FUSION MODULAIR® VPAC SYSTEM

VRV IV VAV PACKAGED ROOFTOP WITH ULTRA HIGH EFFICIENCY DUCTLESS AIR DISTRIBUTION

The world's leading solution for conditioning large volume spaces.

FUSION MODULAIR®

The Fusion Solution

HVAC designers and contractors typically design, supply and install air conditioning systems on a case-by-case basis by piecing together myriad technical components tied to one another with customised piping, ducting and controls. This not only requires specialist expertise but is costly and time consuming. It also means that each solution is unique and untested – rather like a first prototype – and is therefore unoptimised, often producing unknown or unpredictable results, along with compromised energy usage.

In contrast, Fusion Modulair, by Fusion HVAC, is a specially designed, purpose-built range of modular HVAC solutions for large volume spaces. Each HVAC "module" in the Fusion Modulair palette is a fully self-contained, ductless HVAC product. Systems are made up of multiple – typically identical – HVAC modules located largely uniformly on the roof, communicating with one another to work in unison. HVAC modules are not one-offs that can neither justify development investment nor the research required to create industry-leading designs. Each has been designed and tested to excel, benefitting from on-going development and optimisation over years. Individual components, as well as the HVAC modules themselves, have been fine-tuned to work together harmoniously, with iterative changes providing ever improving performance, based on evidence and real data gathered from the recorded performance of thousands of Fusion Modulair systems world-wide.

The VPAC MODULE is the largest of the Fusion modules. It combines motorised swirl air diffusion with our dedicated building management system (BMS) and a sophisticated rooftop packaged unit. It provides adaptable, reliable and exceptionally efficient operation that benefits from both variable refrigerant volume (VRV) and variable air volume (VAV) technology, as well as variable discharge direction (VDD) control.

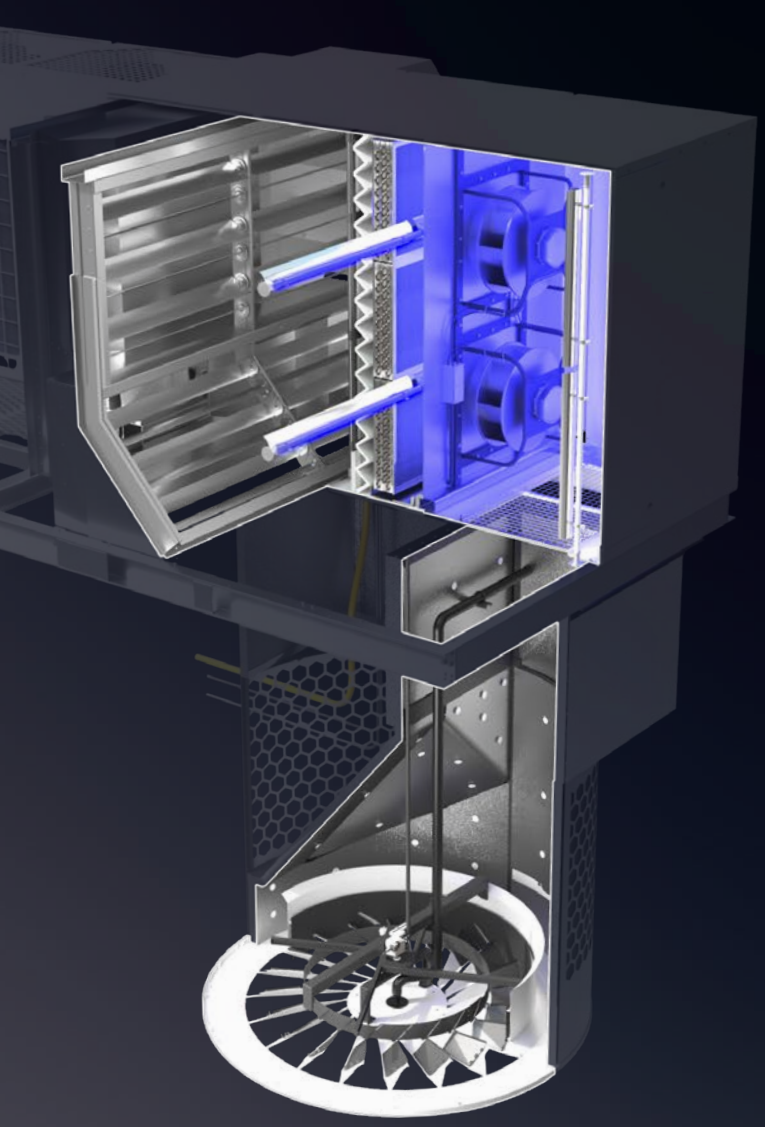
The module's combined supply / return air dropper, attached to the underside of the rooftop packaged unit, features specially designed high induction swirl air diffusion. Multiple aspects are protected by various international patents and registered designs. It eliminates spaghetti runs of inefficient ducting, and its motorised discharge direction adjustment optimises the distribution of conditioned air across vast spaces, no matter what the season. High induction, variable discharge direction of VAV supply air provides exceptionally uniform and gentle air coverage, both when heating and cooling, without creating hot or cold spots, or draughts interspersed by

stagnation. The same high-tech air diffusion that is used in many premium Green Star buildings and that maintains billions of dollars of pharmaceutical products is used in retail, commercial, sport environments, distribution centres, and more.

Fusion Modulair systems are suitable for operation in a vast variety of climates, from hot, dry or tropical all the way to cold and icy conditions – capable of operation in basic form from minus 20°C to above a scorching 50°C.

Whether the large volume space is for retail, wholesale, temperature controlled storage, or large sporting / public venues, our expertise and products have been selected by the most discerning customers to provide them with innovation, energy efficiency, lower cost and faster installation in each of these environments.

What's more, these systems will change your thoughts on integrated design of mechanical services. We eliminate exposed runs of duct and pipe, and minimise building work, penetrations and internal coordination to cut overall time on site to just a fraction of the norm. Our record of installing temperature control to a 50,000 square metre building in a single day truly sets Fusion Modulair apart.



FLEXIBILITY, ECONOMY,
EFFICIENCY & COMFORT.
WITHOUT COMPROMISE.

Air Diffusion

Swirl air diffusion is an integral part of each VPAC module, which utilises patented, industry-leading, high-induction motorised swirl diffusers by Smartemp, exclusively engineered for Fusion Modulair.

SMARTEMP CSW-AD

The CSW-AD is a highly inductive side-blow swirl diffuser that supplies large volume flow rates of air over large horizontal throws in voluminous spaces, in such applications as exhibition centres, convention halls, airports, shopping malls and factories. Substantial fan energy savings are realised by an electrically operated variable air volume (VAV) damper assembly that allows diffuser airflow to be reduced in times of low demand – to as little as 30% – whilst maintaining substantially constant horizontal coverage. The central jet of the CSW-AD directs the discharged air stream, via motorised variable discharge direction, over long throws, whilst the surrounding swirl pattern strongly decelerates the primary air stream velocity, reducing draught risk and improving comfort.

SMARTEMP HCS-AD

The HSC-AD in its largest size – DN1340 – is the world's highest capacity swirl diffuser and is exclusive to Fusion. Its highly inductive swirl discharge rapidly mixes the VAV supply air stream, which may turn down to 40%, to gently spread across vast spaces. Motorised variable discharge direction control optimises indoor air patterns to achieve draught-free cooling and effective heating to floor level no matter what the season.

SMARTEMP®

Dropper Options

Fusion Modulair solutions offer a variety of dropper options depending on the requirements of the space. Alternatively, connection of a ducted system to a Fusion Modulair module is also available.

BASKET

- Lowest cost
- Even circular throw pattern
- Bottom discharge
- Patented swirl diffusion technology
- VAV discharge
- Variable discharge direction
- Our most widely used dropper

CLASSIC

- Long throw
- Side discharge
- Extended VAV range of operation
- Variable discharge direction

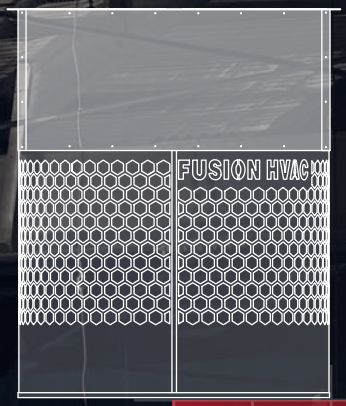
BOAT

- Lowest profile
- Long throw
- Side discharge
- Large VAV range of operation
- Variable discharge direction

MODULAIR SPECIFICATION	BASKET	CLASSIC	BOAT
Maximum supply air duty	8,000 L/s	8,500 L/s	8,500 L/s
Discharge height range (COOLING)	5 m to 30 m	5.5 m to 9 m	4.5 m to 9 m
Discharge height range (HEATING)	5 m to 15 m	5.5 m to 7 m	4.5 m to 7 m
Diffuser	HSC-AD-DN1340 Motorised Adjustable Swirl	CSW-AD-DN630 Motorised Constant throw VAV Swirl	CSW-AD-DN630 Motorised Constant Throw VAV Swirl
ADPI rating	Typically > 80%		
VAV range	40-100%	30-100%	30-100%
Motorised discharge direction	YES	YES	YES
Module spacing (center to center)	16 m to 40 m	16 m to 50 m	16 m to 50 m
Dropper weight	340 kg	450 kg	550kg

Air Velocity - Heating Mode

HSC-AD-DN1340



(m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
0.0	0.50	12.70	0.59	0.24	0.12	0.25	0.21	0.11	0.09	0.12
0.5	2.20	4.30	0.38	0.22	0.25	0.15	0.17	0.15	0.11	0.10
1.0	2.66	4.20	1.97	0.33	0.32	0.29	0.17	0.18	0.16	0.12
1.5	2.00	4.34	2.82	0.23	0.15	0.12	0.35	0.45	0.16	0.10
2.0	1.54	4.38	2.63	0.66	0.26	0.20	0.10	0.10	0.07	0.10
2.5	1.10	3.20	2.66	0.84	0.13	0.16	0.10	0.11	0.07	0.08
3.0	1.90	2.10	3.45	1.40	0.20	0.67	0.42	0.24	0.09	0.16
3.5	0.85	1.26	2.13	0.80	0.25	0.49	0.17	0.12	0.09	0.11
4.0	0.59	0.98	1.05	0.28	0.13	0.07	0.09	0.08	0.09	0.07
4.5	0.78	0.56	0.34	0.25	0.12	0.09	0.15	0.10	0.06	0.07
5.0	1.09	0.35	0.24	0.24	0.46	0.45	0.22	0.54	0.26	0.20
5.5	0.87	0.44	0.69	0.27	0.34	0.47	0.50	0.37	0.23	0.14
6.0	0.33	0.56	0.23	0.30	0.29	0.24	0.17	0.11	0.08	0.06
6.5	0.25	0.37	0.20	0.09	0.11	0.13	0.16	0.09	0.09	0.08
7.0	0.23	0.16	0.09	0.08	0.09	0.08	0.05	0.04	0.03	0.05
7.5	0.25	0.37	0.21	0.36	0.25	0.08	0.10	0.15	0.11	0.09
8.0	0.19	0.14	0.12	0.07	0.09	0.12	0.07	0.06	0.05	0.04
8.5	0.12	0.17	0.24	0.33	0.11	0.13	0.10	0.14	0.10	0.11
9.0										

FLOOR LEVEL

Velocities in m/s

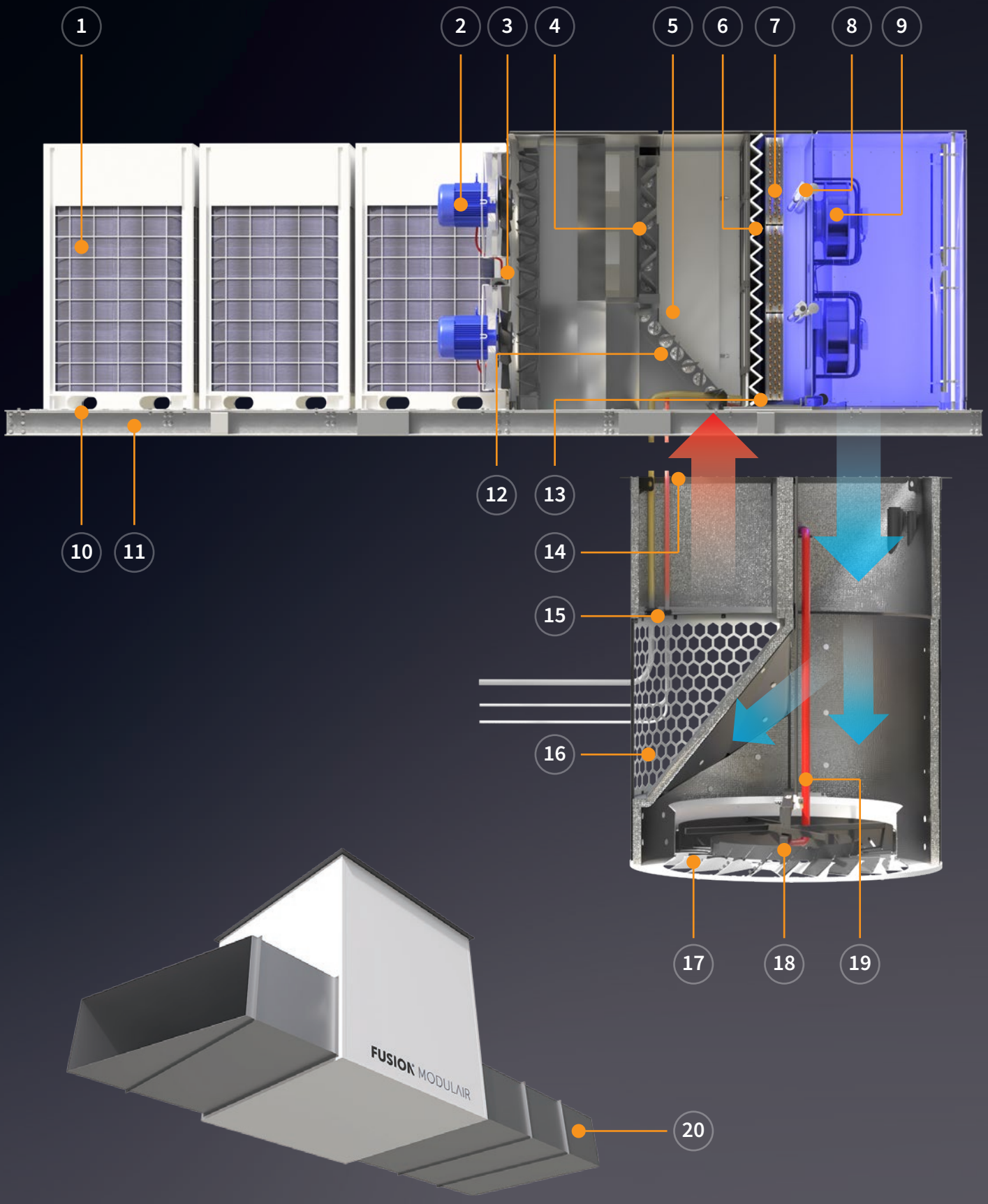
Air Velocity - Cooling Mode

HSC-AD-DN1340

(m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
0.0	0.38	14.30	4.24	3.90	1.63	0.40	0.22	0.30	0.29	0.35
0.5	0.14	0.38	0.31	0.34	0.43	0.56	0.56	0.45	0.25	0.36
1.0	0.09	0.20	0.21	0.55	0.43	0.46	0.70	0.57	0.51	0.49
1.5	0.09	0.08	0.19	0.14	0.18	0.44	0.29	0.26	0.37	0.32
2.0	0.09	0.12	0.28	0.26	0.20	0.35	0.26	0.24	0.19	0.20
2.5	0.09	0.12	0.23	0.35	0.29	0.25	0.31	0.15	0.17	0.14
3.0	0.10	0.35	0.50	0.13	0.21	0.21	0.32	0.20	0.21	0.14
3.5	0.09	0.16	0.12	0.16	0.15	0.13	0.11	0.11	0.14	0.13
4.0	0.08	0.12	0.13	0.13	0.06	0.07	0.12	0.06	0.07	0.09
4.5	0.10	0.07	0.08	0.08	0.09	0.09	0.10	0.09	0.15	0.17
5.0	0.07	0.13	0.09	0.04	0.07	0.07	0.06	0.08	0.07	0.08
5.5	0.08	0.10	0.07	0.08	0.05	0.04	0.06	0.13	0.10	0.11
6.0	0.06	0.08	0.08	0.06	0.07	0.09	0.16	0.08	0.11	0.11
6.5	0.10	0.11	0.10	0.12	0.13	0.09	0.11	0.11	0.12	0.10
7.0	0.15	0.15	0.12	0.14	0.13	0.14	0.09	0.12	0.13	0.14
7.5	0.25	0.16	0.15	0.18	0.14	0.14	0.17	0.15	0.13	0.07
8.0	0.11	0.11	0.09	0.15	0.15	0.13	0.14	0.08	0.15	0.13
8.5	0.20	0.15	0.13	0.12	0.08	0.12	0.10	0.11	0.13	0.14
9.0				FLOOR LEVEL						

Velocities in m/s

System Features



1. Blue fin treated coils salt water resistant for 960 hrs. Acetate water resistant for 300 hrs.
   - Optional blygold treatment available.
2. 2x smoke or relief fans rated at 200˚C for 120 mins and 300˚C for 30 mins.
3. Smoke rated relief damper complete with tip seals in fire rated chamber within VPAC.
4. 2x fresh air dampers - sized for economiser operation with optional prefilters.
5. Factory fitted, tested and commissioned controls. Mounted in return air chamber for constant operating temp and longevity. Designed for redundancy and continuous operation in extreme conditions. Local service interface for ongoing maintenance.
6. Pleated disposable 100 mm filters merv 8/9 with differential pressure monitoring.
   - Optional up to merv 13/14 filtration.
7. 3 row cooling / heating coils:
   6 coil sections - enhanced dehumidification, redundancy and part load operation.
8. Ultraviolet high-output lamps provide air disinfection.
9. 4x ebmpapst EC plug fans – individually variable speed (added redundancy).
10. Anti-vibration mounts within condenser unit, protected from external weather conditions.
11. Hot dipped galvanised base frame creates 100% over-flashing, creating 100% weather-tight seal with no additional roof work required.
12. Return air damper. Smoke rated to 200˚C.
13. Single piece drain pan with safety overflow.
14. High quality long life closed cell concealed weather tight gasket for complete air seal and vibration isolation.
15. Power and comms enter below the roof, via dropper, through provided glands.
16. Return air grille. Also smoke spill/relief air path with fire rated internal insulation.
17. SMARTEMP HSC-AD-DN1340 Adjustable Swirl Diffuser
    - Developed to supply air from 5m up to 12 m in height for both cooling and heating modes.
    - Designed for large volume spaces, especially where quiet and draught-free air distribution is required.
    - Motorised variable discharge direction.
    - Stepless discharge direction.
    - Modulating control allows cool supply air to be discharged horizontally to maximise throw. This can also be directed to reduce unwanted mixing at a high level. Warm supply air is discharged vertically to allow maximum penetration to the occupied zone.
    - Modulation between these two extremes facilitates fine-tuning of airflow patterns to suit changing loads in the space.
18. Discharge direction actuator access from below.
19. Sprinkler pipe included in dropper; connection between spinkler pipe and spinkler head by fire contractor.
20. Ducted connection option available for particular space requirements.

Intelligence & Controls

Fusion's advanced BMS controls integrate individual VPAC modules, each controlled independently, to perform in concert with one another – like the conductor of an orchestra directing multiple individual performers to a collective focus that plays to a unified vision.

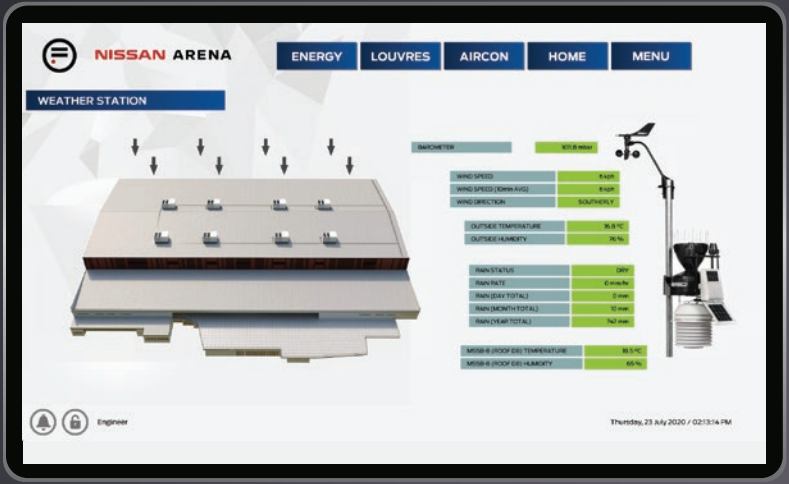
Each packaged rooftop unit contains its own Fusion BMS controller that, if required, can operate independently of others, providing redundancy. It examines and controls such aspects as local space temperature, humidity and CO_2 levels, fresh air requirements, cooling or heating demand, supply temperature and air flows as well as discharge direction. It, additionally, takes care of all critical systems in the unit, continuously optimising their infinitely variable operation.

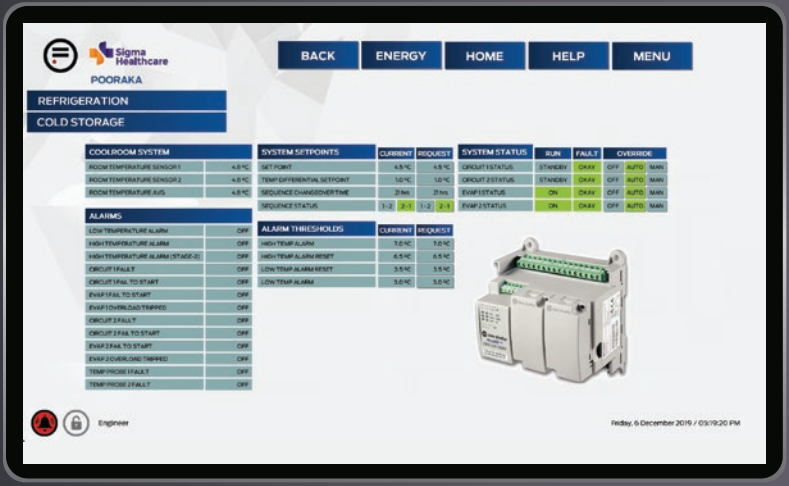
Within each unit, multiple levels of redundancy are further provided, such as multiple independent refrigeration systems, multiple EC supply air plug fans, even position sensors for air dampers and backup sensors for critical variables like space temperature. This, together with local independent control of each packaged rooftop unit maximises reliability.

All Fusion modules on a project are linked together via a communications network, as well as with a remote touchscreen computer, typically mounted in the facility manager's office.

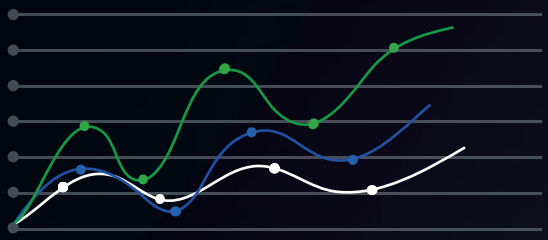
They share critical information with one another and are co-ordinated to work together in harmony, to rapidly counter localised heat load variations, as may be caused by the opening of a roller shutter door, whilst optimising energy efficiency and stable temperature control for the space as a whole. All user functions, such as set points, time schedules and so on can be set through the user interface, and the operating status can easily be seen at a glance.

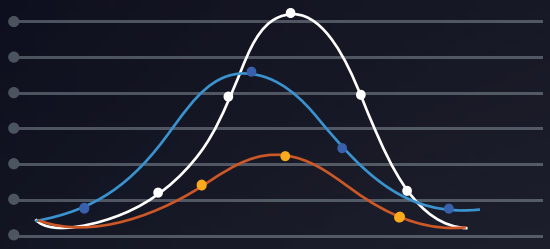
This simple to use user interface hides an exceptionally powerful platform, where hundreds of system parameters are logged and checked constantly. Simple dashboards provide fast indication of total system status for air-conditioning, temperatures and more. Likewise, total system utilisation, number of circuits or compressors in operation, temperatures and modes are just some of the data-points that can be monitored.





Energy Dashboards





Low Energy HVAC is only one element of building energy use. As such, Fusion HVAC has developed a unique building energy monitoring system*, which will monitor, analyse and report on all aspects of building energy usage such as lighting, power, HVAC, refrigeration, solar, and more.

The platform provides instantaneous and historic data and provides key metrics in unique ways that are important to the client to rapidly identify the highest usage per service / per site / or as an overall fleet management tool. The system can also report on internal comfort levels, regardless of whether or not the HVAC system is a Fusion system.

LIVE ENERGY

The latest Fusion Modulair systems feature their own active energy monitoring in every module*. Combined with advanced analytics, even more information is available to building owners and operators, and a vast amount of additional information is available to our remote support, service, and controls teams.

In an industry first, the packaged rooftop units can provide live calculations and data on actual real energy used and the live efficiency and coefficients of performance (COP) from minute to minute. Energy dashboards will enable us and our customers to compare zones within buildings, buildings within regions – and even different climate zones – against each other for the most advanced optimisation possible.

* Optionally available.

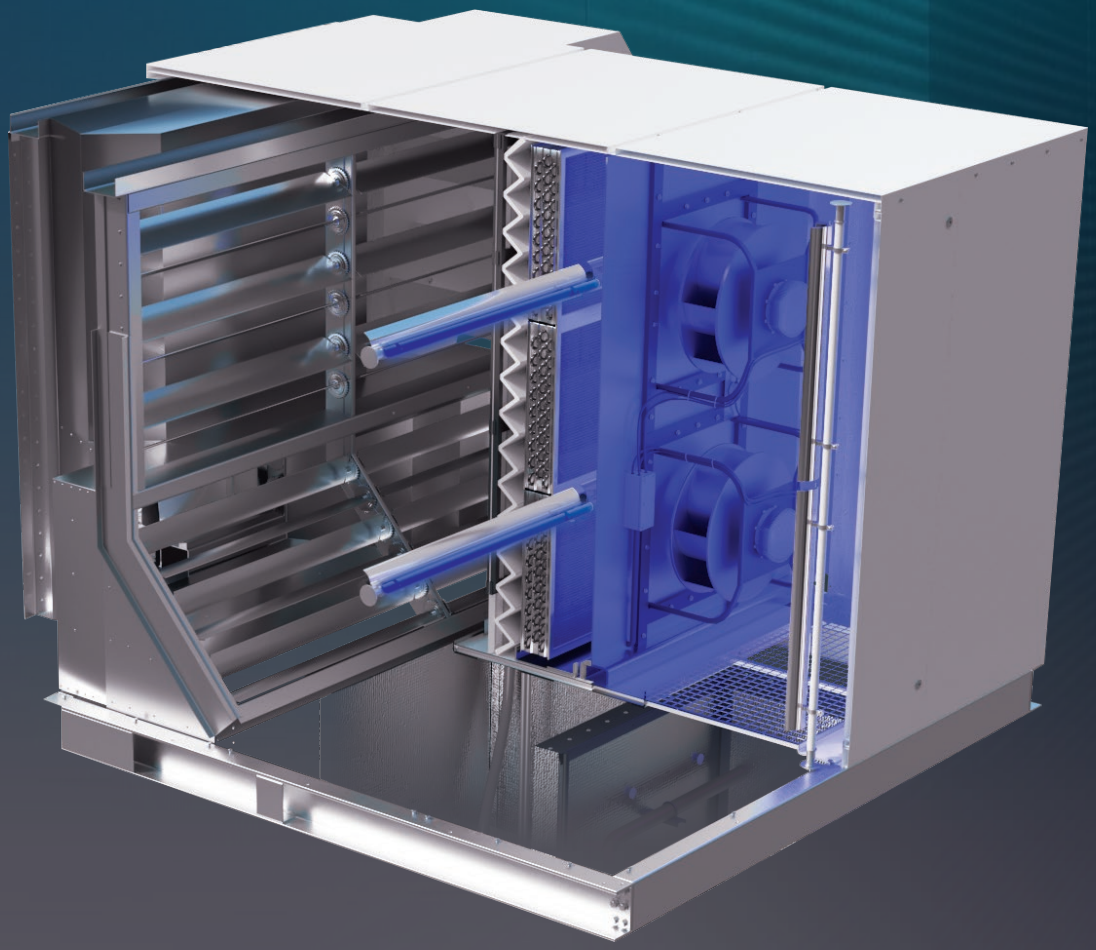
Health & Air Quality

Fusion HVAC, together with industry world leaders, have developed a unique Ultraviolet Air Sterilisation and Coil Cleaning system (patents pending). This optional system can be built-in (for new packaged rooftop units) or retrofitted into existing Fusion Modulair units, and combats such pathogens as COVID-19, SARS, tuberculosis, measles, and more. In addition, internal components of the system, such as cooling coils, condensate trays, drains, etc, are kept spotlessly clean and free of biofilm, maintaining an “AS NEW” condition and preventing a degradation of efficiency over time.

COIL CLEANING

AIR DISINFECTION

ODOR REDUCTION



Using the same wavelengths as those produced by the sun, the U-VC light emitted by our system eliminates contaminants and micro-organisms on a molecular level, disinfecting the air and neutralising odours.

Applications

Fusion HVAC are the provider of choice to owners, operators, builders and developers throughout Australia and New Zealand for applications from comfort relief in warehouses, through high quality retail environments, to sports facilities of Olympic standards and spaces requiring critical temperature control.

RETAIL / COMMERCIAL

Whilst Fusion Modulair systems are well known for their installation simplicity, cost effectiveness, energy efficiency and reliability, Fusion HVAC can also save time, effort and money for retail and commercial installations.

IKEA are recognised around the world as cost, quality, energy and environment leaders. Fusion are pleased to have delivered HVAC to retail and warehouse sites for this prestigious customer, not only in Australia, but for sites in China and Indonesia, and are looking to provide services in many more countries.

Our modular solution means that extreme savings are made in the building.

Fusion Modulair deletes the need for chiller plant rooms, pump plant rooms, boiler plant, cooling tower decks, and more. This reduces building costs, and this space can be freed up for more retail or NLA area. Our dedication to our clients to provide the best outcomes has resulted in Fusion Modulair systems serving more than 50 Bunnings stores, more than 60 Masters stores, various AMart and other retail outlets, and the Warehouse Group for more than 20 years.

SPORT INFRASTRUCTURE / SPORTS HALLS / PUBLIC SPACES

The ability to delete extensive, costly, difficult and expensive runs of duct, combined with high performance, high capacity, low noise and low draught mean that Fusion Modulair systems proudly serve world class facilities such as NISSAN ARENA, AFL Play, and more.

Unique features and advanced controls allow these systems to respond to an occupancy of 50 people or 5,000 in various modes and configurations. Fusion Modulair provides site wide BMS and energy monitoring, which monitors weather, opens natural vent louvres, and can even lock the public entry doors.

PHARMACEUTICALS / TEMPERATURE CONTROLLED SPACES

Fusion HVAC are the supplier of choice for pharmaceuticals and critical temperature-controlled spaces. We are proud to provide our systems to DHL Cold Chain, SIGMA Healthcare, SYMBION, CH2 Clifford Hallam, Healthcare Logisitics, and others, throughout Australia and New Zealand.

Fusion Modulair systems, BMS and energy monitoring have been deployed to over 4.5 million cubic metres of controlled space in the past few years, with a history going back much further. Our ability to accurately control temperature and humidity with little variance throughout the space – from floor level to top of storage – is unparalleled. Our high induction VAV swirl discharge with motorised discharge direction allows our BMS to actively stratify or destratify the space. Each system has multiple levels of redundancy built in and every element of hardware and operation is continuously logged for verification, continuous tuning and improvement, and on-going reliable operation. Simply put, Fusion Modulair has become the reference standard.

INDUSTRIAL

Tony Rutz, General Manager of Millenium Plastics, has said “We really have received excellent service from Fusion, as well as innovative design” , and has explained how the Fusion solution has enabled increased productivity, reduced product loss and extremely low energy usage at their industrial facility.

This is true of Fusion systems in industrial applications throughout Australia and New Zealand. Fusion HVAC are proud to have provided solutions in a large variety of industrial projects for key national / international clients such as AMAZON, Blackmores, Booktopia, Mazda, providing excellent comfort with all the Fusion Modulair benefits.

VPAC Technical Specification

The Fusion Modulair systems match the chosen modular (or ducted) diffusion method with one of two advanced, unique cooling and heating packaged rooftop units. The VPAC180 provides excellent energy efficiency, and leading low-cost metrics. The VPAC135 is a premium efficiency unit with even higher resilience to extremely high temperatures.

	VPAC 135HE	VPAC 180SE
CAPACITIES / OPTIONS		
Nominal cooling capacity	134 kW GTH	173 kW GTH
Nominal heating capacity	150 kW	200 kW
At Air on condenser	35 °C	35 °C
At Air on evaporator	27 °C DB / 19 °C WB	27 °C DB / 19 °C WB
Operational range VRV IV	-20 °C to 50 °C	-20 °C to 50 °C
Maximum (nominal) supply air quantity	8,000 L/s	9,000 L/s
KEY FEATURES		
On demand additional cooling capacity	YES	YES
Refrigeration capacity range	Variable approx. 3% - 100%	Variable approx. 3% - 100%
Heat recovery from relief over condensers	YES	YES
Resulting additional energy saving (Approx.)	5%	5%
Supply air flow technology	VAV	VAV
Supply air capacity range	Variable approx. 30% - 100%	Variable approx. 30% - 100%
Economy cycle operation	Enthalpy Differential	Enthalpy Differential
CO2 Demand control ventilation	YES	YES
Space sensors (field fitted)	Low Level Temp, Humidity, CO2	Low Level Temp, Humidity, CO2
Integrated smoke spill kit available	YES	YES
Approx. smoke spill exhaust rate	10,000 L/s	10,000 L/s
Smoke spill can function as economy relief	YES	YES
Smoke spill compliance standard	AS1668. 1 & 2	AS1668. 1 & 2
Weight of VPAC	2650 kg	2950 kg
Unit Dimensions	5864 L x 2280 W x 1852 H (mm)	5319 L x 2280 W x 2350 H (mm)
Sound pressure Level at 4.5 m from diffuser dB(A)	43 – 48	43 – 48
VPAC + MODULAIR system pressure drop (ex. filters)	240 Pa	220 Pa
ELECTRICAL / CONTROLS		
Power supply (AMPS 3 phase + E + N) under standard test conditions	100 MCA @ 415v 50Hz	120 MCA @ 415v 50Hz
Power factor correction	Included in unit	Included in unit
Communication options between VPAC MODULAIR™ machines	LAN / RS485 / Wireless	LAN / RS485 / Wireless
Remote access to VPAC MODULAIR™ machines via Internet	YES	YES
Remote access protocol	ADSL2 or Mobile Data	ADSL2 or Mobile Data
BMS interface supported	MODBUS	MODBUS
EFFICIENCY AND ENERGY (VPAC + MODULAIR)		
COP Information	Refer to Table **	Refer to Table **
Typical Energy Savings - VPAC MODULAIR™ compared to:		
Standard Rooftop Unit - Moderate Climates / Retail Environments	> 69%	> 60%
Standard Rooftop Unit - Very Cold Climates	> 69%	> 60%
Chilled Water: Air Cooled, Moderate Climates	> 32%	> 27%
Chilled Water: Water Cooled, High Efficiency	> 25%	> 22%
Standard Test Conditions		

Performance

COOLING COP (Total System)

Nominal Cooling Capacity at AS/NZS 3823 Conditions:
- Indoor Entering Air Temperature 27˚C D.B., 19˚C W.B.
- Outdoor Entering Air Temperature 35˚C D.B.

FUSION MODULAIR UNIT		135 kW HIGH EFF	180 kW Std EFF	135 kW HIGH EFF	180 kW Std EFF
	AIR ON CONDENSER	35 deg °C		39 deg °C	
LOAD POINT [%]	100	3.7	3.2	3.4	2.9
	90	4.2	3.5	3.7	3.1
	80	4.6	3.8	4.0	3.3
	70	5.1	4.3	4.4	3.6
	60	5.7	4.7	4.9	4.0
	50	6.6	5.5	5.5	4.6

HEATING COP (Total System)

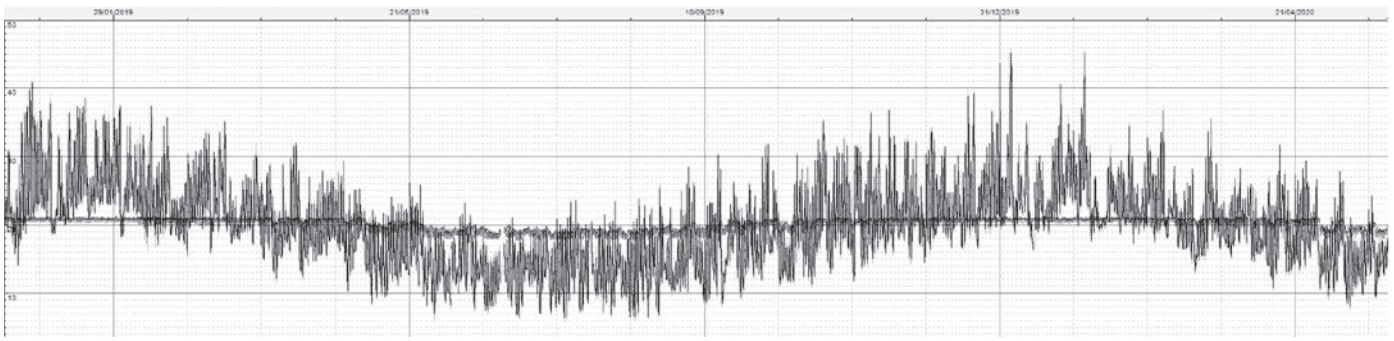
Nominal Heating Capacity at AS/NZS 3823 Conditions:
- Indoor Entering Air Temperature 21˚C D.B.
- Outdoor Entering Air Temperature 7˚C D.B., 6˚C W.B.

FUSION MODULAIR UNIT		135 kW HIGH EFF	180 kW Std EFF	135 kW HIGH EFF	180 kW Std EFF	135 kW HIGH EFF	180 kW Std EFF	135 kW HIGH EFF	180 kW Std EFF
	AIR ON CONDENSER	7 Deg °C		0 Deg °C		-5 deg °C		-10.5 deg °C	
LOAD POINT [%]	100	3.8	3.6	3.3	3.1	3.2	2.8	2.9	2.6
	90	4.1	3.9	3.2	3.0	3.0	2.8	2.8	2.6
	80	4.4	4.2	3.5	3.2	3.1	2.9	2.8	2.6
	70	4.7	4.5	3.7	3.5	3.2	3.1	2.8	2.7
	60	4.9	4.7	3.9	3.7	3.4	3.2	2.9	2.8
	50	5.1	4.9	4.1	3.9	3.5	3.3	3.0	2.8
	40	5.3	5.0	4.2	4.0	3.7	3.5	3.1	3.0
	30	5.4	5.1	4.3	4.1	3.6	3.4	3.1	2.9

Data for VPAC-AUS shown.
Data may vary slightly for your region. Always check with local Fusion Modulair representative.

EXAMPLE

75 week (Dec 2018 to May 2020) runtime performance summary of actual installed system in Sydney, Australia, demonstrating accurate and stable temperature control.



FUSION MODULAIR®

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