AIR CONDITIONING

CITYSPHERE S Standard

Installation instructions

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SPHEROS

Improper installation or repair of Spheros heating and cooling systems can cause fire or the leakage of deadly carbon monoxide leading to serious injury or death.

To install and repair Spheros heating and cooling systems you need to have completed a Spheros training course and have the appropriate technical documentation, special tools and special equipment.

NEVER try to install or repair Spheros heating or cooling systems if you have not completed a Spheros training course, you do not have the necessary technical skills and you do not have the technical documentation, tools and equipment available to ensure that you can complete the installation and repair work properly.

ALWAYS carefully follow Spheros installation and repair instructions and heed all WARNINGS.

Spheros rejects any liability for problems and damage caused by the system being installed by untrained personnel.

Highlighted words like Warning, Caution, ATTENTION and NOTE in these evacuation and charging instructions signify the following precautions:

	This caption is used to indicate possible severe injuries or fatal accidents if instructions or procedures are carried out incorrectly or entirely disregarded.
	This caption is used to indicate possible minor injuries if instructions or procedures are carried out incorrectly or entirely disregarded.
ATTENTION:	This caption points to actions which may cause material damage.
NOTE:	This caption is used to draw attention to an important feature.

NOTE: Subject to modification. The latest version of these installation instructions can be downloaded from **www.spheros.com**.

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1 Safety information and regulations

- The rooftop air-conditioning system has been designed and built in accordance with EC Directives.
- The system is safe if it is installed properly and used according to the installation and service instructions.
- If the Citysphere S is retrofitted, the empty weight and possibly the height of the vehicle are changed. Then, within the scope of the German Road Traffic Licensing Regulations (StVZO) an official acceptance inspection and an appropriate entry into the vehicle documents according to Section 19 of the StVZO is required. Outside the scope of the StVZO can apply appropriate rules. The vehicle owner is responsible for the entry in the vehicle file.
- The general safety regulations for the prevention of accidents have to be observed strictly. “General safety regulations” beyond the scope of these regulations are detailed below.
- The specific safety regulations are highlighted in the individual chapters resp. procedures.

1.1. General safety regulations

- Non-compliance with the installation manual and its included notes will lead to liability exclusion by Spheros. The same applies to unskilled repairs or repairs not using original spare parts.
- Electrical wiring and operating elements of the air-conditioning system must be arranged in the vehicle in such a way that their correct functioning cannot be impaired under normal operating conditions.

1.2. Safety instructions for maintenance

- If faults develop in the refrigerant circuit, the system must be tested and repaired by an authorized specialist repair shop according to the rules. Under no circumstances may refrigerant be discharged into the atmosphere.
- Never heat refrigerant cylinders with a naked flame.
- Liquid refrigerant must never be allowed to come into contact with body parts. The safety data sheet must be observed.
- Always wear protective clothing and goggles when handling refrigerant.

ATTENTION:

- **The vehicle load capacity is diminished by the weight of the additional components.**
- **A placard with the vehicle’s new total height is to be installed in the drivers field of vision.**

- **Do not perform soldering or welding directly on components of the closed refrigerant circuit or in its vicinity. The heating will cause a rise in the circuit pressure. There is a danger of explosion.**

- **Before performing any work allow the system to cool down completely. Risk of injury due to burns on the condenser, compressor and refrigerant hoses.**
- **Installation, maintenance and repair work must be carried out by duly qualified personnel. Such work may only be undertaken with the engine off and the power supply switched off.**
- **The battery must be disconnected before starting the work.**
- **Do not wear metal jewellery (bracelets, watches, necklaces, rings) when working on the air-conditioning system.**
- **The electrical supply of the unit is done from the vehicle's power supply via a cable (not included in the scope of delivery).**
- **The unit is laid out for 24 V operating voltage.**
  The unit is prefilled with refrigerant (R134a) and need to be connected during installation to the on-board power supply and in regard the refrigeration system to the evaporator in the frontbox.
- **The evaporator and the hoses must be evacuated to a pressure less than 10mbar. Only after that, the shut-off valves of the rooftop air-conditioning system can be opened.**

Certification

- The electromagnetic compatibility (EMC) has been checked.
- Standard requirements of the ECE Regulation R10 Rev. 05 are complied.

2 Preparation for installation

2.1. Safety instructions

- The safety instructions outlined on pages 13 and 14 must be read and noted before starting work.
- Installation should be performed by someone well versed in auto mechanics/auto electrics..

2.2. Conditions for assembly

- Before assembling and operating the air-conditioning system(s), the vehicle's power supply must be checked for sufficient capacity, and must be upgraded if necessary.
- A free generator capacity of 65 A (max. current consumption per unit) must be at disposal per unit to be constructed. This capacity must be guaranteed at idle speed, and at the same time at maximum engine compartment temperature (low speed and high ambient temperature diminish the output of generators).

2.3. Preparations on vehicle's roof

	**Warning!**	**Danger of severe injuries or fatal fall!**

When working on the bus roof or on any hoisting equipment, scaffolding etc. suitable safety precautions must be taken to prevent falls.

	**Caution!**	**Danger of cut injuries due to sharp metal edges!**

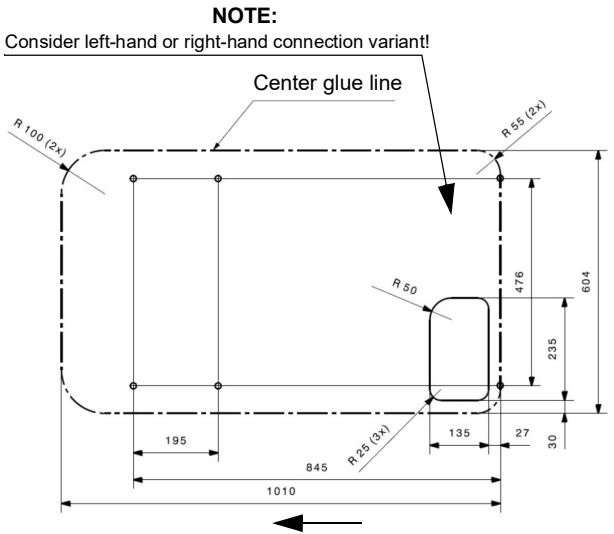
Wear protective gloves!

2.4. Roof cut-outs

The required roof cut-outs (opening for refrigerant connection and electrical interfacing) must be clearly indicated on the roof. Make the roof cut-out using suitable tools. Cut edges should be deburred and protected against corrosion.

NOTE:

Interface drawings can be obtained from Spheros!



Roof cutout Citysphere S

2.5. Fastening drill holes

The air-conditioning unit is fastened to the vehicle's shell with nuts (M8) and matching washers. For this purpose, corresponding stable retaining plates/bows must be provided on the shell. We suggest making the drill holes sufficiently large or long to compensate for the frame tolerances. Make fastening drill holes according to installation sketch above (6 x d - min. 8.5mm).

2.6. Cleaning the vehicle's roof and the AC unit

Once all cut-outs and drill holes are made on the vehicle's roof the areas must be cleaned with compressed air. Roughen bonding area of the base pan and the roof surface according to the adhesive joint, clean with Sika Cleaner, and preprocess with Sika Primer (follow product information).

NOTE:

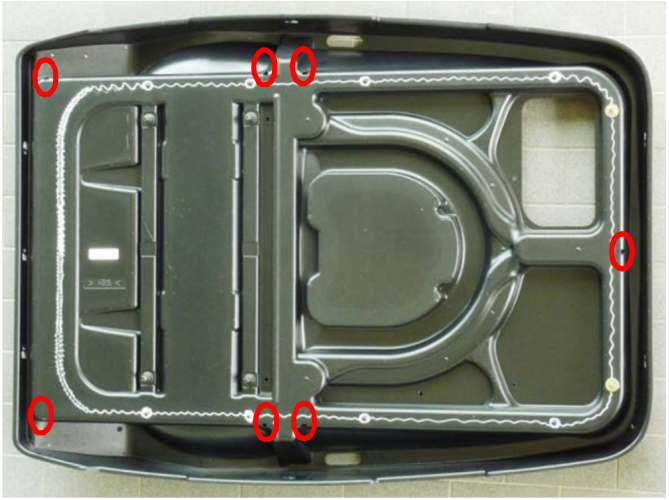
The customer is responsible for the selection and verification of the adhesive material's bonding with the vehicle's roof.

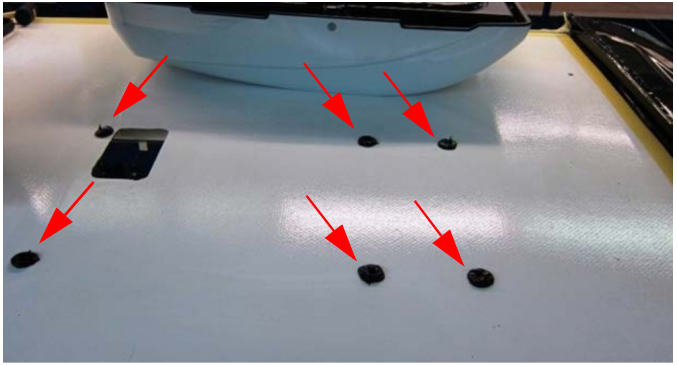
3 Mounting the air-conditioning unit

	**Warning!**	**Danger of injuries due to air-conditioning unit crashing down**

3.1. Applying the adhesive

The best method for preparing sealing between the air-conditioning unit and the vehicle's roof is to apply the adhesive material onto the base pan when the AC unit is lying. Apply the Sika bead all round, along the screws and support points, min. thickness 10mm. Make sure that the drain holes for rain water remain free. Apply Sika also around the drill holes in the roof.

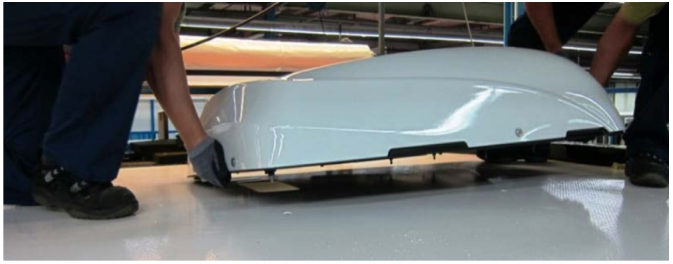




The figure shows the connection variant left in direction of travel.

3.2. Position the air-conditioning unit

Position the air-conditioning unit onto the roof and insert the fastening bolts through the drill holes on the roof. (Follow processing time prescribed by the manufacturer of the adhesive material!)



3.3. Fastening the unit

Fix all fastening screws from inside using adequately large washers and nuts M8 and tighten them uniformly (torque: 14 ±1 Nm).

4 Connecting the air-conditioning unit

4.1. Connecting the refrigerant / water piping

In delivery condition, the connecting points on the air-conditioning unit are closed with sealing caps. Prior to mounting the refrigerant piping the sealing caps must be removed. The unit is pre-filled with 1.1 kg refrigerant R134a. The amount of refrigerant is designed for a max. pipe length to the front box of 4m.

NOTE:
Extends the pipe a length of 4 m, a reappraisal of the system filling quantity by Spheros is required.

Theme oil return: A trap must be installed in the suction gas line (place holder). The refrigerant piping and shut-off valves (Item 1 & 2) in the vehicle must be provided for thermal reasons and to prevent condensation with an insulation (Recommendation: Suction and pressure line).

4.2. Hook-up

The hook-up of the unit should be made according to the wiring diagram on page 21.

For connecting power supply bolts are provided M8 (+24V) and M10 (ground). Connect wires with a cable lug acc. DIN 46234.

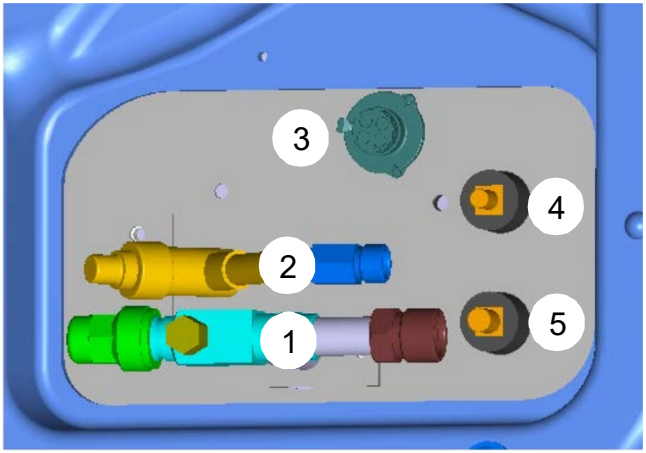
Take the following torques:

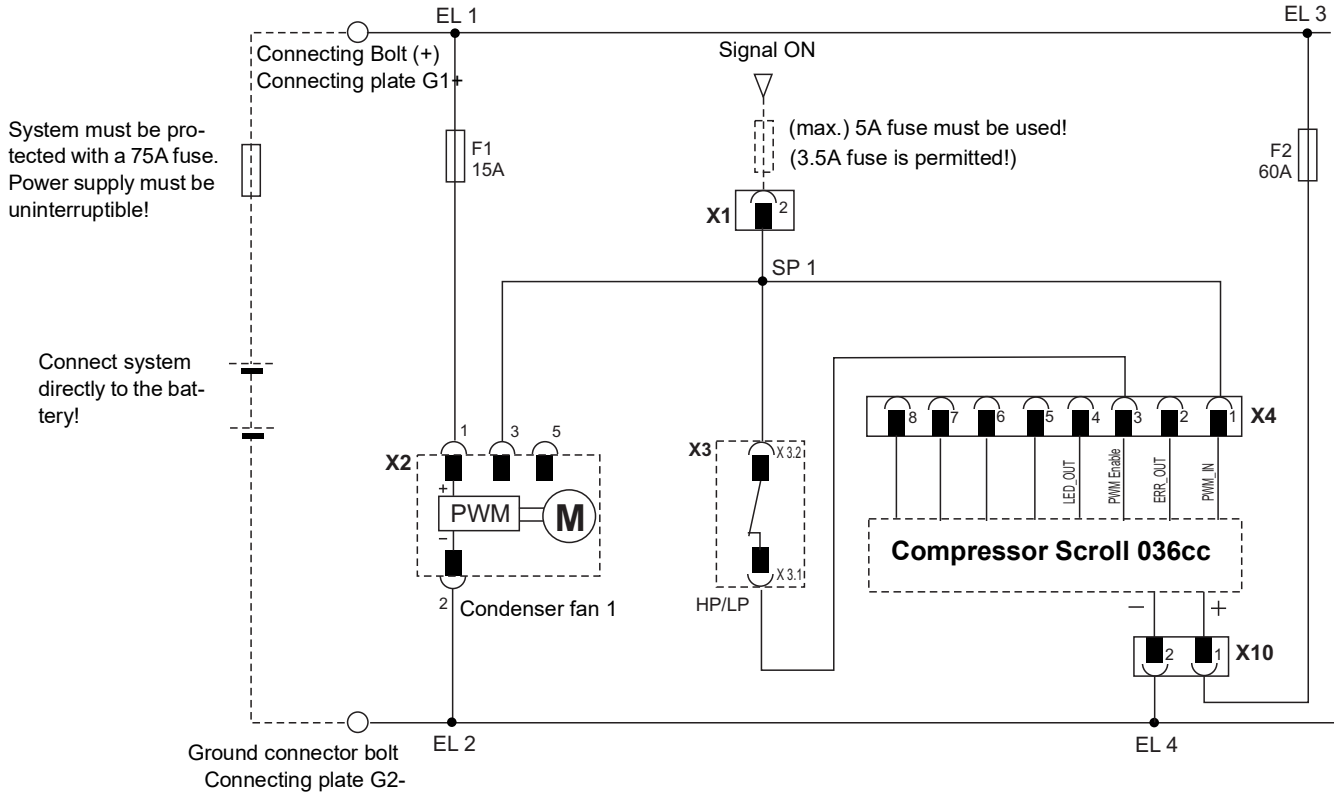
- Bolt M8: 15 Nm
- Bolt M10: 20 Nm

The plus pole must be protected after installation with the included cap to prevent anyone touching it. Use Tyco/AMP ST-GEH 2.5mm socket housing fort the control signals.

Connections

1 Pressure line: solder sleeve 5/8“: 15 Nm
2 Suction line: solder sleeve 7/8“: 20 Nm
3 Control signal: AMP Connector
4 Plus pole: Bolt M8 max. 15 Nm
5 Ground: Bolt M10 max. 20 Nm




EL 1
EL 3
Connecting Bolt (+)
Connecting plate G1+
Signal ON
System must be protected with a 75A fuse. Power supply must be uninterruptible!
F1
15A
(max.) 5A fuse must be used!
(3.5A fuse is permitted!)
F2
60A
X1
2
SP 1
Connect system directly to the battery!
X2
1
3
5
+
PWM
M
-
2
Condenser fan 1
X3
X 3.2
X 3.1
HP/LP
8
7
6
5
4
3
2
1
X4
LED_OUT
PWM Enable
ERR_OUT
PWM_IN
Compressor Scroll 036cc
–
+
2
1
X10
Ground connector bolt
Connecting plate G2-
EL 2
EL 4

4.3. Evacuation and charging of the refrigerant cycle

Warning! **Danger to life and health!**

The safety instructions on page 13 and 14 must be observed.

Evacuate the front box inclusive the piping. Ensure the system is leak proof. Then, open system valves. The unit is pre-filled with 1.1 kg refrigerant R134a (amount of refrigerant is designed for a max. pipe length of 4m).

Extends the piping a length of 4 m, the system filling quantity including front box must be new defined.

5 Technical Data

5.1. Air conditioning system

Designation	Citysphere S
Dimensions (rooftop air-conditioning unit)	
Length x width x height	1200 mm x 860 mm x 250 mm
Weight	ca. 37 kg
Operating voltage (acc. to vehicle's electr. system)	24 V DC
Current consumption	
Total current consumption	65 A (max.)
– Compressor motor	55 A
– Condenser fan	10 A
Switching points, low-pressure switch	
– On	2.1 ± 0.3 bar
– Off	2.0 ± 0.2 bar
Switching points, high-pressure switch	
– Off	26.5 ± 2 bar
– On	20 ± 2 bar
Rated power at temperature inside 25°C and at temperature outside 29°C	3.8 kW
Refrigerant	R134a, 1100g (already prefilled)

5.2. Electrical fuses

Protected components	Fuse Letter symbol	Fuse ratings
Condenser fan	F1	15A
Compressor	F5	60A

5.3. Compressor Scroll 036cc

Lubricating oil for refrigerating compressors (type / quantity)	POE RL68H / 220 ml
Speed (const. speed via ON-signal)	2800 U/min

6 Troubleshooting

6.1. General

a) A systematic approach is advisable for troubleshooting. Appropriate action must be undertaken as described below for faults of a general nature or when normal conditions are not obtained during the pressure test.
b) Certain faults can only be located and remedied by skilled personnel using special tools.

6.2. Cause of faults in the electrical system

The individual circuits must be systematically checked with the aid of the circuit diagram (see para. 4.2) and the fault localized. Above all plug connections, switches, relays, etc., should be checked for continuity. The following possibilities must always be checked and excluded as a possible cause of the malfunction:

– Defective fuses
– Corrosion of plug contacts
– Loose contact in plug connectors
– Wrong crimping on connector
– Corrosion on wiring and fuses
– Corrosion on battery poles

6.3. Cause of faults in the air-conditioning system

– defective condenser fan
– soiled condenser fins
– shortage of refrigerant in the system
– check front box also

If the system is deactivated continuously, we recommend that it be checked by an authorized workshop.

6.4. Dealing with problems in the refrigerant circuit

If faults develop in the refrigerant circuit, the system must be tested and repaired by an authorized specialist repair shop according to the rules. Refrigerant must never be discharged into the atmosphere.

memos

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