AIRSOL®

Circuit connected system

Contents

St. Jakobshalle, Basel

AIRSOL® CCS-HR

Ventilation systems in large buildings (total air volume > 100 000 m³/h) are often equipped with circuit connected systems with heat recovery (CCS-HR), as air intake and output systems can be installed in different places and are not physically linked to each other. Plate and rotation heat exchangers for large air volumes per unit are difficult to implement (spatial conditions).

The application field of circuit connected systems is extensive. From primary ventilation systems for supplying building room areas to hospital buildings, laboratory buildings, chemistry, pharmacies, undercutting, pressing facilities, gantries, stores, trade fair halls, kitchens, restaurants, office buildings, biological laboratories, university buildings, administrative buildings, theatres, museums, fine mechanics production rooms and process technical room ventilation or renovations where the air intake and output cannot be installed together.

Advantages

Functional description

AIRSOL® high-performance CCS-HR systems work with maximum exchange degrees. On the exhaust air side, the water-glycol mixture (intermediary medium) is warmed as close as possible to the exhaust air temperature. The warmed medium then circulates to the outdoor air systems and can warm up the air from outdoors. The AIRSOL® heat exchanger also has a maximum exchange degree in this area. The correctly regulated water-glycol amount in the intermediary circuit guarantees the maximum temperature difference.

In the summer mode, the exhaust air can be humidified adiabatically, the intermediary circuit cooles down and a supply air cooling is generated. The effect is maximised through the use of Mountair hybrid cooling elements.

The lacking heat (additional heating) or cold (additional cooling) can be supplied by plate heat exchangers in the water-glycol circuit. This makes additional heat exchangers in the airflow unnecessary, and the ventilation requires less energy.

In network systems, one or more air handling units are connected. The AIRSOL® controller calculates and provides the ideal volumes of fluid and guarantees the maximum annual efficiency.

The system optimisation is ensured in all operating states. A better exchange degree also means a higher pressure drop. If the additionally spent energy reserve is more valuable than the recovered heat, the system is “maxed out”. The annual efficiency shows what percentage of the total heating energy is recovered by the CCS-HR. The consideration of the energy used for humidification and cooling is essential.

Customer uses

- Maximum heat recovery with separated intake and exhaust air flows
- Network systems to use decentralised exhaust heat sources
- Controller for system optimisation and energy monitoring
- Simple subsequent equipment of existing air conditioning stations for energy saving
- Cost and benefit simulation
- Defroster circuit for the outdoor air filter
- Adiabatic cooling
- Heat and cold supply in the circuit. No additional heaters or coolers needed.

  Less pressure drop, better SFP (Specific Fan Power)
- Annual efficiency (AE) and electrothermic amplification factors (EAF) in accordance with the energy ordinances.

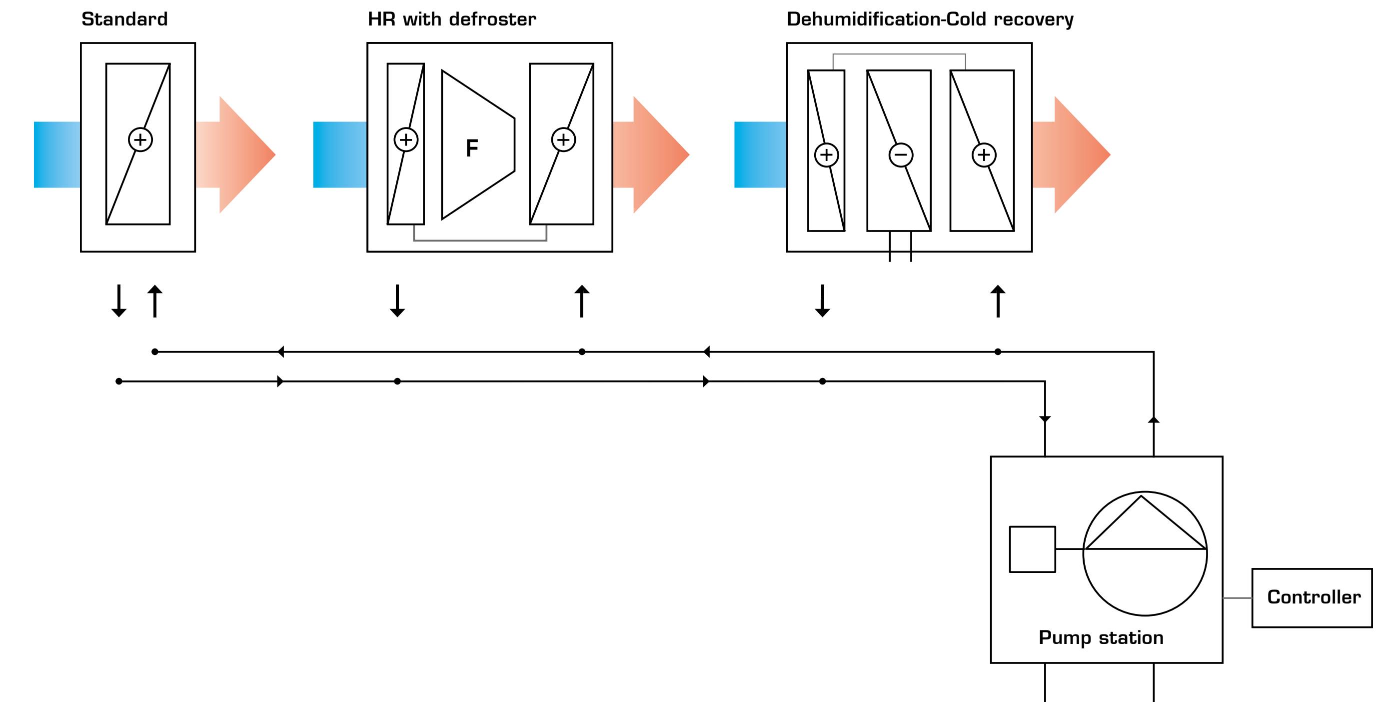
Material and quality

The material and production quality is in accordance with the AIRSOL® standard, i.e.:

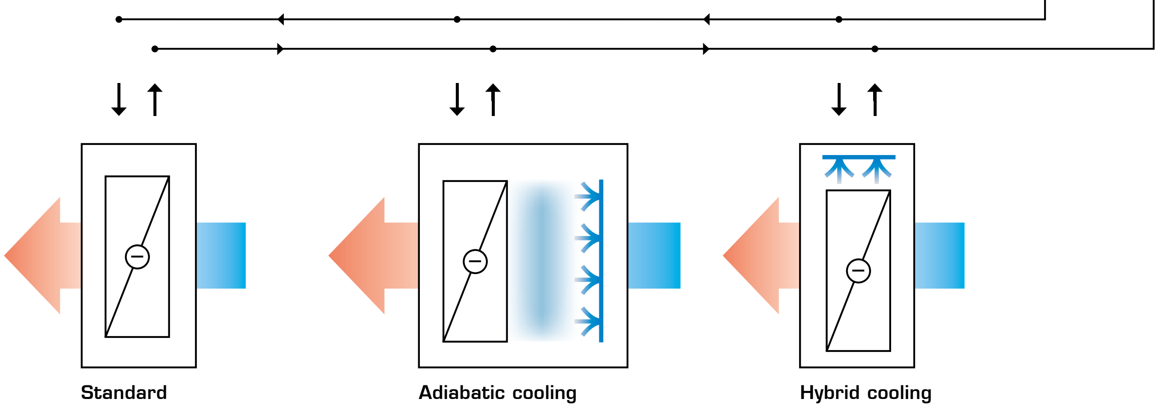
- Pipe wall thickness Cu 0.4 mm
- Hydraulically widened (less pressure loss than with mechanical widening)
- Fin thickness min 0.2 mm
- Exchanger solely out of non-ferrous metals
- Exchanger can be fully ventilated and emptied
- Optimised AIRSOL® circuit for maximum counter flow
- Pressure: PN 16
- Design according to Eurovent, consideration of hygienic aspects regarding cleaning
- External piping in steel, copper and chrome steel

Principle scheme

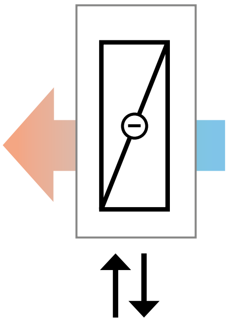
Air intake system (energy output / consumer)



Air output system (energy source / generator)

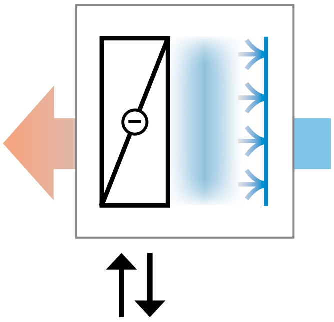


Air output systems



Standard

On the exhaust air side, the water-glycol mixture is warmed as close as possible to the exhaust air temperature. (Heat is removed from the exhaust air and transported to the supply air via the water-glycol mixture).

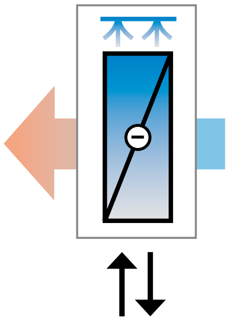


Adiabatic cooling

Adiabatic cooling via exhaust air humidification. The following humidification systems are used for this:

- Contact humidifier for operating with soft water. Circulating water with automatic desalination.
- Atomizing humidifier (high/low pressure systems). Operation with desalinised water. Sensible use with simultaneous supply air humidification in winter with the same pump.

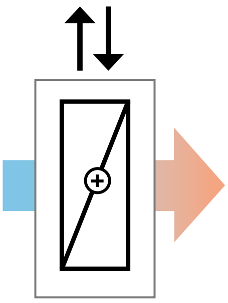
Connection of the recooling / humidification and control of the maximum exhaust air humidity.



Hybrid cooling / recooling

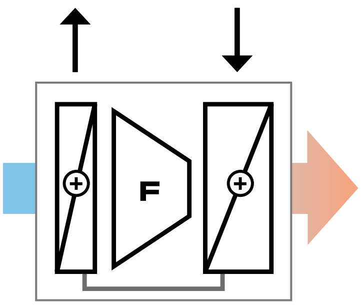
On the exhaust air side, the water-glycol mixture is cooled as close as possible to the wet bulb temperature. High power density! Use of Mountair Hybaco® elements, using desalinated water.

Air intake systems



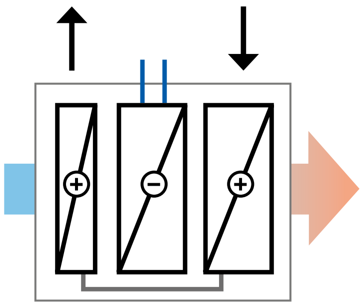
Standard

AIRSOL® High-performance CCS-HR systems work with maximum exchange degrees. The standard consumer is an air intake system. The cold outdoor air is heated with heat recovery.



HR with defroster

Weather changes can lead to ice on the fresh air filters. It is therefore recommended to split the CCS heat exchanger in the fresh air between a defroster (few pipe rows, wide fin spacing) and an air heater (many pipe rows, small fin spacing) and pass the glycol through them serially (hygiene guideline).
The heating in the defroster is sufficient to prevent any ice on the filter. The defroster installed in front of the filter with wide fin spacing can be cleaned without problems.

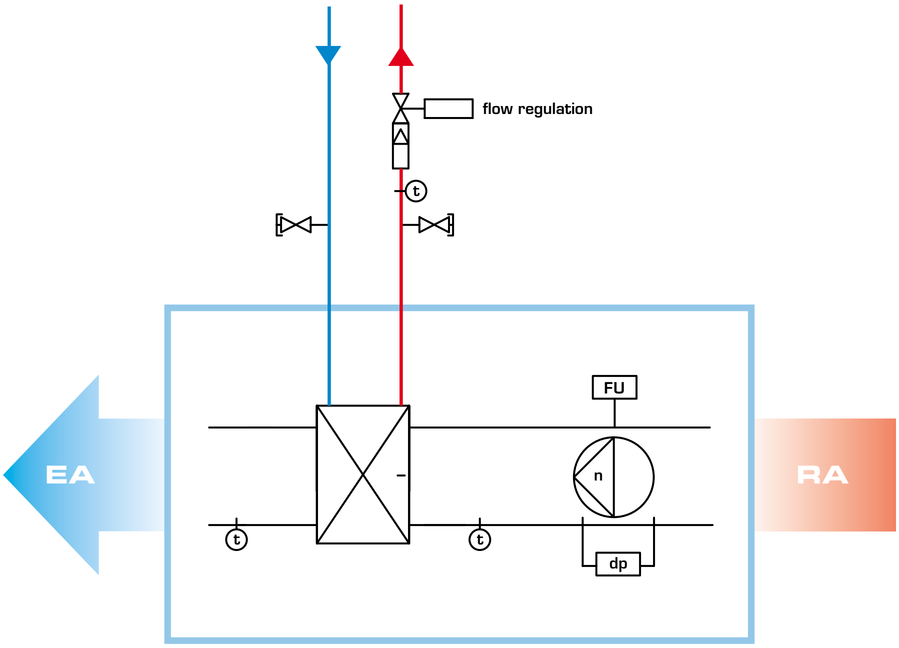


Dehumidified cold recovery

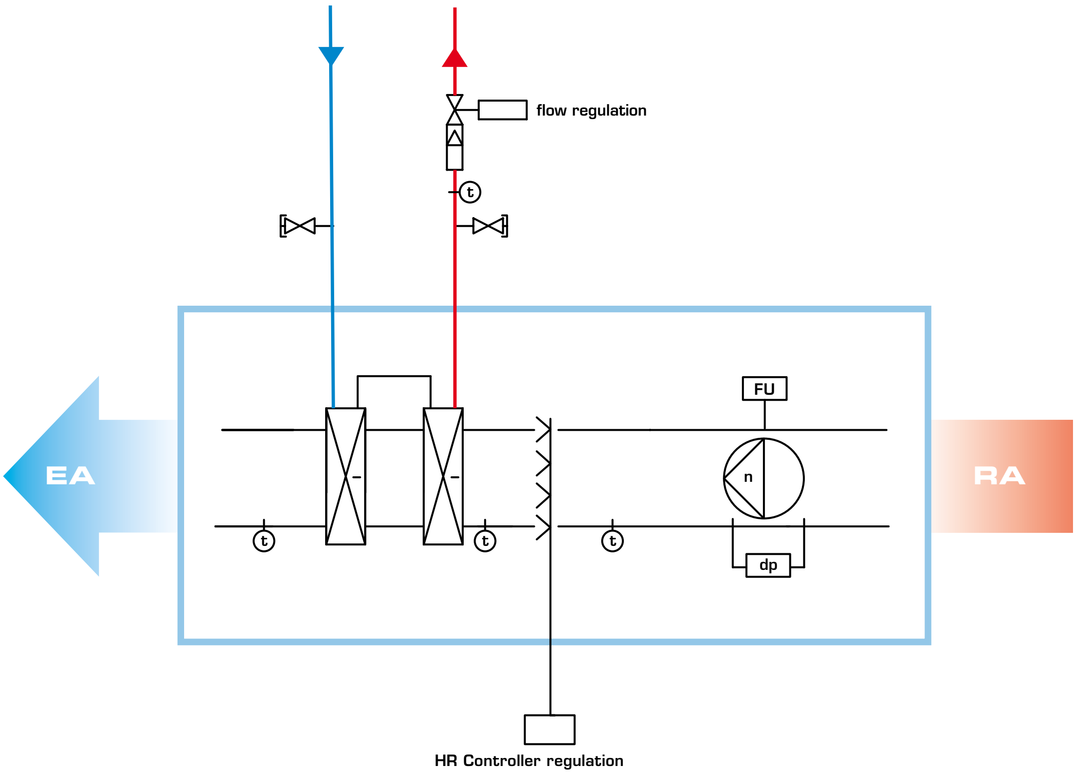
CCS3 means that the large HR battery is split into two coils. In the summer, in the drying mode, the glycol mixture circulates serially through the exchangers. In-between, the cooler is set to condensation dehumidification.
The necessary additional heating is thus used for pre-cooling. The power requirement of the cooler is significantly reduced. The cooler is supplied by external refrigerating machines. Triple splitting with additional defroster.

Hydraulic diagrams

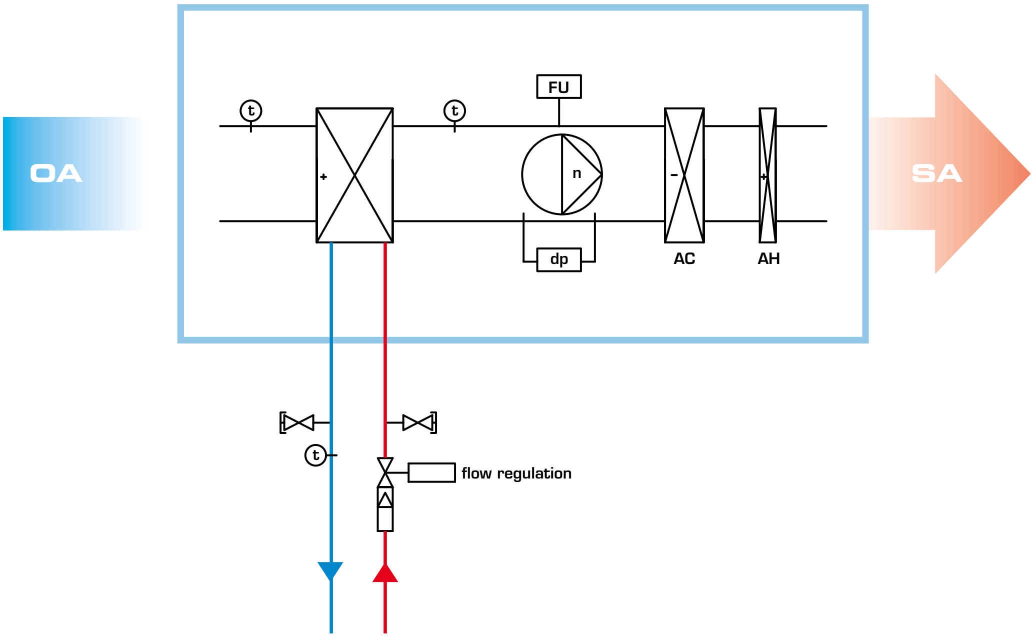
Standard exhaust air



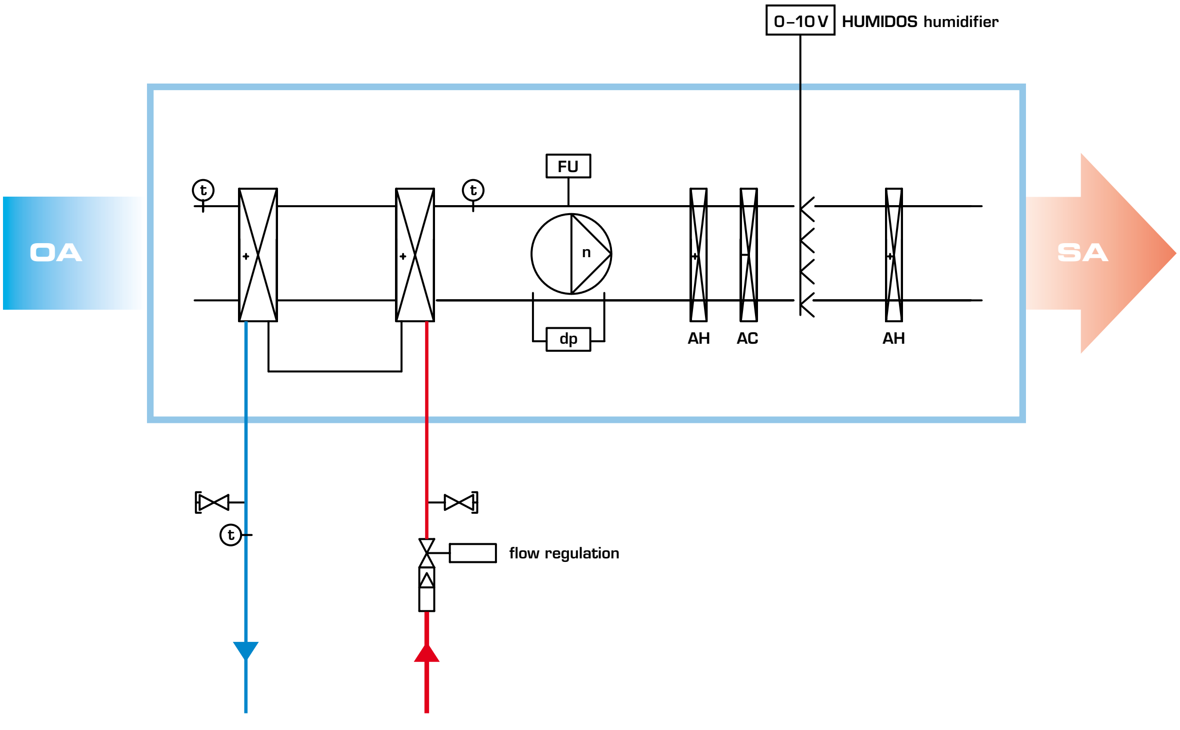
Exhaust air with adiabatic cooling



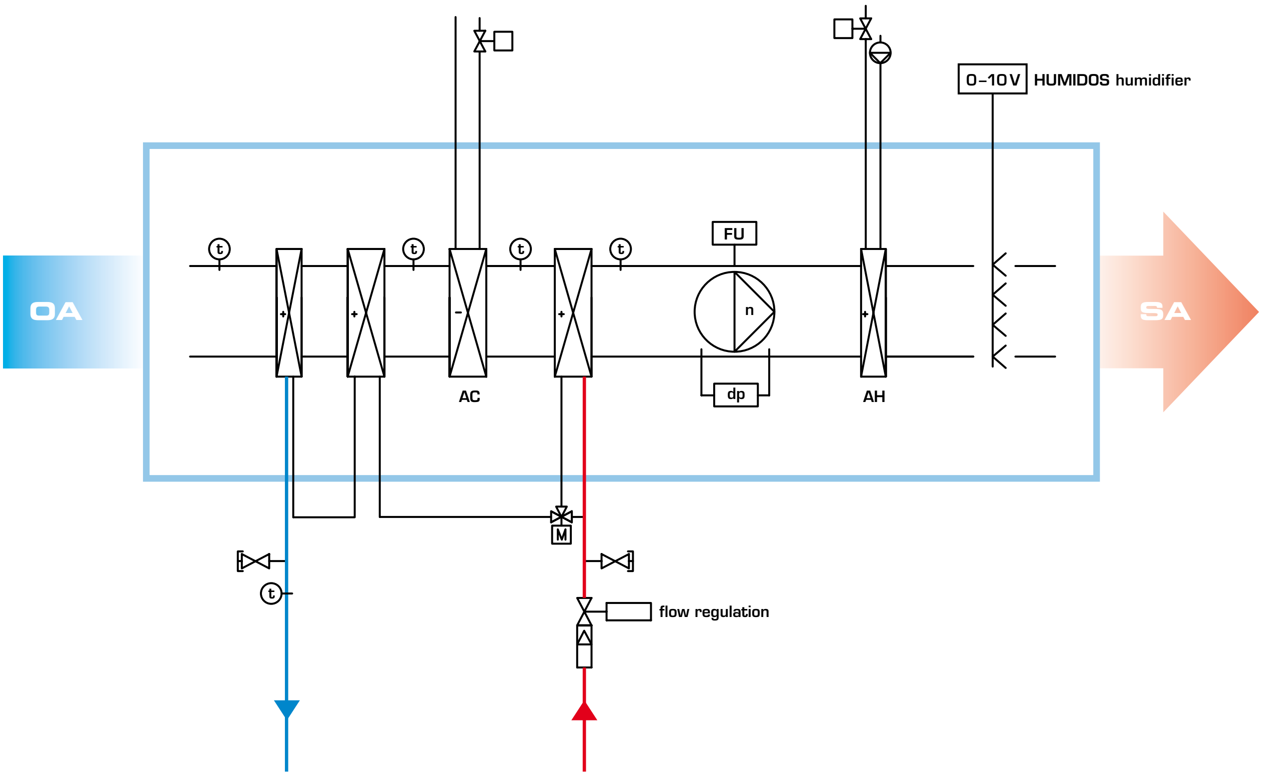
Standard supply air



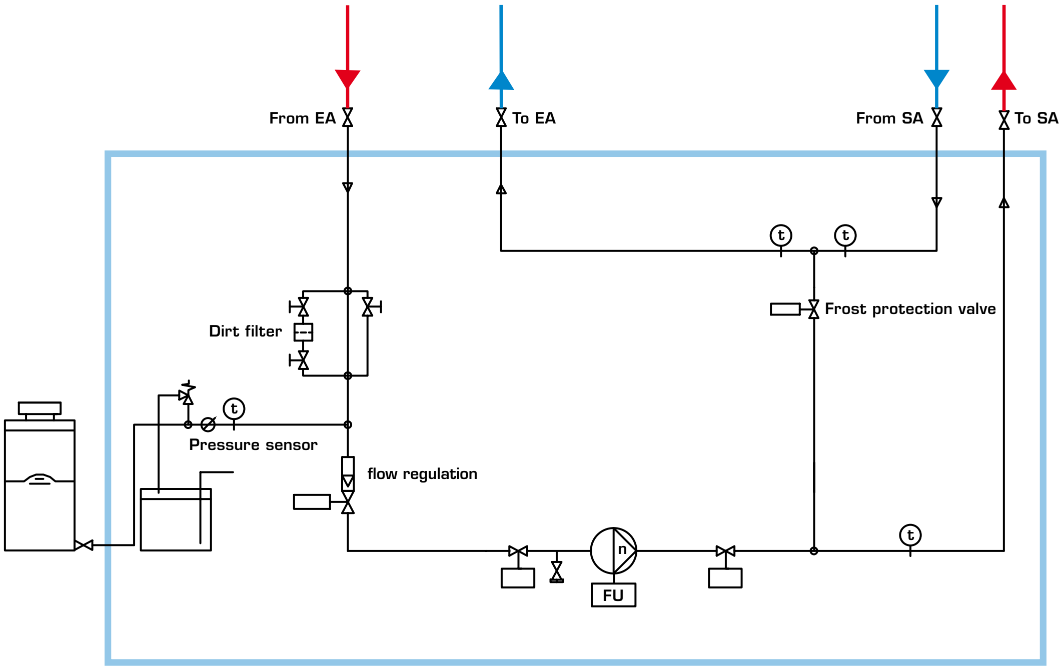
Supply air split with defroster



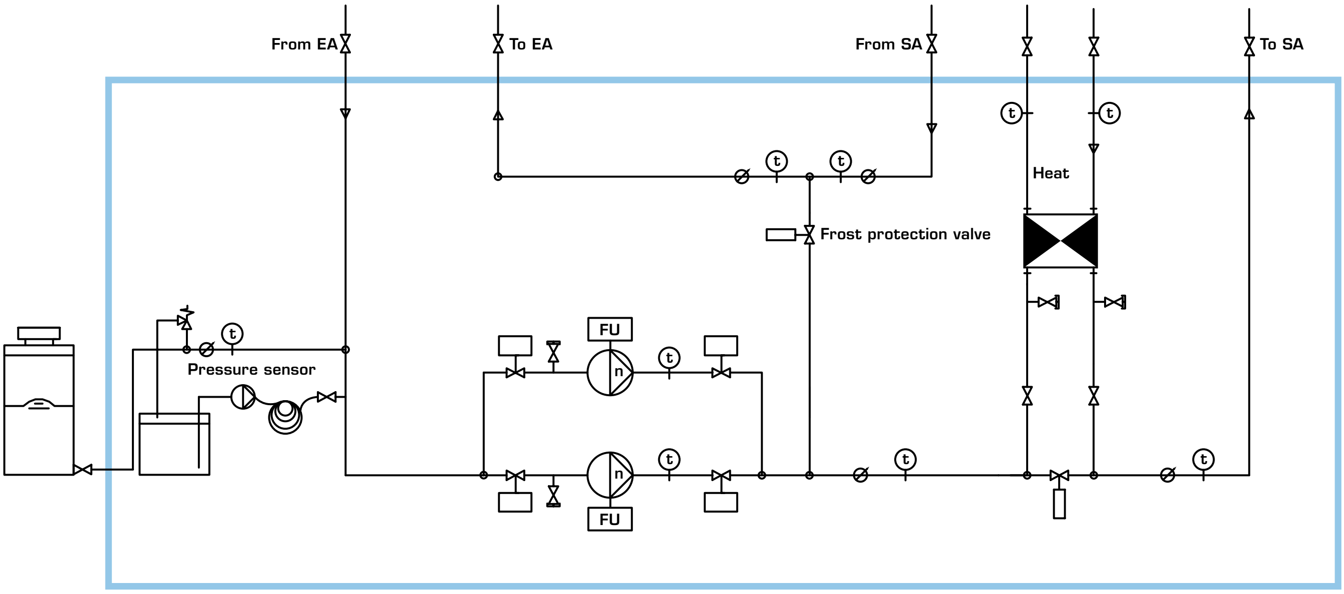
Multiple-split supply air with defroster, dehumidification and cold recovery



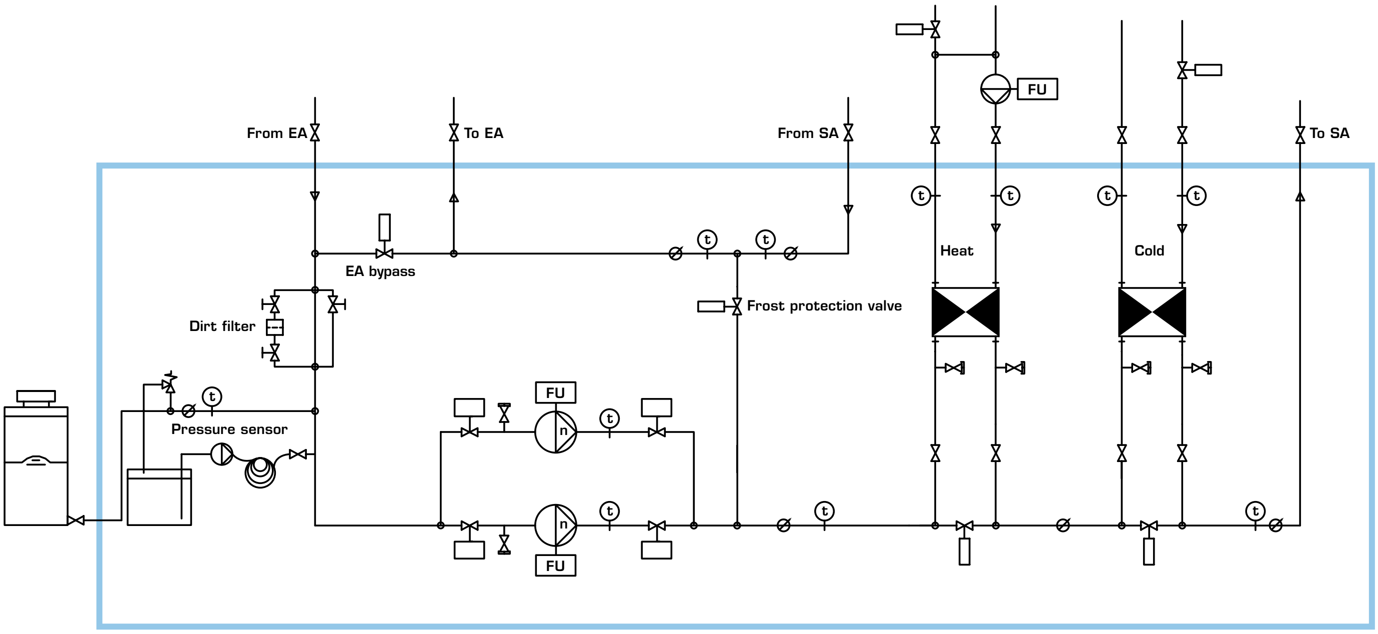
Hydraulic station with frost protection bypass



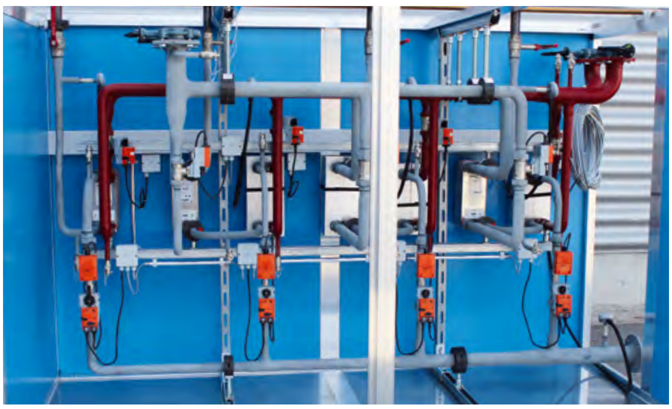
Hydraulic station with redundancy pump and heat supply



Hydraulic station with heat and cold supply



Hydraulic stations



Controller

The HR controller is responsible for the system optimisation, regulation and monitoring.

Measuring

The air condition and the pressure losses are recorded via the system-relevant elements – as well as via the overall system. The air volumes, water-glycol volumes and drive capacities are measured.

Calculating

The performances are calculated based on the air volumes and air conditions. The drive capacities from the pressure losses are split between the HR and the overall installation.

Regulating

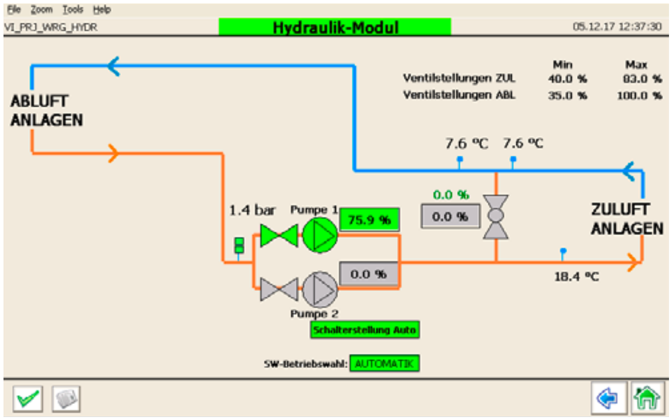
The heat values of the air mass flows and of the glycol mass flows are optimised through the regulation of the glycol mass flows. In network systems, the supply air side is regulated in volume according to the effective requirements. On the exhaust air side, the glycol volume is limited to a maximum determined by the air mass flows.

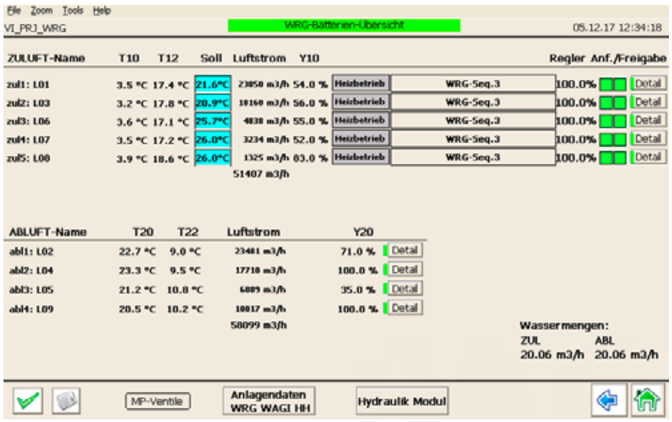
Evaluating and representing

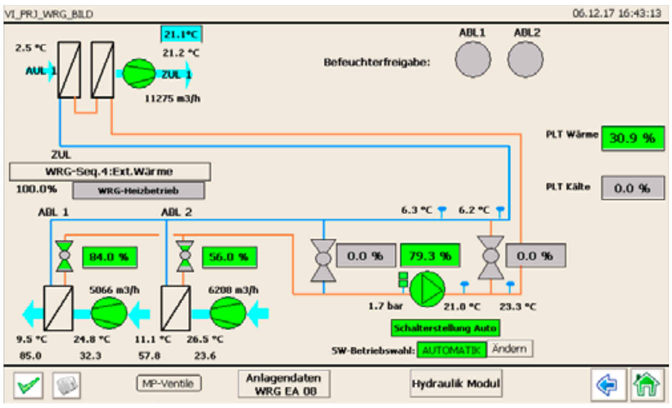
The summation in intervals shows the total energy consumption in heat, cold and optional humidification, dehumidification. The part of the recovery in the total required energy is represented as the degree of use. The electro-thermal amplification factor is determined through the summation of the energy reserves.

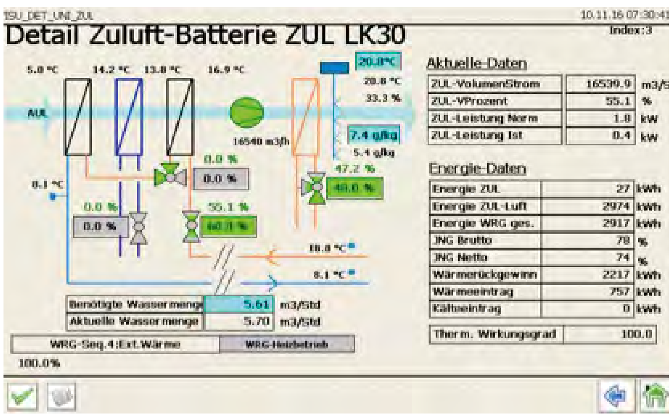
Monitoring

The system is monitored through plausibility checks and a correction is required in case of errors. This is based on the comparison between the theoretical ideal values and a tolerance limit. Sensor breaks and component failures are monitored based on the measured values. Performances and energy quantities must remain within the predefined range on the basis of the calculated values.

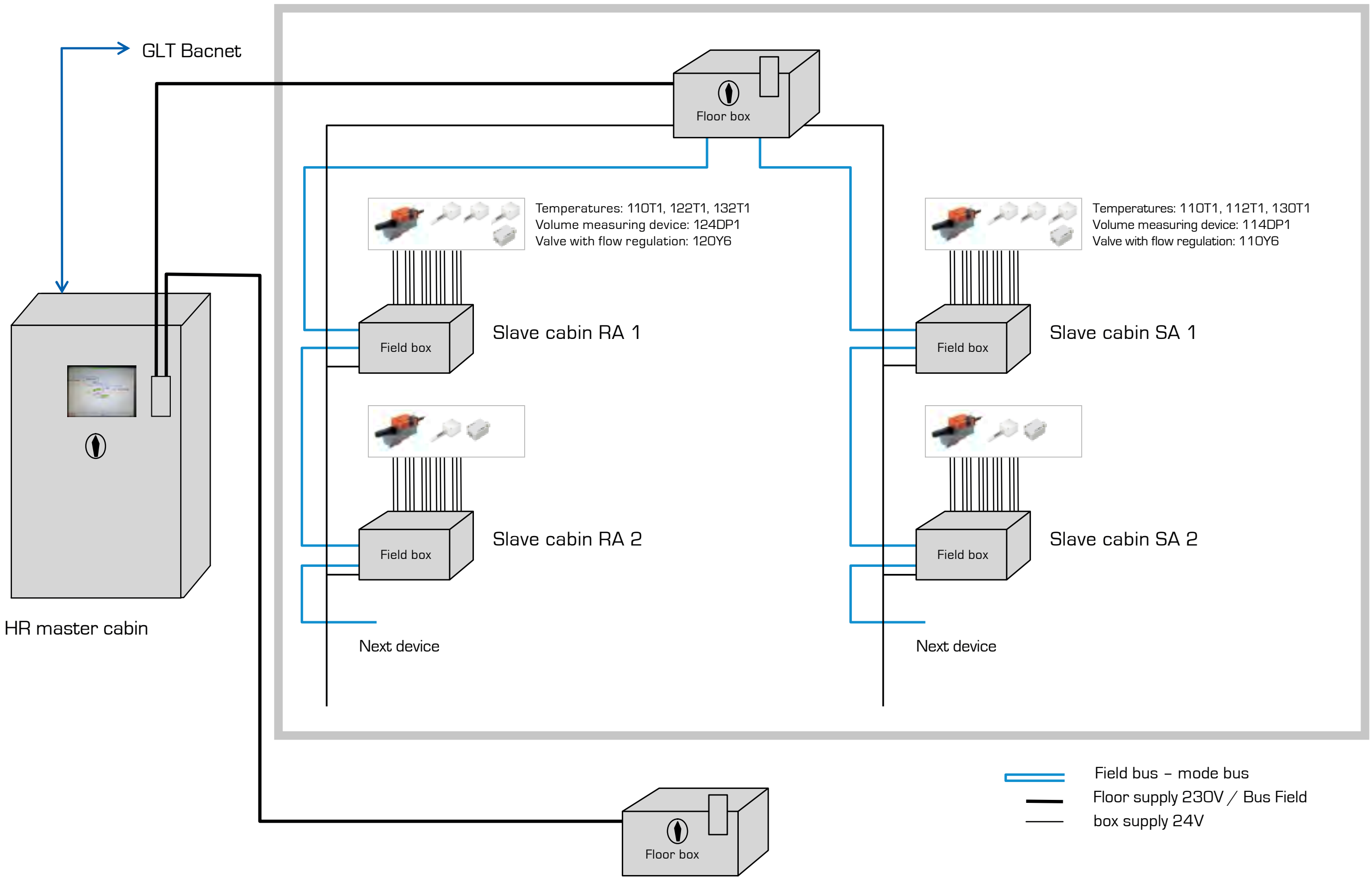








Network systems with master-slave principle



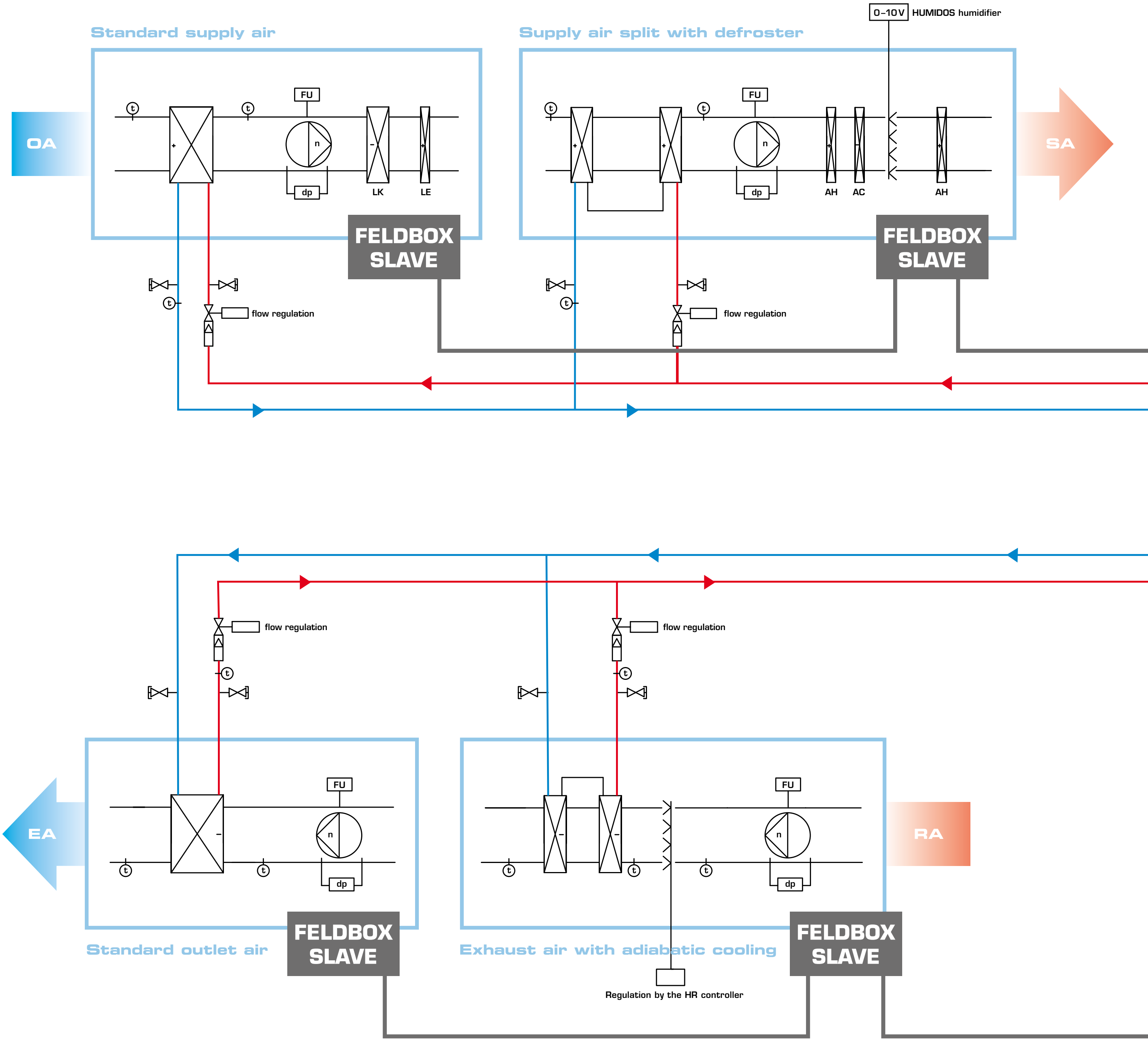
The systems are coupled to each other via a medium (circuit connected system). The number of systems that are connected in one network is determined by the use of the ventilation system (for example: conference rooms, sports halls, restauration). The common point between all the designs is a central hydraulic station per network that conveys the medium from the exhaust air to the supply air systems.

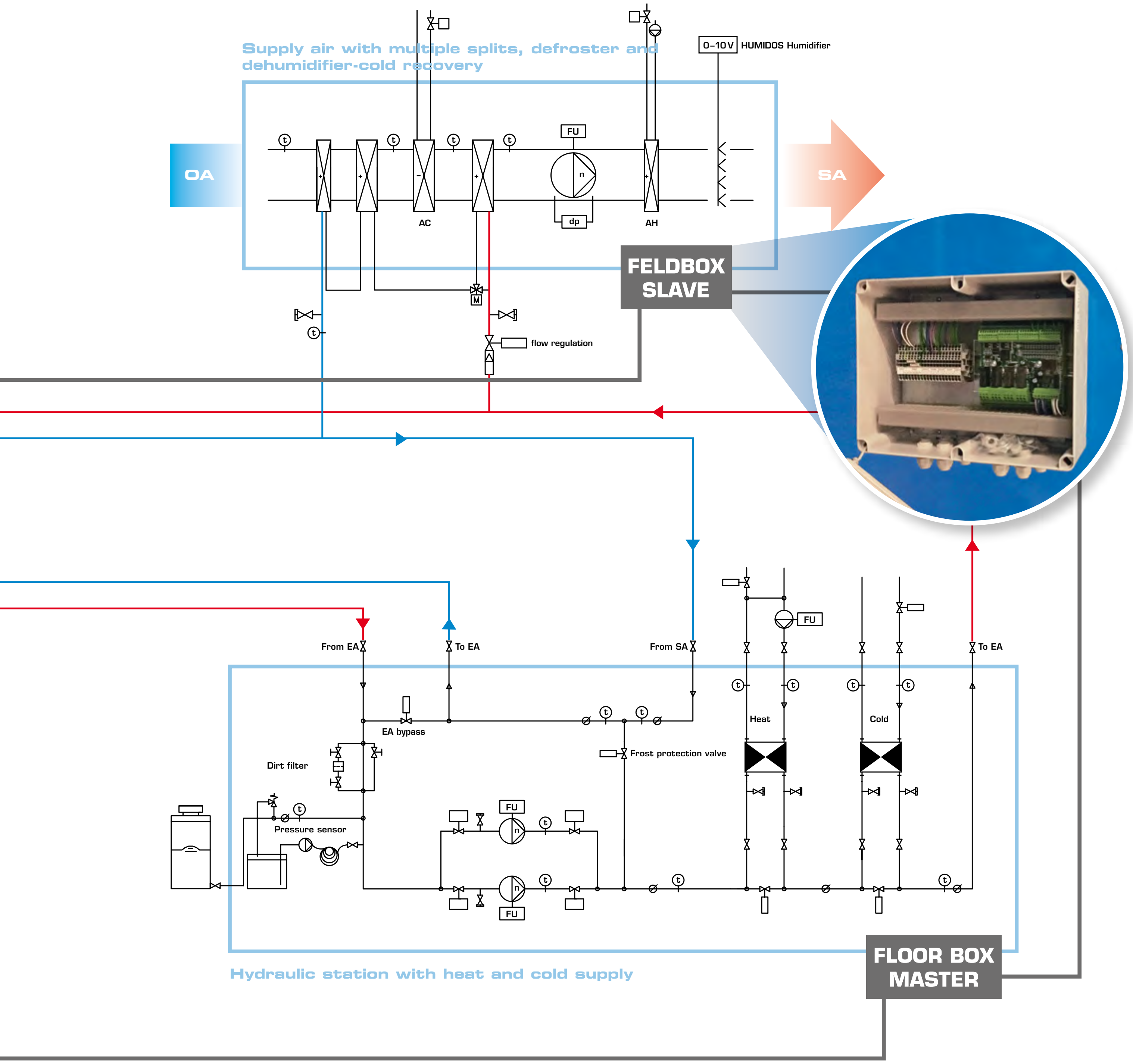
The HR controller is usually installed with the hydraulic station. All the ventilation systems included in the network must also be connected to each other electrically (sensors, ideal values, alarms etc.).

Mountair further developed the master-slave principle, so that the field devices can be wired directly to a cabinet at the Monobloc.

This means we can avoid long stretches of cables, which often cause problems. Communication is ensured via bus. This is not only advantageous for the electrical wiring, but also for problem analyses that may need to be conducted. The field boxes are unambiguously linked to one Monobloc, where the data points that are present in the unit are gathered.

Hydraulic diagrams with network system




Supply air with multiple splits, defroster and dehumidifier-cold recovery
0–10 V
HUMIDOS Humidifier
OA
SA
FU
n
dp
AC
AH
M
flow regulation
FELDBOX
SLAVE
From EA
To EA
From SA
To EA
FU
Heat
Cold
EA bypass
Dirt filter
Frost protection valve
Pressure sensor
FU
n
FU
FLOOR BOX
MASTER
Hydraulic station with heat and cold supply

Specifications text

Heat recovery CCS

Brand: Mountair
System: AIRSOL®

System delivery scope

HR consisting of a network of 1 exhaust air with 1 supply air system
Heat exchanger built into the Monobloc

Supply air – Heat exchanger split into
– 1 defroster as filter pre-heater
– 1 HR heater in the supply air

Exhaust air – One-piece heat exchanger
– 1 HR – cooler in the outlet air

HR controller

HR regulation (HR controller) incl. commissioning, operation optimisation and operation monitoring. Includes control cabin, hardware, software, remote monitoring via modem / Internet. Proof of the guaranteed performances by the HR manufacturer.

Hydraulic pump station

Hydraulic component group with circulation pump, redundancy pump, all necessary valves, expansion vessel, fittings etc.

External piping

Connection pipes incl. glycol filling, rinsing, ventilation and adjustment of the circulation volumes. HR system completely installed and adjusted, incl. all necessary fastening materials and the flow volume measurement devices for an optimum operation.

Engineering and design criteria

Engineering, dimensioning for an optimum operation, establishing the hydraulic diagram and control strategy, proper commissioning, operation optimisation in the first year of operation and proof of the guaranteed performances. Dimensioning of the HR to cover the annual use according to the SWKI and energy saving regulations.
Simulation of the annual progression under consideration of the internal loads. Profitability calculation under consideration of the fan and pump driving energy, energy costs and amortisation.

Operation optimisation

HR operation optimisation in the 1st year of operation, with the following services:

- Observation of the dynamic system behaviour for full load and part load operation ("Day – night – weekend" or "Winter – transition time – summer")
- Interpretation of the measurement results
- Optimisation of the standard parameters
- Searching for and diagnosing disruptions in the HR system
- Remedying disruptions caused by components that were delivered by the HR manufacturer (in the first year of operation), customer counselling for remedying other disruptions.
- Delivery of a modem incl. communication software for data preparation and graphic representation of the dynamic and static operation of the entire HR system on the Internet.

Efficient operation optimisation for the HR regulation (HR controller) through remote monitoring of the HR system via the Internet / modem.

Guarantee

Delivery of the CCS-HR as a whole system incl. the hydraulic station group and HR regulation (HR controller) for optimum and disturbance-free operation. The company / HR manufacturer provides a functional guarantee and bears the responsibility for the optimum and disturbance-free operation of the entire HR system (incl. heat exchanger). They are also responsible for the choice of the control strategy and hydraulic circuit, under consideration of the provisions and boundary conditions. The consumption figures determined by the defined boundary conditions form the basis for penalisation / contracting.

System description and requirements

High-performance circuit connected system

High-performance circuit connected system with heat recovery coils (CCS-HR) with hydraulically optimised heat exchangers between the air and the water-glycol mixture. Heat recovery for systems with fully separated supply and exhaust air flows. The heat recovery circuit can contain several connected units. Decentralised heat sources are connected to the circuit and use the waste heat to heat the air from outdoors. System controllers guarantee the optimum operation and maximum annual use across the entire year. The adiabatic exhaust air humidification allows a natural partial conditioning (supply air cooling) without a mechanical cooling system.

- Maximum heat recovery with separated supply and exhaust air streams
- Network systems to use decentralised waste heat sources
- Controller for system optimisation and energy monitoring
- Simple equipment of existing air handling unit for energy saving
- Cost and profit simulation
- Defroster system for the outdoor air filter
- Adiabatic cooling
- Heat and cold supply in the circuit. Additional heaters and coolers are not necessary. Less air pressure drop, better SFP (Specific Fan Power).
- Annual use (AU) and electro-thermal amplification factors (ETA) in accordance with the energy regulations.

AIRSOL® high-performance CCS-HR systems work with maximum exchange degrees. On the exhaust air side, the water-glycol mixture (intermediate medium) is warmed as close as possible to the exhaust air temperature. The heated medium then circulates to the outdoor air systems and can warm up the outdoor air. The AIRSOL® heat exchanger also has a maximum exchange degree in this area. The correctly regulated water-glycol amount in the intermediary circuit guarantees the maximum temperature difference.
In the summer mode, the exhaust air can be humidified adiabatically, and the intermediary circuit is cooled. An adiabatic supply air cooling is generated. The effect is maximised through the use of Mountair hybrid cooling elements.
Lacking heat or cold can be supplied by plate heat exchangers in the water-glycol circuit. This makes additional heat exchangers in the airflow unnecessary, and the ventilation requires less energy.
In network systems, one or more air output and intake units are connected. The AIRSOL® controller calculates and provides the ideal volumes of fluid and guarantees maximum heat recovery.
The entire system is optimised. A better exchange degree also means a higher air pressure drop. If the additionally spent energy reserve is more valuable than the recovered heat, the system is "maxed out". The annual efficiency shows what percentage of the total heating energy is recovered by the CCS-HR. It is to be noted that systems with humidification are subject to a different calculation!

Construction characteristics

AIRSOL® heat exchangers are characterised by a high production quality, robustness and a long useful life. The heat exchangers are fully manufactured from non-ferrous metals, so that no corrosion can occur even if no maintenance is performed (the glycol becomes acidic). The copper pipes have a wall thickness of 0.4 mm and are hydraulically widened, which leads to low pressure losses with regard to the liquid. The heat exchangers are completely ventilatable and emptiable. Fin thicknesses 0.2 – 0.25 mm, minimum fin spacing 4.0 mm (defroster), 2.4 mm (SA), 2.8 mm (RA coil) . The frames are in AlMg3, V2A or V4A, the connection thread in red brass. The layering for QS4 is performed with Heresite®, which guarantees the highest degree of corrosion protection. The geometry used (40/35) is ideal for low air pressure drops with maximum performance. All laminated heat exchangers are PN16 pressure-tested by the manufacturer. The hydraulic circuit is set to the maximum counterflow proportions (AIRSOL® circuitry). Consideration of the applicable hygiene guidelines in accordance with VDI 6022 and SWKI 2003-5. Division of deep heat exchange blocks with intermediate empty spaces for impeccable cleaning. A high degree of corrosion protection through galvanised pipes (CuSn) and saline water-resistant fins (Al Mg3). Corrosion protection in accordance with the material quality SWKI QS 1–4. Dimensioning of the heat exchangers for a sufficient degree of turbulence, for an ideal partial load behaviour.

Use-dependent HR system regulation

The entire HR system is regulated depending on the usage by the HR regulation (HR controller), under consideration of the operating conditions of the ventilation system (air volume flows, heat requirements, internal and external heat loads) and the operating maps of the HR exchanger. The power transferred should be ideal at every point in time. The HR controller regulates the transition from winter mode to summer mode.
The HR controller has a modem and the corresponding communication software. All the important data is measured, prepared and optionally graphically represented on the Internet. This makes it possible to constantly monitor the dynamic functioning of the HR. Furthermore, statistical operating states can be consulted.
The building management system (BMS does not perform any regular tasks for the HR system.
The BMS determines and transfers the following data:

- Fan operating notifications
- Current ideal values for the supply air temperature

If desired by the owner, all HR controller data can be transferred via a standard interface to the BMS (optional, to be represented as an additional cost).

The HR controller is to determine and display (locally and via the Internet):

- Energy requirements for warming the outdoor air
- Heat recovered by the HR system
- Raw degree of use
- Efficiency / Heat recovery figures

Establishing the control strategy according to the engineers specifications:

- Creating the data point diagram
- Creating the electrical diagrams for the HR controller
- Establishing the interface definition for the connection with the building management system (in agreement with the planner)

Serial interface to the building control system

Additional price for serial interfaces to the building management system: TCP/IP mode

Operation monitoring

The operation monitoring data are provided in graphical form as a 24-hour diagram.
Further data is archived, so that it can be used to prove performance or provided upon request of the operators / owners. The cost of this remote monitoring for the first year can be included in the HR controller price.

Emergency mode

Emergency mode for the system or important devices in the electrical cabinet, even if the automation station is not available. The emergency mode is built into the control cabinet and not operable from the exterior. The positioning of the emergency mode devices (manual / automatic) is assessed from the controller.

The emergency mode also includes a watchdog function, which automatically switches to pre-defined values in case of a failure of the control system. The emergency mode is hereby given highest priority.

Hydraulic component station

Mountair S2 Monobloc housing construction. Housing design without welded joints and thus completely demountable. Removable covering panels. Panels completely powder-coated after production. Layer thickness min. 60 µm, RAL 5012. Galvanised or powder-coated base frame with openings for crane transport. Hydraulic station base made of 1.4301 stainless steel panels. Door closing via lockable hand lever. Oval light made of a plastic lower part, self-extinguishing and halogen-free. Fittings for 1 × E27, max. 40-watt lightbulb. Cable entry with clamping gland. Transparent upper part made of shock-resistant plastic. Hinged and galvanised wire guard. Protection class IP 44. Lamp wired to the interior 230-volt switch/socket combination.

Centrifugal pump

For the water/glycol pumping medium. Vertical, multiple-layer centrifugal pump with glycol-resistant seals. Impellers and intermediate chambers in chrome-nickel-steel 1.4301. Head and base part in grey cast iron. Mechanical seal with installation dimensions according to DIN 24960.
Maximum conditions: 16.0 bar / 80 °C. Directly flanged IEC motor with built-on frequency inverter, with cold-conductor thermometer probe. Protection class IP 55.

Frequency converter

Fully digitised with voltage vector control and variable tract frequency. Housing IP 54. Integrated radio control filter.

Functions:
- Current limitation
- Current monitoring
- Full electronic motor
- Ramp function
- Frequency bypasses
- DC brake
- Integrated PID controller

Redundancy pump

Consisting of:

1 Centrifugal pump
- pump constantly regulated with frequency inverter
- Pre-set FC (ext. Ideal value 0 – 10 V, ext. FC release)
- Incl. isolator for HR pump

2 Butterfly valves
- with integrated one-way valves incl. installation, piping and cabling within the component group

Control valve

2 or 3 way control valve for frost protection or power regulation with constant operation.

Safety devices

Expansion tank for closed systems, muff, brass cap valve, diaphragm safety valve with exterior output, pressure gauge, pressure gauge tap, ball valve with spindle sealing, bi-metal thermometer, filling and emptying system.

Inner piping and additional components

Complete piping within the hydraulic station, adjusted to the flow volume, including an Armflex sleeve insulation of all pipe parts endangered by condensation water. The media connections and the outlet of the safety valve lead out of the hydraulic station. All components used are glycol resistant. Pressure gauge for aspiration from and pressure on the medium pump. The pump connection to the piping system is decoupled, to absorb vibration and flow noises, as well as to compensate for expansion. All electrical components are wired into a terminal box, incl. the isolator for the HR pump.

AHU-flow measurement and regulation

1 measurement and control valve per system delivered unmounted.
EP valve with integrated volume-flow measurement. Connection to the building piping at the monobloc.

External piping

Piping and connection work between the ventilation units and the hydraulics cabin, incl. pipe insulation. Rinsing, glycol filling, ventilating and hydraulic balancing. Cabling between the control cabin, the hydraulics cabin and the power supply.

Engineering and design

Design according to the annual use SWKI (AU > 75%), minimum requirements according to SIA 382.1 (dry > 70%), SFP (Specific Fan Power)
minimum requirements, ETA (electro-thermal amplification factor) minimum requirements.

System 00 example:

	Air flow volume m^3/h	**Air intake °C / % r. F.**	**Air output °C**	**Power kW**
Filter pre-heater	45 000	-11 / 90	-8.2	40
HR air heater	45 000	-8.2 / 70	11.1	282
HR air cooler	40 000	22 / 30	0.3	322

System 01 example:

	Air flow volume m³/h	Air in-take °C / % r. F.	Air output °C	Power kW
Filter pre-heater	20 000	-11 / 90	-7.9	20
HR air heater	20 000	-7.9 / 68	12.1	130
HR air cooler	20 000	22 / 30	1.3	150

The legal provisions are to be observed.
Planning brand: Mountair AG, Kreuzlingen
Type: AIRSOL®
Alternatives of equal value can be offered separately. The installation company is to provide the proof of equal value. The HR manufacturer bears the responsibility for the functionality and proper operation of the HR system.
They are therefore responsible for the correct choice of the hydraulic system and are to establish a proposition for the control strategy. The cost of the engineering is included in the prices of the HR exchanger.

Hydraulics
The HR manufacturer provides a proposition for the hydraulic diagram. This dimensions the conveyor pump and all the valves for the HR system.

AIRSOL® operation optimisation
The ideal water / glycol conveyed volume of a CCS-HR depends on the operation conditions of the ventilation technical system (air flow volumes, exterior temperature, internal and external heat loads) and on the exchanger characteristics. Variable air flow volumes require an adjustment of the water/ glycol conveyed volume, under consideration of these influence factors. A constant adjustability of the pump with the help of a frequency inverter is a precondition for operation optimisation.

- The HR controller starts the HR pump and regulates the conveyed volume (pump rotation speed), so that an ideal heat recovery is constantly achieved.
- The HR controller minimises the pump energy: the conveyed volume is only increased until the additional energy requirement of the pump exceeds the additional power to heat the outdoor air.
- Once the maximum supply air temperature (limit value) has been achieved, the HR power is reduced.
- The HR controller prevents the condensation from the exhaust air from freezing.
- For ventilation systems with cooling or adiabatic humidification of the exhaust air, the HR controller regulated the HR (summer mode).
- For network systems (several supply and / or exhaust air units), the water / glycol flow volumes are distributed as required. This ensures that the energy is always collected where it is present and brought to where it is needed.
- For HR systems with cold-heat and/or exhaust heat supply, the HR controller completely regulates the supplies.

Guarantees
Measurement
The air conditions and pressure losses are recorded via the system-relevant elements and the overall system.
The air volumes, water-glycol volumes and the drive performances are measured.

Calculating
The performances are calculated from the air volumes and air conditions. The performances are calculated from the pressure losses proportionately for the HR and the overall system.

Regulating
The heat values of the air flow volumes and the glycol flow volumes are optimised through adjustment of the glycol flow volume. In network systems, the supply air volumes are regulated according to the effective requirements. On the exhaust air side, the maximum glycol volumes depend on the air flow volume.

Evaluating and representing
The summation per intervals shows the total energy requirements in heat, cold and optional humidification or dehumidification. The proportion of heat recovery in the total required energy is represented as the degree of use. The summation of the reserve energy serves to calculate the electro-thermal amplification factor.

Monitoring
The system is monitored through plausibility checks and corrections are required in case of errors. This is based on the comparison between the theoretical ideal values and a tolerance threshold. On the basis of the measured values, sensor and component failures are monitored. The measured values for performances and energy quantities must be within the pre-defined range.

Proof of the guaranteed performances
The installation company/HR manufacturer is to prove the guaranteed performances after the first year of operation.
To this purpose, the air flow volumes, the important temperatures (OA, SA depending on the HR, RA, EA, water/ glycol temperatures), the operating conditions and any alarm notifications are to be measured, recorded and graphically represented. The entire area of the exterior temperatures and air flow volumes must thereby be recorded. This proof replaces the performance measurements upon acceptance. In the acceptance record, a corresponding note is to be added. The measured and prepared data should be graphically represented.

The standardized AIRSOL® CCS-HR in the Mountair S2 Monobloc

Calculation basis

HR design example	450 a. s. l.
SA/RA air flow volume proportions	1 / 1
velocity on the ribbed exchanger surface	1,8 m / s
OA dry temperature efficiency level (SIA 382)	70 %
OA entry	– 11 °C / 90 % r.H.
SA exit	12.1 °C / 15 % r.H.
RA entry	22°C / 18 % r.H.
EA exit	– 1 °C / 83 % r.H.
Glycol proportion, anti-freeze N	25 %
Net annual use rate (legal requirement = 75 %)	80 %
Electrical amplification factor (legal requirement = 15)	23

AIRSOL® CCS-HR construction characteristics

Maximum counter-flow circuit	Type: AIRSOL®
Pipe geometry, fully ventilatable/emptiable	40 / 35 mm
Pipe wall thickness	Cu 0,4 mm
Pipe expansion	hydraulic
Fin thickness	0,2 mm
Fin division OA/RA	2.5 mm / 3 mm
Quality level 2 (according to SWKI)	Cu / Alu / Alu / RG7
Quality level 3 (CuSn / AlMg3 / AlMg3 / RG7)	
Quality level 4 (Heresite® dip coating)	

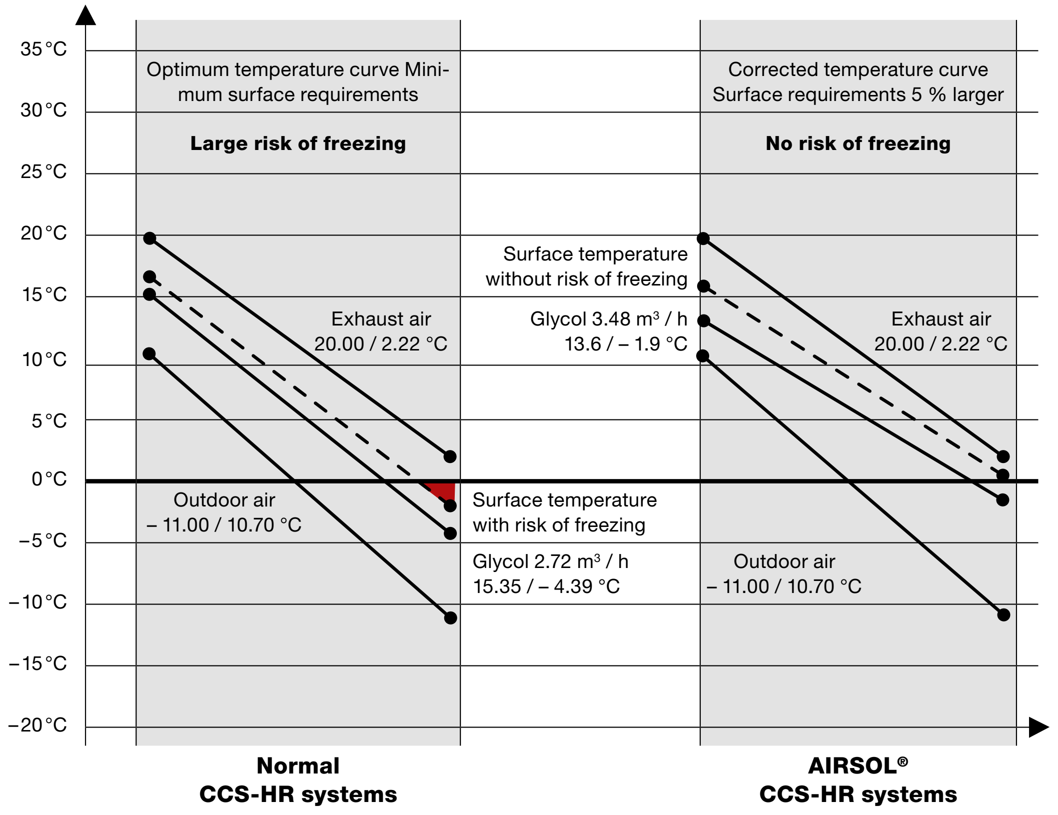
Annual energy calculation

System example with air volume	20 000 m^3/h
Pressure drop OA/RA	100 / 105 Pa
Hydraulic pressure loss OA/RA	126 / 126 kPa
Water/glycol mass flow (15.1 / – 4° C)	6,9 m^3/h
K-value	30 W/m^2K
Transfer surface OA /RA	1160 m^2 / 1160 m^2
Weight /Contents	2 × 700 kg / 2 × 250 l

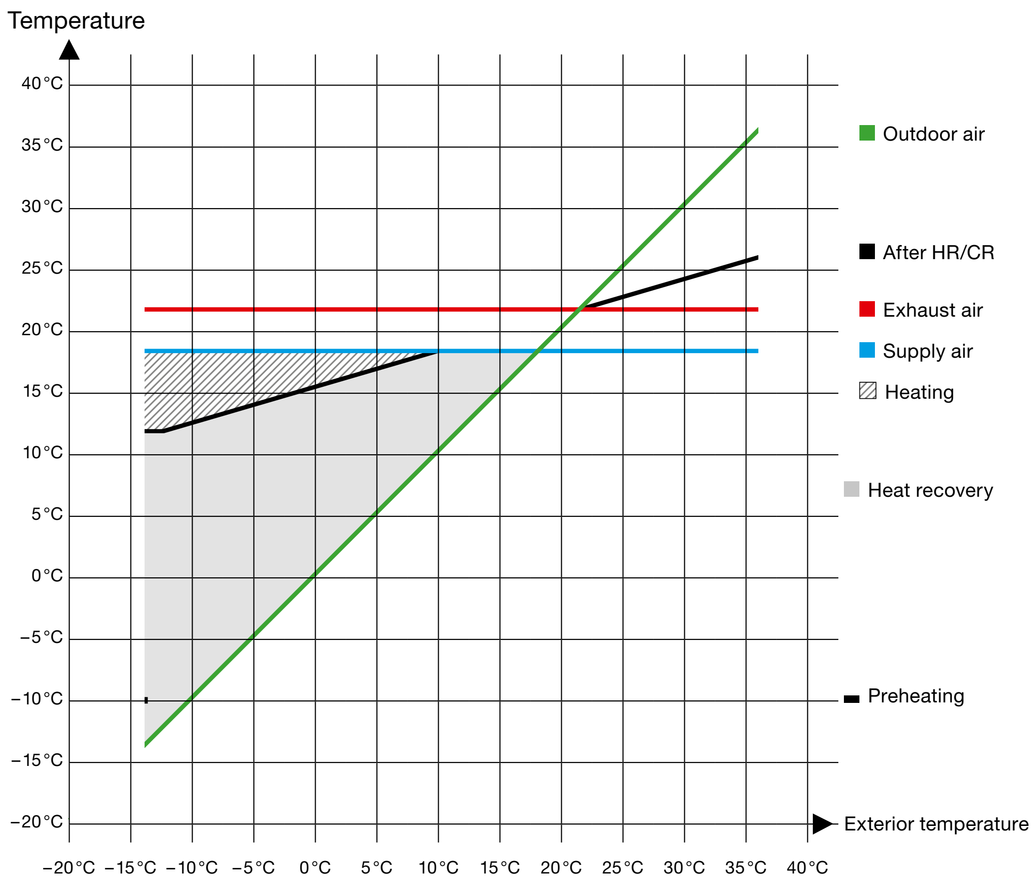
Operation time	8760 h/a
Constant SA / RA temperatures (no condensation)	18° C / 22° C annual
energy consumption Total heat without HR	493 MWh /a
Heat recovery	444 MWh /a
Energy reserve for HR (fans/pump)	19 MWh /a
Annual use level raw /net	84 % / 80 %
Amortisation times for 24h constant use	approx. 2 years
Amortisation times for normal office use	approx. 4.5 years

This calculation is an example. It is to be established according to the system.

Water-glycol temperature curve



Air temperature curve



References

2020

University Irchel, 5th stage, Zurich

- 4 x SA/RA laboratory main systems, each 60'000 m³/h
- 6 CCS pump station units in total with redundancy pumps
- CCS controller with slave field boxes for the monoblocs/AHU

2020

The Circle, Zurich Airport, Kloten

- Various monoblocs with different CCS systems
- Units with AIRSOL® CCS-HR

2019

Cantonal hospital Winterthur, new building

- Air volume SA approx. 283'000 m³/h
- 3 x heat recovery pumping stations with central heating and cooling
- Master-slave system with heat recovery controller and field boxes

2019

Adeline Favre, Winterthur

- CCS pumping station with redundancy pumps, flow rate = 40 m³/h
- 8 stations for SA and RA systems each
- Total air volume of each SA and RA = 118'000 m³/h

2018

Plattenstrasse, University Zurich

- Air volume SA = RA = 17'000 m³/h
- CCS pump station, 5.4 m³/h with PHE heating and cooling

2016–2018

St. Jakobshalle, Basel

- Total air volume approx. 372 000 m³/h
- Divided into 3 compound systems
- 3 hydraulics stations with heat and cold supply
- Master-Slave with HR controller, floor boxes, field boxes

2017

Givaudan ZIC, Kemptthal

- 2 SA and EA laboratory systems with 87 500 m^3/h each
- Adiabatic EA humidification
- 2 hydraulics stations with redundancy pump
- 1 SA/EA system with separate hydraulics station

2017

Wagi skyscraper 2, Schlieren

- Total air volume approx. 106 000 m^3/h
- Network system for laboratory, chapels, reception, conference room
- Hydraulics station 32 m^3/h with redundancy pump

2017

FHNW, Muttenz

- Network system with a total of 31 ventilation devices
- Total air volume approx. 340 000 m^3/h
- Hydraulics station 118 m^2/h with redundancy pump
- Master-Slave with HR controller, 3 floor boxes, 31 field boxes

2017

Felix Platter hospital

- Total air volume approx. 165 000 m^3/h
- 1 network system with 5 supply air/exhaust air systems
- Hydraulics station 55 m^3/h with redundancy pump

2017

Campus clinic of Balgrist, SERI expansion

- 1 × Supply air / Exhaust air system each
- Air volume 15 000 m^3/h
- Water-Glycol approx. 5 m^3/h

2015

- 2 separate CCS network systems
- With 1 × Supply air / Exhaust air system each
- Air volume per system 31 000 m^3/h

2016

Zollikerberg hospital

- Total air volume approx. 32 000 m³/h
- Divided between 2 network systems (19 000 / 13 000 m³/h)
- 6 supply air and 5 exhaust air zones per network
- Each with hydraulics station with redundancy pump

2016

Westlink Tower and Cube, Altstetten

Divided into 3 network systems (1 × Tower, 2 × Cube)

- Tower: 78 000 m³/h air and 23 m³/h water-glycol
- Cube-1: 16 000 m³/h air and 5 m³/h water-glycol
- Cube-2: 24 000 m³/h air and 7 m³/h water-glycol

2015

Cantonal pharmacy of Zurich, Schlieren

- HR network system with 4 supply air and exhaust air systems
- Hydraulics station with heat supply and cold uncoupling
- Adiabatic, atomizing humidifier (Humidos) for cold recovery in summer

2015

GH Rorschacherstrasse, St. Gallen

- 2 separate CCS network systems
- With 4 supply air and 2 exhaust air systems each
- Air volume 15 000 m³/h each
- Hydraulics station 4.5 m³/h with heat supply

2015

Europaallee, Baufeld H, Zurich

- Air conditioning systems for the hotel, cinema, service rooms, restaurant, kitchen
- Total air volume approx. 210 000 m³/h
- 11 CCS network systems (supply air, exhaust air)
- 11 hydraulics stations with HR controller
- Exhaust air systems with adiabatic humidification (CR in summer)

2014

Botanical garden, university of Zurich

- Supply air / exhaust air system renewal
- Air volume per device 110 000 m³/h
- HR station with heat supply

2014

AXA Superblock, Winterthur

- Total air volume approx. 43 000 m³/h
- 4 supply air and 4 exhaust air systems
- 1 network system with 13 m³/h and heat supply

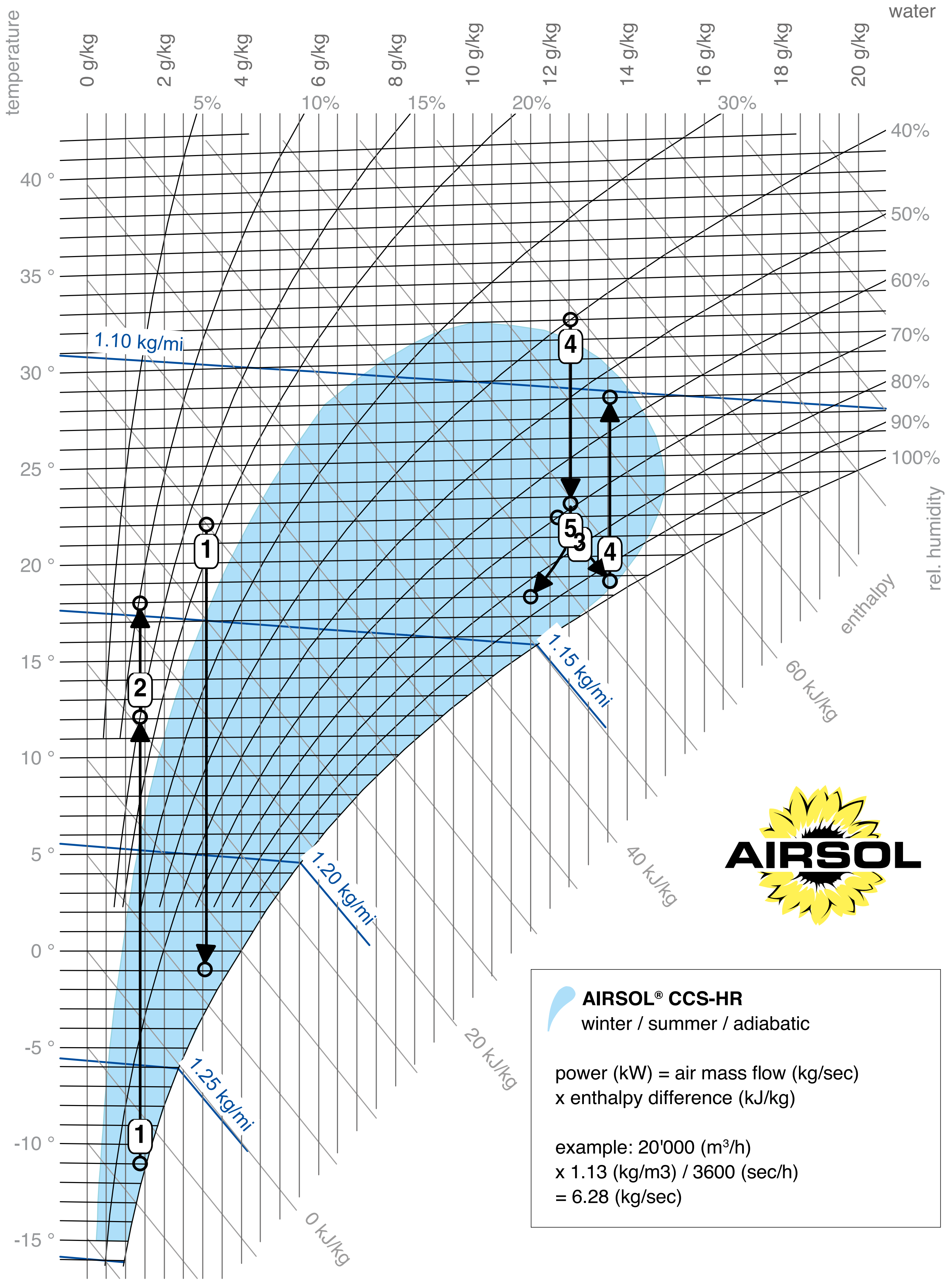
2013

Triemli hospital of Zurich (construction stage B/C)

- S2 hygiene devices implemented. Devices for primary air conditioning, operation rooms with dehumidification, insulation chamber and many individual systems for the various medical areas.

Mollier h-x diagram

Mollier-h-x diagram for humid air / pressure 0.960 bar (450.000 m / 10.000 °C / 80.000 % r. H.)



AIRSOL® CCS-HR
winter / summer / adiabatic

power (kW) = air mass flow (kg/sec)
x enthalpy difference (kJ/kg)

example: 20'000 (m³/h)
x 1.13 (kg/m3) / 3600 (sec/h)
= 6.28 (kg/sec)

Quote enquiry AIRSOL® CCS-HR

Project name			
Company		Date	
Contact person		Deadline	
E-Mail		Telephone	

TECHNICAL DATA

Plant number / name						
Hight above the sea						m a.s.l
Insulation thickness [mm]	☐ 42 / 54		☐ 54	☐ 100		
Minergie	☒ Yes					
Supply air quality level	☐ Q1	☐ Q2	☐ Q3	☐ Q4		
Supply air flow volume (20 °C/40 %)						m³/h
Supply air external pressure						Pa
Supply air filtering	☐ G4	☐ M5	☐ M6	☐ F7	☐ F8	
	☐ F9	☐ H10	☐ H11	☐ H12	☐ H13	
Exhaust air quality level	☐ Q1	☐ Q2	☐ Q3	☐ Q4		
Exhaust air flow volume (20 °C/40 %)						m³/h
EA external pressure						Pa
Exhaust air filtering	☐ G4	☐ M5	☐ M6			
	☐ F7	☐ F8	☐ F9			
Installation	☐ inside		☐ outside			
Colour	☐ Standard: RAL5012, blue					
	☐					
Connectors	☐ Yes	☐ No	☐ Insulated			
Valves	☐ OA	☐ EA	☐ CA	☐ SA	☐ RA	
Base frame height						mm
Maximum dimensions			Length			mm
			Width			mm
			Height			mm
Type of heat recovery		☒ CCS				
Min. heat recovery efficiency level						%

Glycol proportion	☐ Ethylene-Glycol			%
	☐ Propylene-Glycol			%
Circulating air (CA)				%
Air flow steps	☐ 1	☐ 2	☐ variable	
Air heater	Flow	°C	Return	°C
Air cooler	Flow	°C	Return	°C
Type of fan	☐ EC fan			
	☐ Direct drive with AC motor			
	Belt-driven fan	☐ Flat	☐ Wedge	
Humidifier	Vapour humidifier		☐ SA	
	Contact humidifier		☐ SA	☐ RA
	Atomizer		☐ SA	☐ RA
Humidifier water quality		☐ soft	☐ desalinated	
Dehumidification circuit		☐ Yes	☐ No	
Accessories	☐ Assembling	☐ Disassembled on-site mounting		
	☐ Refrigerant			
	☐ Controls			

AIR CONDITIONS

	SUMMER	WINTER
OA: Temperature	°C	°C
OA: Rel./Abs. humidity	%/g/kg	%/g/kg
SA: Temperature	°C	°C
SA: Rel./Abs. humidity	%/g/kg	%/g/kg
RA: Temperature	°C	°C
RA: Rel./Abs. humidity	%/g/kg	%/g/kg

MOUNTAIR

AIRSOL

Mountair AG
Lufttechnischer Apparatebau
Sonnenwiesenstrasse 11
8280 Kreuzlingen

T +41 71 686 64 64
F +41 71 686 64 76

Mountair AG, Basel
Florenzstrasse 9
4142 Münchenstein

T +41 61 841 09 74
F +41 61 841 09 75

Mountair AG, Suisse Romande
Route de Saint Julien, 275
1258 Perly

T +41 (0)79 104 90 38

info@mountair.com
www.mountair.com

2020-09 | cinziadesign.ch