Rittal – The System.

Faster – better – worldwide.

TopTherm LCP Rack DX
TopTherm LCP Inline DX

3311.410/420
3311.430/440

Montage-, Installations- und Bedienungsanleitung
Assembly and operating instructions
Notice d'emploi, d'installation et de montage
Montage- en bedieningshandleiding

Foreword

Dear Customer!

Thank you for choosing a Rittal Liquid Cooling Package DX (referred to hereafter also as "LCP DX").

This documentation applies to the following devices in the LCP DX series (DX = Direct Expansion):
– LCP Rack DX
– LCP Inline DX

Those sections where information only applies to one of the three units are labelled accordingly in the documentation.

Please take the time to read this documentation carefully.

Please pay particular attention to the safety instructions in the text and to section 2 "Safety instructions".

This is the prerequisite for:
– secure assembly of the LCP DX
– safe handling and
– the most trouble-free operation possible.

Please keep the complete documentation readily available so that it is always on hand when needed.

We wish you every success!

Your,
Rittal GmbH & Co. KG

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We are always happy to answer any technical questions regarding our entire range of products.

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1 Notes on documentation

1.1 Documentation status

This documentation reflects the current status of the device at the time it was prepared. Design modifications may lead to retrospective amendments to the content; for this reason, this documentation is labelled as a "Draft".

1.2 CE labelling

Rittal GmbH & Co. KG hereby confirms that the cooling units in the LCP DX series are compliant with the EC EMC Directive 2004/108/EC. A corresponding declaration of conformity has been issued and enclosed with the documentation package supplied with the unit.

The cooling unit bears the following mark.

CE

1.3 Information on electromagnetic compatibility

The LCP DX is a class A device as defined by EN 55022. Under certain circumstances, the device may cause radio interference in domestic environments. In such cases, the operator may be asked to implement appropriate measures.

1.4 Storing the documents

The assembly and operating instructions as well as all applicable documents are integral components of the product. They must be handed out to those persons who are engaged with the unit and must always be available and on hand for operating and maintenance personnel.

1.5 Symbols in these operating instructions

The following symbols are found in this documentation:

Danger!
Hazardous situation which may lead to death or serious injury if the instructions are not followed.

Warning!
Hazardous situation which may lead to death or serious injury if the instructions are not followed.

Caution!
Hazardous situation which may lead to (minor) injuries if the instructions are not followed.

Note:
Information concerning individual procedures, explanations, or tips for simplified approaches. Also indicates situations which may result in material damage.

- This symbol indicates an "Action Point" and shows that you should carry out an operation/procedure.

1.6 Other applicable documents

In conjunction with these assembly and operating instructions, the superordinate system documentation (if available) also applies.

Rittal GmbH & Co. KG is not responsible for any damage which may result from failure to comply with these assembly and operating instructions. The same applies to failure to comply with the valid documentation for accessories used.

1.7 Normative instructions

1.7.1 Legal information concerning the operating instructions

We reserve the right to make changes in content. Rittal GmbH & Co. KG will not be held liable for any mistakes in this documentation. Liability for indirect damages which occur through the delivery or use of this documentation is excluded to the extent allowable by law.

1.7.2 Copyright

1.7.3 Revision

Rev. 0A of 04/03/2013

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2 Safety instructions

The devices in the LCP DX series produced by Rittal GmbH & Co. KG are developed and produced with due regard for all safety precautions. Nevertheless, the unit still poses a number of unavoidable dangers and risks. The safety instructions provide you with an overview of these dangers and the necessary safety precautions.

In the interests of your safety and the safety of others, please read these safety instructions carefully before assembly and commissioning of the LCP DX.

Follow the user information found in these instructions and on the unit carefully.

2.1 Important safety instructions:

Danger! Electric shock!
Contact with live electrical parts may be lethal.
Before switching on, ensure that there is no possibility of accidental contact with live electrical parts.
The unit has a high discharge current. Before connecting to the supply circuit, therefore, it is essential to make a 6 mm² earth connection (see section 14.4 "Circuit diagram").

Danger! Injury caused by fan impellers!
Keep persons and objects away from the fan impellers! Do not remove covers until the power supply is disconnected and impellers are not moving! Always use mechanical protection when working! Shut down the respective fan during maintenance work, if possible! Tie long hair back! Do not wear loose clothing!
Fans start up automatically following power disruptions!

Danger! Hot components may cause injury!
In particular, never touch the compressor and cables while operational and for some time thereafter, as they may still be hot.

Danger! Risk of poisoning from coolant gases created under the influence of heat.
When carrying out welding and soldering work on the coolant circuit, use protective gloves and breathing apparatus with a filter. In case of major leaks, stop smoking immediately. Avoid fire and naked flames.

Danger! Risk of injury from incorrect installation.
Installation of the coolant lines and other media connections must only be carried out by qualified plumbers or cooling technology specialists.

Danger! Threat to the environment from escaping coolant!
Never allow the coolant to escape into the environment if at all possible. In case of unintentional release, direct water jets at the gases, and allow any residue to evaporate.

Danger! Injury due to falling loads!
Do not stand under suspended loads when transporting the unit with a hoist trolley, a forklift, or a crane.

Warning! Danger of cut wounds, especially from the sharp edges of the fan module and heat exchanger modules!
Put on protective gloves before beginning assembly or cleaning work!

Warning! Injuries from escaping coolant!
Escaping gas may freeze the skin. Before working on the cooling circuit, put on protective gloves and goggles.

Caution! Risk of malfunction or damage!
Do not modify the unit! Use only original spare parts!

Caution! Risk of malfunction or damage! Proper and flawless unit operation can only be ensured when it is operated under the intended ambient conditions. As far as possible, observe the ambient conditions for which the unit was designed, e.g. temperature, humidity, air purity.

Caution! Risk of malfunction or damage! All media required for the control system, such as the correct fill volume of coolant, must be available throughout the entire operating period of the device.

Caution! Risk of malfunction or damage! Installation, and in particular the coolant line pipework between the external condenser and the LCP DX, must only be carried out by trained, qualified and accredited cooling system specialists.

Caution! Risk of malfunction or damage! In order to prevent EMC-related malfunctions during operation, and to allow access for servicing purposes, cross-wiring through the LCP DX to the bayed racks is prohibited.

As a general requirement, please observe the following five safety rules to DIN VDE 0105 when working in and on the LCP DX, in order to avoid accidents:

1. Switch off!
   Switch off the LCP DX at the master switch.
2. Prevent reactivation!
3. Ensure that all poles are de-energised!
4. Earth and short-circuit!
5. Cover or shield adjacent, live parts

2.2 Service and technical staff

The installation, commissioning, maintenance and repair of this unit may only be carried out by trained, qualified mechanical and electro-technical personnel. Only properly instructed personnel may service a unit while in operation.

2.3 Operator requirements

In accordance with EU Regulation 842/2006, the operator must carry out a leak test using a suitable test device at least once a year. Any leaks that are detected must be repaired immediately.

Note:
Rittal offers leak testing of the device as a service.

2.4 RoHS compliance

The LCP DX fulfils the requirements of EU Directive 2011/65/EC on the Restriction of Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) of 1 July 2011.

Note:
Corresponding information about the RoHS Directive may be found on our website at www.rittal.com/RoHS.

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3 Device description

3.1 General functional description

The Liquid Cooling Package DX (DX = Direct Expansion) is essentially a split air conditioning unit used to dissipate high heat losses from server enclosures or for the effective cooling of devices built into a server enclosure.

The air routing in the LCP DX supports the "front to back" cooling principle of the devices built into the server enclosure. The hot air expelled by the devices in the server enclosure is drawn in by the fans at the rear directly from the server enclosure (LCP Rack DX) or from the hot aisle (LCP Inline DX) and thus routed through the heat exchanger module.

In the heat exchanger module, the heated air is directed through a heat exchanger (coolant evaporator), and its thermal energy (heat losses from the server) is transferred to the coolant. This causes the coolant to change from a liquid to a gaseous state. As a result, the air is cooled to a freely selectable temperature within the authorised parameters and then routed directly in front of the 482.6 mm (19") level in the server enclosure (LCP Rack DX) or into the cold aisle (LCP Inline DX).

In its delivered state, cold air from the LCP Inline DX is expelled to the front; it is also possible to expel the cold air on both sides, or by mounting a side panel, at one side of the device.

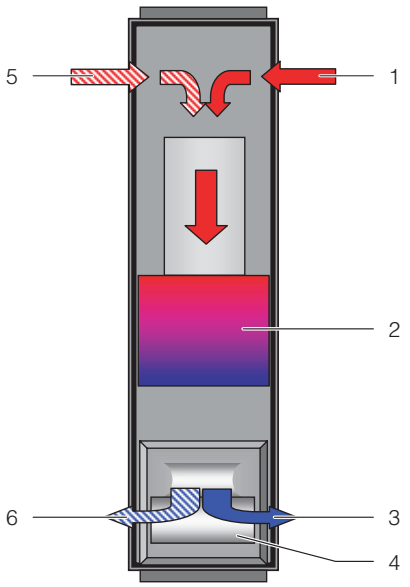

Fig. 1: Air routing on the LCP Rack DX – top view

Key

1 Air inlet
2 Heat exchanger
3 Air outlet
4 Fan module
5 2nd air inlet
6 2nd air outlet

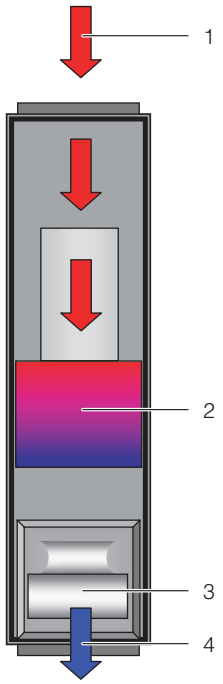

Fig. 2: Air routing on the LCP Inline DX – top view

Key

1 Air inlet
2 Heat exchanger
3 Fan module
4 Air outlet

In the LCP Rack DX and LCP Inline DX, the temperature of the impelled cold air is controlled by continuously comparing the actual temperature with the setpoint temperature (preset to +22°C).

If the actual temperature exceeds the setpoint temperature, the speed of the compressor is automatically increased, providing a greater cooling output from the heat exchanger, until the setpoint temperature is reached.

In the LCP Rack DX and LCP Inline DX, the temperature differential between the setpoint and the warm air intake is used to calculate and control the fan speed.

Any condensate incurred is collected in the condensate collecting tray integrated into the LCP DX below the heat exchanger, and from there is routed outside via a condensate discharge hose.

3.2 Air routing

3.2.1 General

In order to achieve sufficient cooling in the server enclosure, it is important to ensure that the cooling air passes through the interior of the built-in units and is unable to flow past at the sides.

Targeted air routing inside the server enclosure has a major effect on the heat loss to be dissipated.

In order to ensure targeted air routing in the system, the server enclosure should be divided vertically into warm air and cold air sections. The division is accomplished in the front section of the server assembly to the left and right of the 482.6 mm (19") level using foam strips or air baffle plates which, depending on the enclosure width and the number of server enclosures to be cooled, can be ordered as an accessory (see section 13 "Accessories").

If devices which require sideways air throughput are also built into the server enclosure (e.g. switches, router, etc.), these may be cooled by means of targeted placement of the foam strips or air baffle plates.

Note:
The 482.6 mm (19") level must likewise be completely sealed. This is already the case in a fully equipped server enclosure. With a partially configured server enclosure, the open height units (U) of the 482.6 mm (19") level must be sealed with blanking plates, which are available as Rittal accessories (see section 13 "Accessories").
The more devices are installed in the server enclosure, the more important it becomes to follow this specification.

3.2.2 LCP Rack DX

The LCP Rack DX may optionally be bayed on the right or left of a server enclosure or between two server enclosures, according to preference.

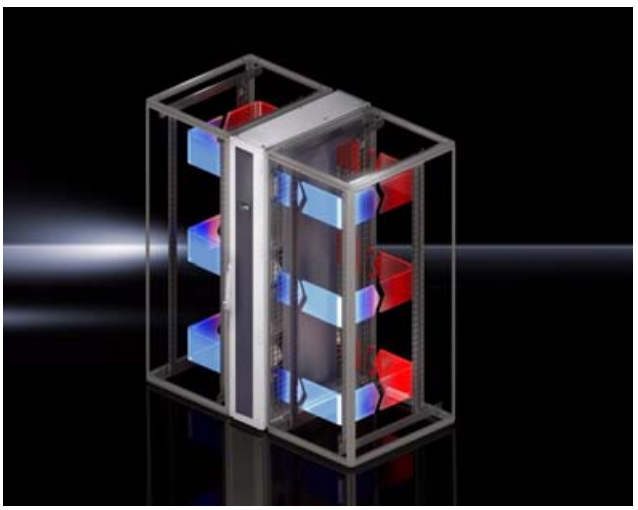

Fig. 3: LCP Rack DX on two server enclosures

Together with the bayed server enclosure, the LCP Rack DX forms an airtight cooling system with horizontal air routing. It places no additional demands on the room's climate control system.

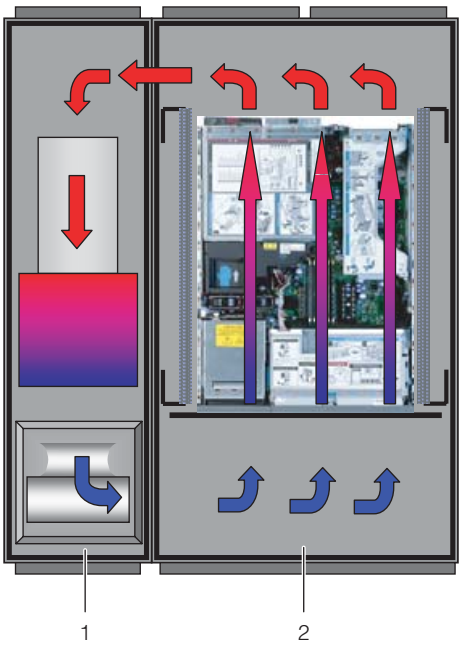

Fig. 4: Air routing with a bayed server enclosure – top view

Key
1 LCP Rack DX
2 Server enclosure

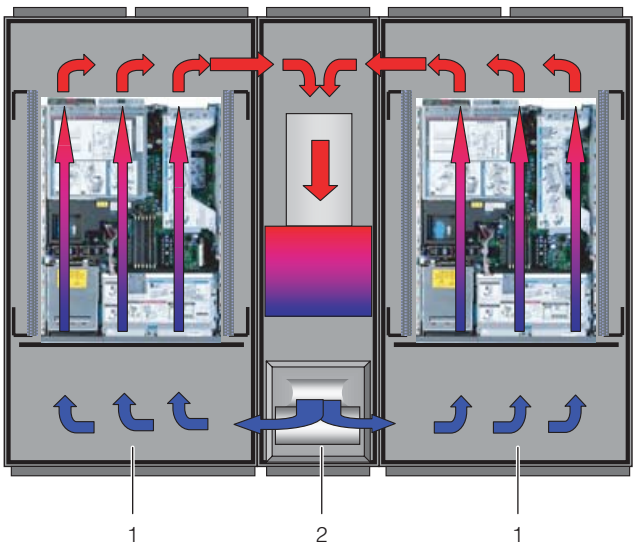

Fig. 5: Air routing with two bayed server enclosures – top view

Key
1 Server enclosure
2 LCP Rack DX

The system consisting of the LCP Rack DX and the server enclosure should be sealed as effectively as possible in order to prevent the loss of cooling air. To accomplish this, the enclosure is equipped with side panels, roof and gland plates. Any existing cable entries should be sealed e.g. using suitable brush strips. Whilst the system is in operation, both the front and the rear doors should be kept completely shut.

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Note:
However, the system does not need to be completely airtight, thanks to the high, coordinated air throughputs of the server and LCP fans.

3.2.3 LCP Inline DX

Targeted air routing by hot air extraction from the hot aisle and cold air blown into the cold aisle has a fundamental effect on the amount of heat to be dissipated.

In order to achieve sufficient cooling in the server enclosure, it is important to ensure that the cooling air passes through the interior of the built-in units and is unable to flow past at the sides.

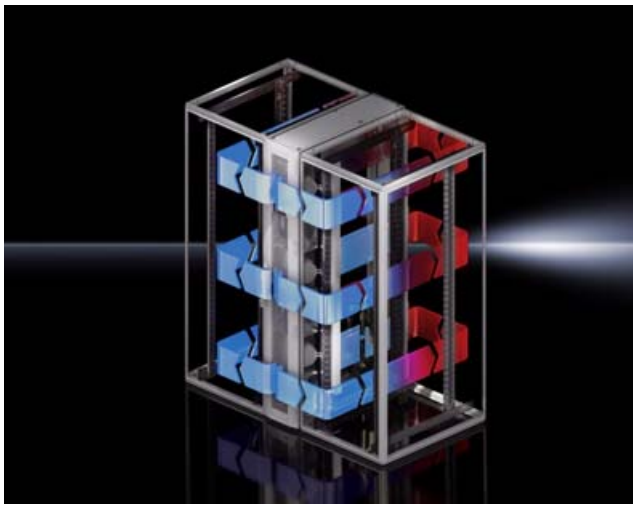

Fig. 6: LCP Inline DX on two server enclosures

For this purpose, the system consisting of LCP Inline DX, server enclosure and cold aisle containment should be well sealed in order to avoid a decrease of the cooling capacity due to mixing of cold and hot air. This is achieved by sealing the cold aisle with doors at the beginning and end of the rack rows, and sealing it against the ceiling with roof elements. Existing cable entry glands are additionally sealed e.g. using suitable brush strips.

3.3 Equipment assembly

3.3.1 Unit components

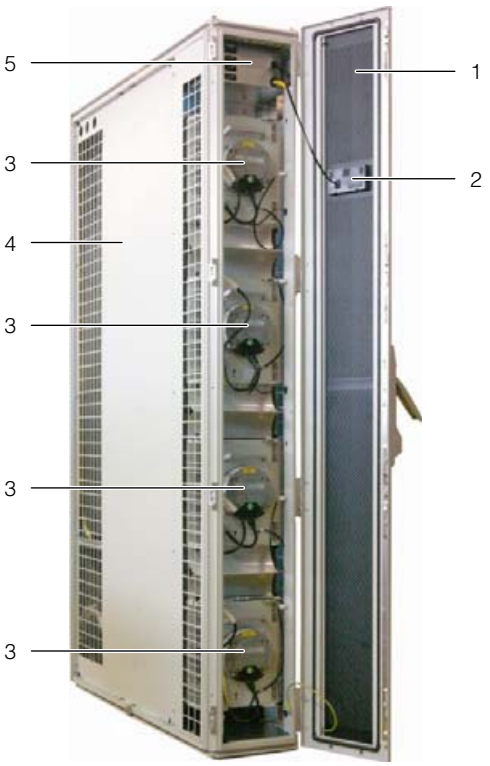

Fig. 7: LCP Rack DX front – open front door

Key

1 LCP door
2 Display
3 Fan
4 Rack
5 Electronics box with switches for fans

The device variants differ as follows at the front:
– LCP Rack DX: Solid front door
– LCP Inline DX: Perforated front door

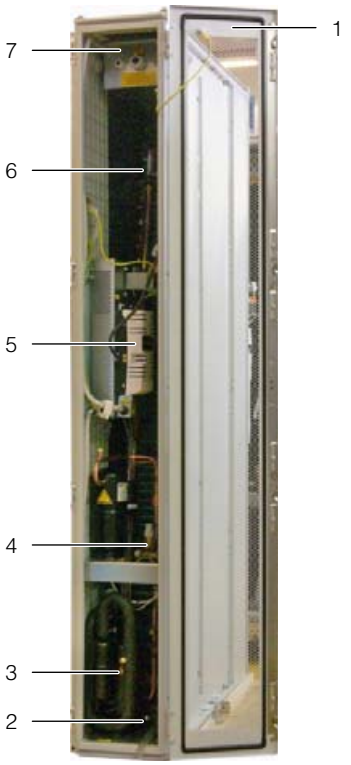

Fig. 8: LCP Rack DX rear – rear door open

Key

1 Rear door
2 Condensate collecting tray
3 Compressor
4 Connection lines to the external condenser
5 Inverter
6 Heat exchanger (evaporator coil)
7 Electronics box with voltage connection and network connection

The device variants differ as follows at the rear:
– LCP Rack DX: Solid rear door
– LCP Inline DX: Perforated rear door

The LCP DX consists of a solid welded frame in which the evaporator coil, fan modules and compressor are installed.

3.3.2 Heat Exchanger Module

The heat exchanger module consists of the following components:
– Compressor: The compressor compresses the coolant and causes it to circulate from the low-pressure side (evaporator coil) to the high-pressure side (external condenser). The motor is activated by an external inverter, which controls the speed of the compressor and therefore allows the cooling output to be precisely adapted to the actual cooling requirement.
– Evaporator coil: The evaporator coil (air/coolant heat exchanger) is positioned in the centre of the LCP DX. Any condensate incurred is discharged into a condensate collecting tray in the bottom section of the device.
– Electronic expansion valve: The expansion valve supplies the evaporator coil with the required volume of coolant to provide the corresponding cooling output in the current ambient conditions.
– External condenser: The condenser is sited outdoors from the room where the LCP DX is situated. Connection details for the LCP DX may be found in section 6 "Installation".

Note:
Condenser unit 3311.360 is required in order to operate the LCP DX. No other external condenser may be used.

Fig. 9: External condenser (3311.360)

– Temperature sensors: There are three temperature sensors installed on the front of the device near the fans. These measure the cold air temperature and forward the readings to the control unit. There are three further temperature sensors installed on the rear of the evaporator coil. These measure the hot air temperature and likewise forward the readings to the control unit.

3 Device description

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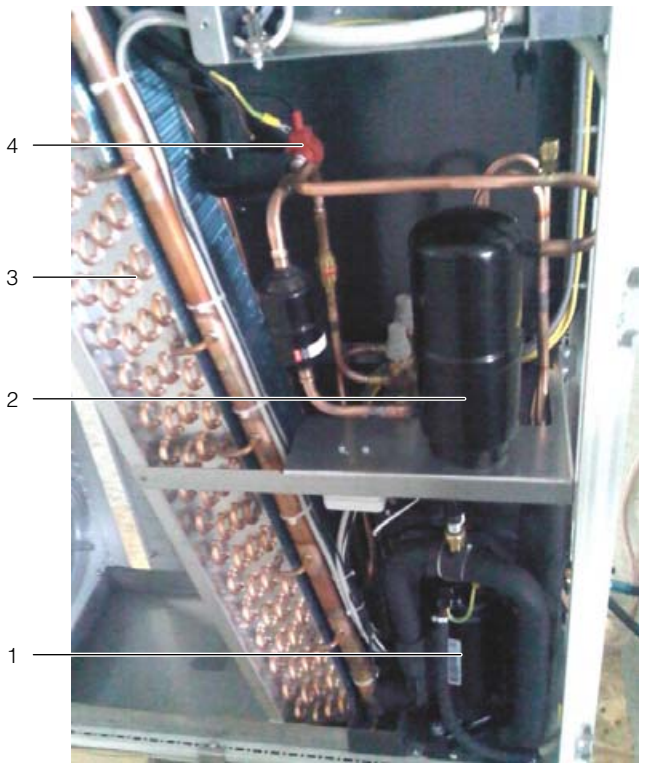

Fig. 10: Heat Exchanger Module

Key

1 Compressor
2 Refrigerant collector
3 Evaporator coil
4 Electronic expansion valve

3.3.3 Fan module

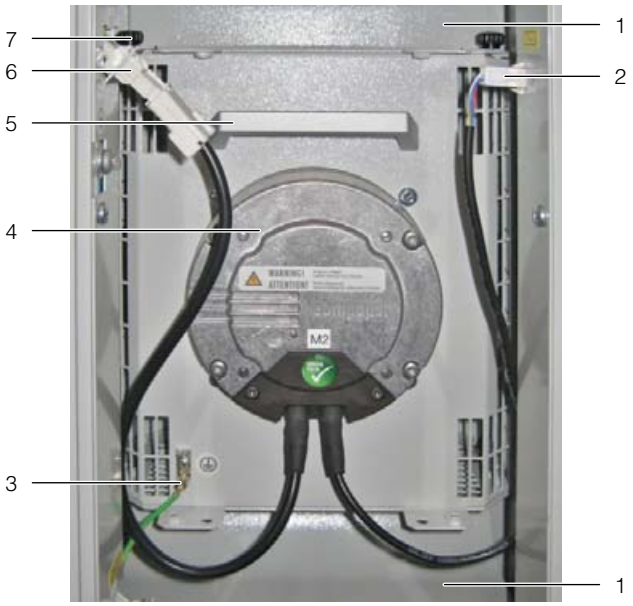

Fig. 11: Fan module in fan tray

Key

1 Air baffle plate
2 DC connection cable (control voltage)
3 Earth connection
4 Fan
5 Handle
6 AC connection cable (power supply)
7 Knurled screws

A fan module is essentially comprised of the fan itself. All fan modules are controlled via a joint control unit mounted in the electronics box in the upper section of the LCP DX. Fans may be operated with linear control between 30% and 100%.

The fan modules are installed on rack-mounted shelves in the front section of the LCP DX.

It takes approximately 2 minutes to replace a single fan module with the system operational (see section 5.3 "Fan installation").

3.4 Proper and improper usage

The LCP DX is used to dissipate high heat losses and effectively cool devices built into a server enclosure. The unit is designed solely for stationary use in sealed rooms.

The unit is state of the art and built according to recognised safety regulations. Nevertheless, improper use can present a hazard to life and limb of the user or third parties, or result in possible damage to the system and other property.

Consequently, the unit must only be used properly and in a technically sound condition.
Any malfunctions which impair safety should be rectified immediately. Follow the operating instructions!
Proper usage also includes following the operating instructions and fulfilling the inspection and maintenance conditions.

Inappropriate use can be dangerous. Examples of inappropriate use include:
– Using a different condenser unit other than Model No. 3311.360.
– Use of impermissible tools.
– Improper operation.
– Use of a coolant other than R410A.
– Use of a coolant fill volume other than that specified.
– Installation of the external condenser in an unsuitable position.
– Operation with less than four installed fans.
– Improper rectification of malfunctions.
– Use of replacement parts which are not authorised by Rittal GmbH & Co. KG.
– Non-stationary use, e.g. on moving or vibrating machines.

3.5 Supply scope of a LCP DX

The LCP DX supply includes:

Qty.	Parts
1	LCP DX, ready for connection
	Accessories:
1	Condensate hose
1	Sealing strip
1	Quick Guide – "Getting Started"

Tab. 1: Supply scope of a LCP DX

4 Transportation and handling

4.1 Transportation

The LCP DX is delivered shrink-wrapped on a pallet.

Caution!
Because of its height and small base, the LCP DX is subject to tipping. Risk of toppling, especially after the unit is removed from the pallet!

Caution!
Transport of the LCP DX without a pallet: Use only suitable and technically sound lifting gear and load-bearing devices with sufficient load capacity.

4.2 Unpacking

- Remove the unit's packaging materials.

Note:
After unpacking, the packaging materials must be disposed of in an environmentally friendly way. They are comprised of the following materials:
Wood, polyethylene film (PE film), strap, edge protectors.

- Check the unit for any damage that occurred during transport.

Note:
Damage and other faults, e.g. incomplete delivery, should immediately be reported to the shipping company and to Rittal GmbH & Co. KG in writing.

- Place the unit in its intended location.

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5 Assembly and siting

5.1 General

5.1.1 Installation site requirements

In order to ensure problem-free operation of the LCP DX, the following conditions for the installation location should be observed:

Positioning of the LCP DX in the server room relative to the external condenser

The interior device (LCP DX) and the external condenser must be connected with suitable copper pipework before switching on the system. The entire system must then be filled with coolant (see section 6.2 "Notes on pipework").

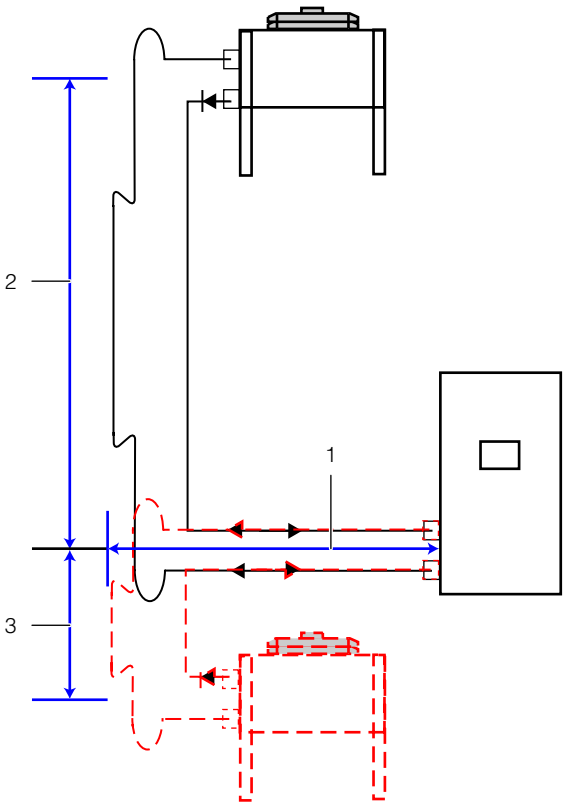

Fig. 12: Relative positioning

Key

1 Offset in a side direction
2 Condenser offset above the LCP DX
3 Condenser offset below the LCP DX

The following distances and geodetic height differences must not be exceeded when installing the LCP DX and the external condenser:

Position	Distance
Sum total of horizontal (fig. 12, item 1) and vertical spacing (fig. 12, item 2 or item 3) between the LCP DX and the condenser	Max. 30 m equivalent length
Condenser above LCP DX (fig. 12, item 2)	max. 20 m
Condenser below LCP DX (fig. 12, item 3)	max. 3 m

Tab. 2: Distances and height differences

Supply connections required at the installation site

Type of connection	Connection description:
LCP DX power inlet	380–480 V ±10%, 3~, N, PE, 50/60 Hz, 20 A, 3~, CEKON, 5-pole
External condenser power inlet	230 V,1~, 50/60 Hz, 1.8 A
Coolant connection:	Copper pipework, $Ø_a$=12 mm, 1 mm thick

Tab. 3: Supply connections required at the installation site

Note:
A voltage of at least 380 V is required to start the device.
To operate the device, the mains voltage may deviate by ±10% from the voltage stated on the rating plate.

Note:
Please also observe the instructions and data relating to the coolant connection as outlined in section 6 "Installation".

Recommendation:
For easier servicing of the LCP DX, maintain a distance of at least 1 m between the front and rear of the device and the nearest wall.

Floor conditions

– The floor of the installation space should be rigid and level.
– Choose the installation site so that the unit is not situated on a step or uneven surface, etc.

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Recommendation:
Room temperature +22 °C at 50% relative air humidity, according to ASHRAE guidelines.

Electromagnetic interference
– Interfering electrical installations (high frequency) should be avoided.

Heat loss from the equipment
– The equipment in the server enclosure being cooled must generate a heat loss of at least 3 kW.

5.1.2 Prepare the installation room for the LCP Inline DX

The installation room of the LCP Inline DX must be divided into one cold air zone and one hot air zone. This ensures that no cooling capacity is lost due to mixing of cold and hot air.

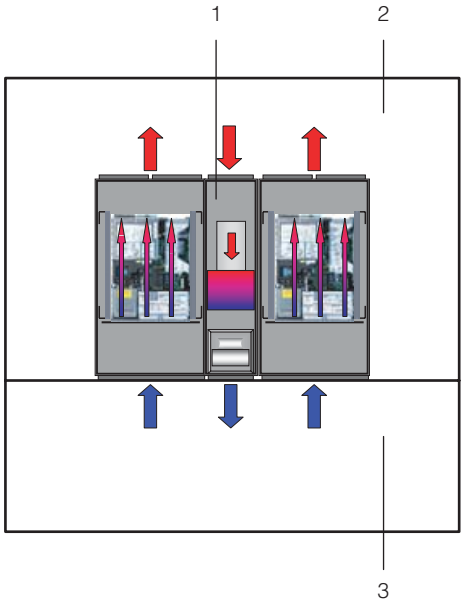

Fig. 13: Installation room with cold aisle compartmentalisation

Key
1 LCP Inline DX
2 Hot aisle
3 Cold aisle

Note:
All the components needed for cold aisle containment are available from Rittal as accessories.

5.1.3 Installation guidelines for LCP Inline DX

The positioning in the rack aisles must be considered when planning the layout. The following points are to be considered:
– Heat loss in the adjacent server racks
– Air throughput in the adjacent server racks
– Distances from the adjacent server racks

Heat losses in the adjacent server racks
If the LCP Inline DX is used in combination with server enclosures with high heat losses, the number of LCP Inline DX units must be adapted according to the characteristic curves. The air temperature difference between server inlet and server outlet, which is determined by the equipment used, is particularly important. As a rule of thumb, a temperature difference of 15K can be expected. There may, however, be greater differences.

Air throughput in the adjacent server racks
Due to the containment of the hot and cold zones, it is important to ensure that the LCP Inline DX delivers a sufficient amount of cold air into the cold zone. From there, the cold air is drawn back into the server enclosures by the equipment. A small surplus of air should generally be provided in order to compensate for any short-term demands of the equipment.

Distances from the adjacent server racks
In small applications and short aisles, the above points will not have a major impact on properties or cooling capacity provided the hot zone is thoroughly and precisely sealed off from the cold zone. For larger applications and long aisles, however, it is important to ensure even spacing of the cooling units, due to the loss of air throughput caused by external pressure losses and convection or radiation heat of the equipment. Other factors, such as high-temperature rooms adjacent to the cold zone or exterior walls warmed by the sun, can also occur.

5.2 Assembly procedure

5.2.1 General

Before the LCP DX can be bayed onto a server enclosure, the following work should be carried out.
– Dismantle the side panels,
– Seal the server enclosure and
– Dismantle the server enclosure door.

5.2.2 Dismantle the side panels

Caution! Risk of injury!
The side panel holders have sharp-edged teeth, which enable earthing of the server enclosure's side panel.

If there is a side panel or partition mounted on the server enclosure side to which the LCP DX is to be bayed, this must be removed first.

- Loosen and remove the 8 assembly screws found on each side panel of the server enclosure.
- Remove all side panel securing elements from the side of the server enclosure onto which the LCP DX is to be bayed.
- Dismantle both side panel mountings from the upper mounting rail of the server enclosure, using an appropriate lever.
- Loosen and remove the screws on both of the side panel mounting brackets (top and bottom) in the middle of the mounting rail.
- Loosen and remove the screws from the 6 side panel holders on the side mounting rails.

5.2.3 Seal the server enclosure

In order to ensure targeted air routing in the system, the server enclosure is vertically divided into hot air and cold air zones by sealing the 482.6 mm (19") level.

Proceed as follows to seal the 482.6 mm (19") level:

- If the server enclosure is only partially configured, seal the open sections of the 482.6 mm (19") level using blanking plates. Screw these tightly into the server rack from the front side.

Note:
Blanking plates in a range of height units (U), together with both narrow and wide foam strips and air baffle plates, are available as Rittal accessories (see section 13 "Accessories")

- Fasten the wider (Model No. 3301.370 / 3301.320) of the two foam strips from the LCP DX accessories onto one of the front supports of the server rack from the outside (fig. 14). Make sure to install this strip on the side of the server enclosure onto which the LCP DX is to be bayed.
- **If you are only baying the LCP DX on one side:** Fasten the narrower (Model No. 3301.380 / 3301.390) of the two foam strips from the LCP DX accessories onto one of the front supports of the server rack from the outside (fig. 14). Make sure to install this strip on the side of the server enclosure which will again be sealed by a side panel.

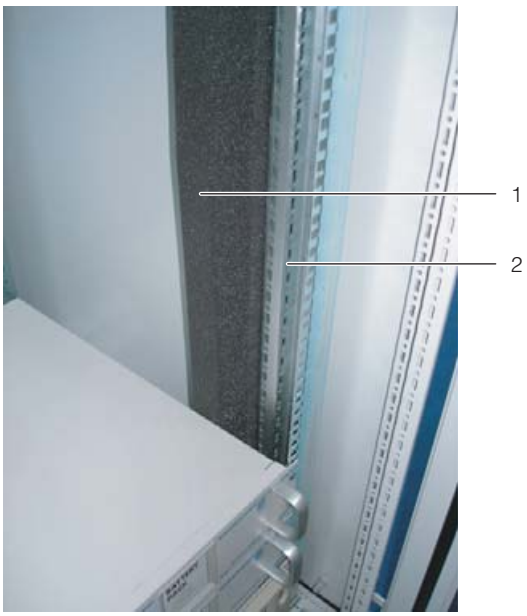

Fig. 14: Foam strip on a server rack support

Key

1 Foam strip
2 Server rack

If the server enclosure contains devices which require cooling via sideways air throughput (e.g. switches, router, etc.), cut-outs must be incorporated into the foam strips.

- To do this, cut out a piece of the foam strip using a sharp knife.
- If several devices which require sideways air throughput are included, cut out several pieces of the foam strip, as is appropriate, so that, ultimately, there is a cut-out in the foam to the left or right at the height of each such device in the server rack. Ensure that there are no gaps on the hot air side of the devices (fig. 15, item 3).
- Using a sharp knife, cut additional pieces from the foam strip that are at least as long as the height of the built-in devices.
- Attach the foam strips to the cold air side of the devices set back towards the rear (fig. 15, item 4), making sure that all fans built into the devices can draw air and that none of them are blocked.

Note:
The foam strips can be attached between the front and rear supports of the server rack along the entire depth of the devices with sideways air throughput (fig. 15, item 5).

5 Assembly and siting

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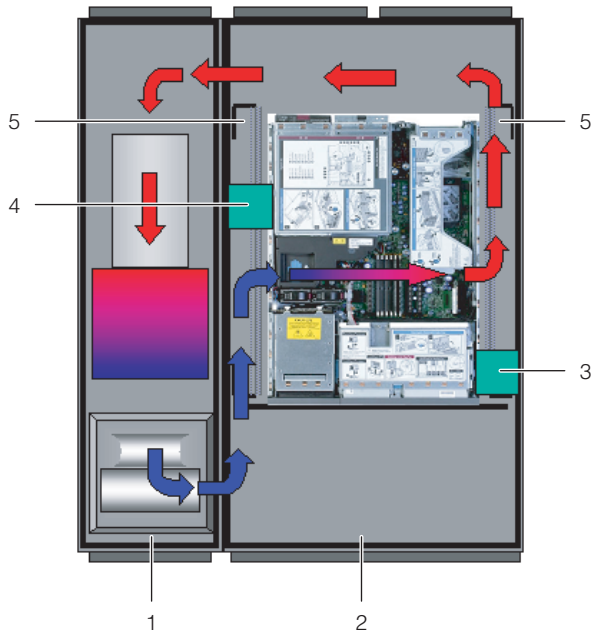

Fig. 15: Placement of foam strips for devices with sideways air throughput (top view) – LCP Rack DX

Key

1 LCP Rack DX
2 Server enclosure
3 Foam strips on hot air side
4 Foam strips on cold air side
5 Area in which the foam strips can be positioned

- If there is any surplus length of the foam strip on the server rack, cut it off at the top edge of the rack.

Note:
The LCP DX may optionally be bayed onto a server enclosure either 600 mm or 800 mm wide. For this reason, the LCP DX accessories include a total of four foam strips or corresponding air baffle plates with differing dimensions (see section 13 "Accessories").

- On the side of the server enclosure opposite the LCP DX, mount a side panel on the two side panel mountings. Align it with the front and rear side of the enclosure.
- Using the 8 assembly screws, screw the side panel firmly onto the side panel holders and the side panel mounting brackets.
- Seal off any cable entries which may be present with corresponding brush strips or similar.

5.2.4 Dismantle the server enclosure door

Before baying a LCP DX, at least one of the two server enclosure doors must be dismantled so that the attachment points for the baying connectors are accessible and are not covered by a door edge.

Note:
It is only necessary to dismantle a server enclosure door when the LCP DX is to be bayed onto a previously erected server enclosure.
Otherwise, this work is not necessary.
If the LCP DX is to be installed together with a new server enclosure, proceed according to the enclosure's assembly instructions and bay the LCP DX onto the server enclosure before assembling the server enclosure doors.

Proceed as follows to dismantle a server enclosure door:

- Remove the sealing bungs from the four door hinges using an appropriate tool (e.g. screwdriver).
- Release and open the server enclosure door.
- Loosen the hinge bolts from the four door hinges by raising them with an appropriate tool (e.g. screwdriver). Pull the bolts out of the hinge pin holding fixture as far as they will go (see fig. 16, step A). Begin with the lowest door hinge.

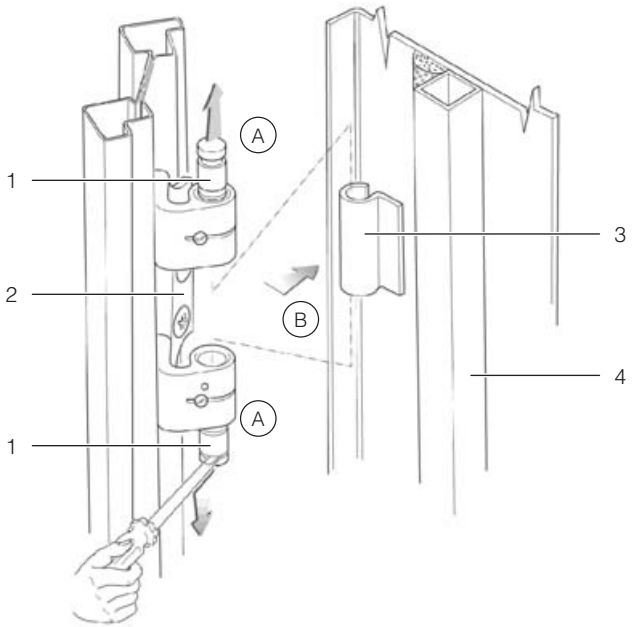

Fig. 16: Removing a door hinge

Key

1 Door hinge
2 Hinge pin holding fixture
3 Hinge joint
4 Server enclosure door

Note:
Support the server enclosure door so that it will not fall as the door hinge pins are loosened. If necessary, work with a second person.

- Remove the server enclosure door (fig. 16, step B).

5.2.5 Installation and baying of the LCP DX

- Position the LCP DX on the side of the server enclosure to which it is to be bayed.
- Align the LCP DX with the server enclosure. Ensure that the LCP DX is aligned horizontally and that both enclosures are adjusted to the same height and are vertically aligned to each other.
- Dismantle the door of the LCP DX whose hinges are on the side on which the server enclosure is to be bayed. Proceed as described in section 5.2.4 "Dismantle the server enclosure door".

Note:
If the LCP DX is to be bayed between two server enclosures, both doors of the LCP DX must be dismantled before the baying connectors are installed, so that the attachment points for the baying connectors are accessible.

- Using the corresponding assembly screws, fasten three baying connectors each (fig.17, item 2) onto the attachment points provided in the mounting strips on the front and rear of the LCP DX (fig.17, item 1).

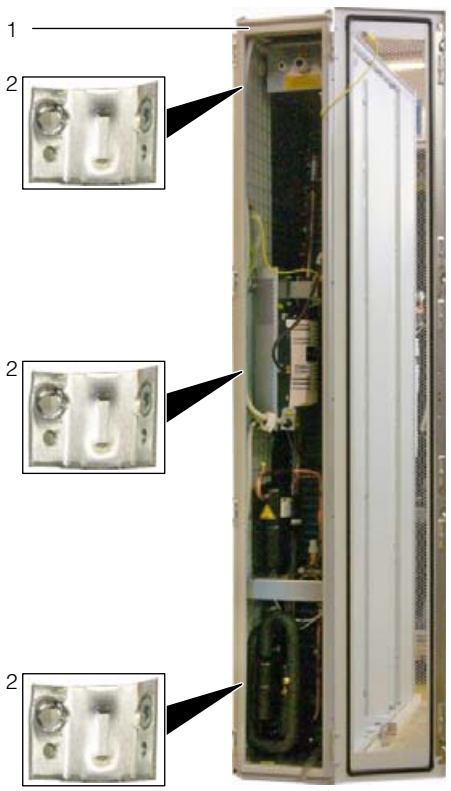

Fig. 17: LCP Rack DX – rear

Key
1 LCP Rack DX
2 Baying connector

- In the same way, fasten the baying connectors onto the attachment points provided in the mounting strips on the front and rear of the server enclosure. As needed, press the LCP DX lightly against the server enclosure in order to bring the baying connectors into alignment with the attachment points.
- If applicable, attach the rear door to the LCP DX.
- Finally, check the stability of the LCP DX once again.

5.2.6 Mounting the side panel

If the LCP DX is not bayed between two server enclosures, close it off with a side panel.

Caution! Risk of injury!
The side panel holders have sharp-edged teeth, to enable earthing of the side panel through the LCP DX.

Proceed as follows to assemble the side panel:

- Remove the various assembly components from the optional side panel package (Model. No. 8100.235) or use those from a server enclosure which has already been dismantled.
- Using the assembly screws, mount the assembly components (2 side panel mountings, 2 side panel mounting brackets, 6 side panel holders) onto the side of the LCP DX which is opposite to the server enclosure.
- Place both side panel mountings as symmetrically as possible onto the upper mounting rail of the LCP DX and, using your hand, press them firmly in place.
- Screw down the two side panel mounting brackets top and bottom in the centre of the mounting rail using one screw each.
- Screw down 3 side panel holders onto each of the two side mounting rails with one screw each.
- Mount a side panel onto the two side panel mountings of the LCP DX and align them to the front and rear of the unit.
- Using the 8 assembly screws, screw the side panel firmly onto the side panel holders and the side panel mounting brackets.

5.3 Fan installation

In its delivered state, the LCP DX contains 4 fan modules as standard. Even if a smaller cooling output is required, all 4 fan modules must remain in the device.

Caution! Risk of injury!
Before installing or removing a fan, be sure to de-energise the relevant fan on the corresponding switch.

If a fan module is defective, it can be replaced quickly and easily with the unit operational.

5 Assembly and siting

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Proceed as follows to remove a fan module:

- Open the front door of the LCP DX.
- On the electronics box, deactivate the switch for the fan you wish to replace.

Fig. 18: Electronics box – Front

Key

1 Switch for fan 1 (top fan in the LCP DX)
2 Switch for fan 2
3 Switch for fan 3
4 Switch for fan 4 (bottom fan in the LCP DX)

- Release the two DC and AC fan connectors on the left and right (fig. 19, items 2 and 6).
- Disconnect the earth connection on the fan (fig. 19, item 3).
- Loosen the two knurled screws, right and left (fig. 19, item 7), at the top and bottom of the fan air baffle plates.

Fig. 19: Fan module in fan tray

Key

1 Air baffle plate
2 DC connection cable (control voltage)
3 Earth connection
4 Fan
5 Handle
6 AC connection cable (power supply)
7 Knurled screws

- Rotate the fan module in the rack in a clockwise direction by 90° (fig. 20).
- Grasp the fan module with both hands on the left and right, and pull it out of the rack.

Fig. 20: Rotated fan module in fan tray

Note:
The LCP DX may only be operated with all four fans running.

5.4 External condenser

The installation site of the external condenser must be selected in such a way as to ensure an adequate supply and distribution of the airflow, even in unfavourable conditions (see section 5.1.1 "Installation site requirements").

To ensure ease of access to the external condenser for servicing purposes, a sufficiently large distance from the surrounding walls must be ensured.

It is also important to ensure that no foreign bodies such as leaves can be drawn into the condenser.

With unprotected siting of the external condenser, it is important to prevent unwanted external air streams through the condenser (e.g. via console installation). Such air streams and other weather factors may alter the control response of the LCP DX.

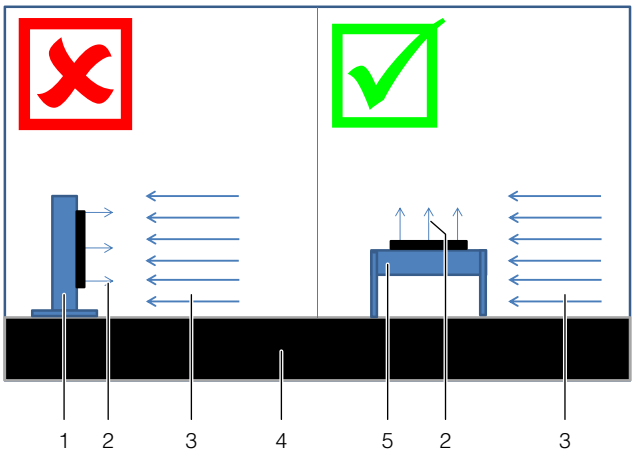

Fig. 21: Air streams with unprotected siting

Key

1 Facade mounting
2 Condenser airflow
3 External air stream
4 Building roof or site floor
5 Console installation

The condenser is weather-resistant and may therefore be installed completely in the open air, with no need for a weather protection canopy etc. If the condenser is installed underneath a canopy, there must be a distance of at least 4 m between the floor and the canopy.

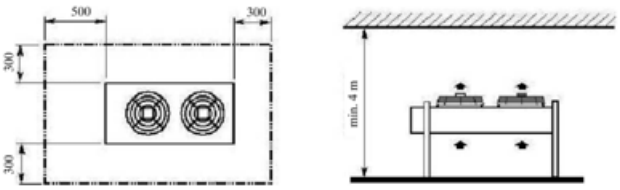

Fig. 22: Minimum distances with vertical mounting.

If the distance is less than 4 m, the condenser must be mounted in such a way that the air outlet is horizontal.

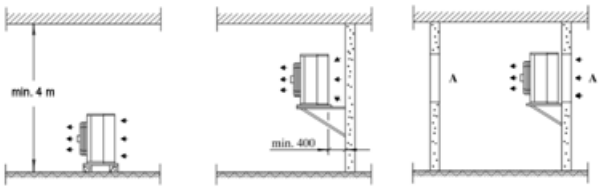

Fig. 23: Installation options with horizontal air outlet

Note:
Opening "A" must be at least as large as the front of the condenser.

The condenser may be installed either horizontally or vertically using the supports included with the supply of the device.

5 Assembly and siting

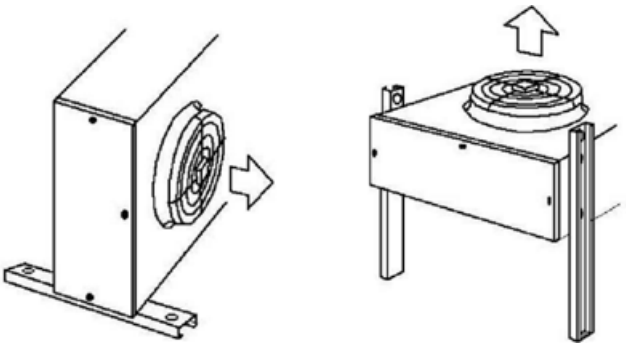

Fig. 24: Horizontal or vertical mounting

In the case of vertical mounting (with a horizontal air-flow), the gas line must be laid above the coolant line.

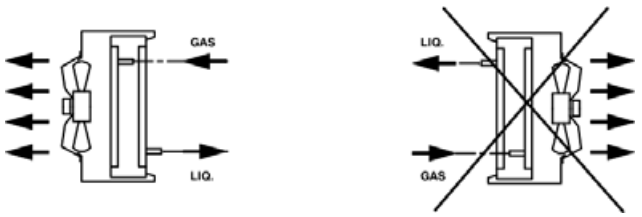

Fig. 25: Laying the gas and coolant lines

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6 Installation

Caution! Risk of malfunction or damage! Installation, and in particular the coolant line pipework between the external condenser and the LCP DX, must only be carried out by trained, qualified and accredited cooling system specialists.

6.1 General

The interior device (LCP DX) and the external condenser must be connected with suitable copper pipework. This pipework may either be inserted from above via a brush strip or, if the device is positioned on a raised floor or on a pedestal from below into the LCP DX.

Prior to delivery, the LCP DX is filled with 1.5 bar nitrogen. It is therefore crucial that the following steps are always carried out in the order shown.

Note:
Installation of the pipework, creation of a vacuum and filling with coolant must only be carried out by qualified, trained staff in accordance with the valid technical regulations.
Furthermore, when carrying out the installation, it is important to observe all the pipework instructions in section 6.2.

6.2 Notes on pipework

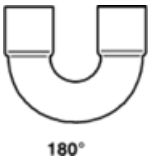
The following basic rules should be observed when connecting the LCP DX and external condenser.

General

1. The piping system may be made exclusively of special copper pipes that have been cleansed inside and sealed on both ends.
2. Copper piping made from hard or soft copper may be used. The external diameter of the copper pipe must be 12 mm, both for the gas line (coolant return) from the compressor to the condenser, and for the liquid line (coolant inlet) from the condenser to the expansion valve. The copper pipe must be suitable for the operating pressure of the R410A coolant.

Laying the pipework

1. The equivalent length of the overall line between the LCP DX and the condenser must not exceed a maximum of 30 m. To calculate the equivalent length, in addition to the actual length of the pipeline, the equivalent length of curves and valves should be taken into account.

		
0.25 m	0.5 m	0.75 m
		
1.90 m	2.10 m	3.0 m

Tab. 4: Equivalent length for external diameter 12 mm

2. The number of curves should be kept to a bare minimum so as to avoid pressure losses. Where curves are unavoidable, the radius chosen should be as large as possible.
3. When planning the piping layout ensure that the lines between the LCP DX and the condenser are as short as possible. Only allow for exceptions to save unnecessary bents.
4. If at all possible, do not conduct refrigerant lines through rooms in which people are staying, such as offices and meeting rooms.
5. The gas line must be laid with an incline of 1% in the direction of flow of the coolant.
6. A distance of at least 20 mm between the gas and the liquid line should be observed. If this is not possible, both lines should be adequately insulated.
7. When laying out the refrigerant lines, be sure no sag is created in which oil may collect; install oil traps if necessary.
8. Provide one elevation arc at least every 6 m of line length.

6 Installation

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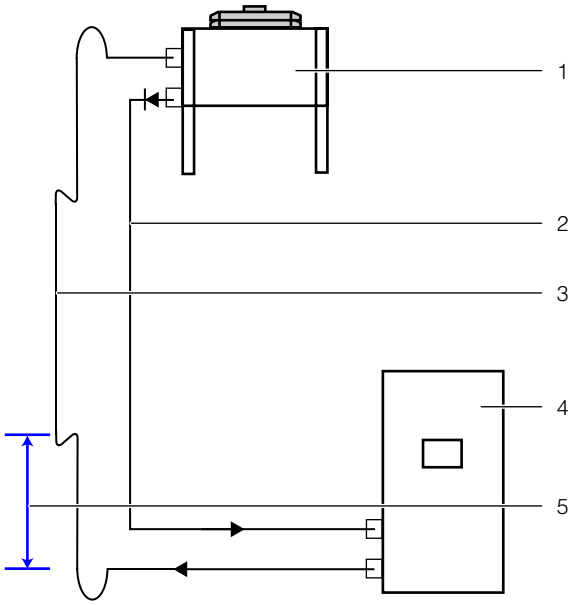

Fig. 26: Oil elevation arc

Key

1 External condenser
2 Liquid line
3 Hot gas line
4 LCP DX
5 Spacing max. 6 m

Pipe brackets

1. Both horizontal and vertical lines must be laid with vibration-damping elements (such as rubber seals). These should be used at a spacing of at least 2 m.
2. The first pipe bracket downstream of the LCP DX and upstream of the condenser should be elastic. Pipe brackets must not be too close to bents, to allow elongation of lines.

Installing the piping

1. To connect the refrigerant piping system open the line ends on the LCP DX and the condenser. Upon opening, gas must escape audibly (ex works nitrogen filling); this is evidence that there are no leakages in the refrigerating circuit.
2. Cut lines exclusively using a pipe cutting device!
3. Never saw lines open, to prevent generation of sawing swarf!
4. Only solder lines while using nitrogen as a protective gas! To achieve this, introduce dry nitrogen on one end of the line already prepared. Before starting soldering, introduce a generous nitrogen flow, when starting soldering reduce it to a minimum and maintain this low protective gas flow during the entire soldering process.
5. Before soldering the last connection, open one screwed union, to prevent overpressure in the piping system. Upon soldering retighten the connection!
6. As an alternative to soldering you may use crimping. However, limit crimped connections to annealed pipes with a diameter of max. 20 mm! After cutting the pipes, slightly open the pipe to the correct inside diameter. The crimps must be tightened to the correct torque using a torque wrench.

Insulation of the liquid lines

1. The liquid lines outside the building must be insulated using a heat insulation of Armaflex or an equivalent material.
2. A wall thickness of 9 mm is recommended. The insulation effect increases only slightly with rising wall thickness.

Insulation of the hot-gas line

1. The gas line should be insulated indoors. If the gas line is laid in the vicinity of electric cables, additional insulation should be added to the line so as to prevent damage to the cables.

Pressure stability and tightness inspection

1. Fill and pressurise the system using dry nitrogen at a pressure of min. 28 bar. The Rotalock valves on the intake and pressure sides of the compressors must be closed. This ensures the compressors are not subjected to the test pressure.
2. Check the system for tightness. We recommend to inspect all connections for tightness, including screwed joints, by applying moisture with a brush or by spraying.

Evacuating

1. Upon successful pressure testing, the air still remaining in the system must be removed. To do so, connect a vacuum pump and evacuate the system to a pressure of <0.3 mbar (absolute pressure).
2. If at all possible evacuate from both ends of the compressor, that is from the intake and the pressure side.
3. Fill the system with dry nitrogen and repeat the evacuation. This removes air and remaining moisture from the system.

Filling with refrigerant

1. If possible, fill the system with a specified refrigerant weight or by checking at the sight glass. Fill the refrigerant in liquid state into the liquid line until the filling volume reaches the calculated filling volume most exactly. Thereafter switch the unit on and, while it runs, continue filling carefully and slowly from the intake side of the compressor, until no more bubbles are visible at the sight glass.
2. Note the refrigerant volume filled in on the nameplate.

3. Refrigerant filling volumes for unit and condenser see technical data. Determine the refrigerant filling volume for the piping system from the individual lengths and interior diameters of the refrigerant lines.
4. The weight of the refrigerant volume actually filled in is determined during filling by means of a refrigerant bottle.

6.3 Connecting the condensate discharge

Any condensate which may develop is collected in the condensate collecting tray (fig. 27, item 2) beneath the heat exchanger.

Fig. 27: Condensate discharge

Key
1 Condensate discharge hose
2 Condensate collecting tray

The LCP DX is additionally equipped with a condensate discharge (fig. 27) via which the condensate is pressurelessly routed out of the LCP DX.
A hose ($Ø_i$ = 16 mm, length = 2 m) is connected to the condensate discharge in the factory. This hose, in turn, must be routed to a drain with odour seal by the customer, so that any condensate can be discharged from the device.

Note:
In order to ensure safe condensate discharge, the following points should be observed:
– Lay the drainage hose so that it always runs downhill and without any kinks.
– Do not constrict the hose cross section.

6.4 Electrical connection

6.4.1 General

Note:
Please keep this electrical documentation readily available so that it is always on hand when needed. This is the only authoritative documentation for this unit.

Caution!
Work on electrical systems or equipment may only be carried out by an electrician or by trained personnel under the guidance and supervision of an electrician. All work must be carried out in accordance with electrical engineering regulations.

Contact with live electrical parts may be lethal.

The unit may only be connected after the above-named personnel have read this information!

Use only insulated tools.

The connection regulations of the appropriate electrical power company are to be followed.

The voltage values shown in the wiring plan or on the rating plate must match the mains voltage.

The pre-fuse specified in the wiring plan / rating plate should be provided to protect the cable and equipment from short-circuits. The unit must be individually fused.

The unit has a high discharge current. Before connecting to the supply circuit, therefore, it is essential to make a 6 mm² earth connection (see section 14.4 "Circuit diagram").

The unit must be connected to the mains via an isolating device which ensures at least 3 mm contact opening when switched off.

No additional control equipment may be connected upstream of the device at the supply end.

6 Installation

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The LCP DX and the external condenser are supplied with voltage independently of one another.

6.4.2 Connecting the LCP DX

Power is supplied to the LCP DX via a 5-wire connection cable (380–480 V, 3~, N, PE). The cable may either be inserted into the device from above via a brush strip, or alternatively, if the device is operated in a room with a raised floor, from below.

Fig. 28: Electronics box – rear

Key

1 Cable gland, power supply
2 Cable gland, collective fault signal
3 Network connection (optional)

Inside the device, the cable is routed into the electronics box via the large cable gland in the centre (fig. 28, item 1). It is connected to the appropriately labelled terminals (PE, L1, L2, L3, N) in the electronics box.

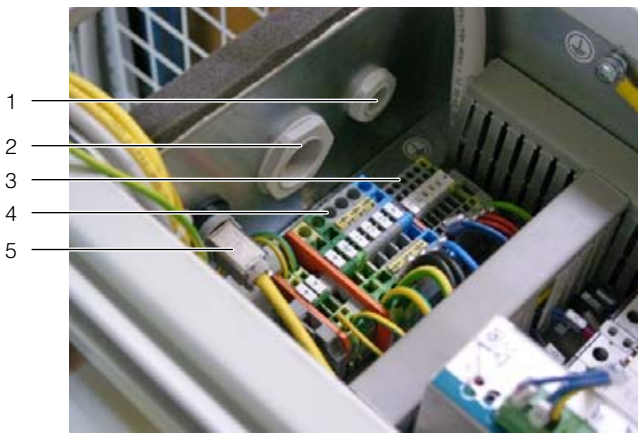

Fig. 29: Connection terminals in the electronics box

Key

1 Cable gland, collective fault signal
2 Cable gland, power supply
3 Terminals 24 and 27 (jumpered), floating
4 Terminals for connection cable
5 Network connection (optional)

- Remove approximately 45 mm from the rubber sheathing of the flexible cable.
- Trim the neutral conductor (N) and the three phase conductors (L1, L2, and L3) to a length of approximately 35 mm. Leave the length of the PE conductor at approximately 45 mm.
- Remove approximately 9 mm from the insulation of all conductors with a suitable tool.

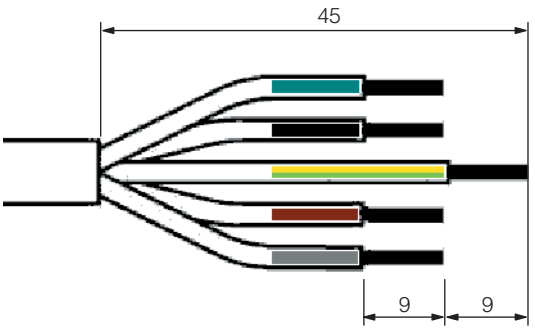

Fig. 30: Dimensions for removing the rubber sheathing and insulation

- Attach wire end ferrules without insulating collar to the ends of the cables, using a four-jaw pressing tool.

Note:
A voltage of at least 380 V is required to start the device.
To operate the device, the mains voltage may deviate by ±10% from the voltage stated on the rating plate.

- The customer should provide a pre-fuse in the supply line to the LCP DX, as specified on the rating plate of the device.
- The customer should also install an emergency off / emergency stop device in the power supply line, outside of the hazard zone.

Danger!
Take utmost care not to short-circuit one of the phases with the zero conductor or the earth conductor. Otherwise, there is a risk of damage or injury.

6.4.3 Installation of the SNMP card (optional)

To link the device into a building management system, an SNMP card may be installed in the electronics box.

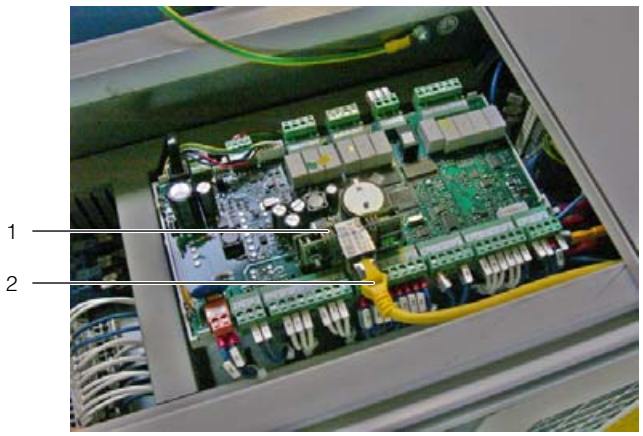

Fig. 31: SNMP card in the electronics box

Key
1 SNMP card
2 Network cable

- Insert the SNMP card into the appropriate slot on the motherboard in the electronics box.
- Insert the network cable from the SNMP card to the connection point at the rear of the electronics box (fig. 29, item 5)

6.4.4 Connecting the external condenser

Connecting the external condenser entails simply plugging it into the external power supply. Internally, the condenser is fully wired, and no connection is needed between the LCP DX and the external condenser (via a data cable etc.). The fan speed of the condenser is controlled via the system pressure.

Power is supplied to the external condenser via a 3-wire connection cable (230 V, 1~, N, PE).

Fig. 32: Pressure switch on the condenser

Key
1 Condenser
2 Pressure switch

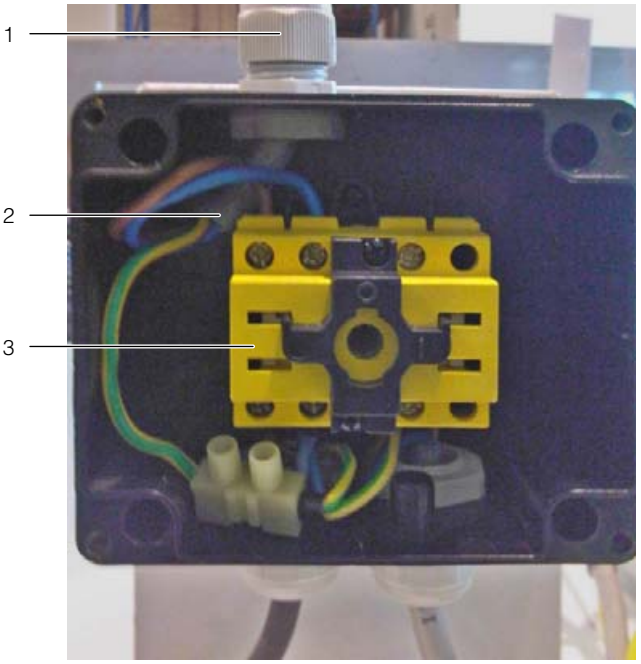

Fig. 33: Main switch box, external condenser

Key
1 Cable gland
2 Connection cable
3 Master switch

The 3-wire cable must be inserted into the main switch box of the external condenser from above. The main switch is wired to the fan control in the factory, and the pressure transducer is mechanically and electrically connected to the condenser.

Once the power supply is connected to the master switch:

- Rotate the master switch into the "I" position.
  The fans will start up as soon as the LCP DX is switched on.

6 Installation

6.4.5 Switching on the LCP DX and the external condenser

Once both the LCP DX and the condenser are electrically connected, carry out the following two steps:

- If you wish to switch the LCP DX on and off remotely:
  In the electronics box, remove the jumper between the two terminals 24 and 27 ("Remote On-Off") and connect a floating remote switch (normally open contact) (fig. 29, item 3).
  If the two terminals are not jumpered, the status message "Din-Off" will appear in the display.
- Change the status of the device in the "On/Off Unit" menu from "Off" to "On" (see section 7.5 "Menu level A "On/Off Unit"").

EN

7 Operation

7.1 Control and display components

Fig. 34: Control and display components

Key

1 Display
2 "Up" button
3 "Return" button
4 "Down" button
5 "Esc" button
6 "Prg" button
7 "Alarm" button

7.2 Layout of the user interface

The user interface is divided into eight menu levels. This level and, where applicable, the level below is displayed in the top right of every menu.

– Level A: Switch the device on and off
– Level B: Enter settings
– Level C: Set time and date
– Level D: View the status of inputs and outputs
– Level E: View and confirm error messages
– Level F: Replace the motherboard
– Level G: Edit basic settings (service)
– Level H: Edit basic settings (manufacturer)

7.3 General operating instructions

You can use the buttons on the command panel to move between the different menu levels and menus and change parameter settings.

7.3.1 Moving between menus

- Press the "Prg" button to move from the start screen to the main menu.
- Press the "Up" or "Down" button to select the entries (sub-menus) in a menu.
- Press the "Return" button to move to the selected sub-menu.
- Press the "Esc" button to move from a sub-menu to the menu above.

7.3.2 Changing parameter values

- Press the "Up" or "Down" button to select the entries (parameters) in a menu.
- Press the "Return" button to change the selected parameter value.
- Press the "Up" button to increase the parameter value, and the "Down" button to reduce the parameter value.
- Press the "Return" button to confirm the amended parameter value.
- Press the "Esc" button to move to the menu above.

7.4 Start screen

Current basic parameters are displayed on the start screen whilst the device is operational.

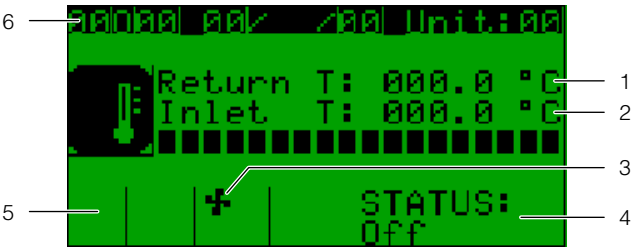

Fig. 35: Start screen

Key

1 Air inlet temperature
2 Air outlet temperature
3 Status of LCP DX
4 Status of fan speed
5 Status of compressor
6 Time and date

7.5 Menu level A "On/Off Unit"

Use this menu to switch the device on and off.

- Press the "Prg" button to move from the start screen to the main menu.
- Press the "Up" or "Down" button to select the entry "A. On/Off Menu".
- Press the "Return" button to move to the selected sub-menu.

7.5.1 Menu A01

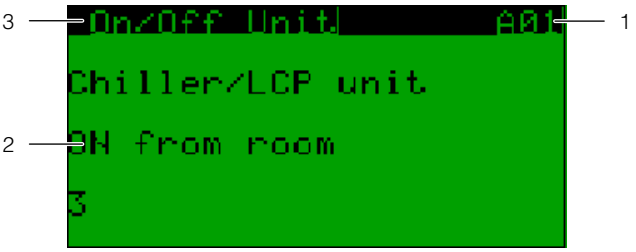

Fig. 36: Menu A01

Key

1 Menu level A01
2 Parameter "ON/OFF"
3 Menu "On/Off Unit"

- Press the "Down" button to select the "OFF" entry.
- Press the "Return" button to edit the selected parameter value.
- Press the "Up" or "Down" button to change the parameter value to "ON".
- Press the "Return" button to confirm the amended parameter value.

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- Press the "Esc" button to move back to the start screen.

7.5.2 Menu A02

A sleep mode may be activated in menu A02. As the LCP DX adapts to the required cooling output in any case, settings are not generally required here.

7.6 Menu level B "Setpoint"

7.6.1 Menu B01

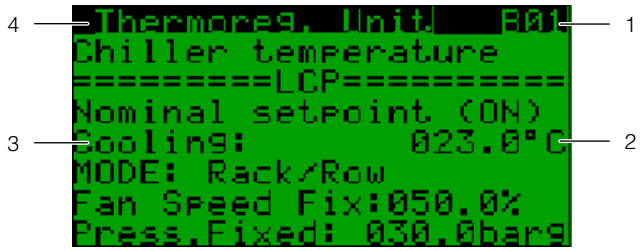

Fig. 37: "Setpoint" menu

Key

1 Menu level B01
2 Current setting
3 "Cooling" parameter
4 "Thermo-reg. unit" menu

Parameter	Explanation
Cooling	Current setting for setpoint temperature
MODE	Operating mode of device
Fan Speed Fix	Set a fixed fan speed.

Tab. 5: Settings in menu B01

7.6.2 Menu B02

Parameter	Explanation
Enable Alarm	Activate an alarm when the limits specified below are exceeded.
Setpoint Diff.	Difference between the actual temperature and the setpoint temperature.
Setpoint ABS	Absolute maximum temperature.
Hysteresis	If both the above limits are exceeded, an alarm is output immediately. The alarm stops when the respective limit is undercut by the value specified here.
Delay Alarm	Time delay by which the alarm is output.

Tab. 6: Settings in menu B02

7.7 Menu level C "Clock/Scheduler"

7.7.1 Menu C01

Set the current time and date in menu C01.

- Press the "Return" button, and the numerical display for the day will start to flash.
- Press the "Up" or "Down" button to change the value for the day.
- Press the "Return" button to move to the entry for the month.
- Again, press the "Up" or "Down" button to change the value for the month.
- Proceed in the same way to set the year, hours and minutes. The display of the week day will change automatically according to the set date.

Parameter	Explanation
Day	Displays the day of the week.
Date	Today's date in the format dd/mm/yy.
Hour	Current time.

Tab. 7: Settings in menu C01

7.7.2 Menu C02 – C04

In menus C02 to C04 it is possible to switch off the device on certain days (such as public holidays) or for a specified period (e.g. factory shutdown). As the LCP DX adapts to the required cooling output in any case, settings are not generally required here.

7.7.3 Menu C05

Settings for the changeover to summertime may be made in menu C05.

Parameter	Explanation
DST	Activate or deactivate the changeover to summertime.
Transition time	No. of minutes by which the clock is set forward or back.
Start	Start of changeover to summertime (e.g. "last Sunday in March at 2.00 am").
End	End of changeover to summertime (e.g. "last Sunday in October at 3.00 am").

Tab. 8: Settings in menu C05

7.8 Menu level D "Input/Output"

The current values of the digital and analog inputs and outputs are displayed in menu level D. We have not included a detailed representation of all parameters, since these displays are not required in normal operation.

7.8.1 Menu D01 – D06

The current values of the analog inputs are displayed in menus D01 to D06.

7.8.2 Menu D07 – D12

The current values of the digital inputs are displayed in menus D07 to D12.

7.8.3 Menu D13

The current values of the analog outputs are displayed in menu D13.

7.8.4 Menu D14

The following parameters of the electronic expansion valve are displayed in an overview screen in menu D14.

– Superheat
– Degree of opening of the valve in %
– Evaporation pressure
– Evaporation temperature

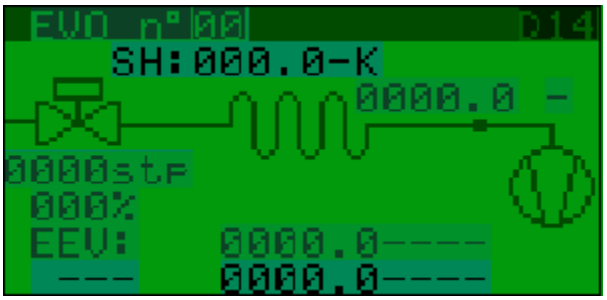

Fig. 38: Menu D14

7.8.5 Input/output menu

Other parameters of inputs and outputs are displayed in the input/output menu. The following parameters showing the compressor's current consumption levels can be viewed here.

Parameter	Explanation
Motor current	Current power consumption of the compressor motor [109].
Motor voltage	Current voltage of the compressor motor [111].

Tab. 9: Displays in the Power+ n°1 menu (3/6)

Parameter	Explanation
Motor power	Current output of the compressor motor [110].

Tab. 10: Displays in the Power+ n°1 menu (4/6)

7.9 Menu level E "Data logger"

7.9.1 Menu E01

Error messages are displayed in menu E01 and in the following menus E02, E03 etc. (see section 8.1 "General").

7.10 Menu level F "Board switch"

The pLAN device addresses of the display and the motherboard are displayed in menu F01. This may be helpful following an exchange of the respective hardware component.

Parameter	Explanation
Unit address	pLAN device address of display and motherboard

Tab. 11: Displays in menu F01

7.11 Menu level G "Service"

7.11.1 Menu Ga "Change language"

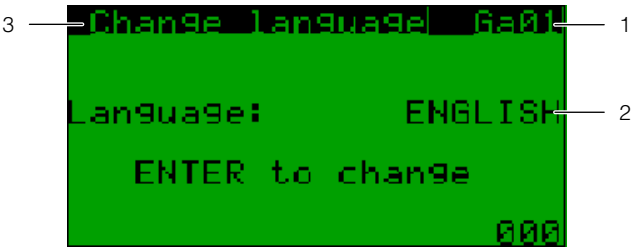

Fig. 39: Menu A01

Key

1 Menu level Ga01
2 Currently selected language
3 Menu "Change language"

■ Keep pressing the "Return" button until your preferred language is selected.

Parameter	Explanation
Disable language mask at start-up	Activate or deactivate language selection when the device is booted up.
Show mask time	Period for which the language selection is displayed.

Tab. 12: Settings in menu Ga02

7.11.2 Menu Gb "Information"

Information on the individual software and hardware components is displayed in menus Gb01 to Gb05.

7.11.3 Menu Gd "Working hours"

The operating hours of the device as a whole and its individual components are displayed in menu Gd01 and Gd02.

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8 Troubleshooting

8.1 General

If there is a malfunction or alarm on the device, a corresponding error message will be displayed. The corresponding LED on the command panel will be illuminated and the alarm relay switched where applicable (collective fault signal).

Errors are divided into three categories.

1. **Alarms:** The device will be stopped (at least individual components).
2. **Warnings:** Selected device functions will no longer be executed.
3. **Messages:** A message is output on the display (for example, if a limit is exceeded) but the device remains operational.

- Press the "Alarm" button on the command panel to view all active error messages.
  The location of the error and the component affected will be shown on the display.
- In the event of multiple errors, use the "Up" and "Down" buttons to scroll through the list.
- Press the "Alarm" button again to confirm the currently selected error.
  Once the cause of the error has been rectified, the error message will be deleted from the list.

Note:
Following an automatic restart, the alarm LED and the corresponding message text will remain active until the "Alarm" button on the command panel has been pressed twice.

The following additional information about the error messages will be output at the end of the aforementioned list of error messages:

1. Sequence of error messages. "E01" is the oldest error, "E02" the one after that, and so on.
2. Date and time when the error occurred.
3. The alarm code, e.g. "ALF01".
4. A brief description of the cause of the error.
5. Inlet and outlet temperature and high and low pressure in the cooling circuit.

Note:
A maximum of 50 error messages will be saved. If further errors occur, the oldest error messages will be overwritten.

8.2 List of error messages and solutions

Alarm code	Display	Possible cause	Possible solution
ALA02	Alarms ALA02 Position: B2 Probe B2 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALA03	Alarms ALA03 Position: B3 Probe B3 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALA04	Alarms ALA04 Position: B4 Probe B4 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALA06	Alarms ALA06 Position: B6 Probe B6 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALA07	Alarms ALA07 Position: B7 Probe B7 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALA08	Alarms ALA08 Position: B8 Probe B8 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALA09	Alarms ALA09 Position: B9 Probe B9 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALA10	Alarms ALA10 Position: B10 Probe B10 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALA11	Alarms ALA11 Position: B11 Probe B11 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALA12	Alarms ALA12 Position: B12 Probe B12 faulty or disconnected alarm	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALB01	Alarms ALB01 Position: ID3 High pressure	High ambient temperature, incorrect coolant filling, defective fan.	Check device limits, check coolant volume and check correct functioning of fan.
ALB02	Alarms ALB02 High pressure compressor 1 by transducer	High ambient temperature, incorrect coolant filling, defective fan.	Check device limits, check coolant volume and check correct functioning of fan.
ALB03	Alarms ALB03 Low pressure compressor/compressors by transducer	Incorrect coolant filling, insufficient quantity of coolant, blocked coolant lines, thermostatic valve closed.	Check coolant volume, check lines for leaks, check thermostatic valve.

8 Troubleshooting

Alarm code	Display	Possible cause	Possible solution
ALC01	Alarms ALC01 Position: ID2 Compressor 1 overload or inverter alarm	High inlet temperature, high heat load, incorrect pipework, incorrect wiring.	Check operating conditions as per compressor specifications, check device limits, check pipework and wiring.
ALC03	Alarms ALC03 Envelope alarm zone	Operating conditions outside of compressor specifications.	Check operating conditions as per compressor specifications.
ALC04	Alarms ALC04 Compressor start failure (temp.:/max.:)	Inadequate pressure difference during device startup, excess current or missing phase on inverter, blocked inverter.	Check operating conditions as per compressor specifications, check device limits, check error codes in inverter manual.
ALC05	Alarms ALC05 High discharge gas temperature	High inlet temperature, high heat load, incorrect pipework.	Check operating conditions as per compressor specifications, check device limits, check pipework.
ALC06	Alarms ALC06 Low pressure differential (insuff. lubrication)	Operating conditions outside of compressor specifications or device limits, blocked compressor, incorrect wiring.	Check operating conditions as per compressor specifications, check device limits, check wiring.
ALF01	Alarms ALF01 Position: ID1 Fan overload	Incorrect wiring.	Check wiring against circuit diagram.
ALD02	Alarms ALD02 Probe S1: Probe S2: Probe S3: Probe S4:	Sensor failure or sensor not correctly connected.	Check the connection on the motherboard or replace the sensor.
ALD03	Alarms ALD03 EEV motor error	Incorrect or missing wiring between motherboard and valve motor.	Check the connection on the motherboard or replace on the valve motor.
ALD04	Alarms ALD04 Low superheat (LowSH)	Incorrect coolant filling, insufficient heat load, insufficient fan speed.	Check device limits, check coolant volume, check fan speed.
ALD05	Alarms ALD05 Low suction temperature	Cf. ALD04 and ALD06.	Cf. ALD04 and ALD06.
ALD06	Alarms ALD06 Low evaporation temperature (LOP)	Incorrect coolant filling, insufficient coolant volume, blocked coolant lines, thermostatic valve closed.	Check coolant volume, check lines for leaks, check thermostatic valve.
ALD07	Alarms ALD07 High evaporation temperature (HOP)	High inlet temperature, incorrect PID valve parameter.	
ALD08	Alarms ALD08 High condensing temperature (HiTcond)	High ambient temperature, incorrect coolant filling, defective fan on condenser.	Check device limits, check coolant volume, check fan on condenser.
ALD09	Alarms ALD09 Driver offline	Cf. inverter manual	Cf. inverter manual

9 Inspection and maintenance

The following maintenance work should be carried out on the LCP DX:

– The condensate discharge device should be checked regularly for correct functioning.
– Regularly check the coolant circuit and all main components for correct functioning.
– Regularly check for leaks using a suitable device (annually).

Note:
At an ambient temperature of 40 °C, the nominal service life of the built-in fan is 40,000 operating hours.

10 Storage and disposal

Caution! Risk of damage!
The air/coolant heat exchanger must not be subjected to temperatures above +50 °C during storage.

During storage, the LCP DX must stand upright.
Disposal can be performed at the Rittal plant.
Please contact us for advice.

Caution! Risk of environmental contamination!
Never allow refrigerant from the cooling circuit or oil from the compressor to escape into the environment.
Refrigerant and oil must be properly disposed of in accordance with the valid regional regulations.

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11 Technical specifications

Technical specifications		
Description/Model No.	TopTherm LCP Rack DX / 3311.410 (1000 mm depth)	
Description/Model No.	TopTherm LCP Rack DX / 3311.420 (1200 mm depth)	
Description/Model No.	TopTherm LCP Inline DX / 3311.430 (1000 mm depth)	
Description/Model No.	TopTherm LCP Inline DX / 3311.440 (1200 mm depth)	
Dimensions and weight		
Dimensions Width x height x depth [mm]	300 x 2000 x 1000 (3311.410/430) or 1200 (3311.420/440)	
Usable U	42	
Weight, max. [kg]	220	
Electrical connection		
Type of electrical connection	Connection clamp	
Rated voltage [V, Hz]	380…480/3~/N/PE, 50	380…480/3~/N/PE, 60
Max. current per phase [A]	7	7
Startup current [A]	11.5	10.9
Pre-fuse T [A]	20	20
Duty cycle [%]	100	
Cooling output (at 35°C exterior temperature and 22°C setpoint temperature for cold air)		
Max. cooling output [kW]	12	12
Power consumption P_{el} [kW]	4	4
Air throughput, max. [m^3/h]	4,800	
Cooling circuit		
Coolant	R410A	
Fill volume [kg]	2.8	
External diameter of coolant lines [mm]	12	
Other information		
Storage temperatures [°C]	-20…+50	
Temperature control	Linear via inverter-controlled compressor	
Ambient temperature [°C]	+6…+35	
Noise level [dB(A)] (Open air above reflective flooring, distance 1 m)	69	
Colour	RAL 7035	

Tab. 13: Technical specifications LCP DX

11 Technical specifications

Technical specifications		
Description/Model No.	Condenser / 3311.360	
Dimensions and weight		
Dimensions Width x height x depth [mm]	1397 x 921 x 620	
Weight, max. [kg]	33,5	
Electrical connection		
Type of electrical connection	Connection clamp	
Rated voltage [V, Hz]	230/1~/N/PE, 50	230/1~/N/PE, 60
Startup current [A]	2,3	2,1
Pre-fuse T [A]	6	6
Duty cycle [%]	100	
Cooling circuit		
Coolant	R410A	
Fill volume [kg]	2,8	
External diameter of coolant lines [mm]	12	
Other information		
Storage temperatures [°C]	-20…+50	
Ambient temperature [°C]	-20…+45	
Noise level [dB(A)] (Open air above reflective flooring, distance 1 m)	43	

Tab. 14: Technical specifications for the condenser unit (for operation with 3311.410/420/430/440)

12 Spare parts

Article	Qty./Pack
Control unit	1
Display	1
Compressor	1
Inverter	1
Electronic expansion valve	1
Fan, single	1
Switch for fan	1
High-pressure switch	1
Temperature sensor hot/cold air	1
Coolant filter	1

Tab. 15: Spare parts list – LCP DX

13 Accessories

Article	Model No.	Qty./Pack	Remarks
Condenser	3311.360	1	Required for operation of the LCP DX.
Vertical shielding (foam strips) for enclosure width 600 mm, for external mounting on side panel	3301.380	1	
Vertical shielding (foam strips) for enclosure width 600 mm, for external mounting on LCP DX	3301.370	1	
Vertical shielding (foam strips) for enclosure width 800 mm, for external mounting on side panel	3301.390	1	
Vertical shielding (foam strips) for enclosure width 800 mm, for external mounting on LCP DX	3301.320	1	
Air baffle plate for TS, for enclosure width 600 mm	7151.206	2	
Air baffle plate for TS, for enclosure width 800 mm	7151.208	2	
Add-on cover	3301.221	1	
Connection cable, three-phase	7856.025	1	EU-type
Server enclosure compensating panel for LCP Inline DX	7067.200	1	
SNMP network card for remote monitoring	3311.320	1	

Tab. 16: Accessories list – LCP DX

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14 Further technical information

14.1 Coolant information

Caution!
The LCP DX may only be operated with coolant R410A. Use of any other coolant will invalidate the guarantee.

To avoid damage to the device, Rittal prescribes the use of coolant R410A.
R410A is virtually azeotropic and is comprised of equal parts of R32 and R125. The basic properties of R410A are:
– No ozone depletion potential
– Clear
– Liquefied gas smelling of ether
– Non-combustible
– Low toxicity

Property	Value
Composition	50%: R32 (CH_2F_2) 50%: R125 (CHF_2CF_3)
Molar mass [g/mol]	72.585
Boiling point [°C]	-52.7
Vapour pressure [bar]	12.46 at 15 °C
Relative density	1.11 at 15 °C

Tab. 17: Material data for R410A

14.2 Characteristic curves

14.2.1 Cooling output

Due to the device configuration comprising two sub-units, and the partially linear operation of the components (fan, inverter-controlled compressor), the cooling output of the device is dependent on various factors:
– External temperature at the installation site of the external condenser
– Heat loss from the server enclosure
– Inlet temperature of hot air into the LCP DX
– Settings

The charts and tables apply to the following operating data:
– Exterior temperatures between -5 °C and +42 °C
– Cooling output from 3 kW to 12 kW in 3 kW increments
– Setpoint temperature +22 °C for the LCP Inline DX/ Rack DX

Exterior temperature -5 °C

Exterior temperature [°C]	-5			
Cooling output [kW]	3	6	9	12
Inlet temperature [°C]	25.23	27.71	29.07	32.97
Outlet temperature [°C]	22.19	22.03	21.68	23.52
dT [°C]	3.04	5.68	7.39	9.45
Output [kW]	0.738	1.522	2.477	4.198

Tab. 18: Tabular view

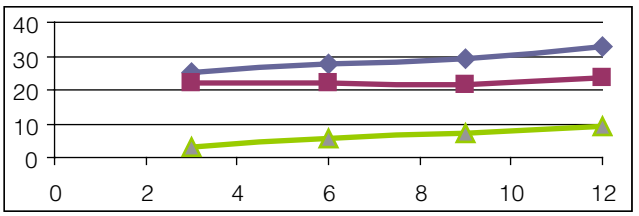

Fig. 40: Diagrammatic view

Exterior temperature 10 °C

Exterior temperature [°C]	10			
Cooling output [kW]	3	6	9	12
Inlet temperature [°C]	25.62	27.53	29.1	33.18
Outlet temperature [°C]	22.15	21.56	21.26	23.66
dT [°C]	3.47	5.97	7.84	9.52
Output [kW]	0.825	1.608	2.639	4.02

Tab. 19: Tabular view

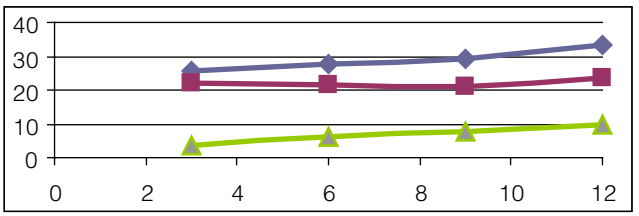

Fig. 41: Diagrammatic view

Exterior temperature 20 °C

Exterior temperature [°C]	20			
Cooling output [kW]	3	6	9	12
Inlet temperature [°C]	25.43	27.45	29.07	32.83

Tab. 20: Tabular view

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Exterior temperature [°C]	20			
Outlet temperature [°C]	21.86	21.5	21.19	23.2
dT [°C]	3.57	5.95	7.88	9.63
Output [kW]	0.777	1.627	2.717	4.142

Tab. 20: Tabular view (Continued)

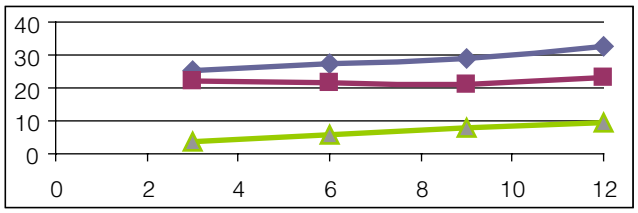

Fig. 42: Diagrammatic view

Exterior temperature 30 °C

Exterior temperature [°C]	30			
Cooling output [kW]	3	6	9	12
Inlet temperature [°C]	25.56	27.59	28.91	33.28
Outlet temperature [°C]	21.89	21.56	21.16	23.6
dT [°C]	3.67	6.03	7.75	9.68
Output [kW]	0.859	1.772	2.861	4.193

Tab. 21: Tabular view

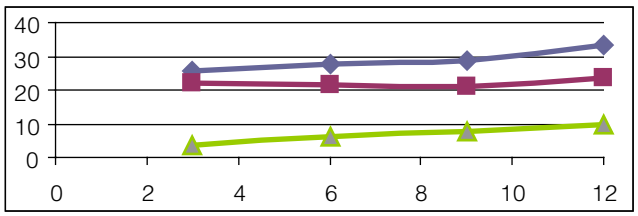

Fig. 43: Diagrammatic view

Exterior temperature 42 °C

Exterior temperature [°C]	42			
Cooling output [kW]	3	6	9	10.46
Inlet temperature [°C]	25.51	27.32	28.67	30.75
Outlet temperature [°C]	21.73	21.22	20.46	22.22
dT [°C]	3.78	6.1	8.21	8.53
Output [kW]	1.084	2.258	4.182	4.521

Tab. 22: Tabular view

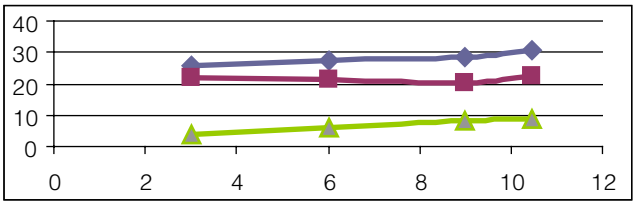

Fig. 44: Diagrammatic view

Exterior temperature 45 °C

At very high exterior temperatures above +45 °C, the device will achieve a maximum cooling output of approx. 10 kW.

Exterior temperature [°C]	45			
Cooling output [kW]	3	6	9	9.76
Inlet temperature [°C]	25.63	26.55	28.39	30.35
Outlet temperature [°C]	22.08	19.87	20.23	22.04
dT [°C]	3.55	6.68	8.16	8.31
Output [kW]	1.084	2.258	4.182	4.676

Tab. 23: Tabular view

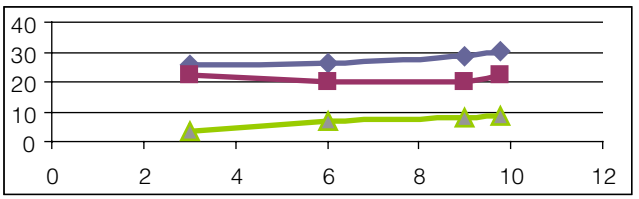

Fig. 45: Diagrammatic view

Exterior temperature -20 °C

The device has also been tested at very low exterior temperatures of -20 °C and very low cooling outputs of 2 kW and 4 kW.

Exterior temperature [°C]	-20	
Cooling output [kW]	2	4
Inlet temperature [°C]		26.08
Outlet temperature [°C]		22.99
dT [°C]		3.09
Output [kW]	2.02	6.07

Tab. 24: Tabular view

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14.3 Overview drawing

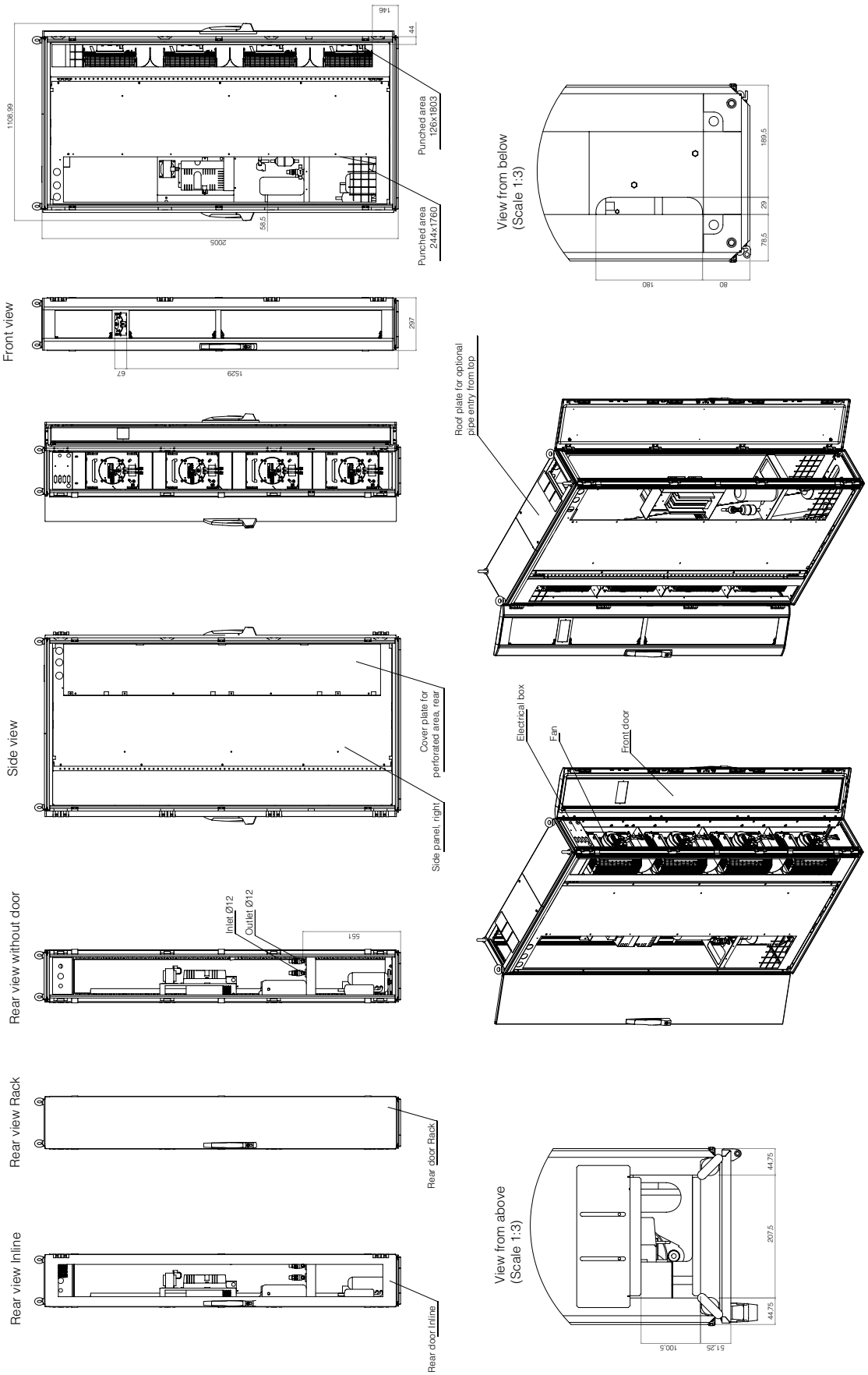

Fig. 46: Overview drawing of the LCP DX (depth 1000 mm)

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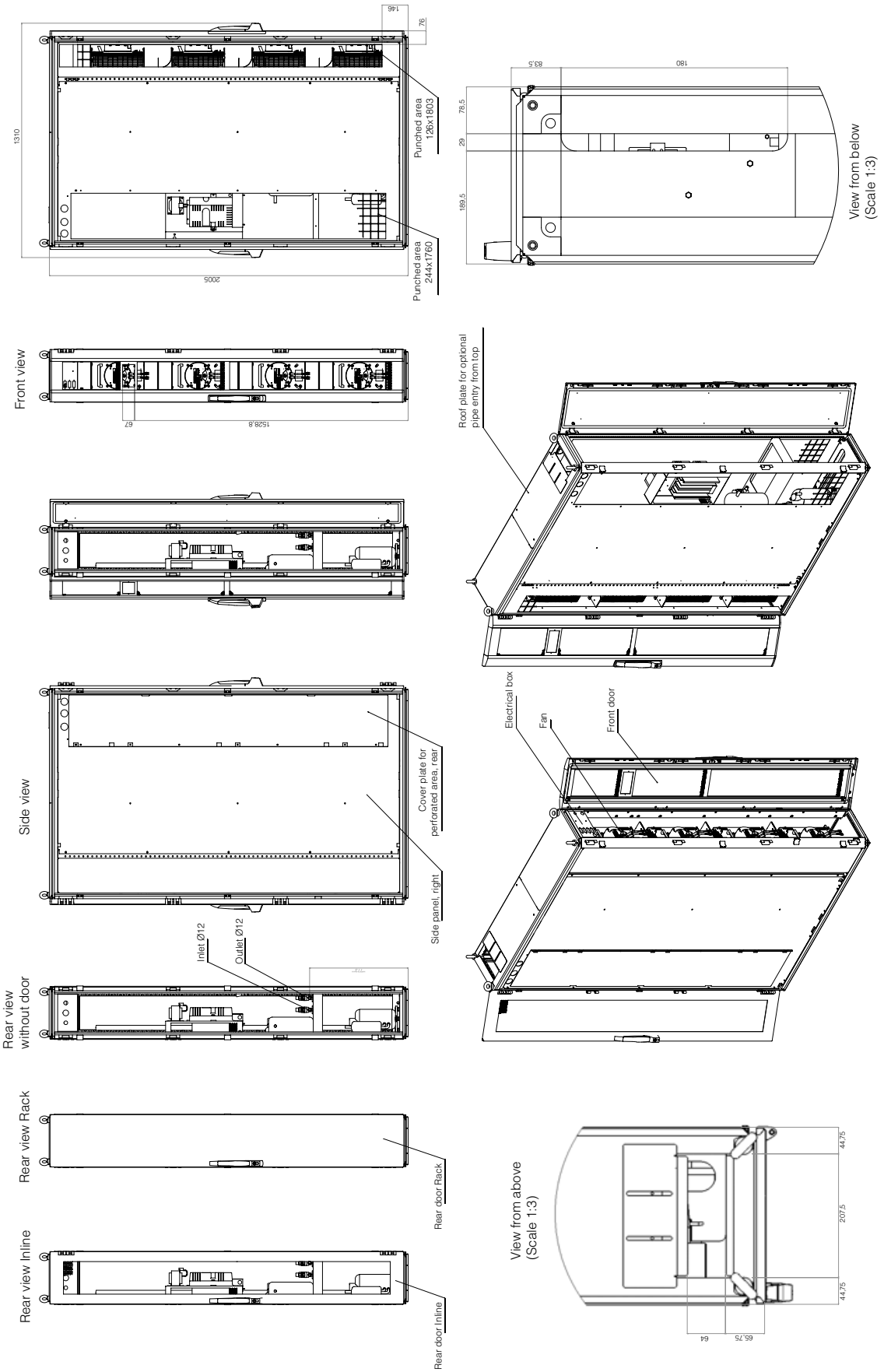

Fig. 47: Overview drawing of the LCP DX (depth 1200 mm)

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14.4 Circuit diagram

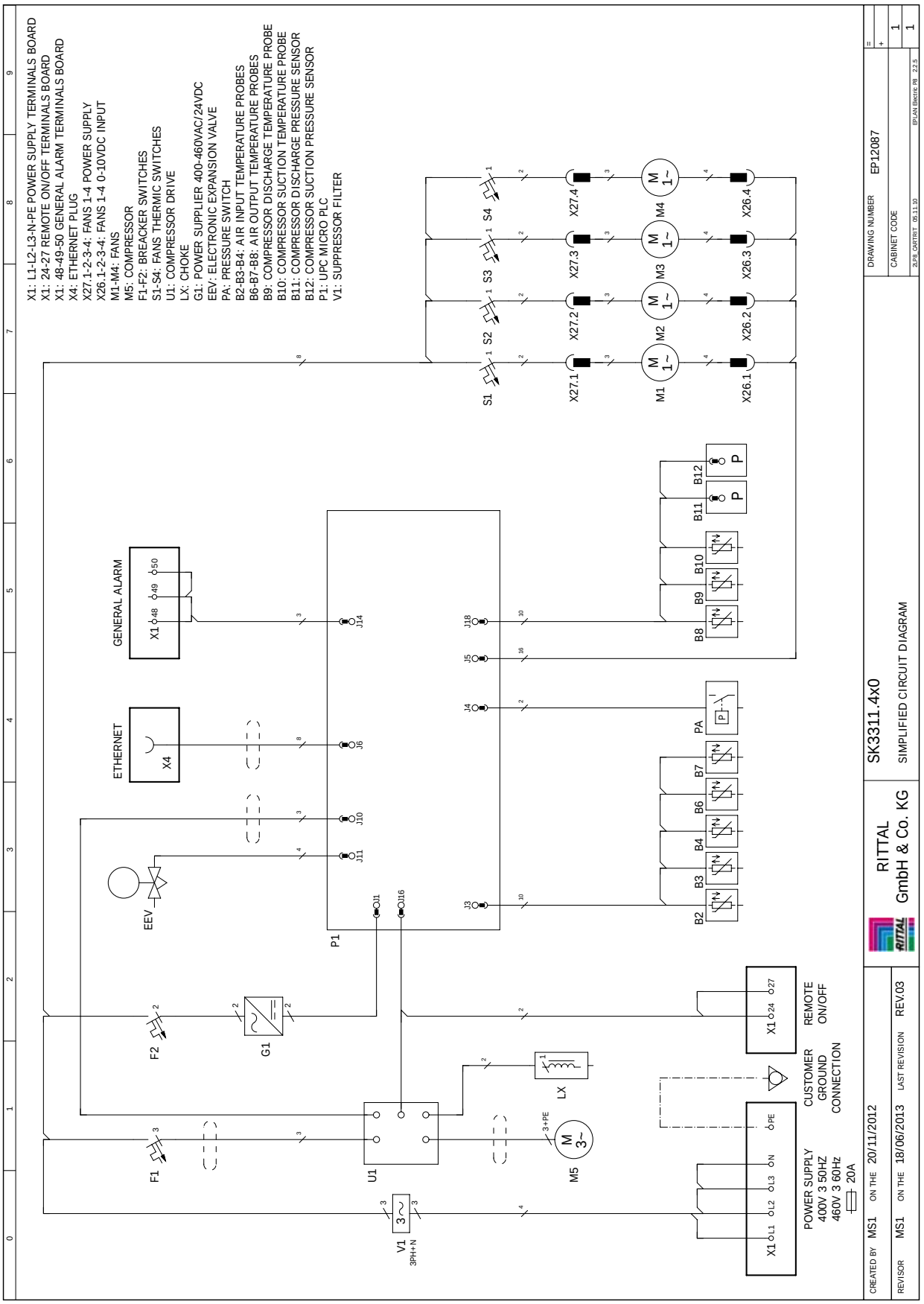

Fig. 48: Circuit diagram of the LCP DX

14 Further technical information

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14.5 Coolant diagram

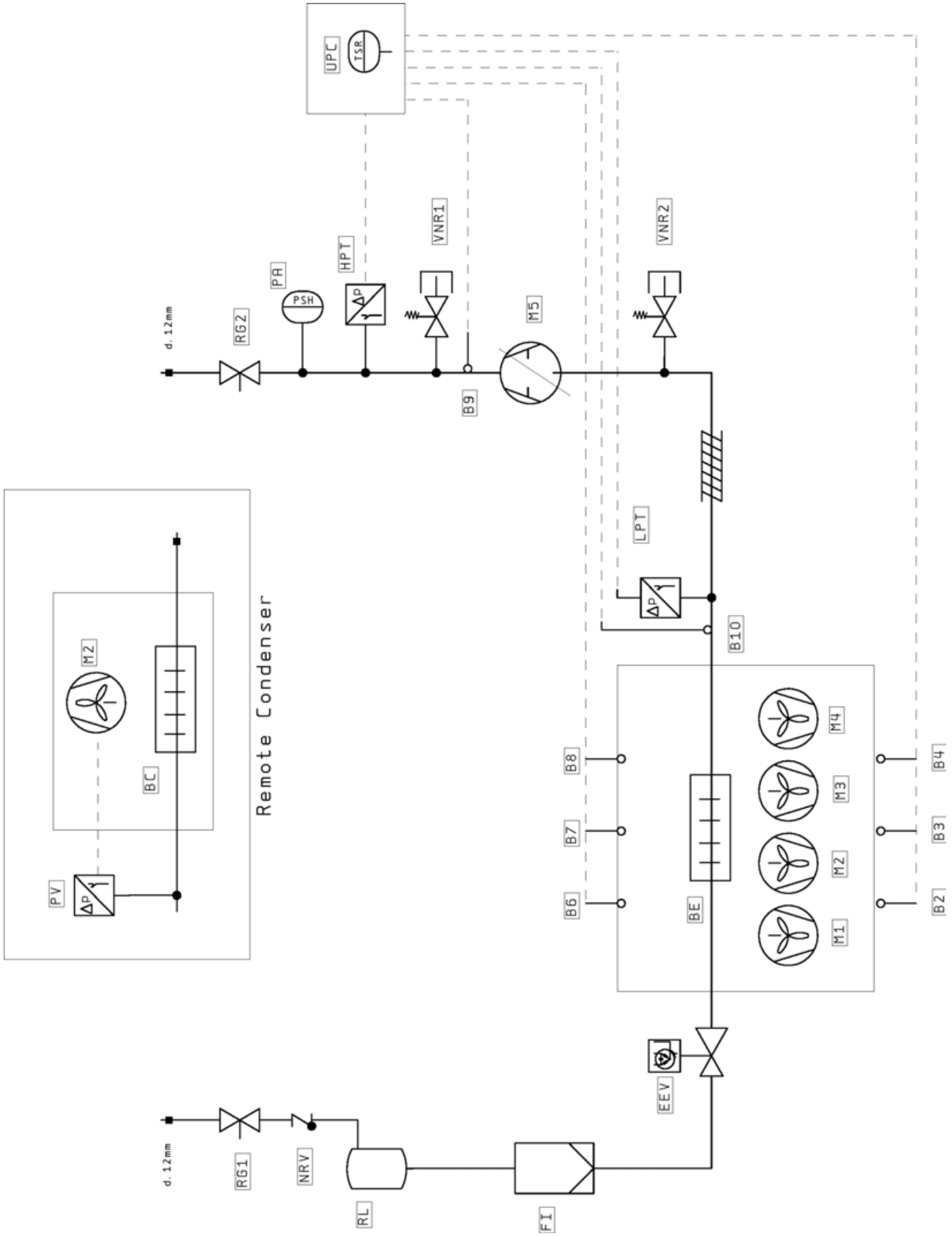
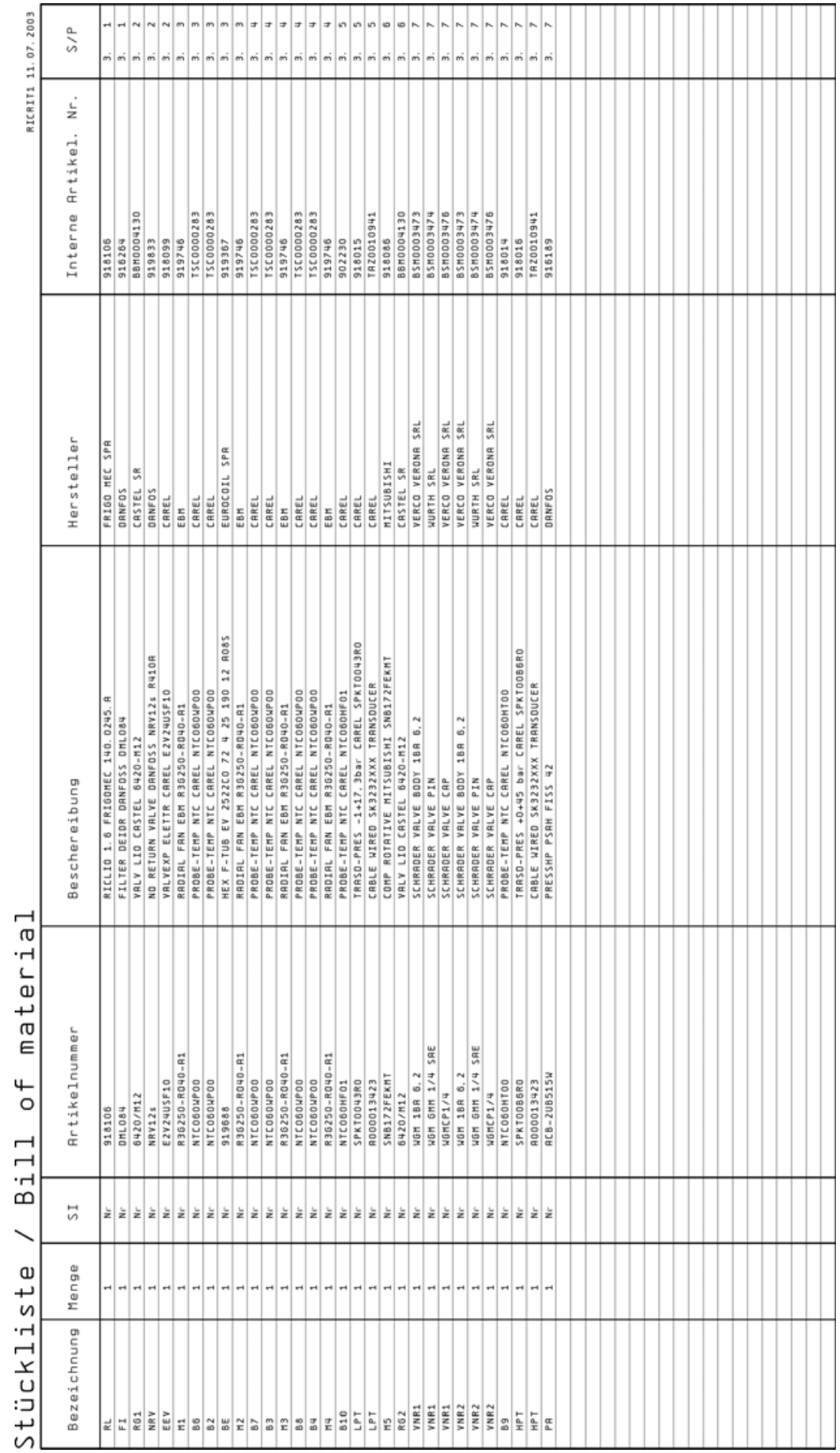


Fig. 49: Coolant diagram



Stückliste / Bill of material

RICRIT1 11.07.2003

Bezeichnung	Menge	SI	Artikelnummer	Beschereibung	Hersteller	Interne Artikel. Nr.	S/P
RL	1	Nr	918106	RICLIO 1.6 FRIGOMEC 140.0245.A	FRIGO MEC SPA	918106	3. 1
F1	1	Nr	DHL084	FILTER DEIDR DANFOSS DHL084	DANFOS	916264	3. 1
RG1	1	Nr	6420/M12	VALV LID CASTEL 6420-M12	CASTEL SR	B8M0004130	3. 2
NRV	1	Nr	NRV12s	NO RETURN VALVE DANFOSS NRV12s R410R	DANFOS	919833	3. 2
EEV	1	Nr	E2V24USF10	VALVEXP ELETTR CAREL E2V24USF10	CAREL	918099	3. 2
M1	1	Nr	R36250-RQ40-A1	RADIAL FAN EBM R36250-RQ40-A1	EBM	919746	3. 3
B6	1	Nr	NTC060WP00	PROBE-TEMP NTC CAREL NTC060WP00	CAREL	TSC0000283	3. 3
B2	1	Nr	NTC060WP00	PROBE-TEMP NTC CAREL NTC060WP00	CAREL	TSC0000283	3. 3
BE	1	Nr	919688	HEX F-TUB EV 2522CO 72 4 25 190 12 R085	EUROCOIL SPA	919367	3. 3
M2	1	Nr	R36250-RQ40-A1	RADIAL FAN EBM R36250-RQ40-A1	EBM	919746	3. 3
B7	1	Nr	NTC060WP00	PROBE-TEMP NTC CAREL NTC060WP00	CAREL	TSC0000283	3. 4
B3	1	Nr	NTC060WP00	PROBE-TEMP NTC CAREL NTC060WP00	CAREL	TSC0000283	3. 4
M3	1	Nr	R36250-RQ40-A1	RADIAL FAN EBM R36250-RQ40-A1	EBM	919746	3. 4
B8	1	Nr	NTC060WP00	PROBE-TEMP NTC CAREL NTC060WP00	CAREL	TSC0000283	3. 4
B4	1	Nr	NTC060WP00	PROBE-TEMP NTC CAREL NTC060WP00	CAREL	TSC0000283	3. 4
M4	1	Nr	R36250-RQ40-A1	RADIAL FAN EBM R36250-RQ40-A1	EBM	919746	3. 4
B10	1	Nr	NTC060HF01	PROBE-TEMP NTC CAREL NTC060HF01	CAREL	902230	3. 5
LPT	1	Nr	SPKT0043R0	TRASD-PRES -1+17.3bar CAREL SPKT0043R0	CAREL	918015	3. 5
LPT	1	Nr	R000013423	CABLE WIRED SK3232XXX TRANSDUCER	CAREL	TAZ0010941	3. 5
M5	1	Nr	SN8172FEKMT	COMP ROTATIVE MITSUBISHI SN8172FEKMT	MITSUBISHI	918086	3. 6
RG2	1	Nr	6420/M12	VALV LID CASTEL 6420-M12	CASTEL SR	B8M0004130	3. 6
YNR1	1	Nr	WGM 10A 6.2	SCHRADER VALVE BODY 10A 6.2	VERCO VERONA SRL	B5M0003473	3. 7
YNR1	1	Nr	WGM GHM 1/4 SAE	SCHRADER VALVE PIN	WURTH SRL	B5M0003474	3. 7
YNR1	1	Nr	WGMCP1/4	SCHRADER VALVE CAP	VERCO VERONA SRL	B5M0003476	3. 7
YNR2	1	Nr	WGM 10A 6.2	SCHRADER VALVE BODY 10A 6.2	VERCO VERONA SRL	B5M0003473	3. 7
YNR2	1	Nr	WGM GHM 1/4 SAE	SCHRADER VALVE PIN	WURTH SRL	B5M0003474	3. 7
YNR2	1	Nr	WGMCP1/4	SCHRADER VALVE CAP	VERCO VERONA SRL	B5M0003476	3. 7
B9	1	Nr	NTC060HT00	PROBE-TEMP NTC CAREL NTC060HT00	CAREL	918014	3. 7
HPT	1	Nr	SPKT00B6R0	TRASD-PRES +0+45 bar CAREL SPKT00B6R0	CAREL	918016	3. 7
HPT	1	Nr	R000013423	CABLE WIRED SK3232XXX TRANSDUCER	CAREL	TAZ0010941	3. 7
PA	1	Nr	ACB--2UB515W	PRESSHP PSRH FISS 42	DANFOS	916189	3. 7

Fig. 50: Parts list, coolant diagram

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15 Glossary

1 U server:

1 U servers are very flat and deep, modern high performance servers, whose height corresponds to one height unit (1 U = 44.54 mm, the smallest standard height division). Typical dimensions are (W x D x H) 482.6 mm (19") x 800 mm x 1 U.

These systems normally include 2 CPUs, many GB RAM and hard drives, so that they require up to 100 m^3/h cooling air at a maximum of 32 °C.

482.6 mm (19") level:

The front sides of the devices built into the server enclosure form the 482.6 mm (19") level.

Blade server:

By orienting dual CPU systems vertically and placing up to 14 units on a common backplane to provide for signal routing and power supply, one has a blade server.

Blade servers can "generate" up to 4.5 kW heat loss per 7 U and 700 mm depth.

"Front to back" cooling principle:

The devices built into the server enclosure are normally cooled according to the "front to back" cooling principle.

Under this cooling principle, cold air supplied by external air conditioning is blown to the front of the server enclosure. The fans in the devices built into the server enclosure direct this air horizontally through the server enclosure. The air is warmed through this process and is exhausted out the rear of the enclosure.

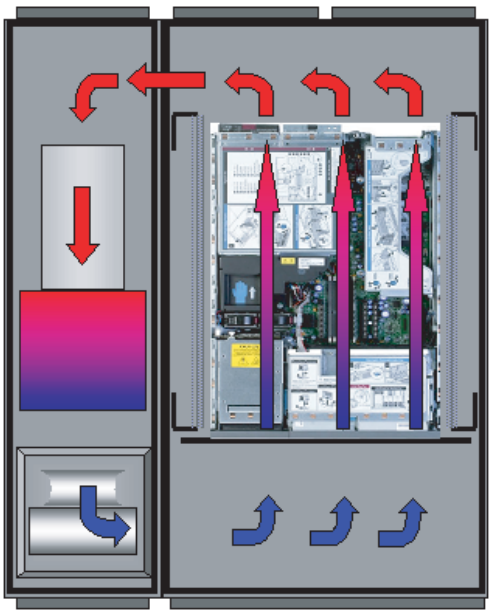

Fig. 51: "Front to back" cooling principle with bayed LCP Rack

Hotspot:

A hotspot is the concentration of thermal energy in a small area.

Hotspots normally lead to local overheating and can cause system malfunctions.

Switch:

Multiple servers normally communicate with one another and in the network using switches.

Because as many inputs as possible are located on the front of switches, they frequently have an airflow from the side, not "front to back" cooling.

Hysteresis:

If an upper limit value is overshot (SetPtHigh) or a lower limit value is undershot (SetPtLow) a warning or an alarm will be output *immediately*. For a hysteresis of x%, the warning or alarm for undershooting an upper limit value or overshooting a lower limit value clears only for a difference of x/100*limit value to the limit value.

16 Customer service addresses

For technical questions, please contact:
Tel.: +49(0)2772 505-9052
E-mail: info@rittal.de
Homepage: www.rittal.com

For complaints or service requests, please contact:
Tel.: +49(0)2772 505-1855
E-mail: service@rittal.de

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