamic setpoint may calculated according to any algorithm in another device, and transmitted over the network.

Supply Temperature Reset

The Predator can run an air handler as a classic constant-temperature VAV system, or it can dynamically adjust the supply temperature to adapt to loading conditions. The temperature may be reset using a built-in adjustable reset schedule, or calculated externally with a custom algorithm, and transmitted via the LonWorks network. The built-in reset schedules directly support the most popular approaches: reset based on space temperature, return temperature, outdoor temperature or a selected percentage demand signal from the zone controllers.

Demand Controlled Ventilation

The Predator can control ventilation by the industry standard approach, using an adjustable minimum OA damper opening or by a demand-controlled strategy that adjusts the OA intake according to IAQ measurements in the occupied spaces. The DCV lets an HVAC designer build the system for the maximum anticipated ventilation requirements, but operate the system more economical ventilation rates when the actual demand is lower.

Night Heating and Cooling

The Predator supports several heating and cooling options for unoccupied periods. Using zone temperature data that either comes from the directly connected zone sensor or delivered over the network, the controller can cycle the air handler to meet heating and cooling needs of the zones. This function requires no intervention from a supervisory node. If some other start/stop criteria is required, another node may implement that logic and command the air handler on and off during the unoccupied period.

In cold climates, to prevent mechanical equipment freeze up, there is a need to keep the air handler warm even when the fan is off. The Predator can cycle or modulate an optional hot water valve to keep the mixed air temperature (or discharge temperature) within a desired range while the fan is off.

The Predator can initiate a warm-up sequence for the zones. When the zone temperature and the outdoor temperature are both below adjustable limits and occupancy is due to start soon, the Predator switches to warm-up mode. It issues a network command for the zone controllers to put them in warm-up mode. The only inputs required are the zone temperature and the LonMark compatible schedule variable.

Adaptive Control of Outdoor Air Damper

Past history has proven that tuning for economizer control loops poses problems. For example, when it is particularly cold outside, a small damper movement can cause a big change in the mixed air temperature. The control loop is likely to overshoot or even oscillate which can cause big problems in the air-handling unit. To prevent oscillation, it is necessary to tune the loop specifically for the cold-weather case. Then when warmer weather arrives, the cold-weather tuning leads to sloppy control and an ineffective air conditioning system.

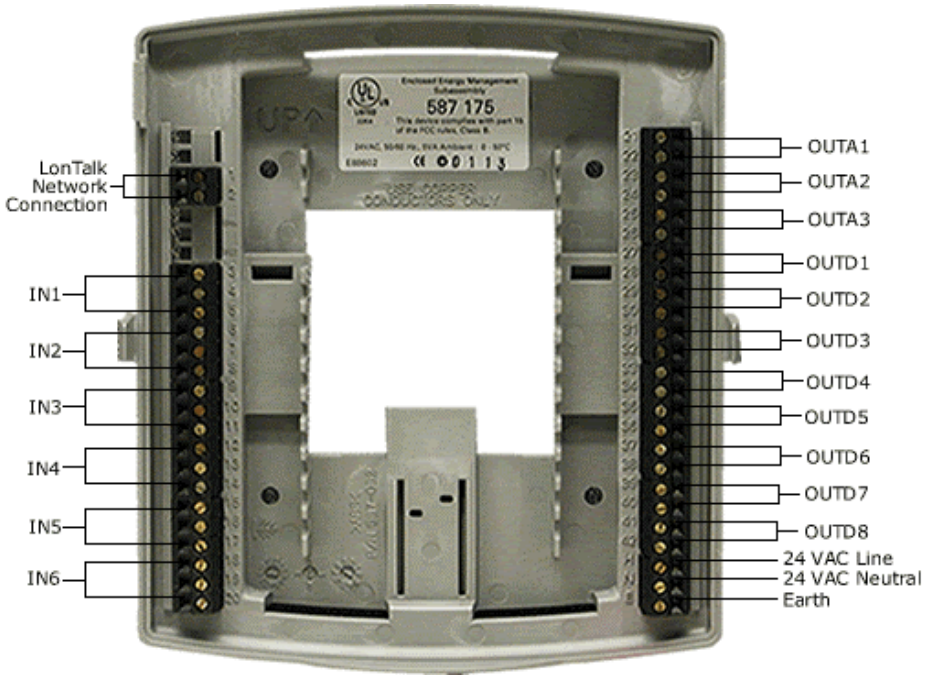
The Predator addresses this dilemma directly by automatically adjusting the economizer control loop tuning to suit the outdoor temperature. Without any attention or maintenance, the loop is always fast, stable and accurate, making the economizer truly economical.

Hardware Map – VAV AHU

Termination Set	Parameter Set in	Element Name	I/O Type	Factory I/O Setting
StatTemp	inputs	statTemp	TEMP	SPACE_TEMP
StatSetpt		statSetpt		IN_UNUSED
StatOvrd		statOvrd	DI	STAT_SWITCH_DI
In1		in1	DI, TEMP	DISCH_TEMP
In2		in2		RETRN_TEMP
In3		in3	DI, PCT, TEMP	DUCT_PRESS
In4		in4		FAN_STATUS_DI
In5		in5		LOW_TEMP_DI
In6		in6		HI_PRESS_DI
OutA1	outputs	outA1	AO	SUP_FAN_CAP_AO
OutA2		outA2		OA_DMPR_AO
OutA3		outA3		HEAT_COIL_AO
OutD1		outD1	DO, FLT_MTR	SUP_FAN_DO
OutD2		outD2		OA_DAMPER_2POS_DO
OutD3		outD3		DX_STAGE1_DO
OutD4		outD4		DX_STAGE2_DO
OutD5		outD5		DX_STAGE3_DO
OutD6		outD6		DX_STAGE4_DO
OutD7		outD7		HEAT_STAGE1_DO
OutD8		outD8		HEAT_STAGE2_DO

Table 1. Hardware Map

Wiring Diagram



Note: Route wiring from either the bottom opening when using a J-box or from the base sides as shown in the picture when flat or din rail mounting. The image above is for illustrative purposes only

Wiring Recommendations:

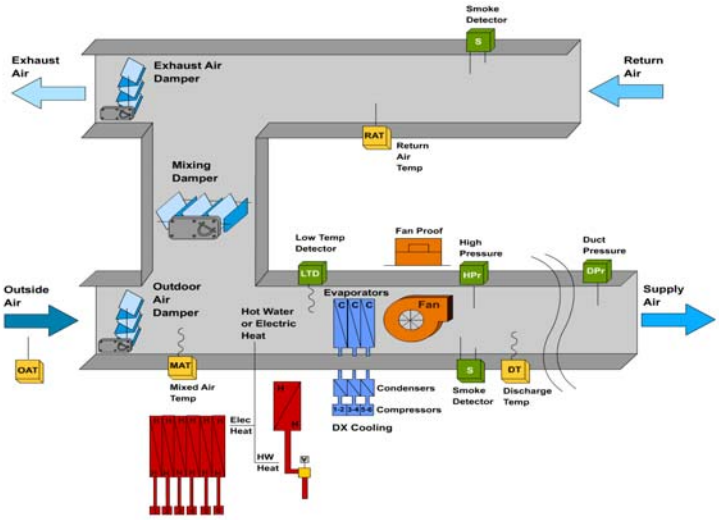
IN and AO:	20 to 22 AWG
DO:	18 to 22 AWG
Power:	16 to 18 AWG
LON Network:	22 AWG Level 4

Transformer Requirements:

Type: Class 2, 24 VAC, 50/60Hz

Figure 3. Predator Wiring Diagrams

Bill of Materials



	Description	Product #
	Predator VAV AHU Controller 6IN 8DO 3AO	587-291
	Predator Full Point Wiring Base	587-175
A.	Predator Room Sensors:	
	Sensing Only	587-180
	Override	587-181
	Temperature Display	587-183(1)
	Override and Temperature Display	587-185(1)
	Notes: (1) Sensor will display Fahrenheit or Celsius temperature	
B.	Duct Sensor (100K thermistor)	535-741
C.	For Network communication: Predator 6-Conductor Room Sensor Cables:	
	25 Foot	588-100A
	50 Foot	588-100B
	100 Foot	588-100C
	- OR -	
	For non-network communications: Predator 4-Conductor Room Sensor Cables:	
	25 Foot	588-101A
	50 Foot	588-101B
	100 Foot	588-101C

Optional Accessories

D.	Outside Air Temperature Sensor	536-778
E.	Low Temperature Stat with auto reset	1341510

Configuration Tables

The application configuration tables below are typical for a VAV AHU controller.

Application Component	Variable Name	Element	Factory Setting
Small VAV Air Handler Core	hVACSeqDelay		5 minutes
	startDelay		0 minutes
	testTime		180 seconds
Cooling Coil CW	clgCoilMtr	TravelTime	125 seconds
		Reverse	False
	coolCoilCtl	Pb	50°F (10.0°C)
		Ti	300 seconds
		Td	0 seconds
	coolCoilEn		False
	coolDeadBand		0.90°F (0.50°C)
	coolLockout	Enable	32°F (0°C)
		Disable	14°F (-10°C)
Discharge Air Temp Sensing	dAClSP		59°F (15°C)
	dAHtSP		95°F (35°C)
	dAResetSrc		0
	maxDAClIn		68°F (20°C)
	maxDAClPct		0.0%
	maxDAClSP		68°F (20°C)
	maxDAHtIn		68°F (20°C)
	maxDAHtPct		100.0%
	maxDAHtSP		104°F (40°C)
	minDAClIn		68°F (20°C)
	minDAClPct		100.0%
	minDAClSP		59°F (15°C)
	minDAHtIn		68°F (20°C)
	minDAHtPct		0.0%
	minDAHtSP		50°F (10°C)
Duct Pressure Sensing	ductStatSP		250 Pa
	ductPresCtl	Pb	500 Pa
		Ti	20 seconds
		Td	0 seconds
	ductPresRange		498 Pa
DX Cooling	coolDeadBand		90°F (50°C)
	coolLockout	Enable	32°F (0°C)
		Disable	14°F (-10°C)
	dXMinOffTime		2 minutes
	dXMinOnTime		2 minutes
	numDXStages		0
	dXStageDelay		3 minutes
Fan Control	fanRampTime		15 seconds
	fanStatusEn		False

Application Component	Variable Name	Element	Factory Setting
Modulating Heat	heatCoilCtl	Pb	68°F (20°C)
		Ti	300 seconds
		Td	0 seconds
	heatCoilEn		False
	htgCoilMtr	TravelTime	125.0 seconds
		Reverse	FALSE
	heatDeadBand		0.90°F (0.50°C)
	heatLockout	Enable	68°F (20°C)
		Disable	71.6°F (22°C)
	heatUnit		Off
OA Damper Control with Mixed Air	econControl		Enabled
	econDBand		1.8°F (1°C)
	econRef	Source	SRC_RETURN_TEMP
		FixedTemp	68°F (20°C)
		Offset	35.6°F (2°C)
	oADmprCntr	Pb	95°F (35°C)
		Ti	200 seconds
		Td	0 seconds
	oAMinPos		0%
	oAReducedPos		0%
	oATempAdaptEn		Enable
	vDmdDesign		100%
	vDmdReduced		0.0%
Occupancy Control	bypassTime		60 minutes
	statSwitchEn		False
	setpoints	OccupiedClg	73°F (23°C)
		StandbyClg	77°F (25°C)
		UnoccupiedClg	82°F (28°C)
		OccupiedHtg	70°F (21°C)
		StandbyHtg	66°F (19°C)
		UnoccupiedHtg	61°F (16°C)
	unocDeadBand		3.6°F (2°C)
	warmupTrig	Duration	0 minutes
		OutTemp	50°F (10°C)
		InTemp	62°F (17°C)
Safeties	hiPressLatch		Enable
	loTempLatch		Enable
Staged Heat	heatDeadBand		0.90°F (0.50°C)
	heatLockout	Enable	68°F (20°C)
		Disable	71.6°F (22°C)
	htStageDelay		300 seconds
	numHStages		0

Control Mode Interaction Table

Device	Mode									
				Occupied		Unoccupied			Safety	
	Off	Fan Only	Starting (Fan Proof)	cool	heat	cool	Idle	heat	low temp	other safety
Fan	off	mod	mod	mod	mod	mod	off	mod	off	off
OA damper	close	close	close	mod	min	mod	close	close	close	close
Cool valve	off	off	off	mod	off	mod	off	off	open	off
Stage heat	off	off	off	stage	stage	stage	off	stage	off	off
Heat valve	off	off	select	mod	mod	mod	select	mod	open	off

Color Key: Red = OFF (not used); Green = Active (fixed in application); Yellow = Selectable (configurable)

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Single Fan VAV AHU
DX Cooling with Options

Application Data Sheet

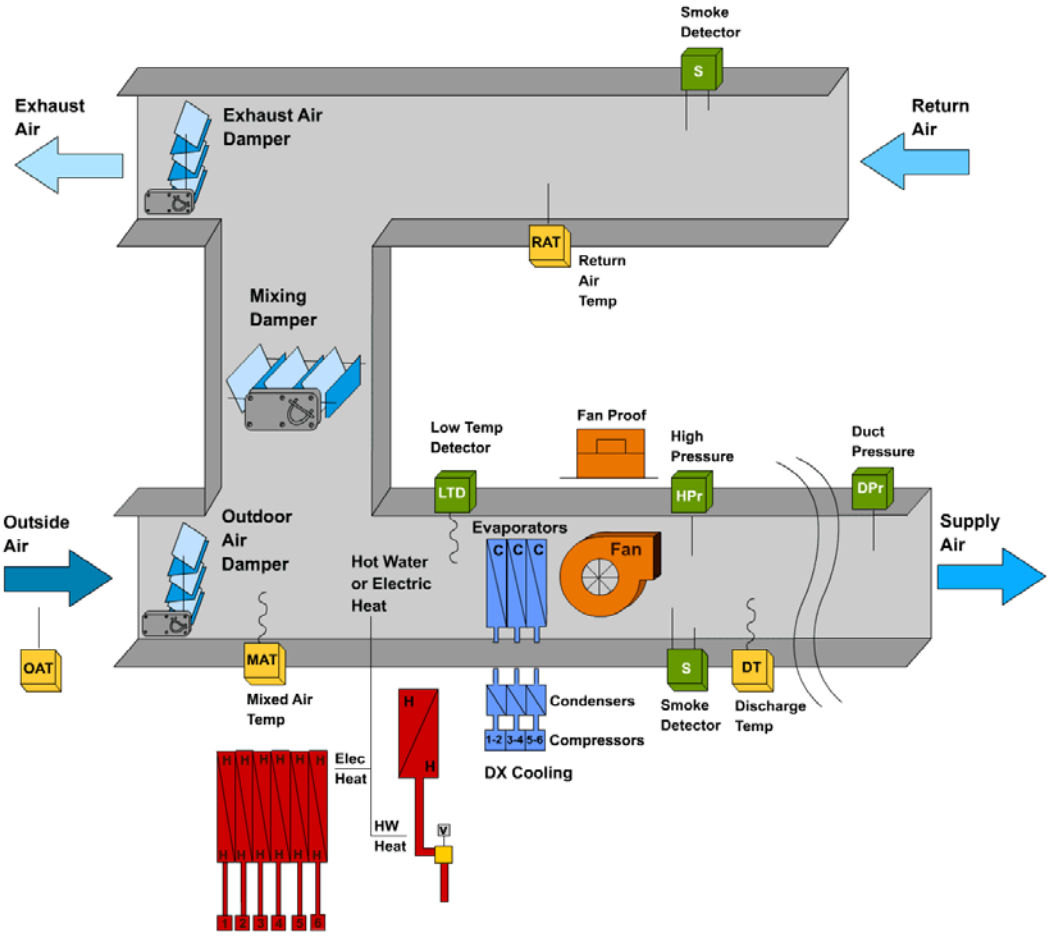

Figure 1. Single Fan DX VAV AHU with selectable hot water or electric heat and options

Features

- LONMARK compliant with Discharge Air Controller Functional Profile (8610)
- Economizer cycle driven by local dry bulb logic or network override
- Minimum ventilation setting responds to air quality input for demand controlled ventilation
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During occupied mode, the outdoor air damper opens to the design ventilation setting and stays open. When Demand Controlled Ventilation (DCV) is implemented, the ventilation setting may be automatically adjusted from internally in the Predator or by another node to a value appropriate for the demand. The Predator DCV function is adjustable, while the ventilation demand value comes from another node.

The supply air temperature setpoint may be adjusted manually or varied according to an adjustable built-in reset function.

Discharge Temperature Control

Hot Water Option
When free cooling is available, the heating coil valve, outdoor air damper, and stages of DX cooling operate sequence to maintain discharge air temperature setpoint. The outdoor air damper does not close beyond the current ventilation setting. When free cooling is unavailable, the outdoor air damper goes to the current ventilation setting; the heating coil valve modulates and stages of cooling operate in sequence to maintain discharge air temperature setpoint.

Staged Heat Option
When free cooling is available, the heat stages, outdoors air damper, and stages of cooling operate in sequence to maintain discharge air temperature setpoint. The outdoor air damper does not close beyond the current ventilation setting. When free cooling is unavailable, the outdoor air damper goes to the current ventilation setting; the heat stages and stages of cooling operate in sequence to maintain discharge air temperature setpoint.

Unoccupied Control

General

During unoccupied periods, the air handler is normally off. The outdoor damper is closed and the DX equipment is off. The optional hot water coil valve may be forced closed, or it may operate to maintain unit temperature above freezing. Optional staged heat stages are turned off.

The Predator may run the air handler intermittently to provide heating or cooling in response to demand from the associated unoccupied zone controllers.

Unoccupied Cooling Mode

The air handler starts in response to a cool or ***pre-cool*** command from the network or measured zone temperature above the unoccupied setpoint. The Predator modulates the supply fan capacity to maintain measured duct pressure at the duct static pressure setpoint. If free cooling is not available, the outdoor air damper closes fully. Mechanical cooling may be locked out during unoccupied periods.

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Safety Shutdown

Low Temperature

If a Low Temperature is detected the OA damper closes and the fan shuts off. The stages of cooling are turned off. The optional hot water coil valve opens fully; optional staged heat is turned off. The system may be configured to re-start automatically after the condition clears, or to remain shut down until a manual reset.

Other Safeties

Any number of other safety devices, such as smoke detectors or a high duct pressure switch, may be applied to shut the unit down. The Predator turns off the fan, closes the OA dampers, closes the hot water coil valve and turns off the cooling stages. The Predator indicates an alarm condition over the network, and remains shut down until reset manually.

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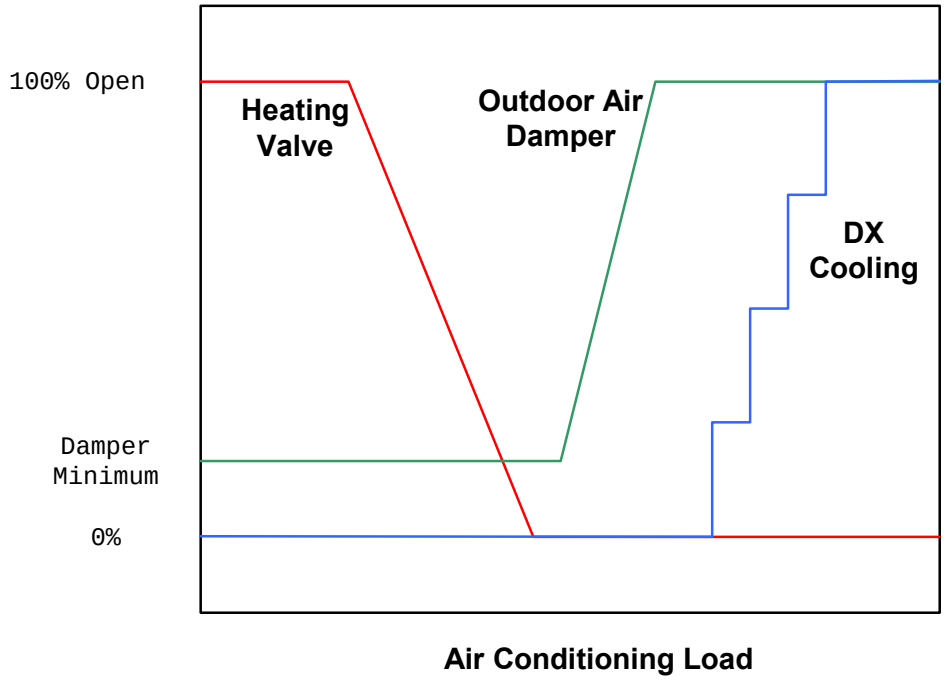
Temperature Control Sequence Diagrams



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Adaptive Control of Outdoor Air Damper

Past history has proven that tuning for economizer control loops poses problems. For example, when it is particularly cold outside, a small damper movement can cause a big change in the mixed air temperature. The control loop is likely to overshoot or even oscillate which can cause big problems in the air-handling unit. To prevent oscillation, it is necessary to tune the loop specifically for the cold-weather case. Then when warmer weather arrives, the cold-weather tuning leads to sloppy control and an ineffective air conditioning system.

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In6		in6		HI_PRESS_DI
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OutD2		outD2		OA_DAMPER_2POS_DO
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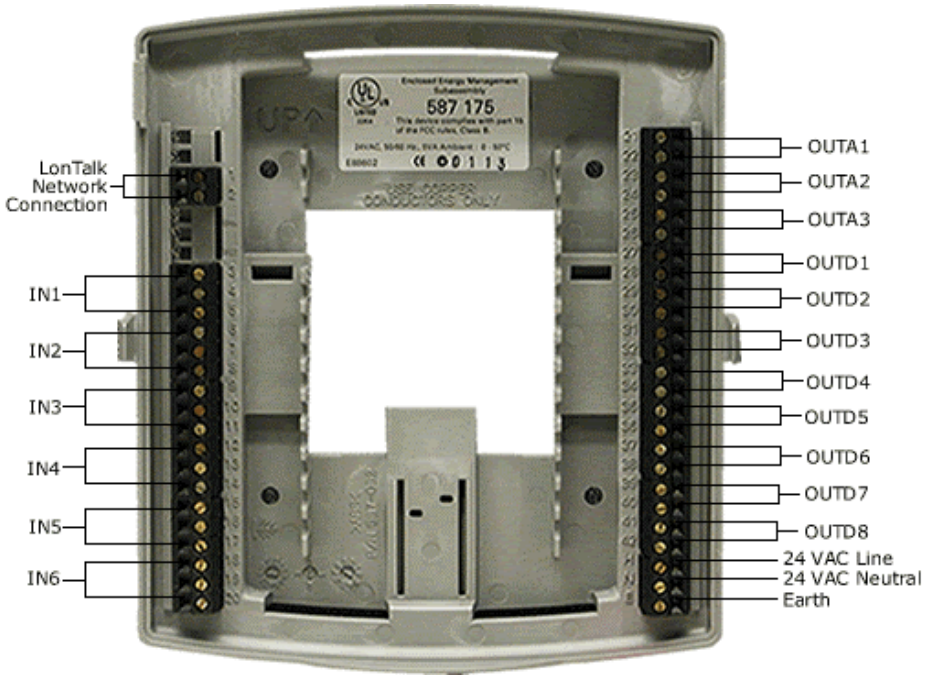
Wiring Diagram



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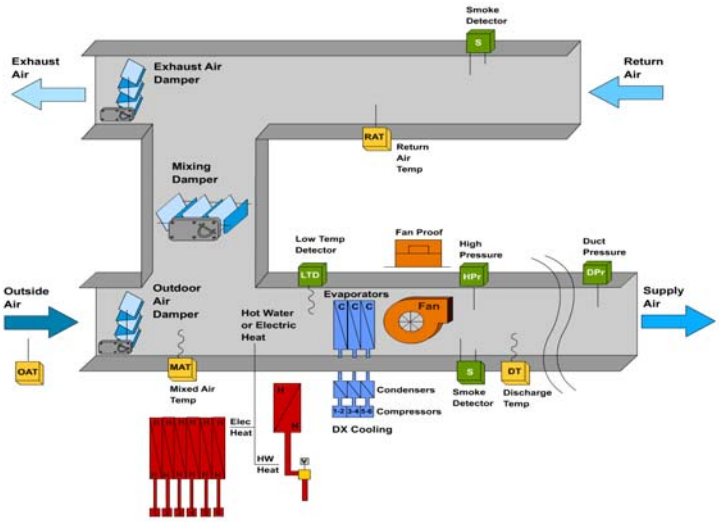
LON Network:	22 AWG Level 4

Transformer Requirements:

Type: Class 2, 24 VAC, 50/60Hz

Figure 3. Predator Wiring Diagrams

Bill of Materials



	Description	Product #
	Predator VAV AHU Controller 6IN 8DO 3AO	587-291
	Predator Full Point Wiring Base	587-175
A.	Predator Room Sensors:	
	Sensing Only	587-180
	Override	587-181
	Temperature Display	587-183(1)
	Override and Temperature Display	587-185(1)
	Notes: (1) Sensor will display Fahrenheit or Celsius temperature	
B.	Duct Sensor (100K thermistor)	535-741
C.	For Network communication: Predator 6-Conductor Room Sensor Cables:	
	25 Foot	588-100A
	50 Foot	588-100B
	100 Foot	588-100C
	- OR -	
	For non-network communications: Predator 4-Conductor Room Sensor Cables:	
	25 Foot	588-101A
	50 Foot	588-101B
	100 Foot	588-101C

Optional Accessories

D.	Outside Air Temperature Sensor	536-778
E.	Low Temperature Stat with auto reset	1341510

Configuration Tables

The application configuration tables below are typical for a VAV AHU controller.

Application Component	Variable Name	Element	Factory Setting
Small VAV Air Handler Core	hVACSeqDelay		5 minutes
	startDelay		0 minutes
	testTime		180 seconds
Cooling Coil CW	clgCoilMtr	TravelTime	125 seconds
		Reverse	False
	coolCoilCtl	Pb	50°F (10.0°C)
		Ti	300 seconds
		Td	0 seconds
	coolCoilEn		False
	coolDeadBand		0.90°F (0.50°C)
	coolLockout	Enable	32°F (0°C)
		Disable	14°F (-10°C)
Discharge Air Temp Sensing	dAClSP		59°F (15°C)
	dAHtSP		95°F (35°C)
	dAResetSrc		0
	maxDAClIn		68°F (20°C)
	maxDAClPct		0.0%
	maxDAClSP		68°F (20°C)
	maxDAHtIn		68°F (20°C)
	maxDAHtPct		100.0%
	maxDAHtSP		104°F (40°C)
	minDAClIn		68°F (20°C)
	minDAClPct		100.0%
	minDAClSP		59°F (15°C)
	minDAHtIn		68°F (20°C)
	minDAHtPct		0.0%
	minDAHtSP		50°F (10°C)
Duct Pressure Sensing	ductStatSP		250 Pa
	ductPresCtl	Pb	500 Pa
		Ti	20 seconds
		Td	0 seconds
	ductPresRange		498 Pa
DX Cooling	coolDeadBand		90°F (50°C)
	coolLockout	Enable	32°F (0°C)
		Disable	14°F (-10°C)
	dXMinOffTime		2 minutes
	dXMinOnTime		2 minutes
	numDXStages		0
	dXStageDelay		3 minutes
Fan Control	fanRampTime		15 seconds
	fanStatusEn		False

Application Component	Variable Name	Element	Factory Setting
Modulating Heat	heatCoilCtl	Pb	68°F (20°C)
		Ti	300 seconds
		Td	0 seconds
	heatCoilEn		False
	htgCoilMtr	TravelTime	125.0 seconds
		Reverse	FALSE
	heatDeadBand		0.90°F (0.50°C)
	heatLockout	Enable	68°F (20°C)
		Disable	71.6°F (22°C)
	heatUnit		Off
OA Damper Control with Mixed Air	econControl		Enabled
	econDBand		1.8°F (1°C)
	econRef	Source	SRC_RETURN_TEMP
		FixedTemp	68°F (20°C)
		Offset	35.6°F (2°C)
	oADmprCntr	Pb	95°F (35°C)
		Ti	200 seconds
		Td	0 seconds
	oAMinPos		0%
	oAReducedPos		0%
	oATempAdaptEn		Enable
	vDmdDesign		100%
	vDmdReduced		0.0%
Occupancy Control	bypassTime		60 minutes
	statSwitchEn		False
	setpoints	OccupiedClg	73°F (23°C)
		StandbyClg	77°F (25°C)
		UnoccupiedClg	82°F (28°C)
		OccupiedHtg	70°F (21°C)
		StandbyHtg	66°F (19°C)
		UnoccupiedHtg	61°F (16°C)
	unocDeadBand		3.6°F (2°C)
	warmupTrig	Duration	0 minutes
		OutTemp	50°F (10°C)
		InTemp	62°F (17°C)
Safeties	hiPressLatch		Enable
	loTempLatch		Enable
Staged Heat	heatDeadBand		0.90°F (0.50°C)
	heatLockout	Enable	68°F (20°C)
		Disable	71.6°F (22°C)
	htStageDelay		300 seconds
	numHStages		0

Control Mode Interaction Table

Device	Mode									
				Occupied		Unoccupied			Safety	
	Off	Fan Only	Starting (Fan Proof)	cool	heat	cool	Idle	heat	low temp	other safety
Fan	off	mod	mod	mod	mod	mod	off	mod	off	off
OA damper	close	close	close	mod	min	mod	close	close	close	close
DX	off	off	off	stage	off	mod	off	off	off	off
Stage heat	off	off	off	stage	stage	stage	off	stage	off	off
Heat valve	off	off	select	mod	mod	mod	select	mod	open	off

Color Key: Red = OFF (not used); Green = Active (fixed in application); Yellow = Selectable (configurable)

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Applications

The Predator Controllers can be configured to control a variety of equipment

Predator Type	Control Functionality
VAV/CV	• VAV/CV cooling only • VAV/CV heating only • VAV/CV with hot water reheat • VAV/CV with electric reheat (up to three stages) • VAV cooling/heating switchover • VAV series or parallel fan-powered with hot water reheat • VAV series or parallel fan-powered with electric reheat (up to three stages)
Heat Pump	• Single-compressor heat pump without reversing valve • Single-compressor heat pump, mixed air control without reversing valve • Single-compressor heat pump with reversing valve • Single-compressor heat pump with reversing valve and mixed air control • Multi-stage compressor (1-3) heat pump, mixed air control without reversing valve • Multi-stage compressor (1-3) heat pump, mixed air control with reversing valve
Unit Vent (ASHRAE Cycle II)	• Cooling and outside air damper • Heating and outside air damper • Shared cooling/heating coil and outside air damper (2-pipe) • Cooling and heating coil and outside air damper (4-pipe) • Cooling and heating coil and outside air damper with face/bypass damper (4-pipe) • Shared cooling/heating coil, plus electric heat and outside air damper (2-pipe) • Shared cooling/heating coil, plus electric heat and OA damper with face/bypass (2-pipe) • One- or two-stage DX cooling with heating coil and outside air damper
Fan Coil Unit	• Fan coil cooling only • Fan coil heating only • Two-pipe fan coil unit shared cooling and heating • Four-pipe fan coil unit cooling and heating • Fan coil unit with 1 to 2 stages of DX cooling and electric heat • Fan coil unit with 1 to 2 stages of DX cooling and hot water coil
Miscellaneous Equipment	The Four Loop Controller contains 4 internally cascaded PID loops and programming logic to perform control of a variety of equipment, such as: • Hot water converters • Simple heating and cooling plants • 2 VAV rooms • IAQ routines • Humidity control • 3 Sensor inputs loops • VFD control • Fan tracking • Heat recovery units • Emergency generators • Up to 4 stat to valves • Up to 4 booster coils • Miscellaneous input / output points • Etc.
VAV Air Handling Unit	For VAV Air Handling units with • OA, RA and DA dampers • Economizer cycle • Demand Control Ventilation routines (DCV) • Supply air temperature reset • Fan speed • Fan status • Safeties

Based upon availability of input and output capacity, perimeter heat, lighting, occupancy and outdoor air temperature sensors can be added to any of these Predator types.

Hardware

The unique design of the Predator Controller consists of two components:

- Enclosure Cover with Embedded Controller Board
- Wiring Base

This design reduces threat of damage to the controller board during installation and reduces service time. The wiring connections are made to the wiring base, allowing this component to be installed early in the project cycle. Additionally, if the board needs repair, the controller board can be removed easily, without disrupting the wiring connections.

Enclosure Cover with Embedded Controller Board

To further enhance the protection of the controller board, it is embedded into the plenum-rated enclosure cover. Installation consists of snapping the enclosure cover onto the wiring base.

The Enclosure Cover with Embedded Controller Board is available in the following configurations:

- 2 Inputs, 4 Digital Outputs, 1 Room Sensor, (1 DPS for VAV/CV only)
- 4 Inputs, 6 Digital Outputs, 1 Room Sensor, (1 DPS for VAV/CV only)
- 6 Inputs, 8 Digital Outputs, 3 Analog Outputs, 1 Room Sensor, (1 DPS for VAV/CV only)

The Controller Board communicates to all LONMARK devices via a Neuron®-chip. The controllers are shipped with pre-loaded applications, reducing engineering start-up time.

The control application is stored in Flash memory. Flash memory allows an application to be changed without removing the existing controller or memory chip.

Spare Input/Output Points

The Predator Controller, depending upon the application, may have up to 3 input and 2 output spare points available. These points can be used for control of devices located in close proximity to the Predator Controller, reducing installation costs.

Differential Pressure Sensor *For VAV/CV Applications*

The Differential Pressure Sensor connects to the air terminal box air-velocity sensing elements to provide measurement of the differential pressure. The measured value is converted to actual airflow in CFM (l/s) by the Predator VAV/CV controller.

Factory Mounted Siemens GDE Actuator *For Basic Predator VAV/CV Applications*

The Siemens OpenAir GDE131.1P Direct-coupled 24 Vac Non-spring Return Rotary Electric Actuator, which is **factory mounted/wired onto the 587-165 Predator Basic Wiring Base,** is designed for three-position (floating) control of building HVAC dampers. This actuator features a compact design, easy-to-see position indicator, and quiet, low-power operation.

Wiring Base

The Wiring Base is available in the following configurations:

1. Basic
2. Basic with factory mounted wired Siemens GDE.131-P Actuator
3. Reduced Point
4. Full Point

The Basic base has been downsized to match the compact design offered by the 2 IN/4DO controller board style. This base and controller offer the most cost effective solution for the basic point VAV and FCU solutions.

The Basic with GDE.131-P Actuator base includes a pre-mounted and wired, Siemens GDE actuator. It features input / output connections designed specifically to meet Predator application requirements, helping make this product package a very cost-effective solution for VAV applications.

The Reduced Point base matches the Reduced Point 4IN/6DO controller board style providing a cost effective solution for lower point count applications.

The Full Point base is designed to handle either Full Point 5IN/8DO/2AO controller or Reduced Point 4IN/6DO controller. This base provides the flexibility of interchanging a Reduced Point I/O-style controller with a Full Point I/O-style controller if needs change.

Controller Specifications

Processor Type	Neuron 3150
Processor Clock Speed	10 MHz - Neuron
Network Communication Speed	TP/XF-10 (78.8K bps)
Memory Size	49 K Flash Memory 10 K SRAM
Voltage Requirements	24 Vac @ 50/60 Hz
Power Consumption	5 VA plus loads
Ambient Operating Environment	+32°F to +122°F (0°C to +50°C) 5 to 95% RH (Non-condensing)
Agency Listings	UL/CUL 916 PAZX/PAZX7 (Enclosed Energy Management) LONMARK 3.2
Regulatory Compliance	FCC Part 15, Class B CISPR 22 Class B CE Mark Australian EMC Framework
Basic Predator Dimensions:	4.5” H x 5.5”W x 2.3” D (114 mm x 139 mm x 58 mm)
Predator with Actuator Base Dimensions:	6.6" H x 10.2" W × .5" D (168 mm × 259 mm × 12.7 mm)
Predator Dimensions:	6.75" H × 7" W × 2.45" D (171 mm × 178 mm × 62 mm)
Basic Predator Weight	1.4 lbs. (.6kg)
Predator with Actuator Base Weight	3.37 lbs. (.X kg)
Predator Weight	2 lbs. (.9 kg)

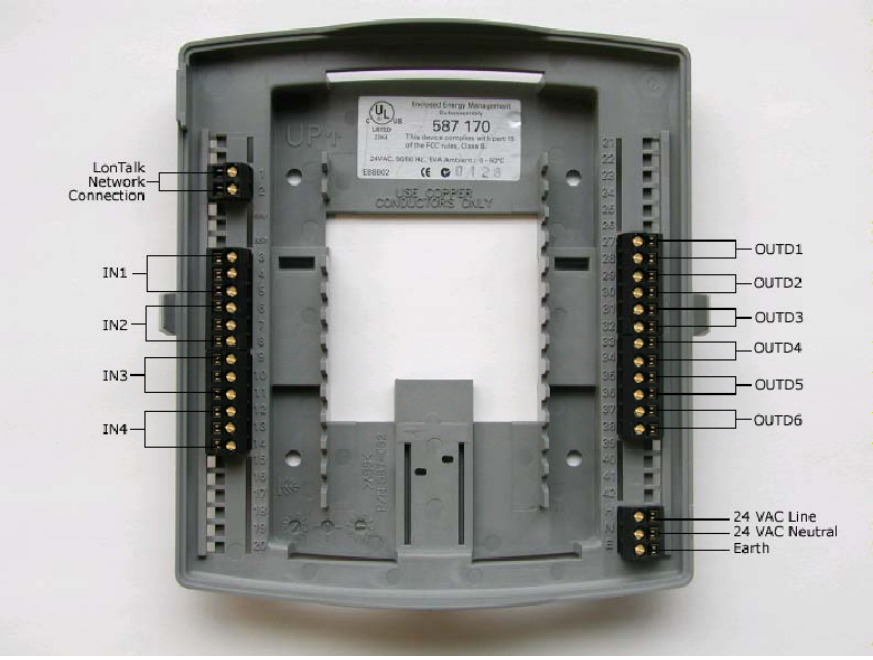
Actuator Specifications For Basic VAV/CV Wiring Base

Power Supply	
Operating Voltage	24 Vac +15%, -15%
Frequency	50/60 Hz
Power Consumption	2.3 VA
Equipment Rating	UL—Class 2, CSA Class III per EN60730
Function	
Torque	44 lb-in (5 Nm)
Runtime for 90° opening or closing	90 sec. At 60 Hz
Nominal angle of rotation	(108 sec. At 50 Hz)
Maximum angular rotation	90° 95°
Mounting	
Shaft size	3/8 to 5/8 inch (8 to 16mm) diameter
Minimum shaft length	1-1/2 inch (38 mm)
Housing	
Material	Durable plastic
Gear lubrication	Silicone free
Ambient Conditions	
Ambient temperature – operation	32 to 122°F (0 to 50°C) (limited by Controller)
Storage and transport	-22 to 140°F (-30 to 60°C)
Ambient humidity (non-condensing)	95% R.H.
Agency Certification	UL listed to UL873; C-UL certified to Canadian Standard; C22.2 No. 24-93
Miscellaneous	
Pre-cabled connection	18 AWG
Life cycle	Designed for over 50,000 full stroke cycles and 1.5 million repositions at rated torque and temperature

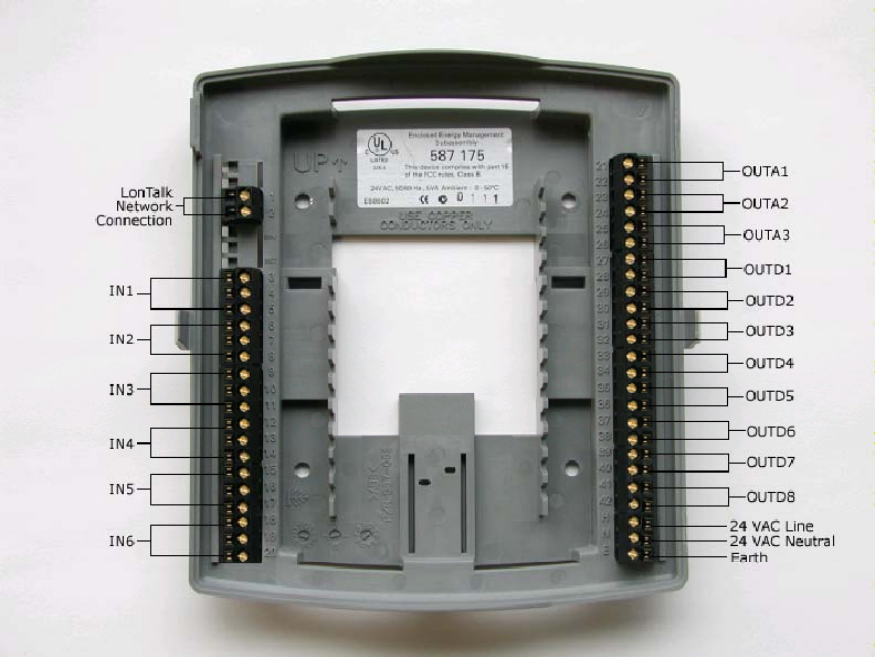
Wiring Diagrams

Basic Wiring Base

Basic Wiring Base with Actuator



Reduced Point Wiring Base



Full Point Wiring Base

Wiring Recommendations:

Input/AO	20 to 22 AWG
DO	18 to 22 AWG
Power	16 to 18 AWG
LONWORKS Network	22 AWG Level 4

Transformer Requirements and Recommended Voltages

Type	Class 2, 24 Vac, 50/60 Hz

Optional Accessories

Predator Room Temperature Sensors

The Predator Room Temperature Sensors offer a wide range of features and functions. The sensors work with the Staefa TALON building-automation system to deliver exceptional occupant comfort in even the most demanding application environments. The product family ranges from temperature-sensing-only variants to sensors that include LCD display, setpoint and override. All sensors incorporate precision temperature-sensing elements to accurately and reliably measure room temperature. Their compact design results in an attractive, inconspicuous installation. A styled ventilation ring optimizes airflow through the cover for fast measurement response.

Predator Room Sensor Specifications

Dimensions	3-11/32" H × 2-1/2" W × 1-1/2" D (85 mm × 63 mm × 38 mm)
Temperature Monitoring Range	55° to 95°F (13° to 35°C)
Thermistor Resistance Value	10,000 Ohms @ 77°F (25°C)
Setpoint Range	55-95°F
Calibration Adjustments	None Required
Standard Colors	White

Predator Ordering Information

Controllers

Description		Product Number
Basic Predator VAV/CV 2IN 4DO 1DPS		587-100
2 IN	(1) 100 K Ω Thermistor / (1) 0-10 Vdc or Dry Contact	
4 DO	24 Vac, 12VA, Triac	
1 DPS	0 to 2 inch Differential Pressure Sensor	
1 RS	10K Ω Thermistor Room Sensor	
Predator Reduced Point SD VAV/CV Reduced Point Controller 4IN 6DO 1DPS		587-110
4 IN	(2) 100 K Ω Thermistor / (2) 0-10 Vdc or Dry Contact	
6 DO	24 Vac, 12VA, Triac	
1 DPS	0 to 2 inch Differential Pressure Sensor	
1 RS	10K Ω Thermistor Room Sensor	
Predator Full Point Single Duct VAV/CV Full Point Controller 5IN 8DO 2AO 1DPS		587-130
5 INI	(2) 100 K Ω Thermistor / (3) 0-10 Vdc or Dry Contact	
8 DO	24 Vac, 12VA, Triac	
2 AO	0-10 Vdc	
1 DPS	0 to 2 inch Differential Pressure Sensor	
1 RS	10K Ω Thermistor Room Sensor	
Predator Reduced Point HP Controller 4IN 6DO		587-240
4 IN	(2) 100K Ω Thermistor / (2) 0-10 Vdc or Dry Contact	
6 DO	24 Vac, 12VA, Triac	
1 RS	10K Ω Thermistor Room Sensor	
Predator Full Point HP Controller 6N 8DO 3O		587-250
5 INI	(2) 100K Ω Thermistor / (3) 0-10 Vdc or Dry Contact	
8 DO	24 Vac, 12VA, Triac	
2 AO	0-10 Vdc	
1 RS	10K Ω Thermistor Room Sensor	
Predator Reduced Point UV CH/HW Controller 4IN 6DO		587-270
4 IN	(2) 100K Ω Thermistor / (2) 0-10 Vdc or Dry Contact	
6 DO	24 Vac, 12VA, Triac	
1 RS	10K Ω Thermistor Room Sensor	

Controllers

Description		Product Number
Predator Reduced Point UV DX Controller 4IN 6DO		587-271
4 IN	(2) 100K Ω Thermistor / (2) 0-10 Vdc or Dry Contact	
6 DO	24 Vac, 12VA, Triac	
1 RS	10K Ω Thermistor Room Sensor	
Predator Full Point UV CH/HW Controller 6N 8DO 3AO		587-280
5 IN	(2) 100K Ω Thermistor / (3) 0-10 Vdc or Dry Contact	
8 DO	24 Vac, 12VA, Triac	
3 AO	0-10 Vdc	
1 RS	10K Ω Thermistor Room Sensor	
Predator Full Point UV DX Controller 6I 8DO 3AO		587-281
5 IN	(2) 100K Ω Thermistor / (3) 0-10 Vdc or Dry Contact	
8 DO	24 Vac, 12VA, Triac	
3 AO	0-10 Vdc	
1 RS	10K Ω Thermistor Room Sensor	
Predator Full Point UV CH/HW with Face/Bypass 6N 8DO 3AO		587-282
5 IN	(2) 100K Ω Thermistor / (3) 0-10 Vdc or Dry Contact	
8 DO	24 Vac, 12VA, Triac	
3 AO	0-10 Vdc	
1 RS	10K Ω Thermistor Room Sensor	
Basic Predator CH/HW FCU 2IN 4DO		587-200
2 IN	(1) 100 K Ω Thermistor / (1) 0-10 Vdc or Dry Contact	
4 DO	24 Vac, 12VA, Triac	
1 RS	10K Ω Thermistor Room Sensor	
Basic Predator DX FCU 2IN 4DO		587-201
2 IN	(1) 100 K Ω Thermistor / (1) 0-10 Vdc or Dry Contact	
4 DO	24 Vac, 12VA, Triac	
1 RS	10K Ω Thermistor Room Sensor	
Predator Reduced Point CH/HW FCU Controller 4IN 6DO		587-210
4 IN	(2) 100K Ω Thermistor / (2) 0-10 Vdc or Dry Contact	
6 DO	24 Vac, 12VA, Triac	
1 RS	10K Ω Thermistor Room Sensor	
Predator Reduced Point DX FCU Controller 4IN 6DO		587-211
4 IN	(2) 100K Ω Thermistor / (2) 0-10 Vdc or Dry Contact	
6 DO	24 Vac, 12VA, Triac	
1 RS	10K Ω Thermistor Room Sensor	
Predator Full Point CH/HW FCU Controller 6IN 8DO 3AO		587-220
5 IN	(2) 100K Ω Thermistor / (3) 0-10 Vdc or Dry Contact	
8 DO	24 Vac, 12VA, Triac	
2 AO	0-10 Vdc	
1 RS	10K Ω Thermistor Room Sensor	
Predator Full Point DX FCU Controller 6IN 8DO 3AO		587-221
5 IN	(2) 100K Ω Thermistor / (3) 0-10 Vdc or Dry Contact	
8 DO	24 Vac, 12VA, Triac	
2 AO	0-10 Vdc	
1 RS	10K Ω Thermistor Room Sensor	

Controllers

Description	Product Number
Predator Four Loop 6IN 8DO 3AO 2 IN 100K Ω Thermistor or Dry Contact 4IN 0-10 Vdc or Dry Contact 8 DO 24 Vac, 12VA, Triac 3 AO 0-10 Vdc 1 RS 10K Ω Thermistor Room Sensor	587-290
Predator VAV AHU 6IN 8DO 3AO 2 IN 100K Ω Thermistor or Dry Contact 4IN 0-10 Vdc or Dry Contact 8 DO 24 Vac, 12VA, Triac 3 AO 0-10 Vdc 1 RS 10K Ω Thermistor Room Sensor	587-291

Wiring Bases

Description	Product Number
Predator Basic Wiring Base Termination support for the 2IN and 4DO only	587-160
Predator Basic Wiring Base and Siemens GDE 131.1P Actuator factory mounted/pre-wired for VAV applications	587-165
Predator Reduced Point Wiring Base Termination support for the 4IN and 6DO	587-170
Predator Full Point Wiring Base Termination support up to 5IN, 8DO and 3AO	587-175

Accessories

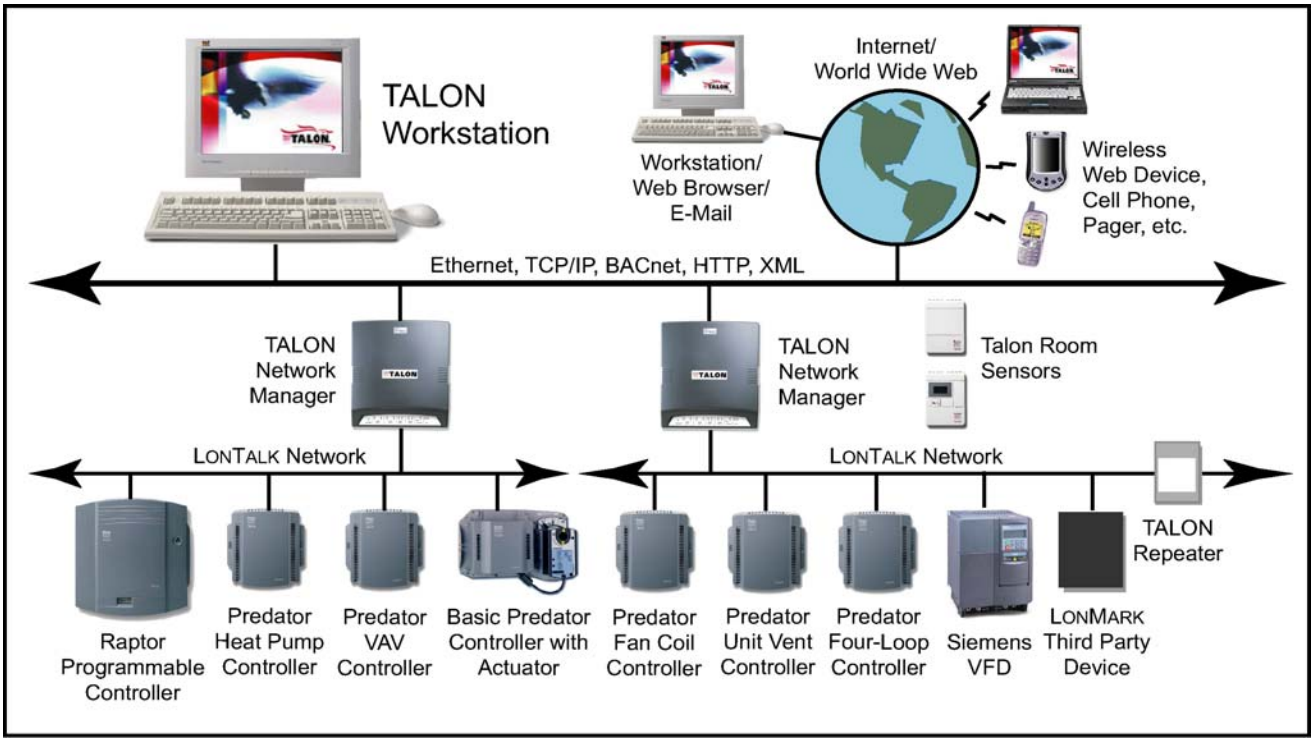
Description	Product Number
Predator Room Sensors	
Sensing Only	587-180
Bypass	587-181
Setpoint	587-182
Temperature Display	587-183[1]
Setpoint and Bypass	587-184
Bypass and Temperature Display	587-185[1]
Setpoint and Temperature Display	587-186[1]
Setpoint, Bypass and Temperature Display	587-187[1]

1. Sensor will display Fahrenheit or Celsius temperature.

Optional Accessories

Description	Product Number
Predator Termination Connector Kit	587-171
No Logo Predator Room Sensors	
Sensing Only	587-550B
Setpoint	587-552B
Setpoint and Bypass	587-554B
Setpoint, Bypass and Temperature Display	587-557B
Blank Logo 100K Thermistor Room Sensor	536983BN
Remote Mount Differential Pressure Sensors	
DP Sensor 0-5” w.c.	590-501
DP Sensor 0-2” w.c.	590-502
DP Sensor 0-1” w.c.	590-503
DP Sensor 0-0.5” w.c.	590-504
DP Sensor –0.25 to .25” w.c.	590-505
DP Sensor 0-5” w.c. in conduit box	590-506
DP Sensor 0-2” w.c. in conduit box	590-507
DP Sensor 0-1” w.c. in conduit box	590-508
DP Sensor 0-0.5” w.c. in conduit box	590-509
DP Sensor –0.25 to .25” w.c. in conduit box	590-510
Conduit Kit	590-511

TALON Architecture



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