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# ModuFlex

## Adaptive, Comfortable, Sustainable Environments

ModuFlex by Price is an Underfloor Air System Solution that is easy to apply. This system combines the benefits of Raised Access Floor (RAF) and Price's years of occupant comfort experience to provide a tailored solution that achieves a comfortable building environment and maximum flexibility.

# SYSTEM APPLICATIONS

Price ModuFlex is easy to apply and a flexible zone based solution for Underfloor Air Systems. These systems are most commonly applied to commercial office spaces to improve air quality and thermal comfort, while saving energy and reducing utility costs.

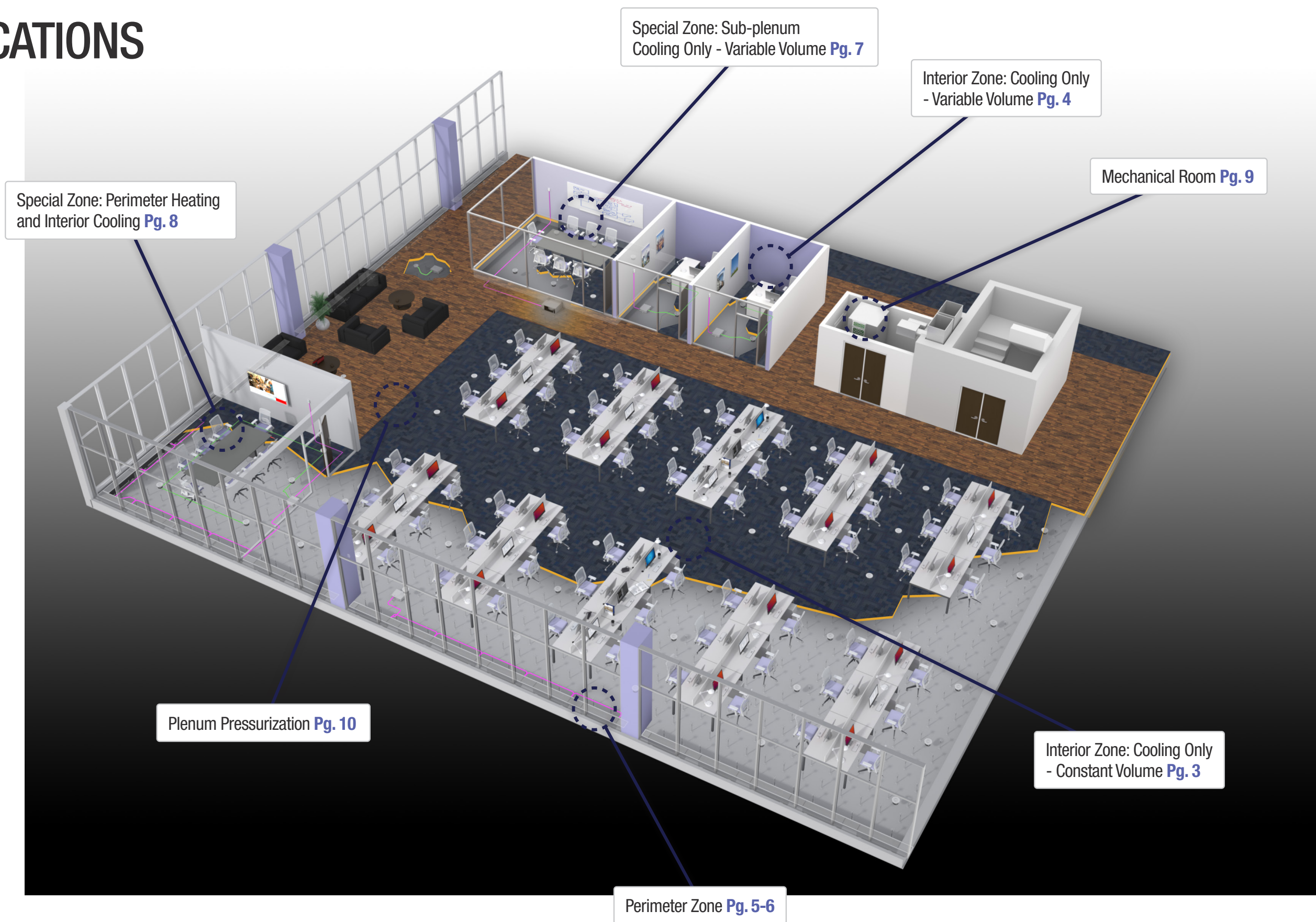
Projects with raised access floors and underfloor air systems typically require flexibility, energy efficiency and improved indoor environmental quality (IEQ); ModuFlex's zone solutions have been strategically designed to provide a modular solution that optimizes energy usage and IEQ.

ModuFlex leverages Price's rigorously tested Underfloor Air Distribution (UFAD) products to ensure occupant comfort, and native BACnet microprocessor controllers to ensure proper control.

Together, these components provide a modular system that is easy to remodel and reconfigure and can communicate with the existing building management system.

## KEY SYSTEM FEATURES:

- Easy-to-apply zone-based solutions.
- Combines Price's years of occupant comfort experience with cutting edge system controls.
- Thoroughly tested controls for a reliable network integration.
- Modular solution that optimizes energy efficiency and IEQ.
- Ability to customize the solution to fit your unique needs.



# INTERIOR ZONE APPLICATIONS

For most large open spaces with cubicles and open meeting areas, large interior zones may be thought of as having nearly uniform conditions. The whole zone has a relatively stable load during occupied hours and may be treated as such. Loads in the interior zone are predominantly composed of occupant, lighting, and equipment loads. These zones will be supplied air via a common main plenum. These zones typically only require cooling to maintain thermal comfort.



## INTERIOR ZONE Cooling Only: Constant Volume (IZ1)

This control zone is formed using manually adjustable constant volume diffusers with air being supplied from the pressurized floor plenum. Pressure nodes placed strategically throughout the plenum monitor the plenum pressure. The Underfloor Pressure Controller (PCU) maintains desired plenum pressure and airflow through signalling the main fan to modulate or adjust the plenum dampers.

## Modular Floor Displacement Diffuser

- Manually adjustable baskets with aluminum (8in. or 10in.) or polymer (8in.) face construction
- Optimal low velocity displacement design, VE of 1.2
- Placement independent of occupant location



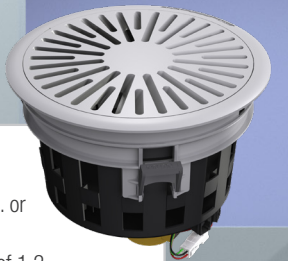
## Price Thermostats

- Dial, LCD, Motion sensing and wireless options
- Password protected adjustment menu
- LinkerSoft port for easy room side program access



## Modular Floor Twist Diffuser

- Automated DBV basket with aluminum (8in. or 10in.) or polymer (8in.) face construction
- Throw no more than 4.5 ft. at 50 fpm, VE of 1.2
- Relatively higher flow capacity



## Power and Control Module

- UMC3 control board, native BACnet
- Power and control signal transmitter over one cable
- Quick connect cables used to daisy chain units together



## INTERIOR ZONE Cooling Only: Variable Volume (IZ2)

This control zone is formed using variable volume modular floor diffusers controlled from the room thermostat. A thermostat monitors the room temperature, while the PCM adjusts the dampers to meet the cooling requirement of the space.

# PERIMETER ZONE APPLICATIONS

These zones are typically more complex than interior zones. Perimeter zones generally have larger and more varying loads and often require auxiliary heat. Using the proper system helps control heating and cooling requirements for the space. The following are the most common applications for conditioning perimeter zones.

## PERIMETER ZONE Trough Heating And Cooling (PZ1)

An efficient mode of conditioning perimeter zones is by placing drop-in plenum heaters within the perimeter grilles to heat and cool. Cooling is handled through variable air dampers in the trough, and heating is used when the thermostat notes a drop in temperature below the set point. This removes the need for ductwork and fan terminals along the perimeter, reducing noise and energy consumption. A thermostat monitors the room temperature, while the PCM adjusts the dampers to meet the space requirements. This minimizes fan energy usage and noise generated by the terminals.

### Natural Convection Heat

Occurs when the plenum damper is closed and room air is heated through natural convection in a heater trough and reintroduced into the space. A thermostat monitors the room temperature, while the PCM adjusts the dampers to meet the cooling requirement of the space.

### Forced Heat

Occurs when plenum air is forced across the heater with the plenum damper open. This is typically only required when high heating capacities are demanded.

## Power and Control Module

- UMC3 control board, native BACnet
- Power and control signal transmitted over one cable
- Quick connect cables used to daisy chain units together
- Can be used with a Price wireless thermostat

## Linear Natural Convection Terminal

- Natural convection heat using hydronic or electric coils
- Drop-in installation
- Plenum VAV cooling

## High Capacity Linear Terminal

- Cooling and heating water coils
- 2 pipe and 4 pipe coil types
- Plenum VAV cooling

## Linear Fan Terminal

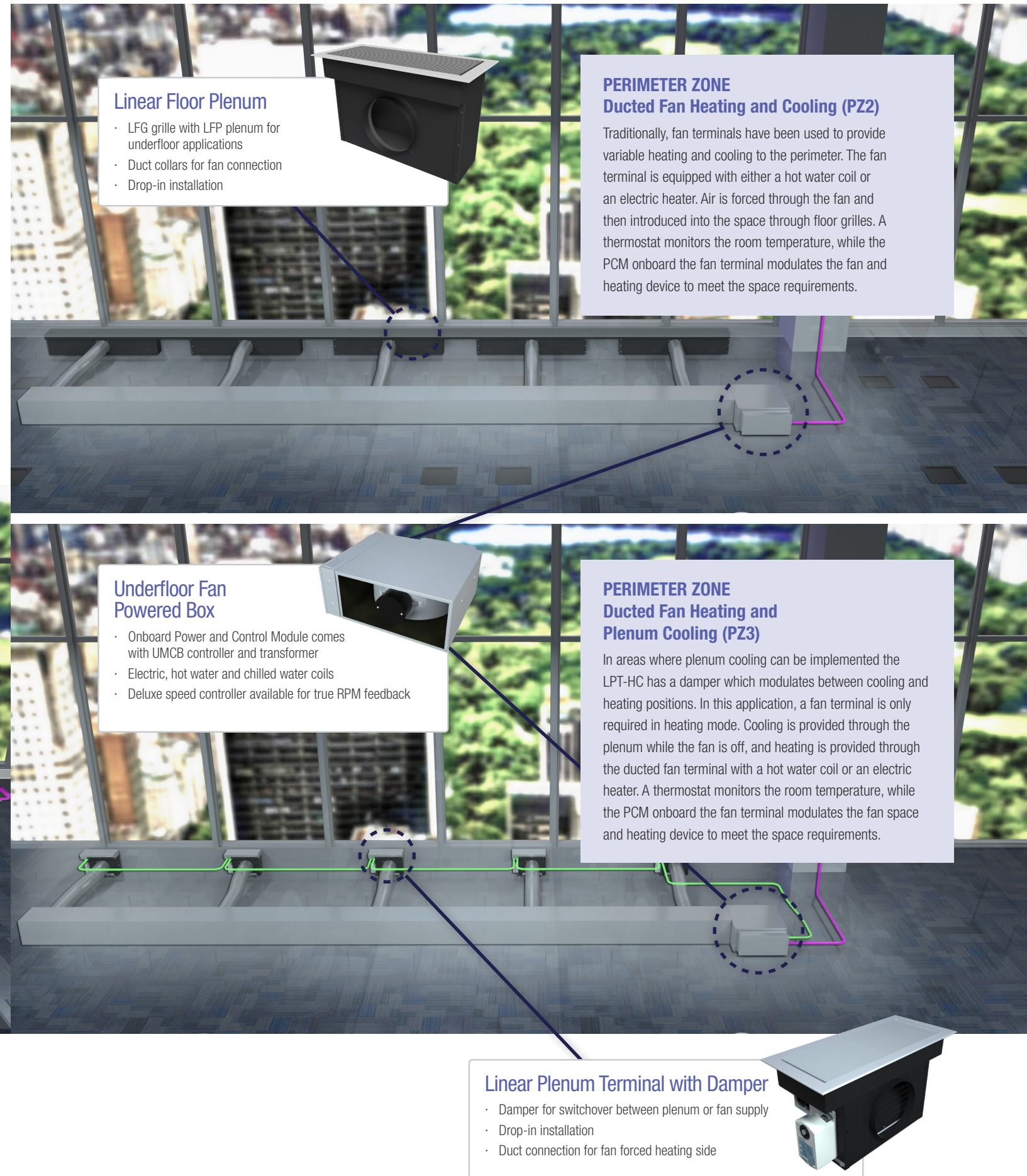
- Compact, high efficiency EC fans
- Drop-in installation
- Electric heat, hot water and chilled water coil options

## Linear Plenum Terminal with Damper

- Damper for switchover between plenum or fan supply
- Drop-in installation
- Duct connection for fan forced heating side

Lower Cost

More Control



# SPECIAL ZONE APPLICATIONS

Conference rooms, meeting rooms and interior private offices can experience wide load swings due to intermittent occupancy or equipment operation. Interior zones with large swings in occupancy or equipment loads, or those that require smaller individual control zones, can also be thought of as special zones. There are several common options available to address these zones in order to maintain comfort levels in all areas.

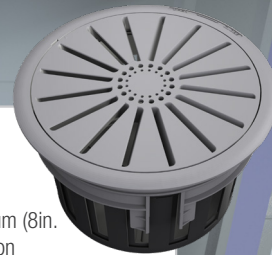
## Price Thermostats

- Dial, LCD, Motion sensing and wireless options
- Password protected adjustment menu
- LinkerSoft port for easy room side program access



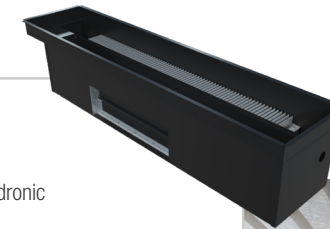
## Modular Floor Displacement Diffuser

- Manually adjustable baskets with aluminum (8in. or 10in.) or polymer (8in.) face construction
- Optimal low velocity displacement design, VE of 1.2
- Placement independent of occupant location



## Linear Natural Convection Terminal

- Natural convection heat using hydronic or electric coils
- Drop-in installation
- Plenum VAV cooling



## Modular Floor Displacement Diffuser

- Automated DBV basket with aluminum (8in. or 10in.) or polymer (8in.) face construction
- Optimal low velocity displacement design, VE of 1.2
- Placement independent of occupant location

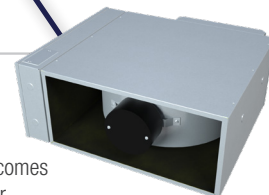


## SPECIAL ZONE Sub-plenum Cooling Only: Variable Volume (SZ1)

This control zone is formed using fixed damper position modular floor diffusers. The pressurized plenum for the space is divided from the rest of the floor plate. This sub-plenum is pressurized by a fan terminal. A thermostat monitors the room temperature and occupancy, while the PCM adjusts the fan to meet the cooling requirement of the space. This strategy is useful for rooms with large temperature swings and higher occupancy, versus smaller break-out style conference spaces.

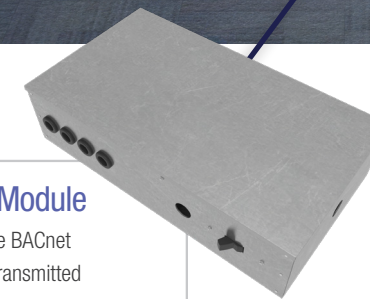
## Underfloor Fan Powered Box

- Onboard Power and Control Module comes with UMCB controller and transformer
- Electric, hot water and chilled water coils
- Deluxe speed controller available for true RPM feedback



## Power and Control Module

- UMC3 control board, native BACnet
- Power and control signal transmitted over one cable
- Quick connect cables used to daisy chain units together

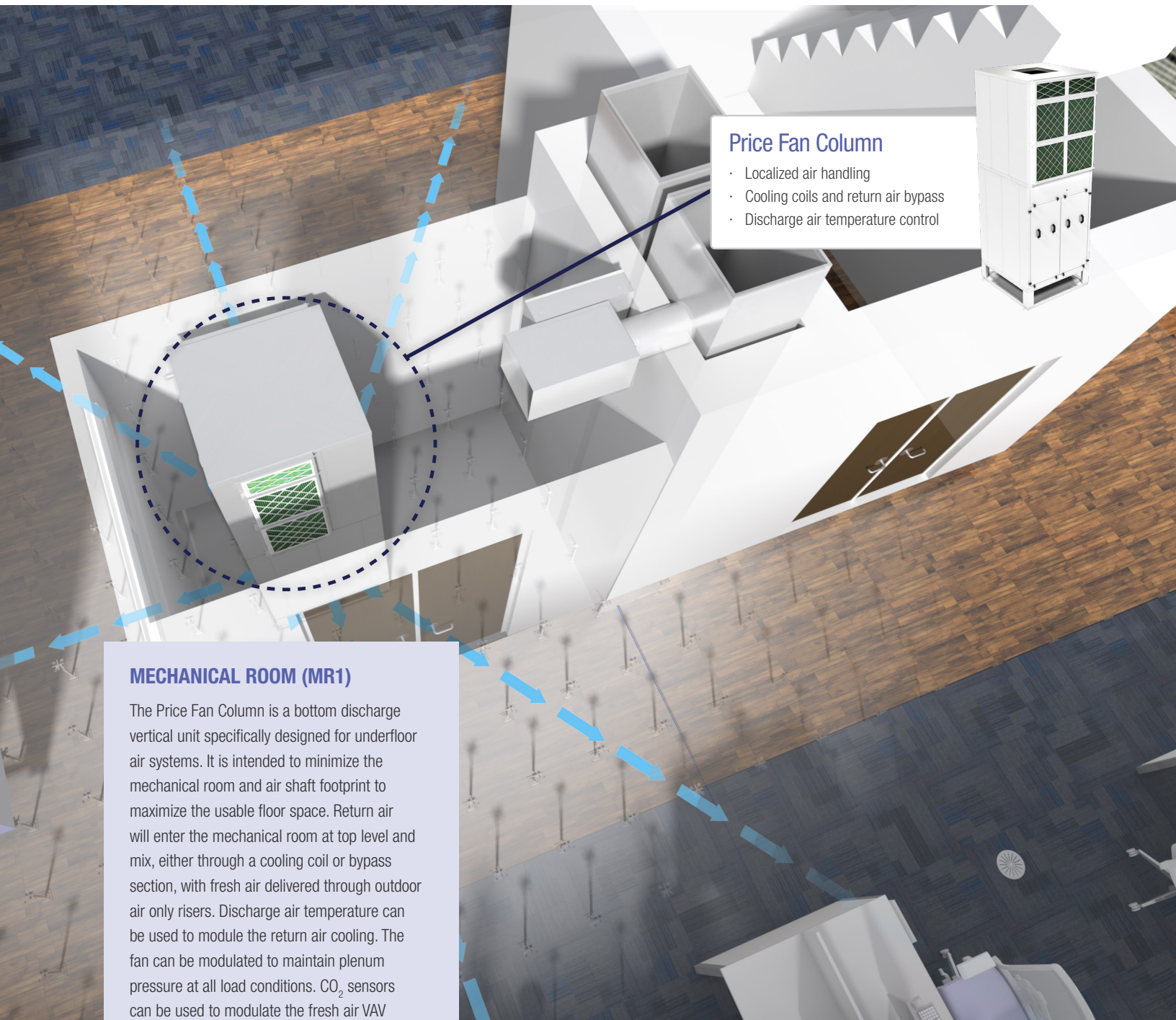


## SPECIAL ZONE Perimeter Heating and Interior Cooling (SZ2)

The cooling for this zone is handled by using variable volume modular floor diffusers controlled by the room thermostat. Heat is provided by heating room air through natural convection in a heater trough and reintroducing it into the space. A thermostat monitors the room temperature and occupancy, while the PCM adjusts the dampers or heaters to meet the space requirements.

# PRESSURE CONTROL

Office spaces are one of the more diversely loaded spaces which in underfloor applications can share a common pressurized plenum. Diffusers and grilles for UFAD are selected based on certain floor static pressures. This demands maintaining floor pressurization for proper comfort and system operation.



## Price Fan Column

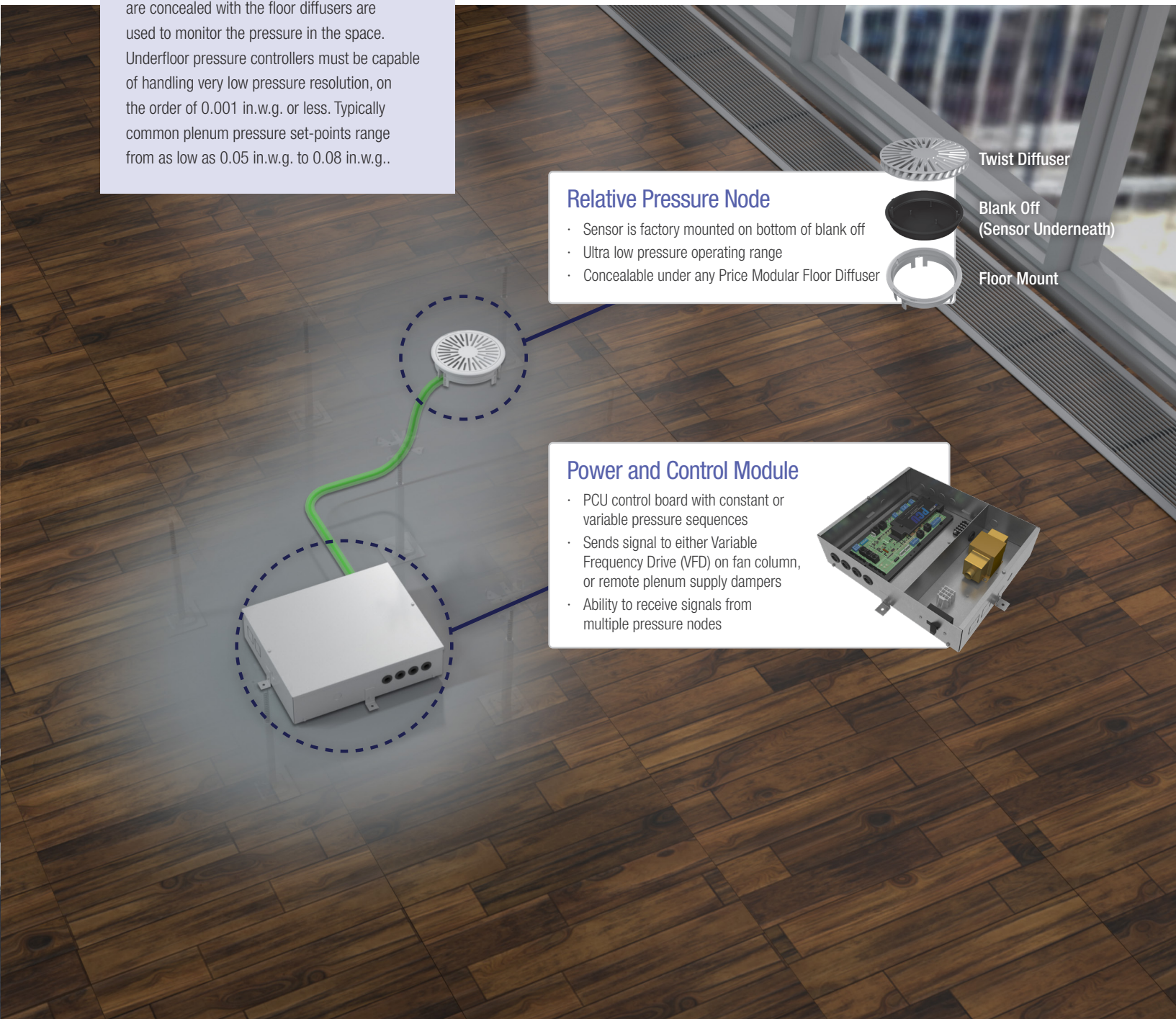
- Localized air handling
- Cooling coils and return air bypass
- Discharge air temperature control

## MECHANICAL ROOM (MR1)

The Price Fan Column is a bottom discharge vertical unit specifically designed for underfloor air systems. It is intended to minimize the mechanical room and air shaft footprint to maximize the usable floor space. Return air will enter the mechanical room at top level and mix, either through a cooling coil or bypass section, with fresh air delivered through outdoor air only risers. Discharge air temperature can be used to modulate the return air cooling. The fan can be modulated to maintain plenum pressure at all load conditions. CO<sub>2</sub> sensors can be used to modulate the fresh air VAV box to provide demand control ventilation.

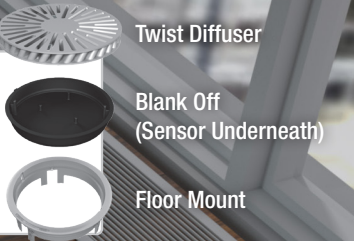
## PLENUM PRESSURIZATION (PP1)

Price's unique solution provides pressure monitoring and control while maintaining the aesthetics of the space. Pressure nodes that are concealed with the floor diffusers are used to monitor the pressure in the space. Underfloor pressure controllers must be capable of handling very low pressure resolution, on the order of 0.001 in.w.g. or less. Typically common plenum pressure set-points range from as low as 0.05 in.w.g. to 0.08 in.w.g..



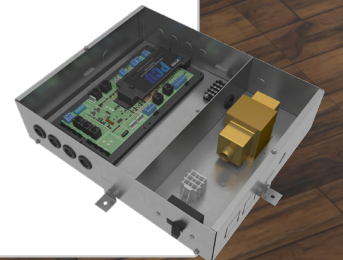
## Relative Pressure Node

- Sensor is factory mounted on bottom of blank off
- Ultra low pressure operating range
- Concealable under any Price Modular Floor Diffuser



## Power and Control Module

- PCU control board with constant or variable pressure sequences
- Sends signal to either Variable Frequency Drive (VFD) on fan column, or remote plenum supply dampers
- Ability to receive signals from multiple pressure nodes

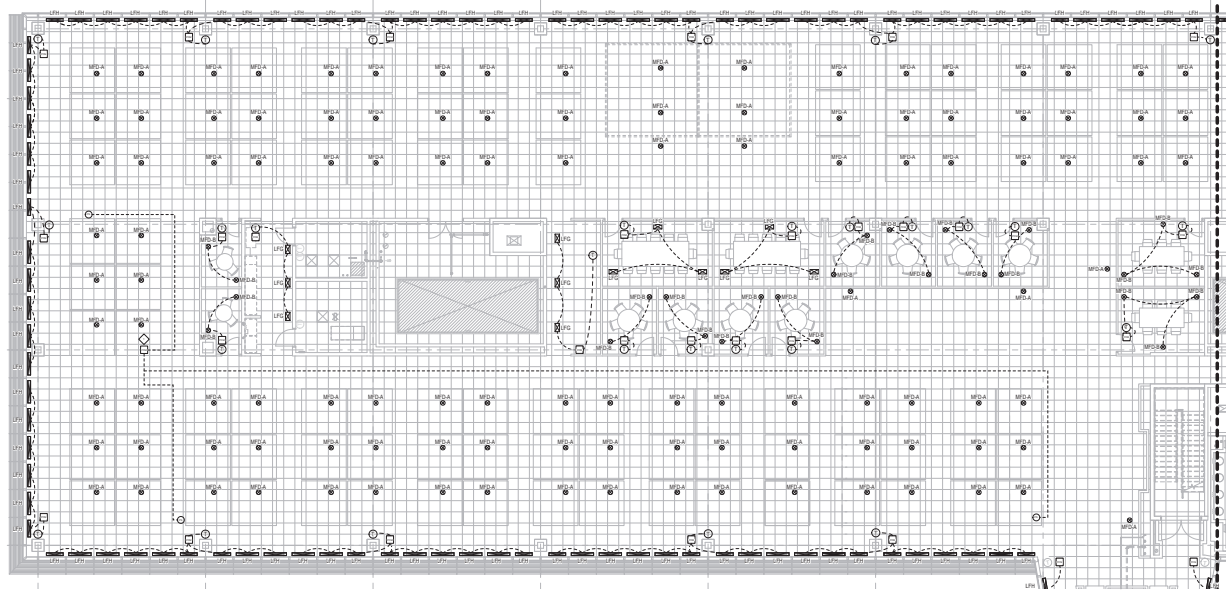


# PRICE DESIGN & LAYOUT ASSISTANCE

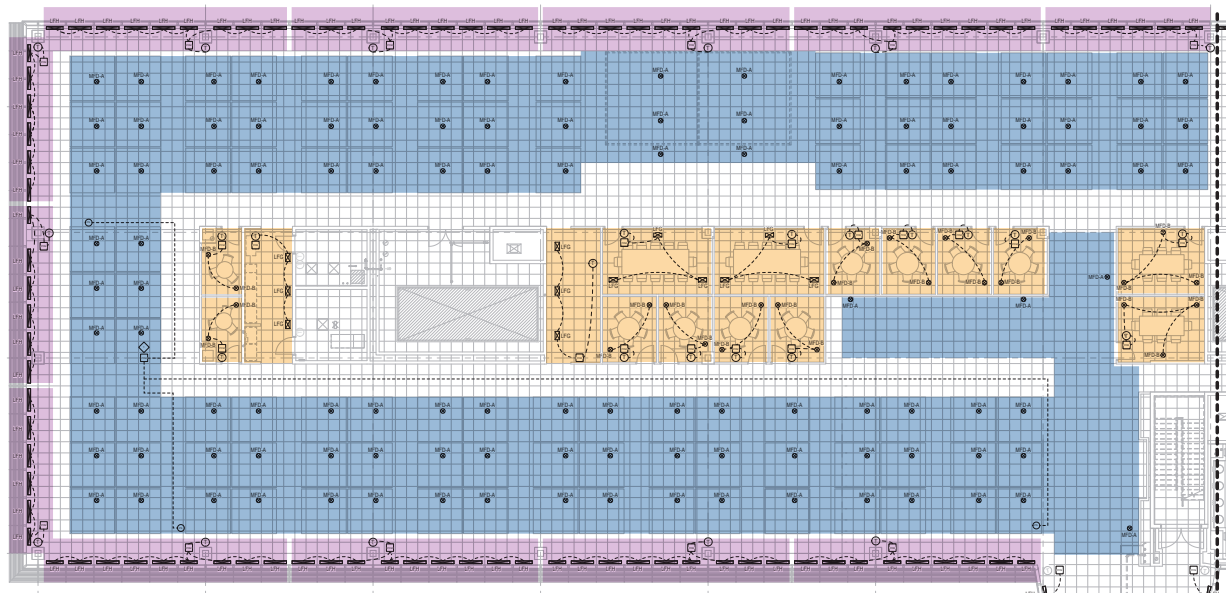
Price ModuFlex solution comes with design assistance. Our experienced team is trained to help with designing and laying out complete underfloor air systems.

- Application support
- Layout assistance
- Detail sheets
- Zone schedule
- Product related performance

As shown in the example below, an underfloor office layout can be divided into typical control zones.

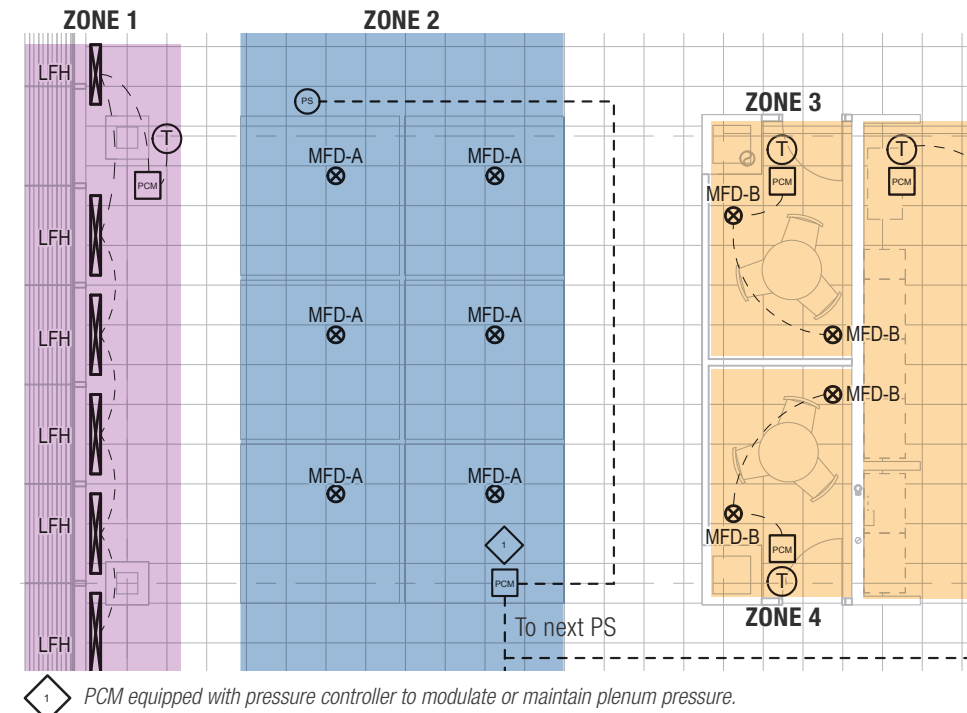


All blue zones shown will have a typical layout as illustrated under Interior Cooling Only: Constant Volume (IZ1). All purple zones illustrated will have a typical layout as shown under Perimeter Trough Heating and Cooling Zones (PZ1). All yellow zones illustrated will have a typical layout as shown under Interior Cooling Only: Variable Volume (IZ2). \*



\*This is intended to show an example of one type of UFAD control strategy. Various project factors can affect the approach of the system solution to achieve the ultimate design goals.

These zones can now be sized and tabulated to provide a detailed zone schedule similar to the illustration below.



Example Zone Schedule\*

ZONE	MARK	LENGTH (FT.)	UNDERFLOOR ZONE SCHEDULE												DEVICE	PCM	ZONE TYPE	REMARKS							
			COOLING			HEATING				WATER															
			PLENUM STATIC (IN. W.C.)	AIRFLOW (CFM)	LAT (°F)	TOTAL CAPACITY (MBH)	PIPING CONFIG	EAT (°F)	AIRFLOW (CFM)	GPM	WPD (FT)	EWT (°F)	LWT (°F)												
Zone 1	LFH-1	3'	0.03"	225	65	12.4	SERIES	65	68	2	1.90	120	107	LFGH-RCV	UMC3	Perimeter Trough Heating and Cooling	High Capacity Coil, 2 Stage Heating.								
	LFH-2	4'		300					90																
	LFH-2	4'		300					65									13.4	SERIES	65	90	2	1.90	120	106
	LFH-2																								
	LFH-2																								
Zone 2	MFD-A	8R	0.05"	68	65	--	--	--	--	--	--	--	MFD with DBA	-	Interior Cooling Only: Constant Volume	TP-Twist Aluminum									
Zone 3, 4	MFD-B	8R	0.05"	66	65	--	--	--	--	--	--	--	MFD with DBV	UMC3	Interior Cooling Only: Variable Volume	TP-Twist Aluminum									
Plenum Pressurization	PS	8R	--	--	--	--	--	--	--	--	--	--	RPN	PCU	Plenum Pressurization	◊									

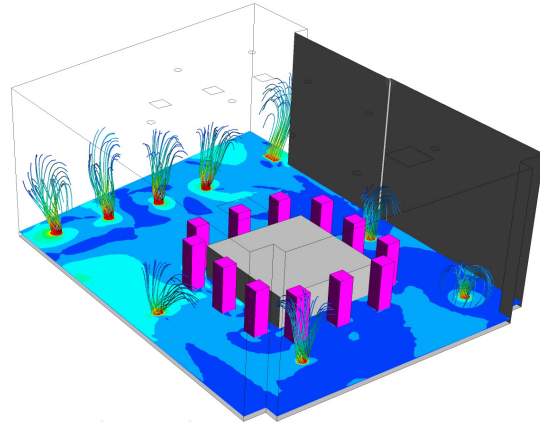
\* All VAV zones are designed for a minimum static pressure set point of 0.03 in. w.c.

Detail Sheets (available on request) and the Zone Schedule can then be added to the construction documents for effective scope communication and informed bidding process.

# RESOURCES AND SUPPORT

## COMPUTATIONAL FLUID DYNAMICS (CFD) MODELING

CFD provides a means to validate design before construction and the confidence that the system will perform as intended in the field. Price's CFD team is amongst the most experienced and proficient in the industry, and we encourage designers to work with us to validate their UFAD designs.

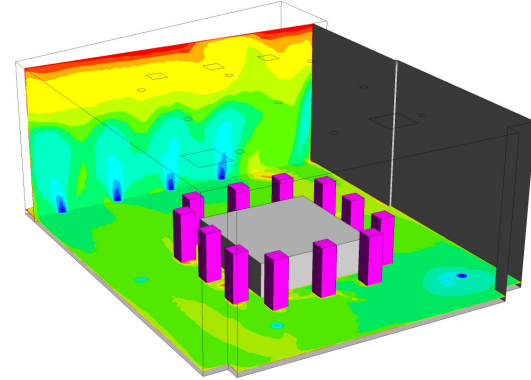


## PRCN: PRICE RESEARCH CENTER NORTH

Price's state-of-the-art research laboratory, Price Research Center North, features the most advanced UFAD flow visualization chambers, testing facilities, and mock-up rooms in North America.

Flow visualizations and mock-ups allow designers to simulate field conditions and evaluate system performance – providing them with the confidence that their space will perform as expected in the field.

Ask about our mock-up services on your next job, or better yet, visit PRCN yourself and tour our facilities.



## APPLICATIONS SUPPORT

Price is a service oriented company and has a dedicated UFAD applications team devoted to answering your questions quickly, completely, and correctly. We are here to help – our applications team regularly provides support on:

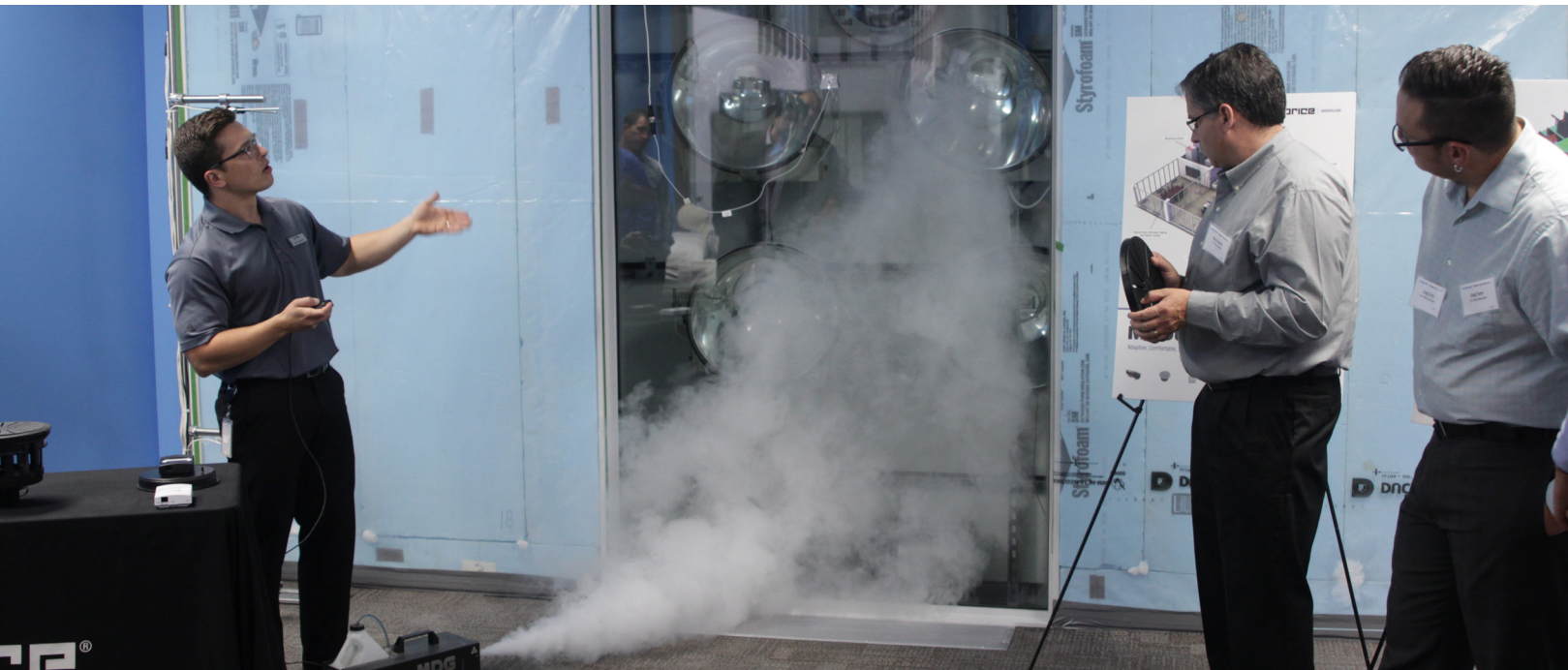
- Model Selection
- Layout Assistance
- Calculation Assistance
- On-site Training
- On-site Performance Validation

## PRICE TRAINING PROGRAMS AND WEBINARS

The Price Training Programs (PTP) provides Consulting and Design Engineers with the training needed to specify and select air distribution equipment to best meet their design criteria. The UFAD course covers everything you need to know about underfloor products, including:

- Introduction to UFAD
- Theory Behind UFAD
- UFAD Products Available
- Design Considerations
- Control Zones

Our webinars are another excellent way to learn about specific topics while gaining professional development hours. Visit [www.priceindustries.com](http://www.priceindustries.com) to register today!





# PRICE CONTROLS START-UP SERVICE

## PRICE ENGINEER'S HVAC HANDBOOK

### The Most Comprehensive Guide to HVAC Fundamentals

The Price Engineer's HVAC Handbook is a compilation of the engineering knowledge related to the application of air distribution and noise control products and approaches gained at Price over the past 60 years.

Within the handbook, chapters on UFAD and its applications feature liberal use of examples and graphics to help illustrate and explain concepts and systems.

### Chapter 17: Underfloor Air Distribution

Contact your local Price sales representative to reserve your copy.



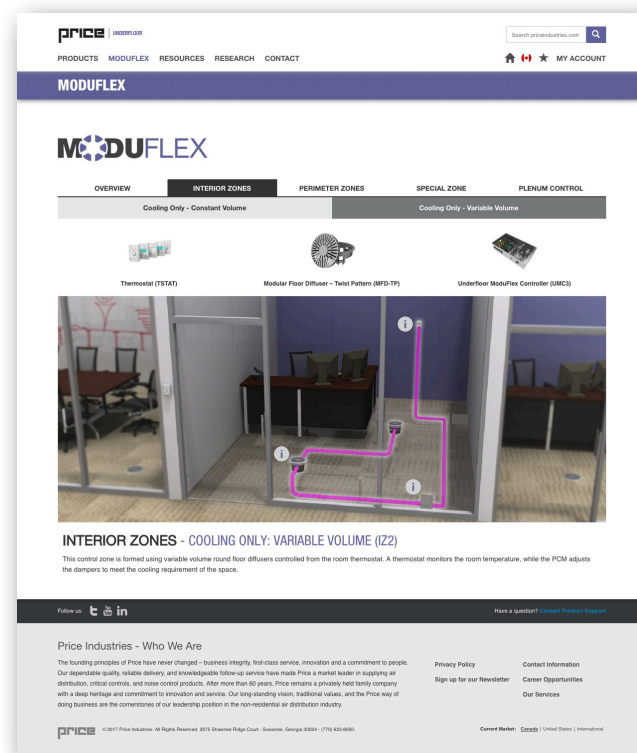
## PRICE UNDERFLOOR MICROSITE

The Price Underfloor Microsite is the ultimate online resource for those looking to learn more about Price Underfloor solutions.

### The site features:

- Product Information
- Interactive ModuFlex application guide
- Case Studies
- Training Modules
- Smoke Test Videos
- Product Videos

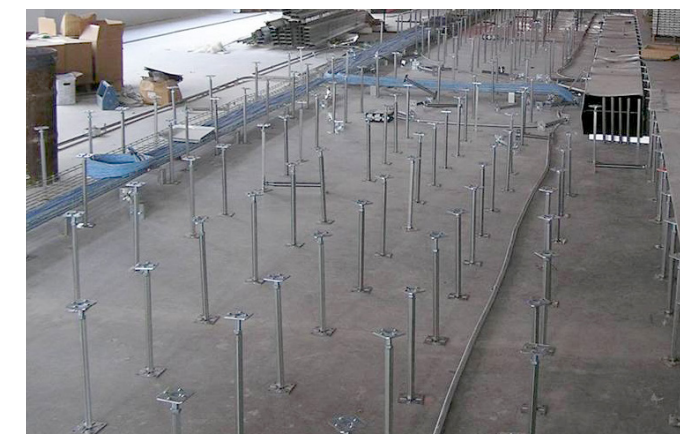
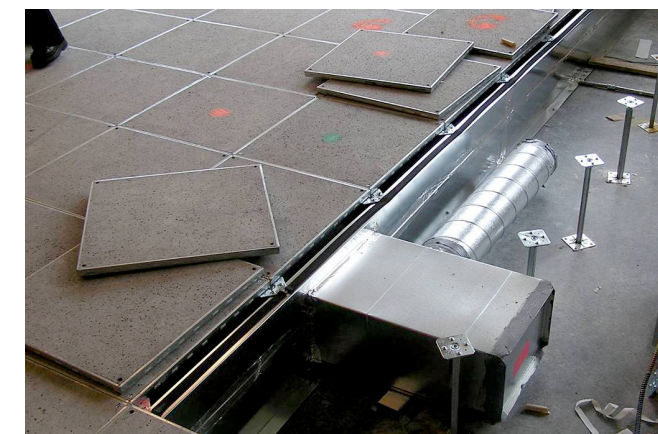
Visit [www.priceindustries.com/underfloor](http://www.priceindustries.com/underfloor) today!



Price offers an industry-leading controls start-up service, through which our trained Applications team will travel to the installation site and perform some or all the following valuable services:

- Pre-construction meetings
- Construction site walk-throughs
- Installation examples
- Controls integration assistance
- Help with the commissioning of typical Price UFAD equipment, including functional testing
- On-site product review and troubleshooting
- Training and education for owner, occupants, and maintenance personnel

Using Price's complete UFAD systems in conjunction with our on-site support service is a great way to **ensure absolute confidence in your Price UFAD system.**







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