

A WORLD OF COMFORT



CLEAN AIR by Eberspächer

INTRO

Living, working and travelling in the new normal is becoming a reality. Nobody would have thought that the requirements for “taking the bus” could change so dramatically within such a short amount of time.

We will help to make travelling feel safe again. With our additions to the Eberspaecher Thermal Management solutions, we provide the safe environment that your customers, vehicle operator and maintenance personnel require.

Thermal management expert Eberspaecher strives to improve air quality in public transport and coach travel. To make travelling by bus and coach safer, Eberspaecher has developed a three-step-solution to provide clean air inside buses: Particulate Filters and the Polarised Media Electronic Air Cleaner in the bus AC system capture contaminated water droplets. UV-C LED modules are an ideal solution to inactivate viruses and thus, complete air purification. With these solutions, Eberspaecher provides a safer environment not only for passengers, but also for vehicle operators and maintenance personnel.

The number of pathogens can increase considerably in enclosed spaces. Hence regular and increased ventilation reduces the risk of infection. Ventilation also improves interior climatic conditions and, by increasing air humidity, prevents dryness in the mucous membranes in the nose and mouth, which in turn gives better protection against pathogens. Providing fresh air or increasing the amount of fresh air is therefore a worthwhile measure – also while using buses or coaches. The AC systems therefore help to improve air quality in buses. To fully benefit from this potential, the Eberspaecher Bus & Coach Business Unit has developed a three-step-solution to treat 100% of the air moving through a bus HVAC system.

We at Eberspaecher believe that we can provide you with the most fitting solution for your bus:

- **CLEAN AIR by Eberspächer Level 1**
Particulate filter solution
- **CLEAN AIR by Eberspächer Level 2**
Polarised Media Electronic Air Cleaner
- **CLEAN AIR by Eberspächer Level 3**
UV-C LED air sterilization





THE TECHNOLOGY

1. When using our particulate filters, all the air is passed through the filters so we treat 100% of the air being moved by our HVAC system.
 - a. The filters will collect the water droplets that contain the virus, that is distributed by aerosol transmission when someone coughs or sneezes.
 - b. These water droplets vary in size from 0,6 to 10 microns: our particulate filters can trap up to 74% of particles size 0,5 micron and up to 90% of particles size 10 micron => and don't forget, we are passing all the air through our particulate filters (there is no other way for the air to go through the unit).
2. The Polarised Media Electronic Air Cleaner can trap even finer particles (see technical data sheet). Eberspaecher has been using this solution since 2009 and has proven expertise. The Polarised Media Electronic Air Cleaner offers a medium to high filtration level. In comparison with the Particulate Filters, it is more effective at removing particles and therefore, can trap up to 97 percent of particles size 0,3 μ and up to 99 percent of particles size 10 μ . The Electronic Air Cleaner (EAC) is a high-efficiency filtration solution with low static pressure drop. It is placed within the return air grille under the AC unit and starts to work automatically when the AC system is turned on.
3. Inactivate or kill the virus using UV-C radiation: we believe UV-C irradiation is a safer and more effective approach. We've enhanced the power and effectiveness of UV-C by using a UV-C LED. By working closely with the International UV organization, we can ensure passengers' safety and remove viruses from the air (see technical data sheet for more information).

We use UV-C LED lights, as compared with other market solutions that use UV Mercury lamps, which have potential safety and reliability issues. The UV-C LED lights provide a significantly higher virus inactivation rate than most products on market and they have minimal risk, as the LEDs have been in use for many years.

Our solution can be used in any bus with air channels and we offer a better range and more "purification" than there has ever been before.

PARTICULATE FILTERS

TECHNICAL SPECIFICATION

High Efficiency Particle Air Filtration

When using our particulate filters, all the air is passed through the filters so we treat 100% of the air being moved by our HVAC system: the air cannot by-pass these filters in either fresh or recirculation modes:

- These filters will collect the water droplets which contain the virus that is distributed by aerosol transmission when someone coughs or sneezes
- These water droplets vary in size from 0,6 μ to 10 μ : our particulate filters can trap up to 74% of particles size 0,5 μ and up to 90% of particles size 10 μ
- Various sizes are available to suit our complete product range



PERFORMANCE DATA*

TYPICAL PARALLEL UNIT APPLICATION (AC 136)

Quantity per unit	Various
Differential pressure drop (Pa)	23 Pa @ 3000m ³ /hr (new) 0,09" H ₂ O @ 1766 cubic feet per minute
Separation Efficiency @ 3000m ³ /hr	
Particle size 0,50 μ m	71%
Particle size 1,00 μ m	74%
Particle size 3,00 μ m	86%
Particle size 5,00 μ m	90%

TYPICAL PARALLEL UNIT APPLICATION (AC 353)

Quantity per unit	10
Differential pressure drop (Pa)	15 Pa @ 3000m ³ /hr (new) 0.06" H ₂ O @ 1766 cubic feet per minute
Separation Efficiency @ 3000m ³ /hr	
Particle size 0,50 μ m	74%
Particle size 1,00 μ m	75%
Particle size 3,00 μ m	82%
Particle size 5,00 μ m	86%

*Specifications subject to change without notice

POLARISED MEDIA ELECTRONIC AIR CLEANER

TECHNICAL SPECIFICATION

High Efficiency Filtration Solutions for Low Static Pressure Drop Solutions

- Polarised Media Electronic Air Cleaners bring powerful air cleaning to bus air conditioning systems
- Captures ultrafine particles, VOCs, odors, formaldehyde and 'off-gases' from carpets, furniture and cleaning products, viruses
- Longer life than disposable or passively charged electrostatic filters
- Operates on less than 1,5 Watts of 24 VDC
- Tested to meet CSA Standard C22.2 No. 187-M19986 and UL standard 867
- CE marked and compliant with UN/ECE R10 (EMC)
- Air Cleaners with an extruded aluminium frame, expanded aluminium screening, a metal tube to hold the powerhead and a replaceable glass fibre media mat"
- With this solution we treat 100% of the re-circulated air passing through the HVAC system

SPECIFICATIONS FOR THE P-1000 BUS AIR CLEANER

1. General: The air cleaner is a 25,4mm (one inch) thick electronically enhanced polarized media air cleaner.
2. Non-ionizing, polarised media electronic air cleaners:

a. Certifications:

The air cleaner is tested and conforms to CSA Standard C22.2 No.187-M19986, UL867, UN/ECE R10 and is CE marked.

b. Operation:

The air cleaner has an active electrostatic filter that polarises a dielectric media. It does not ionise airborne particles or produce ozone.

c. Performance:

The air cleaner removes 97% of the airborne particles 0,3 µm and greater in a re-circulating system. The pressure drop cross the air cleaner is less than 50Pa and 1,5 m/s. Field data is available showing more than 50% reduction in ambient TVOC levels.

d. Construction:

The construction of the air cleaner frame and screens is aluminium and galvanised steel. The electronic power supply (power head) is mounted in a channel on the frame of the air cleaner. Glass fibre media pads are placed between the outside grounded frame and screens. The power head imparts a high DC voltage to the centre of the conductive mesh of the centre screen. The air cleaner frames are hinged so as to allow easy access to the media pad for replacement. Application using twin air cleaners: each of the air cleaners can be connected both mechanically and electrically to the adjacent air cleaner. Neoprene foam strips are used on the mating faces of the air cleaners to block the flow of air between the air cleaners.

e. Electronics:

The power supply converts 24 VDC to 7 kV DC and takes less than 2 Watts of power. The power supply is insulated from the air cleaner frame and transmits the 7 kV DC to the centre screen of the media pad through a titanium filament. Each air cleaner is fitted with a 'Power ON' lamp and is equipped with a high voltage resistor to de-energise the air cleaner when the power is shut off.

f. Filter Media:

The replaceable filter media consists of individual, disposable glass-fibre pillows which consist of two ply of fibre glass with a centre screen of activated carbon mesh. The centre screen is permanently enclosed between the two pieces of glass-fibre and is disposed when the media pad is changed. The glass-fibre media pad has a minimum of class '2' fire rating.

PERFORMANCE DATA*

P1000

Electrical Input	24 VDC (16-32 VDC)
Powerhead Output Voltage	7 kV (DC)
Power Consumption	1,4 Watts
Powerhead Voltage and Current Consumption	1,45 VA
Ozone Generation	None
Initial Static Pressure* @ 1,52 m/s 1,52m/s = 5 feet per second	32 Pa 0,13" H ₂ O

*Final pressure drop is a function of the equipment. Typical 'dirty' static pressure is initial static pressure x 2

APPLICATION EFFECTIVENESS COMPARISON

PARTICLE SIZE	AIRBORNE CONTAMINATION	CAPACITY EFFICIENCY	
	Eberspaecher Electronic Air Cleaner		Typical throw away pleated filters
3-10 microns	Pollen, mold, dust mites, hairspray, water droplets containing Covid-19	99%	98%
1-3 microns	Auto emissions, lead dust, large bacteria, water droplets containing Covid-19	98%	Limited Effectiveness
.3 - 1 micron	Smoke from tobacco and cooking, small bacteria, fine dust, paint pigments, water droplets containing Covid-19	97%	Limited Effectiveness
< .3 micron	VOCs, odors, formaldehyde and 'off-gases' from carpets, furniture and cleaning products, virus	40%	Limited Effectiveness

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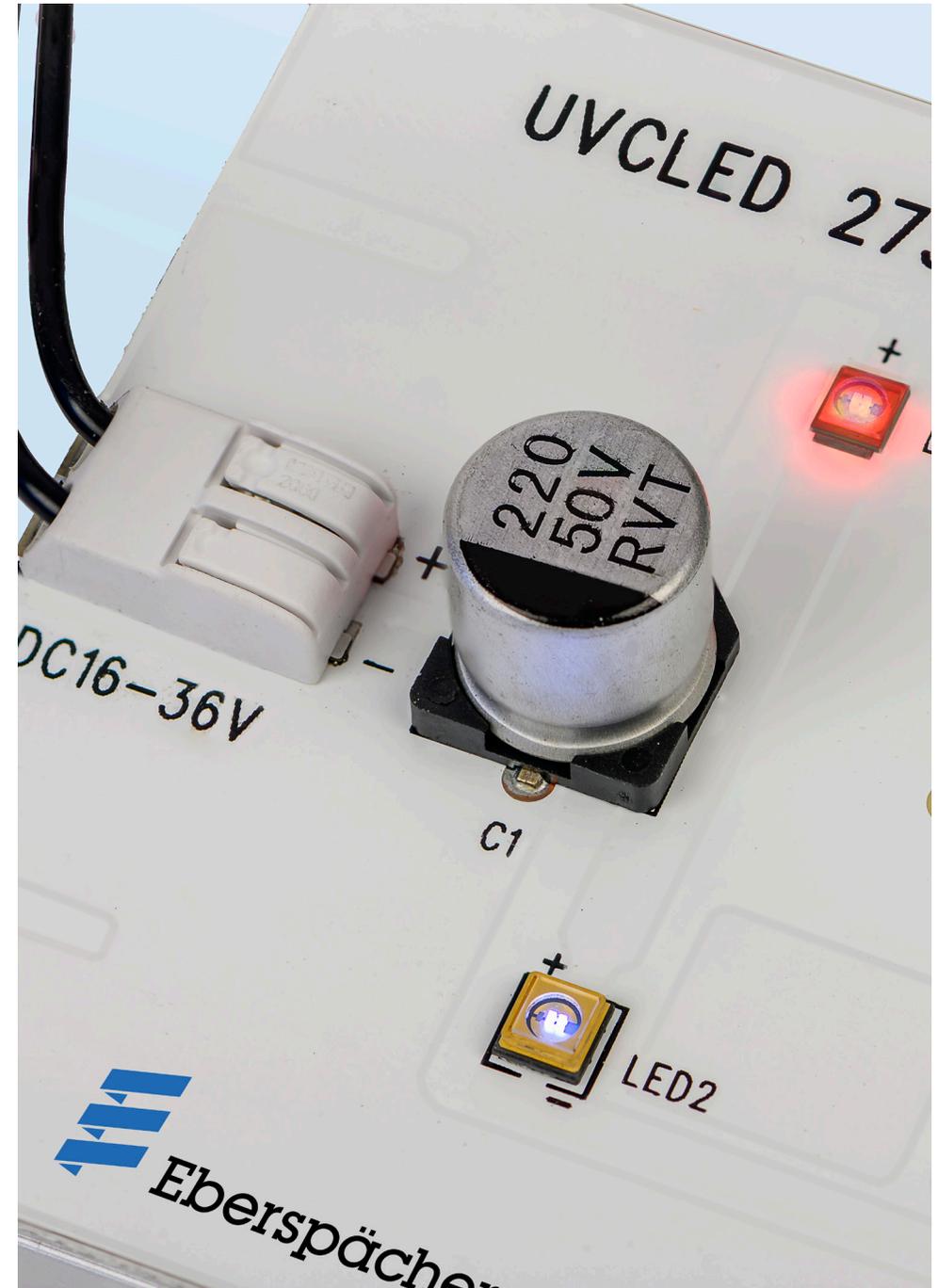
UV-C AIR STERILIZATION MODULE

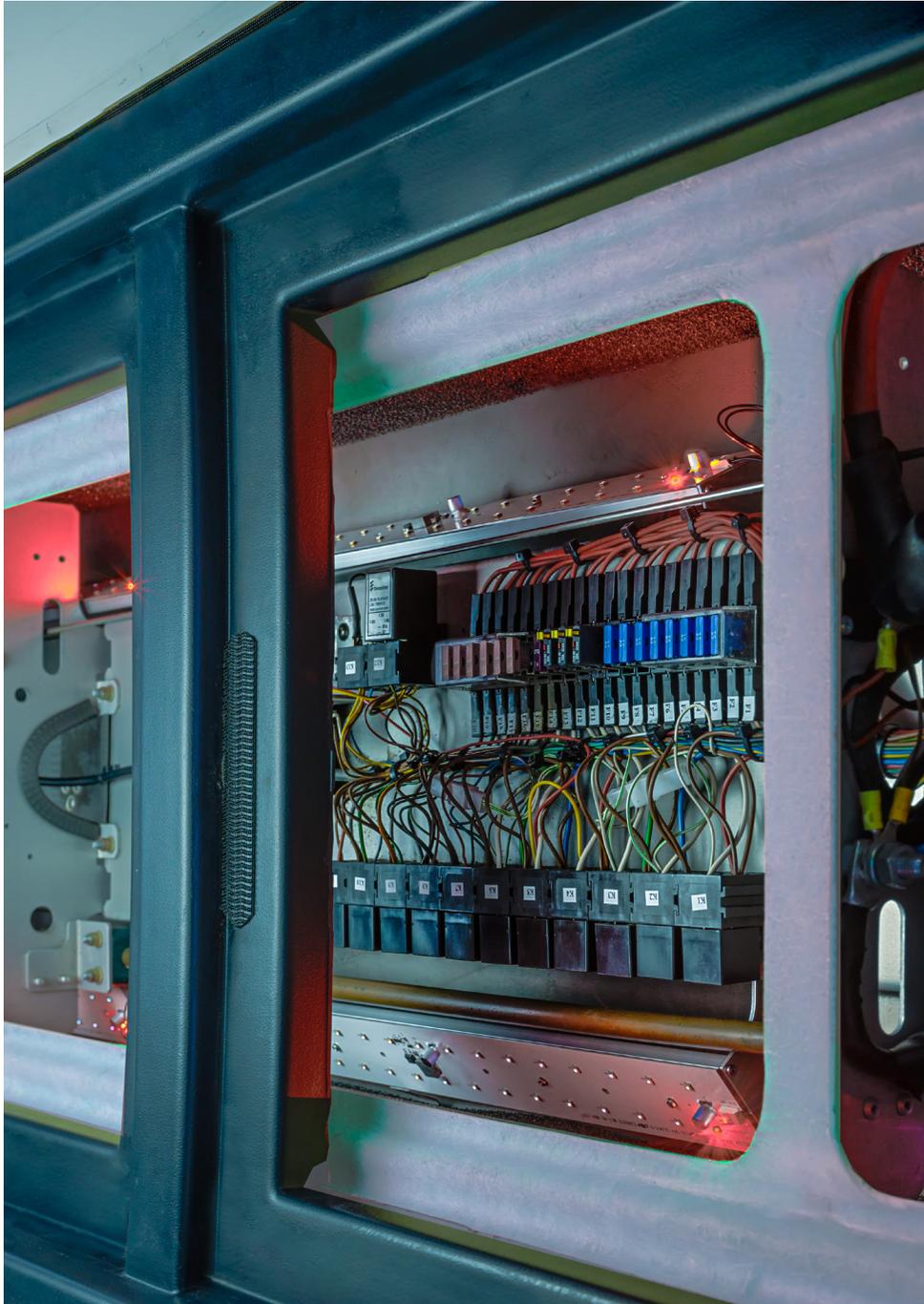
TECHNICAL SPECIFICATION

High Efficiency Air sterilization using UV-C LED for optimal virus de-activation and reliability

- Using UV-C radiation (also known as germicidal or microbicidal radiation), which is known to cause damage to DNA and RNA, that results in the inactivation of microorganisms and viruses. Given that all viruses contain a nucleic acid molecule, either DNA or RNA, and a protein coat (called a capsid) that surrounds the nucleic acid, all viruses are susceptible to inactivation by exposure to UV (Source:White paper prepared by the IUVA)
- We use UV-C Air sterilization profiles which can be part of the Air Conditioning unit or mounted within the bus air channels: 4-6 profiles used per 12m/39,4 feet bus: each profile ncludes 33 UV-C LEDs
- With these profiles, we treat 100% of the air moving through HVAC system and are able to give a level of disinfection of up to 99,9%
- Each profile is fitted with Red ON indicator light
- Each profile operates on less than 20 Watts of 24 vDC
- Benefits from longer life than systems using UV lamps
- CE marked and compliant with UN/ECE R10 (EMC) and UN ECE R118 (Flammability)
- Independent tests confirmed the qualification for disinfection of influenza viruses (strains H1N1 and H3N2)

NB: UV-C can be harmful if the installation is not made in accordance with Eberspächer instructions.

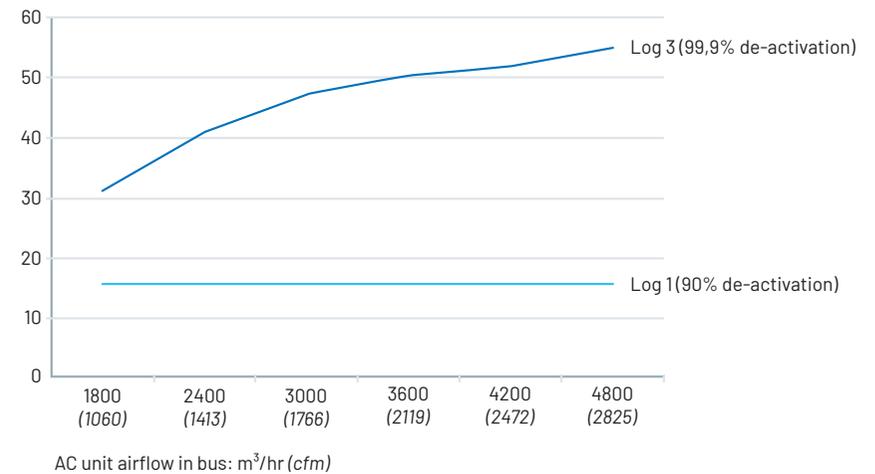




PERFORMANCE DATA*

Electrical Input	24 VDC (16-32 VDC)
Power Consumption	20 Watts
Number of UV-C LED's	33
Irradiance	1529 $\mu\text{W}/\text{cm}^2$
Dimensions	500mm x 60mm x 15mm 19.7" x 2.4" x 0.6"
Weight	0.45 kg 1.0 lb
Mounting	M3 screws at each end of through centre of profile

Time (minutes) to disinfect 47m³ (1660ft³): assumed internal volume of a 12m (39,4 feet) bus



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