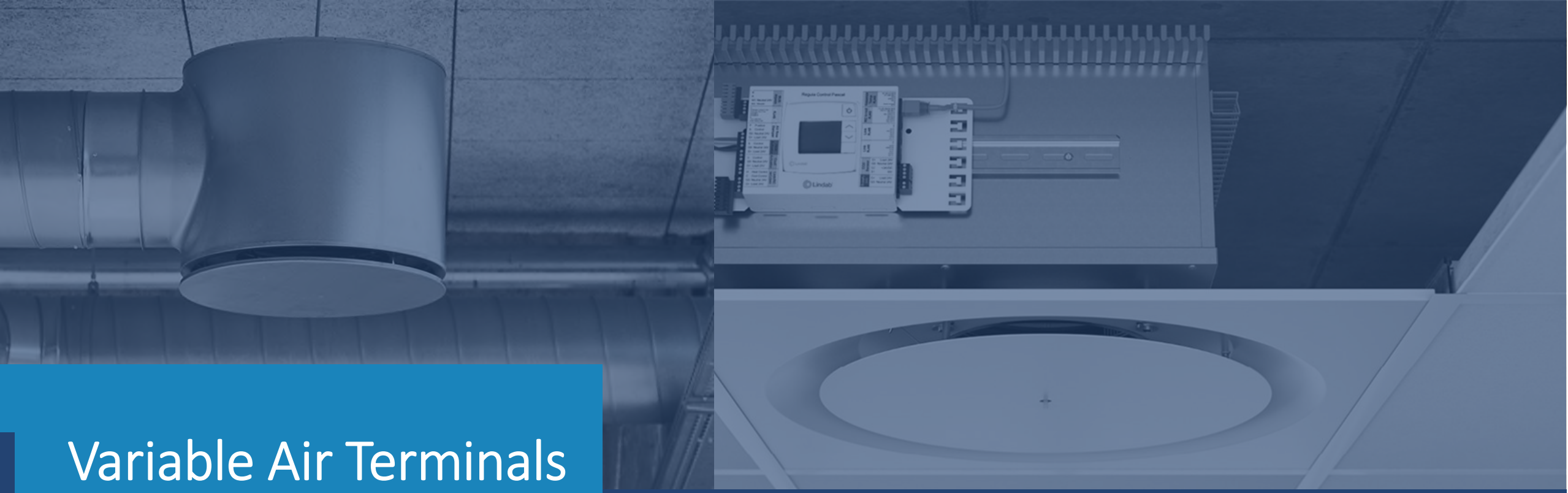


Variable Air Terminals

Optimising comfort and control

Lindab®

ACS
Air Conditioning Systems

DCV ONE – Variable Air Terminal

This pressure-independent, all-in-one VAV/DCV unit utilises a patented linear cone damper technology to ensure accurate low-noise operation at system pressures up to 200Pa, and supply air turndown of up to 90%.

Lindab®

All-In-One Variable Air Terminal

3D Modelling

10%-100% Air Volume

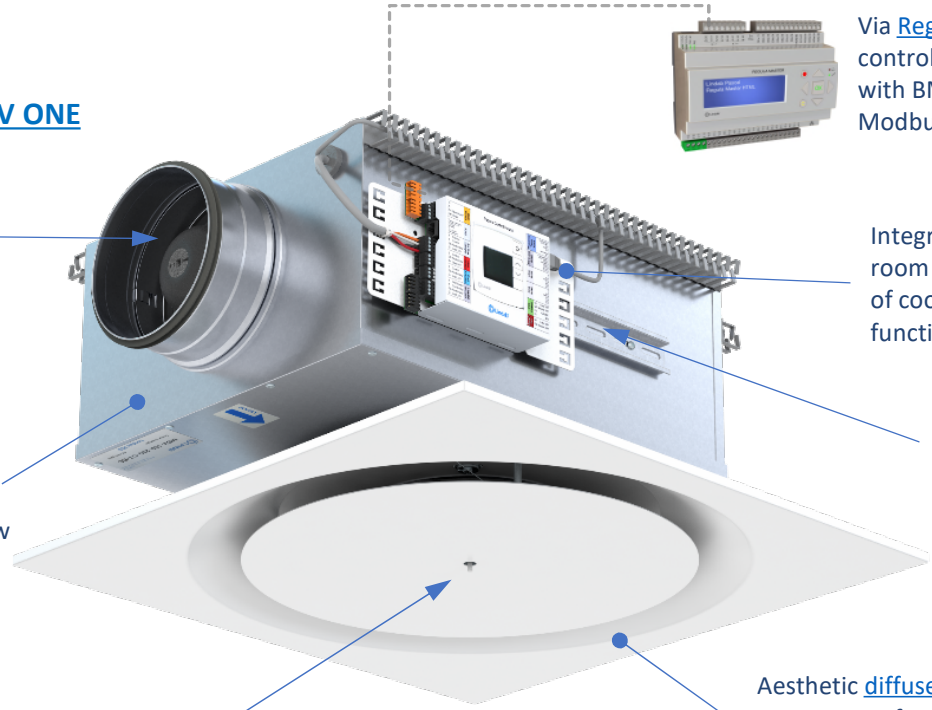
Integrated Sensors

<35 dB(A) Sound Power

Linear Cone Damper

On-Board Controller

DCV ONE



Via Regula Master HTML zone controller, can communicate with BMS via TCP/IP using Modbus or BACnet protocols

Integrated VAV flow regulation, pressure independent up to 200Pa

Integrated Regula Combi room controller for control of cooling and heating functions

Using RJ45 connection, multiple units in a room can be controlled from a single set of sensors

Innovative plenum box insulation ensures very low noise WITHOUT the need for silencers

Integrated temperature and/or presence sensor

Aesthetic diffuser design ensures comfortable and consistent air supply over the entire volume range

Pressure **Independent**

No Attenuation Required

Reliable & Quiet

Access via Diffuser Face

Low Construction Depth

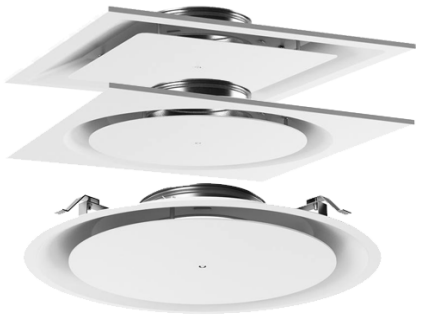
Lindab Innovation...

LKV VAV Diffuser
Motorised Plate

Noise Issues
Pressure **Dependant**

<1990

Integra Passive Diffusers
Coanda Optimised



0%-100% air flow with
Very low sound

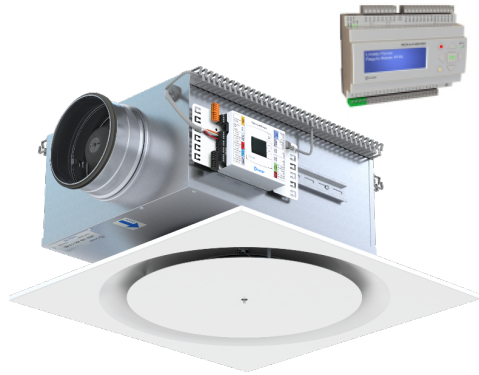
2006

MB Plenum Box
Linear Cone Damper

Pressure **Independent**
Very low sound

2009

DCV ONE
All-In-One DCV



Combined benefits with **DCV** logic for Optimised Comfort at Lowest energy use

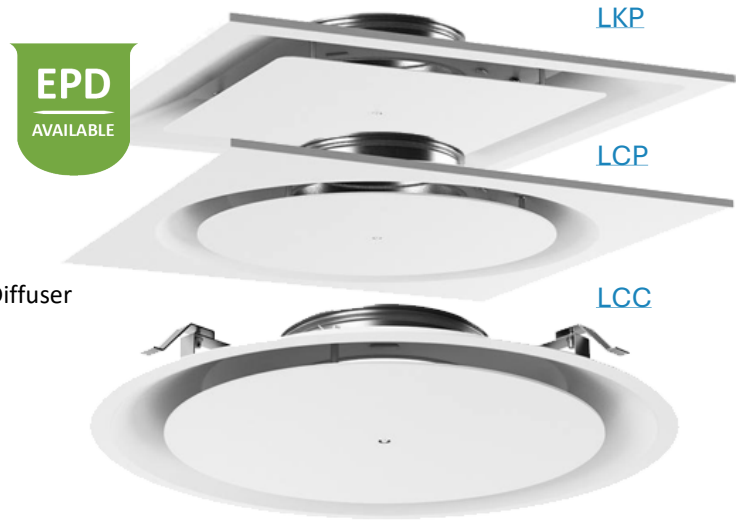
2019

Innovation #1

Coanda-Optimised ‘passive’ Diffusers

A range of advanced diffusers with integrated sensors, that maintain coanda at the lowest air volumes, ensuring occupant comfort with **low flow** and **low air temperature**

- 0-100% airflow
- Integrated temp and/or presence sensors
- Coanda effect at low flow

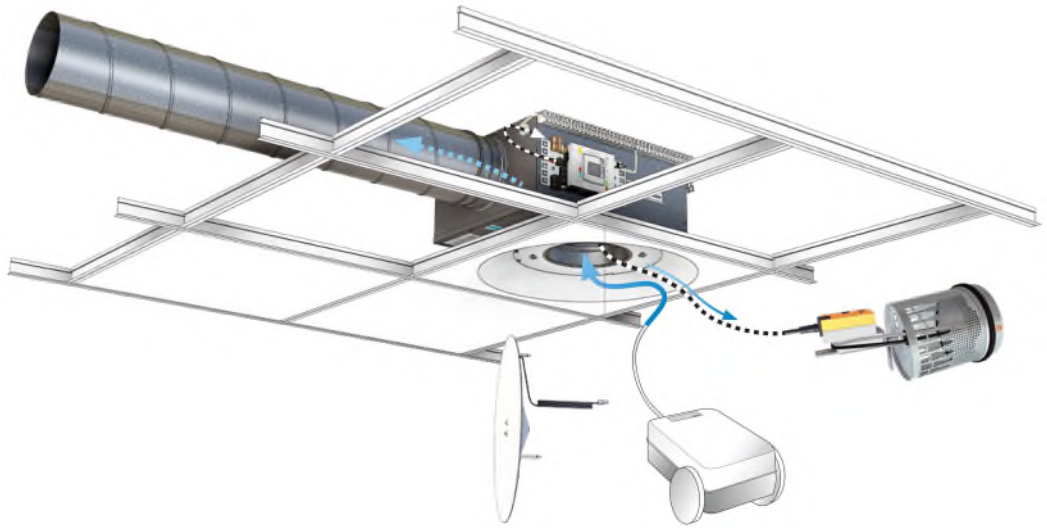


Ceiling Diffuser Options

LCP 200/250 diffuser 180 L/s = 100%

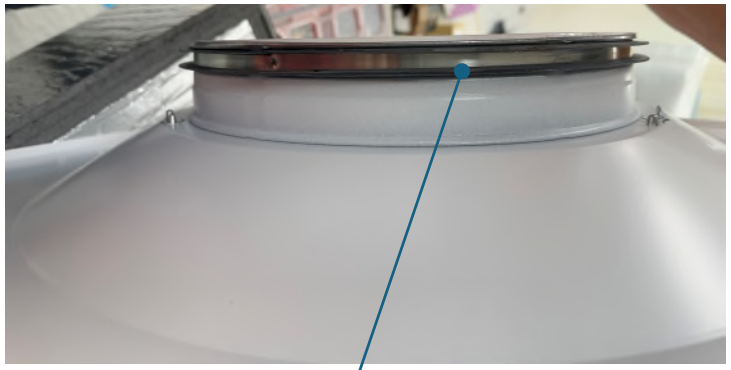
The design of the Lindab DCV diffuser is optimised to introduce the air horizontally, even during significant volume turndown, and even when the diffuser is 'exposed' (LCFV).

Tests were conducted to establish the efficacy of the diffusers at low air volume, witnessed in 2024 by 17 Australian engineers



Access for cleaning and maintenance
via removable centre plate

Video of Access method



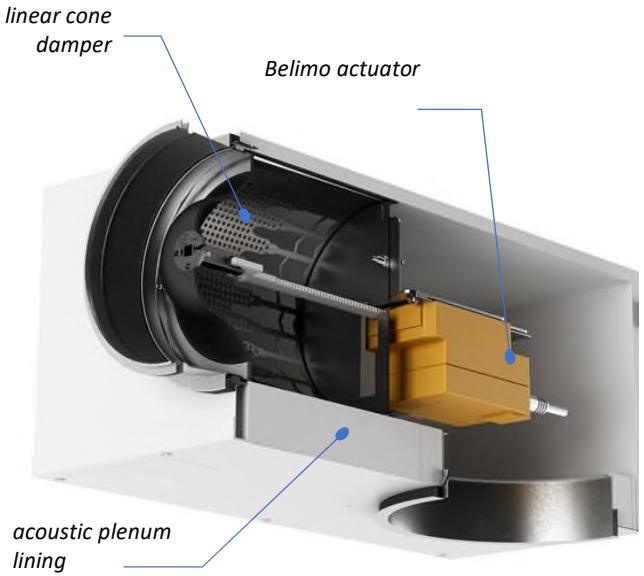
neoprene double seal
Class D tightness

shaped thermal
insulating foam

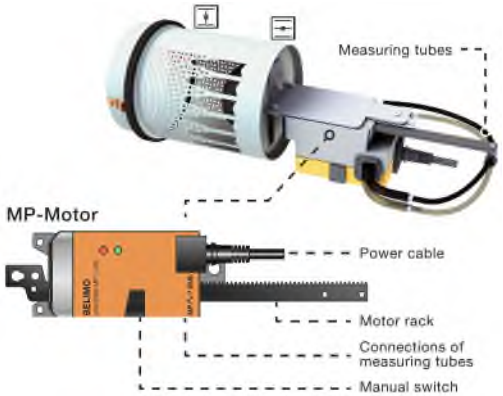
Innovation #2

MB Plenum box with Linear Cone damper

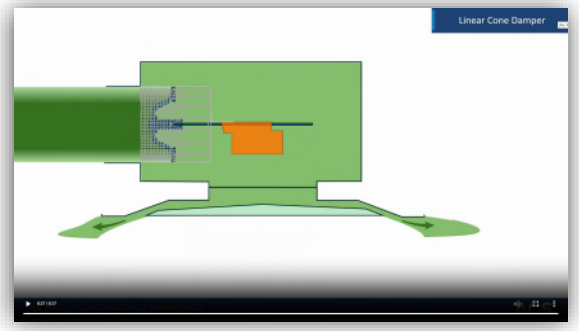
A range of high-quality plenum boxes, comprising internal acoustic lining, patented Linear Cone damper and Belimo actuator. Ensures pressure0independent operation at very low noise level



Plenum Box type MBV



MBV Installation Guide

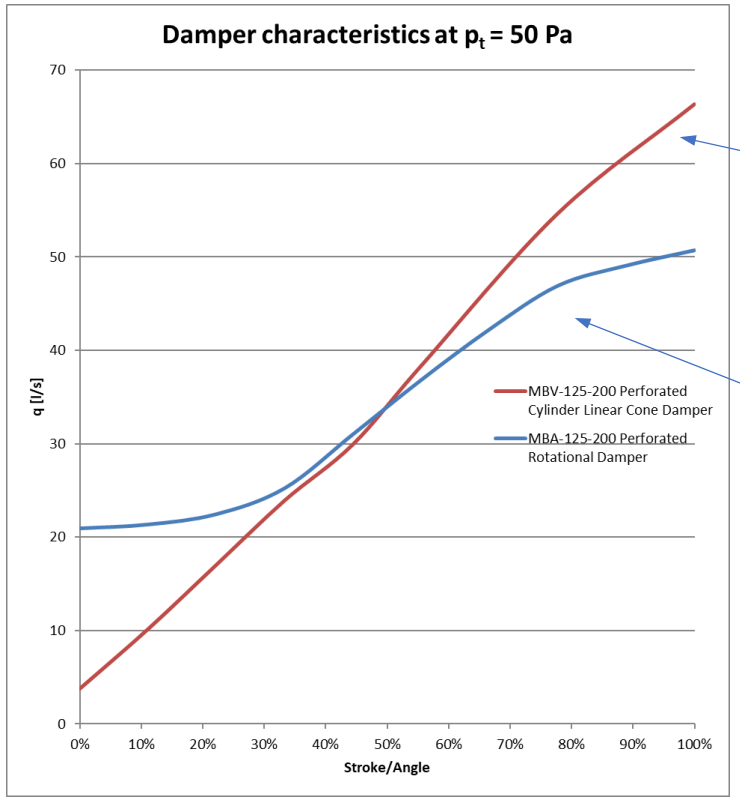


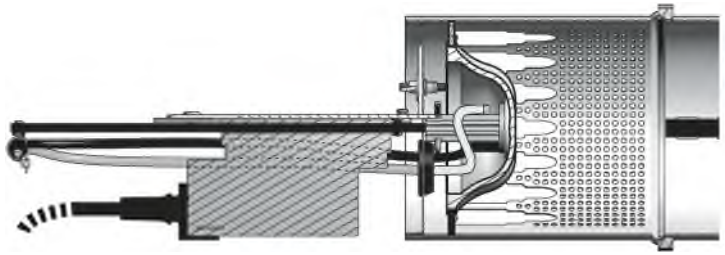
Linear cone damper Operation

Innovation #2

MB Plenum box with **Linear Cone damper**

The linear cone damper – in addition to offering low noise at high pressure drop – is designed with an almost linear relationship between position and flow (at constant pressure).





Linear Cone Damper

Perforated Rotational Damper

Innovation #3

DCV ONE and Pascal

Integrated sensors in the diffuser are connected to an on-board control module, enabling stand-alone operation. Alternatively, control via BMS system.

Regula Room Control

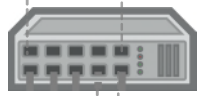
Integrated room controller connected to sensors and linear cone damper. Via Regula Master HTML zone controller, can communicate with BMS via TCP/IP using Modbus or BACnet protocols

DCV ONE

Regula Master HTML

Configurable zone controller, collates data from multiple DCV ONE and extract valves to help inform most efficient AHU operation

TCP/IP



Switch (others)

AHU (via BMS)

Pascal

*Lindab free operating system, containing logic for **most effective** pressure-independent system operation, and ability to configure Lindab system*

BACnet IP

BMS (others)

Ceiling Integrated

Just FOUR plenum box sizes cover air volumes ranging up to 170 L/s

Sound with open damper

Sound with mostly closed damper

	Inlet Diameter (mm)	Neck Diameter (mm)	Air Volume (L/s)	Inlet Velocity (m/s)	Pressure Drop (Pa)	Sound Power LwA (dB(A))	+ 100 Pa Adjustment Pressure: Pressure Drop (Pa)	+ 100 Pa Adjustment Pressure: Sound Power LwA (dB(A))
LCP-200+MBV-125-200	125	200	**70**	5.7	59	34	159	37
LCP-250+MBV-160-250	160	250	**110**	5.5	66	34	166	38
LCP-315+MBV-200-315	200	315	**140**	4,5	54	34	154	38
LCP-315+MBV-250-315	250	315	**170**	3,5	54	35	154	38

Exposed Installation

Just THREE sizes cover air volumes ranging up to 170 L/s

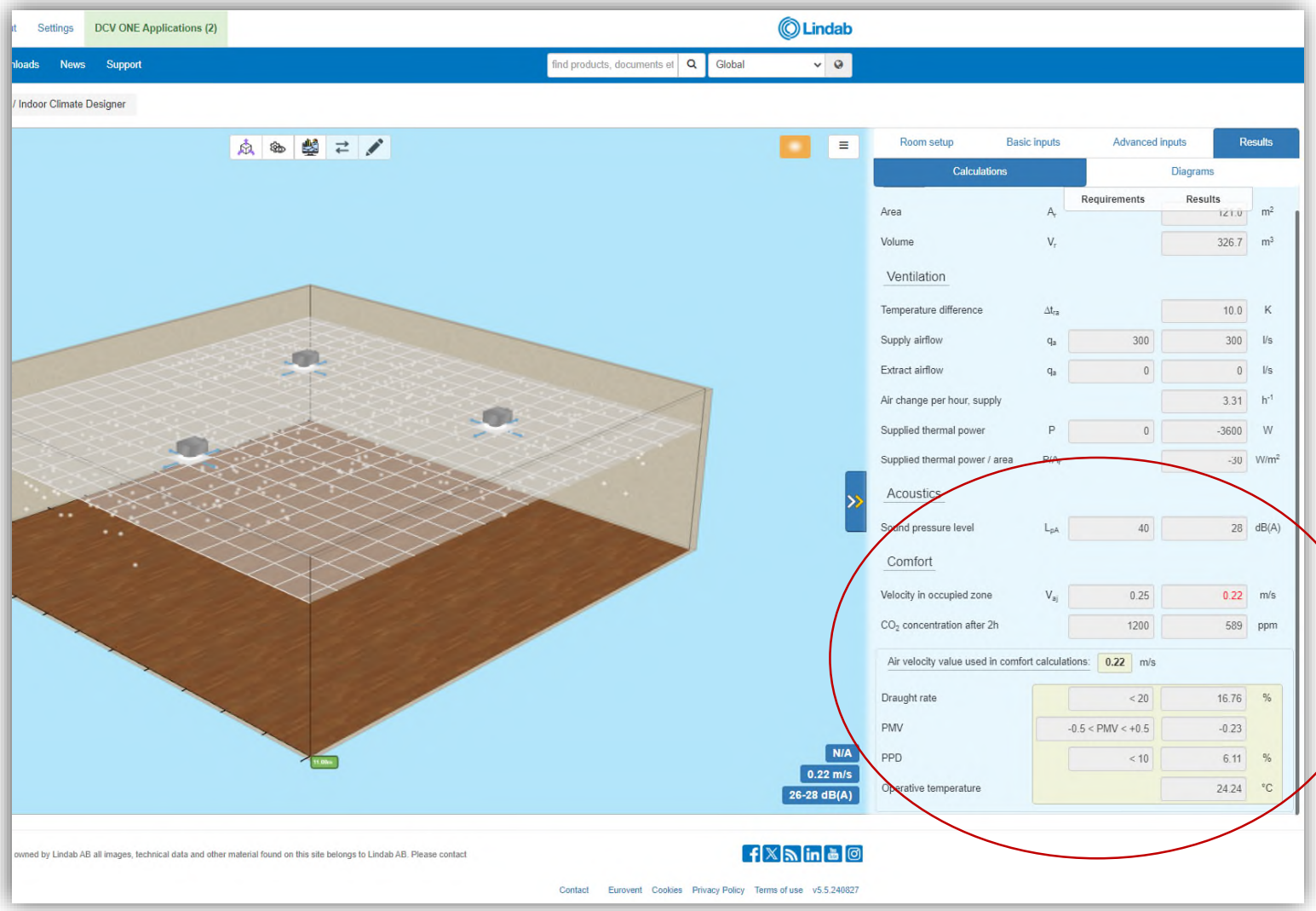
Sound with open damper

Sound with mostly closed damper

	Inlet Diameter (mm)	Air Volume (L/s)	Inlet Velocity (m/s)	Pressure Drop (Pa)	Sound Power LwA (dB(A))	+ 100 Pa Adjustment Pressure: Pressure Drop (Pa)	+ 100 Pa Adjustment Pressure: Sound Power LwA (dB(A))
LCFV-125	125	**70**	5.7	60	35	160	38
LCFV-160	160	**105**	5.2	61	37	161	40
LCFV-200	200	**170**	5.4	66	38	166	40

Acoustic Selection

LindQST.com

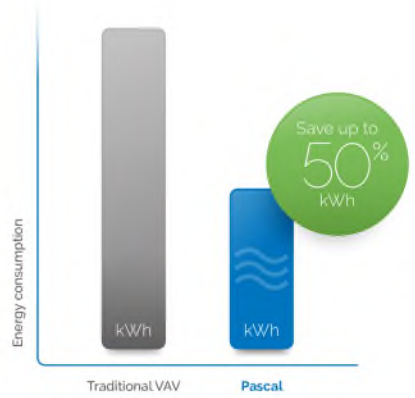


The free LindQST online selection programme provides room modelling of air distribution for the proposed arrangement, and develops much additional data, including...

- Sound level in the room
- Air velocity
- CO2 concentration
- Draught rate
- Predicted Mean Vote **(PMV)**
- Predicted Percentage of Dissatisfied **(PPD)**
- Operative Temperature

Pascal Design Manual (AIR)

Pascal Wiring

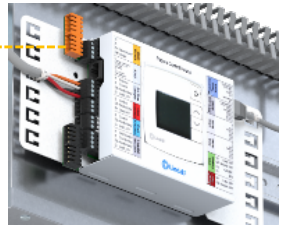


Fan Optimizer

Thanks to our integrated Fan Optimizer, you run at lowest possible fan speed according to actual demands and minimize pressure by opening VAV dampers as much as possible. That results in up to 50% lower fan energy consumption compared to constant pressure fan control.

Lindab Pascal manages the delivery of thermal comfort, noise control and demand-controlled ventilation at the lowest system air volume and pressure.

Air exhaust devices



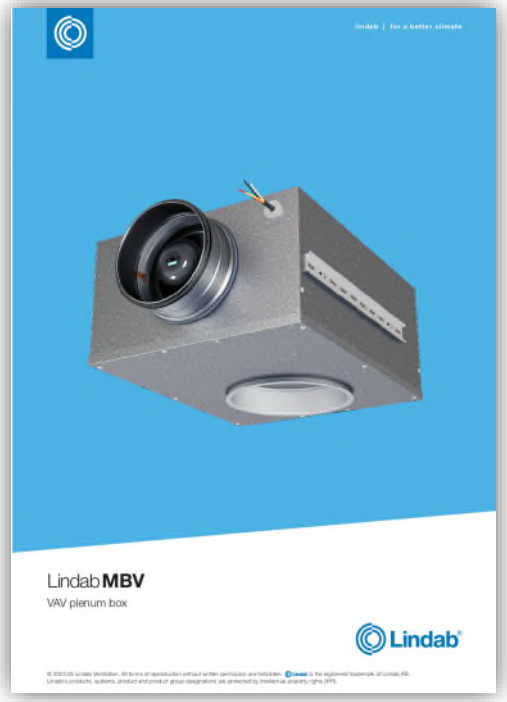
DCV ONE controllers

Wall-mounted controllers

Additional room or system sensors

Let the experts take responsibility

Click image to download



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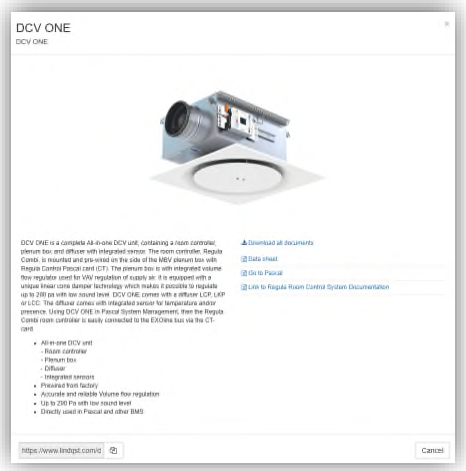


Further information via the LindQST portal

Designer Perspective

General Considerations New Build

Thermal Comfort Achieving occupant thermal comfort is a pre-requisite of any successful system design. LindQST thermal comfort modelling is developed from laboratory testing and can express *PMV/PPD* values for each zone modelled. ACS is experienced in providing this service.

Air Distribution In addition to thermal comfort assessment, the LindQST selection tool will inform where good air distribution is achieved throughout your project.

Acoustics DCV ONE is engineered to create very low noise without the need for additional sound attenuation, even with a closing damper. Lindab provide comprehensive sound data for the acoustic designer.

Fresh Air The capability to integrate CO2 sensors can ensure that the air in the space remains appropriate no matter how many persons are present .

Pressure-Independent Operation The innovative Linear Cone Damper and Belimo motor assembly automatically adjust to system pressures up to and beyond 200Pa, whilst the included acoustic attenuation ensures low noise.

Sensor Location With the possibility to integrate diffuser-mounted presence/temperature sensors into the diffuser face, and to connect these – and additional CO2 or RH sensors – to the on-board thermostat control module, sensors and controllers do not need to be located on walls or columns.

System Feedback The system provides real-time data on airflow and pressure metrics, supporting predictive maintenance and enabling rapid troubleshooting across all connected zones.

Client Benefits With the possibility to provide zone control at each diffuser, future tenant fitout requirements can be accommodated at significantly reduced cost and disruption. 'Exposed' version of DCV ONE is suitable for fit-outs where ceilings are removed. The possibility for on-board sensors and control also simplifies tenancy fit-outs.

Design Adjustments DCV ONE Pascal provides multiple design parameters that are adjustable to refine operation and occupant experience. These parameters can be adjusted either within Pascal, or via a connected BMS where these O/I points are mapped.

Supply Reliability ACS has been supplying innovative Lindab products into Australia for over 20 years, with experienced personnel available to assist throughout the design/supply/install/commissioning process. DCV ONE components have proven to be very reliable (Belimo motors ship with 5-year warranty).

Designer Perspective

General Considerations New Build

DCV Operation A well-designed Demand Control Ventilation system will supply just enough air to meet zone comfort requirements; e.g. 30% for low load/occupancy, 10% in a 'standby' mode during a lunch break. With high-coanda diffusers and pressure-independent air-flow regulation, coupled with the Pascal DCV logic, DCV ONE Pascal ensures that the maximum energy benefits of operating at lowest air volumes are realised automatically, without compromise to occupant comfort.

Low Temp Supply Air From a Thermal Comfort perspective we generally recommend a supply-air temperature of around 14°C however some systems are being designed with lower air temperatures, often employing high-induction swirls to mitigate the cooler air streams. This can be effective at design airflow, however where air volumes are reduced this induction effect will also reduce, with the risk of dumping cold air. The high coanda effect of the Lindab Integra diffusers ensures that the supply air stays at high level for longer; preferable with cooler air temperatures.

System Pressure DCV ONE Pascal with integrated Fan Optimiser constantly seeks the lowest system pressure required to deliver the demanded air volume, with the possibility to generate significant energy benefits.

AHU Optimisation Where AHU fan optimization is available via the BMS, the GRM can aggregate data collected from all connected devices and inform the lowest air volume and system pressure required to deliver occupant thermal comfort.

Air Volume Accuracy The air volume supplied by each diffuser is informed by pressure differential across the Linear Cone Damper. The pressure tapping points can be easily cleaned via the diffuser plate, ensuring continued accuracy of the system.

System Control DCV ONE units can operate with 'stand-alone' control, automatically maintaining design conditions in the space via the included Pascal software. Where appropriate, units can then be inter-connected via Lindab zone controllers, once again operating within Pascal , so that system data can be collated to inform AHU function. Whether stand-alone or connected, Pascal can integrate with an incumbent BMS via Modbus/ BACnet IP communication (read and write).

Control Scalability Lindab Regula Master zone controllers are configurable as Single (SRM), Local (LRM) or Global (GRM) devices. SRM/LRM can handle the data from up to 26 zones – these zones could include multiple 'support' units – and this data can be provided directly to the incumbent BMS. Up to 8x LRM's can be inter-connected to a GRM, with consolidated data available to the BMS. Multiple GRM can be connected in a 'cascade' arrangement.

'Master/Slave' DCV ONE can be configured in a 'Control/Support' arrangement, where the Control unit has an on-board or wall-mounted Regula Combi Pascal determining DCV logic. This unit will also be connected to diffuser-mounted or other sensors to monitor space conditions and inform air volume demand. The Control unit can be daisy-chain connected to up to 11x Support units, with the volume demand to these being informed by the Control unit. All units operate independent of system pressure.

Commissioning The design parameters for each unit can be configured within Pascal, with a 'clone' function available where multiple zones have similar requirements. Once configured, all units can be set to Design Flow so that flow verification checks can be made (usually with a flow hood).

Designer Perspective

Additional Considerations Refurbishment

High System Pressure Some existing projects are designed with relatively high system pressures. The pressure-independent nature of DCV ONE means that quiet and efficient operation is possible with system pressures up to and beyond 200Pa.

Improved Comfort Upgrading from VAV to DCV ONE will usually provide significantly improved thermal and acoustic comfort to occupants, particularly where presence and CO2 sensors are included. LindQST modelling tools can advise resultant PMV/PPD.

Compatibility with Existing So long as it's not introduced after an existing VAV regulator or similar damper, DCV ONE can be easily 'added' to most legacy VAV or CAV systems.

System Control Where no incumbent BMS is available, the Pascal controls architecture shipped with DCV ONE ensures that the full operation of the system is available. This includes real-time data on airflow and pressure metrics, supporting predictive maintenance and enabling rapid troubleshooting across all connected devices.

Operation with Ceilings Removed Many project upgrades look to remove the suspended ceiling system and expose the services. The LCFV version of DCV ONE is designed to operate effectively and quietly in this scenario. No attenuation required.

Additional Considerations Healthcare

Balanced Exhaust DCV ONE Pascal can integrate with other Lindab regulators such as FTCU, such that supply and exhaust air volumes to a room can be balanced. The signal from the FTCU is connected directly to the Regula Combi and Pascal makes the calculation, whether the exhaust is balancing a single or multiple supply units.

Flow Measurement Accuracy Traditional VAV regulators employ measurement grids within the device or preceding ductwork to calculate volume flow, where accuracy can be adversely affected by dust and lint build-up (particularly in an exhaust duct). This can be an issue where the balance of supply/exhaust volumes is important. The FTCU ultrasonic regulator is free of measurement grids, and consequently able to main high flow accuracy with little or no maintenance. Likewise, the pressure tappings within the DCV ONE plenum can be easily cleaned via the diffuser face (no need to access ductwork).

Access for Maintenance Access to the Linear Cone Damper and Belimo motor is via the centre plate in the Integra diffuser. If the DCV ONE unit is to be integrated into a plasterboard soffit, then the Regula Combi control unit can be placed in an accessible area – such as a corridor – potentially removing the need for an access hatch adjacent to the DCV ONE diffuser .

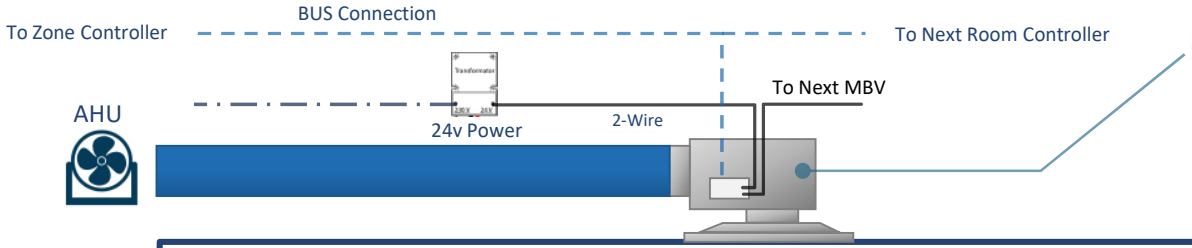
Heating The Regula Combi control modules incorporated within DCV ONE can provide a signal to inform hot water or electric duct heaters to heat the air supplied to individual units .

Window Interlock In lieu of the integrated PIR sensor, the Regula Combi control module can accommodate the signal from a window interlock to ensure that the system is OFF when the window is open.

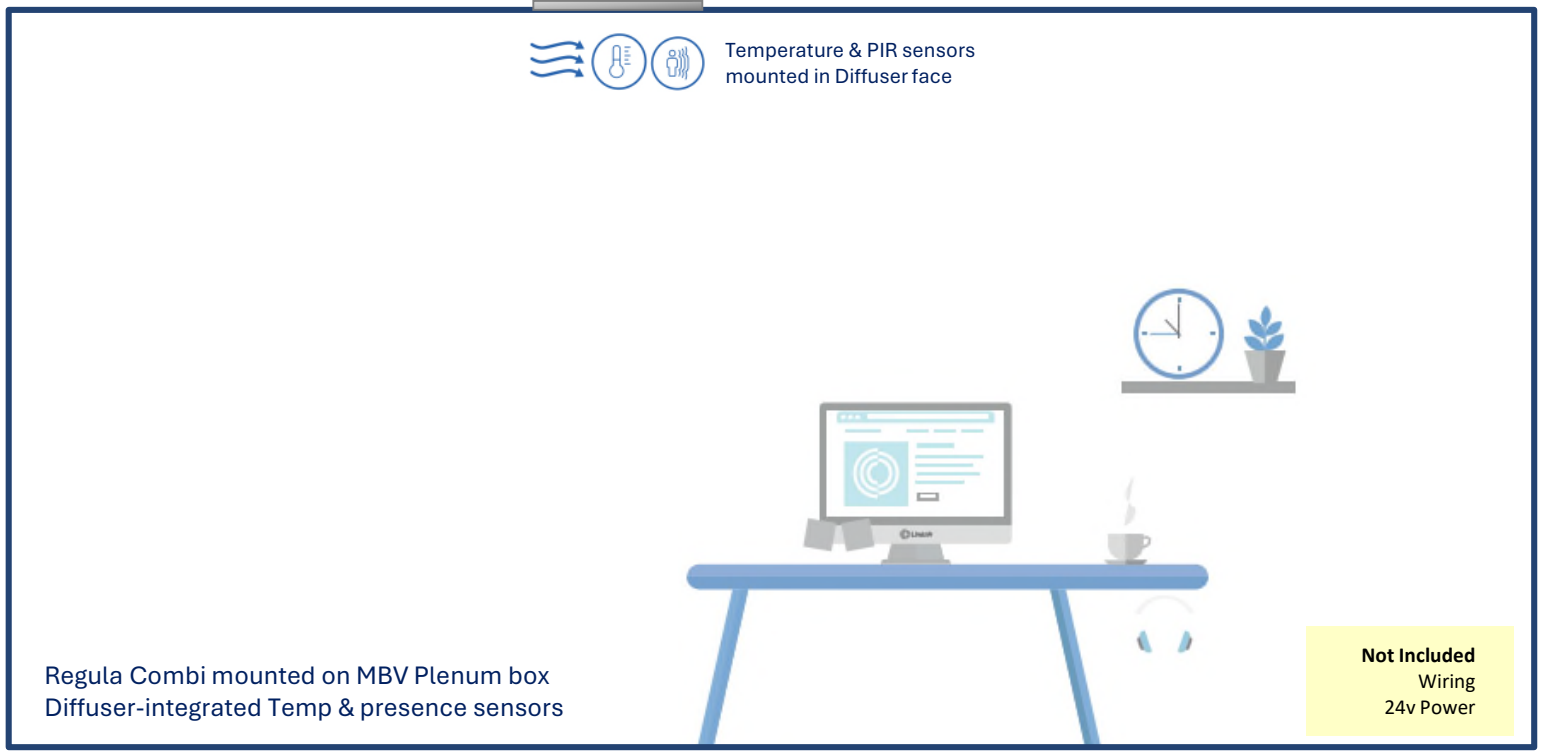
Typical Room Arrangement

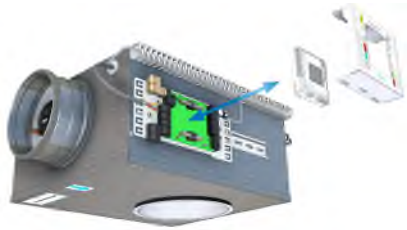
Lindab DCV ONE Pascal

...one of many options available



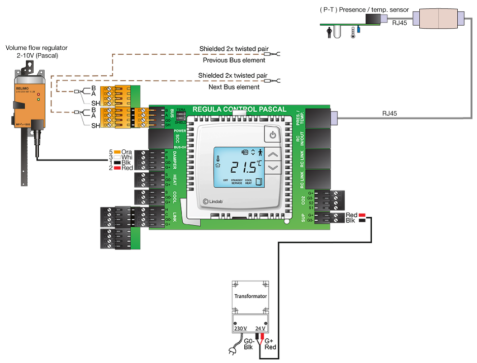
MBV Plenum Box with Linear Cone Damper, Actuator and Acoustic Lining





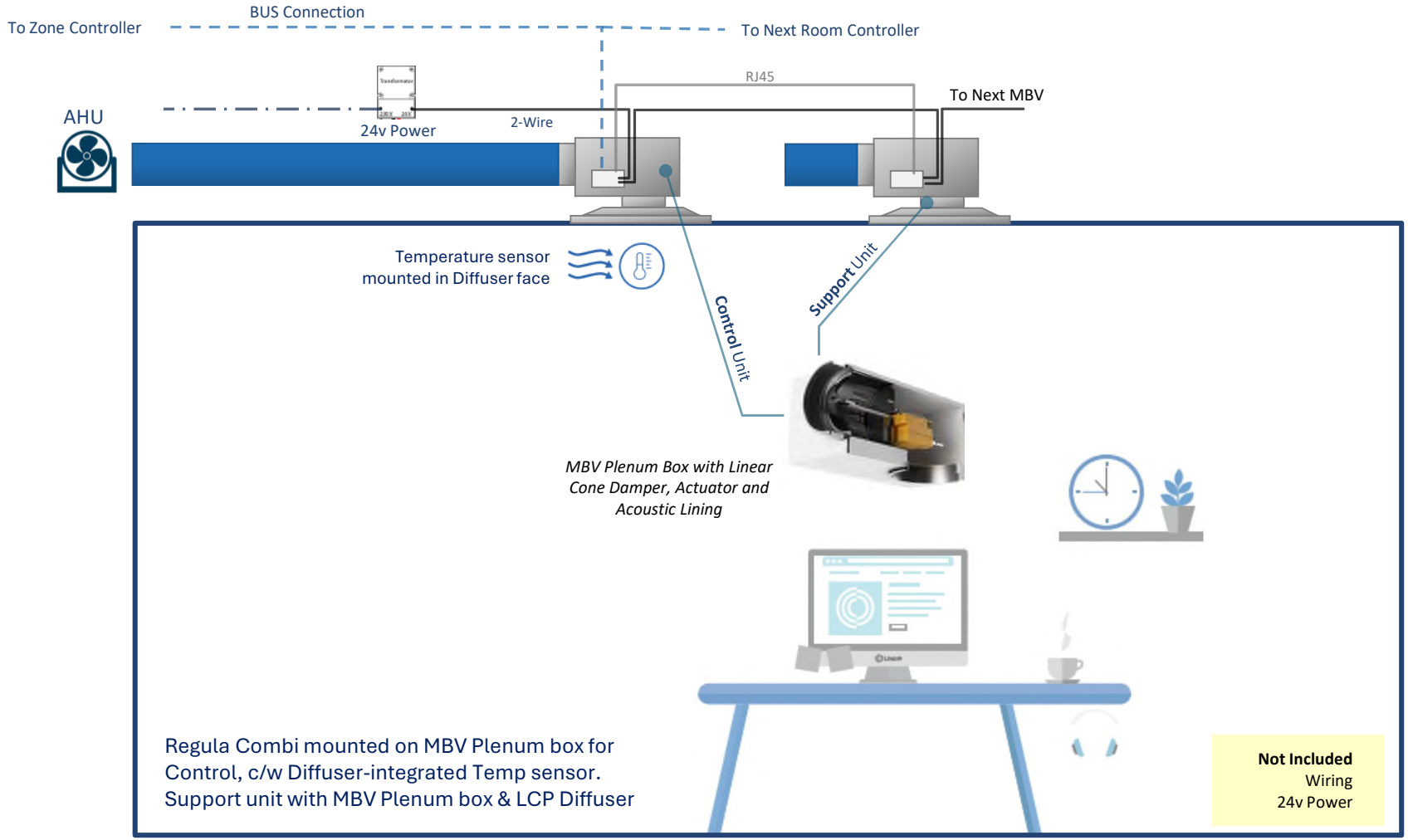
MBV Plenum Box with Damper & Regula Combi control module

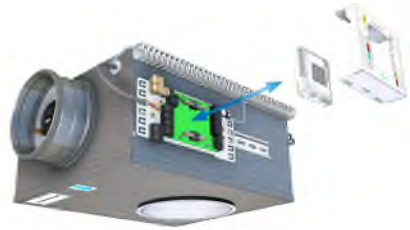
LCP Diffuser with Integrated Temp and PIR Sensor



Typical Room Arrangement

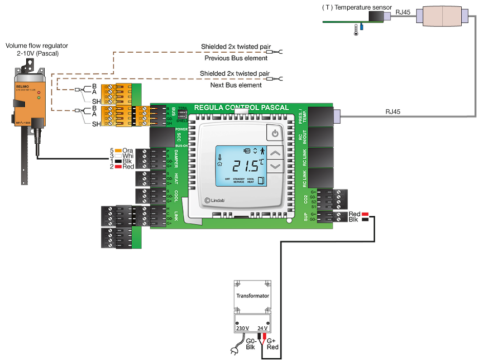
...one of many options available





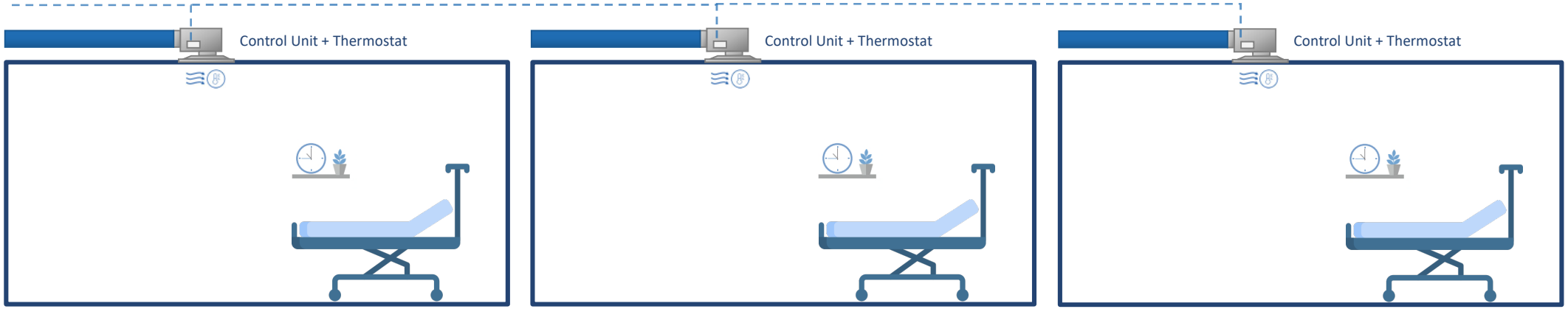
MBV Plenum Box with Damper & Regula Combi control module

LCP Diffuser with Integrated Temp Sensor

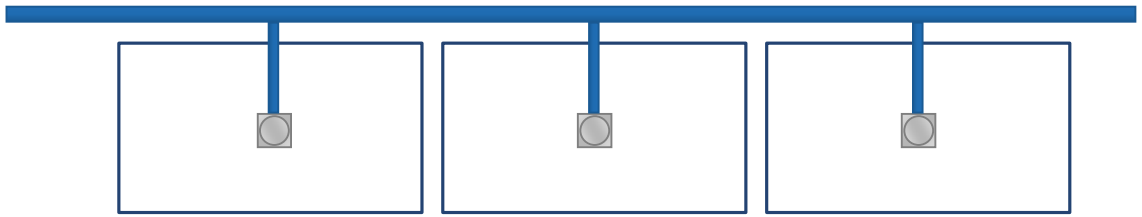


Individual Ward Control

...one of many options available



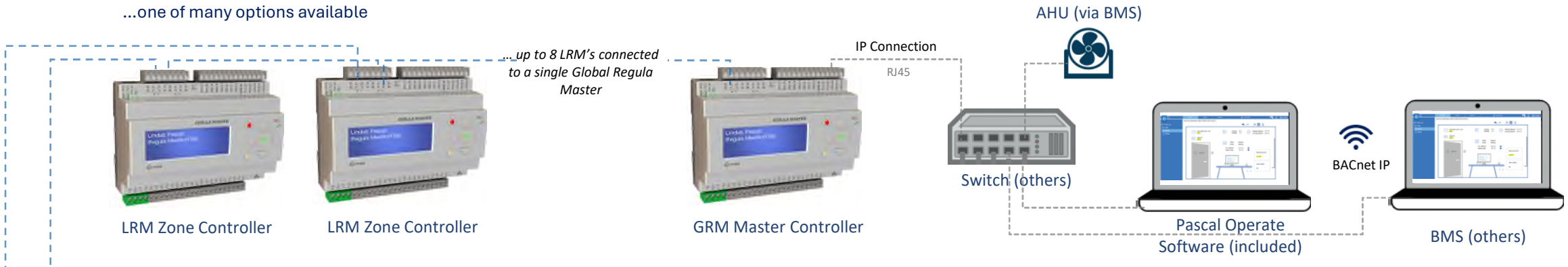
- High Thermal Comfort
- Very Quiet Operation
- In-Diffuser Thermostats
- Individual Room Control

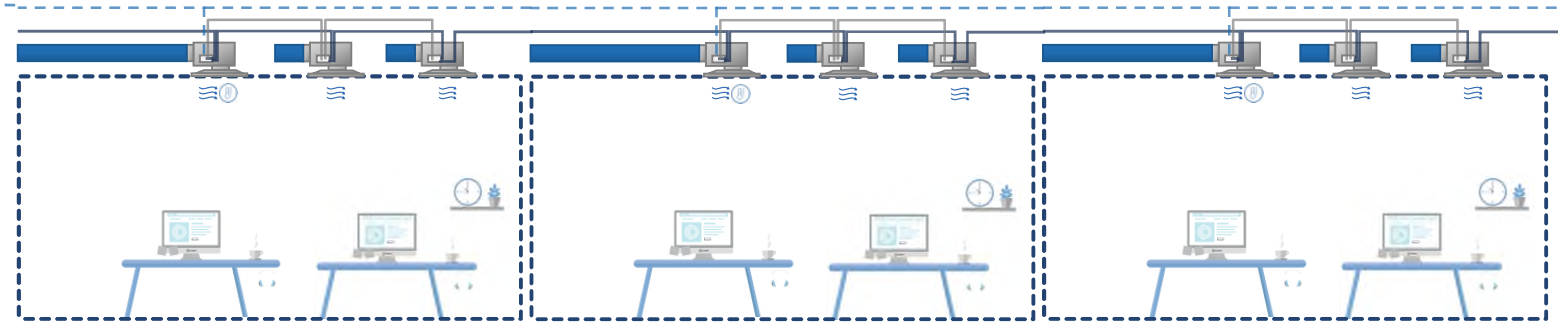


Pressure Independent – No Balancing Dampers

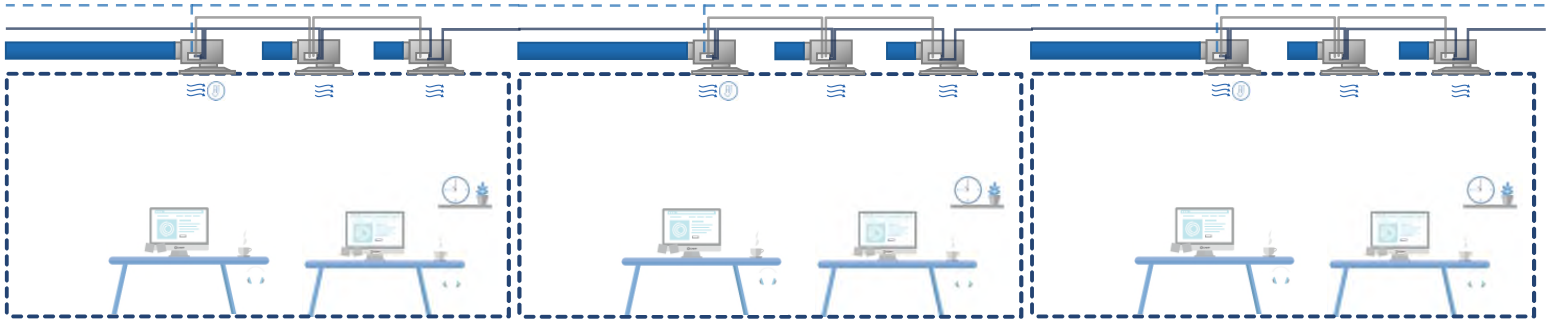
Connected Zone Arrangement

...one of many options available

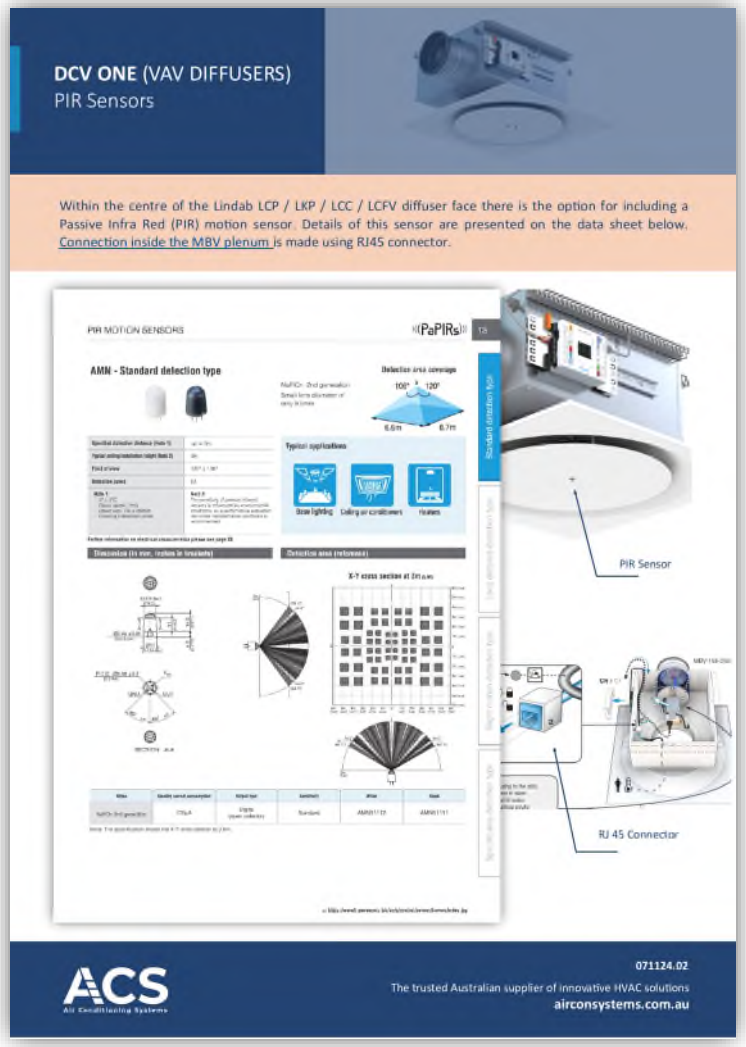


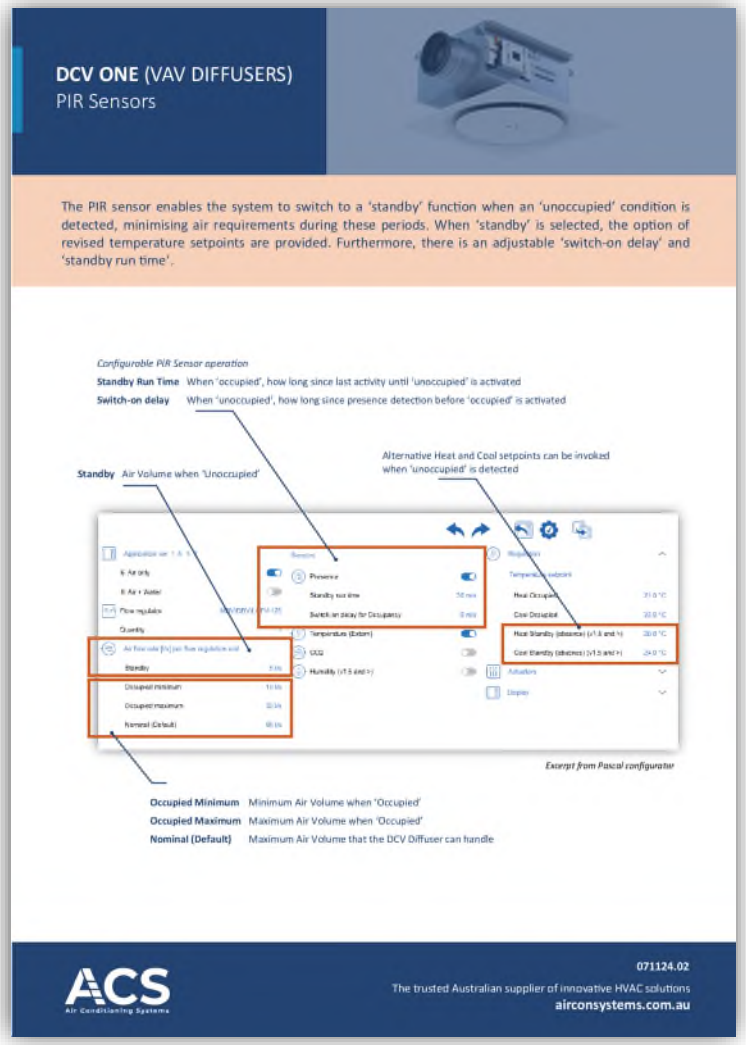


... up to 26 zones connected to an individual zone controller (LRM or SRM)



... up to 26 zones connected to an individual zone controller (LRM or SRM)





Energy saving Opportunity

- Provides unoccupied (standby) air volume option
- Adjustable heating and cooling setpoints when in standby mode
- Response to PIR detection is adjustable

ACOUSTIC DATA
Benchmarking acoustic performance

Manufacturers and suppliers of HVAC items may express product sound in various different ways, Sound Power LwA, Sound Pressure LpA, NR, NC, etc. This can be confusing when attempting to compare data from suppliers with differing approaches. At ACS our preference is that acoustic data of HVAC items be expressed as **Sound Power**, as this is the only constant acoustic characteristic, neither depending on distance or on the acoustic porperties of the surrounding environment.

Apart from Sound Power—or alternative expressions of the sound power spectrum - acoustic assessments attempt to place the product in the 'built environment'. In doing so, assumptions will be made for how the room size and surface treatments may diminish the intensity of the sound (referred to as 'room attenuation' values).

To express product sound level in terms of Sound Power, testing will be conducted in an appropriate test facility and to an appropriate standard. Acoustic performance of active chilled beams and induction units may be tested in accordance with DIN EN ISO 3741, whereas air terminal unit and silencers in accordance with DIN EN ISO 7235. Furthermore, to the Sound Power values (dB) an A-weighting can be applied to better represent what people actually hear, with noise then expressed as Sound Power LwA (dB(A).

Manufacturer's may choose to apply attenuation values in their acoustic data, to realise Sound Pressure Levels LpA (dB(A)), albeit the attenuation value is necessarily project specific. For contemporary office buildings we can assume attenuation values of 2-4dB. In basic terms, this means that a single product with Sound Power Level LwA 30dB(A) located in an office with 4dB attenuation will realise a Sound Pressure Level LpA of 26 dB(A).

Some product manufacturers express 'noise data' simply as a single NR or NC value, which indicates a Room Sound Pressure Level Lp with NR/NC rating. In making these calculations they will often assume room attenuation values of 8-10dB, which may be considered unrealistic for most installations. Furthermore, the difference between LwA and LwNC is generally 5dB on average. Therefore, if the unit is claimed to be NC35, then we can add 5dB to get to an LwA value and then another 8-10 dB to negate the assumed room attenuation, therefore the corresponding Sound Power Level LwA of the NC35 product is likely to be 48-50 dB(A).

Some product manufacturers express sound as Leq (dB(A)) or LpAeq, which is an A-weighted sound pressure level in the room at a defined position, averaged over time. Once again, in making these calculations they may assume unrealistic attenuation values of 8-10dB.

In summary, it is considered that the most appropriate way to 'benchmark' the sound levels of comparative products is that they be expressed as Sound Power Level LwA (dB(A)) - either as spectrum values (preferred) or a summarised value - or LwNR / LwNC (noise criteria rating of sound power level spectrum). Presenting data in these formats enable the acoustic specialists to apply appropriate project and room-specific room attenuation values, providing a better understanding of the acoustic consequences of installing single or multiple products.

ACS Air Conditioning Systems

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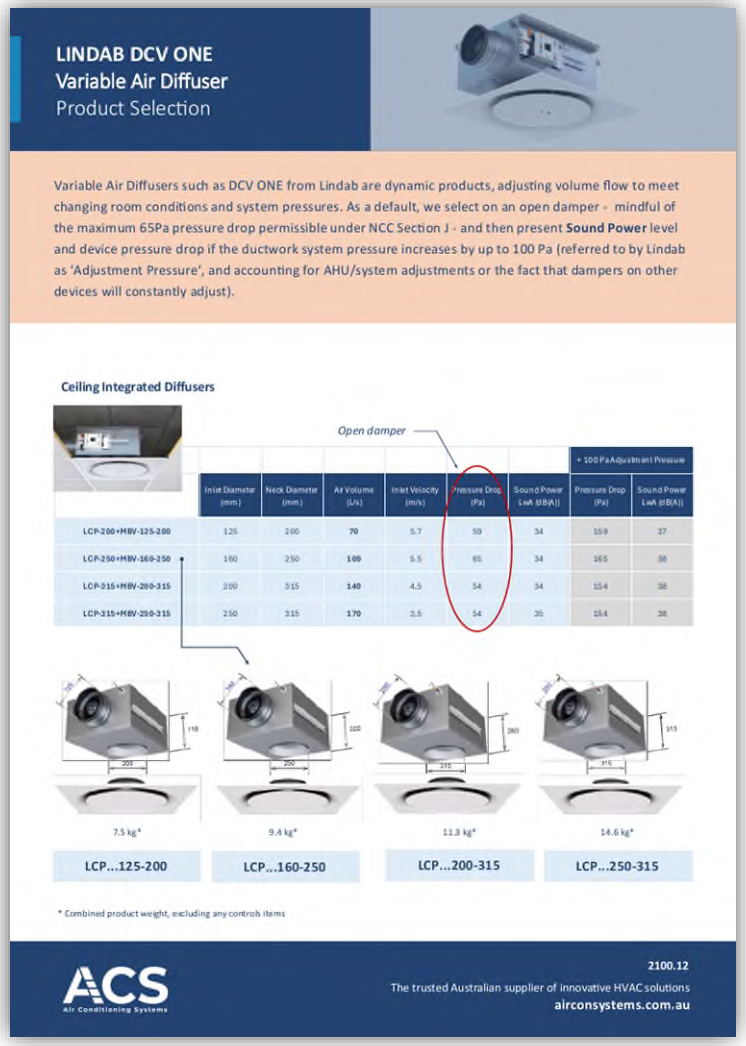

LINDAB DCV ONE
Variable Air Diffuser
Product Selection

Variable Air Diffusers such as DCV ONE from Lindab are dynamic products, adjusting volume flow to meet changing room conditions and system pressures. As a default, we select on an open damper - mindful of the maximum 65Pa pressure drop permissible under NCC Section J - and then present **Sound Power** level and device pressure drop if the ductwork system pressure increases by up to 100 Pa (referred to by Lindab as 'Adjustment Pressure', and accounting for AHU/system adjustments or the fact that dampers on other devices will constantly adjust).

Ceiling Integrated Diffusers

Open damper

	Inlet Diameter (mm)	Neck Diameter (mm)	Air Volume (l/s)	Inlet Velocity (m/s)	Pressure Drop (Pa)	Sound Power LwA (dB(A))	+ 100 Pa Adjustment Pressure: Pressure Drop (Pa)	+ 100 Pa Adjustment Pressure: Sound Power LwA (dB(A))
LCP-200+MBV-125-200	125	200	70	5.7	59	34	159	37
LCP-250+MBV-160-250	160	250	109	5.5	65	34	165	38
LCP-315+MBV-200-315	200	315	140	4.5	54	34	154	38
LCP-315+MBV-250-315	250	315	170	3.5	54	35	154	38

LCP...125-200	LCP...160-250	LCP...200-315	LCP...250-315
7.5 kg*	9.4 kg*	11.3 kg*	14.6 kg*

* Combined product weight, excluding any controls items

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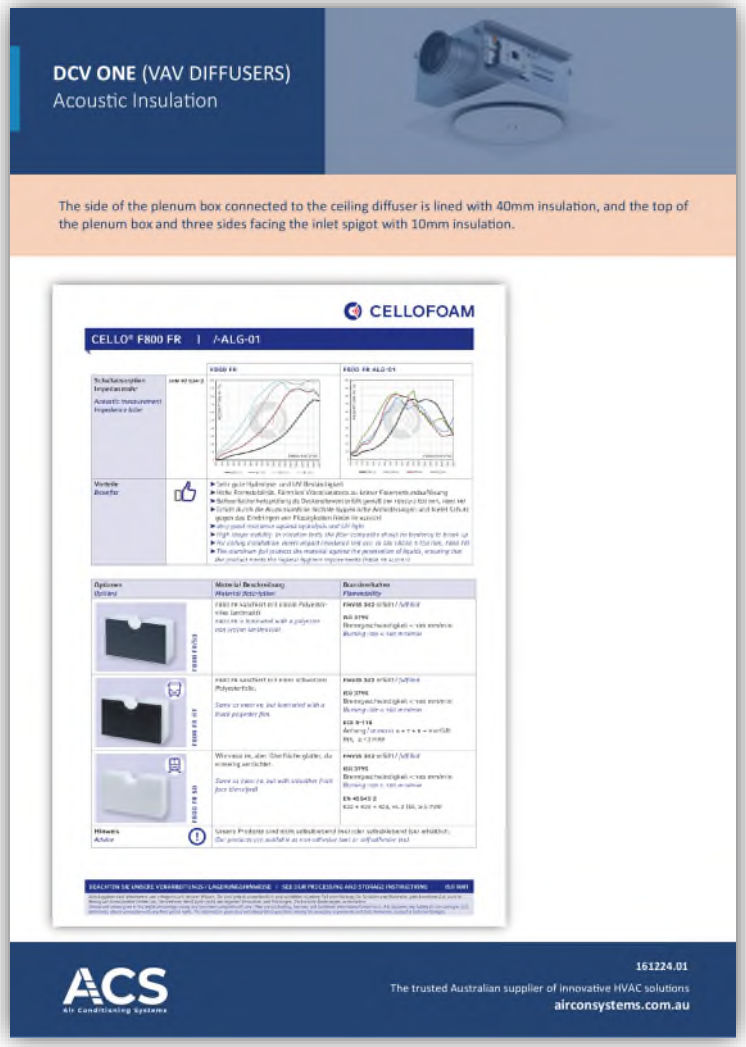
Acoustics are a Priority

- Sound levels rigorously tested to EN 7235, inclusive of plenum, damper and diffuser
- Expressed as Sound Power Levels LwA, albeit all spectrum data available
- ACS explain approach to sound evaluation

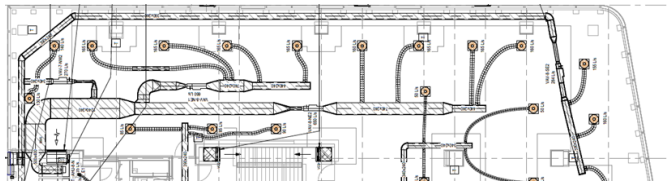


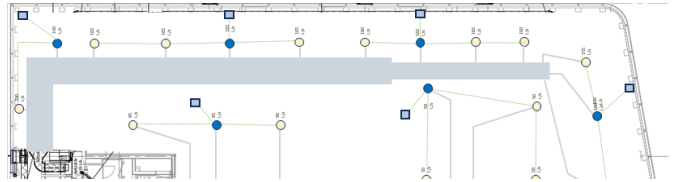
Sound and Fire Integrity

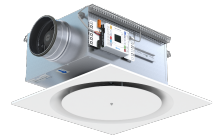
- 30 kg/m3 density non-woven polyester foam used for plenum box attenuation
- Fire classification B-s1, d0
- <= 0.037 W/(m.K) thermal conductivity according to EN 12667

Cost & Benefits

VAV versus DCV ONE Pascal







Capital Cost

- Higher controls cost
- Lower component cost
- Duct attenuation required

Cost NEUTRAL

- Reduced controls cost
- Higher component cost
- Seismic restraint potentially required (AUS)
- Greatly simplified ductwork layout
- Simplified system set-up

Energy Use

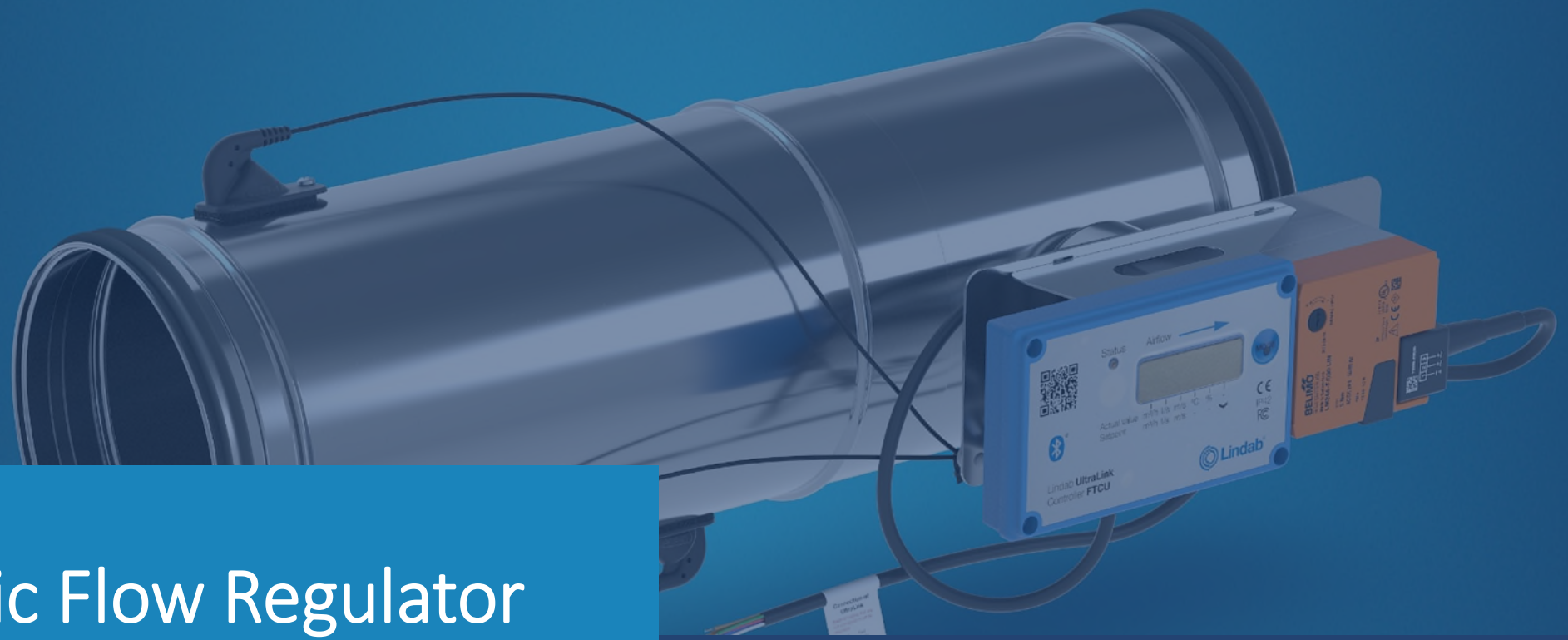
DCV Pascal = Lower Energy Use, ALWAYS

- Lower absolute air volume (reduced air temp)
- Lower operational air volume (increased turndown & PIR)
- Lower system pressure

Client Benefits

DCV Pascal = Added client benefits, ALWAYS

- Comfort optimised; thermal & acoustic
- Higher resolution of space control
- Far simpler to re-design during tenant fit-out
- ACS & Lindab support; design, technical, on-site, stock



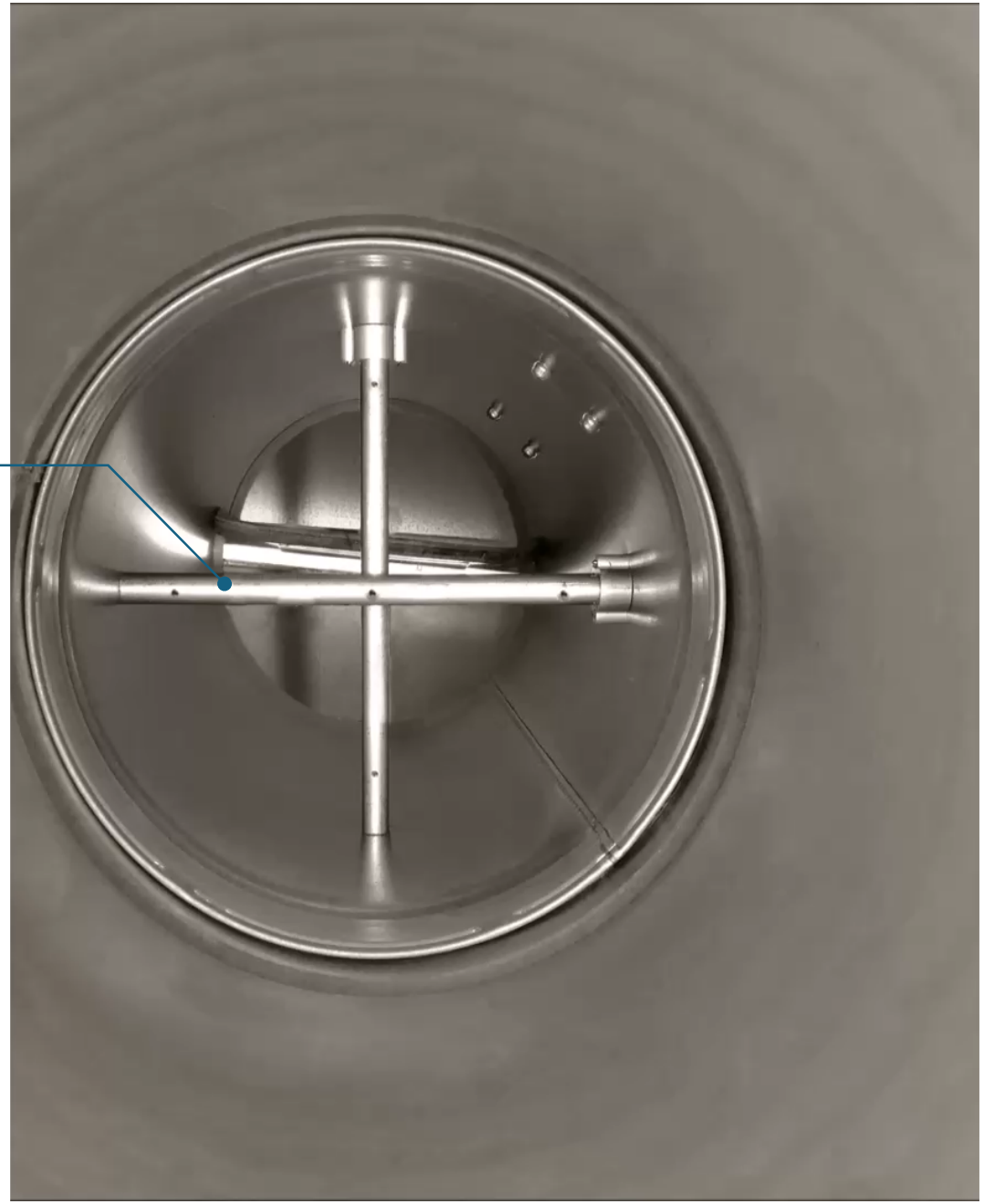
Ultrasonic Flow Regulator

FTCU by Lindab

Lindab

ACS SINGAPORE

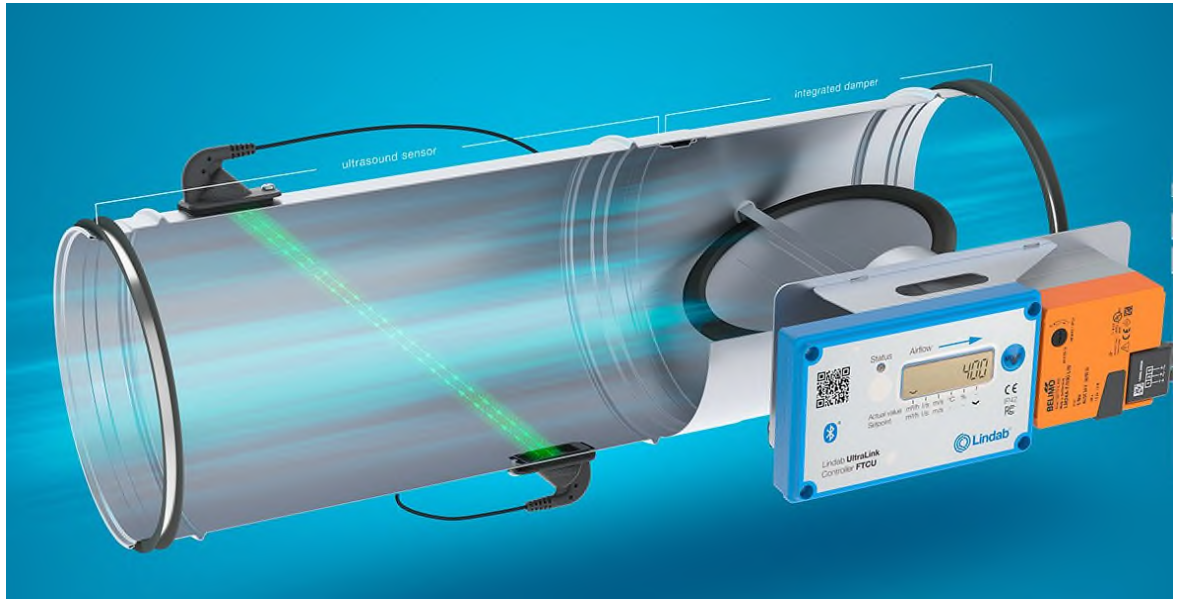
Dirty Ducts



Time-lapse video, filmed over 12 months, showing dust/dirt build-up on the differential pressure measurement array of an extract duct

Lindab UltraLink®

Ultrasonic flow measurement & regulation

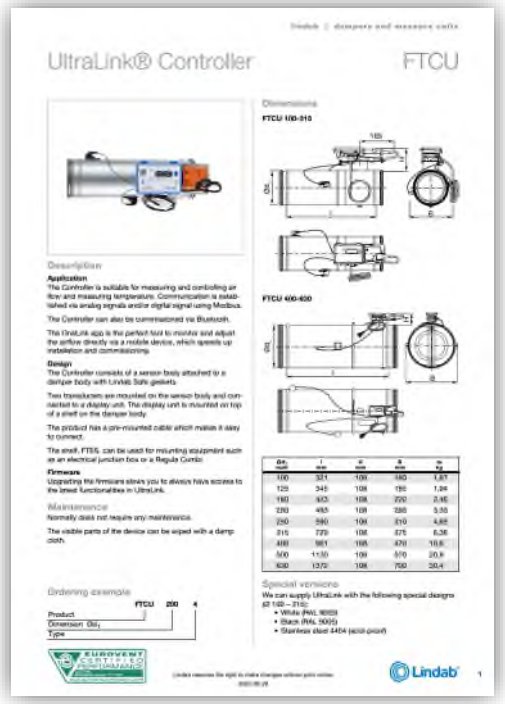


- Air **temperature**, volume & velocity (up to 15 m/s)
- Almost ZERO maintenance requirement
- Reduced pressure drop & noise
- Accurate at low volume flows (+/-5% down to 0.5 m/s)
- Onboard display or signal to BMS via MODbus
- Bluetooth for setup and sensors
- Bend compensation factor

Lindab UltraLink®

Ultrasonic flow measurement & regulation

Click image to download



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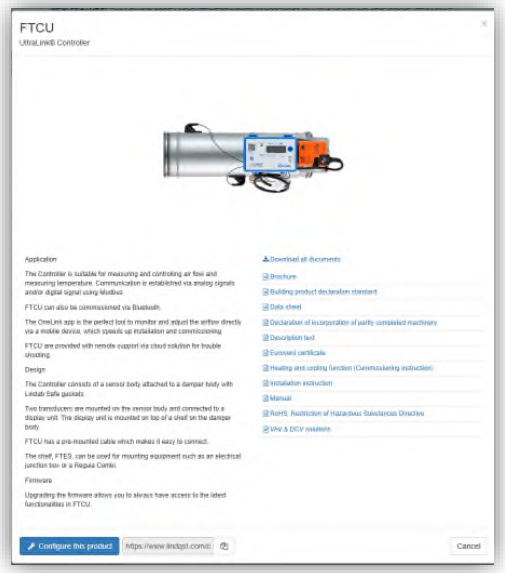
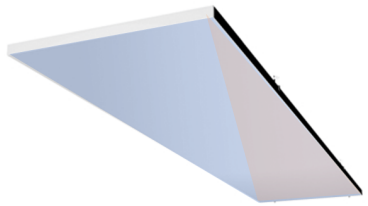


Further information via the
LindQST portal

Chilled Beams

TROX® TECHNIK
The art of handling air



Radiant Systems

Lindab®

Fabric Dispersion

FabricAir

Natural Ventilation

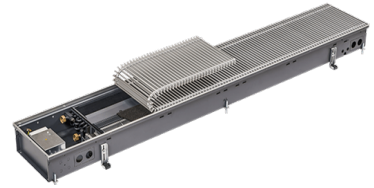
Monodraught

Fan Coil Units

Ability

SABIANA
IL CLIMA AMICO

SINKO



Underfloor Systems

KAMPMANN

Lab Control

TROX® TECHNIK
The art of handling air

Decentralised HVAC

AIRMASTER®

innova
renewing energies

FacadePro

VAV Diffusers

Lindab®

Indirect/Direct Evap

OXYCOM
natural air conditioning

Data Centres

Air$_2$O Intelligent cooling
an ICT Company

Air Curtains

FRICO

Product application specialists, working with designers to apply progressive HVAC technologies from market-leading suppliers, to benefit projects throughout Australia, NZ and Singapore.

Robert Vogrig
Fabric Dispersion and FCU Specialist

Peter Sapiano
Specialist in Chilled Beams & Radiant Systems

James Idle
Specialist Intelligent FCU's Natural/Hybrid Ventilation

Dhruvin Kothari
Lab Control & Product Application Specialist

Harry Richards
Controls Application Specialist

Melvin Thong
Singapore ACMV Application Specialist

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Connecting discerning clients with innovative HVAC approaches

The Trusted Supplier of Innovative HVAC Solutions

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