Airedale by MODINE | IQity

Cooling System Optimiser

A dedicated data centre cooling controls platform, delivering resilience and redundancy for the lowest possible operational cost.

Contents

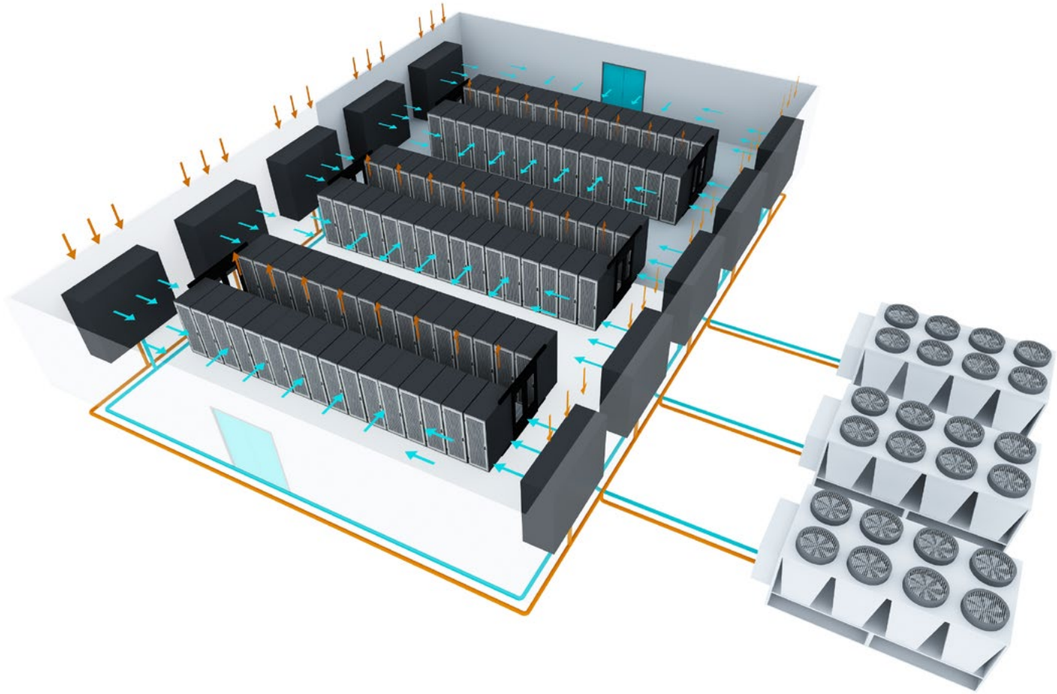
The Opportunity

In every industry, the evolution of technology has fuelled the race to optimise use of natural resources.

Data centres have risen to the challenge and embraced the importance of optimising their cooling equipment to create a more sustainable world for all.

Optimised systems are the best way to dramatically cut energy use, which is both better for the planet, and better for OPEX. Established primary/ secondary systems would traditionally use a low loss header to manage water flow for efficiencies.

Recently there has been a shift towards primary only rings in an attempt to achieve cooling performance with a simplified architecture. These systems are currently less common in Europe, and with less industry knowledge of them along with lower levels of system control redundancy, issues are starting to arise.



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The Solution

With the rise in primary only rings, local optimisers as part of a dedicated controls system are now essential for meaningful maximum efficiencies.

As both a BMS and cooling systems provider, we have unique insights that put us in the best possible position to optimise chilled water systems.

Complex systems require precise control on a number of levels transforming them into dynamic systems that can adapt and balance themselves, flexing and modulating air and water flow to required loads across the system.

This is why we designed the Cooling System Optimiser, for networked units and for full systems.

Why not just use a BMS?

One core issue is that a BMS, whilst still needed for overall monitoring and reporting, is not designed for something so precise. A BMS mostly pushes data, and isn't capable of addressing the anomalies that it identifies. It can't make the necessary changes to optimise the system.

With a BMS, redundancy is not built in. As chillers get larger, and more numerous, this is key to ensuring that cooling requirements are met, and the load is evenly balanced across the system.

The level of built-in modification, control and protection of the system that we can achieve is something that a BMS provider could not achieve alone.

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Key Benefits

Up to 45% Energy Savings

Lower cost of ownership can be achieved, both in running and maintenance costs thanks to the use of latest technologies and full redundancy. Free-cooling is maximised.

Lower Maintenance Costs

Demand is balanced across all chillers and CRAHs with no fixed leading unit, distributing the load evenly and avoiding excessive wear and tear. Full redundancy and the option of remote support leads to fewer call-outs.

Maximum Operating Efficiency

Leveraging the benefits of single-loop water cooling system, the optimiser increases the efficiency of the system, running components at the best possible performance. Infinitely modulating flow in the chillers and fan demand in the CRAHs.

Full redundancy

Failover strategy is built into the optimiser, so each controller can smoothly migrate control to the next one, providing redundancy and eliminating the risk of downtime.

Standardised Solution

We provide a standardised solution that suits customers needs, minimising the requirement of tailor-made applications. The off-the-shelf system works with existing unit controllers

Future Proof

Fully compatible with IoT (Internet of Things) and Machine Learning for in-depth analysis

Free-Cooling

A fully integrated control strategy enables the chillers to operate on a reduced water flow rate during free-cooling operation, sensibly increasing the efficiency of water coils and pumps.

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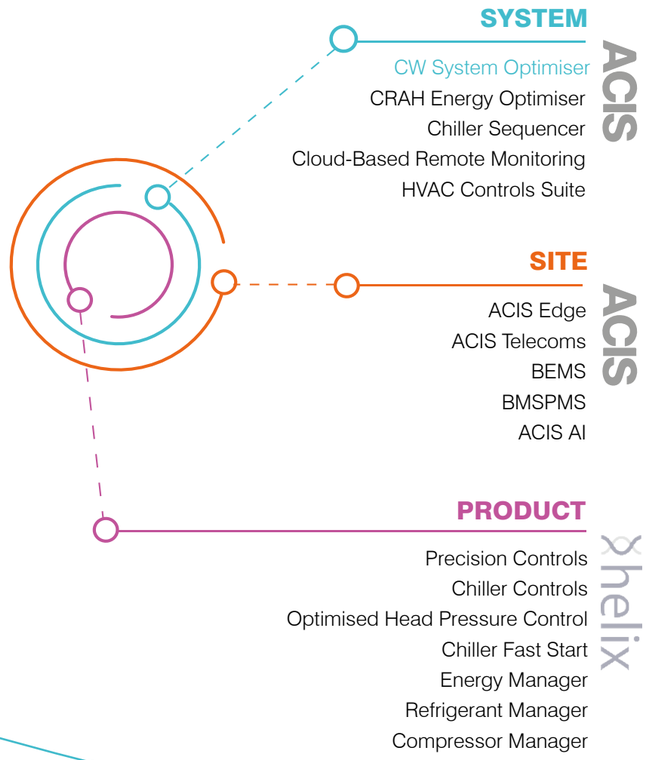
How it Works

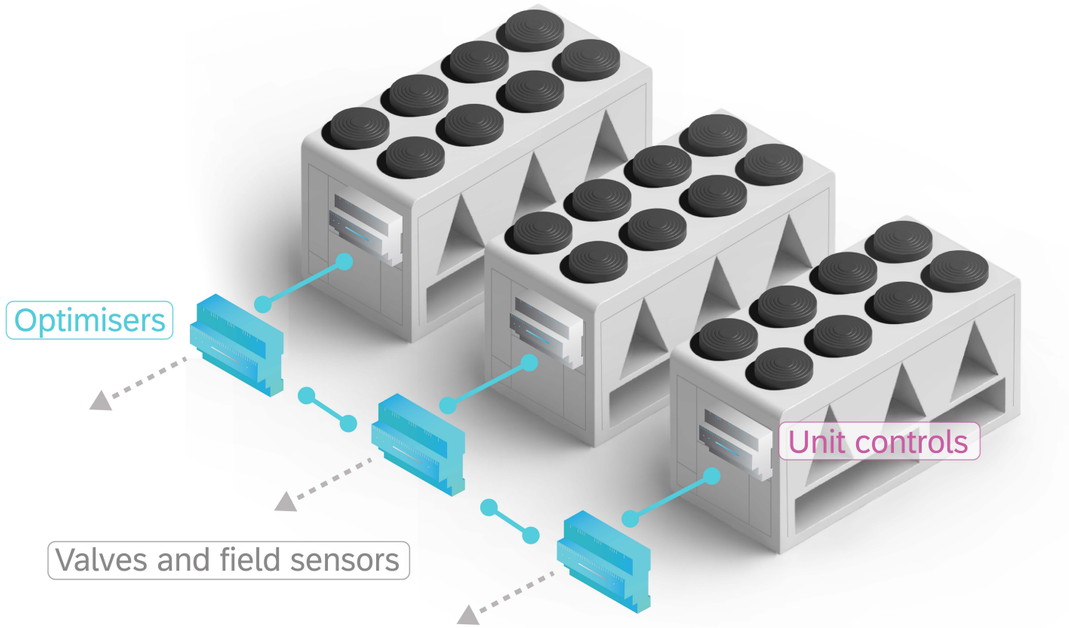
Cooling System Optimiser is part of IQity™ Airedale's IoT-enabled technology framework.

Revolutionising how cooling is connected, controlled and automated at critical facilities.



The optimiser sits above the unit controls and under the BMS, monitoring data from units and field sensors placed at critical points in the system:

- Live water volumetric flow requirement from the CRAHs is used to automatically adjust water flow through the chillers, reducing use of the bypass valves. The optimiser automatically calculates and adjusts the chiller's pumps speed to achieve the water flow required.
- Ambient temperature is monitored intelligently, optimising free-cooling.
- Flow control over the chillers is balanced to primary / secondary ring monitoring, so the chiller's pumps speed will adjust to guarantee that the primary flow is always greater than the secondary.
- All data is then fed back to the BMS for in-depth monitoring, offering a full picture of the system.



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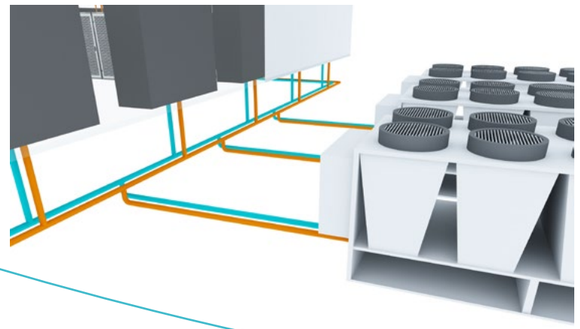
Chillers

HOW IT WORKS

In traditional sequencing systems, the local BMS makes sure that the chiller system is operational, using automatic schedules and alarm driven rotations.

As chiller control strategy and technology has evolved, and designing efficient cooling systems has become more complex, we now need the deeper understanding of chiller operation that the optimizer provides.



Purpose designed control strategy

The optimiser stretches the chiller controllers across the entire network, so that chillers become part of a unique control system rather than a series of devices that work in isolation. This detailed control is only possible with an integrated and purpose-built control system using deterministic controller technology, similar to the one operating inside the chillers.

Dedicated networking strategy

Chiller controllers are fully aware when the Optimiser is in operation and allow for specific functions that have been proven and tested by Airedale to enable system-wide strategies, for example sharing of sensor and component telemetry for further optimization. The Optimiser operates the chillers and the other components of the hydraulic system to improve the overall performance, controlling pumps, valves, units and flow to deliver excellent service at the minimum running cost.

Redundancy

Datacentres are part of the national critical infrastructure and have to withstand multiple failures. The Optimiser with its failover strategy doesn't reside on one controller alone; each controller can smoothly migrate control to the next one in case of failure or maintenance. This guarantees that cooling is always available and minimises disruption in case of failure.

Free-cooling Optimisation

Chillers have strict requirements for water flow rate, where a minimum flow has to be guaranteed for correct operation when refrigerant-based cooling is active. The Optimiser with its fully integrated control strategy enables the chillers to operate on a reduced water flow rate during free-cooling operation, sensibly increasing the efficiency of water coils and pumps.

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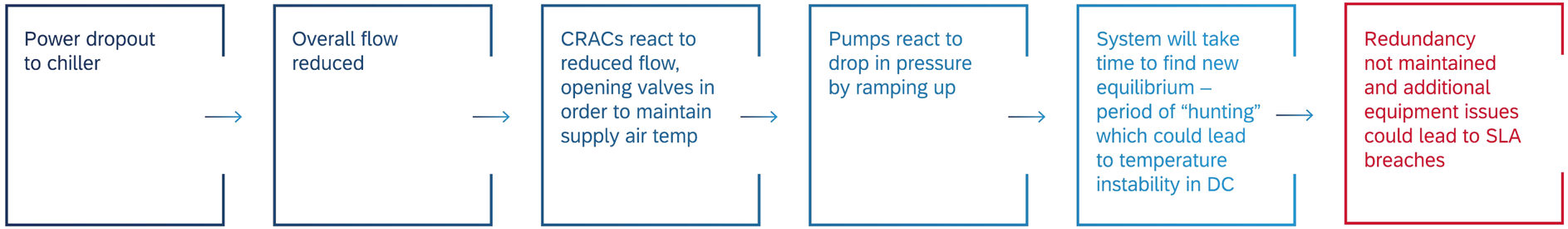
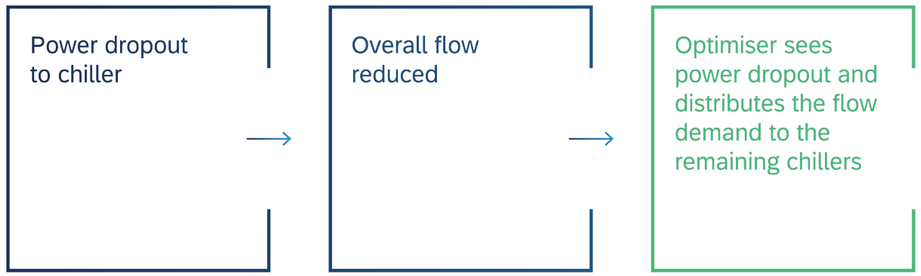
Chillers

SCENARIO 1: POWER DROPOUT

BMS CONTROL



LOCAL OPTIMISER CONTROL



Chillers

SCENARIO 2: HIGH FLOW DEMAND

BMS CONTROL

High flow demand across chillers → BMS initialises additional chiller → Chiller's pump will start at same speed as rest of units → System will see a large jump in flow → Bypass valves will open in order to divert additional flow → System instability and inefficiency with "hunting" to recover. BMS may maintain new condition, even though energy wasted.

LOCAL OPTIMISER CONTROL

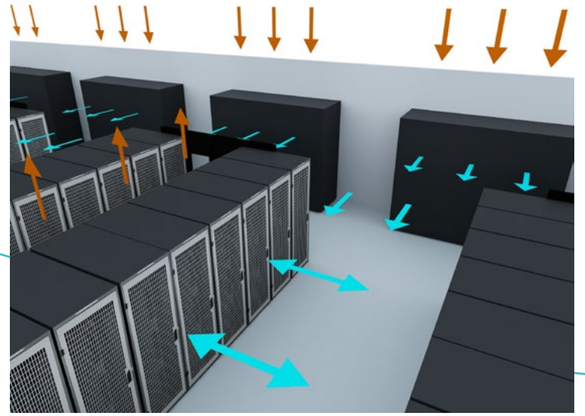
High flow demand across chillers → Optimiser doesn't use flow only as staging input requirement. It sees cooling demand as well. → Additional chiller will not start at same pump speed as existing – it balances the system straight away with all pump speeds adjusted to balance flow.

CRAHs

HOW IT WORKS

Traditionally CRAHs are turned on and off manually according to a rotation scheduler or alarms. The setpoint is manually adjusted to take care of hot spot zones meaning that the overall efficiency of the system is reduced.

The chillers are forced to work harder, and operation of the system is undocumented. With the CRAH Optimiser, CRAHs become part of a unique control system rather than a series of devices that work in isolation.



Purpose designed control strategy

The Optimiser stretches the CRAH controllers across the entire network, so that CRAHs become part of a unique control system rather than a series of isolated devices. As with the Chillers Optimiser, such detailed control is only possible with a fully integrated and purpose-built control system using the latest deterministic controller technology.

Energy Savings

The Optimiser is designed to reduce the power used at the fans, leveraging the quadratic power consumption curve of EC fans, a reduction of speed of 20% can bring a power usage reduction of 50%.

Redundancy

Datacentres are part of the national critical infrastructure and have to withstand multiple failures. As with the Chillers Optimiser, the CRAHs Optimiser with its failover strategy doesn't reside on one controller alone. When each controller can smoothly migrate control to the next one, this guarantees that cooling is always available and minimises disruption in case of failure or maintenance.

Dedicated networking strategy

The Optimiser networking strategy distributes the cooling demand to all of the operating CRAHs to achieve the best energy efficiency, automatically enabling units if required and thermally shifting the load to avoid hotspots, while reducing the energy consumption in the unused areas of the data halls.

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CRAHs

SCENARIO 1: NEW CUSTOMER MOVES IN

BMS CONTROL

New customer moves in and populates a previously empty part of the data centre → CRAHs adjacent to the new racks are manually turned on by the FM team in a trial-and-error fashion → CRAHs turn on with fans and open valves according to their local control strategy → Cooling becomes unbalanced - prone to hot spots and areas with insufficient or excessive air supply → Potential SLA breach

LOCAL OPTIMISER CONTROL

New customer moves in and populates a previously empty part of the data centre → Zonal control turns on adjacent CRAH units according to temperature and air flow requirements → Network control strategy optimises the fan speed and cooling demand to integrate the CRAHs into the overall cooling system

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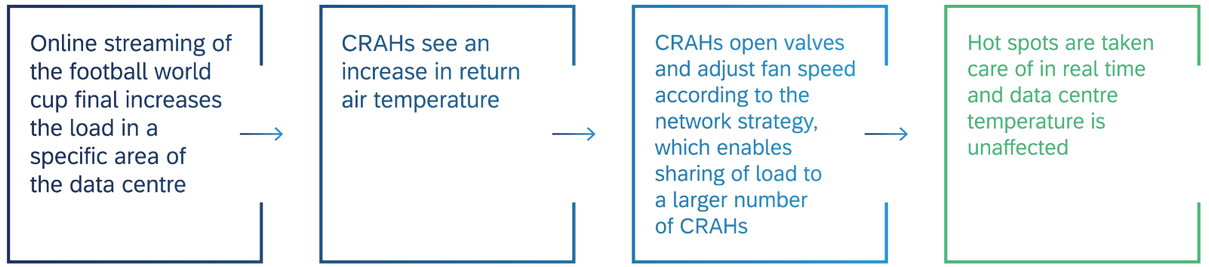
CRAHs

SCENARIO 2: FOOTBALL WORLD CUP FINAL

BMS CONTROL

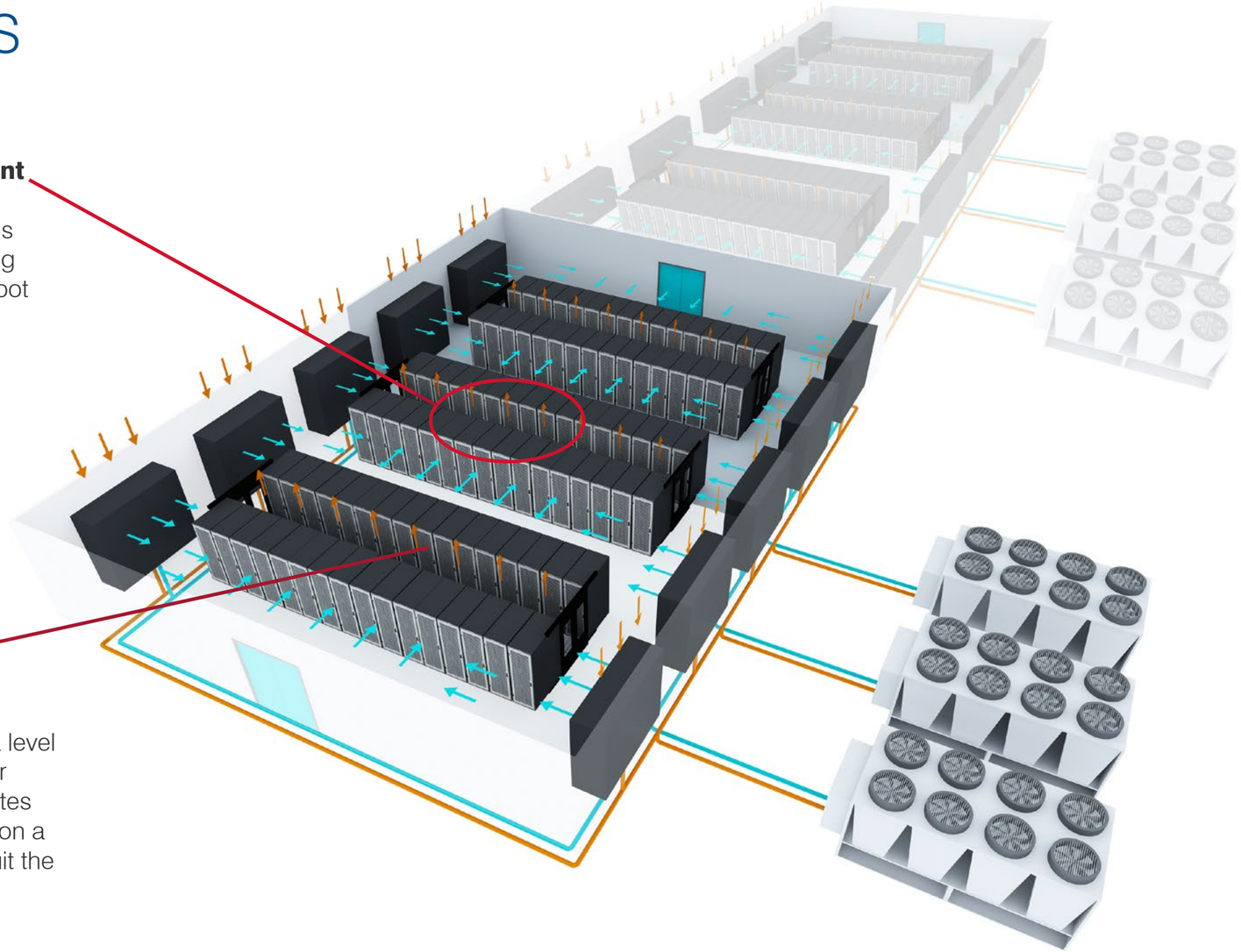
LOCAL OPTIMISER CONTROL



Chilled Water System

KEY FEATURES

Precise hot spot management
Zonal control of the temperature distribution in the data hall means that energy is not wasted, offering more efficient and effective hotspot management.



Modulated flow
As manufacturer of the cooling equipment, we can use the extra level of intelligence from the Optimiser to precisely modulate the flow rates through our chillers and CRAHs on a unit controls level, to perfectly suit the optimiser's analysis.

Fully scalable
The Optimiser can be used to optimise entire systems for data center facilities of various sizes, as well as being a chiller or CRAH solution. By precise integration between inside and outside systems, we can get maximum efficiencies on water temperatures and flow rates.

Distributed intelligence
Failover strategy
Cooling System Optimiser is a failover master distributed control system, with an Optimiser on each unit offering multiple levels of resilience to failure. Whit no single point of failure, your facility is in the safe hands of cooling experts.

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Gain deeper control of your cooling systems

Cooling system components are almost as efficient as they can get in their current formats. Now the only way to make significant gains on efficiencies is through advancements in control strategies and technologies.

A BMS provider alone wouldn't be able to achieve the same level of modification or have the same level of protection inside the system as we can achieve if we control everything; By tightly matching the required chiller flow rate to that of the CRAH units, we can make huge savings in pump power.

Controlling the whole system is the best way to maximise efficiencies, and minimise downtime.

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