

**AIRSKIN®**

Operating manual

# AIRSKIN® Modules

**English**  
[Translation]

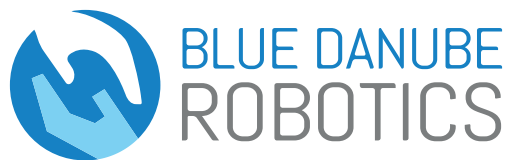
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## AIRSKIN® firmware variants

☐ Default

☐ Volatile



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# Contents

<b>1. General</b>	<b>1</b>
1.1. The AIRSKIN® product	1
1.1.1. Nameplate	1
1.2. Intended operation	1
1.3. Scope of delivery	2
<b>2. Safety instructions</b>	<b>3</b>
2.1. General safety information	3
2.1.1. Signal words and warning symbols used	3
2.1.2. Hazard notes	4
2.1.3. Residual risks	5
2.1.4. Directives, laws and standards	5
2.1.5. Validity	5
2.2. Safety instructions for the operator	6
2.2.1. Occupational safety	6
2.2.2. Technical condition of the AIRSKIN®	6
2.3. Safety instructions for staff	6
2.3.1. Dangerous situations and accidents	7
2.4. Specific life cycles of AIRSKIN®	8
2.4.1. Transport	8
2.4.2. Installation/assembly	8
2.4.3. Service and maintenance	8
2.4.4. Disassembly	8
2.5. Service life	8
<b>3. Description of AIRSKIN®</b>	<b>9</b>
3.1. Functionality	9
3.2. EC type-examination	9
3.3. Connection to the safety controller	9
3.4. Components	9
3.4.1. AIRSKIN® pad	9
3.4.2. External connection cables	10
3.4.3. Support layer	10
3.4.4. AIRSKIN® Connection Box	11
3.5. Designations AIRSKIN® "First Touch" FT1	11
<b>4. Installation</b>	<b>13</b>
4.1. Unpacking AIRSKIN®	13
4.2. Preparations for AIRSKIN® assembly	13
4.3. Assembling AIRSKIN®	13
4.3.1. Support layer	14
4.3.2. Cable connections	15
4.3.3. Mounting the pads	15
4.4. Connect AIRSKIN® to the safety PLC or the robot safety controller	16
4.4.1. Voltage	16
4.4.2. Fuse	16
4.4.3. Electrical connection	17
4.4.4. AIRSKIN® switch test pulses	20
4.4.5. Termination of an AIRSKIN® lane	21
<b>5. Commissioning</b>	<b>23</b>
5.1. AIRSKIN® Firmware Variant "Volatile Actuation"	23
5.2. Preliminary work before switching on AIRSKIN®	23
5.3. Reconfigure AIRSKIN®	24
5.4. Switching on AIRSKIN®	26
5.4.1. Preparing to switch on	26
5.4.2. Switching on the AIRSKIN® System	27
5.5. Stopping and switching off AIRSKIN®	28
5.5.1. Preparing to switch off	28
5.5.2. Stopping and switching off the AIRSKIN® System	28

<b>6. Operation</b>	<b>29</b>
6.1. Before you switch on AIRSKIN®	29
6.2. Switch on AIRSKIN®	29
6.3. Switching off AIRSKIN®	29
<b>7. Error conditions</b>	<b>31</b>
7.1. Check the functionality of the AIRSKIN® Connection Box	31
7.2. Checking the functionality of the AIRSKIN® connection cable	31
7.3. Checking the functionality of the AIRSKIN® Pads	32
7.4. Status codes of the AIRSKIN® pads	33
<b>8. Maintenance</b>	<b>35</b>
8.1. Safety instructions for maintenance	35
8.2. Maintenance activities	36
8.2.1. Cleaning the outside	36
8.2.2. Thorough check-up with internal cleaning	36
8.3. Activities after maintenance/repair	37
8.4. Troubleshooting	37
<b>9. Disposal</b>	<b>39</b>
9.1. Decommissioning and storage	39
9.2. Decommissioning	40
9.2.1. Disassembling AIRSKIN®	40
9.3. Disposal	41
9.3.1. Recyclable materials	41
9.3.2. Special waste	41
<b>10. Technical data</b>	<b>43</b>
10.1. Mechanical	43
10.2. Electrical	43
10.3. Ambient conditions	43
10.4. Standards and norms	44
<b>11. Warranty</b>	<b>45</b>
11.1. Warranty period	45
11.2. Handling of the warranty claim	45
11.3. Disclaimers	45
11.4. Information about the manufacturer and service	45
<b>12. Safety parameters</b>	<b>47</b>
12.1. PFH <sub>D</sub>	47
12.2. B10 <sub>D</sub>	48
<b>13. Declaration of conformity and manufacturer</b>	<b>49</b>
13.1. EC Declaration of Conformity	49
13.2. REACH Compliance Declaration	50
13.3. Declaration of Conformity to EU RoHS	50
<b>A. AIRSKIN® Modules</b>	<b>51</b>
A.1. The AIRSKIN® Module product	51
A.2. Scope of delivery	51
A.3. Cabling	64
A.4. Actuation characteristics	65

This operating manual contains all information on the installation, commissioning and operation of AIRSKIN®. It also contains information and advice in case of problems.

## 1.1 The AIRSKIN® product

AIRSKIN® is a safe collision sensor for robots. AIRSKIN® allows you to use industrial robots, machines or driverless transport systems in collaborative applications. AIRSKIN® is certified for functional safety according to EN ISO 13849 (Performance Level e) or EN/IEC 62061 (SIL3).

AIRSKIN® was developed and manufactured in accordance with the applicable standards and guidelines.

### 1.1.1 Nameplate



Fig. 1.1.: AIRSKIN® nameplate.

## 1.2 Intended operation

AIRSKIN® is only considered to be operated as intended if the following conditions are met:

- The installation and implementation of AIRSKIN® must be carried out by trained personnel.
- The safety functions for AIRSKIN® must not be deliberately or negligently ignored.
- The safety and operating instructions in this operating manual must be observed.
- The operating instructions of the operator must be observed.
- The legal accident prevention regulations must be observed.
- The certification of the application according to ISO/TS 15066 must have taken place.
- The robot/machine controller must be prepared and correctly configured for operation with AIRSKIN® (safe-guard stop, emergency stop, ...) so that a signal leads to a safe state of the robot/machine when a collision occurs.
- A machine/robot with AIRSKIN® may only be released for operation after a risk analysis has been carried out.

The following is considered improper operation:

- Installation and commissioning by unauthorised personnel.
- Operation in violation of safety regulations.
- Operation with modified safety devices.

#### WARNING: Heat sources



Operation in the vicinity of heat sources (fire, flying sparks, welding, ovens, radiators, fan heaters or other heat radiating equipment) is prohibited!

## 1.3 Scope of delivery

Check that the scope of delivery is complete and intact. For the contents of your AIRSKIN® set, please refer to [Section A.2.](#)









**WARNING: Danger of suffocation for children!**

Keep packaging films away from children. Dispose of packaging material in an environmentally friendly manner!

The following basic safety instructions must always be observed when using AIRSKIN®. Read the following safety instructions and information on safe operation of AIRSKIN® carefully. Familiarise yourself with all functions of AIRSKIN®. Only pass on AIRSKIN® to third parties with operating instructions.

## 2.1 General safety information

### 2.1.1 Signal words and warning symbols used

Symbol	Signal word	Meaning
	Danger	Indication of danger to life in case of non-observance
	Warning	Indication of a potential serious risk of injury or death if not observed
	Caution	Indication of potential slight risk of injury if not observed
	Depending on the degree of danger	Indication of dangers due to voltage
	Important	An important note is given here
	Information, tip	General information or special tips

## 2.1.2 Hazard notes



**DANGER: Danger to life, serious injury and/or damage to property due to incorrect operation!**

- Endangering of persons by inadequate qualification and/or installation error of the commissioning engineer.
- Danger to persons through improper commissioning of AIRSKIN® (e.g. mounting of AIRSKIN® onto the robot but no installation as a safety system. This may suggest a false sense of security for other people.)



**IMPORTANT: Follow the instructions for proper operation and correct installation.**

- Never exceed the permissible technical limits, especially not the maximum permissible speed of your robot or your machine which you determined during the risk assessment according to ISO/TS 15066.
- Do not work with machines equipped with AIRSKIN® if you:
  - do not have the necessary qualifications,
  - have not received complete instructions for the machine,
  - have not read or understood these operating instructions completely.



**CAUTION: Gaps**

AIRSKIN® systems can show gaps between pads. Any risks stemming from these gaps need to be addressed in the risk assessment according to the machine directive and in particular according to force and pressure limits in ISO/TS 15066.



**CAUTION: Passive Elements**

AIRSKIN® can have passive elements in addition to the actively sensing AIRSKIN® pads. These elements are easily identifiable through a different colour and structural appearance. These elements do not trigger a protective stop of the system and are only used as shock absorbing elements or for contact protection.



**CAUTION: Wilful Override of the Safety Function**

If the AIRSKIN® Connection Box (see [Section 3.4.4](#)) is accessible to unauthorised persons, the safety function of an AIRSKIN® system can be wilfully bypassed using additional tools. To prevent misuse, access to the AIRSKIN® Connection Box has to be restricted to unauthorised persons with appropriate measures.



### 2.1.3 Residual risks

#### **WARNING: Collisions in the eye or larynx area**



AIRSKIN® is not designed for collisions in the eye or larynx area. If this cannot be ruled out during operation, appropriate protective equipment must be provided.

#### **WARNING: Inactive AIRSKIN® due to damage to all switches**



The AIRSKIN® connection box protects the AIRSKIN® against damage caused by electrical influences from the robot safety controller, the safety PLC or the power supply. If the safety channels after the AIRSKIN® Connection Box are short-circuited to ground at the most unfavorable time – no AIRSKIN® switch tests are active, all switches closed – due to improper operation, in the worst case all AIRSKIN® semiconductor switches can melt through. AIRSKIN® would visualize this error, but would no longer be able to open the safety channels and thus not be safe.

#### **WARNING: Clamping points on robots**



To avoid clamping points, the robot must be mounted at a sufficient distance from walls or other fixed objects.

#### **WARNING: Reaching behind AIRSKIN® components is prohibited**



Reaching behind AIRSKIN® components on a still standing but active robot / machine is not permitted! There is a risk of injury from getting caught when the robot starts up.

#### **CAUTION: Areas not covered by AIRSKIN®**



Areas of the robot that are not covered by AIRSKIN® form potential danger points, depending on the application, which must be taken into account in the risk assessment.

### 2.1.4 Directives, laws and standards

AIRSKIN® is safety certified according to EN ISO 13849 and EN/IEC 62061 and tested according to the Machinery Directive. All the necessary standards and directives were complied with. Further information on the applied standards and norms can be found in [Chapters 12](#) and [13](#).

### 2.1.5 Validity

These operating instructions are valid for an unlimited period of time and independent of region.

## 2.2 Safety instructions for the operator

- The responsibility of the personnel for the respective activity is to be determined by the operator according to the personnel qualification.
- Activities in areas other than those assigned are expressly prohibited.
- The operator has to make clear agreements about who is responsible for the operation, setup, repair and service of AIRSKIN®.

### 2.2.1 Occupational safety

AIRSKIN® is designed as a safety system for robots and machines. In order to guarantee the safety of the machines equipped with AIRSKIN®, the guidelines in ISO/TS 15066 must be followed in addition to the operational specifications.



**DANGER: Correct configuration of the controller.**

AIRSKIN® can only function safely if the controller of the machine/robot is correctly configured. To ensure proper and permissible operation, configuration and risk analysis must be carried out by qualified personnel.

### 2.2.2 Technical condition of the AIRSKIN®

AIRSKIN® may not be changed without permission. Any changes to the installation must be confirmed by means of a new risk analysis.

## 2.3 Safety instructions for staff

- The robot system may only be operated by trained personnel.
- The operating and service personnel must regularly take part in safety training (at least once a year) and confirm their participation in writing.
- Subject-specific (electrical, mechanical, pneumatic) work on the machines or AIRSKIN® may only be carried out by trained personnel in the respective subject.

#### **Operating personnel:**

People who have experience in operating the machine in order to be able to recognize possible dangers and assess risks.

#### **Electrical specialists:**

People who have experience with the operation, service and maintenance of the machine in order to be able to recognize and remedy possible dangers that are caused by an electrical defect.

#### **Mechanics specialists:**

People who have experience with the operation, service and maintenance of the machine in order to be able to recognize and remedy possible dangers that are caused by a mechanical defect.

#### **Pneumatics specialists:**

People who have experience with the operation, service and maintenance of the machine in order to be able to recognize and remedy possible dangers that are caused by a pneumatic defect.

## 2.3.1 Dangerous situations and accidents

### IMPORTANT: Behaviour during accidents



#### 1. Report accident

- Phone: \_\_\_\_\_
- Where did it happen?
- What happened?
- How many injured are there?
- What types of injuries?
- Wait for further questions!



#### 2. First aid

- Safeguard the accident site
- Take care of the injured
- Follow the instructions



#### 3. Additional measures

- Direct emergency services
- Remove onlookers

### IMPORTANT: Use eye protection!



If collisions in the eye area cannot be ruled out during operation, eye protection must be worn.

## 2.4 Specific life cycles of AIRSKIN®

### 2.4.1 Transport

AIRSKIN® must be transported and stored in the packaging provided by Blue Danube Robotics GmbH. When removing from the packaging, carry out a visual check for deformation of the soft plastic parts and replace them if necessary.

### 2.4.2 Installation/assembly

Assembly may only be carried out with the machine or robot switched off. The correct installation must be tested in manual mode of the robot at the slowest possible speed before commissioning. When testing AIRSKIN® on a robot, ISO/TS 15066 must already be observed. Proper ambient conditions are described in [Section 10.3](#). See [Section 4.4](#) or [Attachment A](#) for robot-specific installation instructions.

### 2.4.3 Service and maintenance

If the safety measures provided by AIRSKIN® are bypassed or overridden, the operation of the machine equipped with AIRSKIN® is not permitted.

During service or maintenance activities, the machine equipped with AIRSKIN® must be disconnected from power or switched off.

AIRSKIN® must be visually inspected at least once a month to detect incipient damage, plastic deformation or other changes. In the case of plastic deformation (e.g. due to excessive actuation, use at elevated temperatures, intensive contact with solvents, etc.), the risk analysis or the working instruction must be adapted, if necessary, or the AIRSKIN® part has to be replaced.

Annual maintenance must be carried out by trained personnel using equipment provided by Blue Danube Robotics GmbH. Defective AIRSKIN® parts can be returned to Blue Danube Robotics GmbH free of charge. In warranty cases, the defective AIRSKIN® components must be returned to Blue Danube Robotics GmbH.

### 2.4.4 Disassembly

See the information on installation/assembly. AIRSKIN® parts that are no longer used or defective can be returned to Blue Danube Robotics GmbH.

## 2.5 Service life

When properly maintained, used and stored in accordance with these operating instructions, the service life of AIRSKIN® is 10 years.

## 3.1 Functionality

AIRSKIN® is a collision sensor for robots and machines. The entire danger area in which contact with people could occur, including pinch and squeeze areas, is covered with AIRSKIN® pads. If there is a collision between the robot or the machine and a human or object, this leads to a safe stop.

AIRSKIN® pads are airtight covers equipped with safe sensor electronics. When a pad touches the outer skin, a compression of the pad volume occurs. This results in a change in air pressure inside the pad, which is detected by the electronics. An emergency stop is immediately triggered and the soft pad absorbs the impact of the force.

## 3.2 EC type-examination

AIRSKIN® has been subjected to an EC type-examination (MG17-00411) by TÜV AUSTRIA. Each pad is equipped with the same safety electronics. The only difference between various pads is their volume, which must be no bigger than 1500 cm<sup>3</sup>. This is a physical limit above which the safety function could no longer be guaranteed.

## 3.3 Connection to the safety controller

AIRSKIN® is connected to the safety controller of the robot or machine via the safe IOs of the controller. Due to the architecture and safety level, these must be two redundant safety channels. Each AIRSKIN® pad works autonomously and makes observations on the current state of the pad automatically ("activated", "not activated", "defective"). All AIRSKIN® pads are connected in series. As soon as any pad detects an actuation or a defect, it disconnects the safety channels to signal this to the controller. All AIRSKIN® pads are supplied with 24 V DC voltage (SELV, PELV).

### IMPORTANT: Not potential-free!

The semiconductor switches utilised in AIRSKIN® are not potential-free. Therefore, attention must be paid to equipotential bonding between AIRSKIN® and the robot controller.

## 3.4 Components

An AIRSKIN® set consists of the support layer attached to the robot, a variable number of AIRSKIN® pads, connection cables and an AIRSKIN® Connection Box, which establishes the connection between the safety controller and AIRSKIN®.

### 3.4.1 AIRSKIN® pad

An AIRSKIN® pad is an airtight cover made of polyurethane equipped with safe sensor electronics. Furthermore, AIRSKIN® pads are equipped with internal connection cables and magnetic plugs (plug variant B). Each pad has a variety of point holders to attach it to the robot or the machine. The safety electronics are equipped with LEDs which can display information about the status of the pad. Details on the individual signals can be found in [Section 7.4](#).

Certain applications, such as gripper, use smaller AIRSKIN® pads whose small volumes does not allow the placement of the sensor electronic inside the pad. These are connected by hose connections to larger pads that contain the safety electronics. The small, connected AIRSKIN® pads are called companion pads (see [Figure 5.2b](#)).



Fig. 3.1.: An AIRSKIN® pad is an airtight cover made of polyurethane equipped with safe sensor electronics.<sup>1</sup>

### 3.4.2 External connection cables

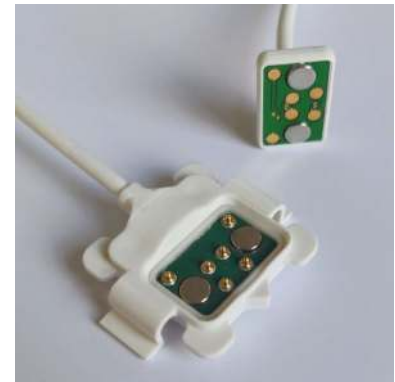
External cables are required to establish the electrical connection across moving elements (e.g. joints). To avoid the risk of the cable getting caught, all external connection cables are equipped with magnetic plugs (variant C). If the robot gets caught on the cable, the magnetic connector is released at low tensile force and thus triggers a stop signal.



(a) External connection cable



(b) Magnetic plug



(c) Magnetic plugs A und C

Fig. 3.2.: All external connection cables are equipped with magnetic plugs (variant C).<sup>1</sup>

### 3.4.3 Support layer

The support layer is a polyamide or aluminum sheet mounting structure that is mounted onto the robot or the machine by the user. Subsequently, AIRSKIN® pads are attached to the support layer. The support layer is equipped with internal connection cables and magnetic plugs (variant A) to establish the electrical connection between the AIRSKIN® pads.



Fig. 3.3.: The support layer is a polyamide or aluminum sheet mounting structure.<sup>1</sup>

<sup>1</sup>Sample illustration, components shown may not be included in the set.

### 3.4.4 AIRSKIN® Connection Box

The AIRSKIN® Connection Box is used to connect AIRSKIN® to a robot or machine controller.

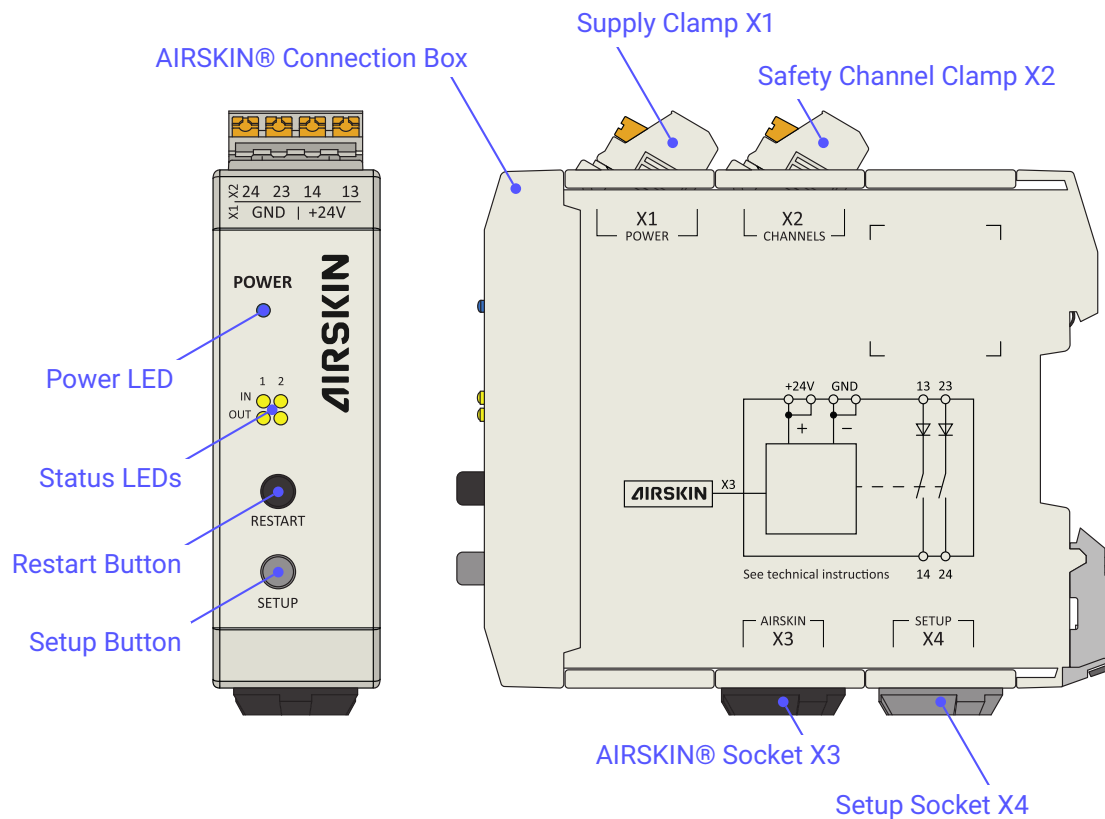


Fig. 3.4.: The AIRSKIN® Connection Box is used to connect AIRSKIN® to a robot or machine controller.

The AIRSKIN® Connection Box has two status LEDs per safety channel, which indicate the status of the two safety channels at the input and output. During normal operation, all four LEDs light up, indicating that the safety channels are conducting. The output LEDs do not light up if any AIRSKIN® pad is actuated, defective or there is no supply voltage.

#### **IMPORTANT: LEDs must always match**

During correct operation, the two LEDs always match. If this is not the case, the configuration is wrong or there is a defect.

The Restart button on the AIRSKIN® Connection Box is used to safely restart the AIRSKIN® pads.

For safety reasons, each AIRSKIN® pad has basic information about the system in which it is located (e.g. the number of pads in the system and its own position in the system). During initial commissioning or when reconfiguring AIRSKIN® (e.g. adding or replacing a pad), this information must be reset using the Setup button on the AIRSKIN® Connection Box.

## 3.5 Designations AIRSKIN® “First Touch” FT1

AIRSKIN® “First Touch” FT1 includes:

- AIRSKIN® Pads, Support layer and magnetic connectors
- AIRSKIN® Electronics Rev.10
- AIRSKIN® Connection Box





This chapter contains important general information on installing AIRSKIN®. For special instructions regarding the installation of robot-specific AIRSKIN®, please refer to [Attachment A](#).

## 4.1 Unpacking AIRSKIN®

AIRSKIN® packaging is insensitive to slow tilting and turning. On receipt, the packaging must be inspected for apparent damage such as dents and cracks. Apparent damage should be reported to the supplier if necessary. The contents must be checked for completeness using the operating manual, and any deviations must be reported to Blue Danube Robotics GmbH. AIRSKIN® should be stored in its packaging on level, firm ground at a humidity of <30 %.

### IMPORTANT: Recycling notice

Dispose of the packaging materials (carton and contents) in an environmentally friendly manner.



## 4.2 Preparations for AIRSKIN® assembly

The system/robot to which AIRSKIN® is to be mounted must be sufficiently secured. During assembly, the system/robot must be switched off, and all brakes must be applied.

- Stand: stable ground
- Mounting surface: cleaned surfaces of the system/robot
- Air: clean, frost-free, as little moisture as possible
- Temperature: +3 °C (37 °F) to +40 °C (104 °F)
- Sufficient room ventilation
- Well-lit installation area (for reading the instructions, carrying out maintenance work ...)
- Secure loose or swivelling parts of the system from lifting
- Use a suitable hoist (weight according to data sheet)

## 4.3 Assembling AIRSKIN®

The system/robot on which AIRSKIN® is being mounted must be securely fastened. During assembly, the system/robot must be switched off, and all brakes must be applied. The surface on which AIRSKIN® is mounted must be clean and free of grease and other deposits. Before assembly, move the system/robot to the assembly position indicated in the installation manual to make assembly of the parts as easy as possible.

### WARNING: Danger from moving parts of the system

Moving machine parts, as well as drives, tools, workpieces, etc., which are freely accessible, can be dangerous. These are, e.g.: bumping point, cutting/stabbing point, pinching point, shearing/cutting point, impact/catching point, cutting point, shearing/crushing point and insertion point.



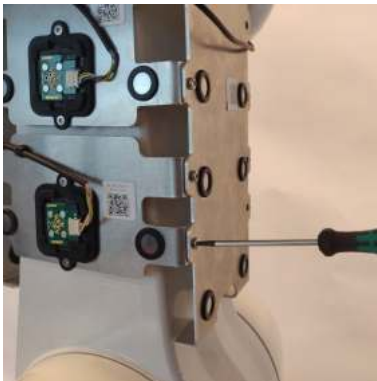
### 4.3.1 Support layer



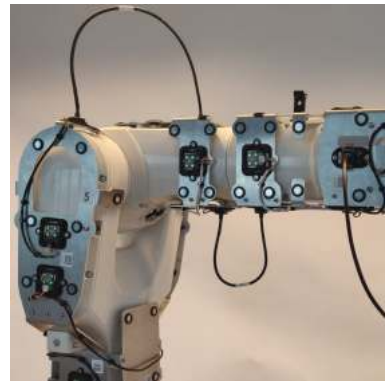
#### Working gloves

The AIRSKIN® support layers do not have any sharp edges or corners, but it is advisable to wear suitable work gloves for larger robot models.

- Remove components of the support layer from the packaging
- Compare individual parts with the parts list in [Table A.1](#) to ensure that all parts are present
- Prepare assembly tool (screwdriver)
- If necessary, (see [Attachment A](#)) prepare plastic support plates and 3M adhesive dots
- Assemble support layer parts in the specified order according to [Attachment A](#) Connect the support layer parts with the cables electrically, if they have not already been connected



(a) Assembly of the support layer



(b) The parts of the support layer are electrically connected by cables.

Fig. 4.1.: After mounting the support layer parts in the order specified in the installation instructions, they are electrically connected with cables.<sup>1</sup>



#### IMPORTANT: Assembly instructions

The parts of the support layer must be fastened in such a way that there is either no gap or an equally large gap at all seams. Care must be taken not to tighten the screws too much so as to not break the support layer.

The system/robot can be subject to high production inaccuracies. To adjust this, the support layer parts must be tightly screwed together. In addition, plastic support plates and 3M adhesive dots can be used. If parts of the support layer do not adhere well to the underlying surface, adhesive dots can be used to increase adhesion.

<sup>1</sup>Sample illustration, components shown may not be included in the set.

### 4.3.2 Cable connections

There are two types of cable connections:

- Internal cables on the support layer and in the pads
- External cables via axles/joints

Out of the box, the individual AIRSKIN® pads and support layers are delivered pre-assembled.



(a) Internal cables



(b) External cables

Fig. 4.2.: Basically, two types of cable connections are distinguished: Internal cables follow specified paths on the support layer and external cables serve for electrical connection via joints.<sup>1</sup>

#### **IMPORTANT: Assembly instructions**

When installing the cables, make sure that there is no tension on the plug connection. This can lead to malfunction of AIRSKIN®.

External cables are only connected after the AIRSKIN® pads have been installed, which is explained in the next step.

### 4.3.3 Mounting the pads

- Store pads on a clean and soft surface. This protects the pads from damage and dirt.
- Compare pads with the complete list in [Section A.2](#).
- Before assembly, wipe the magnetic plugs in the pads with a soft lint-free cleaning cloth using a commercially available alcohol cleaner.
- Assemble the pads in the order shown in the installation instructions.
- Clip the pads onto the support layer from one side, row by row.
- Ensure that the mounting magnets are located exactly above the corresponding mounting magnet disks.
- A soft click signals that the mounting magnets snap into place independently.
- When the pad is positioned and mounted by the point mounts and holders, the electrical connectors (magnetic plugs) are snapping in place, which can be heard by a soft clicking sound.
- Connect external cables as described in the installation instructions.
- Before plugging in, position the external cable so that the marking on the plug matches the marking on the pad.

<sup>1</sup>Sample illustration, components shown may not be included in the set.



(a) Alignment of the mounting magnets



(b) Mounting magnets snap into place

Fig. 4.3.: The mounting magnets are aligned over the provided mounting magnet disks and then snap into place independently.

## 4.4 Connect AIRSKIN® to the safety PLC or the robot safety controller

After AIRSKIN® has been assembled onto the system/robot, it must be connected to the safety PLC or robot safety controller.



### **Danger to life due to high voltage!**

The system/robot to which AIRSKIN® is attached may only be connected by a qualified electrician. Observe the safety instructions (see [Chapter 2](#)).

When connecting to a safety PLC or robot safety controller, you must observe the following notes:

### 4.4.1 Voltage

Connect AIRSKIN® to the robot safety controller connections specified in the robot model-specific installation instructions or to a external PSU (power supply unit). In the case of an external PSU, potential bonding between AIRSKIN® and the system/robot must be ensured in accordance with the robot model-specific installation instructions.



#### **IMPORTANT: Equipotential bonding**

The safety switches of AIRSKIN® are NOT potential-free. With different ground potentials of the system/robot and AIRSKIN®, proper functionality is not guaranteed.



#### **IMPORTANT: Short circuit on magnetic plugs**

When the supply voltage is switched on, care must be taken not to short-circuit the contacts of the magnetic connectors with conductive objects. In the worst case, this can lead to irreversible damage to the AIRSKIN® electronics, which means that proper functionality is no longer guaranteed.

### 4.4.2 Fuse

Make sure that the electrical network is adequately fused.

<sup>1</sup>Sample illustration, components shown may not be included in the set.

### 4.4.3 Electrical connection

- Route the connection cable from AIRSKIN® to the safety controller in such a way that there is no risk of tripping and the robot's freedom of movement is not restricted.
- Connect the cable to the PLC/robot controller via the AIRSKIN® Connection Box according to the robot model-specific installation instructions. A reconfiguration of AIRSKIN® is necessary for commissioning, which is explained in more detail in the [Chapter 5](#) and in the installation instructions.
- The cable connections must be checked for tight fit and good contact.

In general, the connection of AIRSKIN® to a safety PLC / robot safety controller is made according to [Table 4.1](#) (see [Figure 4.4](#)).

Tab. 4.1:

AIRSKIN® Connection Box	Controller
<b>1</b> Supply voltage	+24 V DC from controller or external power supply (PELV/SELV)
<b>2</b> GND	Ground/GND
<b>13</b> Input safety channel 1	Safety output 1 of the controller
<b>14</b> Output safety channel 1	Safety input 1 of the controller
<b>23</b> Input safety channel 2	Safety output 2 of the controller
<b>24</b> Output safety channel 2	Safety input 2 of the controller

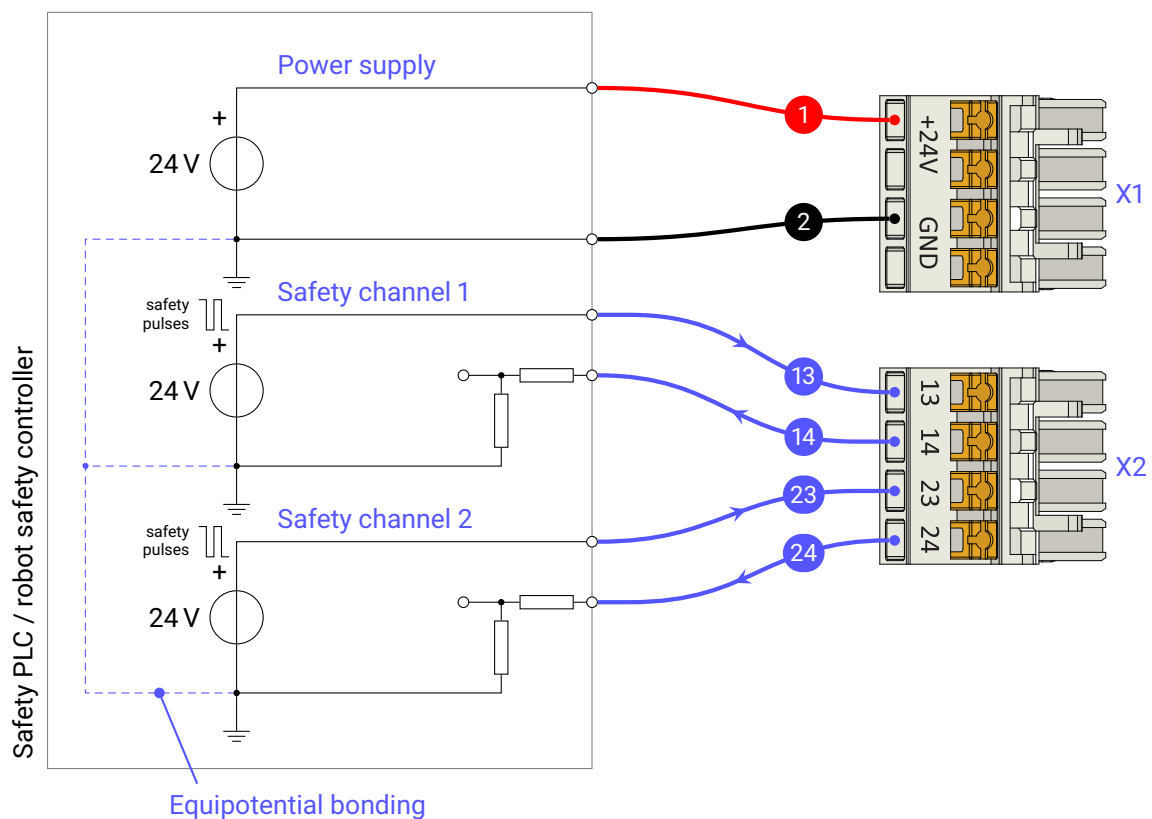


Fig. 4.4.: Connecting AIRSKIN® to the safety PLC or the robot safety controller.

**IMPORTANT: Equipotential bonding**

When using an external power supply unit, ensure correct equipotential bonding between the power supply unit and the controller unit!

**IMPORTANT: Do not lay AIRSKIN® cables next to power lines!**

All AIRSKIN® lines should be routed separately from other energy lines as far as possible in order to avoid disturbances of AIRSKIN® caused by interference and thus an unwanted stop of the robot.

Figure 4.5 shows the connection of the AIRSKIN® connection box to the controller and the connection to an AIRSKIN® pad. By default, AIRSKIN® pads are connected to the AIRSKIN® Connection Box using a connection cable with a LEMO plug.

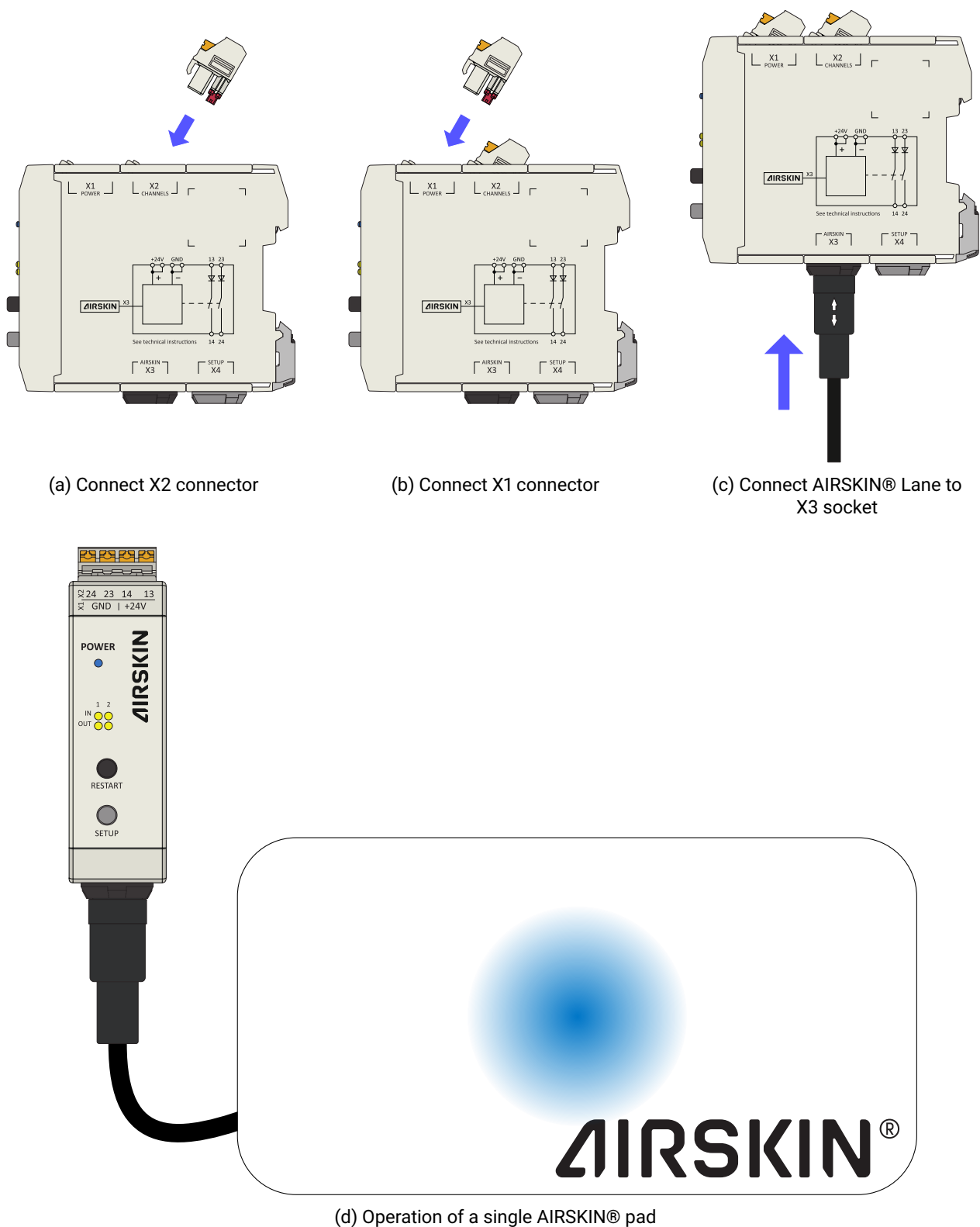


Fig. 4.5.: AIRSKIN® is connected to a controller via the AIRSKIN® Connection Box with a supply cable. AIRSKIN® pads are connected to the AIRSKIN® Connection Box via LEMO connector.

#### 4.4.4 AIRSKIN® switch test pulses

AIRSKIN® carries out cyclic switch tests alternately on both safety channels as shown in Figure 4.6.

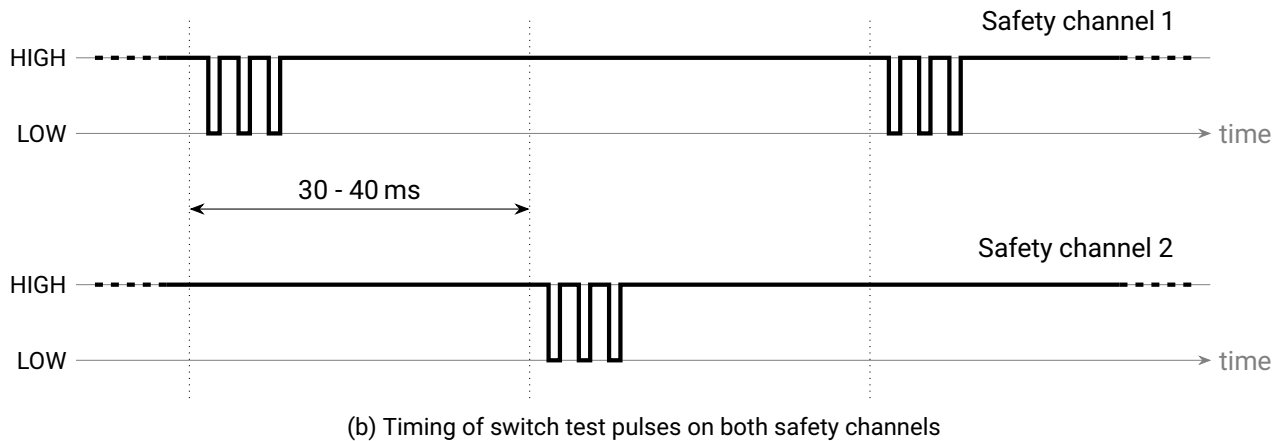
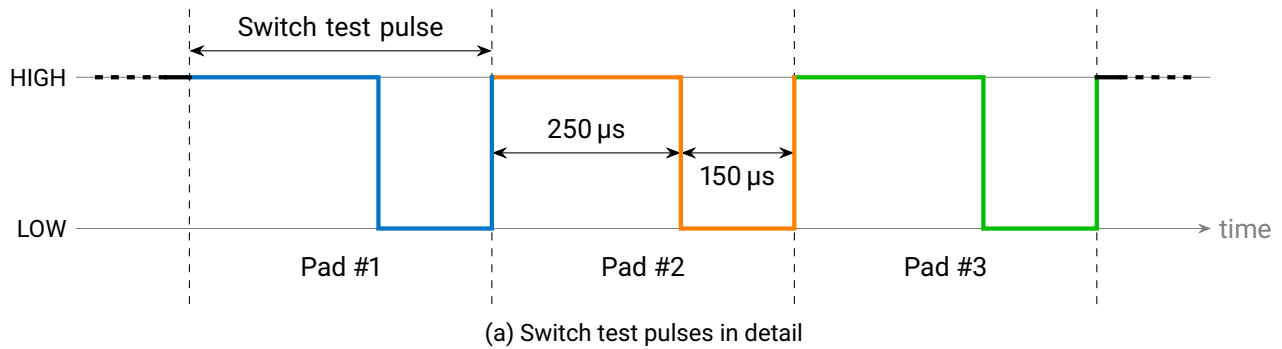


Fig. 4.6.: Switch test pulses from three AIRSKIN® pads on the two safety channels. The configuration of the connected PLC or the robot controller may have to be adapted in order to allow the illustrated switch test pulses with LOW phases of 150 µs on the safety channels.



##### AIRSKIN® switch test pulses

The PLC or the robot controller must be configured in such a way that test pulses with LOW phases of 150 µs are permitted on the safety channels.

If the safety controller or safety PLC used cannot be configured in such a way that the AIRSKIN® switch test pulses described in Figure 4.6 are permitted – robot or machine stops due to interrupted safety channels – it is possible to activate a filter integrated in the AIRSKIN® Connection Box (see Figure 4.7). This filter smooths the safety channel outputs in such a way that the AIRSKIN® switch test pulses no longer cause any interruptions in the output signals. However, it must be taken into account that this filter also smooths out possible pulses from the safety controller, which in turn can lead to errors in the safety controller.

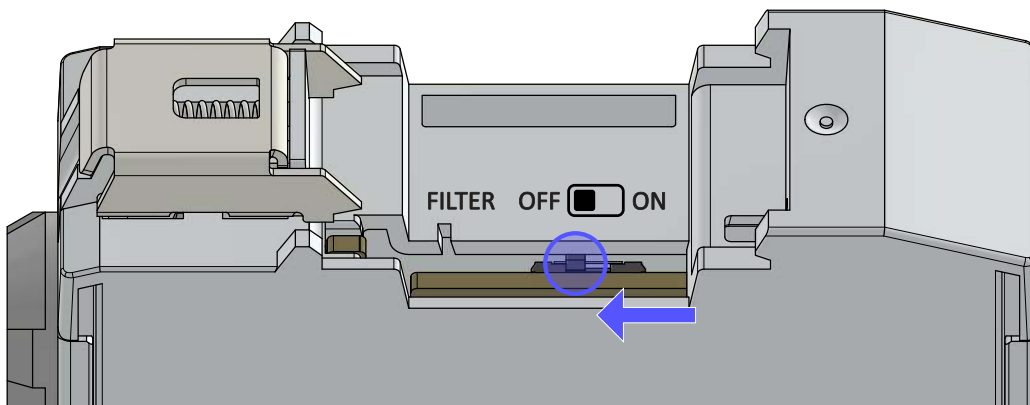


##### IMPORTANT: AIRSKIN® Connection Box with activated output filter

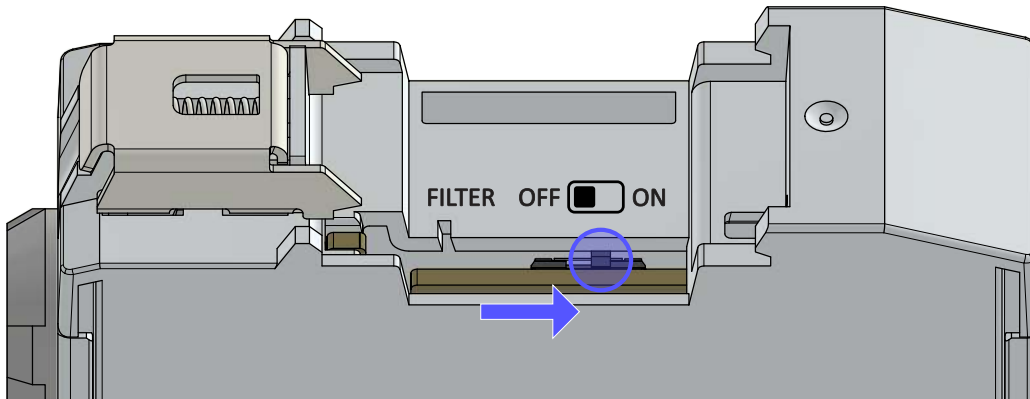
By activating the filter integrated in the AIRSKIN® Connection Box, all pulses on the two safety channels are smoothed out, in addition to those of the AIRSKIN® also those of the safety controller itself.

If neither the safety controller can be configured in such a way that the AIRSKIN® switch test pulses are accepted, nor can the integrated filter be used in the AIRSKIN® Connection Box, a safety relay or a safety PLC must be used, which accept the AIRSKIN® switch test pulses or the integrated filter.





(a) deactivated filter (default switch position)



(b) activated filter

Fig. 4.7.: If required, a filter integrated in the AIRSKIN® Connection Box can be activated to smooth out all pulses on the two safety channels.

#### 4.4.5 Termination of an AIRSKIN® lane

An ACB with the associated AIRSKIN® pads is referred to as a lane in the following. A maximum of 15 AIRSKIN® pads can be connected in series. If an AIRSKIN® set consists of more pads, these are divided into lanes with a maximum of 15 pads each. Each lane is connected to its own ACB. These ACBs must not simply be connected in series, as this simply corresponds electrically to a single lane with an exceeded maximum number of pads. Instead, the various ACBs must each be connected to their own 2-channel safety inputs, e.g. to a safety PLC with a corresponding number of safe inputs.

##### **IMPORTANT: A maximum of 15 AIRSKIN® pads per AIRSKIN® Connection Box**

A maximum of 15 AIRSKIN® pads can be connected to an AIRSKIN® Connection Box. More AIRSKIN® pads mean that the voltage levels on the two safety channels drop to values that are too low.

The end of each AIRSKIN® lane must be terminated with an end plug. A schematic overview of the wiring of an AIRSKIN® Lane is shown in [Figure 4.8](#).

##### **Termination of an AIRSKIN® system**

If an AIRSKIN® system is not terminated with an AIRSKIN® Terminator as shown in [Figure 4.8](#), the safety channels remain permanently open and the AIRSKIN® lights up yellow constantly.

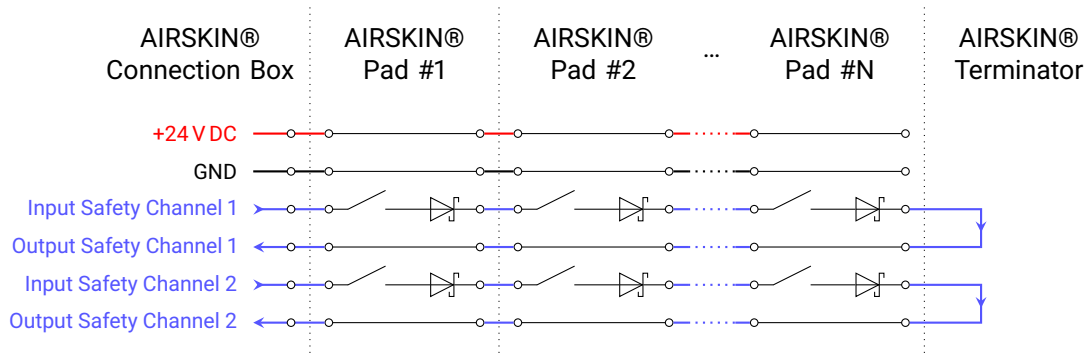


Fig. 4.8.: The two safety channels are led through all pads in an AIRSKIN® lane and must be terminated with an AIRSKIN® Terminator at the end of the lane.

There are different variants for terminating an AIRSKIN® lane. More detailed information on this can be found in the set-specific [Attachment A](#).



(a) AIRSKIN® A-Terminator



(b) AIRSKIN® B-Terminator



(c) AIRSKIN® C-Terminator



(d) AIRSKIN® LEMO-Terminator



(e) AIRSKIN® A-Terminator  
(old version)



(f) AIRSKIN® C-Terminator  
(old version)

Fig. 4.9.: Variants of the magnetic end plugs to terminate an AIRSKIN® system.<sup>1</sup>

<sup>1</sup>Sample illustration, components shown may not be included in the set.

This chapter contains important general information on commissioning AIRSKIN®. This includes initial commissioning or commissioning after complete or partial disassembly and reassembly of AIRSKIN®, installation on another system/robot, modification of the system/robot and after extensive maintenance. For special instructions regarding the commissioning of robot-specific AIRSKIN®, please refer to [Attachment A](#).

The configuration of the safety PLC or the robot safety controller as well as the commissioning of the AIRSKIN® system must be carried out by trained specialists.

## 5.1 AIRSKIN® Firmware Variant “Volatile Actuation”

With this optional variant, in contrast to the standard firmware, the states of the individual AIRSKIN® pads (actuators, errors, etc.) are not saved persistently. As a result, resetting the 24 V DC power supply can restart an AIRSKIN® lane. If no errors occur during the restart, AIRSKIN® closes both safety channels and all pads light up blue.

This modification carries the risk that if the 24 V DC voltage supply is briefly interrupted in the event of a collision, the two safety channels will be closed and the robot or machine could continue to drive into the collision. In order to minimize this risk, the automatic restart must be prevented by the safety controller or the safety PLC. After the two AIRSKIN® safety channels have been opened, the machine or robot may only be restarted after the user has given the required acknowledgment.

### **WARNING: Automatic restart prohibited!**



When using the AIRSKIN® firmware variant “Volatile Actuation”, an automatic restart of the machine or robot is prohibited!

The safety controller or the safety PLC must be configured in such a way that after the two AIRSKIN® safety channels have been opened, the machine or robot can only restart after the user has acknowledged the situation.

Use the delivery note to make sure that this firmware version is available and that the configuration described must be carried out.

## 5.2 Preliminary work before switching on AIRSKIN®

Before working with a system/robot using AIRSKIN® as a safety function, the operator has to be familiar with

- the system/robot on which AIRSKIN® is mounted
- the operation of the system/robot on which AIRSKIN® is mounted
- the workplace
- the activity/mode of operation
- other safety devices installed in addition to AIRSKIN®
- the immediate surroundings
- measures in case of an emergency
- the log of the pre-shift or the previous day

Make sure that access to the electrical installation has been prevented!

Additional preparations to be made before each operation are described in [Chapter 6](#).

## 5.3 Reconfigure AIRSKIN®

In order to use AIRSKIN® on a system/robot, it must be reconfigured before first use and after each change of the AIRSKIN® setup, such as the replacement of a part.

Check the following before reconfiguring AIRSKIN®:

- No cable is visible from the outside or is hanging loosely.
- All AIRSKIN® pads are correctly and firmly assembled on the support layer.
- The connection hoses on any companion pads show no kinks or bruises.
- The AIRSKIN® Connection Box is correctly connected to the controller.
- If the AIRSKIN® Connection Box is supplied with +24 V DC by the controller, this connection must be checked.
- If the AIRSKIN® Connection Box is supplied with +24 V DC via an external source of power, this connection and the equipotential bonding with the controller must be checked.
- The AIRSKIN® connection cable is plugged into the AIRSKIN® Connection Box.
- The controller or the external source of power supplies the AIRSKIN® Connection Box with +24 V DC.

AIRSKIN® is reconfigured by the operator first connecting the AIRSKIN® Lane from the X3 socket to the X4 socket of the AIRSKIN® Connection box (Figure 5.1a), thereby physically opening the two safety channels to the safety PLC or the robot safety controller respectively. Then the setup button is pressed briefly (Figure 5.1b) to start the setup process.

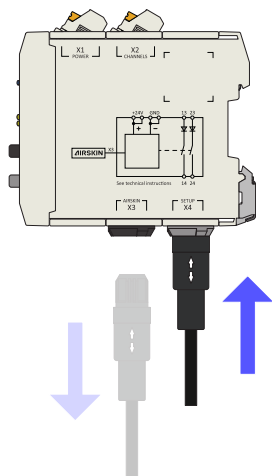
When the setup process starts, the AIRSKIN® pads light up green (Figure 5.1c). Any errors during the setup process are signaled by green flashing. At the end of the setup process, the LEDs on the AIRSKIN® pads go out again (Figure 5.1d). If an error occurs during the setup process, the process can be repeated by pressing the setup button (Figure 5.1b) again. Otherwise, after a successful reconfiguration, the AIRSKIN® Lane can be reconnected from the X4 socket to the X3 socket of the AIRSKIN® Connection Box (Figure 5.1e). All AIRSKIN® pads light up blue (Figure 5.1f), AIRSKIN® is functional again.



### IMPORTANT: Failed reconfiguration

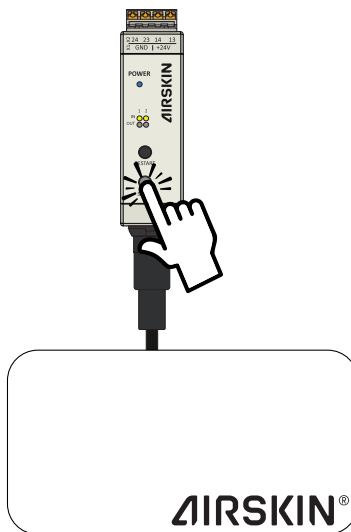
If the AIRSKIN® pads start flashing green when reconfiguring an AIRSKIN® lane, the process has failed. Possible reasons for this are a non-terminated AIRSKIN® lane or an incorrectly mounted AIRSKIN® pad.

1



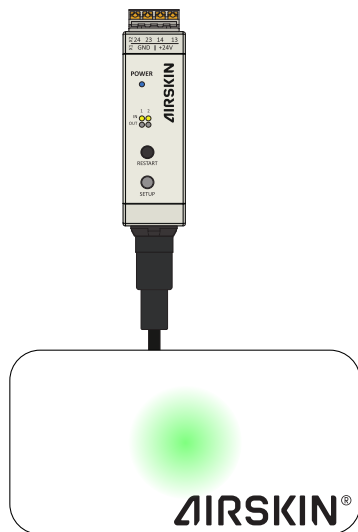
(a) Switch to X4 socket

2



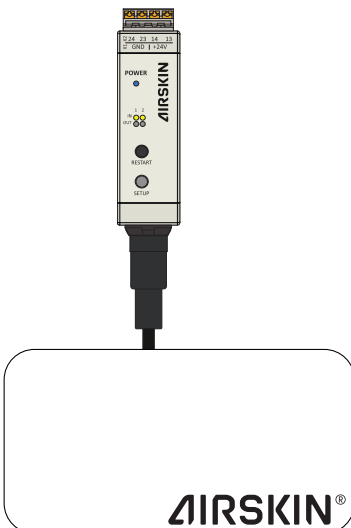
(b) Press the setup button

3



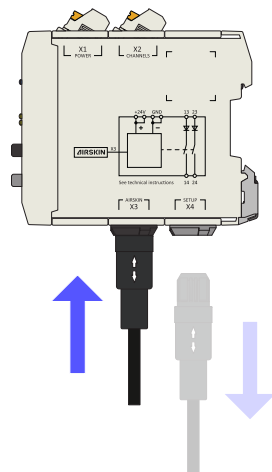
(c) The setup process is signaled by a green light

4



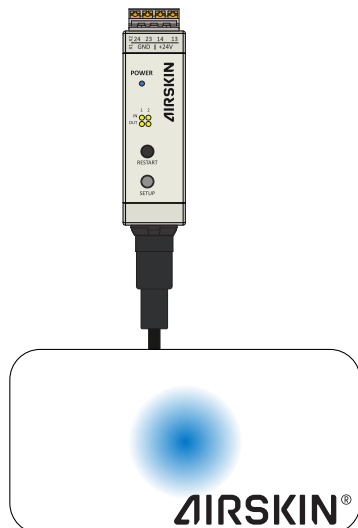
(d) Setup process complete

5



(e) Switch to X3 socket

6



(f) AIRSKIN® pads light up blue

Fig. 5.1.: Illustration of the process of reconfiguring AIRSKIN® using the AIRSKIN® Connection Box.<sup>1</sup>

<sup>1</sup>Sample illustration, components shown may not be included in the set.

## 5.4 Switching on AIRSKIN®



### **WARNING: Follow the safety instructions!**

You may only switch on AIRSKIN® if you have observed the above instructions. The safety instructions in [Chapter 2](#) must also be observed.

### 5.4.1 Preparing to switch on

Check that AIRSKIN® is in good condition:

- No cable should be visible from the outside or should be hanging loosely.
- All AIRSKIN® pads are correctly and firmly assembled on the support layer.
- The connection hoses on any companion pads show no kinks or bruises.
- The connection cable between AIRSKIN® and the AIRSKIN® Connection Box is firmly plugged into the AIRSKIN® Connection Box.
- The AIRSKIN® Connection Box is correctly connected to the controller.
- If the AIRSKIN® Connection Box is supplied with +24 V DC by the controller, this connection must be checked.
- If the AIRSKIN® Connection Box is supplied with +24 V DC from its own power supply, this connection and the equipotential bonding with the controller must be checked.
- Make sure that no AIRSKIN® pad is pressed before switching on AIRSKIN® or the robot / system.
- Make sure that the emergency stop button can be pressed easily, quickly and safely from any operating station on the machine.



### **CAUTION: No activated AIRSKIN® pads before switching on!**

Make sure that no AIRSKIN® pad has already been pressed before switching on the AIRSKIN® or the robot / system. Releasing the actuation after switching on can lead to an error state of the relevant AIRSKIN® pad or impair the sensitivity of the pad.



### **IMPORTANT: Check connection hoses!**

If companion pads are in the AIRSKIN® system, make sure that their connection hoses are free of bruises or kinks.



(a) actuated AIRSKIN® pad



(b) AIRSKIN® companion pad

Fig. 5.2.: Before switching on AIRSKIN®, make sure that no AIRSKIN® pads are actuated and any connection hose on companion pads show no bruises or kinks.<sup>1</sup>

<sup>1</sup>Sample illustration, components shown may not be included in the set.

### 5.4.2 Switching on the AIRSKIN® System

Step	Activity
1	If the AIRSKIN® Connection Box is supplied externally with +24 V DC, the PSU must be switched on.
2	Switch on the controller of the robot/system correctly (see operating instructions of the robot/system).
3	Visual check if an AIRSKIN® pad shows an error code. If this is the case, disconnect the cable from the AIRSKIN® Connection Box and reconnect it or (if present) press the button on the AIRSKIN® Connection Box. The error codes can be found in <a href="#">Section 7.4</a> .
4	If no pad shows an error code, but the control LEDs on the AIRSKIN® Connection Box are off, press each AIRSKIN® pad once to acknowledge the situation. This is not a fault condition, but a safety function when a pad has been turned off in an actuated state.
5	If both control LEDs on the AIRSKIN® Connection Box light up and no pad indicates an error (all pads glow static blue), AIRSKIN® is ready for use.
6	If all pads light up statically blue and change to green within 10 seconds, there is a wrong configuration of AIRSKIN®. Reconfigure AIRSKIN® according to <a href="#">Section 5.3</a> .
7	All pads must be pressed once from the base upwards to check the function. This procedure must be documented in the safety log.
8	Start the program on the robot/system (see operating instructions of the robot/system).

## 5.5 Stopping and switching off AIRSKIN®



### CAUTION: EMERGENCY STOP switch

In the event of malfunctions or in an emergency, the robot/system to which AIRSKIN® is attached must be stopped by pressing the EMERGENCY STOP button.

### 5.5.1 Preparing to switch off

Make sure that no AIRSKIN® pad is pressed before switching off AIRSKIN® or the robot/system. Only switch off AIRSKIN® and the robot/system with no AIRSKIN® pads actuated. If it is not possible to end the actuation of AIRSKIN® pads without switching off AIRSKIN®, the respective pads must be acknowledged when AIRSKIN® is switched on again.

### 5.5.2 Stopping and switching off the AIRSKIN® System

Step	Activity
1	Switch off the controller of the robot/system correctly (see operating instructions of the robot/system)
2	If the AIRSKIN® Connection Box is supplied with ++24 V DC by the controller, AIRSKIN® switches off together with the controller.
3	If the AIRSKIN® Connection Box is supplied by an external power supply, this must be switched off separately.



## 6.1 Before you switch on AIRSKIN®

Make sure that

- AIRSKIN® is free of collisions, i.e. it does not touch any structures or walls or other objects (tools, etc.),
- no AIRSKIN® pad is visibly damaged,
- all AIRSKIN® pads are properly fastened,
- each AIRSKIN® set is connected to the respective AIRSKIN® Connection Box,
- each AIRSKIN® Connection Box is connected to the appropriate safety IOs of the robot / system and +24 V DC power supply,
- all cables between the AIRSKIN® pads are properly connected.

**WARNING: Follow the safety instructions!**



If AIRSKIN® is not free of collisions when switched on, AIRSKIN® may not function properly!

## 6.2 Switch on AIRSKIN®

AIRSKIN® turns on as soon as it is supplied with +24 V DC; usually by switching on the robot controller. Immediately after switching on, each AIRSKIN® pad goes through an initialisation phase which lasts between 0 and a maximum of 20 seconds. During this initialisation phase, a soft whistling sound can be heard coming from the respective AIRSKIN® pad. After the initialisation of all AIRSKIN® pads is completed, each pad glows statically blue, AIRSKIN® is ready for operation, and both control LEDs of the AIRSKIN® Connection Box light up green.

**IMPORTANT: Check functionality!**



After switching on AIRSKIN® and the subsequent initialization phase, the function of AIRSKIN® as an active safety device must be checked:

- Do all AIRSKIN® pads steadily light up blue?
- Are the safety channels interrupted (status LEDs on the AIRSKIN® Connection Box go out) when an AIRSKIN® pad is actuated?

## 6.3 Switching off AIRSKIN®

AIRSKIN® is switched off by removing the power supply; usually by switching off the robot controller.



Before you check the following list of errors, ensure that:

- you have precisely followed the instructions in this Manual,
- there is no improper operation (see [Section 1.2](#)).

Use the following sections to check whether the error/fault is described and whether the measure outlined eradicates the error/fault.

Contact your AIRSKIN® dealer if the problem cannot be resolved.

## 7.1 Check the functionality of the AIRSKIN® Connection Box

Check to see whether the AIRSKIN® Connection Box is correctly connected by disconnecting the connection cable to AIRSKIN® and connecting a AIRSKIN® LEMO-Terminator (shown in [Figure 4.9d](#)) directly to the AIRSKIN® Connection Box (socket X3).

- If the Power LED does not light up, check the 24 V DC power supply of the AIRSKIN® Connection Box at supply clamp X1.
- If the two IN status LEDs on the AIRSKIN® Connection Box do not light up, check the connection of the AIRSKIN® Connection Box to the safety PLC or to the robot safety controller according to the robot-specific installation instructions.
- If the status LEDs on the AIRSKIN® Connection Box are flickering, make sure that the ground line of the AIRSKIN® Connection Box has good electrical contact with a ground terminal of the robot controller.
- If all status LEDs on the AIRSKIN® Connection Box are lit, remove the AIRSKIN® LEMO terminator and reconnect the AIRSKIN® system to the AIRSKIN® Connection Box (socket X3).

**WARNING: Remove the AIRSKIN LEMO-Terminator before commissioning!**



An AIRSKIN® LEMO terminator closes the two safety channels without any AIRSKIN® pads in lane. The safety function of the AIRSKIN® pads is thus overridden! Such an operation is not permitted!

## 7.2 Checking the functionality of the AIRSKIN® connection cable

In order to rule out a defect in the AIRSKIN® connection cable, it is terminated directly with an A or C terminator, depending on the version.

- If the OUT status LEDs of the AIRSKIN® Connection Box do not light up, check the plug connection and the magnetic contacts.
- If the OUT status LEDs of the AIRSKIN® Connection Box light up, remove the AIRSKIN® terminator and reconnect the cable to the AIRSKIN® lane.

## 7.3 Checking the functionality of the AIRSKIN® Pads



### Active AIRSKIN® pads

AIRSKIN® Pads that flash in any color or constantly light up are designated as active.



### Restart the AIRSKIN® Connection Box

To restart the AIRSKIN® Connection Box, press the Restart button on the AIRSKIN® Connection Box and wait for 3 seconds.

#### No pads are active:

- If none of the pads are active, check the connections of external cables, reconnect them, and then restart the AIRSKIN® Connection Box.
- Dismount the pad closest to the AIRSKIN® Connection Box and wipe the magnetic contacts of the pad and support layer. Mount the pad again and restart the AIRSKIN® Connection Box.
- In order to rule out a defect in the AIRSKIN® pad, dismount the pad and bridge the magnetic contacts of the support layer with a suitable AIRSKIN® C-C cable, or exchange the pad for another identical pad in the same AIRSKIN® lane.

#### At least one pad is active:

- If only some of the pads are active (the others are not), check the connections of external cables and make sure the active pad is properly connected to the next inactive pad. Then restart the AIRSKIN® Connection Box.
- Dismount the inactive pad and wipe the magnetic contacts of the pad and support layer. Mount the pad again and restart the AIRSKIN® Connection Box.
- Dismount the active pad and wipe the magnetic contacts of the pad and support layer. Mount the pad again and restart the AIRSKIN® Connection Box.

#### All pads are active:

- If each pad is active, the following section will show all the status codes of each pad.

## 7.4 Status codes of the AIRSKIN® pads

### Flashing red:

Restart the AIRSKIN® Connection Box. If the problem persists, the AIRSKIN® pad is permanently damaged and must be replaced.

### Flashing yellow:

Dismount the affected pads and wipe the magnetic contacts of the pad and support layer. Remount the pads and restart the AIRSKIN® Connection Box.

### Flashing green:

A configuration error has occurred, e.g. the total number of mounted pads has changed. Perform the reconfiguration of AIRSKIN® as described in [Chapter 5](#).

### Flashing blue:

Briefly press each affected AIRSKIN® pad to acknowledge. These should then light up yellow. After acknowledging the last blue flashing pad, all pads will glow steadily blue.

### Steadily red:

Make sure that no cable, hose or similar of the robot/system touches AIRSKIN® and resolve any collisions.

### Steadily yellow:

Check whether the safety channels of the safety PLC or the robot safety controller are active and have a level of 24 V.

Check the connections of external cables. If a pad has both an input (IN) and an output (OUT) for external cables, make sure that the cables at the input are always towards the base and those at the output are towards the end effector.

Check that the termination part is connected correctly and then restart the AIRSKIN® Connection Box.

Dismount all the pads in turn (beginning with the one closest to the end effector), wipe off the magnetic contacts on the pads and support layer, and then reattach the pads. Then restart the AIRSKIN® Connection Box.

### Steadily green:

Restart the AIRSKIN® system by pressing the Restart button on the AIRSKIN® Connection Box.

### Steadily blue:

AIRSKIN® is ready for operation.



This chapter contains all important general information on the maintenance of AIRSKIN®. While AIRSKIN® is a low-maintenance to maintenance-free system, its service life can be extended by simple regular maintenance. The safety function of AIRSKIN® is not affected by the absence of maintenance or incorrect maintenance.

## 8.1 Safety instructions for maintenance

Following is general information that should be observed for all maintenance and repair work.

### **DANGER: Follow the safety instructions!**



If AIRSKIN® is not used as an active safety function of the system, it has no safety and protective function. The robot/system must be operated as if it did not have AIRSKIN®, which means a high-risk potential.

### **IMPORTANT: EMERGENCY-Stop button when AIRSKIN® is not in operation**



Maintenance and repair work on AIRSKIN®, during which AIRSKIN® is not used as an active safety function of the system and the robot/system must be moved, may only be carried out by trained specialists.

As long as AIRSKIN® is used as an active safety function of the system, simple maintenance work can also be carried out by normal personnel, as there is no danger to the personnel. Only trained specialists may switch off or bypass AIRSKIN® as an active safety function for maintenance purposes. All subsequent work on the system/robot and AIRSKIN® may also only be carried out by trained specialists.

Safety instructions for maintenance work for which AIRSKIN® is not used as an active safety function:

Possible danger by ...	Measures for avoidance
Crushing by moving parts of the machine	Always keep a sufficient distance to all moving parts during test runs.
Insufficient marking of the inactivity of AIRSKIN® as a safety function	The robot/system without AIRSKIN® may only be used by trained specialists. Clear identification by barrier tape and warning sign.
Unsuitable spare parts	Only use spare parts that are listed in the maintenance instructions and spare parts lists.
Illegal/premature release of the system	Do not release the machine for operation as functional and safe device without AIRSKIN®.

## 8.2 Maintenance activities

The following maintenance work is provided on recommendation for AIRSKIN®.

### 8.2.1 Cleaning the outside

Clean all AIRSKIN® surfaces accessible from the outside with commercially available alcohol cleaners or isopropanol (70 %). Also, clean the spaces between the pads and check the connection hoses of any companion pads for kinks and bruises, as well as all AIRSKIN® pads for dents, scratches, paint damage, discolouration and other abnormalities. These must be noted in the maintenance log. In case of doubt, affected parts must be replaced.

This maintenance should be carried out as required, but at least once every three months.



#### **IMPORTANT: Cleaning agents compatibility**

In order to prevent major damage to the components, the compatibility of cleaning agents, which are not explicitly recommended by Blue Danube Robotics GmbH, must be tested before extensive use.

### 8.2.2 Thorough check-up with internal cleaning

This more extensive maintenance work requires the complete removal of all pads from the machine. Clean each pad on all sides with commercially available alcohol cleaners or isopropanol (70 %). Inspect each pad for dents, scratches, paint damage, discolouration and other abnormalities as well as the connection hoses of any companion pads for kinks and bruises.

In addition, special attention should be paid to the internal AIRSKIN® electronics and the mechanical and electrical connectors that connect each AIRSKIN® pad to the underlying support layer. The AIRSKIN® electronics should be examined more closely for damage, discolouration, abnormalities and good condition of the visible white filter cap. The mechanical and electrical connectors (magnetic plugs) must be inspected for dirt, cracks, other damage and abnormalities. Damage and abnormalities must be noted in the maintenance report.

This maintenance should be carried out as required, but at least once a year.



Fig. 8.1.: Housing of an AIRSKIN® electronics including mechanical and electrical connectors (magnetic plugs).<sup>1</sup>

<sup>1</sup>Sample illustration, components shown may not be included in the set.



## 8.3 Activities after maintenance/repair

At the end of the work, you must carry out the following tasks:

Step	Activity
1	Draw up the maintenance or test reports.
2	Check the function of AIRSKIN® as an active safety device. Do not release the machine for production if not all safety devices, including AIRSKIN®, are functioning properly.
3	Mount and secure dismounted safety precautions.
4	Remove any tools, foreign parts and operating materials left during maintenance.
5	Perform a test run of the machine.
6	For maintenance without AIRSKIN® as an active safety function: Do not remove the clear labelling of inactivity (barrier tape) and warning label until AIRSKIN® has been functionally tested and the machine has been released for production again.

## 8.4 Troubleshooting

While troubleshooting, observe the following points:

Step	Activity
1	Ensure that the machine can be switched off by another person at any time and clearly mark AIRSKIN® as non-operational.
2	Observe the safety instructions in the operating manual for handling the machine equipped with AIRSKIN®.
3	Only attempt to fix faults if you have the necessary qualifications.
4	Information on further measures to fix faults can be obtained from Blue Danube Robotics GmbH.
5	If troubleshooting work is interrupted, it must be ensured that all persons present are informed that the safety function provided by AIRSKIN® is not active. This must also be indicated by a barrier tape and warning sign.



## 9.1 Decommissioning and storage

Here you will find information that you must observe if you intend to take AIRSKIN® out of operation for a longer period of time, and what you must observe if you put AIRSKIN® back into operation after this period of time. Observe the maintenance instructions for all decommissioning work (see [Chapter 8](#)), as well as notes in the maintenance manual of the machine. Familiarise yourself with the installation before decommissioning. During decommissioning, some installation steps are performed in reverse order. Make sure that AIRSKIN® and all its components are cleaned before decommissioning and storage. Commercially available alcohol cleaners or isopropanol (70 %) can be used for this.

The machine is prepared for longer decommissioning as follows

Step	Activity
1	Switch off the machine at the main switch. Disconnect the machine from the power supply and secure it against unintentional start-up or switching on by third parties, e.g. disconnect the mains cable.
2	Clean parts with the cleaning agent provided by Blue Danube Robotics GmbH.

- Store AIRSKIN® in a cool, dry place.  
Air: clean, frost-free, as little moisture as possible
- Store AIRSKIN® in the supplied packaging

Recommissioning after a long shutdown

Step	Activity
1	Check parts for completeness
2	Clean parts with the cleaning agent provided.
3	Connecting AIRSKIN®: see <a href="#">Chapter 4</a>

## 9.2 Decommissioning

Adhere to the following safety instructions, the safety instructions in [Chapter 2](#) and the instructions in the supplier's documentation!



### Working gloves

The AIRSKIN® supportlayer does not have any sharp edges or corners, but it is advisable to wear suitable work gloves for larger robot models.

### 9.2.1 Disassembling AIRSKIN®

Step	Activity
1	Switch off the machine at the main switch. Disconnect the machine from the power supply and secure it against unintentional start-up or switching on by third parties, e.g. disconnect the mains cable.
2	Unplug AIRSKIN® from the machine
3	Disassembling AIRSKIN® pads <ul style="list-style-type: none"><li>• Disconnect external cables.</li><li>• Carefully remove the pads from the robot and put them into the packaging. Pay attention to the places provided for each pad.</li></ul>
4	Disassemble internal cables between support layers
5	Disassemble the support layer. Proceed in reverse order to assembly in the user manual. Place support layer parts in the designated places in the packaging.

# 9.3 Disposal

AIRSKIN® should be returned to Blue Danube Robotics GmbH for disposal. Some of the materials can be reused. By recycling some parts or raw materials from used products, you make an important contribution to environmental protection. Contact your local authorities if you need information about collection points in your area.

## IMPORTANT: Disposal



The following instructions must be followed exactly because of possible environmental damage. Even if disposal is carried out by an approved specialist company, the operator of the machine must ensure that it is carried out properly!

## 9.3.1 Recyclable materials

Material	Occurrence
Copper	Cables, Circuit boards, Connectors
Plastic, rubber, PVC, TPU	Pads, Seals, Cables
Silicone	Hoses/tubes
Spring steel wire (EN 10270-1 DH)	Hoses/tubes
Tin	Circuit boards
Polyester	Circuit boards

## 9.3.2 Special waste

Material	Occurrence
Electronic waste	<ul style="list-style-type: none"><li>• Electrical supply</li><li>• PCBs with electronic components</li></ul>

## Disposal



Dispose of all parts of AIRSKIN® in such a way that health and environmental damage is avoided.



## 10.1 Mechanical

Response time (from an actuation until signal reaches the controller)	Min. 0.5 ms, Max. 9 ms
Weight of an AIRSKIN® set	1 to 10 kg
Weight of an AIRSKIN® pad	25 to 500 g, (100 mm × 100 mm × 30 mm $\hat{=}$ 65 g)
Thickness of the pads on the robot	15 to 100 mm (depending on range of movement)
Assembly method	Magnetic
Installation time	<2 h
Emission sound pressure level	<70 dB(A)

## 10.2 Electrical

Supply voltage	+24 V DC ( $\pm 5\%$ )
Power consumption of an AIRSKIN® pad	10 mA, max. 35 mA
Connection to robot controller	4x OSSD (2 channels) + Power supply (+24 V DC, GND)
Test pulse length	150 $\mu$ s (LOW)
AIRSKIN® topology	In series/daisy chain
Connection of AIRSKIN® to the controller/PLC	Block terminal (min. 0.2 mm <sup>2</sup> , max. 1.5 mm <sup>2</sup> )
Maximum length of Supply cable	3 m
AIRSKIN® pad connection internally	Magnetic connector
Cabling	Internal or external

## 10.3 Ambient conditions

Chemical resistance	Common cleaning agents, oil, alcohol, disinfectants
UV resistance	100 %
Temperature range	5 to 40 °C
Humidity	10 to 85 %
Temperature range for transport	-40 to +70 °C

## 10.4 Standards and norms

Safety level	EN ISO 13849 PLe and EN/IEC 62061 SIL 3
Certification body	TÜV AUSTRIA
UL VDE (material AIRSKIN® pad)	UL 94 V-2
Flammability (material AIRSKIN® pad)	UL 94 V-2



### **IMPORTANT: Heat sources**

Operation in the vicinity of heat sources (fire, flying sparks, welding, ovens, radiators, fan heaters or other heat radiating equipment) is prohibited!

Safety parameters can be found in [Chapter 12](#).



## 11.1 Warranty period

The warranty period is 12 months from the date of delivery unless this has been individually agreed upon otherwise in the offer, partner contract or the General Terms and Conditions.

## 11.2 Handling of the warranty claim

As a rule, warranty claims are handled by the sales partner unless this has been regulated differently and individually in the offer, partner contract or the General Terms and Conditions.

## 11.3 Disclaimers

Damage or defects caused by improper handling or improper operation, as well as defects caused by usage of non-original parts or accessories, are not covered by the warranty. The warranty does not cover damage caused by external influences such as lightning, water, fire or any transport damage. All warranty claims expire if AIRSKIN® has been repaired or modified by the operator. Liability for damage to third-party equipment is excluded. For details, see General Terms and Conditions. The General Terms and Conditions of Blue Danube Robotics GmbH apply at the time of purchase.

## 11.4 Information about the manufacturer and service

**Blue Danube Robotics GmbH**  
Niedermoserstrasse 14  
A-1220 Vienna, Austria  
Helpdesk: +43 1 890 86 97-900  
[sales@airskin.io](mailto:sales@airskin.io)  
[www.airskin.io](http://www.airskin.io)



AIRSKIN® "First Touch" FT1 is certified and EC type-examined by TÜV AUSTRIA according to EN ISO 13849 in Performance Level e, Category 3 and EN/IEC 62061 in SIL3 as a safety component.

## 12.1 PFH<sub>D</sub>

Depending on the number of AIRSKIN® pads used, there is a PFH<sub>D</sub> value for the set, which can be taken from the following table.

Tab. 12.1: Safety parameters

Number of AIRSKIN® pads	PFH <sub>D</sub> <sup>1</sup>	MTTF <sub>D</sub> <sup>2</sup>	DC <sup>3</sup>
1	2.5 × 10 <sup>-8</sup>	2007.57	99 %
2	2.5 × 10 <sup>-8</sup>	1082.30	99 %
3	2.5 × 10 <sup>-8</sup>	740.85	99 %
4	2.5 × 10 <sup>-8</sup>	563.17	99 %
5	2.5 × 10 <sup>-8</sup>	454.24	99 %
6	2.5 × 10 <sup>-8</sup>	380.61	99 %
7	2.5 × 10 <sup>-8</sup>	327.53	99 %
8	2.5 × 10 <sup>-8</sup>	287.44	99 %
9	2.5 × 10 <sup>-8</sup>	256.09	99 %
10	2.5 × 10 <sup>-8</sup>	230.91	99 %
11	2.5 × 10 <sup>-8</sup>	210.24	99 %
12	2.5 × 10 <sup>-8</sup>	192.96	99 %
13	2.5 × 10 <sup>-8</sup>	178.31	99 %
14	2.5 × 10 <sup>-8</sup>	165.72	99 %
15	2.5 × 10 <sup>-8</sup>	154.80	99 %
16	2.5 × 10 <sup>-8</sup>	145.23	99 %
17	2.5 × 10 <sup>-8</sup>	136.77	99 %
18	2.5 × 10 <sup>-8</sup>	129.24	99 %
19	2.5 × 10 <sup>-8</sup>	122.50	99 %
20	2.5 × 10 <sup>-8</sup>	116.43	99 %
21	2.5 × 10 <sup>-8</sup>	110.93	99 %
22	2.5 × 10 <sup>-8</sup>	105.92	99 %

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Tab. 12.1: Safety parameters [Continued]

Number of AIRSKIN® pads	PFH <sub>D</sub> <sup>1</sup>	MTTF <sub>D</sub> <sup>2</sup>	DC <sup>3</sup>
23	$2.5 \times 10^{-8}$	101.35	99 %
24	$2.5 \times 10^{-8}$	97.16	99 %
25	$2.7 \times 10^{-8}$	93.30	99 %

<sup>1</sup> Probability of a Dangerous Failure per Hour

<sup>2</sup> Mean Time To Failure dangerous

<sup>3</sup> Diagnostic Coverage

## 12.2 B10<sub>D</sub>

The PFH<sub>D</sub> values stated are calculated assuming each pad is activated once per shift in a 3-shift operation. To calculate PFH<sub>D</sub> values with other requirement rates, please contact Blue Danube Robotics GmbH.

## 13.1 EC Declaration of Conformity

**Manufacturer:**

Blue Danube Robotics GmbH  
Niedermoserstrasse 14  
A-1220 Vienna, Austria

**Authorized person for compiling the technical documentation:**

Michael Zillich  
Niedermoserstrasse 14  
A-1220 Vienna, Austria

**Product:**

AIRSKIN®, "First Touch", Taktiler Sicherheitssensor

**Notified body for the type examination according to Annex IX:**

TÜV Austria GmbH  
Deutschstrasse 10  
A-1230 Vienna, Austria  
MG17-00411

Blue Danube Robotics GmbH hereby declares that the product described above complies with all relevant provisions of the Machinery Directive 2006/42/EC.

**Other applied directives and harmonized standards:**

- EMC directive 2014/30/EU
- RoHS directive 2011/65/EG
- EN 61000-6-7  
Electromagnetic compatibility (EMC) – Generic standards – Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations
- EN 55011  
Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement

**Other applied standards or specifications:**

- EN 60664-5  
Insulation coordination for equipment within low-voltage systems
- EN 60068-2-1  
Environmental testing – Test A: Cold
- EN 60068-2-2  
Environmental testing – Test B: Dry heat
- EN 60068-2-6  
Environmental testing – Test Fc: Vibration (sinusoidal)
- EN 60068-2-14  
Environmental testing – Test N: Change of temperature
- EN 60068-2-27  
Environmental testing – Test Ea and guidance: Shock
- EN 60068-2-30  
Environmental testing – Test Db: Damp heat, cyclic (12 h + 12 h cycle)

### 13.2 REACH Compliance Declaration

Blue Danube Robotics GmbH is aware of the European REACH regulation (Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of December 18th, 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals).

Blue Danube Robotics GmbH is a downstream user according to Article 3, No. 13 of the REACH regulation and therefore not obliged to register its products.

Blue Danube Robotics GmbH hereby declares based on information provided by its suppliers that AIRSKIN® “First Touch” FT1 complies with the requirements of the REACH regulation. Furthermore, under normal and reasonably foreseeable circumstances of application, AIRSKIN® “First Touch” FT1 shall not release any substances. Blue Danube Robotics GmbH will control on a regular basis whether its suppliers fulfil their obligations under the REACH regulation.

In case that the substances mentioned in the most recent list of substances of very high concern (published by the European Chemicals Agency (ECHA), <http://echa.europa.eu/web/guest/candidate-list-table>) are contained in AIRSKIN® “First Touch” FT1 in concentrations above 0.1 %, Blue Danube Robotics GmbH shall inform its customers and disclose the Safety Data Sheet.

### 13.3 Declaration of Conformity to EU RoHS

Blue Danube Robotics GmbH declares, that, to the best of our knowledge, all sold AIRSKIN®-products are in compliance with Directive 2011/65/EU of the European Parliament (RoHS2) and Commission Delegated Directive (EU) 2015/863 (RoHS3).

Our AIRSKIN®-products do not contain any of the following substances in more than the issued concentrations in any of the homogeneous materials:

Tab. 13.1:

Substance	Maximum Limit
Lead (Pb)	0.10 % by weight
Cadmium (Cd)	0.01 % by weight
Mercury (Hg)	0.10 % by weight
Hexavalent Chromium (Cr6+)	0.10 % by weight
Poly Brominated Biphenyls (PBB)	0.10 % by weight
Poly Brominated Diphenyl ethers (PBDE)	0.10 % by weight
Bis(2-ethylhexyl) phthalate (DEHP)	0.10 % by weight
Butyl benzyl phthalate (BBP)	0.10 % by weight
Dibutyl phthalate (DBP)	0.10 % by weight
Diisobutyl phthalate (DIBP)	0.10 % by weight

The data provided are correct to the best of our knowledge.

## Read operating manual



First, familiarize yourself with the general part of the operating manual before starting with this set-specific section.

## A.1 The AIRSKIN® Module product

An AIRSKIN® Module is a modular AIRSKIN® unit, consisting of

- an AIRSKIN® Pad,
- an AIRSKIN® Supportlayer and
- an AIRSKIN® Cable A-A 400 mm [27](#).

In order to be able to put a modular AIRSKIN® system into operation, the following additional components are required:

- an AIRSKIN® Cable A-Lemo 5 m [28](#)
- an AIRSKIN® Connection Box [29](#)
- an AIRSKIN® A-Terminator [30](#)



Fig. A.1.: The supportlayers of the different AIRSKIN® Module variants can be mounted in a common 25 mm grid.

## A.2 Scope of delivery

Tab. A.1: AIRSKIN® Modules product catalog

Pos.	Component	Item-No.
<a href="#">1</a>	AIRSKIN® Module 200x100, H0	BLASMOD200X100H0
<a href="#">2</a>	AIRSKIN® Module 200x100, H1	BLASMOD200X100H1
<a href="#">3</a>	AIRSKIN® Module 200x200, H0	BLASMOD200X200H0
<a href="#">4</a>	AIRSKIN® Module 200x200, H1	BLASMOD200X200H1
<a href="#">5</a>	AIRSKIN® Module 300x200, H0	BLASMOD300X200H0
<a href="#">6</a>	AIRSKIN® Module 300x200, H1	BLASMOD300X200H1

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Tab. A.1: AIRSKIN® Modules product catalog [Continued]

Pos.	Component	Item-No.
7	AIRSKIN® Module 400x200, H0	BLASMOD400X200H0
8	AIRSKIN® Module 400x200, H1	BLASMOD400X200H1
9	AIRSKIN® Module 200x160x100E, H0	BLASMOD200X160X100EH0
10	AIRSKIN® Module 400x200x100E, H0	BLASMOD400X200X100EH0
11	AIRSKIN® Pad 200x100	MP-PUC_20X10_P5
12	AIRSKIN® Pad 200x200	MP-PUC_20X20_P6
13	AIRSKIN® Pad 300x200	MP-PUC_30X20_P5
14	AIRSKIN® Pad 400x200	MP-PUC_40X20_P5
15	AIRSKIN® Pad 200x160x100	MP-PUC_200X160X100E_P1
16	AIRSKIN® Pad 400x200x100E	MP-PUC_400X200X100E_P1
17	AIRSKIN® Supportlayer 200x100, H0	AM-SL_SI_200X100_H0_P1
18	AIRSKIN® Supportlayer 200x100, H1	AM-SL_SI_200X100_H1_P1
19	AIRSKIN® Supportlayer 200x200, H0	AM-SL_SI_200X200_H0_P1
20	AIRSKIN® Supportlayer 200x200, H1	AM-SL_SI_200X200_H1_P1
21	AIRSKIN® Supportlayer 300x200, H0	AM-SL_SI_300X200_H0_P1
22	AIRSKIN® Supportlayer 300x200, H1	AM-SL_SI_300X200_H1_P1
23	AIRSKIN® Supportlayer 400x200, H0	AM-SL_SI_400X200_H0_P1
24	AIRSKIN® Supportlayer 400x200, H1	AM-SL_SI_400X200_H1_P1
25	AIRSKIN® Supportlayer 200x160x100E, H0	AM-SL_SI_200X160X100E_H0_P1
26	AIRSKIN® Supportlayer 400x200x100E, H0	AM-SL_SI_400X200X100E_H0_P1
27	AIRSKIN® Cable A-A 400 mm	AS-MSV8-A-A-400
28	AIRSKIN® Cable A-Lemo 5 m	AS-MSV8-A-Lemo-5000
29	AIRSKIN® Connection Box (no filter)	AS-ACB1.6-V1-NF
30	AIRSKIN® A-Terminator	AS-MSV8-MT-A
31	AIRSKIN® LEMO-Terminator	AS-Lemo-T





Fig. A.2.



(a) AIRSKIN® Module 200x160x100, H0 9



(b) AIRSKIN® Module 400x200x100, H0 10

Fig. A.3.



Fig. A.4.: AIRSKIN® Cable A-A 400 mm 27

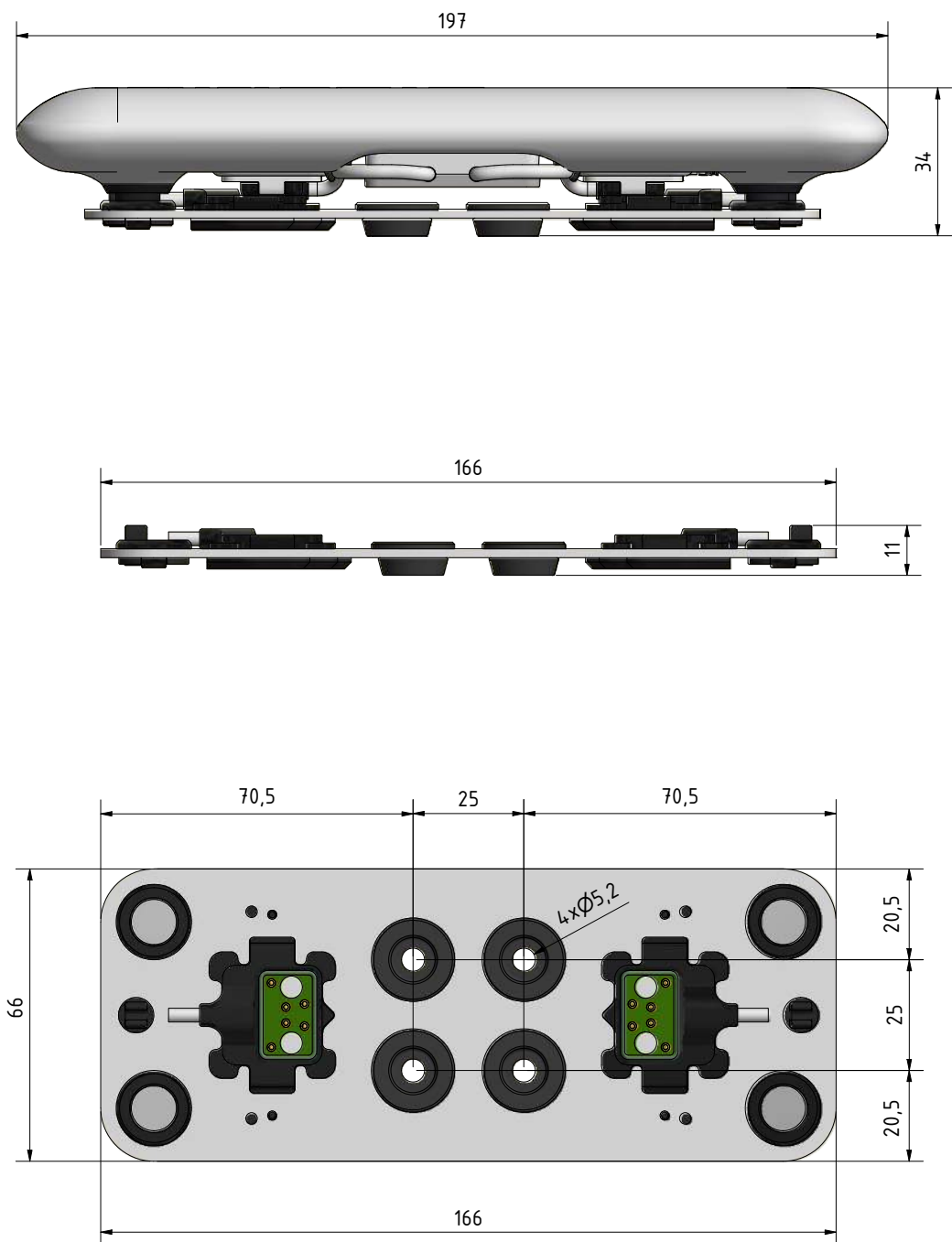


Fig. A.5.: AIRSKIN® Module 200x100, H0 1

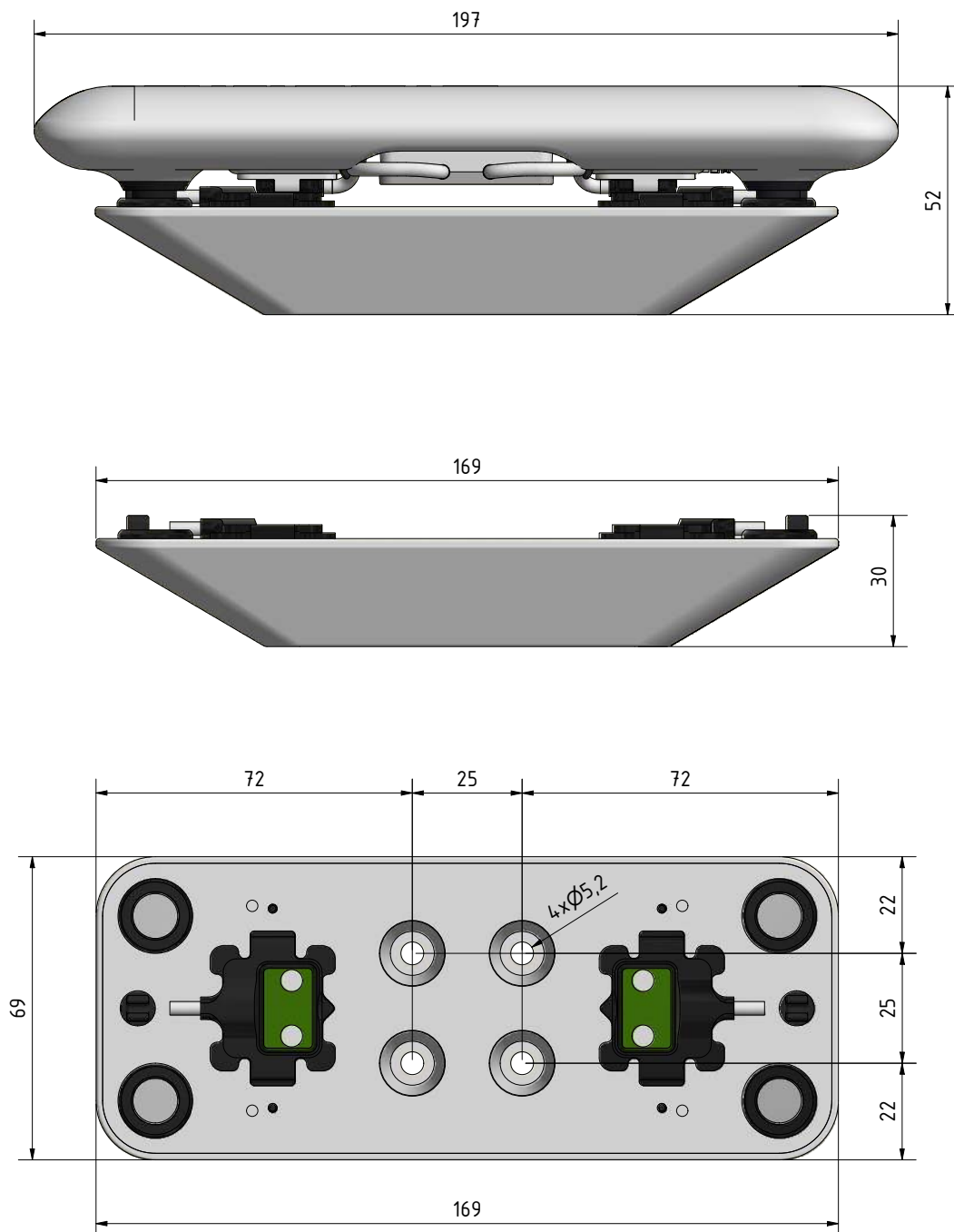


Fig. A.6.: AIRSKIN® Module 200x100, H1 2

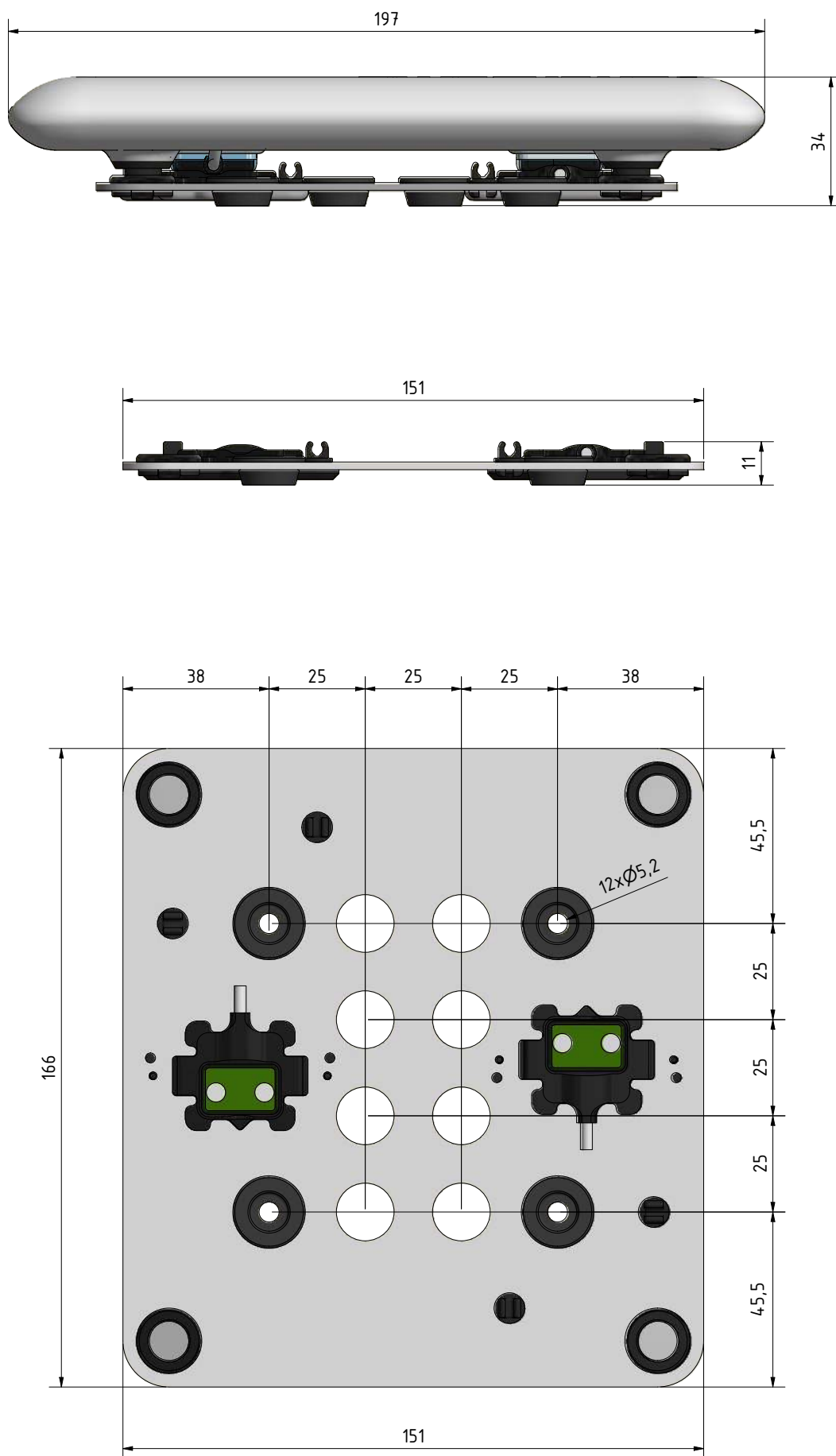


Fig. A.7.: AIRSKIN® Module 200x200, H0 3

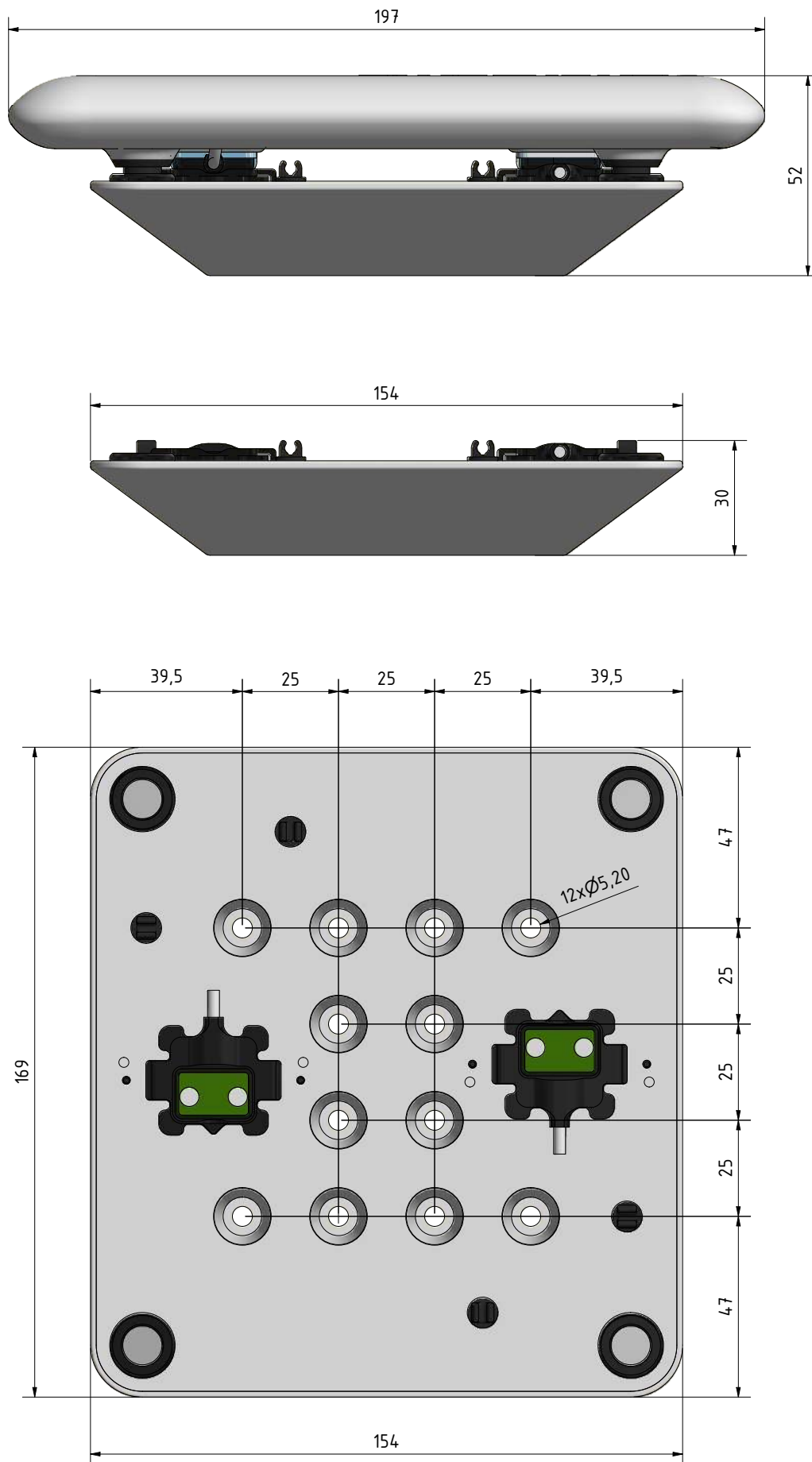


Fig. A.8.: AIRSKIN® Module 200x200, H1 4

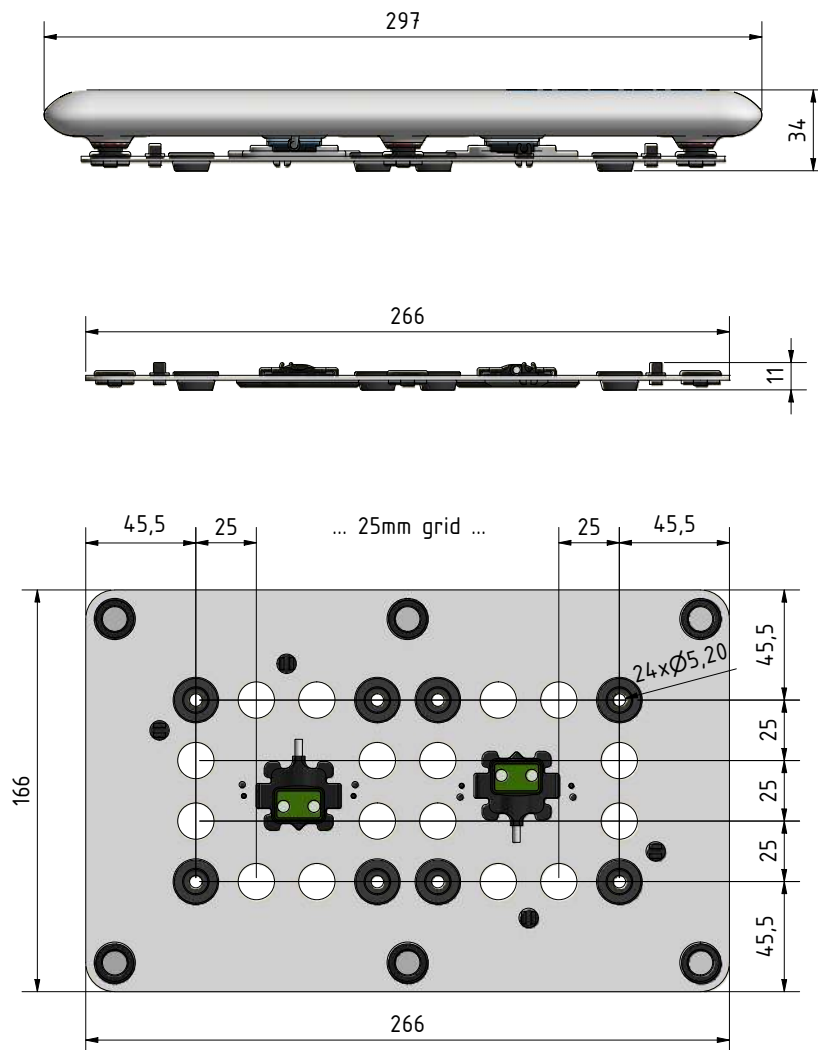


Fig. A.9.: AIRSKIN® Module 300x200, H0 5





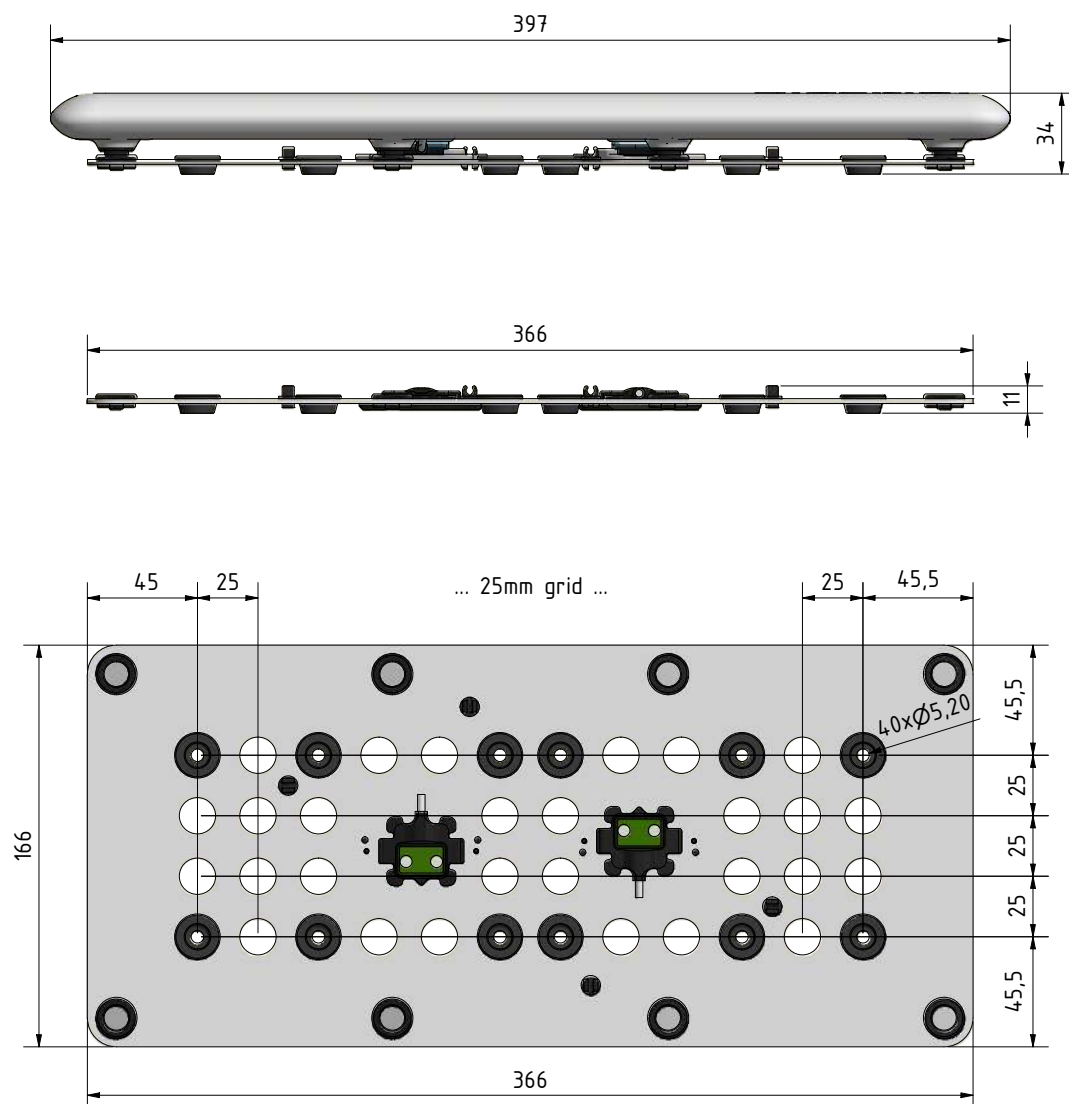


Fig. A.11.: AIRSKIN® Module 400x200, H0 7

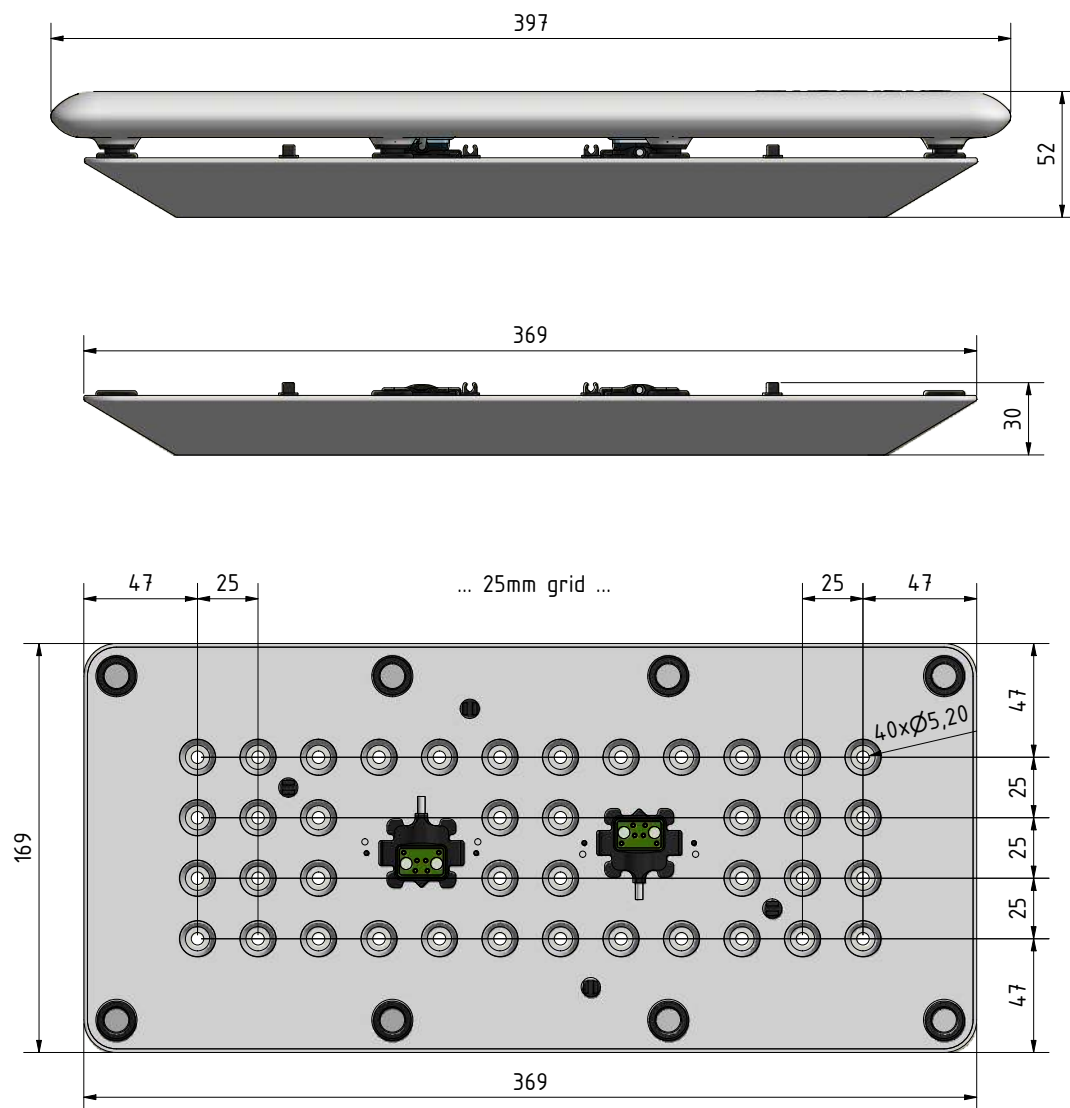


Fig. A.12.: AIRSKIN® Module 400x200, H1 8

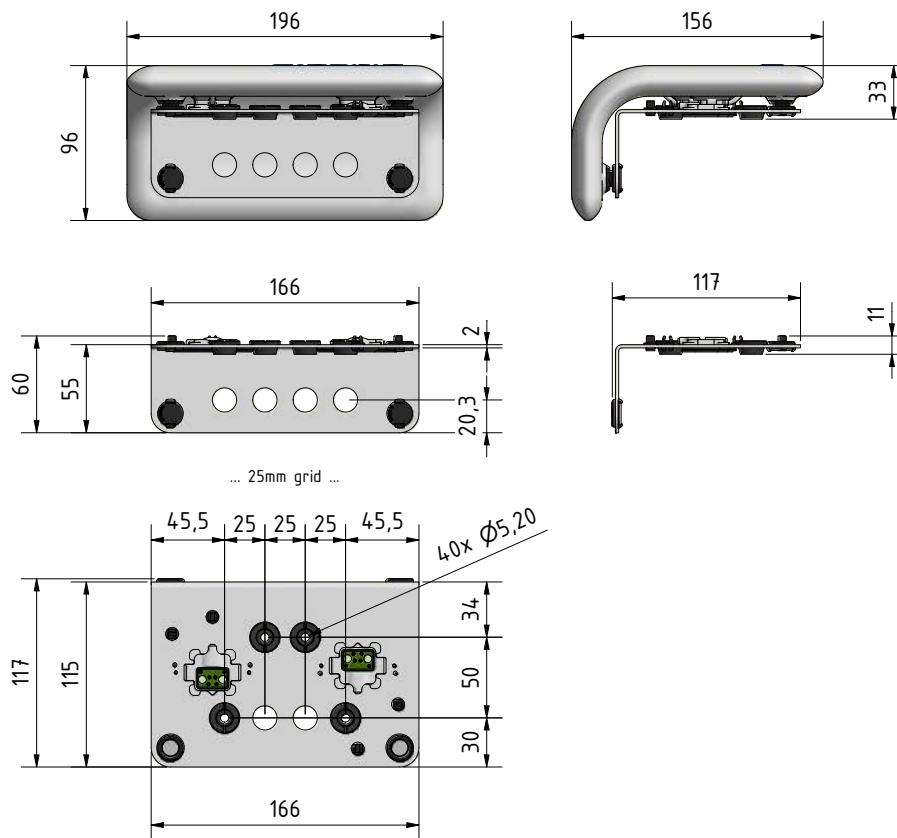


Fig. A.13.: AIRSKIN® Module 200x160x100E, H0 **9**

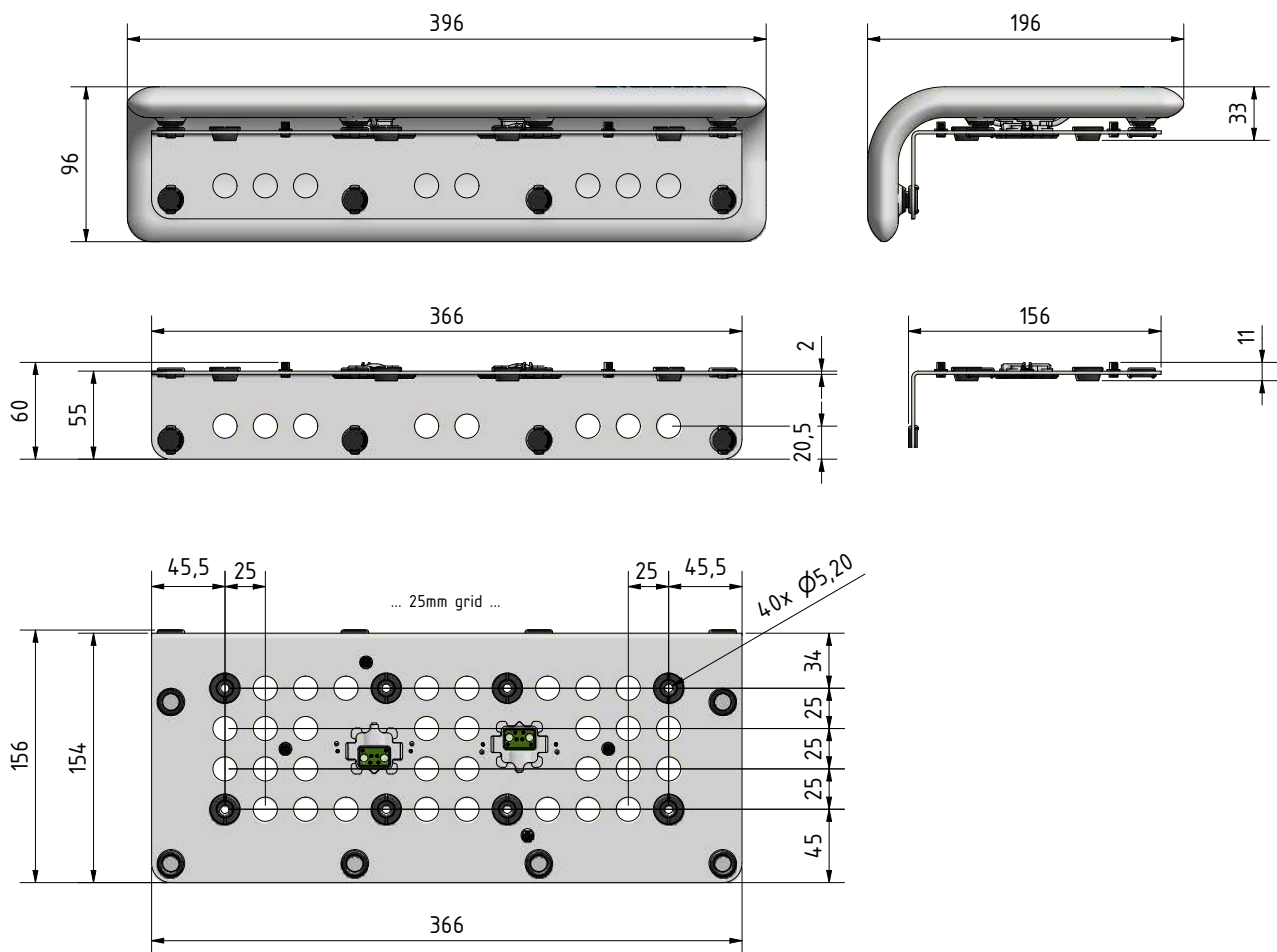


Fig. A.14.: AIRSKIN® Module 400x200x100E, H0 **10**

## A.3 Cabling

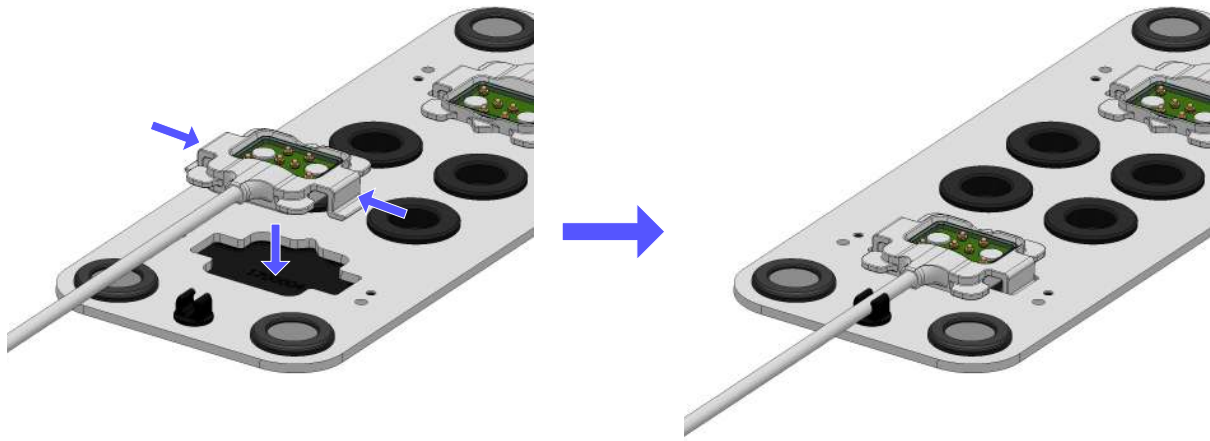


Fig. A.15.: The AIRSKIN® cables with magnetic connector A are clamped into the respective recesses in the support layer. To do this, the two side clamps of the magnetic connector are pressed together and the connectors are pressed into the recesses.

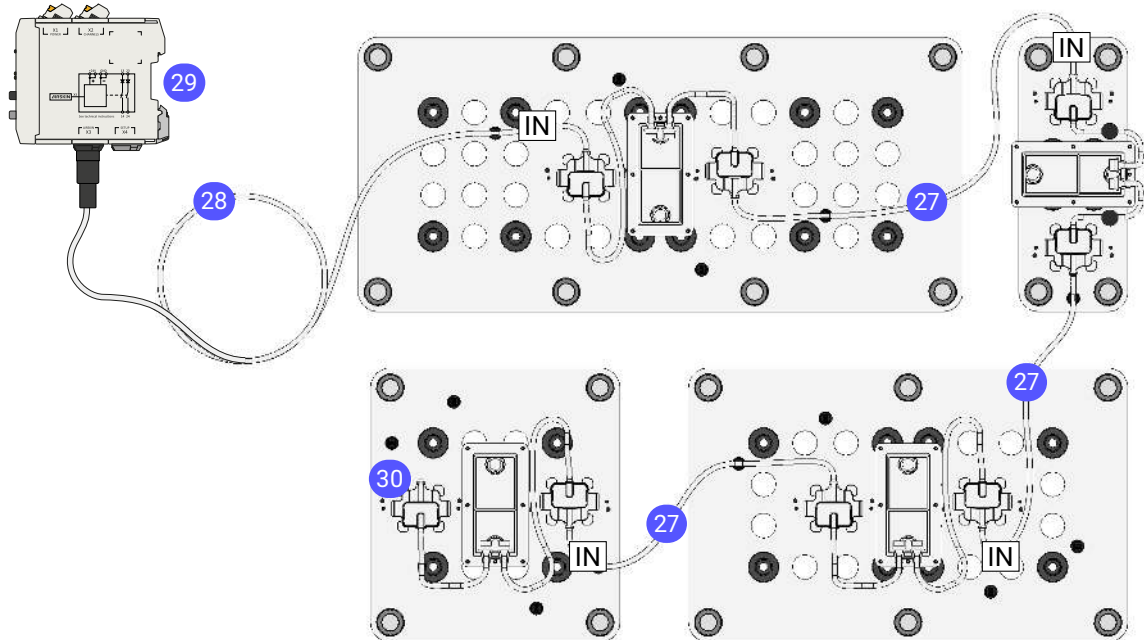


Fig. A.16.: Starting from the AIRSKIN® Connection Box, all AIRSKIN® Pads must be serially connected and terminated with an AIRSKIN® terminator. Pay attention to the orientation of the AIRSKIN® Pads when assembling. The contacts marked with "IN" must either be connected to the AIRSKIN® Connection Box or the output of a previous AIRSKIN® Pad in the lane as shown.

## A.4 Actuation characteristics

The actuation characteristics were determined with a test cylinder (30 mm diameter) and a suitable force sensor. Figure A.17 shows the schematic implementation of the measurements.



Fig. A.17.: Schematic measurement implementation to determine the actuation characteristics with a  $\varnothing 30$  mm test cylinder.

The resulting, averaged actuation forces and indentation depths at the time of the actuation of an AIRSKIN® Module H0 are shown in Figure A.18.

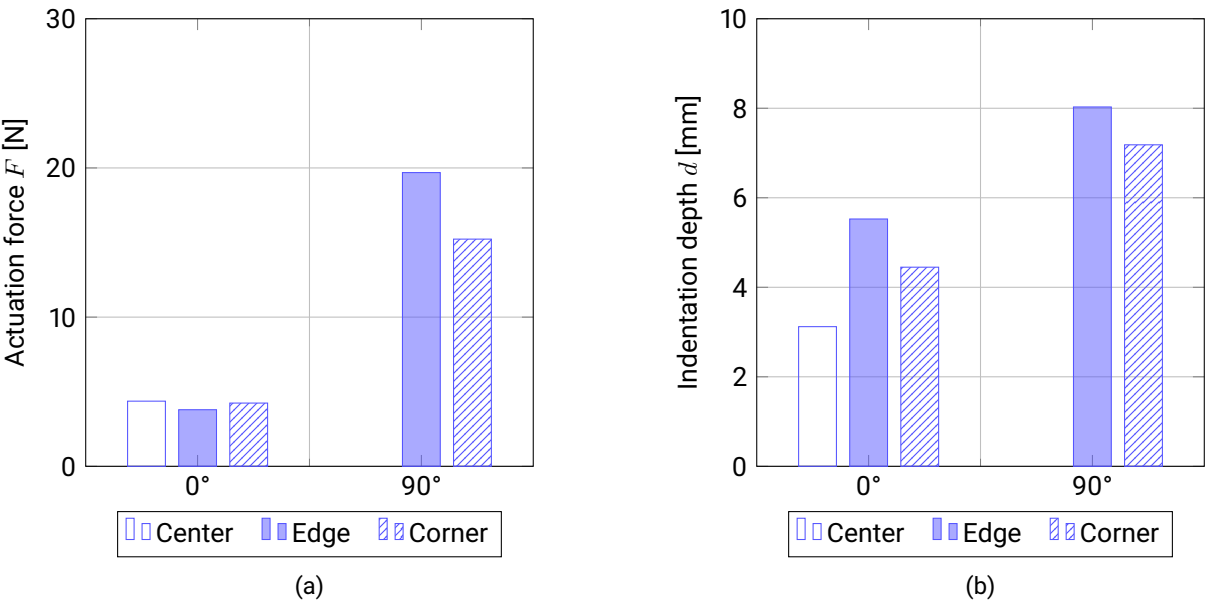


Fig. A.18.: Required actuation force  $F$  and indentation depth  $d$  to actuate an AIRSKIN® Module H0.