

PUBLIC TRANSPORT COURIER

# TECHNIK SERVICE NEWS

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**Spheros at IAA 2014**  
Competent theme presentation rather than an exhibition of products  
*Page 3*



**Coradia Lint with HVAC equipment by Spheros**  
Complete solution from one source  
*Page 6*



**The race is on for intercity buses!**  
With heating & air conditioning units of the finest quality  
*Page 8*



**Costs of bus operation:  
Service and maintenance pay off**





Dear Readers,

Spheros is presenting itself at this year's IAA Commercial Vehicles in Hanover with a completely new trade fair concept that highlights many widely discussed subjects of the bus industry. We are familiar with the needs of our customers and stakeholders, and want to address these in order to inform, educate and find joint solutions for the future.

This is only a small taste of what awaits you at the IAA. But one thing is for sure: things are going to heat up quite a bit in terms of communication. In this issue we will thus be dealing with several important topics that are on the agenda at the trade fair. Our interview with SSB (Stuttgarter Straßenbahnen AG), for example, stresses the significance attributed to the "Maintenance in bus operations". Messrs Wiedemann and Raff from SSB give us an interesting insight into bus operation cost structures and reveal on which optimisation priorities they are currently focusing. In addition, our Chief Technology Officer Helmut Scheid takes a stand on the subject of "Refrigerant types" and talks about a key topic in the bus industry: "Alternative drives". With our new category "Behind the scenes of a manufacturer" – from now on a regular feature on the back page of our magazine – in each issue we will be introducing a new topic from the Spheros manufacturer's world. This time you can take a look behind the scenes of Spheros' heater production. We provide an exciting insight into our testing and manufacturing processes, accompanied by interesting pictorial material. You'll be surprised at the wealth of information we have to offer!

The Spheros team looks forward to your feedback at the IAA Commercial Vehicles! Until then we hope you enjoy reading the current issue of Technik Service News 1/2014.

Fabienne Ehmann

## CONTENTS

CHAPTER	PAGE
<b>EDITORIAL</b>	<b>2</b>
<b>CORPORATE NEWS</b>	<b>3</b>
IAA 2014 – Hot topics, cool facts busplaner Innovation Award	3 3
Maintenance and repair pays off – Interview SSB	4
Spheros plays host to VDV Coradia Lint with complete HVAC equipment by Spheros	6 6
Interview with Helmut Scheid: The right mixture is the key	7
<b>PRODUCT NEWS</b>	<b>8</b>
The race is on for intercity bus!	8
Spheros wins major IVECO contract	9
Thermo G gas heater Spheros's future commitment to training	10 10
<b>TECHNOLOGY</b>	<b>11</b>
Wiring diagram for timer 1531	11
Citysphere diagnosis in the EvoBus Citaro	12
Citysphere in Germany The GMT shop-in-shop concept	13 13
Overview of Spheros fresh air filter kits	14
Behind the scenes of a manufacturer: Today's topic – Spheros heating systems	16

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## Spheros at IAA 2014

# Hot topics, cool facts

True to the motto of IAA 2014 "Driving the Future" Spheros places the focus of its trade fair presentation (Hall 11, Stand D01) on topics relevant to the future instead of products.

Currently there are many burning issues for the bus industry – in particular relating to power units of the future and the role of air conditioning. Nor is the discussion about various refrigerant types and their impact on the environment by any means exhausted. For the bus operator the accruing life-cycle costs remain topic Number 1. Weight reduction in the bus and efficiency of its components are further key issues.

Spheros is striving to set an accent at the IAA in Hanover from 25 September to 2 October 2014 with a completely new trade fair concept. Instead of displaying

exhibits, the manufacturer of bus air conditioning systems, heating systems, hatches and control systems is providing a pure communication platform. Bus manufacturers, transport undertakings and service companies are invited to take part in a constructive dialogue on the basis of provocative questions such as "Can a refrigerant fill-up really cost € 2,500?", "What if every bus stop in Berlin was an inductive charging station?" or "How much diesel is needed for electric power?"



Spheros invites to the IAA Bus Climate Talk 2014.

## busplaner Innovation Award

The readers of busplaner magazine have cast their votes: Spheros receives the Innovation Award 2014 for REVO-E in the category ÖPV (Public Transport).

The Innovation Award is presented every two years in the categories Technology, Tourism and Public Transport by the German trade magazine busplaner. Spheros already received the award for the Citysphere in 2010.

The all-electric air conditioning unit REVO-E for hybrid, electric and trolley buses has already earned a reputation for intelligent energy management and special compressor integration. For the first time the electric compressor is positioned on the roof and not, as previously, in the rear of the vehicle. This makes the closed system more efficient, leak-proof and virtually maintenance-free due to the integration of all refrigerant-carrying components.



Stefan König, Dr Robert Basile, Helmut Scheid and Ralf Häring proudly accept the award from busplaner Editor-in-Chief Thomas Burgert (2nd from right).

We are delighted to have been nominated for this award and our sincere thanks go to all who voted for us!

# Costs of bus operation: Maintenance and repair pays off

Disruptions to bus services incur high follow-up costs and jeopardise the company's positive image as far as passengers are concerned. Bus operators aim for maximum availability of their vehicles, in order to keep expenditure as low as possible. Spheros decided to take a closer look at the topic "Costs of bus operation" and conducted an interview with Markus Wiedemann (Head of Repair Workshops) and Steffen Raff (Workshop Supervisor Motor Vehicles) from Stuttgarter Straßenbahnen AG (SSB).

Stuttgarter Straßenbahnen AG (SSB) is the public transport undertaking of the city of Stuttgart and a member of the Verkehrs- und Tarifverbund Stuttgart (VVS). The SSB operates 44 bus routes with a current fleet of 265 vehicles. Vehicles are prepared for service at the depots in Möhringen, Gaisburg and Sielmingen.

## What is your strategic approach in the cost structure for vehicle operation?

We place the main focus on long-term expense and revenue planning for our vehicles, always within reasonable limits. As in many other business sectors, it is obvious that short-term cost cutting and efficiency peaks can only be achieved at the expense of medium- and long-term results. The key point of our strategy is intensive cyclical maintenance with the primary objective of optimum availability.

## Can you give any examples?

One example is the air conditioning units in our buses. Many operators omit the scheduled filter replacement or extend the intervals. The fact that replacement reduces wear on the fans – a substantially higher cost factor – is often ignored. Not to mention the increased need to clean the more heavily soiled bus interior. The scales are, of course, tipped even more when damage preventing bus operation has to be repaired. Nothing is more costly than unplanned vehicle breakdowns.

## Which sector incurs the greatest costs?

The biggest per kilometre cost item is personnel, in both operation and maintenance. This component is even growing. The overall costs for air conditioning and heating are comparatively low. Even if we consider servicing on its own, wage costs including those for



Markus Wiedemann, Principal and Head of Repair Workshops at Stuttgarter Straßenbahnen AG (SSB)



Steffen Raff, Workshop Manager Motor Vehicles

vehicle maintenance are double those of the parts.

## What are the strategic priorities for cost optimisation in bus operation?

The main priority for us is ensu-

ring maximum availability of our vehicles. This goes hand in hand with avoiding inconvenience to customers. That is of course not only a cost factor, but also has a significant impact on image.

To this must be added criteria derived from the main priority, like interlocking cogwheels. We strive to minimise replacement during operation, and as a result we have to keep less replacement vehicles in reserve. The high residual value of our buses underlines the strategy at the end of the utilisation cycle.

## What are the greatest outage risks in bus operation and why?

The biggest outage factor is still the bus door, due of course to the extremely high strain and stress exerted on it. This is followed by other technical problems, ticket machines and motor.

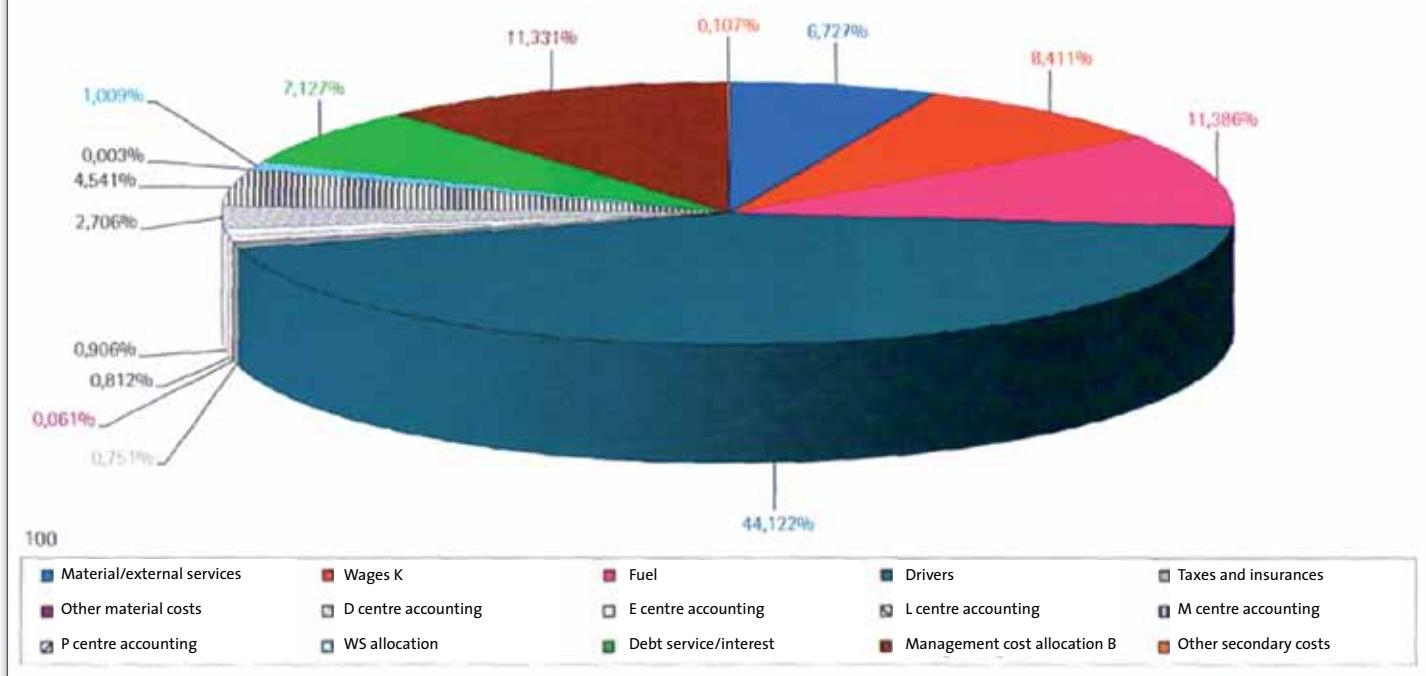
## What requirements do you place on your bus parts suppliers?

We need replacement and wearing parts whenever we are in operation. And that means more or less 24/7 (24 hours, 7 days a



Photo: Stuttgarter Straßenbahnen AG (SSB)

## Total bus operating costs 2011 (in %)



Copyright Stuttgarter Straßenbahnen AG (SSB)

week). In our opinion, one of the most effective solutions for recurring wearing parts is the shop-in-shop concept set up with GMT: a fully stocked store on site. Parts are paid for only when withdrawn. The service partner attends to overall care, including cleaning and replenishment, on site. This has considerable advantages due to the elimination of administrative costs and capital commitment.

### Where do you see the biggest savings potential with regard to bus life-cycle costs? What is necessary to realise this?

As mentioned previously, an intelligent maintenance concept and ongoing maintenance is quintessential. A public service bus will always be a long-lived economic product.

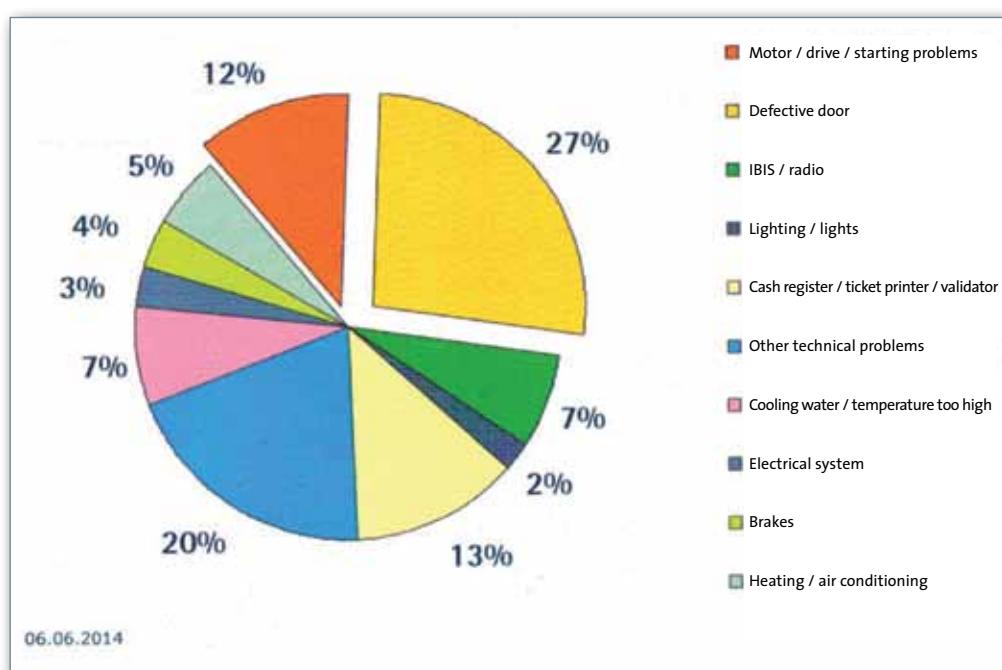
Many companies forego the preventative replacement of components, despite the fact that this is recommended and even prescribed by the manufacturer. In the event of a vehicle breakdown the costs are disproportionately higher.

### What are the biggest challenges in bus operation today and in the future?

One of the principle challenges faced by a bus operator today is compliance with the steadily growing legal requirements, which can no longer be predicted. We order

vehicles in the configurations valid today, but upon delivery in a year's time they may already be superseded. This applies in particular to local requirements concerning air pollution, noise and equal status in the combination of vehicle and infrastructure.

Mr Wiedemann, Mr Raff, many thanks for your time and the interesting information.



Causes of outage and weighting – excluding traffic accidents.

Copyright Stuttgarter Straßenbahnen AG (SSB)

# Spheros plays host to VDV

The VDV Committee for Automotive Engineering meets at regular intervals to develop industry-wide standards for optimum bus technology. The 186th meeting with a focus on bus air conditioning took place on 6 March 2014, for the first time at Spheros Europa GmbH in Neubrandenburg.

Many topics were on the agenda, one of the most hotly discussed being refrigerants. A further central issue was the heating of e-buses while in operation. The cost effectiveness of hybrid buses was viewed by the committee with scepticism, in particular the promised high fuel economy. There was a general consensus on the fact that the latter depends heavily on the route and elevation profile of the respective city.

Buses of lightweight construction for pure diesel operation that have proven successful in saving fuel were a topic of conversation. Whether diesel, hybrid, gas or electric bus, things certainly remain exciting in this sector and an end to the discussion is still a long way off.



Members of the VDV Committee for Automotive Engineering with Spheros employees.

In the course of the event, Spheros provided the VDV members with an overview of the various different air conditioning and heating solutions for hybrid electric buses.

A subsequent factory tour enabled the guests to gain an idea of the vertical range of manufacture and take a closer look at the comprehensive test processes.

The safety zones specially set up for the production and testing of electric air conditioners (handling of 400 volts) met with great interest.

## Coradia Lint with complete HVAC equipment by Spheros

The Coradia Lint diesel multiple unit from Alstom is currently one of the most successful commuter trains in Germany and has proved to be ideal for short distances.



The new Lint train with the Spheros HVAC system.

In close collaboration with Alstom, Spheros adapted the existing HVAC system to the new generation Lint trains that have been in series production since 2012. This system comprises specially modified Aerosphere World rooftop a/c units, Spheros thermal stations and a climate control unit for the overall system. In addition, Spheros supplies the train manufacturer with all components for the integration of HVAC system modules.

Within the framework of tenders won by Alstom from Deutsche Bahn a final system test was performed in the climate chamber of the RTA Institute in Vienna. The

entire train and HVAC system was successfully tested according to European railway standards "EN 14813 Parts 1 and 2" and "EN 14750 Parts 1 and 2".

As always, the HVAC system components are manufactured at the Spheros plant in Neubrandenburg. From here the systems are delivered to the Alstom production facility in Salzgitter. The company has maintained customer relations to Alstom for more than 15 years. And in the coming projects the complete HVAC system from Spheros will remain an integral part of the successful Lint train.

## Interview

# The right mixture is the key

**Helmut Scheid, CTO of Spheros GmbH, knows how the international bus markets “tick”. In an interview with customer magazine compact of Bitzer GmbH he provided information on top issues such as refrigerants of the future, alternative drives, reduction of exhaust emissions and the role of air conditioning.**

### Mr. Scheid, how much does the discussion about the refrigerant of the future concern you?

Of course we constantly keep up to date and test alternatives. We take a very clear position, but we don't support just the “one” correct solution. We offer variety – and can thus accommodate every customer's wishes. Personally, I see that for example on the subject of “CO<sub>2</sub> as an alternative refrigerant in buses” that this is a discussion which is essentially led in Germany – also, of course, driven by the car market. Buses have quite different requirements to cars. You have to take a close look to ultimately see which is the best solution for the environment and for the operator. Notwithstanding that over the years we have significantly reduced the amount of refrigerant required and we offer completely hermetically sealed solutions. On the international front there is scarcely any interest in alternative solutions on the subject of refrigerant in buses. There are quite different subjects which drive the market.

### What is the most important subject in the bus sector, from your point of view?

It is quite clearly alternative drives, in other words vehicles with a hybrid or purely electrical drive. Reducing emissions in conurbations and metropolitan areas is a huge subject in Asia – and increasingly in other corners of the world. Here too, you must be aware of the differences. While we in Europe discuss which is the best solution, in Asia products are being delivered. For many years now, hybrid solutions have been in daily use. Just recently for example, Shanghai ordered 1,200 hybrid buses in one go.

### How do you deal with this situation?

We have pushed our range of products for hybrid and electrical buses extremely hard and can now offer differing variants of completely electrically driven, highly efficient HVAC systems. Moreover, we are active in research projects. After all, the optimization of auxiliary units is of increasing significance when it concerns the efficiency of hybrid buses in public transport. Together with the Fraunho-

fer Institute for Transportation and Infrastructure Systems, in the “load-synchronous thermal management” project, we have designed a special air conditioning system for hybrid city buses and have introduced a set of strategic rules, which adjust themselves to the driving profile. The aim is to develop a holistic concept which controls all of the components integrated in a system (including the traction batteries) via a higher-level control system – depending on the driving profile and on the amount of energy which is available.

### Is this why Spheros is building up its core skills for control and vehicle electronics?

Precisely. When the aim is to manage all of the components in a bus to produce an optimal climate in the bus, behind the efficient and fault-free control, there is the intelligence of the software – for example a CAN bus based networking of the system components, not just those from the HVAC area. In future air conditioning systems, more and more components will be included; the vehicle's operating state will be read out, evaluated and taken into consideration. The demands made of the systems are growing – and we are preparing for that.

With internal solutions, we minimize the interfaces, thus creating functional and cost benefits for our customers. However, we also develop and supply bus electronics and multiple-branching systems, which extend beyond the simple control of the



Helmut Scheid,  
Chief Technology Officer  
at Spheros GmbH since 2010

air conditioning, encompassing far more components in the bus. In South America we are already a recognized partner for the development and supply of bus electronics – starting with infotainment right through to vehicle destination displays.

### What future challenges do you see on the horizon?

New tasks come from the differing markets around the world. In all of the strongly growing markets for modern buses outside of Europe, we need individually customized functional concepts. Together with our partners, we have to examine cost structures, meet special requirements on operating philosophies, on quality and reliability and we have to take account of many other external influences. Working together, from all of these factors, we have to derive the correct strategies and products.



Electrically powered HVAC systems for increased efficiency.





MeinFernbus double-decker buses are equipped with the Spheros Aquasphere system.

## The race is on for intercity buses!

**Now there is a popular alternative to travelling by train or plane. More and more operators are offering a low-cost alternative with comfortable long-distance coaches.**

On-board amenities include free WiFi, snack and beverage sales – no comfort is spared. Bookings can be made online, and comparison portals will find the cheapest operator for the selected route and date.

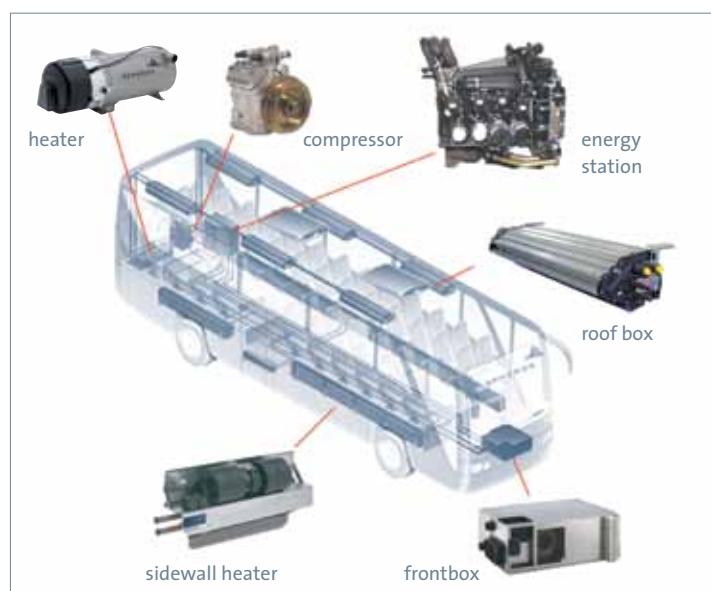
These companies make their choice from the premium segment of manufacturers – Setra Top Class, MAN Starliner or similar. It goes without saying that their buses

are also equipped with the highest standard of heating and air conditioning. Our Spheros products such as Aquasphere ensure supreme travel comfort.

In order to entice customers from the train and plane, everything has to be just right, particularly in terms of reliability and comfort. Without doubt, there is still enormous potential in this growth market.



Flixbus offers approx. 500 long-distance connections daily in Germany.



Spheros Aquasphere HVAC system.

The German market is already shared by over 10 providers. The top three intercity bus companies are: MeinFernbus with a 32.5% market share, followed by Flixbus with 22.8% and ADAC Postbus with 11.5% (Q1 2014). Operator Flix-

bus offers approx. 500 long-distance services daily to all parts of Germany. The most popular bus connections in 2014 are Berlin-Hamburg and Berlin-Munich.

## SC 1000 climate control in new Crossway Euro 6 Spheros wins major IVECO contract

Spheros, manufacturer of bus heating and air conditioning systems, has signed a framework agreement with IVECO for equipping its new Crossway with the SC 1000 climate control.

This order is not to be underrated: every year IVECO manufactures over 3,000 Crossway type buses in the Line, Pro and Low Entry (LE) versions, which have meanwhile become firmly established in Europe as market leaders in intercity buses. Also on board the new Euro 6 model: Spheros' easy-to-operate SC1000 central electronics for heating and air conditioning comfort. In addition, from the middle of the year the new roof hatch generation of the Modus series is to be installed, including the all-electric DHC digital hatch control, and the Aquavent 6000 water pump. The first vehicles left the production halls in the Czech Republic in February.

### Clearly arrange cockpit

Spheros has responded to the growing demand for integral so-

lutions for climate controls that avoid interfaces, thus creating functional and cost advantages. It has developed a control unit that regulates the air conditioning in the passenger compartment and driver's section. In addition, it assumes control of the roof and floor heating and the heating pre-selection timer. Where four separate control elements were previously needed, the new SC 1000 unit combines all functions in one clearly laid out and user-friendly device. The required software was developed and programmed in close cooperation with IVECO and covers a total of eight different vehicle configurations.

"We have been supplying IVECO with heaters, roof hatches and air conditioning systems for many years now. Having the opportunity to demonstrate our electronics



The control unit SC 1000 from Spheros.

competence is a big success and an endorsement of the many years of pioneering work," says Markus

Hummel, Spheros Key Account Manager.



The SC 1000 control unit serves the passenger compartment and driver's section.

# Tailor-made for the gas-powered bus: Thermo G gas heater

The Thermo G is a new gas heater that is based on the many years of experience and tradition of the successful previous model GBW and developed to the current state-of-the-art. The natural gas-powered heater will be available from January 2015.

Spheros is the world's only series manufacturer for bus gas heaters. The devices have hitherto been used in Europe, Russia and North America, bus also Asian markets such as China and South Korea will in future be embracing the new gas heater.

Like its predecessor, the Thermo G has a heating output of 30 kW. The main advantage over the GBW is that the heater is designed for a wider temperature range. Consequently, the Thermo G can be used at temperatures of up to -40°C. In addition, it has an optimised gas pressure regulator, less weight and more compact dimensions, resulting in easier installation in the vehicle. The diagnostic capabi-

lity was also optimised in the GBW successor. The Thermo G can be read out via flash code and the PC-based Spheros Thermo Test (STT) diagnostic system. And because the Thermo G consists of substantially fewer components and small parts, the device scores additional points for greater reliability. The gas heater is extremely quiet in operation and its interfaces (water, mounting, air intake and exhaust gas outlet) compatible with Spheros diesel heaters.

Furthermore, the 19 kg light-weight gas heater is compatible with the Spheros Aquavent 5000, 5000S, 6000C and 6000SC circulatory pumps.



Spheros Thermo G heater.

## Spheros' future commitment to training

In times of globalization and technical progress, demands placed on employees are steadily increasing, particularly in the bus industry.

Vehicles from all over the world are coming to Europe, the introduction of Euro 6 vehicles has brought about some changes and

new diagnostic systems are on the market, to name but a few. Nor does time stand still when it comes to bus air conditioning and

heating. New technologies have found their way into the industry. First and foremost for employees in the workshops, this means an increased need for training on new products or technologies. In response, Spheros is now planning to expand the training sector. Starting next year, training courses on heating and air conditioning will be offered in Gilching near Munich and in Neubrandenburg. A training calendar containing all dates and a registration form will be available from 2015 onwards at the Spheros website under the heading "Service". The content ranges from basic technical

training and troubleshooting to maintenance and repair work. The air conditioning courses also include instruction on draining and filling a system, as well as handling refrigerants. In Neubrandenburg participants also have the opportunity to participate in a plant tour.

Due to the differing substantive requirements for training, we offer worldwide target group-specific product training in the heating, ventilation and air conditioning sector.



From 2015 onwards Spheros training programmes will also be offered in Gilching and Neubrandenburg.

# Wiring diagram for timer 1531

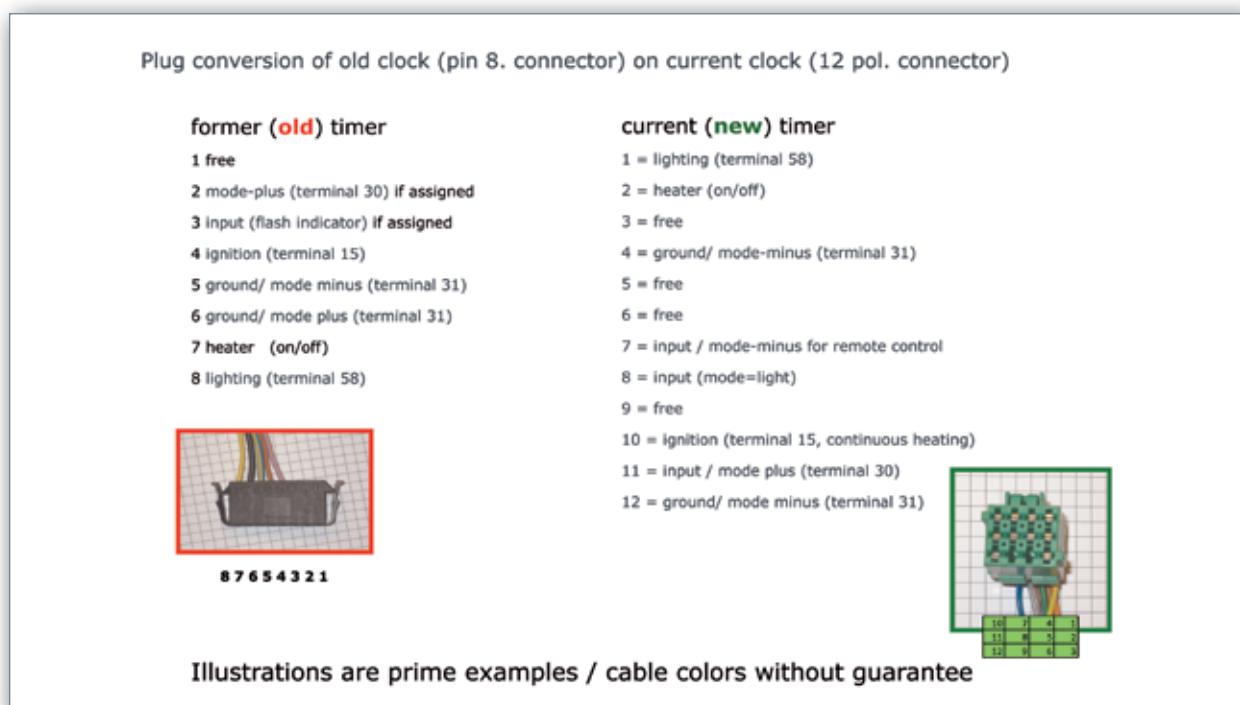
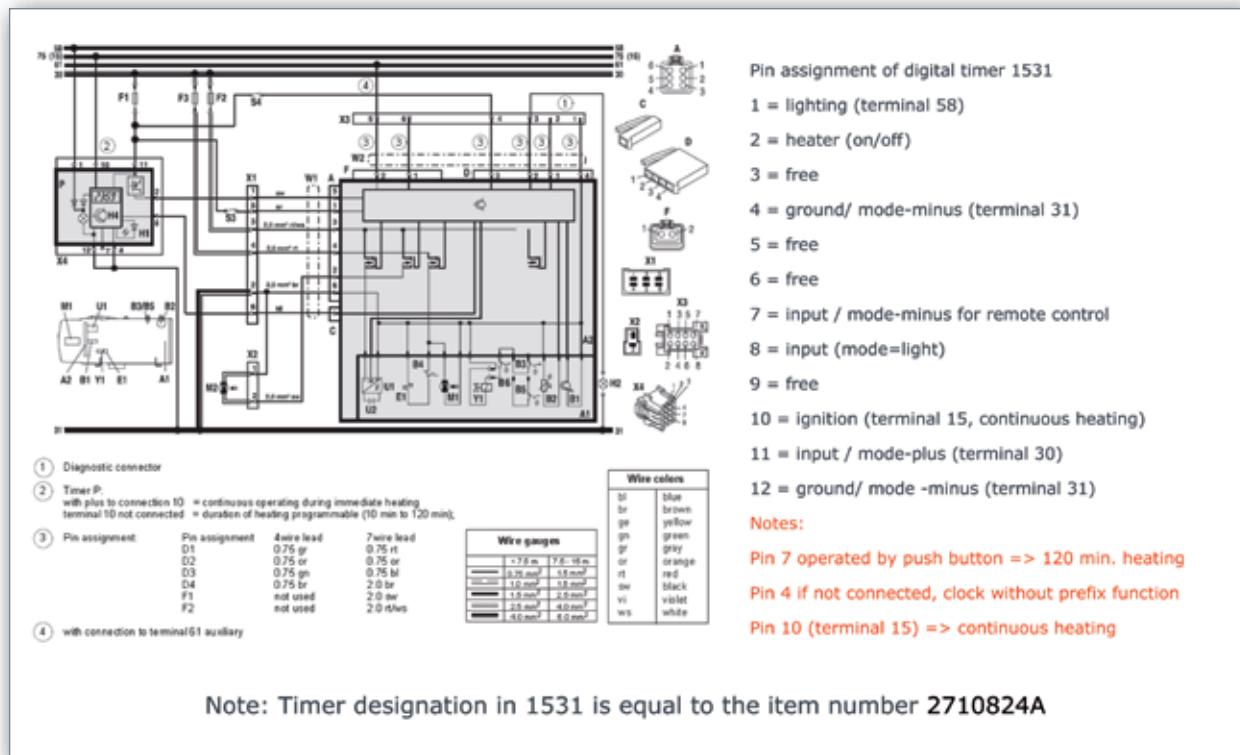
Order No.: 2710824A (complete with connection accessories)

Due to conversion of the timer generation from Type 1529 (15720B) to the current timer model 1531 (2710824A) the cable harness or plug connection must be changed as described in the following.

The timer is designed for use in 12 volt or 24 volt vehicles. Only the light bulb must be suitable for the vehicle voltage.

12 volt light bulb,  
black base: 90807 A  
24 volt light bulb,  
green base: 90808 A

For retrofitting the 7-day, 3-selection digital timer (2710824A) we recommend using installation/mounting frame 474630.



# Citysphere diagnosis in the EvoBus Citaro

The control unit in the Citysphere master unit offers two options for an error message.

## 1. Flash code

A 2-pin plug (X23), into which a LED test lamp can be inserted, is located on the left edge of the roof at the same level as the Citysphere master unit.

Pin 1 = Error signal  
Pin 2 = Ground (GND)

In the event of errors the LED flashes in difference sequences. An error code consists of a 2-digit number. The respective digits

are output in short flashing frequencies. Between the two digits there is a pause (LED off) of approx. 1.25 sec.

Following output of the second digit there is a pause of approx. 3.25 sec. Then either a further error signal is issued or a single error signal is repeated.

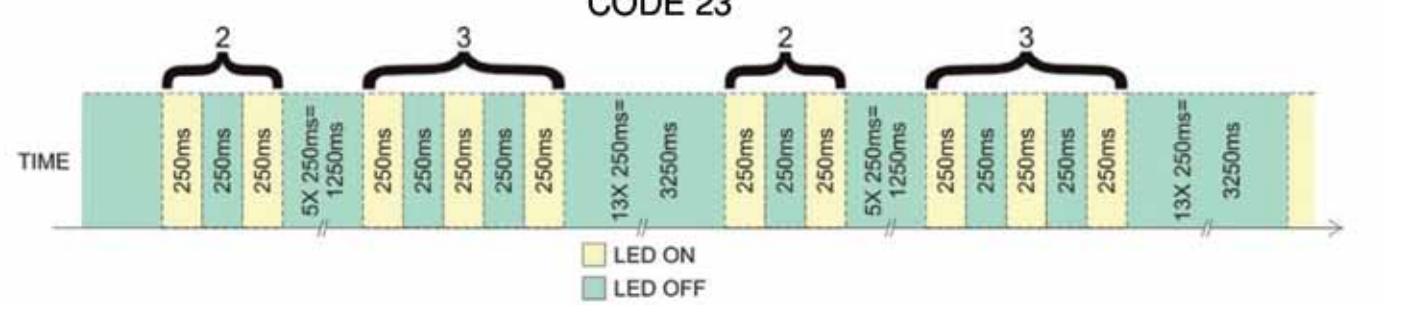
In the following, the output of flashing frequencies is shown using error 23 as an example.



Control unit 2710688 B for forced control & diagnosis



Plug connector for Spheros control unit  
Plug connector for flash code output "LED test lamp"



The error codes of the flash code output are described in the following table.

Failure	Description	Action
<b>11</b>	No Failure	
<b>12</b>	Return Sensor Failure	1. Shows failure code F1 2. If External Temperature (ET) > CE Condenser Fan is ON, Evaporator Blower is ON with Lb (manual change possible) and Compressor is ON with LC. 3. If ET < CE everything is OFF
<b>13</b>	External Sensor Failure	1. Shows failure code F2 2. Compressor and Condenser Fan are OFF 3. If Room Temperature (RT) >= 23°C Evaporator Blower runs with Lb (manual change possible) 4. If RT <= 22°C Evaporator Blower is OFF
<b>14</b>	EBM Fan Failure	No action. Just display failure
<b>15</b>	EBM Evaporator Failure	No action. Just display failure
<b>16</b>	High Voltage (Battery Voltage > 33V)	All outputs will be OFF
<b>17</b>	Low Voltage (Battery Voltage < 17V)	All outputs will be OFF
<b>18</b>	Battery Voltage lower than bt parameter for 15 seconds. <sup>1</sup>	1. Air Conditioning and Heating function is OFF. 2. Ventilation change manually.
<b>19</b>	Battery Voltage lower than bA parameter. <sup>1</sup>	All outputs will be OFF
<b>21</b>	ISKRA Failure	No action. Just display failure
<b>22</b>	19.5V > D+ > 10V	No action. Just display failure
<b>23</b>	10V > D+ > 5V	No action. Just display failure
<b>24</b>	D+ < 5V	No action. Just display failure

<sup>1</sup> The error code only disappears when the system is restarted by the ignition switch (clamp 15).

## 2. Error output with the SPHEROS control unit

An 8-pin plug (X23) to be found on the left edge of the roof, at the same level as the master unit, can be connected to the SPHEROS 2710688B control unit. Errors are shown on the display.

The error codes are described in the following table.

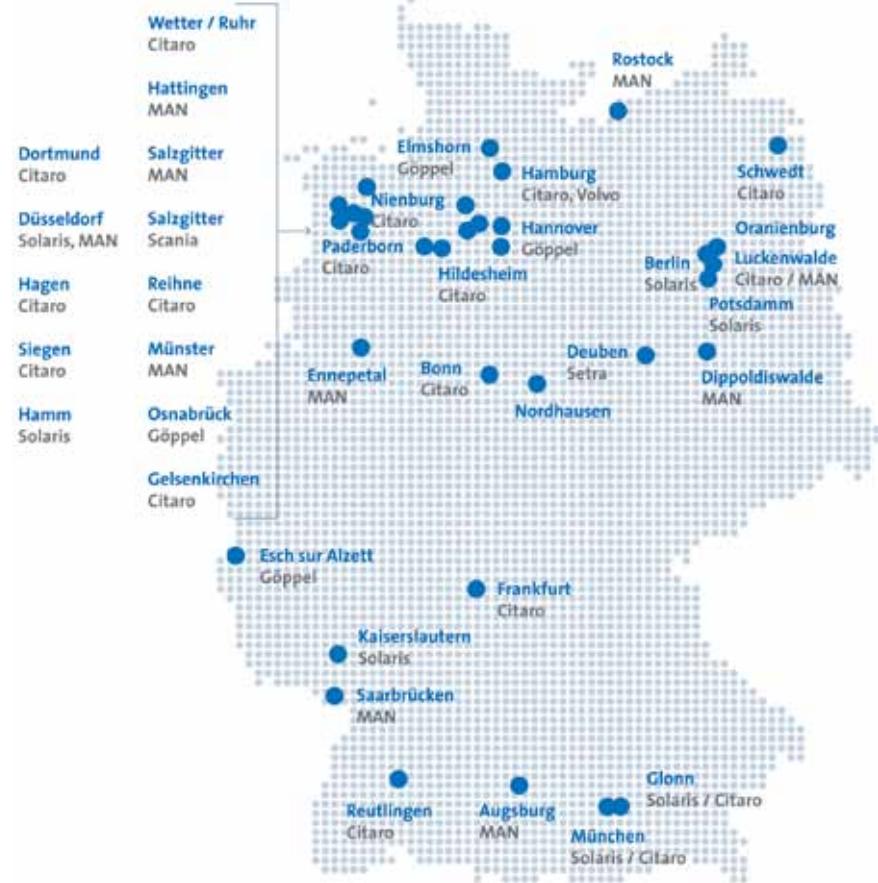
Failure	Description	Action
<b>F1</b>	Room temperature sensor failure	1. Shows failure code F1 2. If external temperature (ET) > CE Condenser Fan is ON, Evaporator Blower is ON with Lb (manual change possible) and Compressor is ON with LC. 3. If ET < CE everything is OFF
<b>F2</b>	External temperature sensor failure	1. Shows failure code F2 2. Compressor and Condenser Fan are OFF 3. If room temperature (RT) >= 23°C Evaporator Blower runs with Lb (manual change possible) 4. If RT <= 22°C Evaporator Blower is OFF
<b>F3</b>	19.5V > D+ > 10V	No action. Just display failure
<b>F4</b>	10V > D+ > 5V	No action. Just display failure
<b>F5</b>	D+ < 5V	No action. Just display failure
<b>FF</b>	EBM Fan failure	No action. Just display failure
<b>Fb</b>	EBM Evaporator failure	No action. Just display failure
<b>HH</b>	High voltage (battery voltage > 33V)	All outputs will be OFF
<b>LL</b>	Low voltage (battery voltage < 17V)	All outputs will be OFF
<b>FA</b>	ISKRA failure	No action. Just display failure
<b>FC</b>	Communication failure	See the item 6.1

<sup>1</sup> The error code only disappears when the system is restarted by the ignition switch (clamp 15) or manually by pressing (off and on).

# Where is the Citysphere on the road?

With an eye to the environment and reduced operating costs, when selecting an air conditioning system for their city buses more and more transport undertakings are opting for the Citysphere modular air conditioning system with patented air circulation system. Alone in Germany, approx. 700 buses meanwhile have a Citysphere on their roof.

The core piece of the modular unit is a hermetically sealed compressor. Combined with the absence of hose lines in the unit, it contributes to best-possible leak-tightness of the overall system and thus reduction of its environmental impact. This means that the Citysphere is nearly maintenance-free and provides for hitherto unachieved low life-cycle costs. Furthermore, the unit is already designed for operation with alternative refrigerants.



## The GMT shop-in-shop concept

The so-called “shop-in-shop” concept was developed by upmarket retailers. In selected department stores such as KaDeWe in Berlin or Oberpollinger in Munich lucrative floor space is leased directly to the manufacturers and retailers of goods.

The advantages for both sides are obvious: the merchandise is maintained and organised by the supplier's employees. The specialised sales staff is already intimately familiar with the products and the department store commits neither capital nor resources. Customers' wishes and corporate goals can thus be optimally fulfilled.

Admittedly, a bus operator's workshop is not necessarily comparable to brand selling – or perhaps it is: the latest analysis of cost efficiency in the bus workshop sees the parts store as a shop.

And it must be optimally maintained, with minimal deployment of staff and capital resources. All this is under the assumption that the basic quality and availability standards are upheld. The logical consequence of these goals is the shop-in-shop concept. It is precisely here that distributors such as GMT come into the picture: in Stuttgart, Munich and Mannheim.

As an exception to the rule, this integral shop unit – usually with a separate storage area or individual shelves – is not run by the store's own warehouse staff. The shop-in-shop is managed and

supervised by the supplier, i.e. GMT. In the specified areas the latter attends to supply, stocking and dispatch. Rather than the entire stock, only items that have actually been removed are invoiced. GMT thus remains the owner of the goods until they are needed.

With an eye to the ever growing manpower shortage in businesses, this shop-in-shop concept offers an ideal future strategy for the guaranteed supply of parts.



GMT shop-in-shop.

# Overview of Spheros fresh air filter kits

Manufacturer - vehicle type	Air conditioner	Designation	Part number Date 7.7.2014
Alle / all	REVO	Spare part kit fresh air filter REVO	11117394A
Alle / all	REVO E	Spare part kit fresh air filter REVO E	11117885A
Alle / all	Easysphere	Recirculated air filter	1103605A
<b>SETRA / MERCEDES</b>			
Capacity	Aerosphere World	Spare part kit fresh air filter	1102618B
Citaro	Aerosphere	Spare part kit fresh air filter	1100372B
Citaro	Aerosphere World	Spare part kit fresh air filter	1102618B
Citaro	Frontbox	Air filter assembly (ZSB)	1101899A
Citaro	Frontbox	Air filter FB ERA	1302907B
Citaro CNG/ G CNG	Aerosphere World	Spare part kit fresh air filter	1102618B
Citaro Ü / GÜ / LE Ü	Revo	Spare part kit fresh air filter REVO E	11117885A
Comfort Class	Aerosphere World	Spare part kit fresh air filter	1102618B
Connecto	Aerosphere World Trope	Spare part kit fresh air filter	1102619B
Integro	Aerosphere World	Spare part kit fresh air filter	1102618B
Integro (O 550)	Aerosphere	Spare part kit fresh air filter	1100372B
Intouro	Aerosphere World	Spare part kit fresh air filter	1102618B
Multi Class (UL)	Revo	Spare part kit fresh air filter REVO E	11117885A
Multi Class (UL/NF)	Frontbox	Air filter mat EU3	1100710A
O 405 / 407 / 408	CC220	Air filter CC220	88980A
Setra 3er Serie	Aerosphere	Spare part kit fresh air filter	1100372B
Setra 3er Serie	Frontbox	Air filter fleece black FB E	85695B
Setra 3er Serie	Frontbox	Air filter assembly (ZSB) Kombibus	91769A
Setra 3er Serie	Kombibusanlage	Spare part kit fresh air filter	1100372B
Setra 3er Serie	Kombibusanlage	Filter mat KK	89697A
Setra 4er Serie	Aerosphere World	Spare part kit fresh air filter	1102618B
Setra 4er Serie	Frontbox	Filter assy.	68910B
Setra Comfort Class 500	Revo	Spare part kit fresh air filter REVO E	11117885A
Top Class	Dachbox	filter roof box	68951A
Top Class	Dachbox	Nonwoven filter for cassette	1100807A
Top Class	Dachbox	Air filter	1100895B
Top Class	Dachbox	Cassette with filter	1100800B
Top Class	Dachbox	Air filter	1101120A
Top Class	Frontbox	Filter assy.	68910B
Top Class	Frontbox	Air filter element FB	1100960A
Top Class	Frontbox	Air filter mat EU3	1100710A
Tourismo (MBR2)	Aerosphere World	Spare part kit fresh air filter	1102618B
Tourismo (MBR2)	Frontbox	Filter assy.	68910B
Tourismo (MBR2)	Frontbox	Air filter mat EU3	1100710A
Tourismo (O 350)	Frontbox	Air filter mat	84830A
Tourismo (O 350)	Top Cooler S 300	Air filter	81851A
Travego (MBR1)	Aerosphere World	Spare part kit fresh air filter	1102618B
Travego (MBR1)	Frontbox	Filter assy. FB	68910B
Travego (MBR1)	Frontbox	Air filter mat EU3	1100710A
Travego (O 580)	Aerosphere	Spare part kit fresh air filter	1100372B
Travego (O 580)	Frontbox	Filter assy. FB	68910B
Travego (O 580)	Frontbox	Air filter mat EU3	1100710A
<b>GÖPPEL</b>			
Midibus / Göppel MIDI TRAIN	Aerosphere Midi	Air filter	1102574A
go4city	REVO	Spare part kit fresh air filter REVO	11117394A
go4city	Citysphere	Air filter mat G4	2710587B
MIDI TRAILER / MAXI TRAILER	Citysphere	Air filter mat G4	2710587B
MIDI TRAIN	Citysphere	Air filter mat G4	2710587B
MAXI TRAIN	Citysphere	Air filter mat G4	2710587B
<b>HESS</b>			
Swiss Diesel	Aerosphere World	Spare part kit fresh air filter	1102618B
Swiss Diesel	REVO	Spare part kit fresh air filter REVO	11117394A
Swiss Diesel Trailer	Citysphere	Air filter mat G4	2710587B
Buszug	REVO	Spare part kit fresh air filter REVO	11117394A
Buszug	Citysphere	Air filter mat G4	2710587B

Manufacturer - vehicle type	Air conditioner	Designation	Part number Date 7.7.2014
<b>MAN / NEOPLAN</b>			
A01	<b>Aerosphere</b>	Spare part kit fresh air filter	1100372B
A78	<b>Revo</b>	Spare part kit fresh air filter REVO E	11117885A
Centroliner / Centroliner E	<b>Aerosphere</b>	Spare part kit fresh air filter	1100372B
Centroliner / Centroliner E	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
Jetliner	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
Lion's City (A2x)	<b>Aerosphere</b>	Spare part kit fresh air filter	1100372B
Lion's City (A2x)	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
Lion's City Gelenkbus	<b>Revo</b>	Spare part kit fresh air filter REVO E	11117885A
Lion's Classic (A7x)	<b>Aerosphere</b>	Spare part kit fresh air filter	1100372B
Lion's Classic (A7x)	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
Lion's Coach (R07/08/09)	<b>Aerosphere Top 2000</b>	Spare part kit fresh air filter	1100372B
Lion's Regio (R12/13/14)	<b>Aerosphere Top 2000</b>	Spare part kit fresh air filter	1100372B
Starliner 2 (P11/12)	<b>Aerosphere World lang</b>	Spare part kit fresh air filter	1102619B
Tourliner (P21/22)	<b>Aerosphere Top 2000</b>	Spare part kit fresh air filter	1100372B
Trendliner (P23/24)	<b>Aerosphere Top 2000</b>	Spare part kit fresh air filter	1100372B
<b>OTOKAR</b>			
Territo U	<b>Aerosphere Tropical</b>	Spare part kit fresh air filter	1100372B
<b>SCANIA</b>			
Citywide	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
Citywide	<b>Easysphere S</b>	no filter	---
Citywide	<b>Revo</b>	Spare part kit fresh air filter REVO E	11117885A
OmniLine, OmniCity	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
OmniLink	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
OmniWide	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
OmniExpress (Lahden)	<b>Revo</b>	Spare part kit fresh air filter REVO E	11117885A
<b>TEMSA</b>			
Avenue EU / LF	<b>Aerosphere Tropical</b>	Spare part kit fresh air filter	1100372B
Avenue L/C	<b>Revo</b>	Spare part kit fresh air filter REVO E	11117885A
Diamond	<b>Top 2000</b>	Fresh air filter XXL	1101194A
LD13IC / Safari RD/HD	<b>Revo</b>	Spare part kit fresh air filter REVO E	11117885A
MDO9 Coach	<b>Aerosphere Midi</b>	Air filter	1102574A
Safir	<b>REVO</b>	Spare part kit fresh air filter REVO	11117394A
<b>SOLARIS</b>			
Urbino 12/18	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
Urbino 12/12LE/15/18/18,75	<b>REVO</b>	Spare part kit fresh air filter REVO	11117394A
Urbino 12/12LE/15/18/18,75	<b>Citysphere</b>	Air filter mat G4	2710587B
Alpino	<b>Citysphere</b>	Air filter mat G4	2710587B
Trollino	<b>Citysphere</b>	Air filter mat G4	2710587B
<b>VOLVO</b>			
7000	<b>Aerosphere</b>	Spare part kit fresh air filter	1100372B
7700 Hybrid	<b>Citysphere</b>	Air filter mat G4	2710587B
7900 Diesel ART (Euro 5)	<b>Easysphere S</b>	no filter	---
7900 Hybrid / ART (Euro 6)	<b>Citysphere</b>	Air filter mat G4	2710587B
7900 CNG	<b>REVO</b>	Spare part kit fresh air filter REVO	11117394A
8900 / 8900 Low Entry (Euro 5)	<b>Easysphere S</b>	no filter	---
8900 / LE (Euro 6)	<b>REVO</b>	Spare part kit fresh air filter REVO	11117394A
<b>IRISBUS / IVECO</b>			
Crossway 32kw	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
Crossway 35kw	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
Crossway 39kw	<b>Aerosphere World lang</b>	Spare part kit fresh air filter	1102619B
Crossway Line / LE / Pro13	<b>Revo</b>	Spare part kit fresh air filter REVO E	11117885A
Heuliez GX (Euro 5)	<b>Easysphere S</b>	no filter	---
Magelys (Euro 5)	<b>Integrierte Anlage</b>	Air filter NC	1102987B
<b>ALSTOM</b>			
Coradia LINT bis 2012	<b>Aerosphere</b>	Spare part kit fresh air filter	1100372B
Coradia LINT bis 2012	<b>Aerosphere</b>	Support fresh air filter standard	93817A
Coradia LINT bis 2012	<b>Aerosphere</b>	Air filter assembly (ZSB)	1101899A
Coradia LINT bis 2012	<b>Aerosphere</b>	Filter mat	93127A
Coradia LINT bis 2012	<b>Aerosphere</b>	Recirculation filter cartridge	93260B
Coradia LINT ab 2013	<b>Aerosphere World</b>	Spare part kit fresh air filter	1102618B
Coradia LINT ab 2013	<b>Aerosphere World</b>	Recirculation filter cartridge	93100B
Coradia LINT ab 2013	<b>Aerosphere World</b>	Recirculation filter cartridge	93260B

## Today's topic Spheros heating systems

- Air conditioning
- Heaters
- Hatches / Fans
- Control Units
- Service
- Genuine Parts



## Tradition and future

The development and manufacture of bus heaters has a long tradition at Spheros. The success story began as early as 1956 at the Neubrandenburg production site, then owned by Webasto. Since Spheros became an independent manufacturer and specialist for bus air conditioning eight years ago, we have been able to increase heater production to approx. 40,000 units per year.

The demand is increasing worldwide and we now manufacture heaters for a wide range of energy sources such as diesel, gas and electricity – in performance classes 16 to 47 kW. We deliver them to major manufacturers all over the world including EvoBus, MAN, Iveco, Scania, Volvo, Marcopolo, King Long, Higer, Ashok Leyland and Tata.

Our heaters ensure pleasant warmth in all European cities such as Berlin, Munich, Budapest, Warsaw, Vienna, Prague, Moscow and St Petersburg. Even the 850 buses for the Winter Olympics in Sochi were equipped with Spheros auxiliary heaters.

We are proud of our broad vertical range of manufacture. For example, on the welding line one can observe step-by-step the process

of forming a heat exchanger from steel plate.

We have succeeded in making our new generation of heaters more lightweight, quieter, maintenance-friendlier and more efficient – always with the aim of achieving quality and safety standards. In heater production each unit is 100% tested and set on the final test bench to the required CO and CO<sub>2</sub> values, to

ensure that the required emission limits are adhered to. In the current Thermo and Thermo S heaters the control unit is also programmed to customer-specific parameters such as switching thresholds. The objective of this test procedure is to ensure that 100% impeccable devices are delivered to the customer.

