OPERATING INSTRUCTIONS
CONTROLLERS FOR AC SYSTEMS

This description is only valid for the following AC systems:

Operation and temperature control by
AC control system E-Control

Eberspächer

Imprint

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88-50-40-00453-00 Rev. A

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The currently valid version of these operating instructions is available from your local Eberspächer Sütrak dealership. Dealership overview see https://www.eberspaecher.com/en/products/air-conditioning/thermo-management-bus/service-parts/dealer-search.html

Disclaimer
These operating instructions have been put together with all due care and attention.

However, Eberspächer Sütrak does not assume any warranty for the provided information being up to date, correct, complete or of the requisite quality. Liability claims against Eberspächer Sütrak GmbH & Co. KG referring to material or immaterial damage caused by the use or non-use of the provided information or by using faulty and incomplete information is fundamentally ruled out insofar as Eberspächer Sütrak is not culpable of verifiable wilful intent or gross negligence.

Vehicle and AC system details
Please keep the following information available in the interests of correct **spare parts orders** and for **service queries**. Any missing details for the AC system can be found on the nameplate. Position of the nameplate on page 28.
Please use block letters.

Vehicle details	**AC system details**
Brand / model	System type
Vehicle identification number	System serial number
Initial registration	Compressor type
Customer	Compressor serial number
	Compressor driven by: ☐ vehicle engine ☐ separate diesel engine ☐ without pre-glow device ☐ with pre-glow device
Installation company (company stamp)	Initial commissioning
	Part number AC controller
	Software version AC controller

Contents

1 Introduction

1.1 Foreword

Read these operating instructions through carefully before starting to operate and work on the AC system. These operating instructions are an integral part of the AC system.
Always keep these operating instructions in the vehicle with the mounted AC system. It must be possible to consult these operating instructions at all times.

Comply with the warning and safety instructions from page 5 to avoid any injury to persons or damage to the product. Operation of the system in other countries is also subject to the corresponding legislation, guidelines and regulations of the country concerned.

Deviations from these installation instructions may occur, depending on the version or modification status of the product.

1.2 Target group

The operating instructions for the AC controller and the care instructions for the AC system address the vehicle driver.

The maintenance instructions in these operating instructions only address trained, qualified skilled staff with professional knowledge in vehicle engineering and vehicle air conditioning systems.

1.3 Styles used in this document

Differing styles are used to highlight the meaning of a text in these operating instructions.

Descriptive text is presented without a prefixed character.

- Text preceded by a dot (▪) indicates a list which is started by a heading.
  – Text preceded by a dash (–) is subordinate to a list with a dot.

→ Indented text preceded by an arrow (➔) indicates measures to prevent danger.

Underlined blue text denotes a cross-reference, which can be clicked in the PDF document. The part of the document named in the text is then displayed.

1.4 Spare and wear parts

As a basic principle, only original spare parts and accessories supplied by Eberspächer Sütrak should be used.
Spare parts and accessories not supplied by Eberspächer Sütrak have not been tested and approved.
Other spare parts and accessories may be used after obtaining Eberspächer Sütrak's approval. The installation or use of products that have not been confirmed may possibly change the design attributes of the AC system.
Eberspächer Sütrak does not assume any liability for damage caused by using spare parts and accessories that have not been approved or by carrying out incorrect work to the AC system.

Note

Eberspächer Sütrak uses copper and aluminium components in its AC systems which are capable of lasting for the lifetime of the AC system under normal ambient conditions. However, corrosion to the copper and aluminium components cannot be ruled out if the AC systems are operated under aggressive ambient conditions, e.g. in air with extreme levels of salt, phosphate or ammonia. The standard copper and aluminium components fitted in the Eberspächer Sütrak systems are not suitable for these extreme operating conditions. Special applications are available for this on request.
Eberspächer Sütrak draws explicit attention to the fact that corrosion is not covered by material defect liability. Eberspächer Sütrak does not assume any liability for corrosion or damaged caused by cleaning the systems with compressed or corrosive substances.

1.5 Guarantee

Warranty claims against Eberspächer Sütrak will be voided if:

- Individual parts or parts of products are damaged by negligence, accident or other cases of misadventure,
- The owner does not perform the normal maintenance at all, or only in part, or deficiently,
- The AC system is not operated according to the written operating instructions from Eberspächer Sütrak,
- Eberspächer Sütrak parts are replaced because of normal wear,
- Parts or products are repaired or changed by third parties unless the repair or modification was approved in writing by Eberspächer Sütrak,
- Parts fitted as spare parts in Eberspächer Sütrak AC systems are not original parts from Eberspächer Sütrak.

2 Safety instructions

2.1 Warnings and indications

Warnings and indications can be found in each case before the operating instruction which could result in a hazard or damage to property.

2.2 Explanation of the indications used in the text

Danger!
This indication refers to a high-risk hazard which, if not heeded, will result in imminent death or serious physical injury.
→ This arrow marks the corresponding precaution for preventing the hazard.

Warning!
This indication refers to a medium-risk hazard which, if not heeded, can result in possible death or serious physical injury.
→ This arrow marks the corresponding precaution for preventing the hazard.

Caution!
This indication refers to a low-risk hazard which, if not heeded, can result in possible slight to medium physical injury or damage to property.
→ This arrow marks the corresponding precaution for preventing the hazard.

Note
The note provides recommendations for use and useful tips for operation, installation and repair.

Regulation!
This information indicates a statutory regulation.

2.3 Warnings on machinery and packaging

The following pictograms are used as warnings on the machinery and packaging of Eberspächer Sütrak GmbH & Co. KG, in addition to and possibly in combination with the danger indications.


General warning.


Warning of dangerous electrical voltage.


Warning of hot surface.


Warning of the risk of crushing/hand injuries.


Warning of rotating parts with sharp edges.

2.4 Accident prevention

General and specific national accident prevention regulations and the corresponding workshop and operating safety instructions are to be observed.

2.5 Directives, legislation and standards

Due consideration must be given to the following directives and regulations:

- Machinery Directive 2006/42/EC
- Pressure Equipment Directive 97/23/EC
- Low Voltage Directive 2006/95/EC
- Electromagnetic Compatibility Directive 2004/108/EC
- Guidelines for safety and environmental requirements for refrigerating systems and heat pumps to EN 378
- Directive 2006/40/EC on the emissions of refrigerants from air-conditioning systems in motor vehicles with fluorinated gases
- Regulation (EC) 307/2008 relating to training attestations regarding the handling of fluorinated gases in air-conditioning systems
- Regulation (EC) 842/2006 relating to the test intervals of refrigeration equipment and the corresponding records to be kept

2 Safety instructions

2.6 General safety instructions

All instructions stated below must be read and heeded. Failure to comply fully or correctly with these instructions can result in malfunctions and/or serious physical injury or even death.

- Eberspächer Sütrak recommends the use only of refrigerant R134a to ARI standard 700. It is forbidden to use additives as leak-detecting contrast agent.
- Air-conditioning systems of Eberspächer Sütrak GmbH & Co. KG are developed and built to state-of-the-art refrigeration and air-conditioning standards. They offer optimum safety for the operating and maintenance personnel.
- During normal operation, all moving parts are protected against accidental contact. However, there may be open access to moving parts during inspections, checks and maintenance work. It is therefore important to observe sufficient clearance to these parts when the air-conditioning system is working. Removing the guards is strictly forbidden.

2.7 Requirements made of the staff

Installation, maintenance and repair work on diesel or electric air-conditioning systems may only be carried out by skilled staff with corresponding training and certified technical know-how.

For work on all-electric (AE) systems, documented training by a specialist for work on high-voltage (HV) intrinsically safe vehicle is also necessary. Only this specialist may put the vehicle into operation again on completion of the work.

2.8 Personal safety gear

Persons working on the AC system and in the immediate vicinity must wear the personal safety equipment at all times.
This includes:


Safety gloves


Safety goggles


Non-slip safety boots

It is also urgently recommended not to wear loose clothing or jewellery. Loose clothing and jewellery can get trapped in rotating fan wheels.

A safety harness must be used when working on the vehicle roof.


Safety harness

2.9 Working area

- Highly concentrated refrigerant vapours can cause cardiac arrhythmia and sudden death.
  - Ensure there is adequate ventilation of closed rooms.
  - Wear a respirator mask.
- The heat developed by a glowing cigarette can decompose the refrigerant with the release of highly toxic substances.
  - Smoking is strictly forbidden when working on the AC system and with the refrigerant.
- When working on the vehicle roof, there is a risk of falling off with serious injuries or death.
  - Use safety harness and ropes for a secure working position.
  - Use a safety platform with safety grille or safety net.

2.10 Electrical safety


Danger!

Risk of fatal injury from electric shock.

Mains-powered compressors and heater elements work with AC voltage of up to 400 volts.

→ Switch off the vehicle ignition.
→ Observe the 5 safety rules:
  - Disconnect,
  - Secure against reconnection,
  - Verify that the power is off,
  - Earth and short-circuit the system,
  - Cover or cordon off any live neighbouring parts.
→ Do not touch unprotected cables.
→ Have unprotected cables repaired by a qualified electrician.

During work on high-voltage (HV) vehicles


If it is necessary to open HV components to establish that they are no longer live, special gloves must be worn as protection against high voltages.

2 Safety instructions

2.11 Safety during installation, operation and maintenance

Refrigerants can cause frostbite on contact with the skin or eyes.

- Wear personal safety gear (safety gloves, safety goggles, safety boots), see Personal safety gear.
- If refrigerant is spilled on the skin, rinse the affected area with warm water. Seek medical advice immediately.
- If refrigerant is spilled in the eyes, rinse for at least 10 minutes with clean water or preferably an eyewash. Seek medical advice immediately.

Pressure lines can heat up considerably during operation of the system and cause burns.

- Wear personal safety gear (safety gloves, safety goggles, safety boots), see Personal safety gear.

Thin fins with sharp edges on the evaporator and condenser can cut your hands.

- Wear personal safety gear (safety gloves, safety goggles, safety boots), see Personal safety gear.

The impeller wheels of the ventilators and fans can cause crushing injuries and may even result in severed limbs.

- Do not remove any safeguards while the system is working.
- Do not do any work to the AC system while it is working.
- Only proceed with work on the AC system when the ventilators and fans are at a standstill.

When there is an increase in temperature, overfull refrigerant bottles can burst because of the generated overpressure.

- Fill refrigerant bottles only up to the stipulated level.

AC systems operate under high pressure. Uncontrolled refrigerant leaks may cause serious injuries and permanent damage to health.

- Do not exceed the maximum pressure and level in the AC system.

When doing soldering work to the refrigerant circuit, any residual refrigerant may emit highly toxic decomposition products.

- Drain the refrigerant circuit completely before starting work.
- Purge the refrigerant circuit with forming gas 95/5 (H_2N_2) or dried nitrogen (quality 4.6 or 5.0).

In an overfilled refrigerant circuit the overpressure caused by a rise in temperature can reduce the performance of the air-conditioning system or cause faults and failures.

- Always only fill the refrigerant circuit up to the stipulated level.

The unit covers of the AC system are secured with locks. Any unit covers that are not locked may work loose while the vehicle is moving and cause considerable damage to the vehicle, the AC system and other road users.

- Always check that the locks have been correctly secured every time after maintenance work has been carried out.

Any unexpected activation of the AC system during installation, maintenance or repair work can cause serious injuries.

- Turn the ignition off before any kind of work begins on the AC system and secure it to prevent it being switched on again.

2.12 Safety for the environment

The refrigerant must not be allowed to drain into the environment and certainly not discharged in the local sewage system.

- Always dispose of refrigerant at suitable collection points.

2.13 Liability and warranty

The manufacturer is not liable for damage caused by unintended use or incorrect operation.
Failure to comply with the safety instructions renders the warranty null and void and precludes any liability on the part of Eberspächer Climate Control Systems GmbH & Co. KG and Eberspächer Sütrak GmbH & Co. KG.

3 How an AC system functions

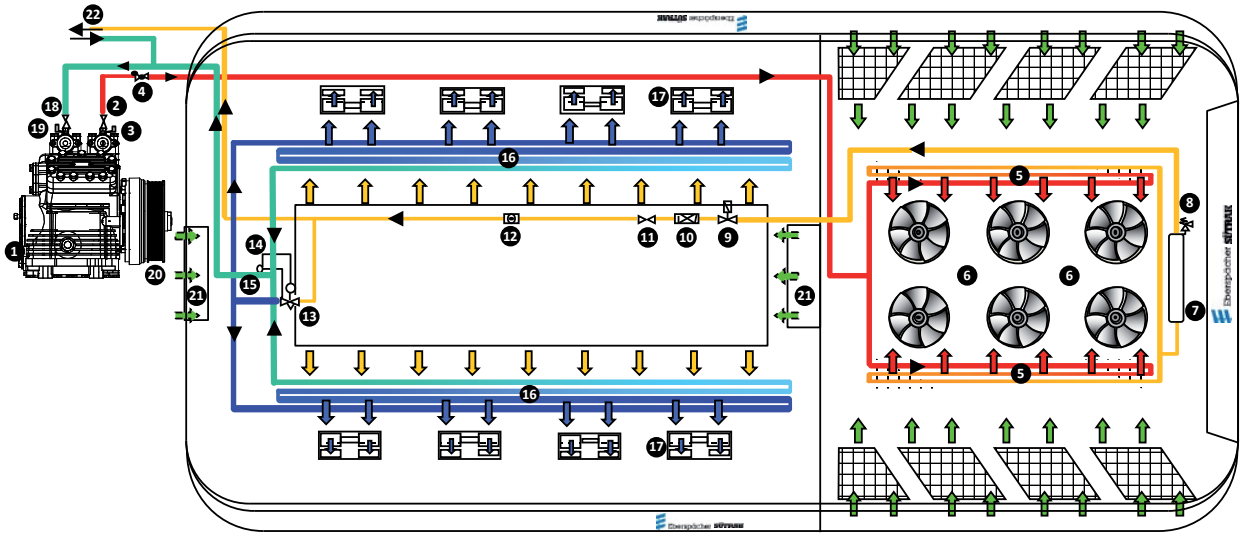
3.1 Functional principle

The refrigerant is drawn in gaseous state from the evaporator (16) into the compressor (1). During compression, both the temperature and the pressure of the gaseous refrigerant increase. The hot, pressurised refrigerant is forwarded to the condenser (5).
In the condenser (5), heat is withdrawn from the hot, pressurised refrigerant so that the refrigerant condenses and becomes liquid. The heat is released to the outside air, expelled by the condenser fans (6) via the condenser fins (5).
The condenser (5) now forces the liquid refrigerant through various components into the drier (10).

From the drier (10), the refrigerant flows through the liquid line via the sight glass (12) to the expansion valve (13).

The expansion valve (13) controls the quantity of fluid refrigerant flowing into the evaporator (16) and keeps the pressure on a constant level in the interests of optimum cooling.
The refrigerant is distributed evenly in the evaporator (16) by feeding the refrigerant into the individual evaporator coils (16) via a distributor and several injection pipes.
The evaporator fans (17) suck in room air and convey it to the evaporator fins. Some of the heat from the air is transferred to the refrigerant, which starts to evaporate due to the low pressure, thus cooling the room air as it flows by. The cycle is repeated constantly.

Example of an in-line AC system



Refrigerant aggregate state

Low pressure - gaseous	Outside air
High pressure - gaseous	Heated extraction air
High pressure - liquid	Heated inside air
Low pressure - liquid	Cooled inside air

1	Compressor
2	Pressure shut-off valve
3	HP pressure switch
4	Non-return valve
5	Condenser with fins
6	Condenser fan
7	Receiver
8	Pressure-relief valve (safety valve)
9	Solenoid valve
10	Drier
11	Shut-off valve
12	Sight glass
13	Expansion valve
14	Sensor for expansion valve
15	Equaliser line
16	Evaporator
17	Evaporator fan
18	Suction shut-off valve
19	LP pressure switch
20	Electromagnetic clutch
21	Fresh air flap
22	Front box connection

4 Operating the AC system

4.1 Operating an AC system with E-Control interface

AC systems by Eberspächer Sütrak are operated

- with the vehicle engine,
- a separate diesel engine or
- a converter connected to a battery

and regulated with a control unit.

The AC system can also be operated directly via the CAN bus. This chapter describes control of the AC system with the E-Control unit. For the configuration of the fitted AC system, see “Information about the vehicle and AC system” on page 2.

E-Control can be used for:

- Solo bus with or without driver's seat air-conditioning
- Articulated bus with or without driver's seat air-conditioning
- Double-decker bus with or without driver's seat air-conditioning

4.1.1 General information

When operating the E-Control AC controller for the first time, switching the IGNITION ON activates the default functions for the temperature control (driver's seat/passenger compartment) and for the driver's seat fan (stage 1). The air flow at the driver's seat is adjusted to up and down.

All other function settings are selected and adjusted individually. The selected settings are saved so that they are retained even after **the engine and ignition have been switched off** and are restored again next time the vehicle starts up. The AC controller always starts up in automatic mode.

4.1.2 Installed monitoring functions

The standard E-Control AC controller is fitted with under- and overvoltage monitoring and with temperature sensor monitoring as well as the pressure monitor for the high- and low-pressure circuit. Feedback from the motor valves and damper motors is also monitored.

If the corresponding signal is connected to E-Control, the condenser fan speed is reduced when the vehicle doors are open.

Possible faults and error messages are described in the chapter on warnings and error messages in the display on page 24.

4.2 Actuations, settings and polling

The control unit of the E-Control AC controller can be used to adjust and poll different values for the driver’s seat and passenger compartment, and to activate or disable various functions. Which values and functions are available depends on whether the ignition is switched on or off and whether the engine is running.

4.2.1 Settings with ignition on

- Switch display on
- Climate functions for compartment 1 to 3 depending on bus configuration
- Fan setting
- Air flow at driver’s seat (TOP, MIDDLE, BOTTOM) when controlled by E-Control.
- Adjust the fresh air flap (RECIRCULATION, FRESH AIR or AUTO)
- Adjust temperature setting for temperature control
- Smog mode
- Pre-heater ON/OFF
- Temperature readout
- AC system status

Note

- When the ignition is switched off, the settings of the active functions are saved and restored again next time the ignition is switched on.
- Adjusted settings for the driver's seat and passenger compartment remain saved even after the power supply is interrupted.

4.2.2 Settings with ignition off

When the ignition is off, the E-Control display and the AC system are also switched off.

- Press the knob to start the AC system manually. The following functions are then available:
  - Settings menu
  - Switch pre-heater on and off

4.2.3 Settings with engine running

- All functions including defrost/reheat mode are activated when the engine is running

4 Operating the AC system

4.3 E-Control interface control panel

E-Control has six function keys:

- one knob that can be pressed
- four function keys with one or two control LEDs
- one menu key.

The display is monochrome with resolution of 192 x 64 pixels.

4.3.1 Description of the function keys

Note

When the LED in the function key is green, the corresponding function is activated.

Function key AUTO

- GREEN LED: automatic mode activated for adjusting the fan and fresh air flap settings in **all** compartments.
- The control LED goes off when the settings for a compartment are changed.
- If **AUTO** is activated, **SMOG** and **REHEAT** are disabled.
- RED LED: error in the AC system. Remedy see chapter 4.10 on page 26.

Function key FAN

- Open the fan setting menu (see chapter 4.8.4 on page 15) to adjust the fan speed for a certain compartment.
- GREEN LED: the fan setting for this compartment differs from the AUTO fan settings.
- Press the knob again to change to the next compartment.
- Press and hold the FAN key to change to the air flow settings menu for the driver's seat (see chapter 4.8.7 on page 17).

4 Operating the AC system

Function key SMOG

- GREEN LED: SMOG function is activated. **ALL** fresh air flaps are closed.
- Press the **AUTO key** to end the SMOG function.
- LED OFF: all fresh air flaps follow the settings of the corresponding compartment (see chapter 4.8.5 on page 16)

Function key REHEAT / DEFROST

- The REHEAT/DEFROST function is only available **when the engine is running**!
- GREEN LED: REHEAT/DEFROST is activated. The REHEAT mode for dehumidifying the passenger compartment is switched on, together with the DEFROST mode for defrosting the windscreen (maximum fan setting, air flow to the windscreen, heating on), if the front box or driver's seat air-conditioning is controlled with E-Control. If there is no roof heating, then only the DEFROST mode is on.
- Press the **AUTO key** to end the REHEAT/DEFROST function.
- REHEAT/DEFROST function has a time limit. The default setting is three minutes.

  Note

  This time can be extended in the CHANGE PARAMETER menu.

MENU key

- Press the **MENU key** to open or close the main menu (see chapter 4.7 on page 13).

  Note

  No LED in this key.

- Within a menu: press the MENU key to return to the previous page or exit the opened menu.

4.3.2 Description knob

Turning clockwise

- **Increases** the adjusted value or changes the selection within the menu.

Turning counterclockwise

- **Decreases** the adjusted value or changes the selection within the menu.

Press briefly:

- Switches the E-Control AC controller on. Opens the settings menu for setpoint temperature (see chapter 4.8.3 on page 15).
- Confirms the chosen option.
- Opens the selected menu.

Press and hold:

- Switches the E-Control AC controller off and the display goes blank.

  Note

  To restart the AC system, press and hold to switch the AC system off, wait for a minute then press briefly to restart.

4 Operating the AC system

4.4 Menu structure

There are **four** levels in the menu structure of the E-Control panel. The available menus depend on the bus configuration (see chapter 4.5 on page 13) and on the number of options.
The following diagram shows the example of a menu structure for a solo bus with roof-mounted AC system.

1			**HOME** menu see chapter 4.6 on page 13
2			**MAIN MENU** see chapter 4.7 on page 13
3			Settings/compartment menu
	SETTINGS MENU see chapter 4.9 on page 17	**COMPARTMENT MENU** see chapter 4.8 on page 14)	
4	 Time  Date  Info  Programming the pre-heater Other settings: see settings menu	 Setpoint temperature  Fan strength  Fresh air flap  Pre-heater manual on/off Other settings: see compartment menu	Submenus

4 Operating the AC system

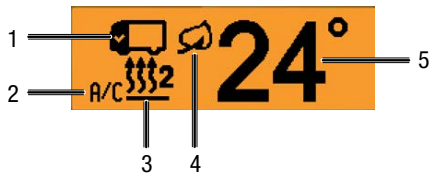
4.5 Picture symbols depending on the bus configuration

The picture symbols show the various compartments (air-conditioning areas).

The following table explains the meaning of all compartment picture symbols. The number of compartments depends on the specific bus configuration.

		Number of compartments					
		1	2	2	2	3	3
	Bus configuration	**Solo bus**	**Solo bus with defroster**	**Articulated bus without defroster**	**Double-decker bus without defroster**	**Articulated bus with defroster**	**Double-decker bus with defroster**
Compartment 1	Symbol						
	Description	Passenger compartment	Driver's seat	Front section	Upstairs	Driver's seat	Driver's seat
Compartment 2	Symbol						
	Description		Passenger compartment	Rear section	Downstairs	Front section	Upstairs
Compartment 3	Symbol						
	Description					Rear section	Downstairs

4.6 Home menu



Item	Icon	Description
1	Compartment	Shows the compartment for which settings can be adjusted
2	A/C	Appears when the compressor is running
3	Pre-heater	Appears when the pre-heater is on
4	ECO	ECO function appears when the function is activated for this compartment. The setpoint temperature then depends on the outside temperature.
5	Setpoint temperature	Shown in °C or °F The setpoint temperature can be adjusted between 17 and 28 °C (62 and 82 °F). **Note** The displayed unit can be changed in the settings menu for setpoint temperature (see page 15).

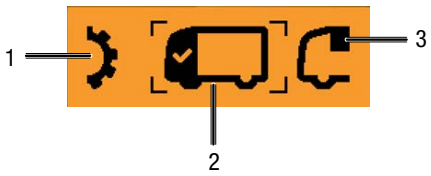
Functions in Home menu

- Open the main menu (see page 13) by pressing the MENU function key.
- Open the settings menu for setpoint temperature (see page 15) by turning the knob briefly.
- Open the settings menu for fan strength (see page 15) by pressing the fan function key.

4.7 Main menu

The compartment menu and the adjustment menu can be opened in the main menu.

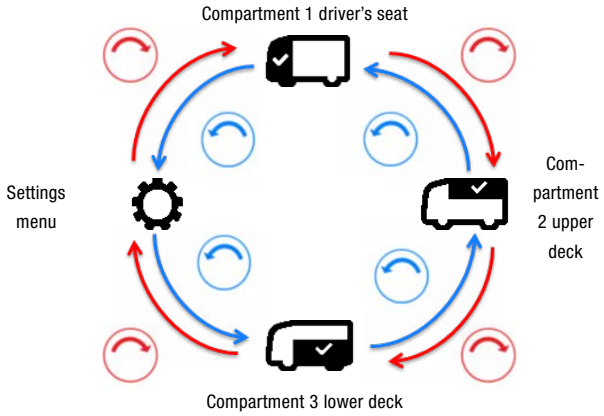
The available picture symbols depend on the bus configuration (see page 13). The example used in this chapter consists of a double-decker bus with front box.



Item	Description
1	previous option
2	selected option
3	next option

4 Operating the AC system

1. Turn the knob to select the required menu.

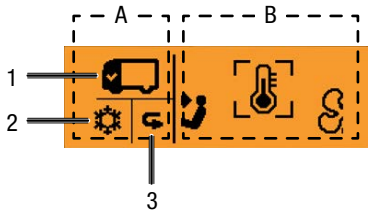


2. Press knob to confirm selection.
3. Adjust settings for the selected compartment or in the settings menu.
4. Press MENU function key to return to Home menu.

4.8 Compartment menu

The compartment menu consists of two sections:
display section and action section. More submenus can be opened in the action section.

4.8.1 Meaning of the symbols in the display section

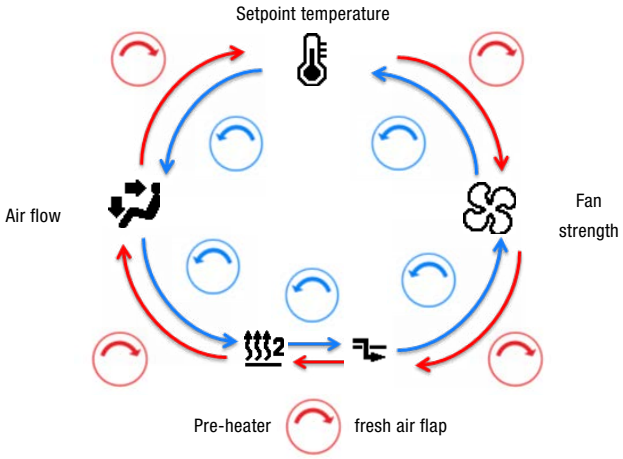


Item	Icon	Description
A	---	Display section
B	---	Action section
1	Current compartment	Driver's seat
2	Operating state	Current status for the selected compartment
		OFF
		Ventilate
		Cool
		Heat
		Reheat / Defrost
		Error (see Troubleshooting)
3		Appears when the fresh air flap of the current compartment is set to recirculation.

4.8.2 Navigation in the action section

The options available in the action section vary according to compartment type (driver's seat, passenger compartment) and system equipment (fresh air flap, pre-heater, etc.). Use the knob to navigate through the action section.

1. Use the knob to select the required option for the current compartment.



2. Press knob to confirm selection.
3. Adjust settings for the selected compartment.
4. Press MENU function key to return to Home menu.

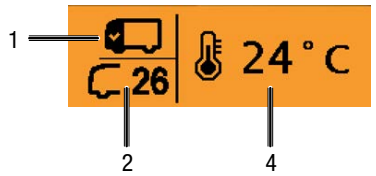
4 Operating the AC system

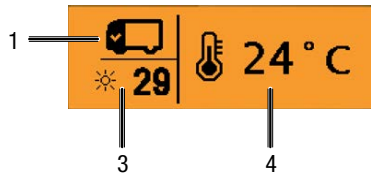
4.8.3 Settings menu for setpoint temperature

The **setpoint temperature** for the current compartment can be adjusted in this submenu. The display shows the inside temperature alternating with the outside temperature, if the bus has an outside temperature sensor.

Note

The temperatures are shown in °Celsius or °Fahrenheit, depending on the setting.



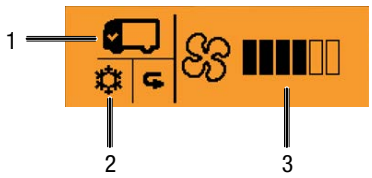


Item	Description
1	Current compartment
2	Current inside temperature
3	Current outside temperature
4	Adjusted setpoint temperature in °C

1. Use the knob to select the required setpoint temperature for the current compartment.
2. Press the knob to confirm your selection and change to the next compartment, if there is one.
3. Press MENU function key to return to compartment menu.

4.8.4 Settings menu for fan strength

In this menu, you can adjust the **fan strength** manually or press the **AUTO** function key to return to the automatic mode.



Item	Description
1	Current compartment
2	Current state of the AC system
3	Adjusted fan strength

1. Use the knob to select the required fan strength for the current compartment.

   Note

   0 = fan off

   1 – 6 (1 = min, 6 = max),

   AUTO = automatic mode

2. Press the fan key to change to the next compartment if there is one.
3. Press knob to confirm selection.
4. Press the knob or the MENU function key to return to the compartment menu or to the Home menu.

Defrost / Reheat

In the **defrost / reheat** mode, the fans are always set to automatic. The fans cannot be adjusted in the **reheat** mode!

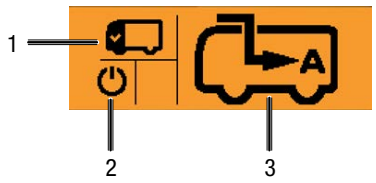
Cooling mode

The fans cannot be switched off in cooling mode but continue to run at a low fan strength. This ensures that the evaporator does not freeze when the compressor is running.

4 Operating the AC system

4.8.5 Settings menu for fresh air flap

The operating mode for the **fresh air flap** can be adjusted in this menu.

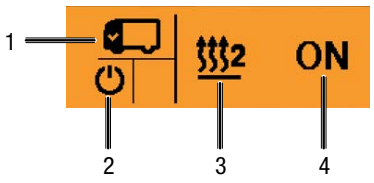


Item	Description	
1	Current compartment	
2	Current state of the AC system	
3	Fresh air flaps	
		**Automatic** = fresh-air flap is automatically adjusted to the optimum position for the current mode
		**Fresh air** = the fresh air flaps are open to let fresh air inside the bus.
		**Recirculation** = the fresh air flaps are closed. The air inside the bus is circulated, there is no supply of fresh air from the outside.

1. Use the knob to select the required operating mode for the current compartment.
2. Press the knob or the MENU function key to return to the compartment menu or to the Home menu.

4.8.6 Settings menu for the pre-heater

If the bus is fitted with a pre-heater, this menu can be used to adjust the **pre-heater** manually.



Item	Description
1	Current compartment
2	Current state of the AC system
3	Menu point pre-heater
4	Current operating mode of the pre-heater

1. Use the knob to select the required operating mode for the pre-heater.
2. Press knob to confirm selection and return to compartment menu.

   Note

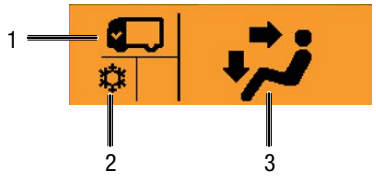
   When the pre-heater is on, this is shown accordingly in the home menu.

3. Press the menu function key to leave the menu without changing the operating mode of the pre-heater and return to the compartment menu.

4 Operating the AC system

4.8.7 Settings menu for air flow

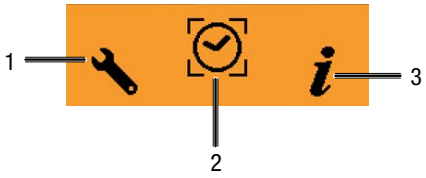
If integrated in the AC control unit, the **air flow for the driver's seat** can be adjusted in this menu. If not, this setting has no influence. For information about the air flow, please refer to the bus manufacturer's manual.



Item	Description	
1	Current compartment	
2	Current state of the AC system	
3	Air flow	Settings option
		**Top**: fan points to the windscreen and feet.
		**Middle**: fan points to the body and feet.
		**Bottom**: fan points to the feet.

1. Use the knob to select the required air flow for the driver's seat.
2. Press knob to confirm selection and return to compartment menu.
3. Press menu function key to exit menu and return to compartment menu.

4.9 Settings menu

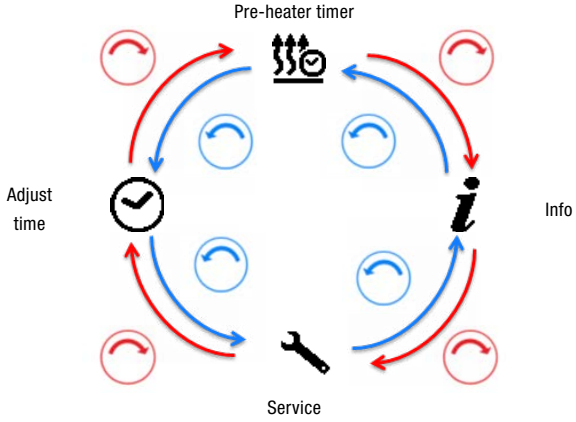


Item	Description
1	previous settings menu
2	current settings menu
3	next settings menu

4.9.1 Navigating through the display section

The options available in the action section depend on the bus configuration. Use the knob to navigate through the action section.

The following diagram shows the possible options and their meaning.



4 Operating the AC system

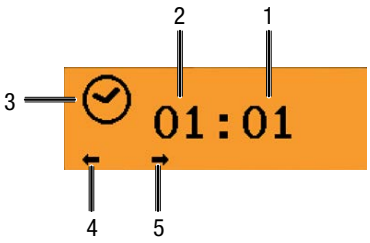
4.9.2 Adjust time

The time and date of the system can be adjusted in this menu. The setting should be adjusted when commissioning the system. The AC control uses these data to save any occurring errors with the correct time stamp. The clock is shown in 24-hour format.

Note

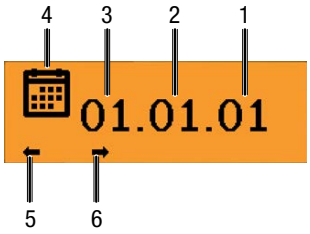
The system time does not change over automatically to summer time.

1. In the “Adjust time” menu, press AUTO, fan or the knob to activate the setting. Adjust the time as soon as the position flashes.
2. Go to the required position with the AUTO function key and fan.



Item	Icon	Description
1	01:**01**	Minutes
2	**01**:01	Hours
3		Menu point for adjusting time
4		To adjust the hours, press AUTO AUTO
5		To adjust the minutes, press the fan key

3. Use the knob to adjust the required value for this position.
4. Press the knob to confirm and change to adjusting the date.
   - The position that can be adjusted flashes.
5. Select the day, month or year with the function key AUTO and the fan key.
6. Use the knob to adjust the required value for the date.



Item	Icon	Description
1	01:01:**01**	Year
2	01:**01**:01	Month
3	**01**:01:01:	Day
4		Menu point for adjusting the date
5		To adjust the day or month, press AUTO AUTO
6		To adjust the month or year, press the fan key

7. Press the knob to confirm the date and return to the settings menu.
8. Press the menu function key to return to the settings menu without many any changes.

4.9.3 Info

The INFO menu shows the part number, software version of master nodes and control panel together with service information. The display automatically changes to the next display after ten seconds or after pressing the knob.

Display 1

Item	Designation	Description
1	PN: 88-50-38-XXXXX-00	Eberspächer part number for the E-Control Box master
2	SW Box V X.XX	SW version E-Control Box (master)
3	SW Interface V Y.YY	SW version E-Control interface (control panel)

4 Operating the AC system

1. Press the knob to change to display 2.
   Display 2 shows when the next service of the AC system is due.

Display 2

Item	Description
1	Service
2	Remaining time until the next service

2. Press the knob to end the info menu and return to the settings menu.

Note

If the next service is due in less than 30 days, this message also appears when you switch the E-Control on.

4.9.4 Adjust pre-heater timers

When the vehicle is fitted with a pre-heater, up to three timers can be programmed for automatic pre-heating. Every timer can be activated for any days.

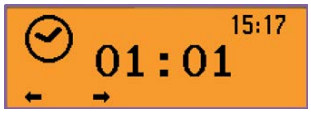
Note

All texts appear only in English.

1. Turn the knob to select the required timer. The selected timer appears against a black background.

2. Press the knob to confirm selection. The selected timer is activated (ON) and can now be programmed.

3. Adjust the starting time with the knob and press the knob to confirm selection.
4. Adjust the required starting time with the knob. Use the AUTO and fan keys to change between hours and minutes, as when adjusting the time.



5. Press the menu function key to confirm the starting time setting and return to the previous menu.
6. Use the knob to go to the setting for the day of the week and choose the required days of the week.
7. Press the menu function key to confirm the days of the week setting and return to the previous menu.
8. Press the menu function key again to return to the timer menu.
9. Continue programming the timer if necessary.

➔ As soon as the timer is activated (TIMER ACTIVE = ON), the pre-heater switches on at the required time on the required day.

Note

The activation only applies for one week to avoid unnecessary heating cycles. To start the pre-heater at the same time again in the next week, the corresponding timers have to be activated again, but the adjusted times and days of the week are saved.

4.9.5 Service

Only trained staff may make adjustments in the service menu. The menu is therefore PIN-protected. For initial commissioning, the PIN is 0000. It is advisable to change the PIN accordingly (see page 23).

Item	Icon	Description
1	Key	Protected area
2	XXXX	Adjusted PIN

The service menu has a vertical structure. Navigation is by turning and pressing the knob and by pressing the menu function key (see page 10). The black line shows the current selection.

4 Operating the AC system

The following sub-menus are available:

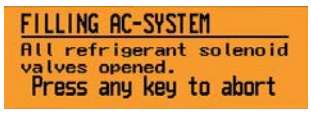
- FILL AC-SYSTEM: Filling the AC system
- RECHARGE AC-SYSTEM: Recharging the AC system
- SYSTEM TEST PROGRAMS: System test programs
- HMI TEST ROGRAMS: HMI test programs
- CHANGE PIN: Changing the PIN
- RESTORE SERVICE COUNTER: Resetting the service counter
- CHANGE PARAMETERS: Changing the parameters
- ERROR MEMORY: Error memory

4.9.5.1 Filling the AC system

This menu activates a service function to fill the AC system with refrigerant.

1. Select the service function “Fill AC System” with the knob and press the knob to confirm.

➔ The AC control is switched off. All refrigerant valves are open.



2. Press any key to abort the service function and return to the service menu.

4.9.5.2 Recharging the AC system

This menu activates a service function to recharge refrigerant in the AC system. While this service function is activated, the AC control is switched off. Instead, permanent cooling mode is activated: the compressor runs continuously, regardless of the room temperature, and all refrigerant valves are open. The evaporator fan and condenser blower also run to warrant correct operation and correct system pressures.

1. Select the service function “Recharge AC System” with the knob and press the knob to confirm.

➔ The AC control is switched off, permanent cooling mode is activated, i.e. the compressor runs continuously, regardless of the room temperature, and all refrigerant valves are open.

2. Press any key to abort the service function and return to the service menu.

4.9.5.3 System test programs

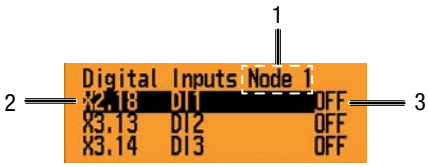
This enables the service technician to red out or change the statuses and values of the inputs and outputs of the installed nodes.

1. Select required node.

2. In the selected node, select the required pin category.
   - DI (digital inputs)
   - DO (digital outputs)
   - AI (analog inputs)
   - AO (analog outputs)

4.9.5.3.1 Digital inputs

No adjustments are possible in the digital inputs (DI) menu. It is used to read out the status of the corresponding pin.



Item	Name	Description
1	Node #	Shows the selected node (Node 0 = Master, Node 1 = Slave 1, Node 2 = Slave 2,…)
2	PIN ID	As in circuit diagram XY.Z (XY = plug number, Z = pin number)
3	Input status	**OFF** = no voltage at input. **ON** = 24 V or 12 V at input.

4 Operating the AC system

4.9.5.3.2 Digital outputs

The digital outputs (DO) menu can be used to switch the selected digital output on or off.

Caution!

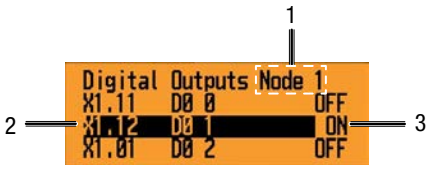
Incorrect use of this test can cause damage to the system.

➔ Settings may only be adjusted out by trained staff!

1. Select the required digital output with the knob.
2. Press the knob to change the state of the selected digital output (ON/OFF).

Note

The Force Mode remains active until the system test program has been exited.

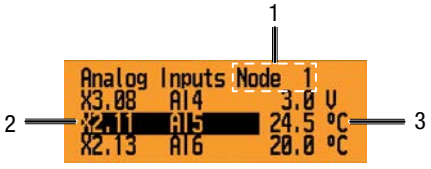


Item	Name	Description
1	Node #	Shows the selected node (Node 0 = Master, Node 1 = Slave 1, Node 2 = Slave 2,…)
2	PIN ID	As in circuit diagram XY.Z (XY = plug number, Z = pin number)
3	Output status	**OFF** = no voltage at input. **ON** = 24 V or 12 V at input.

3. Press MENU function key to return to the previous menu.

4.9.5.3.3 Analog inputs

No adjustments are possible in the analog inputs (AI) menu. It is used to read out the value of the corresponding pin. The unit and representation may differ depending on the type of input, e.g. °C for analog inputs allocated to temperature sensors, bar for pressure sensor inputs and V (volt) for electrical analog inputs.



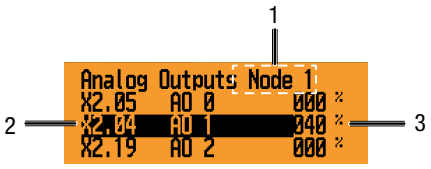
Item	Name	Description
1	Node #	Shows the selected node (Node 0 = Master, Node 1 = Slave 1, Node 2 = Slave 2,…)
2	PIN ID	As in circuit diagram XY.Z (XY = plug number, Z = pin number)
3	Input status	Depends on the type of input.

4.9.5.3.4 Analog outputs

This menu can be used to control the analog outputs (AO), e.g. voltage outputs or PWMs.

Caution!

Incorrect use of this test can cause damage to the system.



Item	Name	Description
1	Node #	Shows the selected node (Node 0 = Master, Node 1 = Slave 1, Node 2 = Slave 2,…)
2	PIN ID	As in circuit diagram XY.Z (XY = plug number, Z = pin number)

1. Press the knob to select the analog output and open the sub-menu.
2. Adjust percentage value for the selected analog output.
3. Press the knob to confirm and exit the sub-menu.

Note

The Force Mode remains active until the system test program has been exited.

4 Operating the AC system

– pin X2.4 and X2.5: the supply voltage is reduced to this percentage, e.g. for 24V, 50% equals 12V at the output and 75% equals 18V.

Note

There can be a drop in voltage depending on the connected elements.

– pins X2.15, X2.16, X2.19 and X2.20: the percentage corresponds to the working cycle of a pulse width modulated signal (PWM).

Caution!

These pins are normally used as digital signals for driving electric motors, e.g. flaps and valves, so that the only permissible values in this case are 0% and 100%. Otherwise the system can be damaged.

4.9.5.3.5 HMI test programs

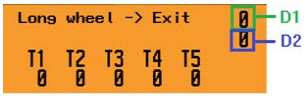
The HMI test programs menu can be used to carry out various tests on the control panel.

The following tests are available:

- KEY test
- KEY LED test
- BACKLIGHT test
- DISPLAY test

4.9.5.3.6 Key test

This test checks the function keys on the control panel. There is one counter each for every function key, and two counters for the knob. Every time a function key is pressed, the counter value is increased by one; turning the knob increases or decreases the counter value by one. If one of the keys is pressed and held for longer than two seconds, the corresponding counter is reset to zero.



Key	Description
AUTO	Increases the counter value for T1
	Increases the counter value for T2
	Increases the counter value for T3
	Increases the counter value for T4
	Increases the counter value for T5
AUTO **long**	Resets counter T1.
long	Resets counter T2.
long	Resets counter T3.
long	Resets counter T4.
long	Resets counter T5.
	Increases the counter value for D1
	Increases the counter value for D1
	Reduces the counter value for D1
long	Ends the test program

4.9.5.3.7 Key LED test

All four function keys (apart from the menu key) have two LEDs each: one red and one green. The LED test checks their functioning capability.

1. Press AUTO to switch ON / OFF the green LED.
2. Press to switch ON / OFF the red LED.
3. Change the LED brightness with the knob.
4. Exit the test program by pressing and holding the knob .

4 Operating the AC system

4.9.5.3.8 Adjusting the backlight

This program can be used to adjust the display backlight between 0 (off) and 100% (maximum brightness).

1. The knob is used to adjust the backlight to the required value.
2. Press the menu key to end the settings program and return to the previous menu.

4.9.5.3.9 Display test

This test checks the functionality of all display pixels. It is thus possible to identify dead pixels. The test program restarts as soon as the right-hand display screen is reached.

1. Change the display brightness with the knob.
2. Press one of the keys to end the display test and return to the previous menu.

4.9.5.3.10 Change PIN

The PIN can be changed in this menu.

1. Use the following keys to change the PIN:

Key	Description
AUTO	Press to move cursor to the left. (⬅)
	Press to move cursor to the right.(➡)
	Increase number value for activated position.
	Decrease number value for activated position.
	Confirm entered value.
	Exit menu

2. Enter new PIN a second time for safety reasons.

Caution!

The service menu is not accessible without a PIN! In this case it can only be unlocked by an Eberspächer service technician on site!

3. Forward PIN to authorised staff and keep accurate records.
   ➔ After the PIN has been entered again, the previous menu appears.

4.9.5.3.11 Reset service counter

The service counter is saved in the master E-Control Box. The master E-Control Box and the control panel communicate during CAN initialisation. In this menu, the service counter can be reset to 365 days to prevent the service message from appearing when the AC system is switched on.

1. Press the knob to reset the service counter.
2. Press the menu key to exit the menu without resetting the counter.

Note

The counter/system must be reset for a change on the control panel to be visible.

4.9.5.3.12 Changing parameters

This menu can be used to change some of the control interface parameters, such as the unit for the displayed temperatures, the minimum and maximum settings, and the reheat duration.

1. Select the required parameter with the knob and press to confirm.
   ➔ The selected parameter appears against a black background.

4 Operating the AC system

➔ For parameters such as “Display Temp. Unit” or “Automatic Start”, press the key to adjust the alternative value, e.g. °C to °F.

➔ A new window appears for adjustable number values.

2. Change the selected value with the knob.
3. Press knob to confirm entry. The arrow in front of the adjusted parameter value disappears.

Note

For safety reasons, for some parameters new values can only be entered within predefined limits.
The reheat duration is stated in minutes.

4. Press the menu key to exit the menu without changing the parameters.

Meaning of the parameters

Note

Bold values show the factory setting.

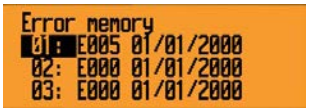
1. **Display Temp Unit:** Unit for all temperatures shown in the display.
   Possible values: **°C** / °F
2. **Min. Set Point (°C):** Minimum adjustable value for the setpoint temperature in °C for all compartments.
   Possible values: 16...30 °C
3. **Max. Set Point (°C):** Maximum adjustable value for the setpoint temperature in °C for all compartments.
   Possible values: 16...30 °C

   Note

   If Min. Set Point and Max. Set Point are set to the same value, the setpoint temperature setting is blocked and can no longer be changed. If the currently adjusted setpoint temperatures do not correspond with this Min. and Max. Set Point, they are blocked as soon as a new set point is to be adjusted.
4. **Reheat duration:** Adjusting the reheat duration in minutes.
   Possible values: 0…20 min
5. **Automatic start:** stipulates whether the HVAC system starts automatically when the ignition is switched on or whether the operator (driver) has to press the knob to start the system.
   Possible values: **ON**/OFF

4.9.5.3.13 Error memory

This menu can be used to read out the error memory of the master E-Control Box. Maximum 20 errors can be recorded in the error memory. If the same error occurs repeatedly, the same memory slot is used, but the previous date and time are overwritten. When the error memory is full and another error occurs, the oldest error is overwritten. The error memory can be deleted with a diagnostics software.



Error code	SW Ref.	Meaning
E000	Zero	Not written
E001	ND1	Low pressure error Compressor 1
E002	ND2	Low pressure error Compressor 2
E003	ND3	Low pressure error Compressor 3
E004	HD1	High pressure error Compressor 1
E005	HD2	High pressure error Compressor 2
E006	HD3	High pressure error Compressor 3
E007	KG1	Compressor1 blocked
E008	KG2	Compressor2 blocked
E009	KG3	Compressor3 blocked
E010	NDT1	Low pressure sensor error Compressor1
E011	NDT2	Low pressure sensor error Compressor2
E012	NDT3	Low pressure sensor error Compressor3
E013	HDT1	High pressure sensor error Compressor1
E014	HDT2	High pressure sensor error Compressor2
E015	HDT3	High pressure sensor error Compressor3
E016	AFO	Ambient temp. sensor open circuit
E017	AFK	Ambient temp. sensor shortcut
E018	IFO1	Return air temp. sensor open circuit room 1
E019	IFO2	Return air temp. sensor open circuit room 2
E020	IFO3	Return air temp. sensor open circuit room 3
E021	IFO4	Return air temp. sensor open circuit room 4
E022	IFK1	Return air temp. sensor shortcut room 1
E023	IFK2	Return air temp. sensor shortcut room 2
E024	IFK3	Return air temp. sensor shortcut room 3
E025	IFK4	Return air temp. sensor shortcut room 4

4 Operating the AC system

Error code	SW Ref.	Meaning
E026	ZFO1	Supply air temp. sensor open circuit room 1
E027	ZFO2	Supply air temp. sensor open circuit room 2
E028	ZFO3	Supply air temp. sensor open circuit room 3
E029	ZFO4	Supply air temp. sensor open circuit room 4
E030	ZFK1	Supply air temp. sensor shortcut room 1
E031	ZFK2	Supply air temp. sensor shortcut room 2
E032	ZFK3	Supply air temp. sensor shortcut room 3
E033	ZFK4	Supply air temp. sensor shortcut room 4
E034	BFO1	Floor convector temp. sensor open circuit room 1
E035	BFO2	Floor convector temp. sensor open circuit room 2
E036	BFO3	Floor convector temp. sensor open circuit room 3
E037	BFO4	Floor convector temp. sensor open circuit room 4
E038	BFK1	Floor convector temp. sensor shortcut room 1
E039	BFK2	Floor convector temp. sensor shortcut room 2
E040	BFK3	Floor convector temp. sensor shortcut room 3
E041	BFK4	Floor convector temp. sensor shortcut room 4
E042	EFO1	Evaporator coil temp. sensor open circuit room 1
E043	EFO2	Evaporator coil temp. sensor open circuit room 2
E044	EFO3	Evaporator coil temp. sensor open circuit room 3
E045	EFO4	Evaporator coil temp. sensor open circuit room 4
E046	EFK1	Evaporator coil temp. sensor shortcut room 1
E047	EFK2	Evaporator coil temp. sensor shortcut room 2
E048	EFK3	Evaporator coil temp. sensor shortcut room 3
E049	EFK4	Evaporator coil temp. sensor shortcut room 4
E050	FFO	Frontbox temp. sensor open circuit
E051	FFK	Frontbox temp. sensor shortcut
E052	WFO	Water temp. sensor open circuit
E053	WFK	Water temp. sensor shortcut
E054	KL1	Condenser fan room 1
E055	KL2	Condenser fan room 2
E056	KL3	Condenser fan room 3
E057	KL4	Condenser fan room 4
E058	KLK1	Condenser fan Calibration room 1
E059	KLK2	Condenser fan Calibration room 2
E060	KLK3	Condenser fan Calibration room 3
E061	KLK4	Condenser fan Calibration room 4
E062	VG1	Evaporator blower room 1
E063	VG2	Evaporator blower room 2
E064	VG3	Evaporator blower room 3
E065	VG4	Evaporator blower room 4
E066	VGK1	Evaporator blower Calibration room 1
E067	VGK2	Evaporator blower Calibration room 2
E068	VGK3	Evaporator blower Calibration room 3
E069	VGK4	Evaporator blower Calibration room 4
E070	DHV1	Roof heating motor valve room 1
E071	DHV2	Roof heating motor valve room 2
E072	DHV3	Roof heating motor valve room 3
E073	DHV4	Roof heating motor valve room 4
E074	BHV1	Floor heating motor valve room 1
E075	BHV2	Floor heating motor valve room 2
E076	BHV3	Floor heating motor valve room 3
E077	BHV4	Floor heating motor valve room 4
E078	FL1A	Fresh air flap side A room 1
E079	FL2A	Fresh air flap side A room 2
E080	FL3A	Fresh air flap side A room 3
E081	FL4A	Fresh air flap side A room 4
E082	FL1B	Fresh air flap side B room 1
E083	FL2B	Fresh air flap side B room 2
E084	FL3B	Fresh air flap side B room 3
E085	FL4B	Fresh air flap side B room 4
E086	LVK	Distribution air flap for driver
E087	EH1	Electric heater error room 1
E088	EH2	Electric heater error room 2
E089	EH3	Electric heater error room 3
E090	EH4	Electric heater error room 4
E091	SH	Preheater error
E092	CAN1	CAN error during operation
E093	CAN2	CAN error by initialization
E094	CIF	CAN error missing E-Control Interface
E095	CSL1	CAN error missing Slave 1
E096	CSL2	CAN error missing Slave 2
E097	CSL3	CAN error missing Slave 3
E098	CSL4	CAN error missing Slave 4
E099	CSL5	CAN error missing Slave 5
E100	CSL6	CAN error missing Slave 6
E101	MPE1	Motor protection error C1
E102	MPE2	Motor protection error C2
E103	MPE3	Motor protection error C3
E104	ULWL	Inverter Low Water Level
E105	UHT	Inverter High Temperature
E106	UVE	Inverter Voltage Error
E107	ULPA	Inverter low Power available
E108	UGE	Inverter General Error
E109	UAC	Inverter AC Error
E110	UDC	Inverter DC Error
E111	UCAN	Inverter CAN Error

4 Operating the AC system

4.10 Troubleshooting

A red LED in the AUTO key indicates a serious system error has occurred. Typically this means that the AC compressor was switched off after more than three pressure errors (overpressure or negative pressure) within ten minutes.

4.10.1 Error eliminated by driver

1. Stop vehicle.
2. Switch engine and ignition off and on again, particularly in all-electric buses.

➔ Red LED off: error is eliminated, the journey can continue and the AC can be started up again.

➔ Red LED stays on: another error has occurred, troubleshooting must continue.

4.10.2 Error eliminated by the workshop

If the red LED stays on after restarting, a return air sensor in one of the passenger compartments may be defective, or the front box sensor. In all-electric buses, there may be an error in the inverter.

1. Check the operating state of the individual compartments in the compartment menu.

➔ If the error icon appears, contact a service workshop.

2. Read out the error memory for more precise diagnosis of the occurred error.

5 Refrigerants and oils

5.1 Refrigerant

§ Regulation!

AC systems by Eberspächer Sütrak may only be operated with the chlorine-free HFC coolant R134a. This corresponds to the statutory classification L1 and safety group A1.

Failure to comply with this regulation results in expiry of the type-approval for the AC system and exclusion of any guarantee and liability claims against Eberspächer Climate Control Systems GmbH & Co. KG and Eberspächer Sütrak GmbH & Co. KG.

Quantity of refrigerant

Refrigerant hoses differ in length depending on the vehicle and the installation position. The quantity of refrigerant can vary, depending on the length and cross-section of the refrigerant hoses. The correct quantity of refrigerant is stated on the nameplate or can be obtained from Eberspächer Sütrak or authorised dealerships.

5.2 Oils

⚠ Caution!

Never mix different types of oil as this is detrimental to the properties of the oil and can cause considerable damage in the AC system. Furthermore, no additives may be mixed with the refrigerating machine oil (including leak-detecting contrast agents).

→ Any contraventions will make the guarantee null and void.

Refrigerator oil

Eberspächer-Sütrak recommends using refrigerator oil with the Eberspächer specification. See spare parts list for article and order numbers. Alternatively, the following oil types can be used, depending on the design of the AC system or AC compressor:

- **SE 55 (POE):**
  - Fuchs (DEA) Triton SE 55
  - Fuchs Reniso E 68
  - ICI RL 68 S
  - EAL Arctic 68
  - Mobil Arctic EAL 68
- **PAG:**
  - PAKELO PAG ISO 100 (recommended)
  - PAKELO PAG ISO 46
- **SE 170 (Hermetic / Compact Screw Compr. VSK):**
  - BSE 170
  - ICI EMKARATE RL 170H
  - CPI SOLEST 170
  - Castrol SW 220 HT
  - BP Enersyn MP-S170

For AC systems with rigid refrigerant pipes:

- Castrol Icematic SW 68

6 Identification of the AC system

6.1 Nameplate

Every AC system by Eberspächer Sütrak GmbH & Co. KG can be unequivocally identified by the details on its nameplate. It is advisable to enter these details in the table on page 2 of this document to ensure they are available for quick access.
The positioning of the nameplate on the AC system differs according to the particular version, as illustrated below.

The nameplate contains the following details:

- Model number
- Serial number
- Parts list number (BOM)
- Order number
- Refrigerant type
- Date of manufacture of the AC system

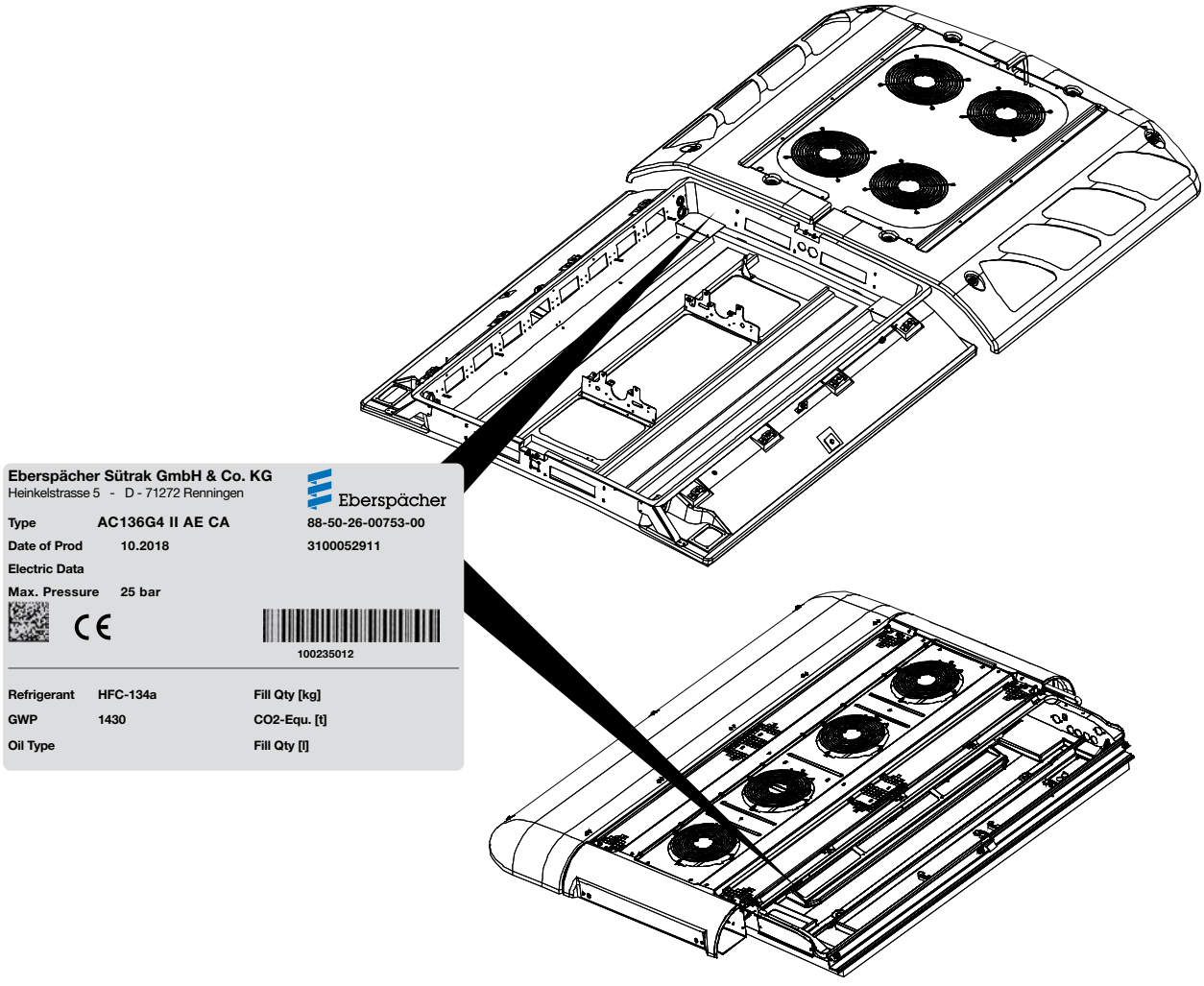
Another plate fitted to the switchboard contains the corresponding circuit diagram.

Please contact your local Eberspächer Sütrak dealership directly in the event of technical problems with the AC system.

Dealership overview see
https://www.eberspaecher.com/produkte/air-conditioning/thermo-management-bus/service-parts/haendlersuche.html

Eberspächer Sütrak needs the following data for customer service and further support:

- Name
- Order number
- Serial number
- Possibly parts list number



7 Technical data

7.1 Pressure controllers and safety valves

AC system type		All standard AC systems	
AC system version		Mobile roof-mounted AC systems for driver cabs and buses	
Rated voltage:		The AC system is preconfigured according to the customer requirements.	
	DC voltage:	12 V DC, 24 V DC, < 850 V DC	
	AC voltage:	230 V AC, 400 V AC, 460 V AC for adjustable frequency	
Pressure controllers:		Pressure gauge switching pressure OFF	Pressure gauge switching pressure ON
HP pressure switch depending on compressor (piston, screw, scroll compressor)		18 – 25 bar; 261 – 362 psig	13 – 16.5 bar; 188 – 239 psig
LP pressure switch depending on compressor (piston, screw, scroll compressor)		+0.35 bar; 5 psig	+2.10 bar; 25 psig
Safety valves:		Switching pressure (pressure gauge display) - valves open	
Spring-loaded pressure relief valve (with reset function)		28 bar; 405 psig	
Rupture disk valve (destructive)		30 bar; 435 psig	

In the event of technical problems and/or queries, please contact your local Eberspächer Sütrak dealership.
Dealership overview see
https://www.eberspaecher.com/produkte/air-conditioning/thermo-management-bus/service-parts/haendlersuche.html

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