

# DIAMANT®

Heiz- und Klimasysteme GmbH

www.diamant-klimasysteme.com

**One-stop supply:  
Development, design, consul-  
tancy, planning, sales, installa-  
tion and after-sales service...**

Member of the following associations



Mitglied im Fachverband  
WOHN-WINTERGARTEN E.V.



**Wintergarten  
Fachverband e.V.**



Vereinigung der Freunde und Förderer der  
Gewerblichen Akademie für Glas-, Fenster-  
und Fassadentechnik Karlsruhe e.V.

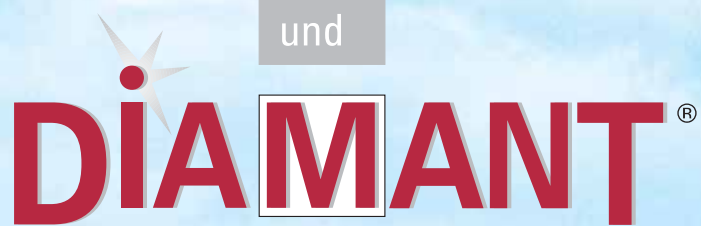
... since 1995, over **5'000** winter garden owners have benefited from the unique advantages offered by DIAMANT heat pumps

- uses sustainable environmental energy - solar energy and geothermal energy
- cooling – less humidity diminishes insect populations
- environmentally friendly, saves primary energy efficient and cost-conscious heating and cooling system
- Economic incentives to comply with German regulations
- no separate boiler room necessary
- individual customised solutions
- easy setting of temperatures via a selection switch and infrared remote control device or, alternatively, via control system
- up-to-date timing device, data saved will be stored during power cuts
- compact appliances for easy maintenance
- uncomplicated installation, also in existing winter gardens
- 100% tested – two years warranty on all mechanical components
- condensation automatically drained  
Protection against humidity and mould
- burglar-proof (no chances of breaking and entering) Security during residents' absence
- state-of-the art engineering, high degree of efficiency, little noise pollution combined with high performance

**There's only one source: your winter garden specialist:**

All about winter gardens:

HEIZ-  
und

DIA MANT®

KLIMA  
SYSTEME

- Plants
- Glazing
- Shades
- Heating systems
- Control systems



The comprehensive winter garden booklet

**DIAMANT**  
**heat pumps**  
**A pleasant**  
**climate in your**  
**winter garden –**  
**all year round**

The most basic summerhouse and the palatial orangery both prove just how much pleasure mankind has always had in cultivating nature. Nowadays, a winter garden is the ideal option for enjoying nature all year round. This booklet gives you an overview of suitable plants and of the climatic and technical conditions for successful winter gardens, enabling you to enjoy your own for many years to come.



- Heating
- Temperature control
- Humidity control
- Air cleaners



Foto: MICKAN, Rippen bei Dresden



### Plants / climate (Tropical winter gardens and interiors)

Before you even start designing your winter garden, you will need to map out your plants: Tropical plants such as ferns, orchids as well as all forms of ficus will need a fairly constant climate, night and day.  
**Pages 4 – 5**



### Plants / climate (Subtropical winter gardens and interiors)

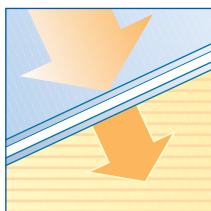
Subtropical plants such as citrus or palm trees thrive in an environment with cooler nights and warm days. Plant longevity depends on the climate and the environment (condensation can be a major problem).  
**Pages 6 – 7**



### Energy bills

As all winter gardens need to be climate controlled, energy consumption cannot be avoided. DIAMANT heat pumps make systematic use of environmental energy and are much more cost-efficient than traditional systems.

**Pages 8 – 11**



### Technical conditions

Your winter garden should reflect your personality. The right choice of glazing and shades is essential for setting the correct climate. Climate control should be geared to the size of your winter garden: DIAMANT heat pumps offer you the ultimate solution.  
**Pages 12 – 15**



### Compact Control for Your Winter Garden

The intelligent control system, optimising the microclimate as well as the shading and controlling the DIAMANT heat pump.

**Pages 16 – 17**

### Technical data

Overview of DIAMANT systems

**Page 18**

## Enjoy a Tropical Climate in the Comfort of Your Home

If you have opted for a tropical winter garden, the temperature should be a constant 20 degrees centigrade by day and by night. Heating is also required at night to avoid the temperature falling below 18 degrees centigrade. As a tropical winter garden climate is largely identical to a normal living room climate, there is no need for dividers to separate such a winter garden from the apartment/house in general.



Basic bed: before/after

### Plants

Tropical plants include the aralia family, bromelias (which thrive in moist surroundings), dracaena and ficus, ponytail palms and other palms, ferns, orchids, philodendron etc.

Climbers suitable for tropical winter gardens: Cissus family, especially Cissus quadrangula, Ficus pumila or creeping fig and climbing Euonymus. Tropical plants should not be used in south facing winter gardens.

Adequate shading is also a prerequisite. Plant size should be taken into account while planning a winter garden – tall palms are not suited for every indoor space. If possible, beds should be continuous under the structure of your winter garden, as connecting them to the outside soil makes for much better humidity control. An automatic watering system linked to a regulator relieves you of what can be a considerable chore.

- Heating
- Temperature control
- Humidity control
- Air cleaners

### Technical conditions

Tropical plants need a constant climate as well as enough shade. Automatic shading and climate control are an ideal solution. An all round control system makes your dream of a winter garden come true.

DIAMANT heat pumps react faster to changes in the micro-climate than other heating systems. Moreover they also have their uses in cooling your winter garden during summer.



Foto: MICKAN, Ripplien



Photo: PALMHOF-SIEGEL, Großsiedlach

## A DIAMANT heat pump has the following advantages

- constant micro-climate to enhance plant longevity
- Acts as a heating or cooling system in as required
- Filters and dehumidifies the air
- rapid air circulation to avoid the clouding and/or streaking of glass panes as well as corners getting mouldy
- DIAMANT heat pumps make efficient use of cost-free environmental energy
- DIAMANT heat pumps make a significant contribution to energy and cost savings
- DIAMANT heat pumps make no direct use of fossil fuels (oil, coal or gas)

## Subtropical climate – citrus flowers galore

Subtropical plants thrive under a natural thermal regime – warm by day and cool at night. In summer, they can stand temperatures of up to 30 degrees centigrade and they like cold winters (5 – 10 degrees centigrade). Therefore, you will not need to heat your winter garden fully at night or in winter, but you should provide a thermal barrier to your living space (e.g. sliding doors).



Foto: PALMENHOF SIEGEL, Großbaldach



Foto: Glanzhaus Rehm

### Plants

Cacti and fig trees as well as the entire citrus family do well in a winter garden. Even banana trees have been known to work in such a "Mediterranean climate" – your own private paradise. Tomatoes and olive trees also

add to the charms of a subtropical winter garden. It should face south, south-east or south-west. Again, getting your plants right in the planning stage is key. A sprinkler system makes watering much easier.



For our readers in Germany: As useful book by Walter Siegel, called "Grün im Wintergarten von Anfang an richtig eingeplant" is distributed by DIAMANT-Heiz+Klimasysteme GmbH, D-73635 Rudersberg.

### Technical conditions

Automatic climate control systems serve to reconstruct the volatile subtropical climate in a winter garden. The DIAMANT heat pump system combined with our control systems helps create ideal conditions for your plants.



Heating and climate control

- Heating
- Temperature control
- Humidity control
- Air cleaners



## Choosing DIAMANT has the following benefits

- Constant climate control for setting a subtropical climate
- Acts as heating or cooling system in accordance with your plants' needs
- DIAMANT heat pump systems cleanse, filter and dehumidify the air
- Our air circulation method reacts much faster to changes in temperature than traditional heating systems
- DIAMANT heat pumps make efficient use of cost-free environmental energy
- DIAMANT heat pumps make a significant contribution to energy and cost savings
- DIAMANT heat pumps make no direct use of fossil fuels (oil, coal or gas)

## New energy savings regulations in Germany (EnEV) in force since 1. February 1, 2002

The EnEV regulations are an update of former heat saving and heating systems regulations. The government wants to lower energy consumption and greenhouse gas exhausts by 28% by 2008 (Kyoto protocol). This means cutting heat consumption by one third from the regulations in force before 2002.

### Impact of EnEV regulations on winter gardens:



#### Lean-to winter gardens with less than 100 m<sup>3</sup> volume, no heating system

This type of winter garden constitutes an extension to an existing outer wall and provides access to the main house. The access has to be of the same type as any other outer door. The law differentiates between extensions of less than 100 m<sup>3</sup> and those of more than 100 m<sup>3</sup>. If total cubic space is below 100 m<sup>3</sup> and if no heating system is needed, no formal registration of energy/heat consumption will be necessary.

#### Newly built winter garden with heating system

If your winter garden is to be built from scratch and features a heating system, drawing up an energy balance will be required by law. The outer surface of your winter garden will be added to the entire surface of the building.

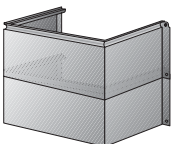
All governments have set up support programmes for sustainable energies and efficient energy use. There are several techniques, the use and promotion of which is subject to regional guidelines. These are solar energy, photovoltaics for generating electricity, passive energy-conserving homes, condensing boilers, heat pumps, combined heat and power (cogeneration) and fully-insulated heating networks.

New thresholds have been set for insulation against summer heat. These apply to limiting the use of energy, which otherwise might exceed heating energy by a large multiple. Efficient shading systems are mandatory to lower energy use even further. Moreover, systems engineering should take the shell of the building into account. EnEV regulations include losses/gains of heat through a building's shell as well as the use of energy in heating and air conditioning. EnEV so closely links thermal insulation of the outer walls to systems engineering that both factors need to be planned in conjunction. DIAMANT heat pumps conform with EnEV regulations. Our engineers continuously work to improve systems and accessories. Pipe insulation (set B2) is made according to DIN

ASTM B280 standards as well as EN 12.735-1 standards (temperatures from -40 degrees centigrade to + 150°centigrade with an upper limit of 175 degrees centigrade)  
Fire class DIN 4201-B2

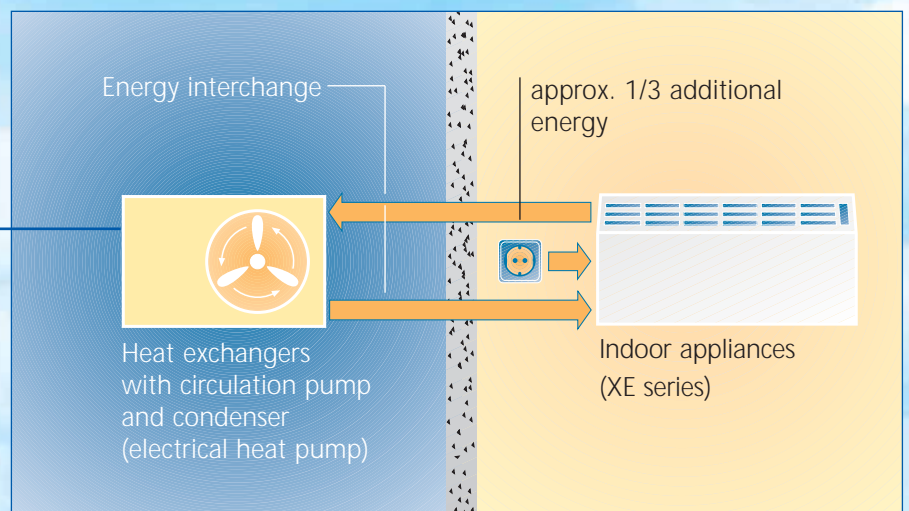
# Save energy through DIAMANT heat pumps

Make use of Nature's resources to lower your energy consumption. No loss of heat, no exhaust fumes – to the benefit of the environment. DIAMANT heat pumps contribute to saving considerable amounts of energy.



DIAMANT outdoor appliances come in all RAL shades of colour, therefore enabling near perfect matches to your house walls. Alternatively, you might use plants to disguise them. Setting the appliance into a pit to hide it from view is yet another option.

**about 66% of the energy used by any DIAMANT heat pump is generated from environmental energy at no cost.**



Copeland® compressors have been tried and tested millions of times.

## The system – economical with a high degree of efficiency.

Environmental energy, i.e. stored solar energy, is boundless. DIAMANT heat pumps use this type of environmental energy for heating purposes (even if temperatures fall below 0 degrees centigrade, stored solar energy will not run out, as absolute zero lies at 0 degrees Kelvin = - 273 degrees centigrade).

The outdoor appliance serves to cool down fresh air. Even at below-zero temperatures, heat will be extracted. Heat thus generated will be condensed and conducted inside via a cooling agent. DIAMANT heat pumps generate over two thirds of the necessary heat from air in a cost-free process. The remaining third is produced via the use of electricity.

# Heating systems for your winter garden

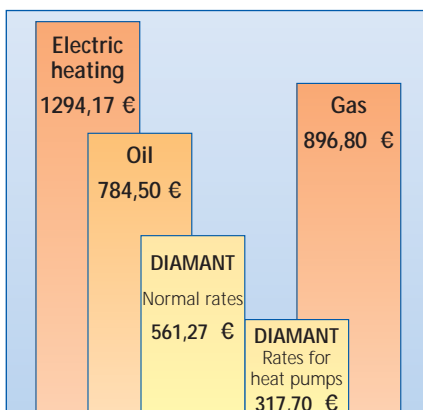
## A comparison

Winter gardens are no different to other rooms: they need to be heated when it's cold outside. The most important criteria in this respect are economic efficiency combined with low operating costs. The correct size of your heating system is key in meeting these two criteria. DIAMANT heat pumps offer more than one advantage for your winter garden:

### Invest in the future – lower your fuel costs.

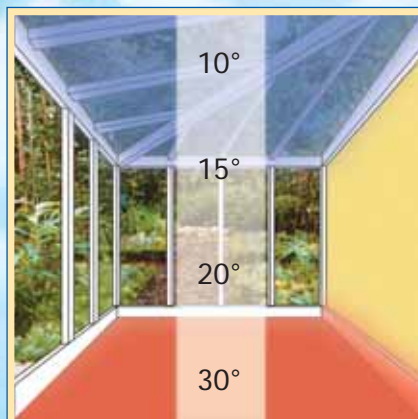
By comparison with oil or gas, e.g. long-distance heating, a DIAMANT heat pump enables you to save over two thirds on your energy bill through the cost-free use of environmental energy by extracting heat from fresh air – even at temperatures below -20 degrees centigrade – and using it as heat energy in the indoor appliance.

The remaining third will be electricity-generated. Therefore, DIAMANT heat pumps are a very cost-efficient and sustainable source of energy.



Comparison of operating costs on a yearly basis. Energy requires: 6.8 kW for 1900 hrs/year for a winter garden size of some 20 m<sup>2</sup>

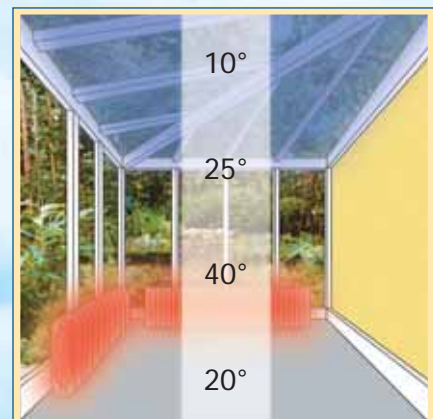
(additional solar energy has not been taken into account, all data as of December 2003).



#### Underfloor heating

Major heat loss from bottom to top. Inadequate as a steady source of heat. Temperature changes may produce condensation where panes and metal structures are joined.

- needs a long time to warm up, until the desired temperature has been reached – systems show exceedingly slow reaction to external effects such as wind or sun
- in order to ensure adequate temperatures, systems basically need to be running around the clock
- invisible heater
- Thermal dust
- Considerable heat requirement, heat on floor level at over 30 degrees centigrade which may lead to contamination
- Declining performance of the existing heating system over time (additional costs)
- central heating cannot be switched off at any time (colder summer days), has to remain on stand-by

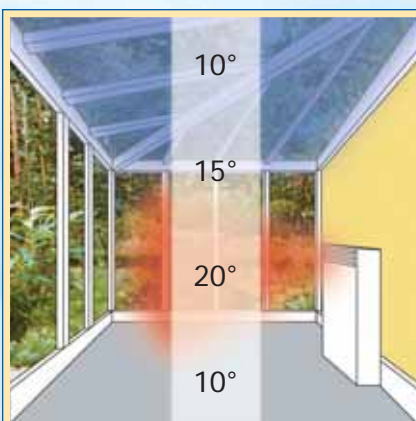


#### Convactor heater

Traditional means of heating a winter garden with strong variations in temperature. Temperature changes may produce condensation where glass panes and metal structures are joined.

- slow reaction until desired temperature is reached
- in order to ensure adequate temperatures, systems basically need to be running around the clock
- Thermal dust
- space-consuming – winter garden must be able to include radiators for the entire glass wall
- Declining performance of the existing heating system over time (additional costs)
- central heating cannot be switched off at any time (colder summer days), has to remain on stand-by

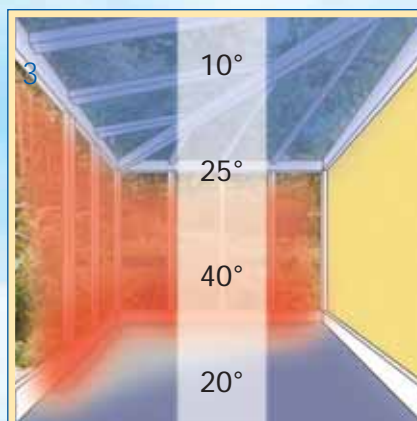
- Heating
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### Climate control unit with integrated heat pump function

Traditional climate control units are designed for living spaces, not as sole sources of heat. Their use in cooling down winter gardens is also limited.

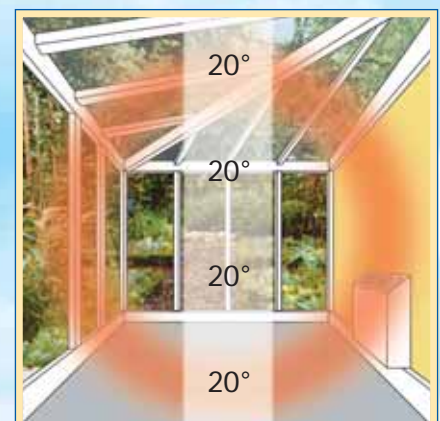
- Inadequate ventilation due to small rotor fan that has to work against the thermal effects in a winter garden
- noise pollution because of rotor fan
- Front suction causes dust and dirt very much visible
- plastic casing only available in white, yellows quickly in strong sunlight
- Little heat output, only efficient in outside temperatures above 5 degrees centigrade
- Intricate remote control, which is not particularly user-friendly
- Pipe assembly in accordance with EnEV regulations only in class B1 thermal conductivity  $\lambda$  at 0 degrees centigrade  $< 0.030 \text{ W/m } ^\circ\text{K}$ , operating temperatures from -40 degrees centigrade to +105 degrees centigrade, UV-resistant insulation (5 years)



### Underfloor heating

Heats winter gardens through inset convector heaters with or without electric fans, or so called skirting board convectors.

- invisible heater
- inadequate as sole heating system, should be combined with floor heating
- noise pollution because of rotor fan
- thermal dust, because dead insects and dust assemble under the grid when heating is switched off
- this type of convector heaters is limited to heating. Cooling requires a second system
- Declining performance of the existing heating system over time (additional costs)
- central heating cannot be switched off at any time (colder summer days), has to remain on stand-by



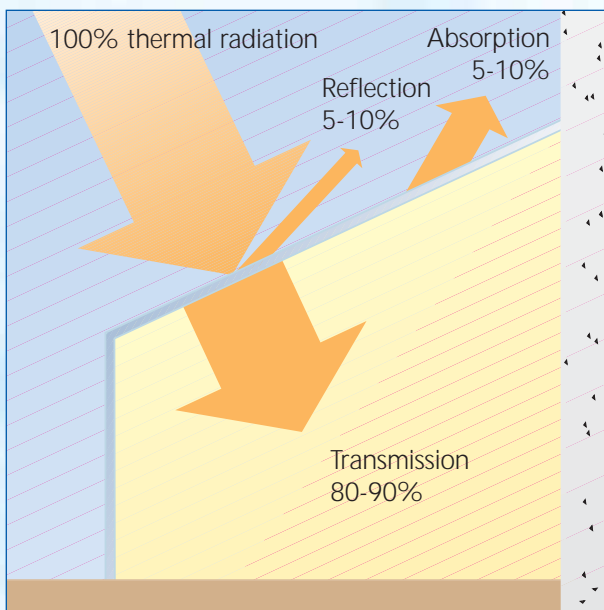
### DIAMANT heat pumps

Stable heat through air circulating at constant temperature. Quiet fans. No difference in temperature between panes and metal structures, no condensation.

- react quickly to changes in temperature - can be programmed
- one system heats in winter and cools in summer
- occupies less space than convector heaters
- filters dust and pollen, dehumidifies
- no condensation on panes
- easy subsequent fitting if necessary
- no moss or mould, no structural damage
- Pipe assembly in accordance with EnEV regulations, class B2 thermal conductivity  $\lambda$  at 0 degrees centigrade  $< 0.040 \text{ W/m } ^\circ\text{K}$ , operating temperatures from -40 degrees centigrade to +105 degrees centigrade, steam resistance  $\mu > 5000$ , UV-resistant insulation (over 5 years)

## Important – the right choice of glazing

Winter gardens add value and comfort and create light and communication with nature. But if your winter garden turns into a sauna in summer or if your sensitive plants freeze in hard winters, winter gardens can quickly become a nightmare. Therefore, the right choice of glazing (EnEV 2002) is key to successful planning. Insulated window frames and athermanous glass with a U-value below 1,3 can make a significant contribution to saving fuel.



### Calculating total energy transmittance

Total energy transmittance is the sum of total solar radiation passing through the glazing. The lower transmittance, the less energy passes and, consequently, heats the rooms behind.

### **u = heat loss**

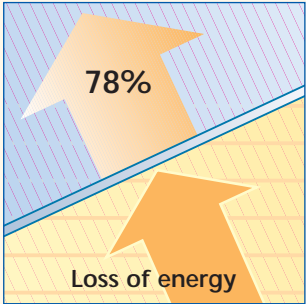
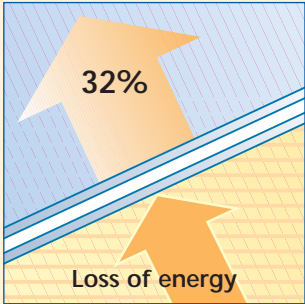
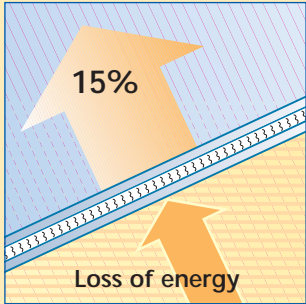
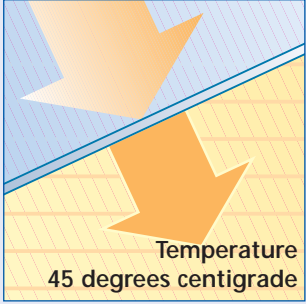
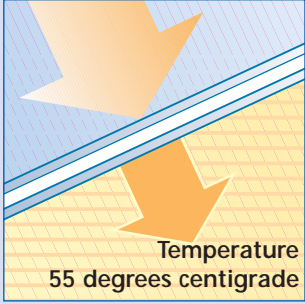
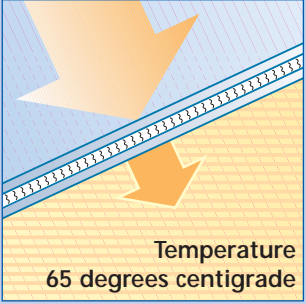
Heat loss through the constructional element from inside out as measured (identical to K)

### **t = transmittance**

Volume of light passing through a transparent construction unit



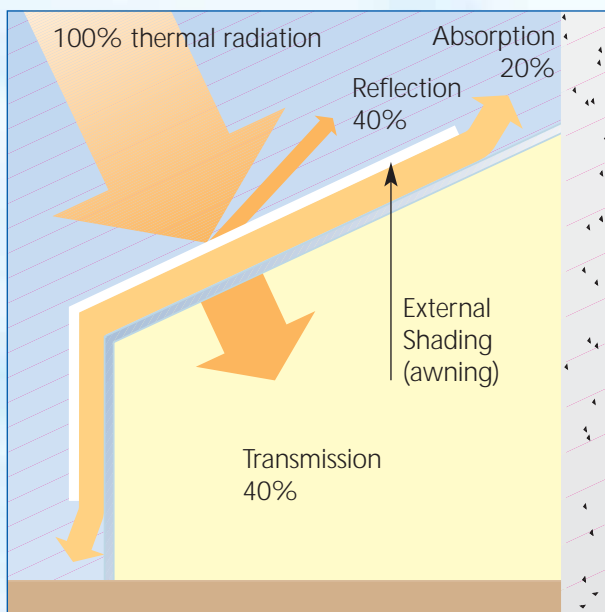
Photo: Kretze Cadenberge

<b>Glazing</b>	<b>Single-glazed winter garden</b> According to the WSchV and EnEV single glazing may not be combined with a heating system. e.g.: energy transmittance worse than 4	<b>Insulated winter gardens</b> in line with the German Wärme-schutzverordnung 1995 (construction in accordance with WSchV) e.g.: energy transmittance of 2.4	<b>Winter garden with thermal shielding</b> in line with Germany's new Energie-einsparverordnung regulations 2002 (construction in accordance with EnEV) e.g.: energy transmittance of 1.3
<b>Heat loss while heating (indicative data)</b>	 <p>78%</p> <p>Loss of energy</p>	 <p>32%</p> <p>Loss of energy</p>	 <p>15%</p> <p>Loss of energy</p>
<b>Solving thermal problems in heating winter gardens</b>	<p>Single-glazed winter gardens should not be heated in winter because of the energy costs (damage to the environment).</p>	<p>This type of winter garden should be equipped with a DIAMANT heat pump to ensure that it can be used all year round.</p>	<p>Efficient air conditioning with a state-of-the-art DIAMANT heat pump gives the best results for heat and energy consumption in this type of winter garden.</p>
<b>Thermal problems in winter garden when cooling</b>	 <p>Temperature 45 degrees centigrade</p> <p>A winter garden that faces south may reach a temperature of 45 degrees centigrade after an hour's solar radiation.</p>	 <p>Temperature 55 degrees centigrade</p> <p>An insulated winter garden that faces south may reach a temperature of 55 degrees centigrade after an hour's solar radiation. Even with near-perfect shading and ventilating system, it is nearly impossible to bring temperatures down to an acceptable level in an insulated winter garden. In summer, they may reach 30 degrees centigrade even in the shade.</p>	 <p>Temperature 65 degrees centigrade</p> <p>A south-facing winter garden with thermal shielding may reach temperatures of above 65 degrees centigrade after an hour's sunshine. On hot summer days, it is impossible to bring temperatures down to an agreeable level, even when using shading and ventilating systems. Temperatures can be brought down to some 35 degrees centigrade on such days. People are uncomfortable - plants dry up and wither.</p>
<b>Solving thermal problems in cooling winter gardens</b>	<p>Temperature can be brought down by choosing the right spot and size for flaps and vents.</p>	<p>This type of winter garden should be climate controlled to ensure it can be used all year round.</p>	<p>The only possible solution is an efficient climate control system combined with shades on the roof and the use of solar glass.</p>

## Adequate sun protection is very important

Sufficient shading (EnEV) needs to be automatically deployed in time to make for habitable winter gardens.

In winter gardens which face south or south-west temperatures can rise to uncomfortable levels when the sun shines in. Awnings on the outside or shading systems on the inside may be solutions for this problem.



### Example: Impact of shading

Awnings are very effective in bringing temperatures down, moreover they almost totally block dangerous UV rays. If solar radiation passes directly through the glass panes, short-wave rays will be transformed into long-wave heat radiation. Glass panes will not let this energy pass, which means the winter garden will heat up.



External shading offers the advantage that up to 60% of radiation – depending on the colour and the material of the awning – will not be transmitted into the interior. The heating effect will be reduced by up to 60% as well.

Interior shades also block direct radiation from plants and furniture, but radiation will still be allowed to pass the panes. Heat therefore accumulates between the glass and the shading, thereby warming up the winter garden.

Solar glasses can replace shading systems. However, the use of solar glass also prevents the sun from warming a winter garden in cooler seasons.

Heating and climate control

- Heating
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Photo: WEINOR



Foto links: WEINOR, rechts: WAREMA



Photo: WAREMA



Photo: DIAMANT

Various indoor shading systems such as gathered curtains, roll-down curtains or slats may replace exterior awnings. Colours and materials range from cotton cloth to PVC-coated or metalized cloths. Kindly consult a specialist or your construction company.

### Enjoy your winter garden all year round

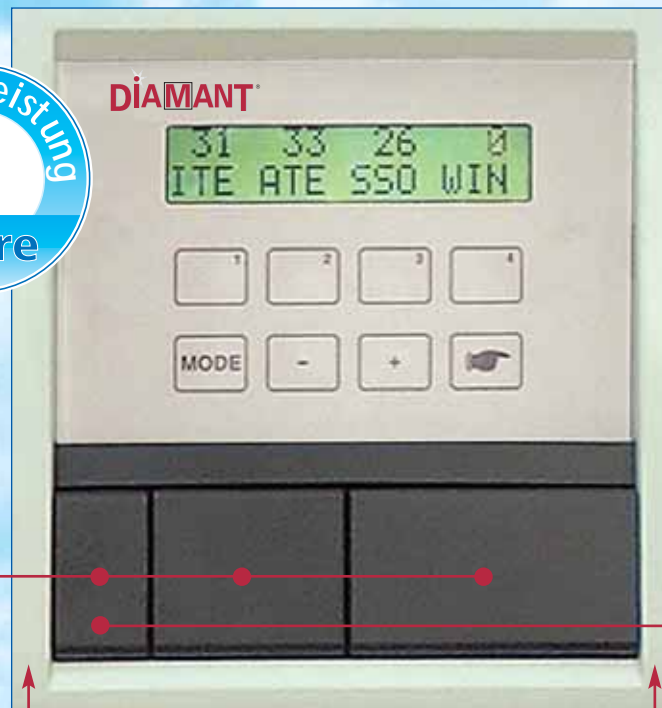
We recommend a state-of-the-art DIAMANT heat pump to cool in the summer heat and heat in winter.

Thus, your winter garden becomes a true extension of your house.

**Both from an environmental and an economic point of view, a DIAMANT control system makes sense for heating and cooling winter gardens:**

The heating system comprises a compact control unit, which allows you to regulate shading through awnings, blinds or louvres and also controls air circulation. It measures all crucial data such as strength of light, exterior and interior temperature, time, wind speed and rainfall. These data are then compared to the system's benchmark data, whereupon the control system automatically regulates heating, shading and air circulation.

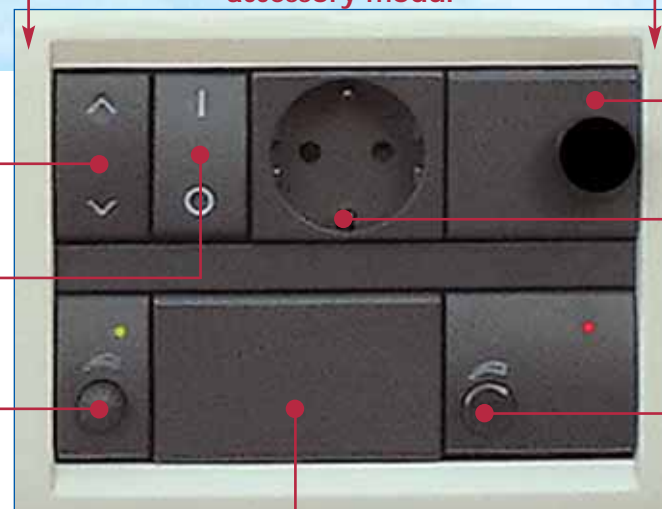
Standard module



Blind cover  
B1 = 1 field  
B2 = 2 fields  
B3 = 3 fields

Up to six small single modules can be integrated into the width

accessory modul



Selector switch e.g. for rolling blinds up and down

Manual speed regulation

On/off switch

Socket

Dimmer 180 VA

Dimmer 300 VA

Control unit for blinds

**The user-friendly compact control enables you:**

to regulate up to 11 output groups of 2000 W, Fully equipped weather station: solar sensors, wind sensors, rain sensors as well as indoors and outdoors temperature sensors: White frame with concealed casing

**The optimal climate  
for your winter  
garden –  
exceedingly  
comfortable  
22 links – just  
press the button**

The DIAMANT control system is the ultimate in technical savoir faire, making it both amazingly flexible and precise at once. The most advanced micro-processors stand for ease of use and flexibility, even in case of subsequent changes.

**DIAMANT**<sup>®</sup>

Heating and climate control

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Fotos: Keller, Troisvierges / Luxemburg

# Technical data DIAMANT DELUXE-XE-Series



Remote control boosts user-friendliness of the conditioning system, the temperature setting system and programming in general

Typ	XE - 15	XE - 20	XE - 26	XE - 30	XE - 35
Interior appliance	1	1	1	1	1
Exterior appliance	1	1	1	1	1
Heat output	4680 W	5580 W	7260 W	8380 W	8940 W
Performance Heating	1303 W	1550 W	2153 W	2277 W	2670 W
Cooling	4300 W	5350 W	7090 W	8060 W	8790 W
Performance Cooling	1533 W	1780 W	2383 W	2677 W	3070 W
Effective airflow	908 m <sup>3</sup> /h	1017 m <sup>3</sup> /h	1173 m <sup>3</sup> /h	1207 m <sup>3</sup> /h	1340 m <sup>3</sup> /h
Dehumidification	1,53 litres/h	2,32 litres/h	2,76 litres/h	3,68 litres/h	4,24 litres/h
Performance data	3,59	3,6	3,37	3,68	3,35
Operating voltage	230V / 1 ph / 50Hz				
Noise level indoor appliance*	38 / 28,4 db (A)	38 / 28,4 db (A)	40 / 30,4 db (A)	42 / 32,4 db (A)	42 / 32,4 db (A)
Noise level outdoor appliance	40 / 30,4 db (A)	41 / 31,4 db (A)	42 / 32,4 db (A)	48 / 38,4 db (A)	48 / 38,4 db (A)
Interior dimensions W x D x H	870x225x610mm		1155x225x610mm		
Exterior dimensions W x D x H	947x334x630mm				
Weight indoor appliance	35 kg	37 kg	39,5 kg	41 kg	41 kg
Weight outdoor appliance	57 kg	61 kg	63 kg	66 kg	69 kg
Fuse protection	K 16 A	K 20 A	K 20 A	K 20 A	K 20 A
Overview of performance data	3 x 1,5 mm <sup>2</sup>	3 x 2,5 mm <sup>2</sup>	3 x 2,5 mm <sup>2</sup>	3 x 2,5 mm <sup>2</sup>	3 x 2,5 mm <sup>2</sup>
Power consumption indoors fan	98 W	98 W	98 W	98 W	98 W
Power consumption outdoors fan	184 W	184 W	184 W	184 W	184 W
Operational current max.	9,3 A	9,95 A	12,8 A	14 A	15,9 A
<b>Installation</b>	All appliances can be installed on either walls or ceilings. A frame for floor level installation will also be delivered.				
Technical changes Reservations	(Note: Performance data have been tested and graded according to ISO R-859 and ARI for 240 hours. A:35 degrees centigrade outside / 27 degrees centigrade inside temperature A: 7 degrees centigrade outside / 21 degrees centigrade inside temperature				
Noise level indoor appliance* / outdoor appliance*:	Sound pressure levels (averages) were measured at a distance of 2 m and 6 m.				



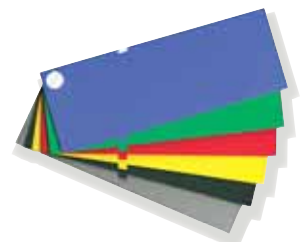
Wall appliance XE -15



Floor appliance XE -15



Ceiling appliance XE -15



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Investing in our systems  
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A good climate – and work  
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