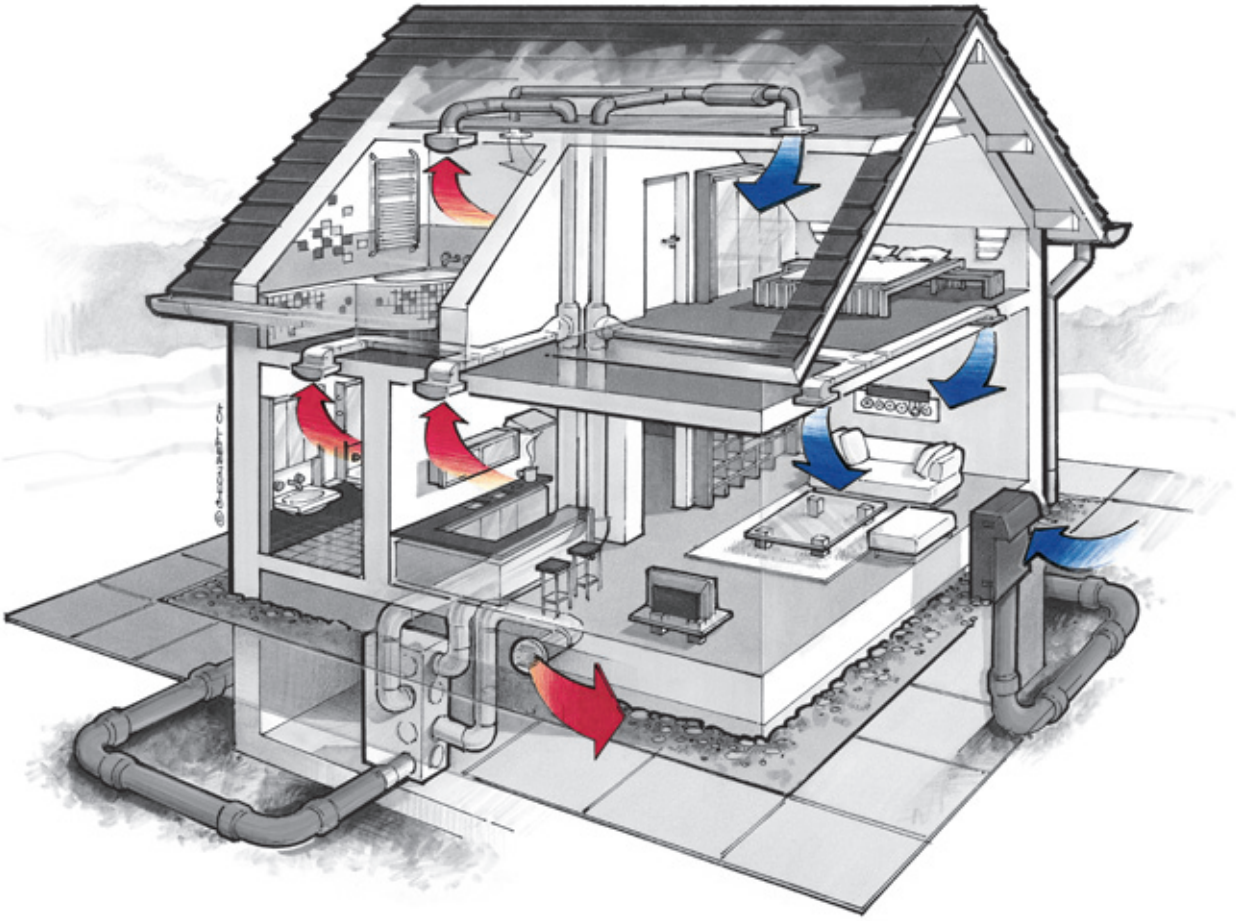
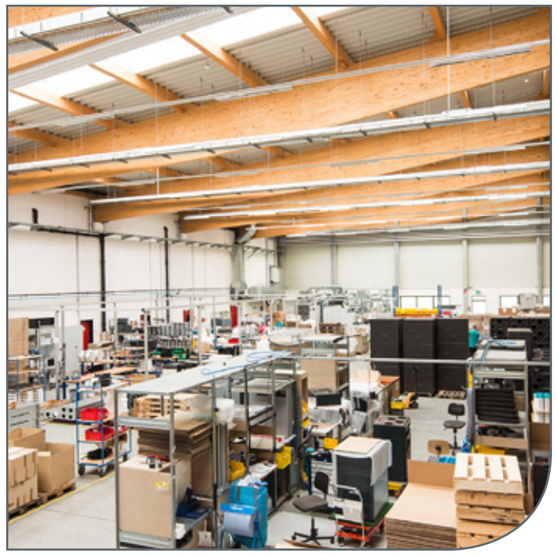
PAUL



Energy-efficient ventilation for healthy living comfort



Company presentation

Since its foundation as sole proprietorship by Dipl.-Ing. Eberhard Paul in 1994 the company PAUL has been ranking among the pioneers and technology leaders in the ventilation industry.

The idea of a new heat exchanger with counter flow channel principle served as a starting point already in the early 90's. The first publications on this issue in **1991** were followed by a wide response and high appreciation among international experts.

The first prototype was developed in **1993**. One year later Eberhard Paul realised the idea of a complete heat recovery unit for building ventilation thus far that the foundation of his own company was a logical step. The team started its work with ten employees in Zwickau and moved into larger premises in the nearby town Mülsen shortly afterwards.

From the beginning the company PAUL committed itself as an expert for highly efficient heat recovery in domestic ventilation. MULTI, the first ventilation device with heat recovery was launched in **1996**, followed by numerous innovative product developments, patents and distinctions.

In **2002** PAUL was the first company in Germany to be awarded the Certificate "Passive House-Suitable Component" of the Passive House Institute Dr. Wolfgang Feist in Darmstadt for its domestic ventilation device THERMOS.

The change of the company's legal status into a GmbH and the access of the participator Zehnder Group in **2004** laid the foundations for the further growth of the company.

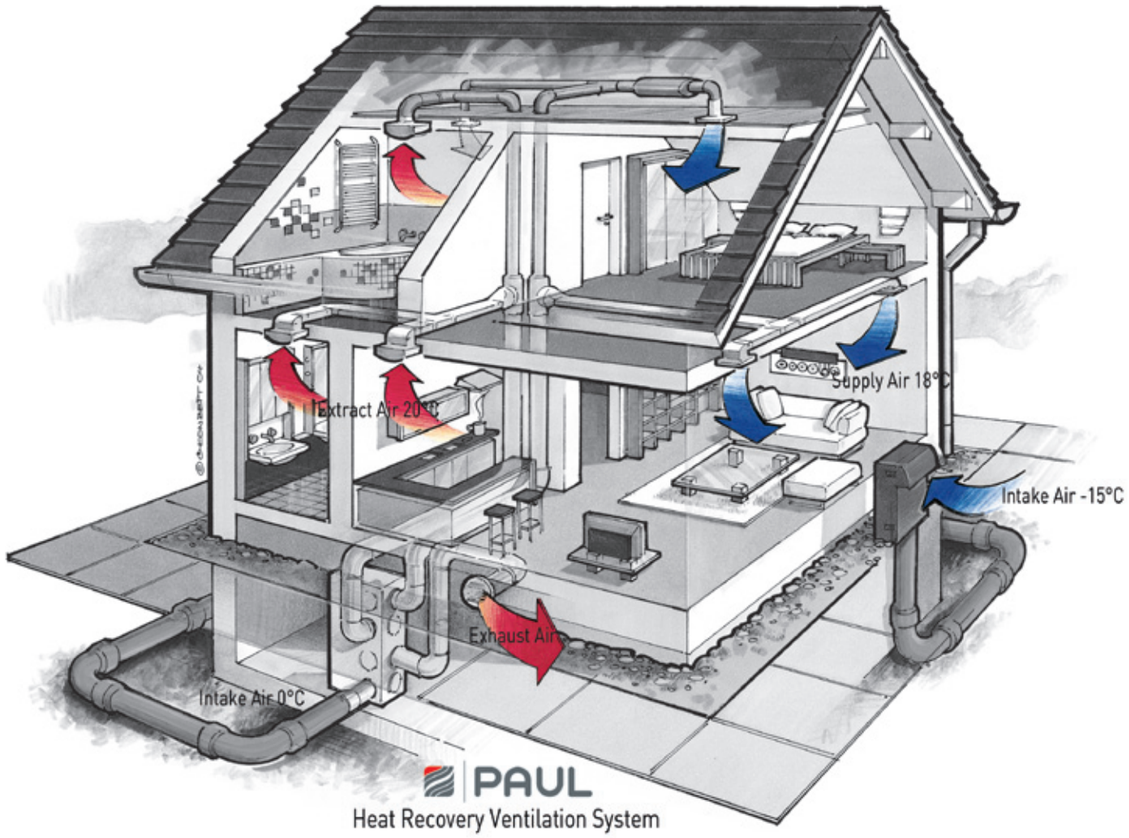
In **2009** the company moved into the present headquarters in the business park Reinsdorf near Zwickau, directly adjacent to the highway A72. Consequently pursuing the company's philosophy, the new administration wing was built in passive house design and was the first non-residential building in Saxony to be certified by the Passive House Institute.

In **2010** PAUL set new standards in the ventilation industry with the NOVUS 300. It is currently the device with the best heat recovery in the market being awarded the Passive House Certificate.

In **2012** the NOVUS F300 was the first ventilation device with moisture heat exchanger to be awarded the Passive House Certificate.

Today PAUL offers a wide range of high-quality, passive-house certified devices Made in Germany all over Europe and ranks among the leaders in the segment of domestic ventilation.

In 2014 the team of "Passive Activists" with approx. 70 employees celebrates its 20th anniversary.



What is controlled ventilation

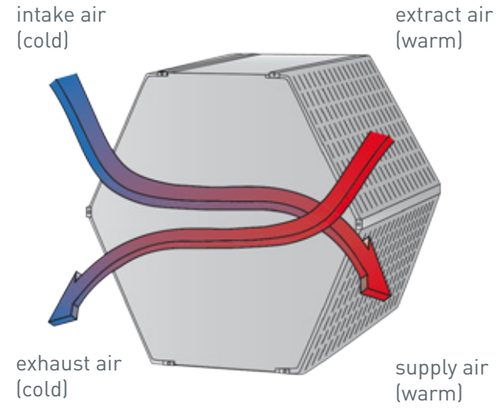
Modern construction methods for low-energy and passive houses, but also for renovations are characterised by high thermal insulation and minimised thermal bridges. The resulting tightness of the building envelope requires a regular active air exchange for the wellbeing of the occupants and for the protection of the structure.

Ventilation systems with heat recovery provide the adequate air exchange for both, the occupants and the building structure at any time of day. Pollutants, odours and excessive moisture are discharged and that the supplied fresh air is filtered and free from dust and pollen. Environmental noise and insects will stay outside. At the same time, the energy consumption is significantly reduced, compared to the traditional natural ventilation.

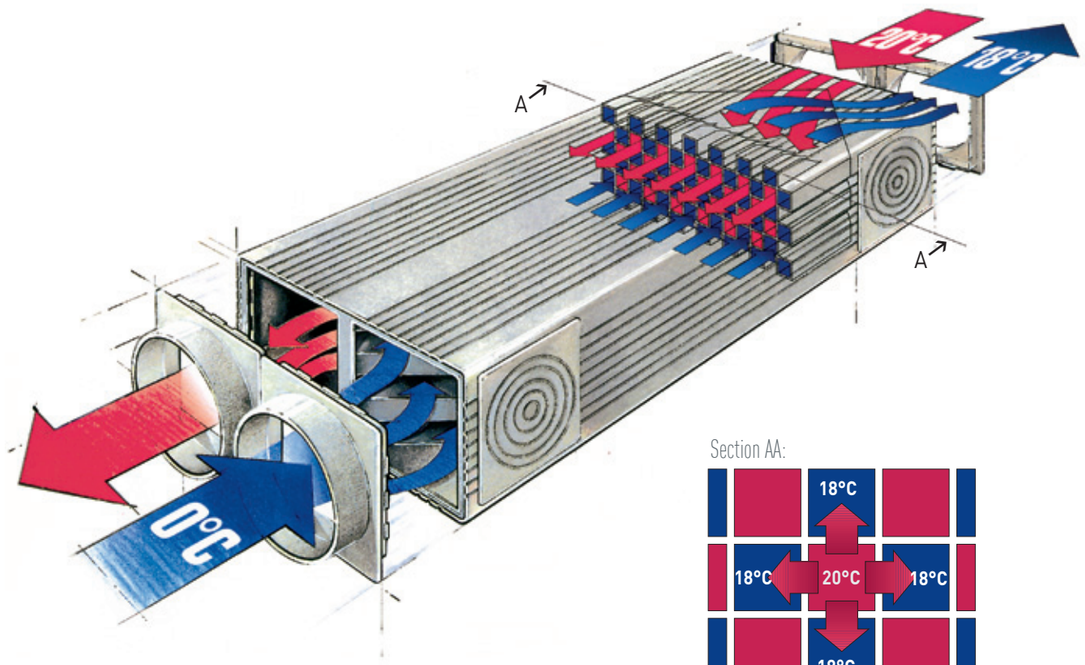
The PAUL heat recovery system for the controlled ventilation of living spaces consists of a heat recovery unit and an air duct system which supplies the house with fresh air, draft-free. Used, odorous and moist air is extracted in the kitchen, bathroom and toilets.

During the cold season, the heat of the extract air is transferred to the fresh air into the dwelling and therefore saves valuable heat energy. In the warmer time of year, a summer by-pass can provide fresh, filteres air without heat recovery.

The „heart“ of every heat recovery unit is the heat exchanger (image below). It transfers the heat of the warm extract air to the cold intake air from the outside. The more the heat exchange rate, the better the effectiveness of the heat exchanger and therefore, the saving of heat energy. PAUL heat exchangers achieve the highest efficiencies.



The intelligent and user-friendly control of the ventilation system ensures adequate fresh air supply at any time, as well as high living comfort at low heating costs. But with a ventilation system, you not only invest in comfort and energy savings, but also in the long-term maintaining of your building structure.



Section AA:

Heat exchange takes place in all directions to the cold medium.

The concept of PAUL heat exchangers

The technology of the heat exchanger contributes mainly to the efficiency of the heat recovery units. A very good heat transfer is necessary for high efficiency heat exchangers.

With the patented PAUL **counter-flow channel heat exchanger** (see image left), we achieve a certified heat recovery of effectively 94% heat supply rate for 144 m³/h (according to the Passive House Institute Dr. Wolfgang Feist, Darmstadt) with our top device NOVUS 300.

This means that the external air can be heated from 0°C to over 18°C using the waste heat (extract air 20°C.)

Counter flow concept:
Cold external air and warm extract air are flowing parallel in opposite directions. The counter flow principle has proven to be much more thermodynamically efficient than the widely used cross-flow heat exchangers (plate heat exchanger).

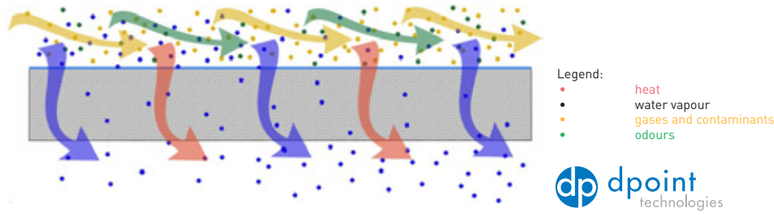
Channel flow concept:
The air flows through the heat exchanger in many small square plastic tubes, whose cross-section resembles a chess board pattern. This channel flow concept enables the heat exchange to all four sides and therefore, a much higher efficiency can be achieved, than with conventional plate heat exchangers.

Alternative moisture heat exchanger

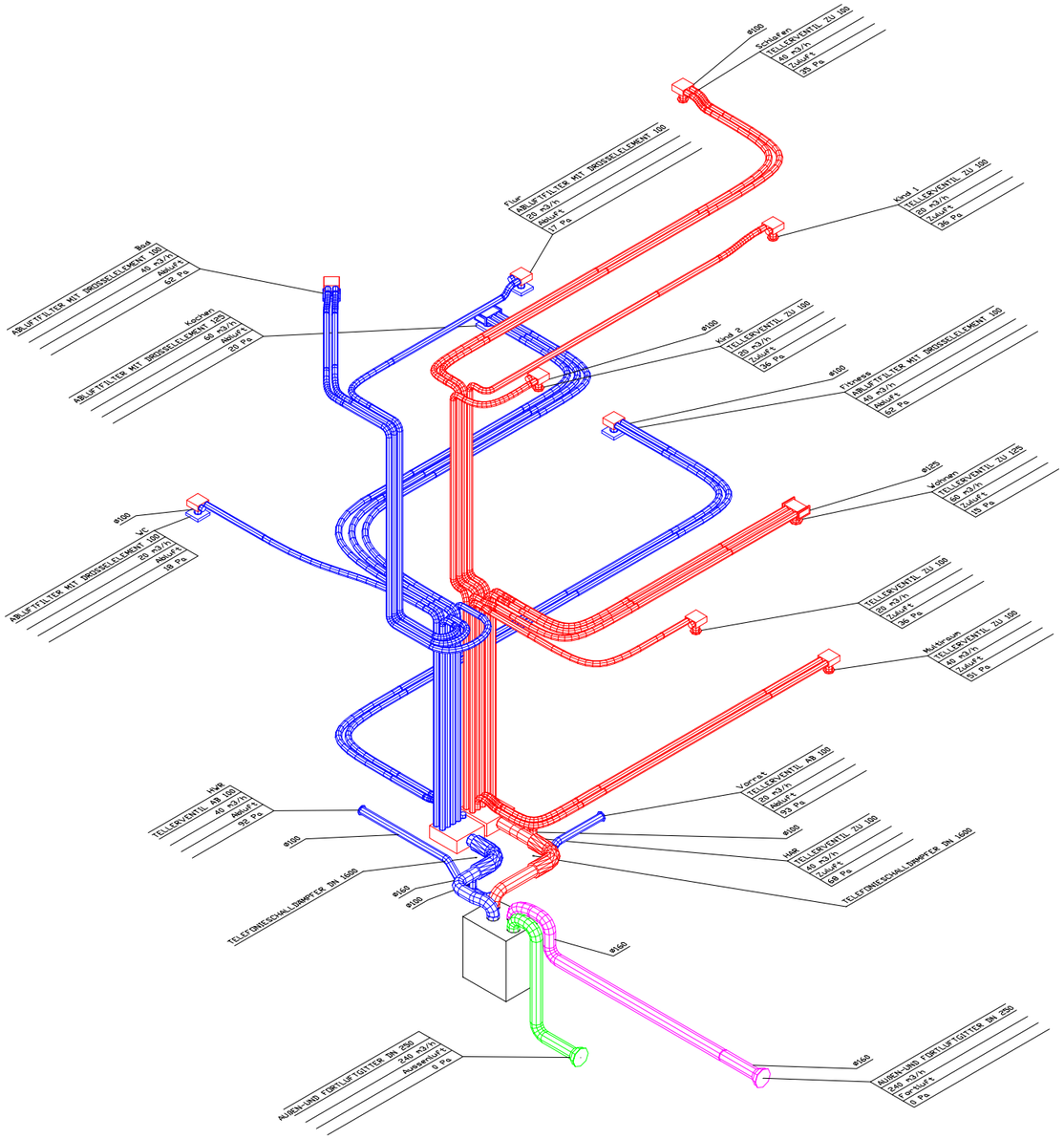
As an alternative to the PAUL standard heat exchanger, most of our heat recovery units can also be equipped with an also highly efficient, moisture-transmitting counter flow heat exchanger (enthalpy exchanger).

In living spaces with low humidity, it provides a convenient humidity due to the additional moisture recovery from the extract air. The warm and cold air flows are separated by a selective polymer membrane film (dpoint technologies). The hygiene is ensured at any time due to the anti-microbial properties of the membrane (Microban®), only heat and water vapour are transferred. The transfer of gases and pollutants is excluded (see image below).

Up to 75% moisture recovery ensure a convenient room climate at any time, without the air drying out.



Function and construction of a PAUL ventilation system



3D string diagram of a ventilation system with the PAUL OCTOPUS system

The PAUL comfort ventilation system mainly consist of the central heat recovert ventilation unit and the air distribution system to the individual rooms. Via the air ducts, the used air (extract air) is discharged and fresh air (supply air) is supplied.

An external air intake provides fresh air for the ventilation unit. Depending on the design, the outside air reaches the ventilation device directly or via a ground heat exchanger. A ground heat exchanger is an underground pipe system which transports the fresh air from an external intake box to the ventilation system. The temperature of the ground enables the pre-warming of the fresh air to approx. 0° during the cold season, and during the summer, to approx. 22°C. Without a ground heat exchanger, a defrost pre-heater (electric or brine) is necessary, in order to protect the heat exchanger from too cold fresh air.

Subsequently, the outside air is filtered in the ventilation unit and is then transported through the heat exchanger. Here, the heat of the warm extract air (approx. 20°C) is used to raise the temperature of the fresh air (down to 0°C) to a convenient temperature level. This process is called heat recovery. The better the heat recovery rate of the ventilation unit, the higher the energy-efficiency of the ventilation system.

In doing so, fresh air and extract air are flowing in separate systems and are not mixed. Two separate fans ensure the air transport. The ventilation unit guides the fresh air into the individual rooms via supply air ducts. The used air is transported to the ventilation unit via extraction air ducts, is filtered and then used by the heat exchanger to heat up the fresh air. Subsequently, it reaches the outside via the exhaust air duct.

Thus, the air distribution system is divided into supply air and extract air ducts. Silencers prevent the transport of the machine noise through the ventilation ducts. Necessary components are also the distribution systems, air passage casings (for octopus system), as well as filters, outlets and valves.

The ventilation is controlled via a control panel, which is often located centrally in the dwelling. It can be adjusted according to the different usage patterns. Our high-end TFT touch panel can be programmed for each day of the week in quarter-hourly steps. it also indicates when the required filter checks or replacements are due.

The main components of the whole house comfort ventilation system are (see image left):

- Outside air inlet with filter, if necessary with ground heat exchanger or defroster elements
- Outside air ducts (green)
- Ventilation unit with heat recovery
- Device silencer
- Supply air ducts (red)
- Air passages with supply grille or supply air valves
- Extract filter elements
- Extract air ducts (blue)
- Exhaust air ducts (purple)
- Control with external control panel

Overview of ventilation units with heat recovery

	Air quantity m³/h (0 – 100 – 200 – 300 – 400 – 500 – 600)	Range: Habitable space	Range: Single-family home	Range: Multi-dwelling unit	Range: Business	Range: Base	Installation: Wall	Installation: Ceiling	Installation: Cabinet	Installation: Floor	Enthalpy (option)	Passive House Certificate (PHI)*	Heat recovery acc. to PHI certificate*	Elektric efficiency in Wh/m³ acc. to PHI certificate*	
VENTOS 50 (decentralized unit)	0 – 100	■					■								
CLIMOS F 200	0 – 200		■	■			■	■			Serie				
FOCUS (F) 200	0 – 200		■	■		■	■				■	■	91%	0,31	
NOVUS (F) 300	0 – 300		■	■		■	■				■	■	93% 84%	0,24 0,26	(Enthalpy)
NOVUS (F) 450	0 – 450		■	■		■	■				■	■	89%	0,29	
SANTOS (F) 570 COOL	0 – 570		■	■	■				■	■	■	■[1]	84%)[1]	0,31)[1]	)[1] for SANTOS 570 without cooling unit
MAXI FLAT SERIES	0 – 2000		■	■	■			■				■[2]	78%)[2]	0,37)[2]	)[2] for MAXI FLAT 600
MAXI SERIES	0 – 6000		■	■	■				■						

* PHI certificate: „Certificate Passive House suitable component"
(Passive House Institute Dr. Wolfgang Feist, 64283 Darmstadt, Germany)

FOCUS (F) 200

TFT touchpanel

LED control panel

- Heat recovery unit for whole house ventilation
- Up to 150 m² room area
- Volume flow range: 60 up to 200 m³/h
- Compact construction
- Optionally with moisture recovery (enthalpy exchanger)
- Left and right device version
- Outside air and extract air filter of filter category G4 (EU4), optional pollen filter F7 (EU7) for outside air
- External control panel: TFT touch panel with colour display (optional: LED control panel)
- Housing made of galvanised, powder-coated steel
- Made in Germany

Heat recovery rate (effective):
*91 % **
Electric efficiency in Wh/m³:
*0,31 **

* FOCUS 200

NOVUS (F) 300 / NOVUS (F) 450

TFT touchpanel

LED control panel

- Heat recovery unit for the whole house comfort ventilation
- Up to 350 m² room area
- Volume flow range 75 up to 300 m³/h (NOVUS 300) or 50 up to 450 m³/h (NOVUS 450)
- Automatic summer bypass control with motorised 100% bypass flap
- Optional with moisture recovery (enthalpy exchanger)
- Installation variants: vertical or horizontal on mounting frame, or wall mounted, left and right handing
- Outside air and extract air filter of filter category G4, optional pollen filter F7 for outside air
- External control panel: TFT touchpanel with colour display (optional: LED control panel)
- Housing made of galvanised, powder-coated steel sheet
- Made in Germany

Heat recovery rate (effective):
93 % [1] / 89 % [2] / 84 % [3]
Electric efficiency in Wh/m³:
0,24 [1] / 0,29 [2] / 0,26 [3]

[1] NOVUS 300, [2] NOVUS 450, [3] NOVUS F 300

CLIMOS F 200

PLUS X AWARD®
honored as:
BEST PRODUCT OF THE YEAR 2014

PLUS X AWARD®
2014 achieved for:
Innovation
Functionality
Ecology

TFT touchpanel

LED control panel

- Heat recovery unit for the whole house comfort ventilation
- Up to 150 m² room area
- Volume flow range 45 up to 200 m³/h
- especially made for new and existing buildings and complicated installation situations
- frost protection guaranteed by an integrated defroster (model ‚comfort')
- serial with humidity transferring heat exchanger, no condensate drain neccessary
- Especially for installation in suspended ceilings
- Custom-made maintenace hatch for drywall construction is available as an option
- left and right device version
- Outside air and extract air filter of filter class F5 (EU5), optional pollen filter F7 (EU7) for the fresh air
- External control panel: TFT touchpanel with colour display, optional: LED control panel (only version „basic")
- Housing made of galvanised, powder-coated steel sheet
- Made in Germany

SANTOS (F) 570 cool

- Heat recovery unit for the whole house comfort ventilation
- Up to 435 m² floor area
- Volume flow range: 50 up to 570 m³/h
- Automatic summer bypass control with motorised bypass flap
- Optionally with moisture recovery (enthalpy exchanger)
- Mounting variants: standing on mounting frame or wall mounted
- Outside air and extract air filter of filter class G4 (EU4), optional pollen filter F7 (EU7)
- External control panel: 3-step switch or Comfosense
- Additional control panel on the device
- Housing made of powder-coated steel
- Optional with cooling attachment as exhaust air-supply air heat pump (image)

ZERTIFIZIERTE KOMPONENTE
Passivhaus Institut

Heat recovery rate (effective):
*84 % **
Electric efficiency in Wh/m³:
*0,31 **

* SANTOS 570 (without cooling unit)

VENTOS 50

- Heat recovery unit for the **decentralised** comfort ventilation
- Up to 60 m² floor area
- Volume flow range: 20 up to 115 m³/h
- As single-room device with ventilation grids (image)
- As isolated application for several rooms with connections for ventilation ducts
- Either visibly wall mounted on the external wall or flush-mounted into the external wall
- Outside air and extract air filter of the filter class G4 (EU4), optional pollen filter F7 (EU7)
- Control panel integrated into the housing (membrane keypad), optionally available as external control panel (PEHA switch program)
- Housing made of galvanised steel, painted white
- Made in Germany

MAXI flat and MAXI series

for MAXI flat 600

- Heat recovery unit series for the central comfort ventilation
- For larger and large-scale objects
- Volume flow range 50 up to 2000 m³/h (MAXI flat) or 100 up to 6000 m³/h (MAXI) in different sizes
- Temperature-controlled, motorised 100 % bypass flap for summer operation
- Standard antifrost function by means of adjustment of the supply air and extract air volume flows for winter operation
- Central terminal box of the control (pre-wired within the factory) at the operational side of the device
- One all-pole main switch each for voltage disconnection of the fans/checking devices and the electrical defroster and/or supplementary heating batteries
- Housing made of aluminium profile frame and thermally insulated, double-walled sandwich elements, galvanised on the inside, powder-coated on the outside, mounted on base frame

Accessories (program excerpt)

OCTOPUS White Line
(HDPE air distribution boxes and valve housings)

air outlets, preliminary filters, valves

heatable air outlets

Air intake tower 300
(for ground heat exchangers)

Brine defroster (for pre-heating or cooling of the intake air)

iso box DN 160 (for air filtration, pre-heating and post-heating)

iso box DN 125 (for air filtration and pre-heating)

Frequently asked questions

Why do I need a ventilation system?
New and refurbished building envelopes are getting more air tight. However for the health and comfort of the occupants, as well as for the preservation of the building structure from damages through humidity, a regular fresh air supply and extract is necessary. It is almost impossible to achieve this in a user-independant way, without technical solutions.

What are the advantages over conventional ventilation?
A ventilation plant significantly increases the living comfort substantially, because it ensures a constantly good air quality (CO2 content) at any time of day, independent of the behaviour of the occupants. Pollen filter ensure a pollen-free environment for people suffering from hay feaver. Compared to natural ventilation (with trickle vents), a whole house ventilation system with heat recovery consumes only a fraction of the energy.

How can the drying up of the air during winter be prevented with a ventilation plant?
For most PAUL units, we also offer a moisture heat exchanger (enthalpy exchanger) which is able to recover both heat and moisture from the extract air. In doing so, it's special technology excludes the transmission of gases and pollutants. For the UK it is usually not necessary to use a moisture heat exchanger due to the different climatic conditions.

How can the contamination of ventilation ducts be prevented?
Dirt particles of the outside air are already held back by preceding filter systems as well as by filters in the ventilation unit and so, the supply air ducts are hardly contaminated at all. Likewise, preliminary filters at the extract air outlets of the rooms and in the unit reduce the contamination of the exhaust air ducts. Regular checks and filter replacements are part of the periodical but very easy maintenance tasks for ventilation plants. Furthermore, the PAUL semi-rigid ducting system is designed in such a way that it can be easily cleaned.

How often do I have to replace the filters in the ventilation unit?
A regular check of the filters shall be carried out every three months which is also indicated by the filter replacement display of the units. We recommend the filter replacement at least twice per year.

What are the possibilities of using the PAUL ventilation plant as a supplement for the heating?
The high efficiency of our heat exchangers already ensures fresh air which is heated up to 18°C. Accessories for additional heating are available in our range (supplementary electric or warm water heating batteries).

How do I avoid noise transmission between the rooms via the ventilation unit?
Different silencers in the system serve the purpose of eliminating device noises, as well as cross-talk between the rooms (when a branch-type ducting system is used). The star-shaped OCTOPUS distribution system by PAUL avoids the cross-talk effect.

Do you recommend to integrate a cooker hood into the ventilation system?
Due to the technical specification of cooker hoods, we do not recommend an integration into the ventilation plant. The most energy efficient solution is the use of a re-circulating hood with active coal filter. Thus, the grease contamination is filtered by the hood and the odorous extract air is discharged via the ventilation system. An extract point for the MVHR system is to be located close by and needs an additional filter to protect the ductwork from grease deposits.

What has to be considered if Heat Recovery Systems are to be installed in buildings with combustion appliances?
In general, a combustion appliance with separate fresh air supply, independent of the room air is recommended. An open-flued combustion appliance is to be located in a positve pressure room (with supply air inlet), e.g. a lounge room.

Who can help me with the planning of the living space ventilation plant?
Die PAUL Wärmerückgewinnung GmbH has a comprehensive network of representatives who in turn are co-operating with many planning offices, architects and installation companies in your region.

Where can I get information on possible subsidies for the installation of a ventilation plant with heat recovery?
Subsidy programs not only differ nationally but also on federal states level. Please ask your contact partner of the representation responsible for your region.

Which services are offered by PAUL as manufacturer?
PAUL supports all planners and qualified servicing companies with the planning of ventilation plants. Based on the EnEV and DIN regulations, commercial businesses can plan and calculate their projects online at www.octopusplan.de. Furthermore, we will prepare a free and non-binding offer based on your construction plans. We will also provide a binding planning dimensioning of the ventilation plant for your your object at a fixed price. We regularly offer different training courses about the general and technical basics of living space ventilation, as well as the application of the extensive range of PAUL for commercial customers and all those interested. For you as an owner of a PAUL ventilation system, or as an installer of our devices, our service team as a contact partner is regularly available to you via telephone and email, and if required, also on site.

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