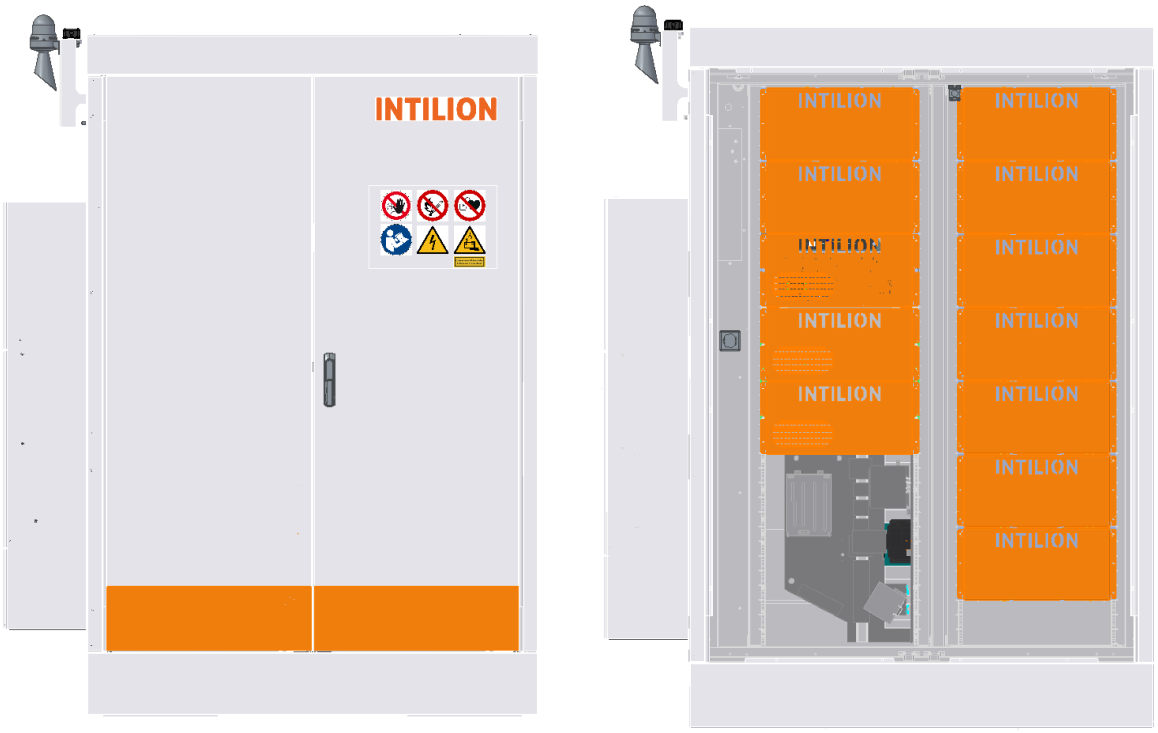
OPERATING INSTRUCTIONS

(Original operating instructions)

INTILION



INTILION | scalebloc energy
INTILION | scalebloc power
INTILION | scalebloc power boost

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Keep for future use!

AC-coupled lithium-ion battery storage system in an IP55 outdoor enclosure.

Version 05.05

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Using the following QR code, the current version of these operating instructions is available for download on the INTILION AG homepage.

URL: https://intilion.com/en/downloads/

Content

1 Introduction

This operating manual provides you with all the information you need to operate the battery storage system INTILION | scalebloc (hereafter referred to as "battery storage unit").

The operating instructions must be read, understood, and applied by all persons who are entrusted with the installation, commissioning, operation, maintenance, decommissioning and dismantling of the battery storage unit. This applies in particular to the safety instructions listed.

After reading the operating instructions, you can do the following:

- put the battery storage into operation
- operate the battery storage system in accordance with safety requirements
- maintain the battery storage as instructed
- take the battery storage out of operation and dismantle it

In addition to the operating instructions, generally applicable, legal, and other binding regulations for accident prevention and environmental protection in the country of use must be observed.

The operating instructions must be always kept at the place of use of the battery storage unit.

1.1 Means of representation

As an indication and direct warning of dangers, text statements in these operating instructions that require special attention are marked as shown in the following subsections.

1.1.1 Section-specific warnings

Section-specific warnings apply not only to a specific action, but to all actions within a section.

1.1.1.1 Structure

SIGNAL WORD

Symbol for more detailed explanation of the hazard (example)

Nature and source of the hazard

Possible consequence(s) of non-compliance

- action(s) to avoid the hazard

1.1.1.2 Hazard levels

DANGER

Hazard with a high degree of risk which, if not avoided, may result in death or serious bodily injury.

WARNING

Hazard with a medium degree of risk which, if not avoided, may result in death or serious bodily injury.

CAUTION

Low-risk hazard that, if not avoided, may result in minor or moderate bodily injury.

NOTICE

Hazard with a low degree of risk which, if not avoided, may result in property damage.

1.1.2 Embedded warnings

Embedded warnings are directly integrated into certain actions.

1.1.2.1 Structure

⚠ **SIGNAL WORD** Type and source of danger

Consequences of non-observance, measures to avoid the danger

1.1.2.2 Hazard levels

⚠ **DANGER** / **WARNING** / **CAUTION**

NOTE (without warning triangle, see section 1.1.1)

1.1.3 Other means of representation

The info icon gives useful information.

– Texts that follow this mark are enumerations.

▪ Texts following this marker describe activities to be performed in the given order.

1.1.4 Symbols used in the manual

In warning notices, special hazards are additionally identified as follows:

Warning of electrical voltage

This symbol warns of the danger to life from dangerous electrical voltage.

Warning about the danger of lithium-ion batteries

This symbol warns of dangers due to the use of lithium-ion batteries.

Access for unauthorized persons prohibited

This symbol prohibits unauthorized persons from entering the designated area.
Unauthorized persons cannot detect dangers.

Follow instructions

This symbol requires that the operating instructions and safety instructions be observed.

No access for persons with pacemakers or implanted defibrillators

This symbol prohibits the presence of persons with medical implants in the area of the battery storage unit due to the risk of malfunction caused by electromagnetic fields.

1.2 Warranty and liability

The obligations agreed in the delivery contract, the General Terms and Conditions as well as the delivery conditions of the battery storage and the legal regulations valid at the time of the conclusion of the contract apply.

All information and notes in these operating instructions have been compiled considering the applicable standards and regulations, the state of the art and our many years of knowledge and experience.

Warranty and liability claims for personal injury and property damage are excluded if they are due to one or more of the following causes:

- Improper or unintended use of the battery storage unit
- Improper installation, commissioning, operation, and maintenance of the battery storage unit
- Operating the battery storage unit with defective safety devices or improperly installed or non-functioning safety and protective devices
- Failure to observe the operating instructions and the notes in the operating instructions regarding installation, commissioning, operation, and maintenance of the battery storage unit
- Use of unqualified or uninstructed personnel
- Structural changes to the battery storage unit (modifications or other changes to the battery storage unit may not be made without the prior written consent of INTILION AG be conducted. In case of infringement, the battery storage device loses its EU conformity)
- Improperly performed repairs
- Use of non-approved spare parts or use of spare parts that do not meet the technically specified requirements
- Catastrophic events, foreign object impact and force majeure

The time between installation and commissioning of the battery storage may not exceed three months.

We reserve the right to make technical changes within the scope of improving the properties of use and further development.

1.3 Performance guarantee

INTILION | scalebloc comes with a performance guarantee which covers a period of 120 months or an energy throughput (1 energy throughput = charge and discharge of 90 % of nominal energy quantity) of 327,500 kWh in total – whatever is reached first. INTILION AG guarantees that the remaining usable capacity of the battery does not fall below a relative minimum value of 70 % of the stated battery capacity during the guarantee period.

The “state of health” (SoH), which indicates the remaining usable capacity of the battery, is a measure of the deterioration of the battery storage.

The end of life of the battery storage unit is reached when the SoH falls below the value of 70 %. The available charging and discharging power are set to 0; from this point on, charging and discharging is no longer possible.

The test procedure for determining the SoH is described in section 1.3.1 and applies to a possible claim under the performance guarantee.

If the conditions of the air conditioning concept are observed, the performance guarantee is valid. In case of a temperature-related deviation, the remaining energy throughput is reduced.

We must emphasize that the product and performance guarantee can only be granted, if the commissioning report has been completely filled in and has been received by INTILION AG four weeks after commissioning at the latest!

1.3.1 Determining the SoH

According to the following standard test procedure, the “state of health” (SoH) shall be determined:

- The temperature inside the battery storage during the test must be in the range of 23 °C ± 5 °C.
- The battery storage shall be fully discharged (to the end-of-discharge voltage or to the “state of charge” (SoC) of 0%, whichever occurs sooner) at a current rate of 1/5 C (1 C is equal to a current in amperes (A), which has the same numerical value as the nominal capacity of a battery cell in ampere-hours (Ah)).
- For a period of 30 min, the battery storage is left to rest in active standby.
- The battery storage shall be fully charged using the CCCV (constant current constant voltage) charging method. This involves charging at a constant current rate of 1/5 C initially up to the end-of-charge voltage, then continuing charging at a constant voltage and decreasing current up to an SoC of 100 % or a cut-off current of 1/20 C.
- For a period of 30 min, the battery storage is left to rest in active standby.
- The battery storage shall be fully discharged at a current rate of 1/5 C (to the end-of-discharge voltage or to the SoC of 0%, whichever occurs sooner).
- For a period of 30 min, the battery storage is left in active standby.

- Repeat the last four steps of the test profile.

The capacity discharged in the second discharge cycle must be measured at the poles of the battery management system. Only this capacity is to be used to determine the SoH.

1.4 Copyright

1.5 Customer service

INTILION AG belongs to the HOPPECKE group of companies.
For technical information please contact our customer service:

HOPPECKE Service Competence Center
Phone: +49 (0) 2963 61 591
Fax: +49 (0) 2963 61-543
Email: service@hoppecke.com

In addition, our employees are constantly interested in latest information and experience resulting from application which may be valuable for the improvement of our products.

2 Safety

Failure to observe the following safety instructions can have grave consequences:

DANGER

- Danger to persons due to electrical, mechanical, or chemical influences
- Failure of major assembly functions
- Environmental damage due to leaking hazardous substances

- Read the safety and hazard information listed in this section thoroughly before operating the battery storage unit.

- In addition to the information in these operating instructions, also observe the generally applicable safety and accident prevention regulations.

- In addition to the information in these operating instructions, the operator / user must observe the existing national work, operating and safety regulations. Existing internal company regulations must also be observed.

DANGER

The battery storage unit does not pose any additional electromagnetic hazard when the doors are closed during operation.

It is nevertheless recommended that persons with medical implants maintain a safety distance of 2 m from the battery storage unit. The specifications of the implant manufacturer must be observed.

2.1 Intended use

The operational safety of the battery storage unit is only guaranteed if it is used as intended.

INTILION | scalebloc is an AC-coupled battery storage system and is primarily suitable for **behind-the-meter** applications in grid-parallel operation.

For the Behind-The-Meter application field, there are three key features:

- The system interacts with the energy meter at the operator's grid connection point
- The system optimizes load and energy flows within the operator's infrastructure
- No energy is released from the system into the public power grid (in Germany: UCTE grid)

In addition, it is possible to switch to grid-forming operation (setting up a stand-alone grid).

The battery storage unit is not intended for any use other than that listed here.

NOTICE

The battery storage is designed for outdoor use.
For indoor use separate measures must be taken after consultation with INTILION AG.

Intended use also includes:

- observance of all instructions in the operating manual
- compliance with inspection and maintenance interval
- compliance with the operating conditions

The technical specifications given in the technical data must be observed without exception.

Only use the battery storage unit as intended to ensure safe operation.

The operator of the battery storage unit, not the manufacturer, is responsible for all personal injury and property damage resulting from improper use.

2.1.1 Structural modifications to the battery storage

Design and manufacturer's acceptance are based on the applicable EU directives. Without the prior written consent of INTILION AG no modifications, additions or conversions may be made to the battery storage unit.

In case of non-compliance, the product loses its EU conformity. In this case, the manufacturer of the battery storage unit is outside the warranty and any warranty claim.

Components which are not in perfect condition must be reported immediately to HOPPECKE Service (see section 1.5). The system must not be operated any further.

Only use original spare parts/wear parts/accessories. These parts are specially designed for the battery storage unit. In the case of externally sourced parts, there is no guarantee that they have been designed and manufactured to withstand the stresses and to meet safety requirements.

Parts and optional equipment that have not been supplied by INTILION AG are not approved for use on the battery storage unit.

2.1.2 Foreseeable misuse

DANGER

Any use of the battery storage unit beyond the intended use and/or use in a different manner can lead to serious injuries.

- Only use the battery storage unit for its intended purpose.
- Do not charge or discharge the battery modules outside the temperature range specified in section 3.3 specified temperature range.
- Do not operate the battery modules outside the operating window defined in the data sheet.

- Do not expose the lithium-ion cells of the battery storage unit to ambient temperatures above 55 °C and below 0 °C, for example during storage. By connecting the battery storage unit to the grid, the compliance with the temperature specifications is taken over by the integrated air conditioning.
- Avoid short circuits.
- Do not operate the battery storage unit in an explosive environment.
- Only operate the battery storage unit in intended networks.

2.2 Requirements for the personnel

DANGER

Work on the battery storage unit is prohibited for unauthorized persons. The operating instructions must be observed.

The battery storage system may only be installed, commissioned, operated, maintained, repaired, decommissioned and/or dismantled by persons who are qualified and/or instructed to do so. These persons must have participated in a INTILION | scalebloc product training, know the operating instructions and act accordingly. The respective powers of the personnel must be clearly defined.

The operating instructions specify the following qualifications for various areas of activity:

Personnel to be trained

Personnel who are to be trained, such as an apprentice or a temporary employee, do not know all the dangers that can occur during operation of the battery storage unit. They may only work on the battery storage unit under the supervision of qualified or instructed personnel.

Instructed personnel

Instructed personnel have been instructed in an instruction by the operator or by qualified personnel about the tasks assigned to them and possible dangers in case of improper behaviour.

Qualified personnel

Qualified personnel, due to their professional training, knowledge, and experience as well as knowledge of the relevant regulations, can carry out the work assigned to them and to recognize and avoid possible dangers independently.

Electrician

Due to their professional training, knowledge, and experience as well as knowledge of the relevant standards and regulations, a qualified electrician can carry out work on electrical equipment and to independently recognize and avoid possible hazards.

The electrician is trained for the specific site in which he or she is working and knows the relevant standards and regulations.

Qualified electrician with WLE pass

Only a specially trained electrician may perform live work (WLE activities). Certification must be in accordance with DGUV Rule 103-011 / 3.2.4 and VDE 0105-100 Para. 6.3.2.

2.2.1 Responsibilities

Improper handling can lead to considerable personal injury and damage to property.

Therefore, have all activities performed only by personnel qualified to do so.

- Only persons who can be expected to perform their work reliably are permitted as personnel. No persons are allowed to work on the battery storage unit whose ability to react is impaired by drugs, alcohol, medication or similar.
- All persons working on the battery storage unit must read the operating instructions and confirm by their signature that they have understood them.
- Personnel to be trained may initially only work on the battery storage unit under the supervision of qualified personnel. The completed and successful instruction must be confirmed in writing.

The operator is responsible for instructing the personnel.

2.2.2 Commitment of the personnel

All persons who are assigned to work on the battery storage unit must commit to the following before starting work:

- to observe the basic regulations on occupational safety and accident prevention
- to read the safety instructions and warnings in these operating instructions and to confirm by signature that they have understood them

2.2.3 Unauthorized persons

Unauthorized persons who do not meet the qualification requirements for personnel are unaware of the hazards in the work area.

- Keep unauthorized persons away from the work area.
- If in doubt, approach the persons and direct them away from the work area.
- Interrupt work if unauthorized persons are in the work area.

2.2.4 Instruction

The personnel must be instructed regularly (e. g. every six months) by the operator. After the instruction has been conducted, a record must be made (see the following exemplary table).

Date	Name	Type of instruc-tion	Instruction takes place through	Signature

Table 1 Instruction protocol

2.3 Personal protective equipment

Follow the instructions for personal protective equipment posted in the work area.

When operating the battery storage system, personal protective equipment must be worn to minimize health hazards, regardless of the workplace hazard assessment.

- Always wear the necessary protective equipment for the job at hand while working.
- Do not wear metallic watches, rings, necklaces, or other jewellery.

The symbols have the following meaning:

Use protective clothing (insulating protective clothing)

Protective work clothing is tight-fitting work clothing designed to protect against physical effects, for example, mechanical and thermal.

Insulating protective clothing is non-conductive and prevents the passage of electric current when the wearer comes into contact with a live part.

Use foot protection (insulating safety shoes)

Wear non-slip safety shoes to protect against heavy falling parts or slipping on slippery surfaces.

Electrical workers need insulating footwear for their work on live parts. The shoes, in combination with insulating protective clothing, are designed to protect the wearer from electrical shocks and to prevent electrical current passing through the body and entering the floor through the feet.

Use hand protection (1000 V protective gloves)

Wear protective gloves to protect hands against friction, abrasions, punctures, or deeper injuries as well as against contact with hot surfaces or chemical substances. Wear insulating (1000 V) protective gloves according to EN 60903 or VDE 0682 Part 311 to protect hands against dangerous body flow when touching live parts.

Use head protection (electrician's safety helmet)

Wear a hard hat to protect against falling or flying parts. Wear an electrician's safety helmet marked 1000 V according to DIN EN 50365 to protect the head against thermal effects, e. g. of an electric arc, and to protect against a dangerous body flow when touching live parts.

Use face protection (electrician's face shield).

Wear a face shield to protect your eyes and face. Wear electrician's face protection suitable for live working (WLE) to protect against an arc fault that may occur.

Use hearing protection

Wear hearing protection to protect against hearing damage.

Use harness

Wear suitable fall protection (safety rope and safety harness) when working at heights.

The personal protective equipment must be provided by the operator and must comply with the applicable requirements.

In addition, the national regulations as well as specifications from the workplace risk assessment and, if necessary, internal instructions of the operator must be observed.

2.4 General safety instructions

The battery storage unit may only be commissioned, serviced, decommissioned and/or dismantled after you have read these operating instructions.

- Only use the battery storage unit as intended (see section 2.1).
- Do not operate the battery storage if there are other persons in the danger zone.
- When operating the battery storage unit, refrain from any working method that impairs the safety of persons or the battery storage unit.
- Never operate the battery storage unit without the associated protection and safety devices. Never put built-in safety devices out of operation.
- After an alarm has been triggered (visual warning light and audible warning tone of the warning indicator go on continuously), keep your distance from the battery storage unit and inform the person responsible for the system. If smoke is detected from outside, follow the instructions in section 2.8 section.
- Always keep the working area of the battery storage unit clean and tidy to avoid hazards from dirt and parts lying around.
- Keep the ventilation openings of the battery storage free. Do not place any materials in front of the ventilation openings from inside or outside.
- Do not exceed the technical performance data (see section 3.3).
- Keep all safety and hazard labels on the product in a legible condition and renew them, as necessary.
- Operation and work on the battery storage unit may only be conducted by qualified and instructed personnel (see section 2.2) may be conducted.
- Remote updates may only be performed under the supervision of a qualified person on site. The qualified person on site can act immediately in the event of a malfunction (e. g. perform a reboot or import the old, executable version).
- In case of malfunctions, immediately put the battery storage out of operation. Have faults rectified by appropriately trained specialists or by INTILION AG or the HOPPECKE service department.
- Always keep the operating manual at the place of use of the battery storage unit. It must be ensured that all persons who conduct activities on the battery storage unit can view the operating manual at all times.

2.5 Safety measures for environmental protection

Observe the regulations on waste prevention and proper waste recycling or disposal during all work.

Particularly during installation and maintenance work as well as during decommissioning, care must be taken to ensure that substances hazardous to groundwater, such as greases, oils, coolants, cleaning fluids containing solvents, etc., do not contaminate the soil or enter the sewage system. These substances must be collected in suitable containers, stored, transported, and disposed of in accordance with national regulations.

2.6 Special hazard warnings

2.6.1 Symbols used on the battery storage

Warning of electrical voltage

This symbol warns of the danger to life due to dangerous electrical voltage. There is an immediate danger to life in the event of contact with live parts.

Warning about the danger of lithium-ion batteries

This symbol warns of possible dangers due to the use of lithium-ion batteries.

Access for unauthorized persons prohibited

This symbol prohibits unauthorized persons from entering the marked area. Unauthorized persons cannot detect dangers.

No access for persons with pacemakers or implanted defibrillators

This symbol prohibits the presence of persons with medical implants in the area of the battery storage unit, as electromagnetic fields may cause a malfunction of e. g. cardiac pacemakers.

No open flame: fire, open source of ignition and smoking prohibited

This symbol prohibits fire, open light, and smoking in the area of the battery storage.

Follow instructions

This symbol requires that the operating instructions and safety instructions be observed.

Keep all safety and danger notices on the battery storage unit in a legible condition. Renew the notices, as necessary.

2.6.2 Dangers due to electrical energy

DANGER

There is a risk of electric shock when touching live parts. Consequently, there is also the risk of secondary accidents due to fright (e. g. falling).

- Always keep electrical components closed.
- Have work on the electrical equipment conducted only by a qualified electrician with an WLE pass who has been specially trained to work on electrical equipment and to work under voltage and who can recognize and avoid hazards.
- Observe the five safety rules when working on the electrical equipment:
  1. Unlock
  2. Secure against restarting
  3. Determine freedom from voltage
  4. Earth and short circuit
  5. Cover or fence off live parts

For the safe execution of electrical work, the operator can transfer his/her obligations to a person(s) responsible for the system (electrician). The transfer of responsibility must be made in writing.

- Before working on the electrical equipment, disconnect the battery storage unit from the power supply and secure it against being switched on again.

DANGER

There is a risk of electric shock when touching live parts.

Since batteries are present in the system and cannot be de-energized, a life-threatening DC voltage is always present in parts of the system.

The battery storage unit can only be de-energized on the grid side up to the battery management system (connections P+ and P-). The individual battery modules cannot be de-energized. Dangerous electrical voltages are always present at the power connections of the battery modules and at the B+ and B- connections of the battery management system.

- Work on the electrical equipment may only be conducted by a competent electrician – e. g. company electrician – with an WLE pass.
- The responsible electrician must have participated in a INTILION | scalebloc product training.
  - Always use insulated tools (up to 1000 V) when working.
  - Check the electrical equipment regularly for defects such as loose connections or scorched cables. Have any defects rectified immediately.
  - Have the electrical equipment and stationary electrical equipment inspected by a qualified electrician once a year or at the required intervals.
  - Stationary electrical equipment is permanently attached equipment or equipment that has no carrying device and whose mass is such that it cannot be easily moved. This also includes electrical equipment that is temporarily fixed and operated via movable connecting cables.
  - Have portable electrical equipment, connection cables with plugs, and extension and device connection cables with their plug devices evaluated by a qualified electrician at least every six months, provided they are used.
  - Portable equipment is equipment that can be moved while live, depending on its type and normal use. This includes, for example, electrical floor cleaning machines.
  - Check all safety devices of the battery storage regularly for their function.
  - Damaged housings and cables must be repaired or replaced immediately before switching on.
- Depending on the weather conditions (e. g. thunderstorms, high humidity, rain), working on the battery storage unit is prohibited.

2.6.3 Dangers from lithium-ion batteries

DANGER

Even at battery voltages greater than 60 V, there is a considerable risk to health and life in the event of electric shock.
Lithium-ion batteries can deliver a high short-circuit current even when supposedly discharged.

As a result of mechanical damage (e. g. impact), electrical faults (e. g. short circuit, deep discharge, overcharging) or thermal effects above 70 °C (e. g. internal overheating), electrolyte and gases may escape in rare cases, which may lead to a fire event due to internal chemical reactions within the cell that intensify thermally.

Contact with leaked electrolyte or leaked gases may cause respiratory problems, suffocation, or poisoning, or may cause cancer.

- The battery modules may only be handled by a specialist. Always use insulated tools when working.
- Always wear protective work clothing and gloves when working on the battery modules.

- Only transport the battery modules in the original packaging or in packaging that complies with the applicable guidelines.
- Keep the packaging.
- Do not heat the battery modules above the allowable temperature and do not burn them.
- Ensure that there are no external ignition sources.
- Do not short-circuit the battery modules and do not damage them mechanically (pierce, deform, disassemble, etc.).

DANGER

- When handling conspicuous battery modules (leakage of contents, deformations, discolorations, dents or similar), wear protective work clothing and gloves and ensure sufficient ventilation. Do not breathe in any escaping gases.
- Secure damaged battery modules against short circuits by taping off the terminals.
- Pack damaged battery modules as airtight as possible and surround them with dry sand, chalk powder ($CaCO_3$) or vermiculite.
- If possible, store damaged battery modules outside buildings in shock- and fire-proof external packaging.
- Mark and secure the storage location with warning labels.

- Have the battery modules disposed of by a certified specialist company or by INTILION AG dispose of them (see chapter 10).

After contact with leaked electrolyte, behave as follows.

- After inhalation, remove the affected person to fresh air and keep him calm. In case of large quantities and irritation of the respiratory tract, consult a doctor.
- In case of contact with skin, immediately flush the area with water for at least 15 minutes. Seek medical attention if skin irritation persists.
- In case of contact with eyes, rinse them immediately with water for at least 15 minutes and consult a doctor. Protect an uninjured eye.
- If swallowed, consult a doctor immediately. Do not induce vomiting. Rinse mouth and surrounding area with water.

2.6.4 Dangers due to hot surfaces

WARNING

Contact with hot components can cause burns.

- Always wear protective clothing and gloves when working near hot components.
- Before working on the battery storage unit, allow the components to cool down to ambient temperature.

2.6.5 Dangers when working at great heights

WARNING

When working on the product, there is a risk of falling from a great height, which can result in fatal injuries.

- Wear fall protection (e. g. safety rope and safety harness) when working at heights of more than 1 m.
- If a harness is used as fall protection, the rescue concept for persons in the harness must be observed. A person must not be suspended in the harness for longer than 15 min, otherwise shock and possibly death could occur.

The qualification for working at heights must be proven.

2.6.6 Noise hazards

CAUTION

The sound pressure level occurring in the work area can lead to permanent hearing damage if exposed to it continuously.

- From a sound pressure level of 80 dB(A), the operator must provide hearing protection.
- Hearing protection must be worn above a sound pressure level of 85 dB(A).

2.6.7 Dangers due to the use of incorrect spare parts

NOTICE

Incorrect or faulty spare parts can lead to damage, malfunction or total failure as well as impair safety.

- Only use original spare parts.
- Procure the spare parts via INTILION AG. You will find the necessary information on the spare parts in the enclosed parts lists. In case of doubt, contact HOPPECKE Service (see section 1.5).

2.7 Safety and protective devices

- Make sure to close off the work area at the battery storage.
- Before switching on the battery storage unit, always check that all safety and protective devices are properly fitted and in working order.
- When partial components are supplied, the protective devices must be fitted by the operator in accordance with the regulations.
- During operation, do not bypass, remove, or otherwise disable safety and protective devices.
- Protective devices may only be removed after the battery storage unit has been shut down and secured against being switched on again.
- Check all safety devices of the battery storage regularly for their function.

2.8 In case of an emergency

Recommendation for the fire department

Smoke emission of the battery storage can be caused by fire of the electronics as well as of battery modules. Therefore, it is important to detect the cause.

Get the key for the battery storage doors from the person responsible for the system. When the doors are open, and you detect an electronics fire early, use a CO_2 fire extinguisher to prevent further property damage to the battery storage. If the cause of the fire cannot be determined, use plenty of water as the extinguishing method.

If it is not possible to open the doors due to a missing key or obvious personal danger from an advanced fire, use plenty of water as an extinguishing method to cool the battery storage unit from the outside and protect the surrounding area from fire spread.

⚠ Preventive measures

- Always be prepared for accidents or fire.
- Keep first aid equipment (first aid kit, blankets, etc.) within easy reach.
- Become familiar with accident reporting, first aid, firefighting, and rescue equipment.
- Keep access routes clear for emergency vehicles and, if necessary, mark them accordingly.

⚠ Measures in case of accidents

- Rescue people from the danger zone.
- Initiate resuscitation immediately in the event of cardiac and/or respiratory arrest.
- In the event of personal injury, notify the First Aid Officer and an emergency doctor or the ambulance service.
- Clear the access routes for rescue vehicles. If necessary, assign someone to instruct the emergency services.

2.9 Obligation of the operator

The battery storage unit is used in the commercial sector. The operator of the battery storage unit is therefore subject to the legal obligations for occupational safety.

In addition to the safety instructions in this operating manual, the safety, accident prevention and environmental protection regulations applicable to the area of use of the battery storage unit must be observed. The following applies in particular:

- The operator must ensure that the battery storage unit is only used as intended (see section 2.1).
- The operator must provide and mark escape routes for outdoor and indoor battery storage facilities. In addition, the operator must ensure that the escape routes are always kept clear.
- The operator must always make the operating manual available in legible condition and complete at the place of use of the battery storage unit.
- The operator must clearly regulate and define the responsibilities for commissioning, operation, maintenance, decommissioning and dismantling.
- The operator may only allow persons to work on the battery storage unit who have reached the legally permissible minimum age.
- The operator may only allow sufficiently qualified and instructed personnel to work on the battery storage system.
- The operator must ensure that all employees who handle the battery storage system have read and understood the operating instructions.
  In addition, he must demonstrably train the personnel at regular intervals and inform them about the dangers.
- The operator must provide the personnel with the personal protective equipment and ensure that it is used.
- The operator must ensure that no persons work on the battery storage system whose ability to react is impaired by drugs, alcohol, medication or similar.
- The operator must ensure that all employees who handle the battery storage system take sufficient rest breaks to be able to exclude fatigue and lack of concentration when handling the battery storage system as far as possible.

The battery storage must always be kept in technically perfect condition.

- The operator must ensure that the maintenance intervals described in these operating instructions are observed.
- The operator must have all safety devices checked regularly for functionality and completeness.
- The operator must regularly check that all safety and warning notices attached to the battery storage unit are clearly legible and remain permanently attached to the battery storage unit.
- The operator must ensure that the battery storage unit remains connected to the grid after commissioning. To prevent deep discharge of the battery modules, it must not be disconnected from the grid for longer than four months.

2.10 Obligation of the person responsible for the plant

The person responsible for the system is responsible for the safe execution of electrical work. The transfer of responsibility is made in writing by the operator.

The person responsible for the system must have read and understood the operating instructions. In case of misunderstandings, he/she must consult with HOPPECKE Service.

3 Description of the battery storage

INTILION | scalebloc is an AC-coupled battery storage system for use in industrial applications. The battery storage system has lithium-ion batteries (battery modules) with a total capacity of 72.8 kWh and has up to three bidirectional battery inverter(s) (in short "inverter") depending on the INTILION | scalebloc model:

INTILION | scalebloc energy	1 x 25 kVA inverter
INTILION | scalebloc power	2 x 25 kVA inverters
INTILION | scalebloc power boost	3 x 25 kVA inverters

Table 2 INTILION | scalebloc variants

The battery storage system consists of different subassemblies which are installed in a climate-controlled outdoor cabinet in 19" racks. These include the battery modules, the battery management system (BMS), the inverter and the ControlShield.

The ControlShield assembly is the internal control and regulation unit of the battery storage system and ensures its safe operation. The ControlShield functionalities include full lightning protection (according to DIN VDE 0185-305, DIN VDE 0100-443, and DIN VDE 0100-534), an energy management system (EMS), external customer interfaces and the protection and control of internally connected components, such as air conditioning.

The field of application is mainly behind-the-meter, for example with the following objectives:

- self-consumption optimisation of locally generated energy
- reduction of load peaks in the industrial environment
- pre-charge storage in relation to the e-mobility infrastructure

Energy flow control for these applications is provided by an intelligent energy management system, which sends data to the HOPPECKE Cloud via an integrated LTE modem for monitoring and service support.

The battery storage unit can also be controlled via an external interface (Modbus TCP/IP) using the "setpoint specification" application. This ensures integration into higher-level control systems – such as an energy management environment. The external setpoints are checked for plausibility by the ControlShield so that the battery storage system is always operated within the specified operating window.

To meet regulatory requirements in advance, various protective measures are integrated within the system. These include extensive lightning protection, an innovative fire protection concept and an uninterruptible power supply (UPS) for the control unit.

Furthermore, the system has an integrated air conditioning system to ensure operation in the optimum temperature window. The cooling process starts at 28 °C and ends at 23 °C, the heating process starts at 16 °C and ends at 21 °C.

To minimize the operating noise emissions of the air conditioning system, a sound insulating hood is optionally available and can be mounted (see section 5.16).

The battery storage unit is available with the air conditioning unit mounted on the left or right side. Accordingly, the subassemblies in the control cabinet are also installed on the other side to ensure maximum efficiency of the air conditioning concept. If several battery storage units are operated together, they can be installed side by side in the two different versions with the respective free side without spacing.

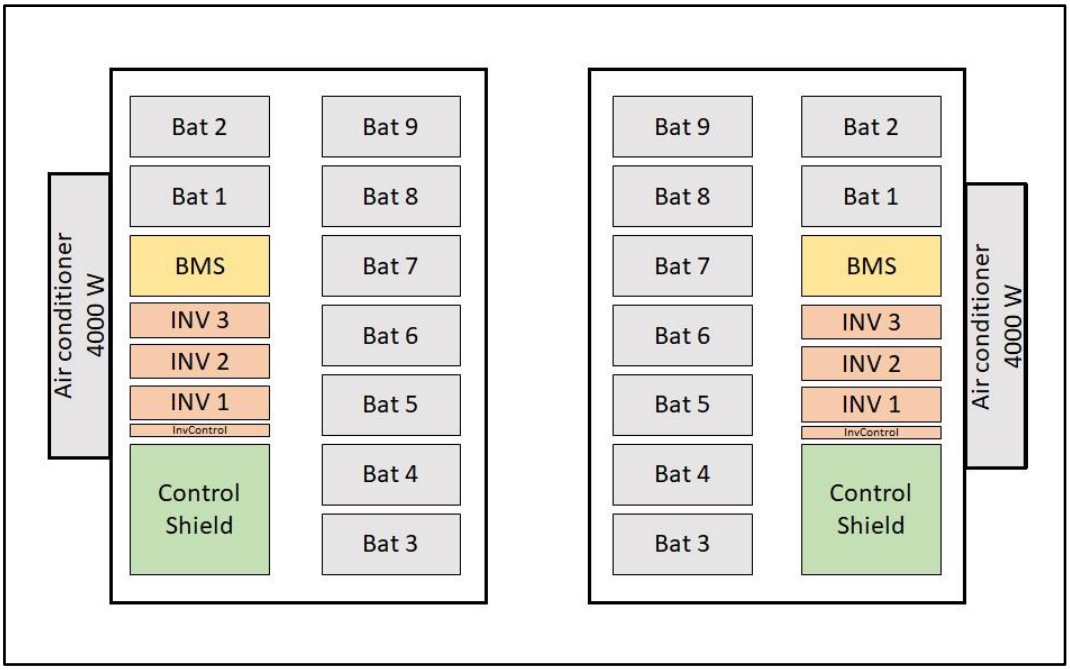


Fig. 1 Two INTILION | scaleblocs placed side by side

Since over temperature and under temperature influence the service life or total cycles and additionally on the maximum available power of the installed battery modules, the air-conditioning concept was validated in an external air-conditioning laboratory, considering various simulated environmental influences.

The installed air conditioning unit has a cooling capacity of 4 kW and a heating capacity of 2 kW. The targeted internal routing of the supply and exhaust air ensures homogeneous air conditioning of the battery modules.

The internal fan of the air conditioning unit runs continuously due to the technically required air circulation at the temperature sensors and the air circulation in the cabinet. The air conditioner is switched on or off when the temperature thresholds are reached.

The air conditioning concept described is designed for the ambient temperatures noted in the technical data (see Table 14). For the validation of the air conditioning concept and its functionality, performance profiles are defined. (See Fig. 2 and Fig. 3 for two typical performance profiles.)

Considering two full cycles per 24 h, which occur with a time interval of min. 4 h offset from each other, the air conditioning ensures that the storage system is operated in a temperature window which provides the maximum system performance and reduces temperature-related aging of the battery modules to a minimum. A load that is higher than the defined performance profiles, for example, caused by excessively high ambient temperature can lead to increased aging of the battery modules.

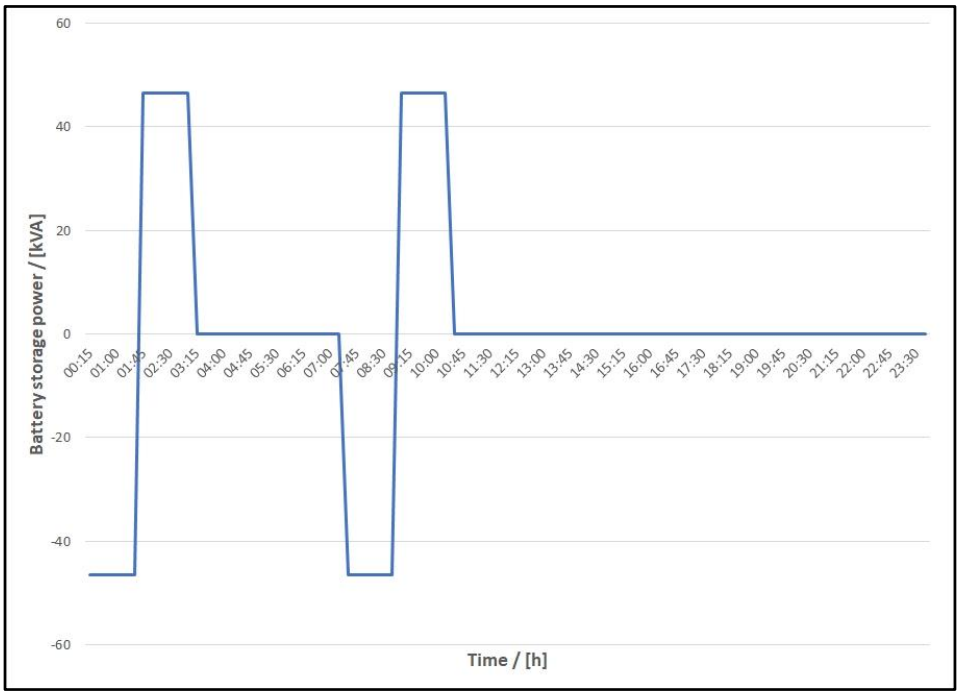


Fig. 2 Power curve with two full cycles per day and 45 kVA load

In the event of a temporary overload of the battery storage system, due to an increase in the number of full cycles per day or violation of the time span between full cycles, the usable power output is reduced by the system depending on the internal temperatures of the modules and the control cabinet (see section 3.1.5.10).

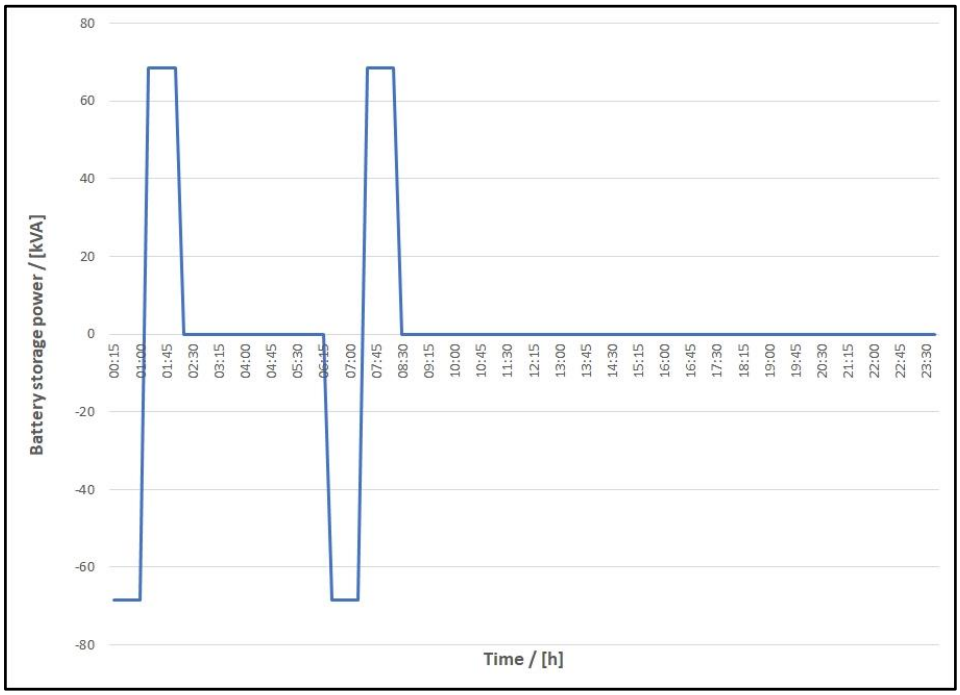


Fig. 3 Power curve with two full cycles per day and 68.5 kVA load

3.1 Overview

3.1.1 Overview of functional elements

3.1.1.1 View with doors closed

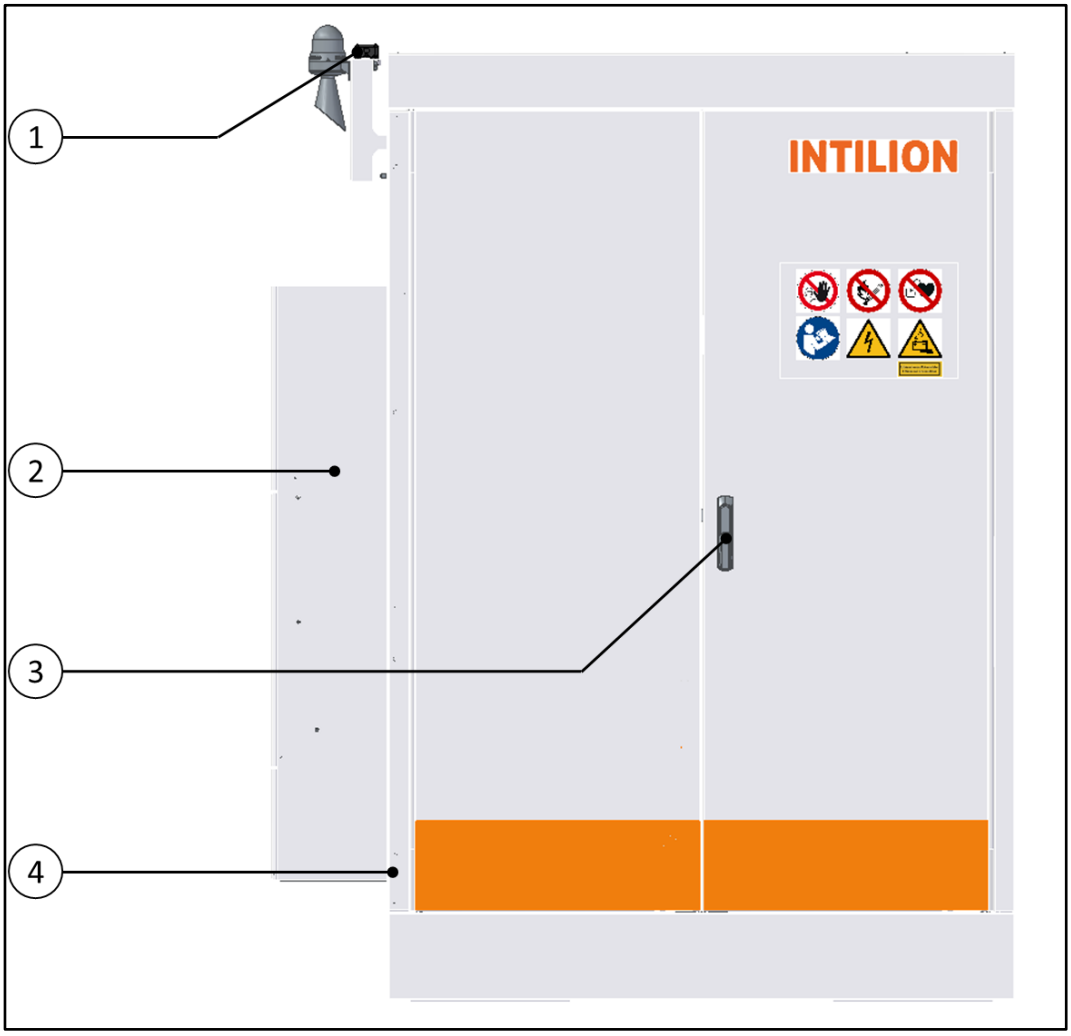


Fig. 4 Functional elements – view with doors closed

(1)	LTE antenna (only master version)
(2)	Air conditioner (mounted on the left side)
(3)	Door
(4)	Outdoor housing IP55

Table 3 INTILION | scalebloc functional elements outside

3.1.1.2 View with doors open

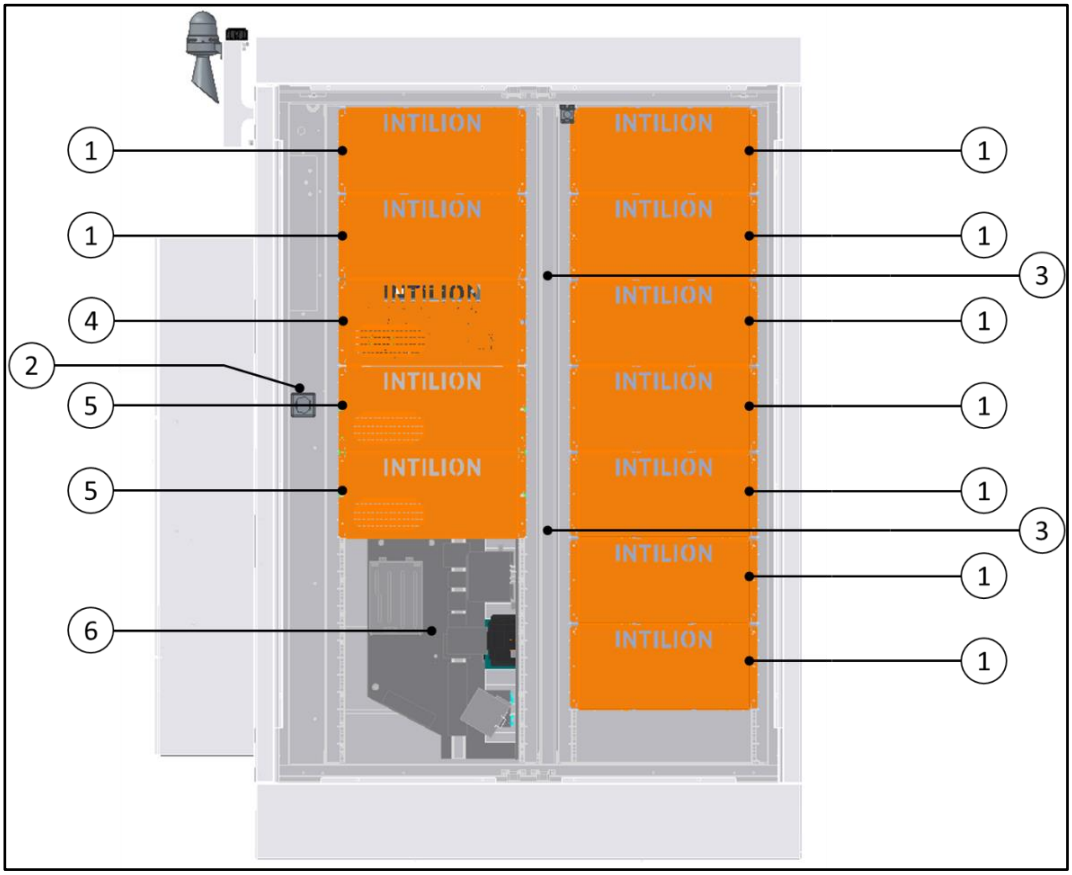


Fig. 5 Functional elements – view with doors open

(1)	Fire protection enclosure with battery module
(2)	Socket
(3)	Temperature sensor PT1000
(4)	Battery Management System (BMS)
(5)	Inverters
(6)	ControlShield

Table 4 INTILION | scalebloc functional elements inside

3.1.2 Overview of safety devices

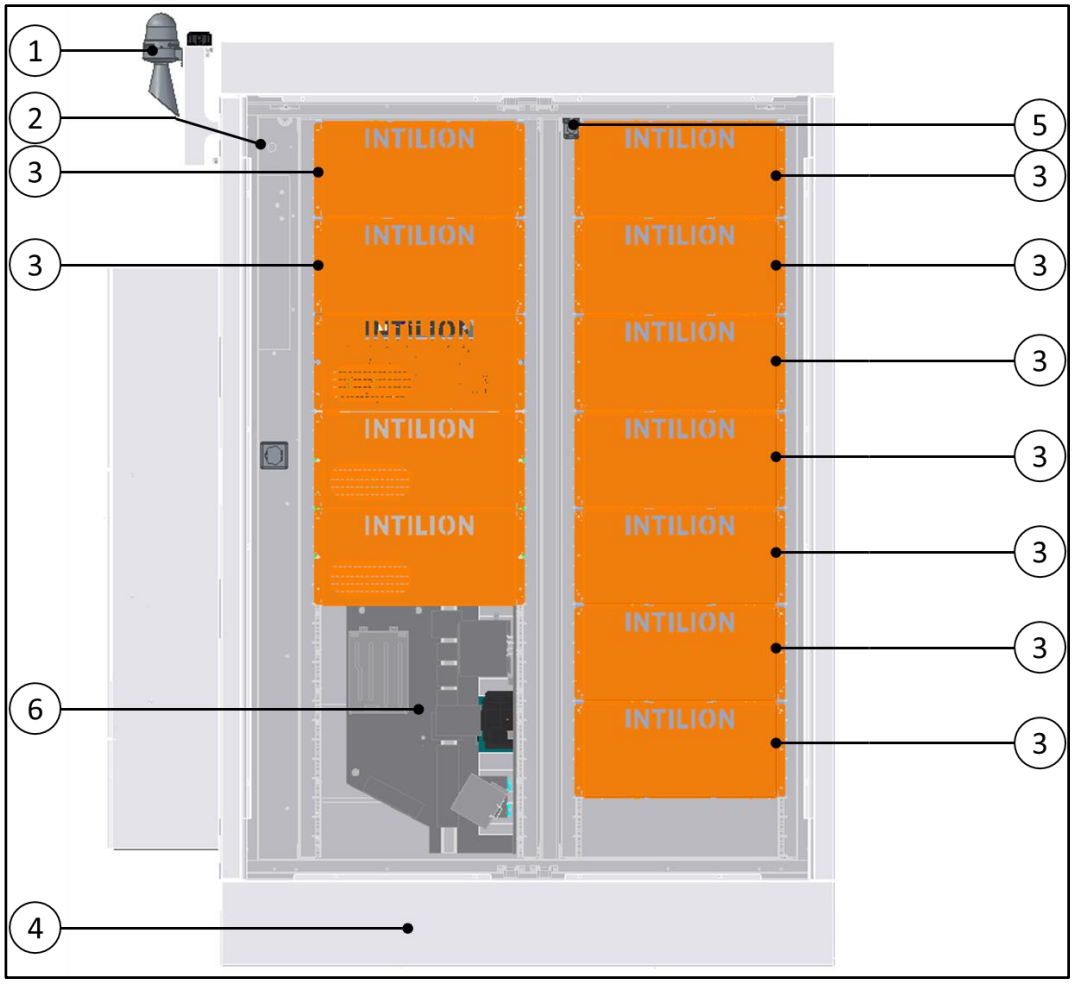


Fig. 6 Safety devices

(1)	Visual and audible alarm
(2)	Smoke detector
(3)	fire protection enclosure
(4)	Smoke venting channel (see section 3.1.5.7)
(5)	Door contact switch
(6)	ControlShield emergency stop contacts (integration in emergency stop circuit possible)

Table 5 INTILION | scalebloc safety features

For the optional implementation of an external lightning protection, it is possible to attach a lightning rod to the attachment point threads also used for transportation (see section 5.5.3). INTILION recommends here the lightning rod of the company *DEHN SE* (item number: 103211).

3.1.3 Nameplate

The nameplate (1) is attached to the base on the side of the air conditioner (near the edge to the front for better readability). In addition, another nameplate is attached to the inside of the air conditioner door.

Fig. 7 Name plate – position

The following figures show sample nameplates.

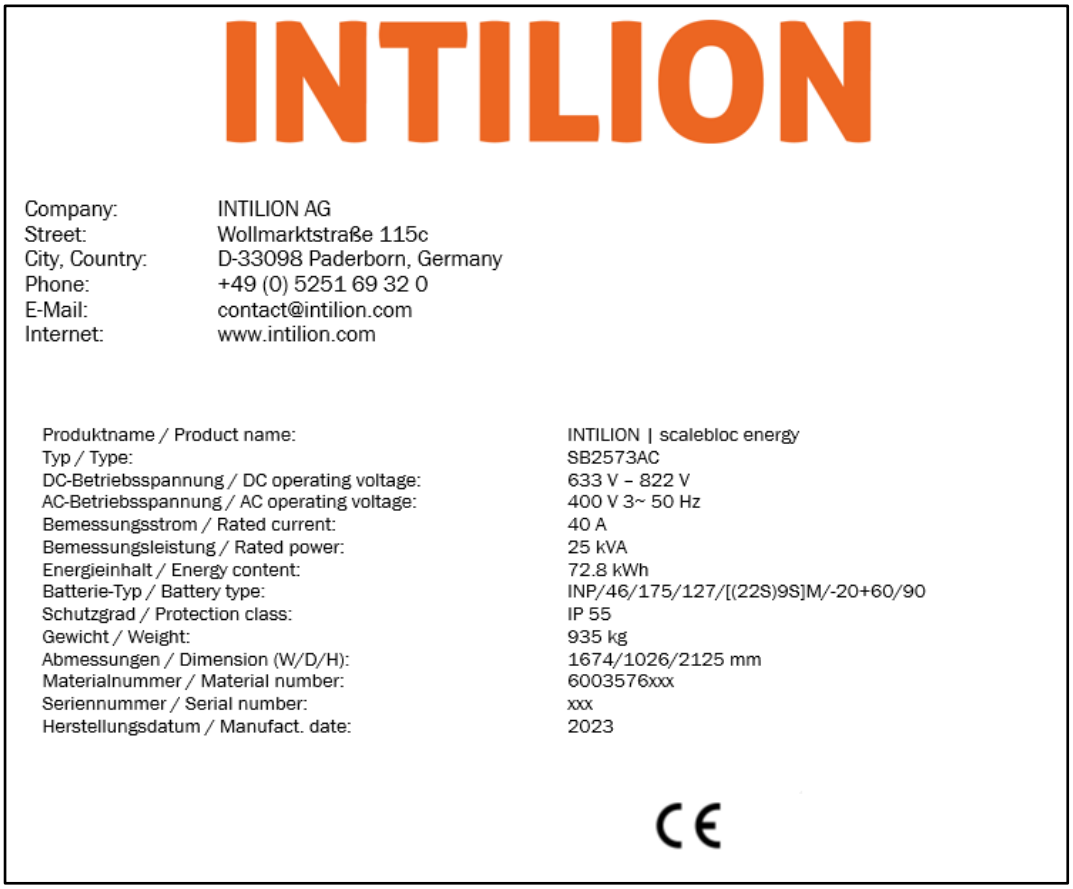
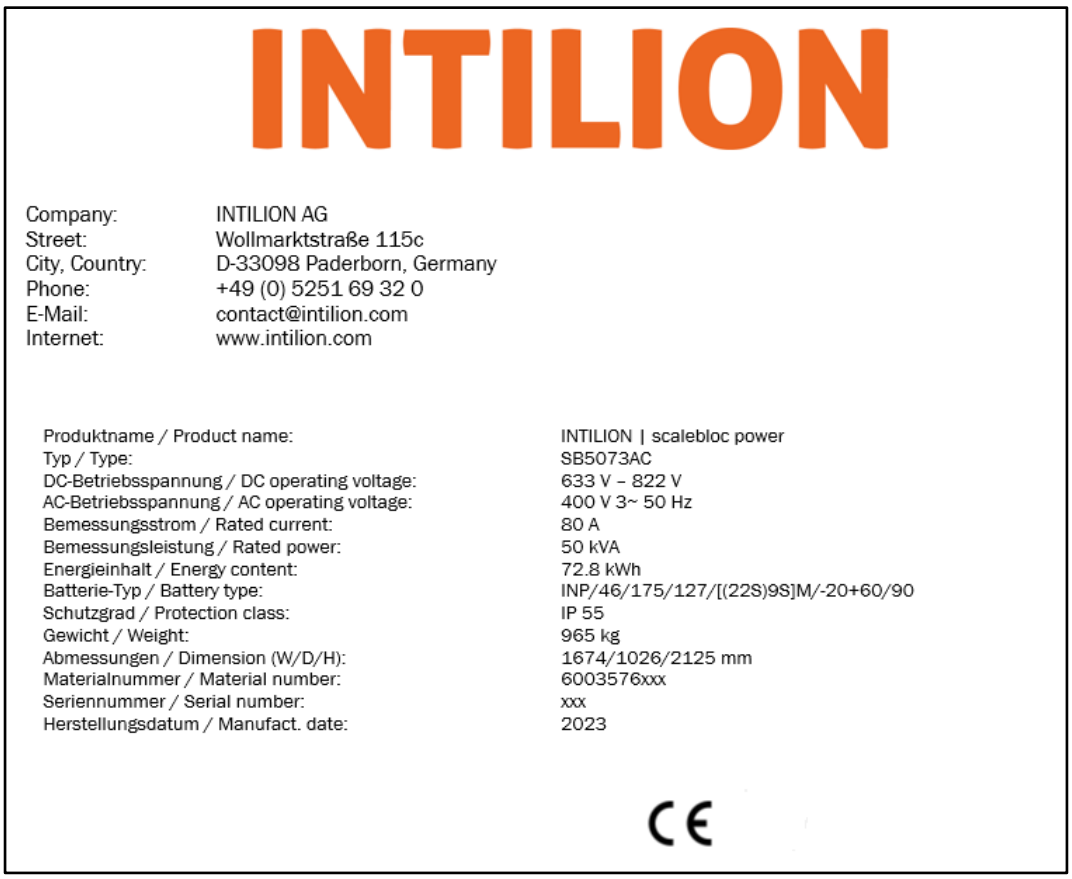


Fig. 8 Nameplate – INTILION | scalebloc energy

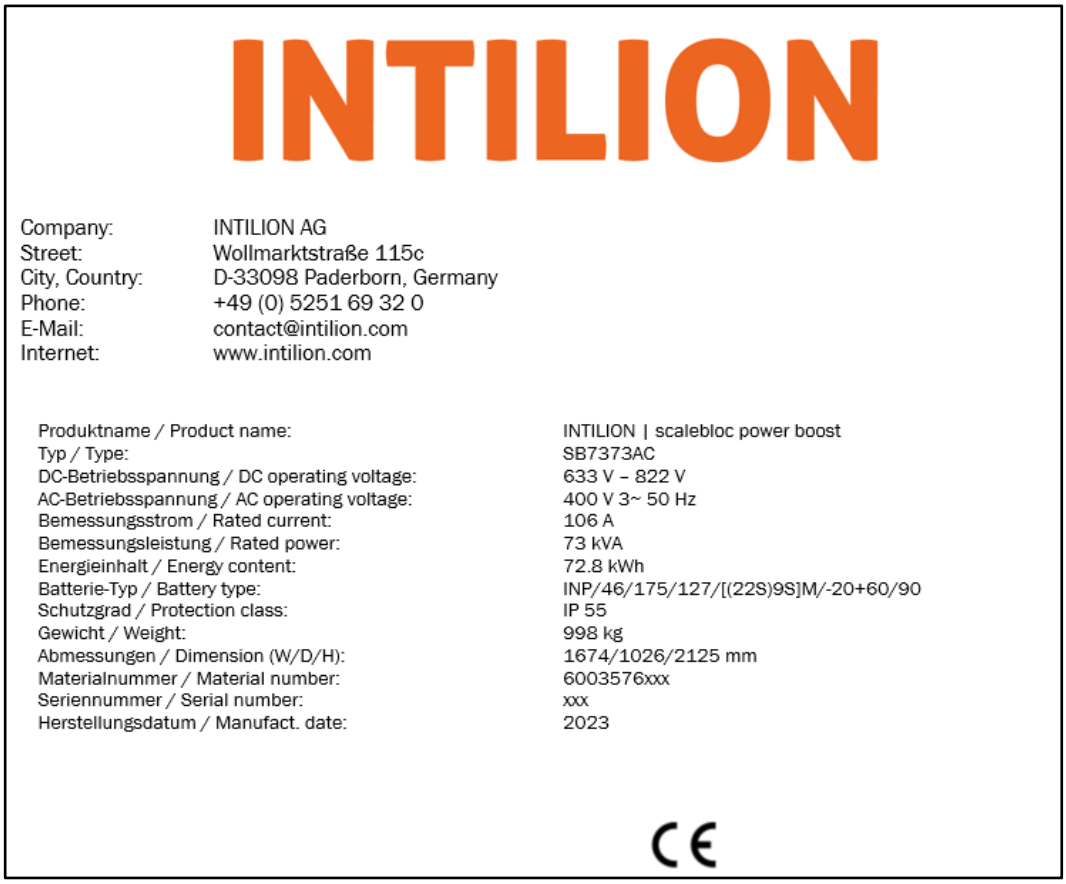

INTILION

Company: INTILION AG
Street: Wollmarktstraße 115c
City, Country: D-33098 Paderborn, Germany
Phone: +49 (0) 5251 69 32 0
E-Mail: contact@intilion.com
Internet: www.intilion.com

Produktname / Product name:	INTILION | scalebloc power
Typ / Type:	SB5073AC
DC-Betriebsspannung / DC operating voltage:	633 V – 822 V
AC-Betriebsspannung / AC operating voltage:	400 V 3~ 50 Hz
Bemessungsstrom / Rated current:	80 A
Bemessungsleistung / Rated power:	50 kVA
Energieinhalt / Energy content:	72.8 kWh
Batterie-Typ / Battery type:	INP/46/175/127/[(22S)9S]M/-20+60/90
Schutzgrad / Protection class:	IP 55
Gewicht / Weight:	965 kg
Abmessungen / Dimension (W/D/H):	1674/1026/2125 mm
Materialnummer / Material number:	6003576xxx
Seriennummer / Serial number:	xxx
Herstellungsdatum / Manufact. date:	2023

CE

Fig. 10 Nameplate – INTILION | scalebloc power


INTILION

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City, Country: D-33098 Paderborn, Germany
Phone: +49 (0) 5251 69 32 0
E-Mail: contact@intilion.com
Internet: www.intilion.com

Produktname / Product name:	INTILION | scalebloc power boost
Typ / Type:	SB7373AC
DC-Betriebsspannung / DC operating voltage:	633 V – 822 V
AC-Betriebsspannung / AC operating voltage:	400 V 3~ 50 Hz
Bemessungsstrom / Rated current:	106 A
Bemessungsleistung / Rated power:	73 kVA
Energieinhalt / Energy content:	72.8 kWh
Batterie-Typ / Battery type:	INP/46/175/127/[(22S)9S]M/-20+60/90
Schutzgrad / Protection class:	IP 55
Gewicht / Weight:	998 kg
Abmessungen / Dimension (W/D/H):	1674/1026/2125 mm
Materialnummer / Material number:	6003576xxx
Seriennummer / Serial number:	xxx
Herstellungsdatum / Manufact. date:	2023

CE

Fig. 9 Nameplate – INTILION | scalebloc power boost

3.1.4 ControlShield 4.0

The ControlShield is the central control unit of the battery storage. If has a variety of functions, like electrical fuse protection, EMERGENCY STOP contacts, uninterruptible power supply for internal peripherals, lightning protection, optional 24 V supply and various connection points for customer systems.

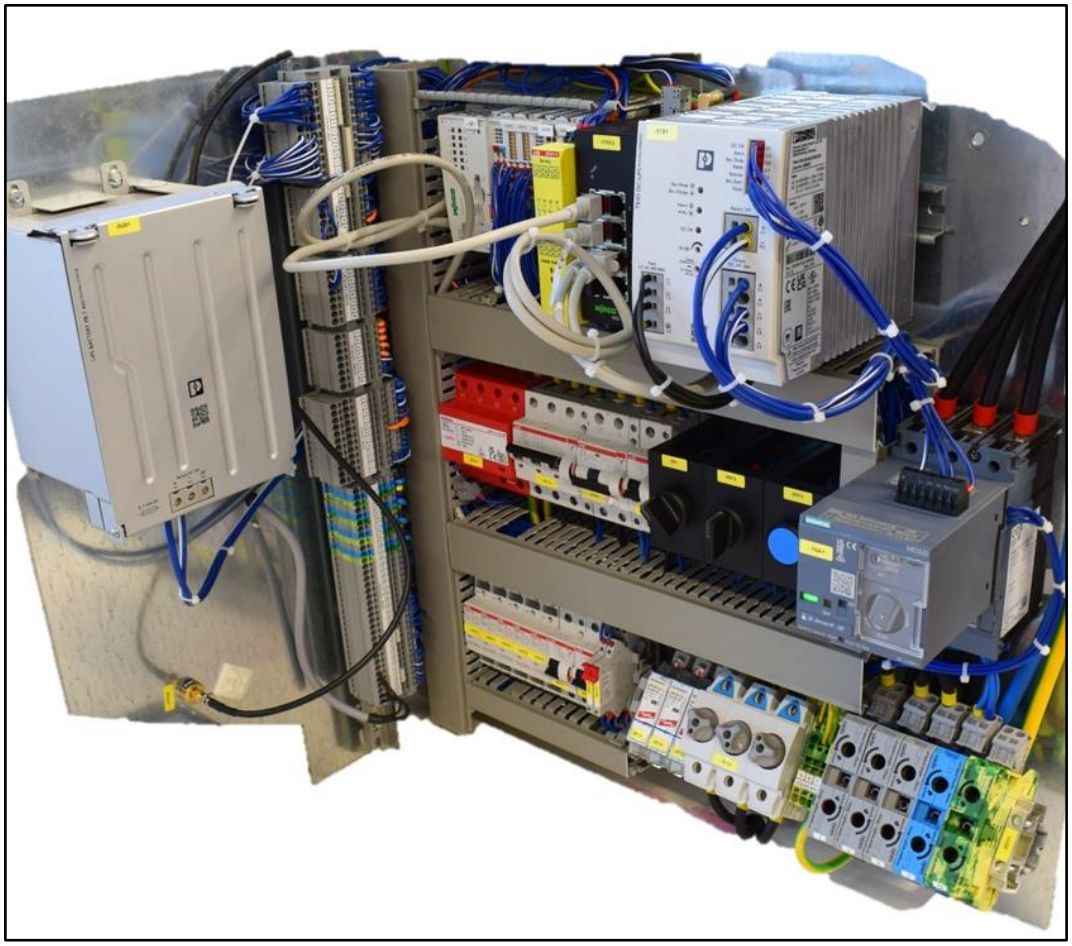

Fig. 11 ControlShield 4.0 (pulled out of the cabinet)

In the following paragraphs, the individual ControlShield elements and their functionality are introduced.

3.1.4.1 The most important controls

Fig. 12 Controls 5S1, 5SF2, 5SF3 in ControlShield right centre

Knob switch 5S1

The knob switch **5S1** has the following switching positions:

Left	The Control Shield's voltage supply is switched off.
Right	When the ControlShield does not have an external voltage supply, then the ControlShield can be started black, if the fuses **5FC1** and **5FC3** are switched on. In that case, the ControlShield starts by means of the internal UPS.

Table 6 Switch positions 5S1

Knob switch 5SF2

The knob switch **5SF2** has the following switching positions:

Left	Manual mode for maintenance and commissioning.
Centre	OFF. The battery and the connection to the grid are disconnected. The system is switched off.
Right	Automatic mode. In the applications „self-consumption optimisation" and „power balancing", the system automatically starts (if an energy meter is mounted and connected correctly). In the application „setpoint specification", the system switches to the „stop" state and can be started using the Modbus interface.

Table 7 Switch positions 5SF2

The knob switch **5SF2** with the integrated LED moreover displays visual status messages of the battery storage:

Operating status of battery storage	Status LED at knob switch 5SF2
Run / standby	Permanent ON
Stop / starting	2 s ON and 0.5 s OFF
Commissioning / SoH calibration / manual mode	Flashing with 0.5 Hz
Warning / error	Flashing with 1 Hz
Critical error / communication error	Flashing with 2 Hz

Table 8 Visual status messages

Pushbutton 5SF3

The blue pushbutton **5SF3** resets the system in case of failure (reset button).

3.1.4.2 Power circuit breaker

Normally, the power circuit breaker **1QA1** does not need to be operated. If the transparent plastic flap on the right-hand side is closed, it is in automatic mode. By opening the flap, the manual mode is activated.

Fig. 13 Power circuit breaker 1QA1 in ControlShield right front

In manual mode, the power circuit breaker cannot be controlled by the Modbus interface. In this state, it is possible to conduct maintenance work on the battery storage.

- The turn switch (behind the transparent flap) activates or deactivates the power circuit breaker, respectively.
- The „TRIP“ display shows the status of the power circuit breaker: 0-OFF and 1-ON.
- The „Lock“ slider secures the power circuit breaker against restart.

3.1.4.3 Circuit breakers

Fig. 14 Lightning protection and circuit breakers in ControlShield central rear

3FA1	Lightning protection
1FB1	Residual current-operated circuit breaker with integrated overcurrent protection (RCBO) for socket
2FC1	Fuse protection of air conditioning
5FC2	Primary fuse protection of power supply unit

Table 9 Functionality of circuit breakers

3.1.4.4 Ethernet ports

Fig. 15 Ethernet ports XF13, XF-14, XF15

XF13	External Modbus TCP/IP interface. See section 6.5.2 for information on configuration.
XF14	Connection of energy meter (in case of master scalebloc, otherwise connection to preceding INTILION | scalebloc).
XF15	Connection to next INTILION | scalebloc.

Table 10 Functionality of Ethernet ports

3.1.4.5 Fuse protections

The internal fuse protection **1FC1** protects the internal components and devices of the ControlShield. The fuses have a rated current of 25 A.

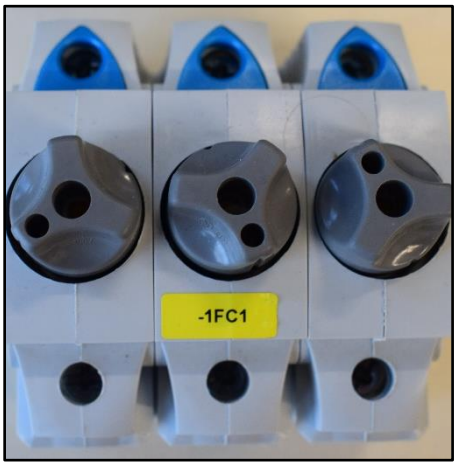

Fig. 16 Melting fuses 1FC1

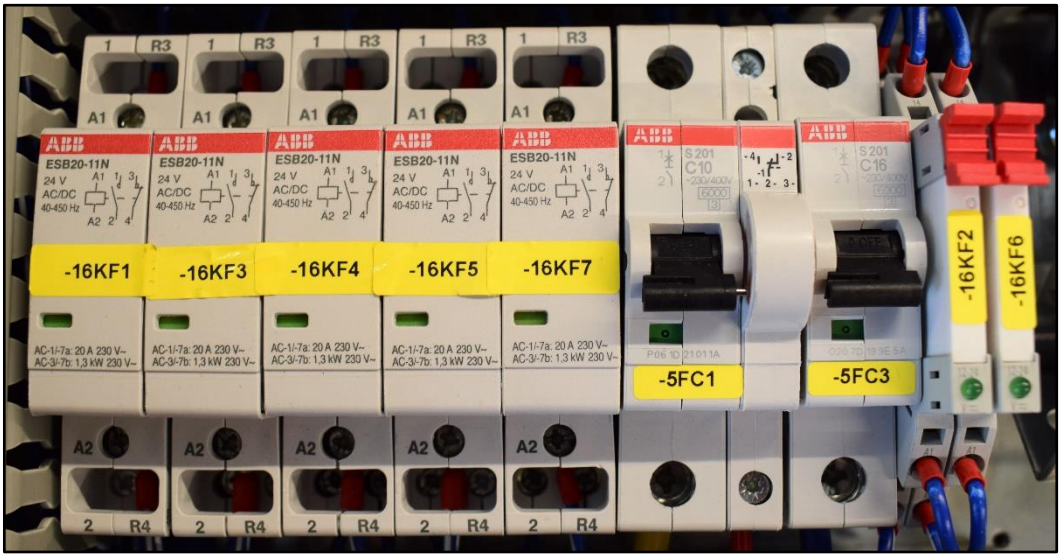

Fig. 17 16KF1, 16KF3, 16KF4, 16KF5, 16KF7, 5FC1, 5FC3, 16KF2, 16KF6

16KF1	Shutdown contactor for inverters and battery management
16KF2	Control of optical and acoustic warning indicator
16KF3 / 16KF4	Switch-on and switch-off contactor for control of power circuit breaker 1QA1
16KF5	Contactor for air conditioning unit
16KF6	Shutoff relay for UPS
16KF7	Contactor for battery fan
5FC1	Protection of UPS battery
5FC3	Secondary protection of power supply unit

Table 11 Functionality fuse protections

3.1.4.6 Main terminal

XD11 is the main terminal. The terminals can hold cables up to 70 mm² cross-section (in the version „fine-wire conductor without ferrule“). For all other conductors, the maximum cross-section is 50 mm² (WAGO POWER CAGE CLAMP 50.00 mm²).

The terminals are mounted to the cabinet at an angle to facilitate wiring.

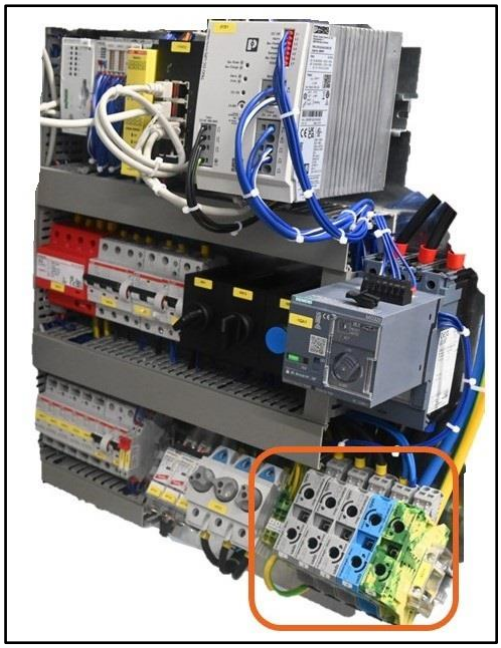

Fig. 18 XD11 Main terminal

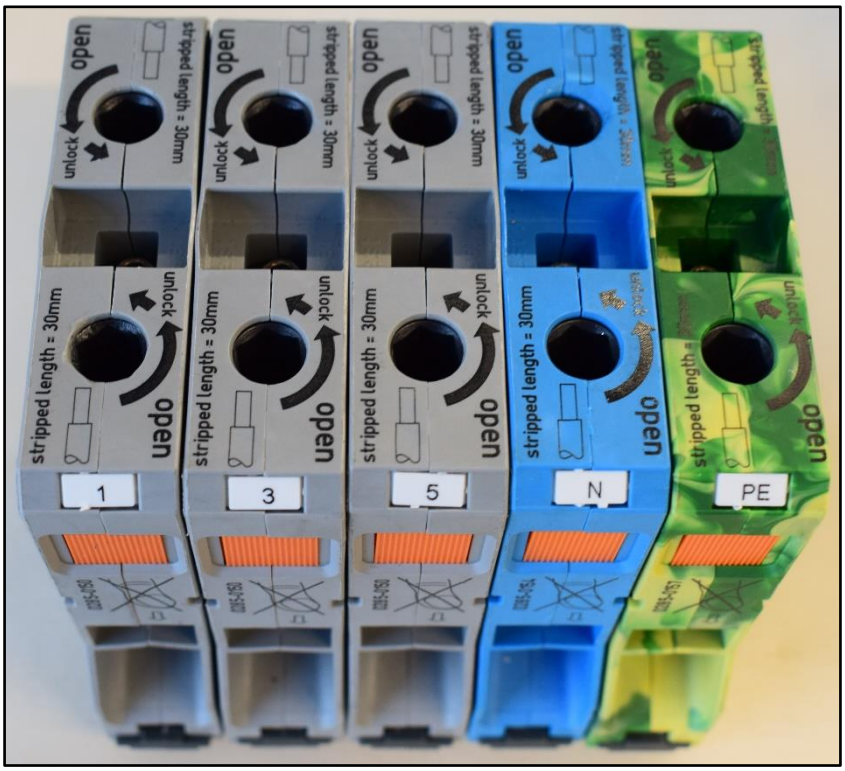

Fig. 19 XD11 Main terminal (close-up)

3.1.4.7 Uninterruptible Power Supply (UPS)

At the back of the cabinet, there is the uninterruptible power supply. The UPS has a 7 Ah battery unit. In case of a power failure, it supplies the ControlShield with 24 V auxiliary voltage for the controls and protection units of the battery storage. The UPS also enables the battery storage for black starting (independent start-up including islanding) of INTILION | scalebloc. When the UPS is active, the battery fans are switched off and the control unit generates a warning.

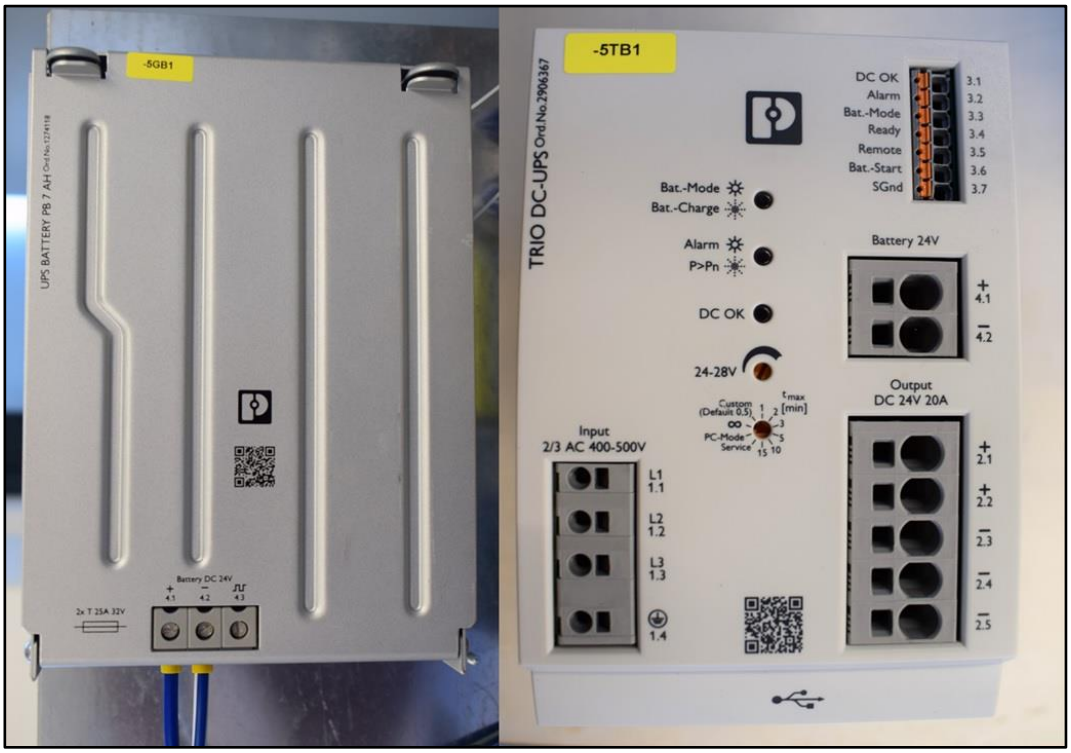

Fig. 20 UPS unit (battery and control)

3.1.4.8 Terminal strips

Also at the back, next to the UPS unit, the terminal strips are mounted vertically (see following illustrations, from top to bottom):

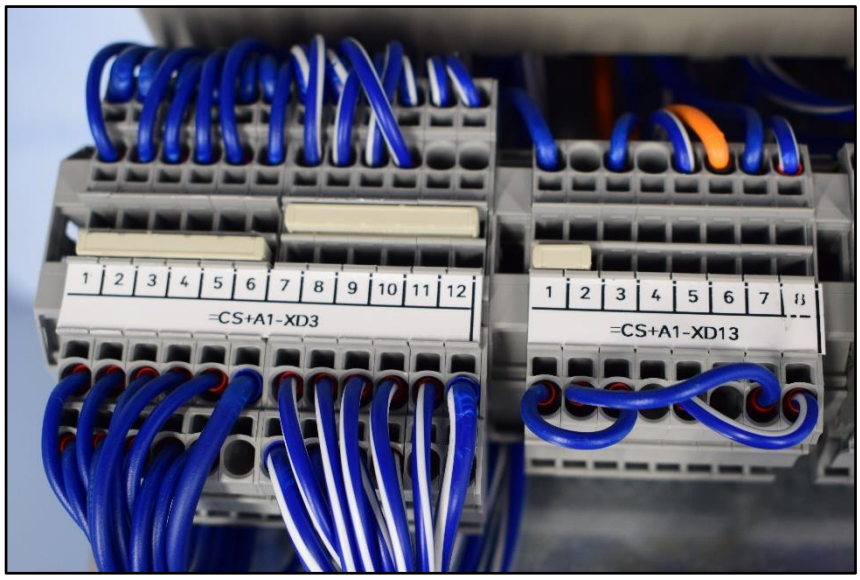

Fig. 21 Terminal strips XD3 + XD13

XD3	24 V supply
XD13	Customer connectivity
XD13.1 and XD13.3	Auxiliary contact for connection of grid and plant protection (NC contact)

Table 12 Functionality XD3 + XD13

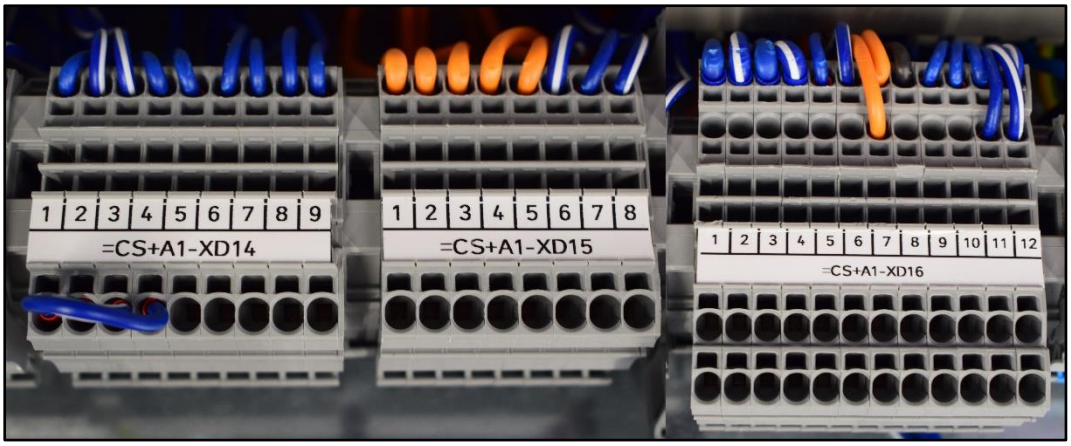

Fig. 22 Terminal strips XD14 + XD15 + XD16

XD14.1 and XD14.4 **XD14.2 and XD14.3**	EMERGENCY STOP contacts
XD14.5	Digital input for islanding
XD15	Control line for optionally subsequent scaleblocs
XD16	Connection of inverter(s) and batteries
XD31	Connection of internal peripherals

Table 13 Functionality XD14 + XD15 + XD16 + XD31

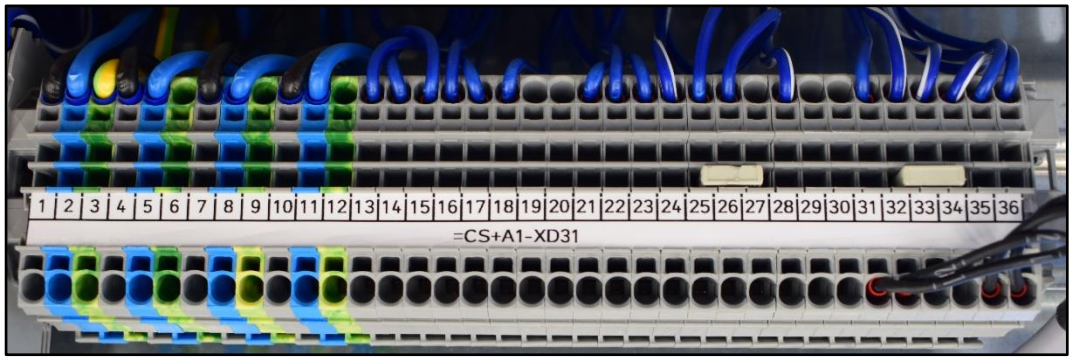

Fig. 23 Terminal strip XD31

3.1.5 Safety devices

3.1.5.1 Smoke detector

Fig. 24 Smoke detector

If the optical smoke detector triggers, the battery modules are disconnected on the DC side by opening the contactors in the battery management system and the entire battery storage system is disconnected from the grid on the AC side by opening the circuit breaker in the ControlShield.

At the same time, the optical and acoustic alarm starts – the signal horn sounds continuously, and the signal lamp lights up permanently.

3.1.5.2 Door contact switch

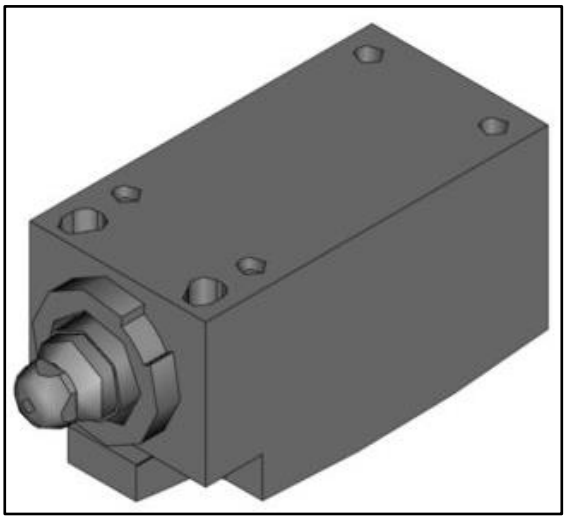

Fig. 25 Door contact switch

The door contact switch monitors the doors of the battery storage. If the doors are opened, air conditioning is switched off.

If the doors are open for more than 30 minutes, the system will shut down. This condition is signalled by the alarm – a short, repeating sound of the signal horn and a short, repeating flashing of the signal light.

Once the doors are closed again, the air conditioning must be reset, and the system must be restarted by a reset (see chapter 7).

3.1.5.3 Warning indicator

Fig. 26 Warning indicator

The visual and audible alarm signals error conditions of the system (e. g. the doors being open for more than half an hour, the smoke detector being triggered).

The signal colour is red. The acoustic signal is a constant warning tone when the smoke detector is triggered. When the doors are open, on the other hand, the acoustic signal is a recurring, short tone.

The warning indicator is attached to the battery storage unit in the delivery state in a position rotated by 90° and is ready mounted on site (see section 0).

3.1.5.4 Emergency stop contacts

The ControlShield has terminals where an emergency stop switch or an emergency stop circuit / safety circuit can be connected.

If this circuit is interrupted, the battery storage unit is disconnected from the grid via an integrated circuit breaker and set to a fused state. If no such disconnection is desired, the corresponding terminals must be bridged. These bridges are provided as factory default.

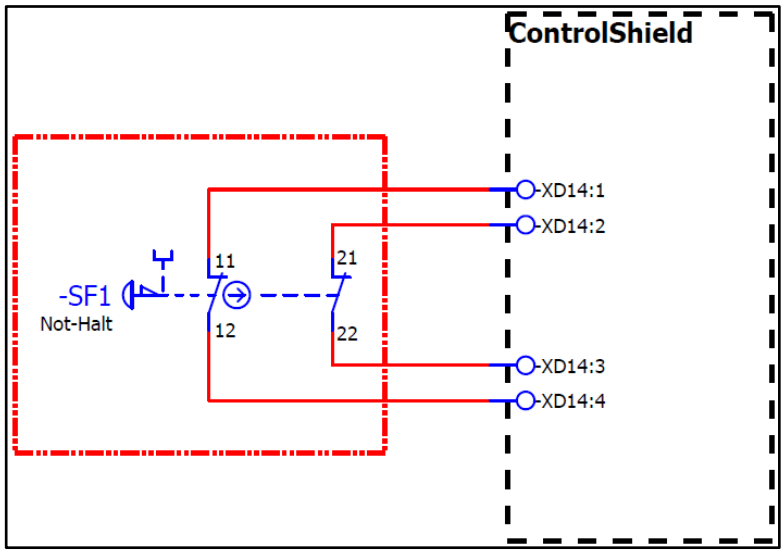

Fig. 27 EMERGENCY STOP contacts

3.1.5.5 Grid and plant protection

The grid and plant protection required by VDE-AR-N 4105:2018 consists of a grid and plant protection relay (monitoring of grid voltage and frequency) and a tie switch controlled by the relay. To meet redundancy or single-fault safety requirements, either two contactors can be connected in series, or the second dry contact of the NA protection relay can be used as a feedback contact for the battery storage. The relay's dry contact must be connected to terminals XD13.1 and XD13.3 of the ControlShield. All information about the connection of the system and the wiring can be found in the "General connection diagram", which is available on request from INTILION AG available on request.

3.1.5.6 Fire protection housing

The fire protection enclosure is a mechanical housing for accommodating battery modules with prismatic cells. Prismatic lithium-ion cells have a so-called venting valve, which opens in the event of thermal breakdown of the cell.

In the event of thermal breakdown of a cell and possibly a propagation to other cells of the battery module, the fire protection enclosure ensures that

- the gases produced in the process do not self-ignite or lead to an explosion due to the flying sparks from the lithium-ion cells
- parts do not fly around
- surrounding battery modules are protected from propagation of the fire

3.1.5.7 Flue gas duct

The optional flue gas venting duct (not included in the scope of delivery) is intended for retrofitting of the indoor version. Before an indoor installation it is mandatory to consult INTILION AG.

WARNING

Risk of injury!

The targeted discharge of resulting flue gases through the flue gas vent is mandatory when installing the battery storage inside buildings.

- To do this, run piping to the outside above the degassing opening below the air conditioner.
- If you have any queries, please contact your specialist installation partner.

The flue gas vent sits in the base of the battery storage unit and is connected to the inside of the control cabinet. Any gas escapes to the outside via the flue gas vent channel in a targeted manner, so that effects on the system and the immediate environment due to the escaping gas are avoided.

The removal of flue gases (e. g. through a chimney), if necessary, is the duty of the operator.

3.1.5.8 Reload algorithm

To protect the battery modules from deep discharge, the battery storage unit must be permanently connected to the grid, even when not in use. If the applications self-consumption optimisation or peak shaving are enabled, then the battery storage recharges itself automatically in case of low battery voltage until it is back within the normal voltage range.

If the external setpoint specification application is enabled, this automatism does however not work. You have to prevent deep discharge of the batteries by suitable programming.

3.1.5.9 Safety-related shutdown – error messages

The battery storage has an internal monitoring of the system parameters. If parameters are outside the specified value range, errors are generated. There are three distinct categories of error messages:

1. **Warning**

   If the battery storage is in the "Warning" state, the system is still ready for operation, but certain system functions may be impaired. After the warning has been rectified, the system continues to run automatically.

2. **Error**

   If the battery storage is in the "Error" state, the charging and discharging power is limited. After the error has been rectified, the system continues to run automatically.

3. **Critical**

   If the battery storage is in the "Critical" state, no energy can be charged or discharged. After eliminating the critical error, the system must be reset. In the event of a critical error, the battery storage is disconnected from the grid on the AC side as well as from the batteries on the DC side.

3.1.5.10 Safety-related power reduction of the system

In addition to the error messages, exceeding or falling below certain limit values of system parameters leads to a reduction of the available power. These dependencies are explained below.

Cell temperature

In each of the battery modules, the temperatures of the installed battery cells are recorded at two points. If the minimum cell temperature is less than 5 °C or the maximum cell temperature is greater than 50 °C, based on all modules, no more power is available. In the temperature range from 10 °C to 5 °C, the maximum power is reduced linearly to 0 kW. The same happens in the range from 45 °C to 50 °C. The following graphic illustrates this dependency.

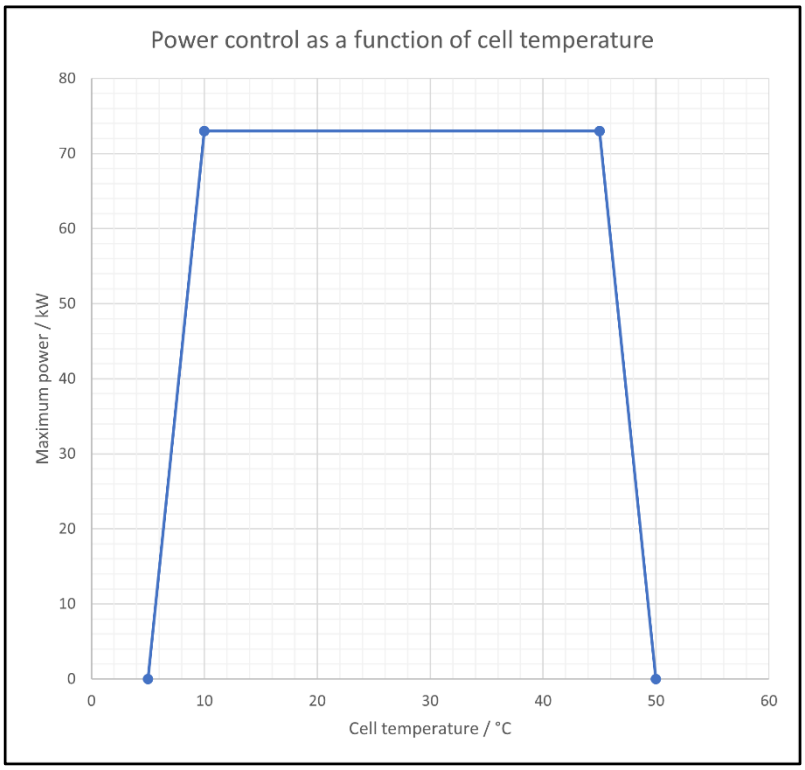

Fig. 28 Available power as a function of cell temperature

If the temperature difference of the minimum and maximum cell temperature, spanning all modules, is greater than 10 °C, then the batteries can no longer be charged nor discharged.

Cell voltage

Each individual cell voltage is measured. At a minimum cell voltage of less than 3.2 V or a maximum cell voltage greater than 4.155 V, no more power is available. In the ranges from 3.25 V to 3.2 V and 4.15 V to 4.155 V, the maximum available discharge or charge power is reduced linearly to 0 kW.

Battery voltage

The total voltage of all battery modules connected in series (battery system voltage) is measured. If the minimum battery voltage is less than 635 V or the maximum battery voltage is greater than 817.6 V, no more power is available. In the lower voltage range from 645 V to 635 V and in the upper voltage range from 815.7 V to 817.6 V, the maximum available discharge or charge power is reduced linearly from the maximum battery power to 0 kW (see Fig. 93).

Battery SoC

In the lower range from 0.6 % to 0 % and in the upper range from 99.4 % to 100 % of the battery state of charge, the maximum available discharge or charge power is reduced linearly from the maximum battery power to 0 kW.

Room temperature

In each battery storage unit, the temperature inside the control cabinet is measured at three points (in the upper and middle area of the centre bar and in the exhaust duct of the air conditioning unit). The humidity in the cabinet is measured likewise.

If the minimum internal temperature is less than 5 °C or the maximum temperature is greater than 50 °C, power is no longer available. In the lower temperature range from 15 °C to 5 °C and in the upper temperature range from 40 °C to 50 °C, the maximum available power is reduced linearly to 0 kW. If the difference between the two measured temperatures is greater than 10 °C, power is no longer available.

3.2 Operating modes

The battery storage system can be operated in grid-parallel (normal operation on the grid) and grid-forming (stand-alone operation) modes.

Switching between the two operating modes is possible via the Modbus interface or the dry contact (DI) at XD14.5 (see Fig. 22) of the battery storage (see also section 7.2).

In grid-forming operation, the battery storage system independently builds up a grid.

3.2.1.1 Grid-connected operation (GCO)

In normal operation (grid-connected operation), voltage and frequency are set by the public grid and the current is impressed to generate the required effective and reactive power.

The battery storage unit is designed for the following applications in this operating mode:

- External setpoint specification
- Self-consumption optimisation
- Peak shaving (power balancing)

For more information on the applications in grid-connected operation, see section 6.7.1.

3.2.1.2 Grid-forming operation (GFO)

In grid-forming operation (also called islanding or stand-alone), voltage and frequency are formed by the battery storage system according to the pre-set reference values. The connected loads and generators set the resulting effective and reactive power in the stand-alone grid.

The dependencies of frequency f to effective power P and voltage U to reactive power Q result from the P-f characteristic and the Q-U characteristic.

For more information on grid-forming operation, see sections 6.7.2 and 7.3.

3.3 Technical data

	INTILION | scalebloc energy	INTILION | scale-bloc power	INTILION | scalebloc power boost
General data			
System type	AC-coupled battery energy storage system (BESS) in air-conditioned IP55 outdoor control cabinet		
Scalability	Up to 4 INTILION | scaleblocs connected in parallel (retrofittable) [1]		
Operating mode	Grid-connected operation (GCO), grid-forming operation (GFO) [2]		
Applications	Setpoint specification, self-consumption optimisation, load peak shaving		
Communication standards	Modbus TCP/IP, cloud connection via LTE		
Compatible EMS	Smart1, Solar-Log Base, Wago Application Customer Substation, Meteocontrol, others on request		
Application areas	Peak shaving, self-consumption optimisation, pre-charge storage electromobility, control via external EMS, emergency power systems		
Electrotechnical data			
Energy content, nominal	72.8 kWh		
Energy content, usable	65.6 kWh (90 % DoD)		
Voltage, nominal	400 V AC (3L, N, PE), 50 Hz		
Grid type [3]	TN-S, TN-C-S, TT		
Power, nominal	25 kVA	50 kVA	73 kVA
Current, nominal	37 A	74 A	106 A
Initial short-circuit alternating current I_k" (GCO)	45.6 A	91.2 A	136.8 A
Max. short circuit current (GFO)	300 % of P_{nom}		
Overload capacity (GFO) [4]	150 %	150 %	125 %
Asymmetrical load (GFO)	25 % of P_{nom}		
Minimum pre-fuse protection	63 A	100 A	125 A
Lightning protection class	Class 1 & 2		
Battery data			
Cell type	Lithium-ion (NMC), prismatic, 100 Ah		
Cell arrangement in the system	198S1P		
Voltage, nominal	729 V DC		
Design data			
Ambient temperature	–20 °C to +50 °C [5]		
Installation height	Max. 2000 m NN (higher installation sites on request)		
Weight (approx.)	935 kg	965 kg	998 kg
Dimensions (H x W x D)	2125 mm x 1674 mm x 1026 mm		
Max. connection cross section	5 x 50 mm²		
Noise emission	< 35 dB(A)(5 m) with optional sound insulation hood		

[1] Parallel connection of five or more INTILION | scaleblocs as well as retrofits on request

[2] Grid-forming operation mode only for 1 BESS possible

[3] Other grid types on request

[4] For dynamic load/generator connection < 1 min at nominal voltage 230 V AC

[5] At temperature extremes (between -20° C and -10° C as well as between +35° C and +50° C) capacity may be derated. Avoid direct solar radiation, if necessary, use solar shield.

	INTILION | scalebloc energy	INTILION | scale-bloc power	INTILION | scalebloc power boost
Performance			
Expected cycles to 70% SoH *[5]	>8000 (@90 % DoD), >9000 (@70 % DoD), >10000 (@50 % DoD)		
Intended service life	15 years		
Performance guarantee	10 years or 5000 cycles on the battery		
Norms & standards			
EU Directives	2014/53/EU (RED), 2014/30/EU (EMC), 2014/35/EU (LVD), 2006/66/EC (BAT Directive)		
Norms & standards	EN 61000-6-2, EN 61000-6-4, EN 62040-2, EN 61439-1, EN 61439-2, EN 62109-1, EN 62619, UN 38.3, VDE-AR-E 2510-50 6.2.6, VDE-AR-N 4105, VDE-AR-N 4110, EN 50549-1, TOR producer type A & TOR producer type B, UNE 217002:2020, UNE 206007-1:2013, UNE 206006:2011		

Table 14 Technical data – Battery storage INTILION | scalebloc

4 Transportation and storage

The transportation of the battery storage is carried out according to the regulations and under the supervision of INTILION AG by INTILION AG or by personnel trained and commissioned by a distribution partner .

NOTICE

In order to ensure the correct installation and thus the functional safety of the battery storage unit, the personnel provided must follow the instructions of INTILION AG or the trained and authorized personnel.

The battery storage is delivered by INTILION AG, by trained and authorized personnel or by an authorized freight company to the customer.

If the location of the battery storage unit is changed, please contact INTILION AG for information on the transportation and observe the following instructions.

4.1 Battery modules

The battery modules may only be transported and stored in the original packaging or in packaging that complies with the applicable guidelines.

Symbols on the packaging must be observed. The battery modules must not be removed from the packaging until shortly before they are inserted in the racks.

Make sure that the battery modules are protected from the weather and from access by unauthorized persons.

NOTICE

If the battery storage is put away for a long time or shut down, deep discharge of the battery modules is possible. Make sure that the ambient temperature is 23 °C and the SoC is in the range of 20 % to 30 % at the beginning. Thereafter, check the condition of the battery modules monthly by measuring the battery voltage. Make sure that the battery storage does not remain in the switched-off state for longer than four months.

In case of improper storage of the battery system, no liability will be assumed for any resulting damage!

5 Installation

The installation of the battery storage is carried out according to the instructions and under the supervision of INTILION AG, by INTILION AG or by personnel trained and commissioned by a distribution partner.

Before an indoor installation it is mandatory to consult INTILION AG.

NOTICE

In order to ensure the correct installation and thus the functional safety of the battery storage unit, the contracted personnel must comply with the instructions of INTILION AG or the trained and authorized personnel.

In case of relocation of the battery storage unit, contact INTILION AG for information on transport. Unless otherwise notified, the transport conditions from chapter 4.

5.1 Notes on hazards during installation

The installation may only be conducted by appropriately qualified and instructed personnel and in compliance with all safety instructions.

The installation may only be conducted by personnel who have the WLE training qualification.

- Wear the necessary personal protective equipment (protective work clothing, safety shoes, protective gloves, and a hard hat) when working.
- Keep the work area neat and tidy.
- During installation, observe the five safety rules (see section 2.6.2).

5.2 Choice of site

If possible, position the battery storage unit with the front doors facing north. This position is thermally more efficient for the battery storage unit, as the double-walled side walls can more easily release the heat caused by solar radiation due to the chimney effect.

WARNING

Risk of injury!

Different hazards emanate from the battery storage.

- Do not put the battery storage in places where there are permanently many people.
- The spacing of the battery storage is based on the local conditions.

WARNING

Hazards due to external influences!

External influences, e. g. flooding or mechanical impacts (e. g. collision with vehicles), can cause hazards.

- Do not place the battery storage in floodplains and in risk areas outside floodplains.
- Do not install the battery storage unit in earthquake areas classified as 1 to 3 according to DIN EN 1998-1/NA:2011.
- Install the battery storage only up to a maximum altitude of 2000 m above sea level.
- Keep your distance from traffic routes.
- Protect the battery storage unit with a bumper (e. g. bollard, edge or similar) if it is installed in urban areas or in places where vehicles are also moved. Keep a minimum distance of 1300 mm.
- We recommend securing the area around the battery storage unit against unauthorized access, for example with a fence.

WARNING

Risk of injury due to lack of space!

There is a risk of injury because of work equipment and/or components being arranged too densely.

The installation location of the battery storage must be chosen in such a way that the required movement space of the personnel in the working area is not restricted or obstructed.

- Close off the danger area.
- Keep unauthorized persons away.
- Designate a responsible person.
- Lay power supply lines so that they are free of trip hazards and barriers (e. g. in cable ducts).
- Mark unavoidable trip hazards.

- When selecting the installation site, consider the necessary maintenance areas.

The free space around the battery storage should not fall below the specifications in the following exemplary graphic:

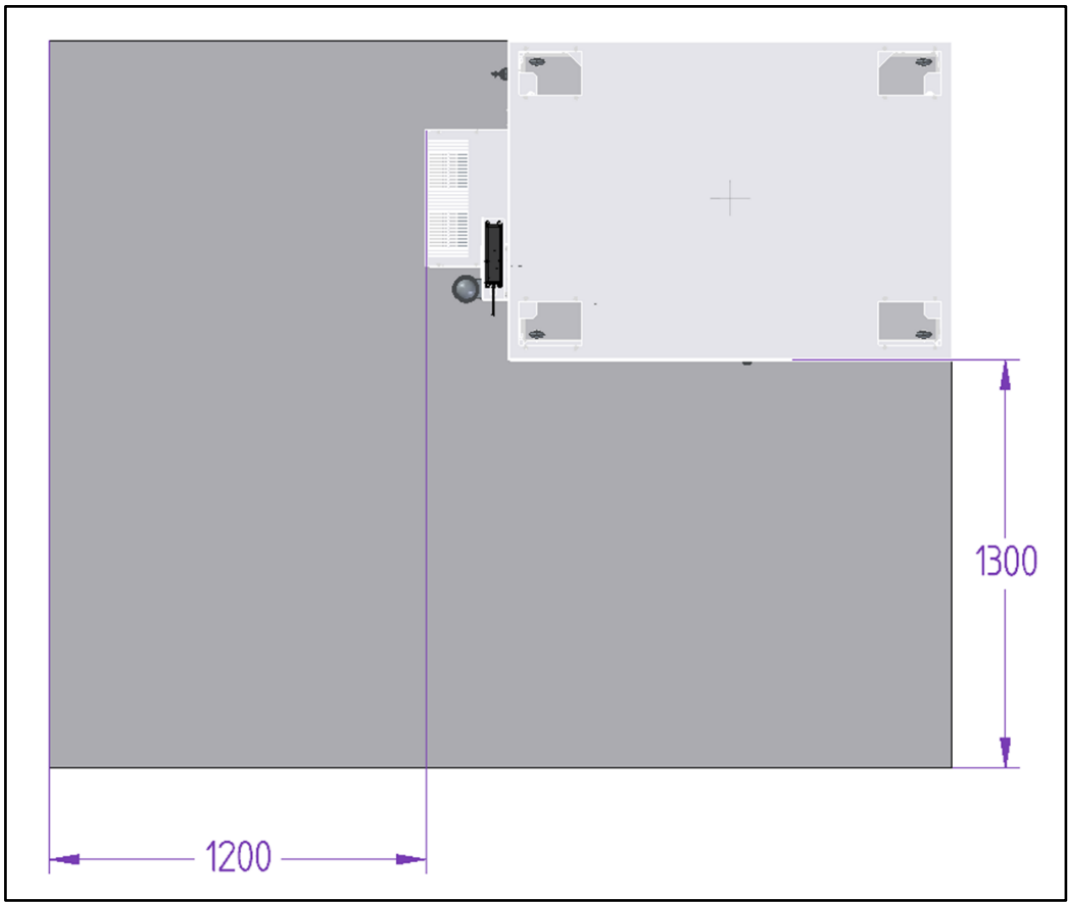

Fig. 29 Maintenance areas

5.2.1 Requirements for the installation site

WARNING

Loss of stability

Loss of stability can lead to considerable risk of injury.

– The footprint must be level.

– The foundation must have the necessary load-bearing capacity of at least 1 t/m².

– The operator is responsible for the statics of the foundation.

▪ Please contact INTILION AG or a distribution partner regarding the foundation regulations.

5.3 Preparatory measures

Before installing the battery storage unit, make sure that

- the foundation is prepared according to the specifications and provided with a foundation earth electrode
- the connections on the AC distributor side are prepared
- the necessary tools for installation are ready

5.4 Unmounting from the transport pallet

The battery storage unit is delivered on a transport pallet. Before unloading, the fastening screws must be removed.

- Unscrew the fastening screws (1) at every corner.

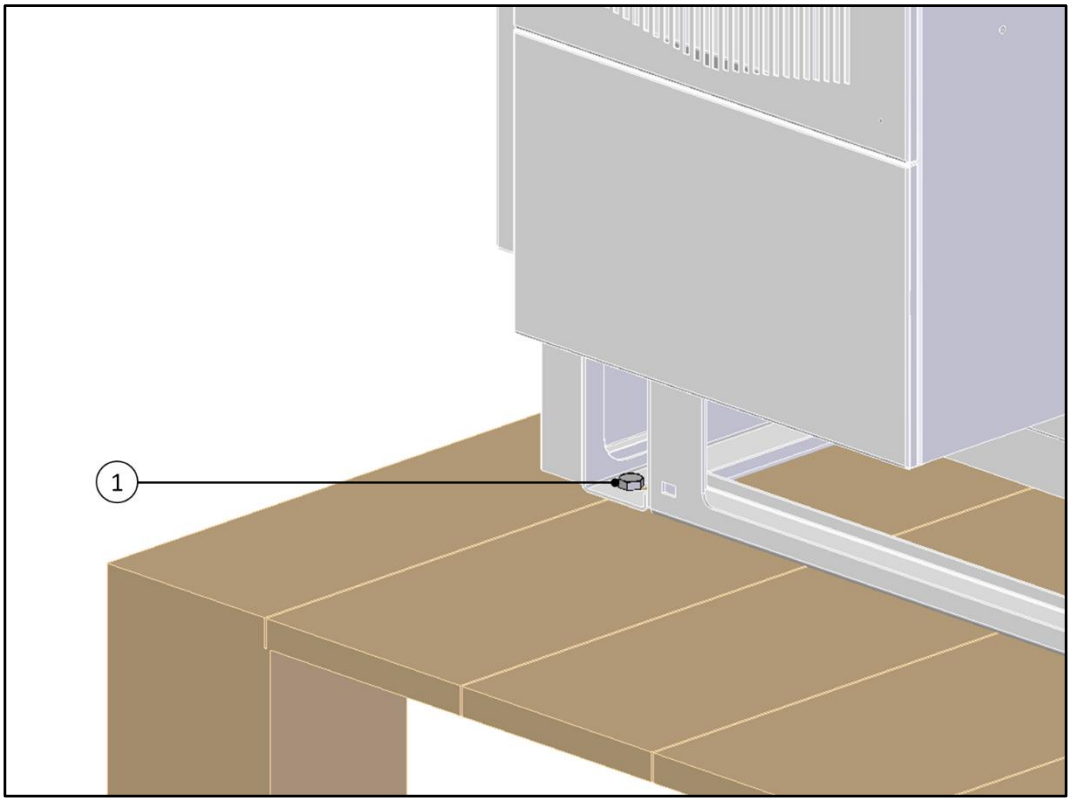

Fig. 30 Removing the fastening screws

- Remove the base plates (1) to (5) – if necessary.

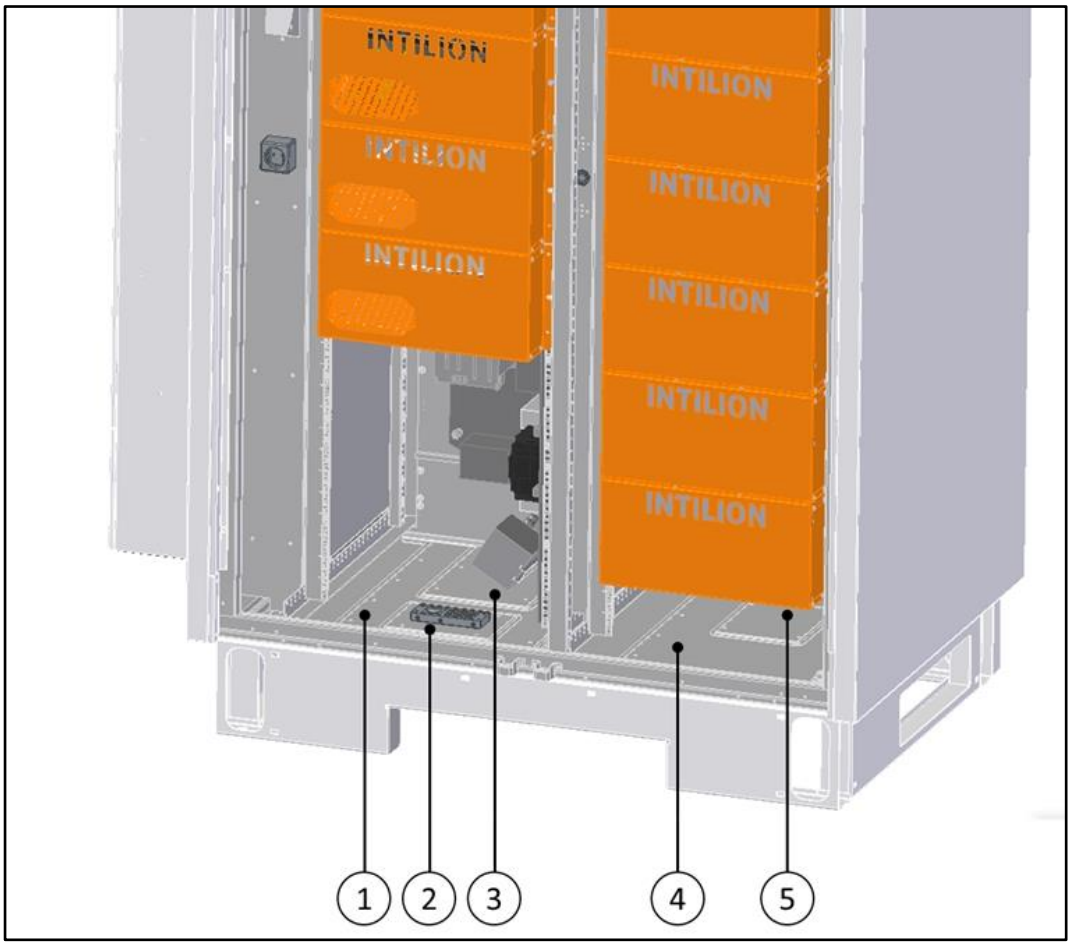

Fig. 31 Disassembly of the transport pallet – removal of the base plates

On the side of the air conditioner there are three base plates (1) to (3). On the side opposite of the air conditioner there are two base plates (4) and (5).

5.5 Fastening the battery storage to the foundation

The following graphic shows the technical drawing of the base for the INTILION | scale-bloc variants energy, power, and power boost. The drilling dimensions for fastening the anchors (slotted holes) can be taken from it.

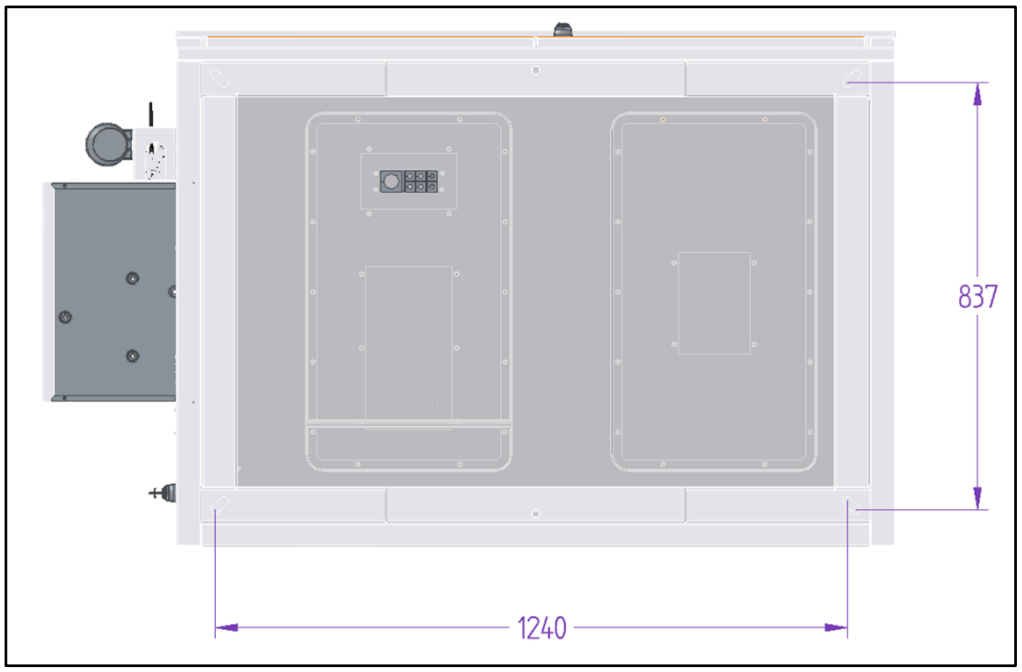

Fig. 32 Base (for 200 mm base height)

5.5.1 Security

Observe the following safety instructions when transporting the battery storage unit or components:

- The battery storage unit or components may only be transported by appropriately qualified and instructed personnel (forklift/crane operator with certificate of competence) and in compliance with all safety instructions.
- When selecting suitable lifting devices and load handling attachments, always consider the weight of the heaviest component.
- If the battery storage unit is lifted at the slinging points, the lifting device must be designed to support a weight of 1000 kg at a height of 3 m.
- Wear the required personal protective equipment (protective work clothing, safety shoes, protective gloves, high-visibility vest, and a hard hat) during work.
- Always secure the transport route with an additional person.
- Keep the work area neat, tidy, and free of tripping hazards.
- Make sure that there are no persons in the travel path or under suspended loads.
- Do not use any piping or attachments as lifting points. Only lift the battery storage unit at the points provided.
- Always lift the battery storage slowly and carefully to ensure stability and safety. Guide the battery storage e. g. through a rope to avoid swinging and turning.
- Lift the battery storage only when external conditions, such as wind, allow it in a safe manner.

5.5.2 Permitted aids for transport

Lifting aids (e. g. shackles, hooks, chains, ropes, and belts) must be selected according to the transport weight of the battery storage unit and must only be attached to the attachment points provided for this purpose. Only use tested aids.

Avoid contact of the supporting chains or ropes with the battery storage unit. If this is not possible, take appropriate precautions to prevent damage to the battery storage unit.

Adjust the length of the carrying means so that the battery storage unit can be transported upright.

5.5.3 Attachment points

On top of the battery storage in the four corners, there are ring screws (“attachment points”) that can be used to lift and load the battery storage. The ring screws sit under the cover plates.

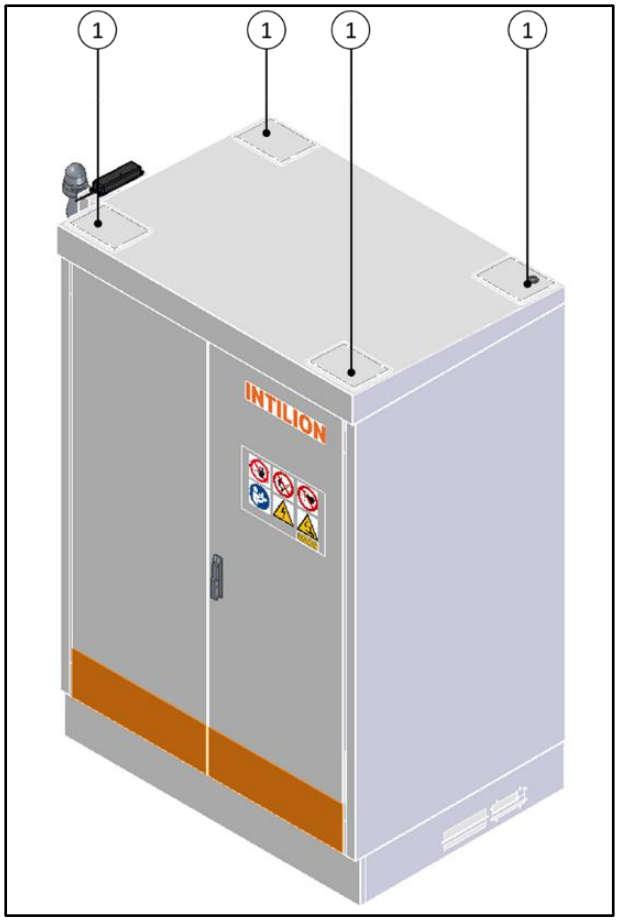

Fig. 33 Attachment points on top of battery storage

- Remove the covers – if present – from the attachment points (1) and attach the shackles or hooks to the ring screws.

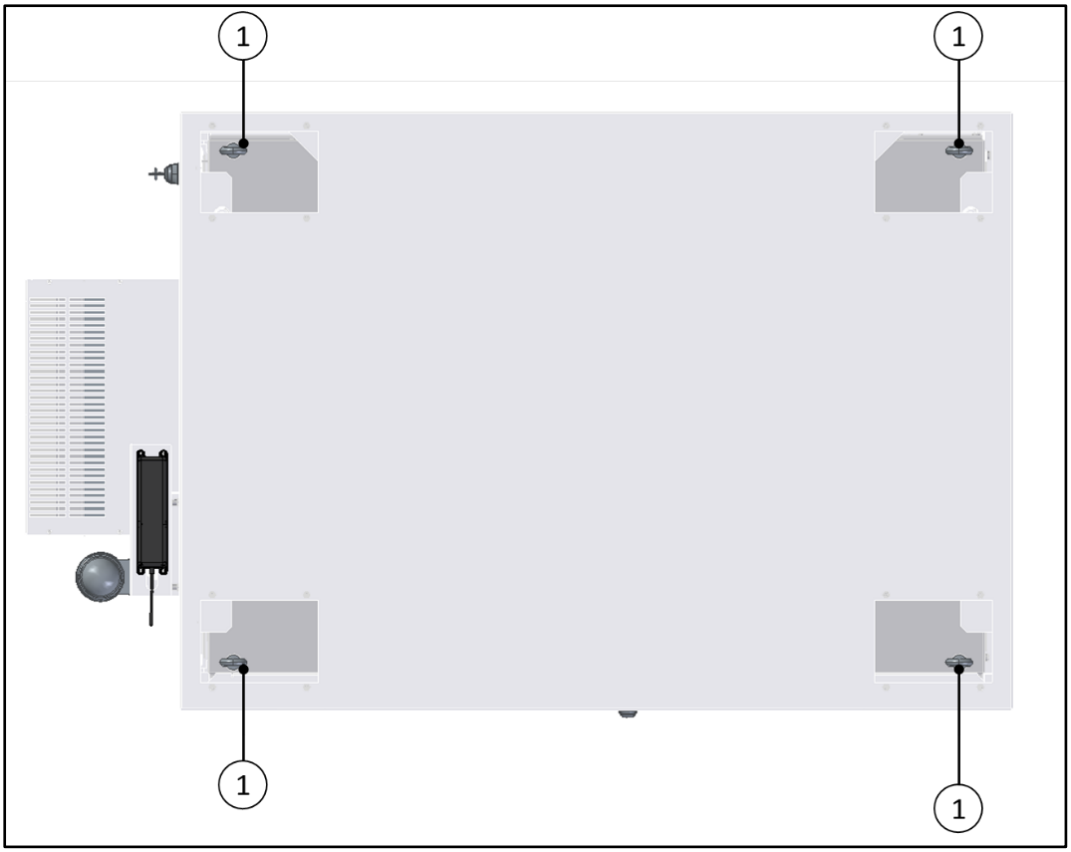

Fig. 34 Removing the cover plates from the attachment points

5.5.4 Unloading, placing, and fixing the battery storage unit

As standard, the battery storage unit is positioned with the aid of a crane. In addition, the battery storage can be placed in its final position using a forklift truck.

WARNING

> **Risk of injury!**
>
> Different hazards can occur when unloading the battery storage.

If the battery storage unit is lifted at the slinging points, the lifting device must be designed to support a weight of 1000 kg at a height of 3 m.

- Wear the required personal protective equipment (PPE) (protective work clothing, safety shoes, protective gloves, high-visibility vest, and a hard hat) during work.
- Always secure the transport route with an additional person.
- Keep the work area neat and tidy.
- Make sure that there are no persons in the travel path or under suspended loads.
- Always lift the battery storage slowly and carefully to ensure stability and safety. Guide the battery storage e. g. through a rope to avoid swinging and turning.
- Only lift the battery storage if the external circumstances allow this in a safe manner (no wind etc.).
- When unloading the battery storage unit with the forklift, make sure that all four base panels are removed.
- The battery storage unit can then be lifted with a forklift, lift truck or similar.
- The pedestal front panels are to be loosened at the four screws and pushed to the left for removal.
- The side panels are loosened by sliding them forward.
- Then loosen the rear panel by sliding it to the left (looking towards the rear of the battery storage unit).

Assembly is conducted in reverse order.

- Lift the battery storage unit from the transport pallet and place it on the foundation.

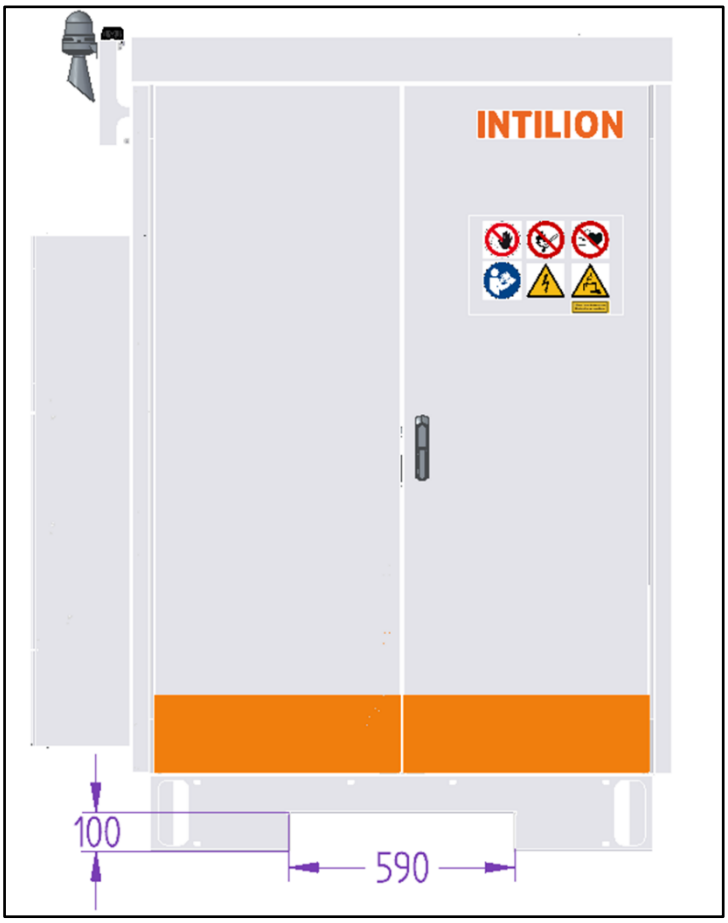

Fig. 35 Forklift receptacle

- Remove the shackles or hooks.
- Fasten the covers for the stop points.
- Tighten the screws with a tightening torque of max. 5 Nm.
- Screw the battery storage unit to the foundation. The tightening torque depends on the screw/anchor size used. For an M10 thread, the tightening torque must be at least 45 Nm.
- If removed, attach the base plates (4) and (5) (see Fig. 31).

5.6 Earthing the battery storage

In accordance with the requirements of VDE 0100-540 “Selection and erection of electrical equipment – Earthing arrangements and protective conductors” in the low-voltage grid, the earth electrode of the battery storage unit must be connected to the foundation earth.

If there is no foundation earth electrode, the earth electrode in the base must be connected to the existing grid earth rail by means of an earth conductor.

The minimum cross-section of the earthing conductor is 16 mm².

- Attach the earthing point/foundation earth electrode provided in the foundation coming from the outside on the inside at position (1) of the battery storage housing. Alternatively, it is possible to check whether equipotential bonding is established by means of an earthing conductor to the equipotential bonding rail instead of a foundation earthing point in the form of an earthing flat strap.
- When mounting, make sure that the front panel can still be mounted.

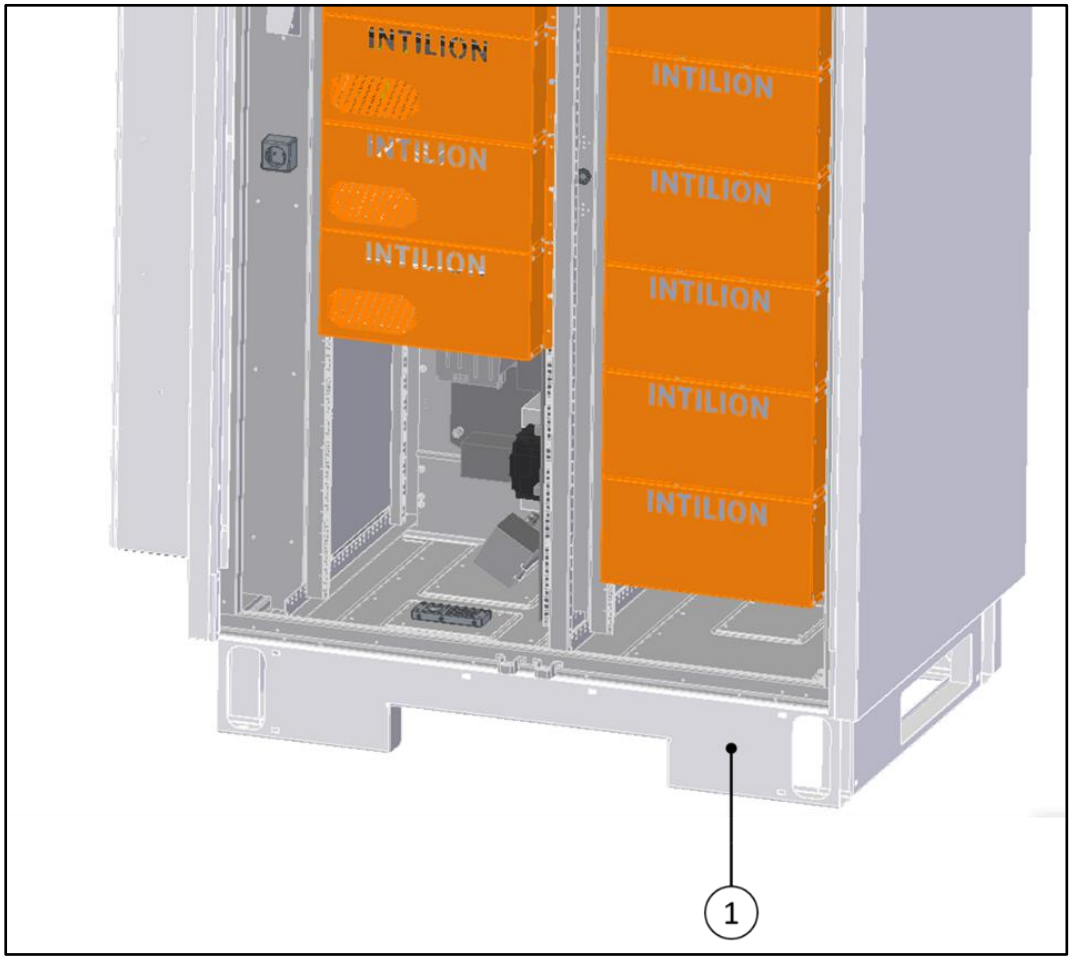

Fig. 36 Fastening the foundation earth electrode

- Attach the earth electrode for the rack poles to position (1) (see Fig. 37).
- To do this, pull the earthing cable through the opening in the base plate and connect it to the foundation earthing electrode. If there is no foundation earth electrode in the form of an earthing flat strap, it can be connected directly to the equipotential bonding rail.

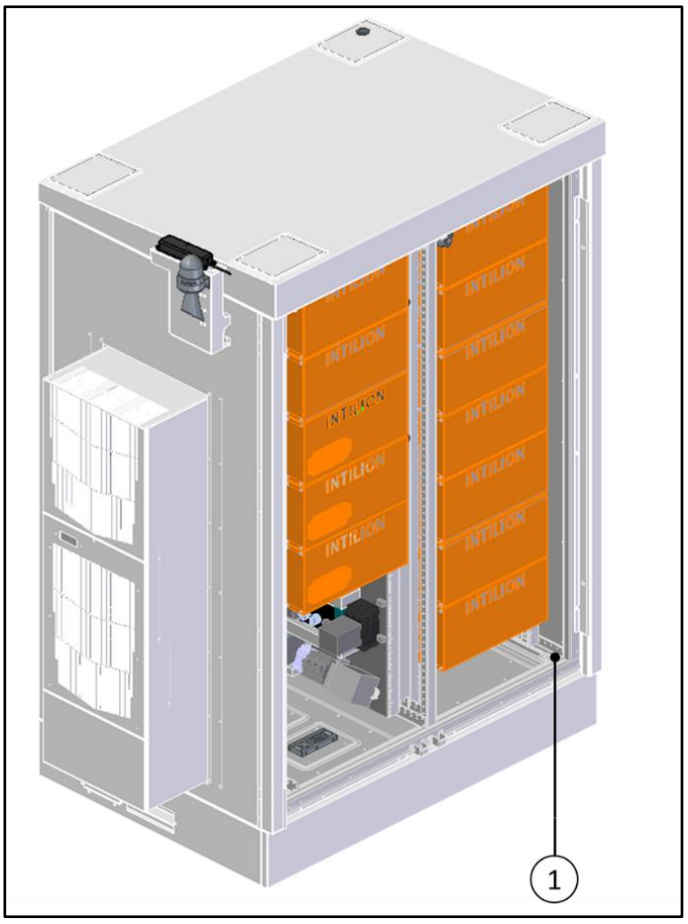

Fig. 37 Mounting the earth electrode for rack poles

5.7 Mounting the warning detector

The visual and audible alarm is attached to the housing of the battery storage unit above the air condition unit. Due to transport conditions, it is fastened with a screw in a position rotated by 90° in the delivery state.

- Turn the warning indicator to its upright end position (see illustration).
- Remove a second screw (M4 x 20) from the enclosed accessories and fix the warning indicator in place.

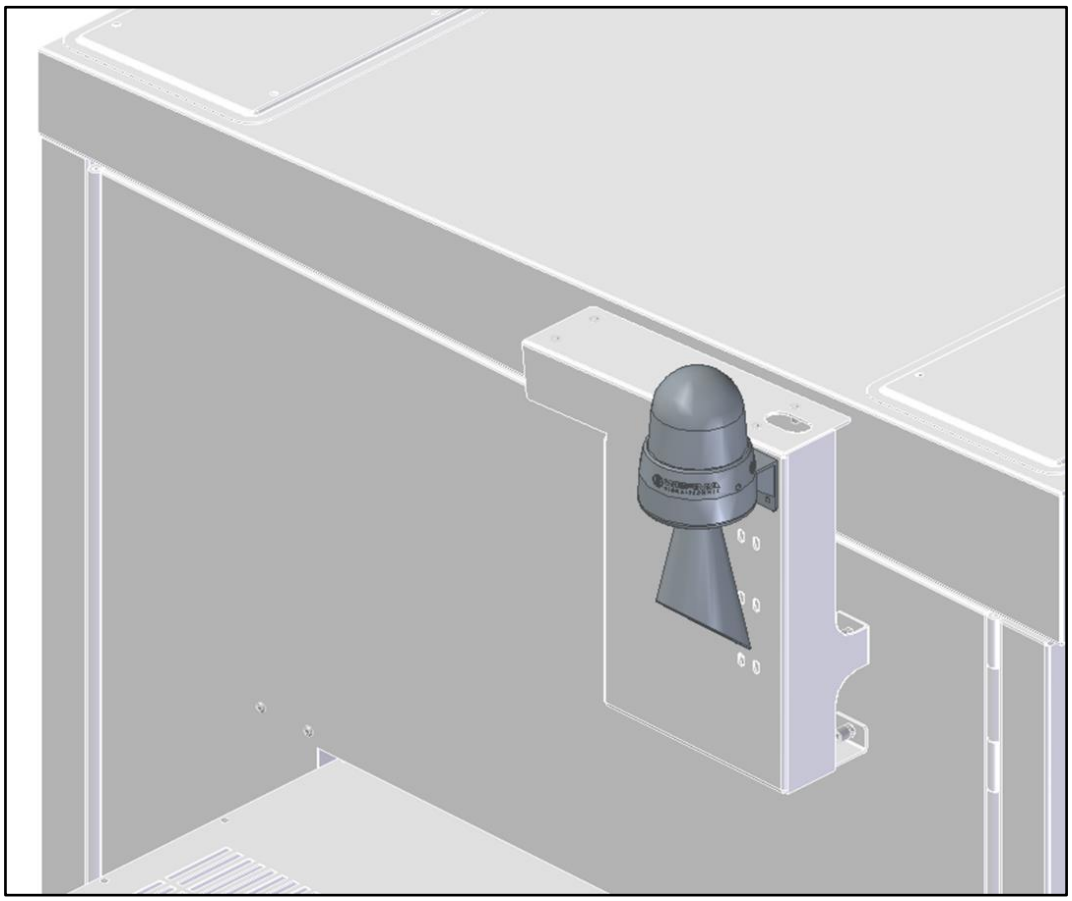

Fig. 38 Mounted warning detector

5.8 Inserting battery modules

The system is delivered with preassembled covers. The covers are fastened with two screws. Before the battery modules are inserted, the covers must be removed.

- Remove the screws and take off the bezels.
- Put the apertures aside for the further work steps.
- Make sure that the orifices do not become dirty.
- Make sure that the mounting surface is free of tripping hazards.

WARNING

Risk of injury

There is a risk of crushing and impact when inserting the battery modules.

- Use the required personal protective equipment (PPE: protective work clothing, protective gloves, safety shoes and hard hat).

CAUTION

Risk of injury due to improper lifting and insertion of the battery modules

There are ergonomic hazards due to improper lifting and insertion of the battery modules.

Proceed as follows when lifting and carrying the battery modules:

- Choose a body position as close and frontal to the load as possible.
- Place your feet at least hip-width apart.
- Make sure you have good, complete foot-to-shoe earth contact.
- Use leg strength to lift, lift from the legs.
- Keep your back naturally straight, avoid a hollow back.
- Avoid jerky movements.
- Avoid twisting the spine.
- Carry the load as close to your body as possible.
- Carry the loads in the middle of the body or divided on both sides of the body.
- Carry heavy, awkward, or bulky loads in pairs.

The battery modules are delivered in individual cartons. Each battery module is protected with a cushioning cardboard and foil.

Fig. 39 Battery module – delivery condition

- Carefully open the respective carton by the adhesive strip and unfold it.
- Remove the foil and the cardboard.

Fig. 40 Battery module – open carton

CAUTION

Risk of injury due to improper lifting of the battery modules

The battery modules are heavy. There are ergonomic hazards due to improper lifting of the battery modules.

- Lift the battery modules with care for your back (see also the note at the beginning of this section).
- Lift the battery modules only in pairs.
- Wear protective gloves for lifting.

Fig. 41 Battery module – removing from carton

- Take the battery module out of the box at the gripping points (1).
- Make sure that the protective caps of the poles are attached. Furthermore, make sure that you do not touch the poles of the battery modules.
- Slide the battery modules into the fire protection enclosures.

WARNING

Danger from dropping the battery modules

When carrying the battery modules, there is a risk of them falling. If this happens, keep your distance from the battery module and observe section 2.6.3.

- Contact the HOPPECKE service department (see section 1.5).

The affected battery modules must not be installed under any circumstances.

- Fasten each of the battery modules to the fire protection enclosure with four screws (1).

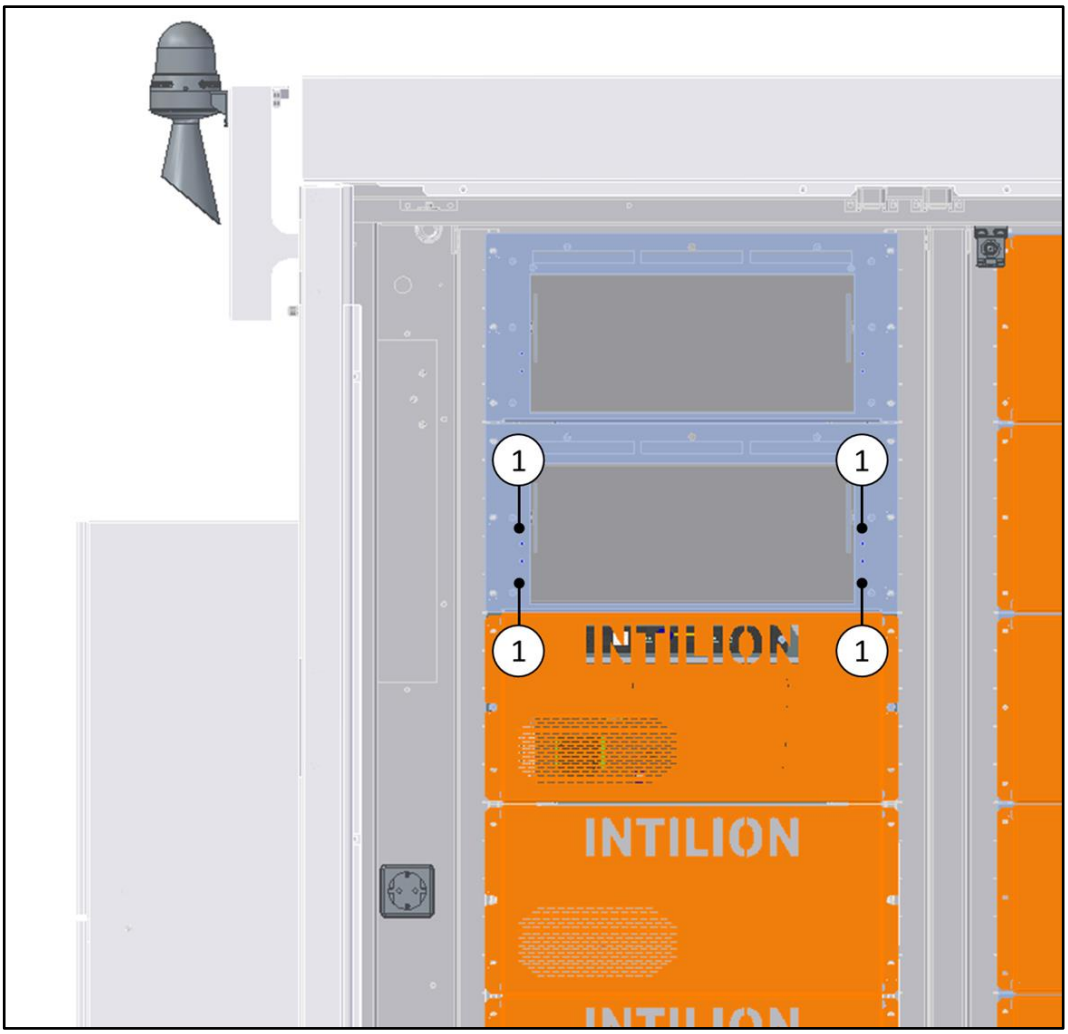

Fig. 42 Battery modules – attaching to the fire protection enclosure

- Tighten the screws with an insulated torque wrench to a tightening torque of 5.1 to 6.1 Nm.
- Note the serial numbers of the battery modules. The serial numbers are 16 digits and are located on the front of the battery modules and on their boxes.
- The serial numbers must be entered in a software tool during commissioning (see section 6.5).

First insert all battery modules and screw them tight before proceeding with their wiring.

5.9 Power wiring of the battery modules

There are three configurations with the INTILION | scalebloc energy, power, and power boost battery storage units. Please refer to the enclosed circuit diagram.

DANGER

Danger to life

Working under voltage when wiring the battery modules poses life-threatening hazards, such as the formation of electric arcs or electric shock.

- Installation by qualified personnel without a valid WLE pass in accordance with DGUV Rule 103-011 / 3.2.4 and VDE 0105-100 Section 6.3.2 is prohibited.
- Installation without valid training by INTILION AG is prohibited, among other things, for safety reasons
- Use arc-resistant work clothing, 1000 V protective gloves, safety shoes and a hard hat with visor to protect against electric arcs. The visor must be kept always closed during subsequent work.
- Use only insulated tools.
- Place at least a 1.5 m x 1.5 m rubber mat in front of the battery storage.

The enclosed wiring diagram specifies the wiring of the battery modules and the battery management system (BMS). The pre-assembled cable package A is required for this purpose. **Cable package A** contains all the cables to be used (power cable, fan cable and communication cable) for connecting the battery modules and the battery management system.

- When screwing the module connectors onto the poles of the battery modules, ensure a torque of 10 Nm.
- Then mark the position of the screw with the cell connector by drawing a line with a touch-up pencil. This allows you to detect whether screws have come loose during maintenance work.
- Follow the sequence described below when wiring the battery modules together and connecting them to the battery management system (BMS).

NOTICE

- Before each step of the installation, remove only the safety caps of the battery modules mentioned in the particular installation step (incl. the mentioned poles).
- Otherwise, open poles of other battery modules not mentioned in the particular installation step must be covered by rubber mats.

- Push the safety caps (1) on the poles upwards (2) and remove them in the direction of the arrow (3).

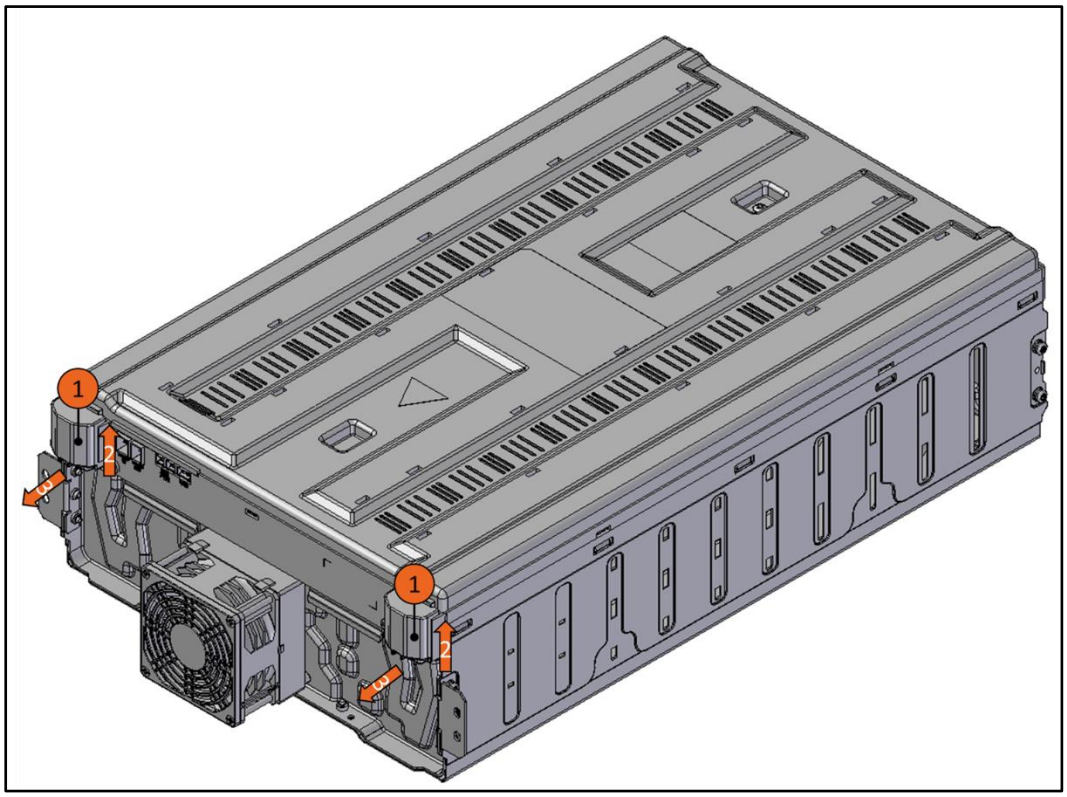

Fig. 43 Battery module – removing safety caps

DANGER

Short circuit hazard

There is a danger to life if the wiring is incorrect.

- Do not confuse the line marked in yellow (both sides marked with +) with the line marked in blue (top marking: 2+, bottom marking: 3-). The lines can be identified, for example, with a continuity measurement.

NOTICE

The cables drawn in the wiring diagram running in the centre web are in the bottom area of the battery storage unit (lower end) or are led out at the top of the centre web and are located between the fire protection enclosures of the battery modules and the roof of the battery storage unit (upper end).

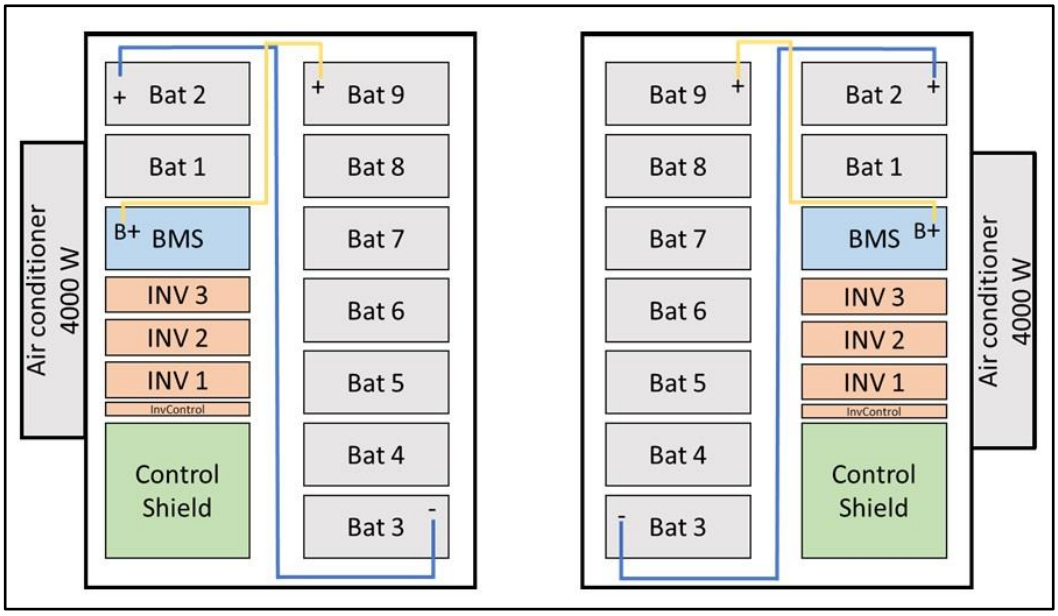

Fig. 44 Wiring sketch

- Connect the wire marked + (lower end) in yellow in the sketch to the B+ terminal of the battery management system (BMS).
- Replace the safety caps with the opening facing upwards.
- Connect the wire marked + (upper end) in yellow in the sketch to the positive pole (+) of the battery module 9 (Bat 9).
- Replace the safety caps with the opening facing upwards.
- Connect the wire marked 3- (lower end) in blue in the sketch to the negative terminal (-) of the battery module 3 (Bat 3).
- Replace the safety caps with the opening facing down.
- Connect the wire marked 2+ in blue in the sketch to the positive (+) terminal of the battery module 2 (Bat 2).
- Replace the safety caps with the opening facing upwards.
- Use the 347 mm long cell connector to connect the B- terminal of the battery management system (BMS) to the negative (-) terminal of battery module 1 (Bat 1).
- Replace the safety caps.

In the following steps, lay the 630 mm long module connectors as follows:

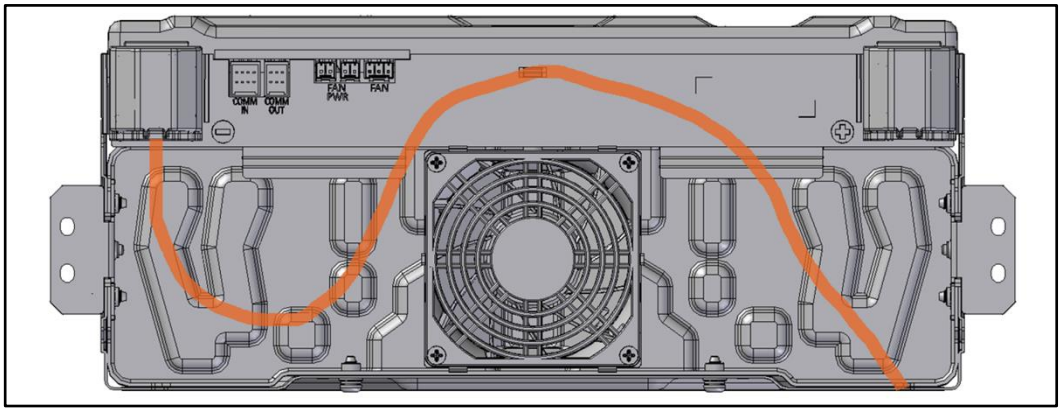

Fig. 45 Laying the cell connectors

- Connect the positive terminal (+) of battery module 1 to the negative terminal (-) of battery module 2 using the 630 mm long cell connector.
- Replace the safety caps.
- Connect the positive terminal (+) of battery module 3 to the negative terminal (-) of battery module 4 using the 630 mm long cell connector.
- Replace the safety caps.
- Connect the positive terminal (+) of battery module 4 to the negative terminal (-) of battery module 5 using the 630 mm long cell connector.
- Replace the safety caps.
- Connect the positive terminal (+) of battery module 5 to the negative terminal (-) of battery module 6 using the 630 mm long cell connector.
- Replace the safety caps.
- Connect the positive terminal (+) of battery module 6 to the negative terminal (-) of battery module 7 using the 630 mm long cell connector.
- Replace the safety caps.
- Connect the positive terminal (+) of battery module 7 to the negative terminal (-) of battery module 8 using the 630 mm long cell connector.
- Replace the safety caps.
- Connect the positive terminal (+) of battery module 8 to the negative terminal (-) of battery module 9 using the 630 mm long cell connector.
- Replace the safety caps.

There is a control line in the centre bar. At each end of the line there are two connectors.

- Use the control line to connect battery module 2 (COMM OUT and FAN PWR connectors (right)) to battery module 3 (COMM IN and FAN PWR connectors (left)).
- Connect the BMS (FAN PWR OUT connector) to battery module 1 (FAN WR connector (left)) using the 800 mm long control cable.
- Connect battery module 1 (COMM OUT and FAN PWR connectors (right)) to battery module 2 (COMM IN and FAN PWR connectors (left)) with the 300 mm long control cable.
- Connect the remaining battery modules to each other with the 300 mm long control line according to the previous instruction. No control line is connected on the outgoing side of battery module 9 (connections COMM OUT and FAN PWR (right)). A dummy plug is inserted into the recess in the cover (see section 5.10).

5.10 Connecting communication, control, and power cables

- Connect the cables according to the terminal assignment in the circuit diagram.

It is recommended to lead the cables to the contacts first and then, in an almost final position (not yet connected), to screw them into the Icotek frame (see illustration).

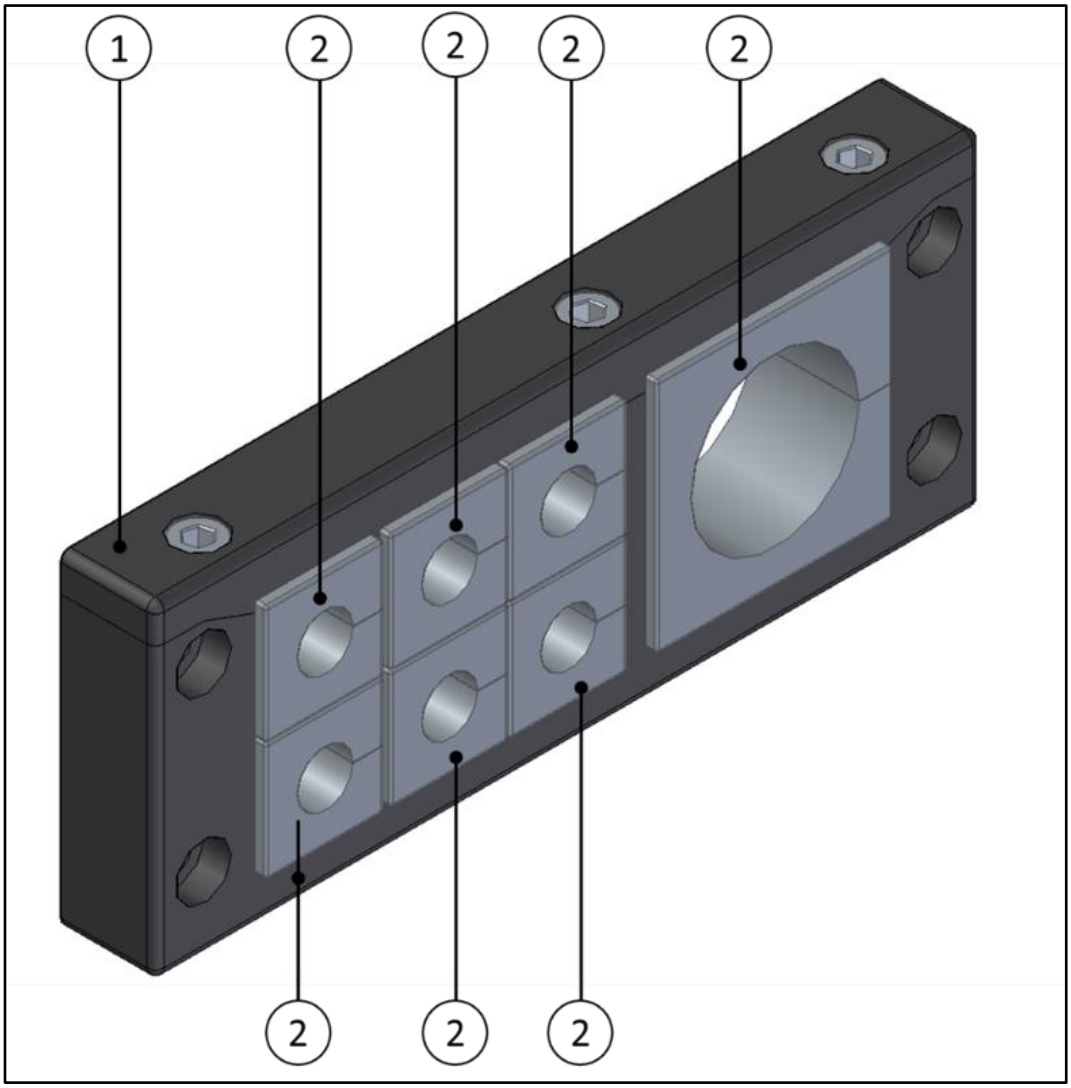

Fig. 46 Icotek frame with grommets

(1)	Icotek frame
(2)	Grommets

Table 15 Icotek elements

To ensure IP55 protection of the battery storage unit, it is important that the cables are routed through the Icotek frame and fitted with the correct Icotek grommet.

- Disassemble the Icotek frame from the base plate.
- Pull the cables in the direction of the clamps on the ControlShield, making sure that there is sufficient excess length for later attachment.
- Guide the base plate without frame over the cables and fasten it in the control cabinet (re-evaluate excess cable length if necessary).
- Place suitable Icotek grommets around the appropriate cables.

An Icotek grommet is suitable if it is closed under some pressure (see following illustrations).

5.10.1 Fitting the Icotek grommets

The Icotek grommet is properly attached if it fits tightly around the cable. Only a small gap is formed, which closes by pressure.

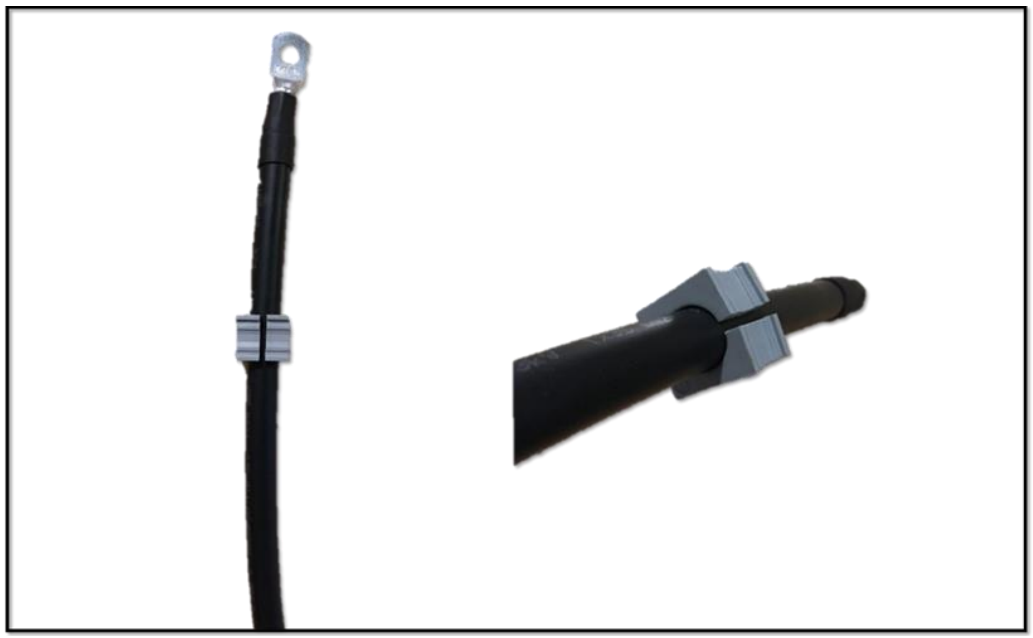

Fig. 47 Icotek grommet – suitable for cable

The following picture shows an Icotek grommet that is too small and does not close around the cable.

Fig. 48 Icotek grommet – unsuitable for cable

- Thread the cables fitted with Icotek grommets into the Icotek frame.
- Make sure that the flat sides of the Icotek grommets are against each other.
- Tighten the screws of the Icotek frame with a tightening torque of 2 Nm.
- Attach the Icotek frame to the base plate (3 Nm).
- If the battery storage connection is laid above ground, the cables must be laid through the base into the system. For this purpose, there is a feedthrough at the back of the base as well as underneath the air conditioner.
- Provide the feedthrough with the brush insert supplied.

NOTICE

Note that the base plate with the Icotek frame is not suitable for cable cross-sections larger than 5 x 50 mm².

Alternatively, use the enclosed "blank plate" in which the holes for cable feedthrough/cable glands (not included) are to be cracked.

5.11 Final tasks

After connecting all the cables, there are only some final tasks left.

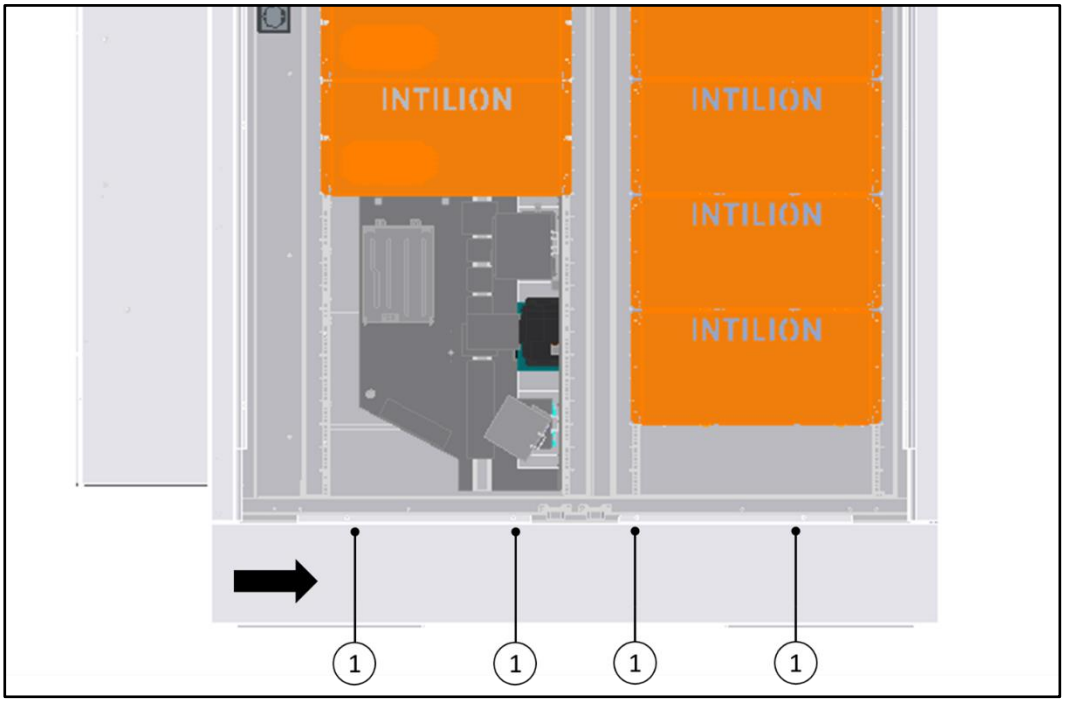

Fig. 49 Fastening the front panel

- Insert the side pedestal panels and slide them back toward the rear of the battery storage unit.
- Insert the front panel and push it as far as it will go (approx. 10 mm) in the direction of the arrow.
- Fasten the front panel with the previously removed screws (1).
- Perform a visual inspection. Pay particular attention to whether there are any tools or trash in the battery storage, whether all base panels are installed, whether any screws or base plates are missing, whether all visible cables are routed through the Icotek frame and/or the Icotek grommet, and whether all earthing cables are connected.
- Close the doors of the battery storage unit. To do this, first lift the respective latching hook.

5.12 Establishing the grid connection

The grid connection (AC distributor side) is made by trained specialists.

DANGER

There is a risk of electric shock when touching live parts.

- Have work on the electrical equipment conducted only by a qualified electrician with an WLE pass who has been specially trained to work on electrical equipment and to work under voltage and who can recognize and avoid hazards.
- Before making the grid connection, the DC contactors of the BMS must be open. This must be ensured by ensuring that all ControlShield circuit breakers are open (OFF) (see Fig. 14).

For the grid connection, the relevant VDE regulations and the technical connection conditions of the local electricity supplier must be observed.

The battery storage unit has a connected load of 25 kVA, 50 kVA or 72.8 kVA per outdoor control cabinet. The connection cable must be designed in accordance with VDE 0100 based on the connected load and cable length and the ambient conditions. The maximum wire cross-section that can be connected to the terminals of the battery storage unit is 50 mm². The terminals of the battery storage unit at the ControlShield are marked with XD11 (see Fig. 18).

5.13 Connecting the energy meter

For the respective applications of the integrated energy management system, an energy and power flow measurement are required at the grid connection point. The entire energy demand, which is optimized by the respective application, flows via the grid connection point. In the figure below, the battery storage is shown in connection with a compatible energy meter (here from the company *Carlo Gavazzi*, not included in delivery).

The current is measured by means of current transformers, for example conversion current transformers. The retrofitting of the measuring device is possible without an interruption of the power supply. The measuring device must be positioned directly at the grid connection point on the **low-voltage side**, for example in the vicinity of the central meter, which measures the total consumption and, if applicable, the total feed-in of the customer system.

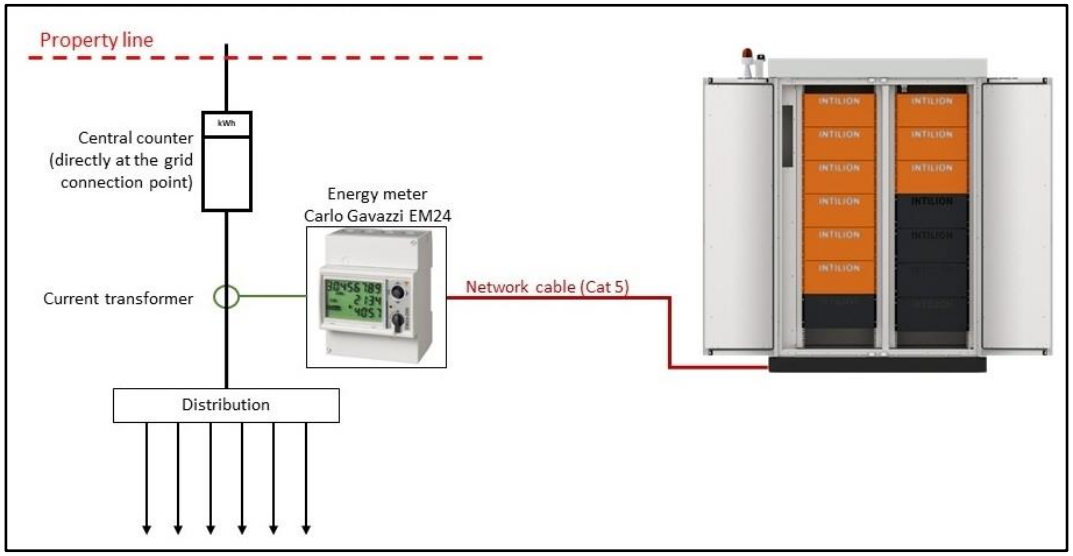

Fig. 50 Connection diagram energy meter

INTILION AG offers various energy meters as accessories. The energy measurement is necessary for the use of the applications from this chapter. For this purpose, please contact HOPPECKE Service.

The battery storage is compatible with the following energy meters:

1. Carlo Gavazzi EM24 (EM24DINAV53XE1X)
2. Janitza UMG 604 PRO

Please note that the "Carlo Gavazzi EM24 (EM24DINAV53XE1X)" energy meter is suitable for low-voltage measurements only. **For a medium voltage measurement via voltage transformers, the Janitza UMG 604 PRO energy meter must be used.** In case of a planned medium voltage measurement, please consult with INTILION AG.

The energy meters must be connected according to the installation instructions of the respective manufacturer (for commissioning of the "Carlo Gavazzi EM24DINAV53XE1X)" energy meter, see section 6.2).

The current transformers are selected based on the maximum connected load, which is recorded by measurement. It should be noted that the secondary current is scaled to 5 A. The following table shows the current transformers to be used depending on the connected load.

Grid connection power	Current transformer to be inserted	Energy meter
up to 100 kVA	3 x current transformer 150 A / 5 A	Carlo Gavazzi (EM24DINAV53XE1X) or Janitza (UMG 604 PRO)
100 kVA – 170 kVA	3 x current transformer 250 A / 5 A	
170 kVA – 270 kVA	3 x current transformer 400 A / 5 A	
270 kVA – 400 kVA	3 x current transformer 600 A / 5 A	
400 kVA – 690 kVA	3 x current transformer 1000 A / 5 A	
690 kVA – 1100 kVA	3 x current transformer 1600 A / 5 A	
1100 kVA – 1700 kVA	3 x current transformer 2500 A / 5 A	
1700 kVA – 2200 kVA	3 x current transformer 3200 A / 5 A	

Table 16 Current transformers depending on the connected load

The energy meter communicates with the battery storage unit via a network cable. This should be at least category 5 (Cat. 5E) and shielded. Ideally, a Cat. 6 cable should be used. On the battery storage unit, the Ethernet port (RJ45) XF14 must be used for the connection (see Fig. 15). When integrating the energy meter into the customer's network, use port XF13.

The copper cables should have a maximum length of 80 m. In case of longer distances, fibre-optic cables are recommended.

The energy meter in combination with the current transformers includes the functionality of the energy flow direction sensor (EnFluRi), which is required in relation to the VDE FNN note "Connection and operation of storage units on the low-voltage grid". It is ensured that the battery storage does not feed any energy into the public power grid.

Since the energy meter contains the energy flow direction sensor required by the grid operator, its location must be coordinated with the grid operator.

For further information, the FNN note "Connection and operation of storage units on the low-voltage grid" can be consulted.

5.14 Communication link for setpoint specification

For the "setpoint specification" application, an energy meter is not required.

The battery storage system can be integrated into existing plants using a defined communication interface and controlled by an external (higher-level) controller – such as an energy management system (EMS). The higher-level controller communicates with the battery storage system via a Modbus TCP/IP interface and a defined data point list.

In the “setpoint specification” application, specified parameters are read or selected from the data point list. The list of Modbus parameters is provided as a separate document. The communication connection as well as the reading of battery parameters is done via port XF13 of the ControlShield (see Fig. 15). The required network cable should be at least category 5E and shielded.

By default, the battery storage is accessible via the IP address 192.168.2.2, this can be changed via the web visualisation (see section 6.5).

Further protocols and communication interfaces, deviating from Modbus TCP/IP, must be discussed for each individual project, and be approved by INTILION AG .

5.15 Parallel connection of several battery storages

Up to four battery storage units can be connected in parallel according to the master-slave principle, meaning there is one master and up to three slaves.

How to identify the master?

Only the master unit has an LTE antenna attached to the roof of the battery storage unit, above the air conditioner.

Each battery storage unit must be connected to the low-voltage distribution system with a separate connection cable. Communication (via network cables, min. Cat. 5E) between the units takes place "from cabinet to cabinet". For the end user, only one Modbus interface is provided for control, as with a single master battery storage unit. Also, the individual, interconnected battery storage units are treated as one system in the web visualisation.

The connection of the energy meter already described is made on the master battery storage. The communication lines and the optional control lines between the battery storage units can be routed through the removable plates on the side and rear panel of the base (see (1) in following illustration).

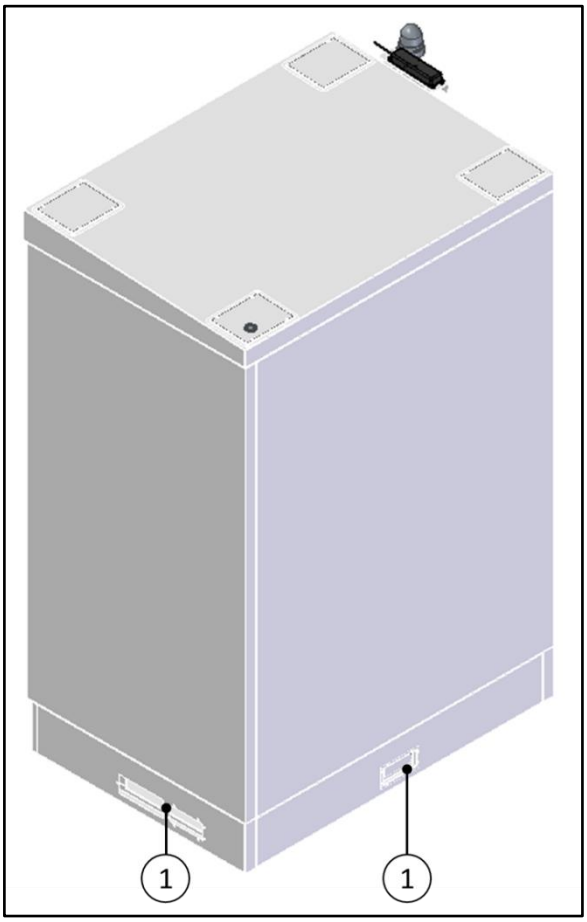

Fig. 51 Feedthroughs of the communication and optional control lines

The schematic connection is shown here:

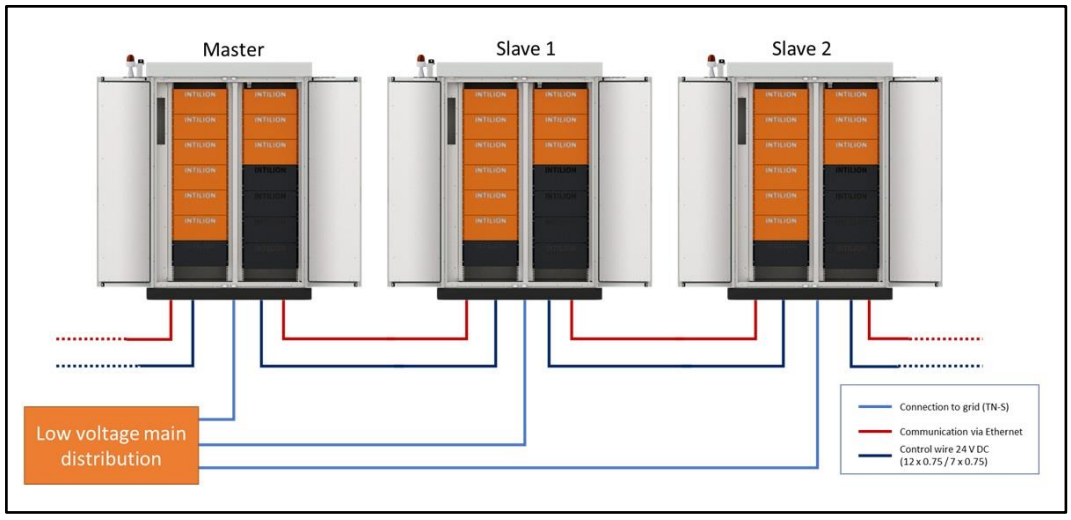

Fig. 52 Scheme for interconnection of several battery storage units

The control lines (dark blue in the illustration) between the battery storage units are necessary if an external emergency stop is to be installed.

The control lines between the battery storage units are to be connected according to the following table.

Pin assignment previous battery storage	Pin assignment of subsequent battery storage
XD15:1	XD13:1
XD15:2	XD13:2
XD15:3	XD13:3
XD15:4	XD13:4
XD15:5	XD13:5
XD15:6	XD13:6
XD15:7	XD13:7

Table 17 Connecting the control lines

The information exchange of the master with the energy meter and the slaves via the Ethernet ports XF14 and XF15 takes place via the communication lines (red in the above illustration). For the connection master-slave or slave-slave, these are enclosed with each slave for outdoor installation, as far as more than one storage system is set up. For the master-energy meter connection, the customer must provide cables.

The previous battery storage or, in the case of the master, the energy meter is connected to port XF14. The following battery storage is connected to port XF15 (see Fig. 15).

5.16 Sound insulation hood (optional)

To reduce the operational noise emissions of the air conditioner, INTILION AG offers an optionally available sound insulation hood, the installation of which is described below.

- Unscrew the screws located in the sound insulation hood on both sides and keep them for later fastening of the sound insulation hood.

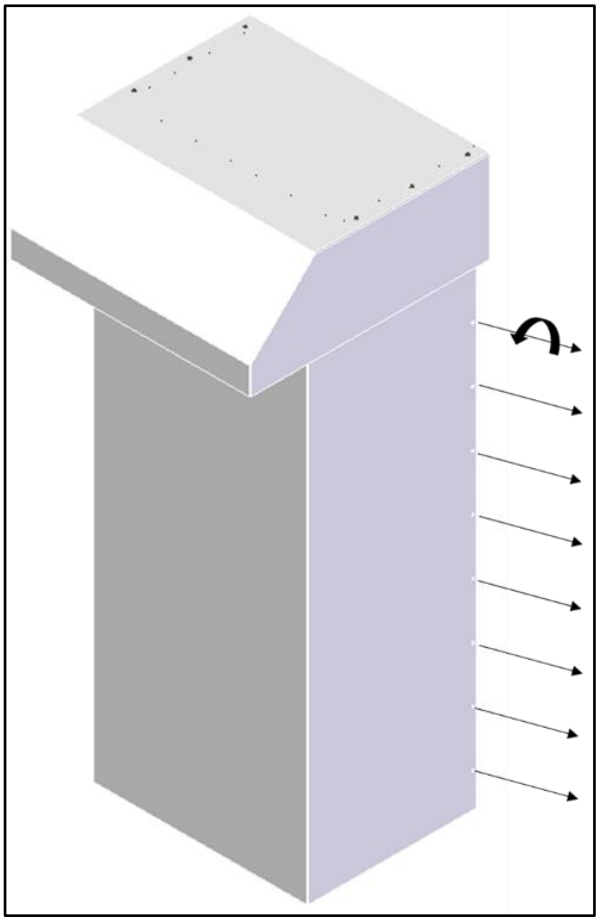

Fig. 53 Sound insulation hood – remove screws

- Now remove the two angle plates from the sound insulation hood:

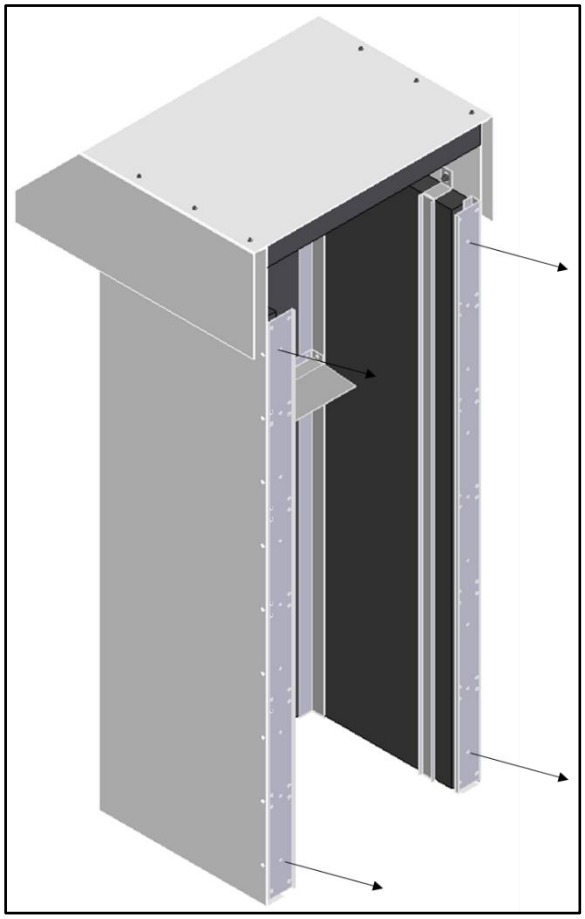

Fig. 54 Sound insulation hood – remove angle plates

- Loosen the screws located to the left and right of the air conditioner in the battery storage unit housing:

Fig. 55 Battery storage – remove screws

- Now use these screws to fasten the angle plates of the sound insulation hood to the housing of the battery storage unit.

Fig. 56 Battery storage – fasten angle plates

- Now place the sound insulation hood on the angle plates.

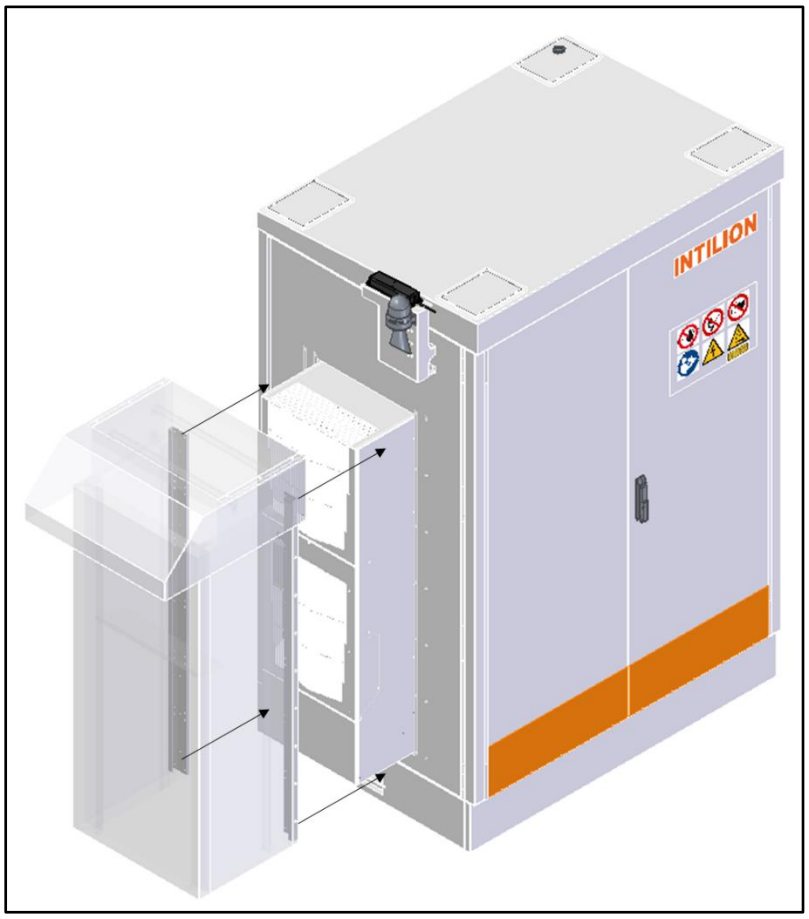

Fig. 57 Battery storage – place sound insulation hood

- Fasten the sound insulation hood with the screws loosened at the beginning on both sides of the angle plates.

Fig. 58 Battery storage – fasten sound insulation hood

6 Commissioning

The initial commissioning (trial operation) of the battery storage system is carried out by INTILION AG or by INTILION AG trained personnel in the presence of the person(s) responsible for the system.

The person responsible for the system must take part in a INTILION | scalebloc product training and instruction.

After the initial commissioning, the document "Commissioning report" must be signed in duplicate. One document is received by INTILION AG, the second document is deposited in the battery storage.

After initial commissioning of the battery storage operation, there are initially capacity restrictions due to cell production because of voltage tolerances between the battery cells. After the final system test at the end of commissioning, the battery storage system is charged to an SoC of greater than 80 %. Due to the internal cell and module balancing thus activated, all cells equalize within two weeks.

During the balancing process the battery storage is not yet ready for operation, a corresponding message is issued via Modbus.

- In case of further questions or recommissioning, please contact HOPPECKE Service.

WARNING

Risk of injury due to lack of space!

When commissioning the battery storage unit, there is a risk of injury because of the required work equipment and/or components being arranged too densely.

- Close off the danger area.
- Keep unauthorized persons away.
- Designate a responsible person.
- Familiarize yourself sufficiently with the following:
  - the operating and control elements of the battery storage
  - the equipment of the battery storage
  - the operation of the battery storage
  - the immediate environment of the battery storage
  - the safety devices of the battery storage
  - the measures for an emergency

6.1 Preparatory tasks and information

Conduct the following tasks before initial commissioning or recommissioning:

- Check and make sure that all safety devices are in place and working.
- Check the battery storage unit for visible damage; rectify any defects found immediately, operation is only permitted in perfect condition.
- Check and ensure that only authorized persons are in the working area of the battery storage unit and that no other persons are endangered by the commissioning of the battery storage unit.
- Remove all objects and other materials from the work area that are not required for the operation of the battery storage unit.
- Before switching on, check the electrical connection of the battery storage unit for correct design and tight fit. Record the result in the test log.
- After initial commissioning or recommissioning, fill in a commissioning report to prove to the grid operator that the battery storage system was installed according to and complies with the applicable standards and regulations.

6.1.1 Changing network settings in Windows

For many settings while commissioning, it is necessary to change the network address of your commissioning computer. This description is intended for the Windows 10 operating system.

- To change the settings, go to the "Network and Internet" section of the Windows Control Panel, and you will see the page shown in the following screenshot.

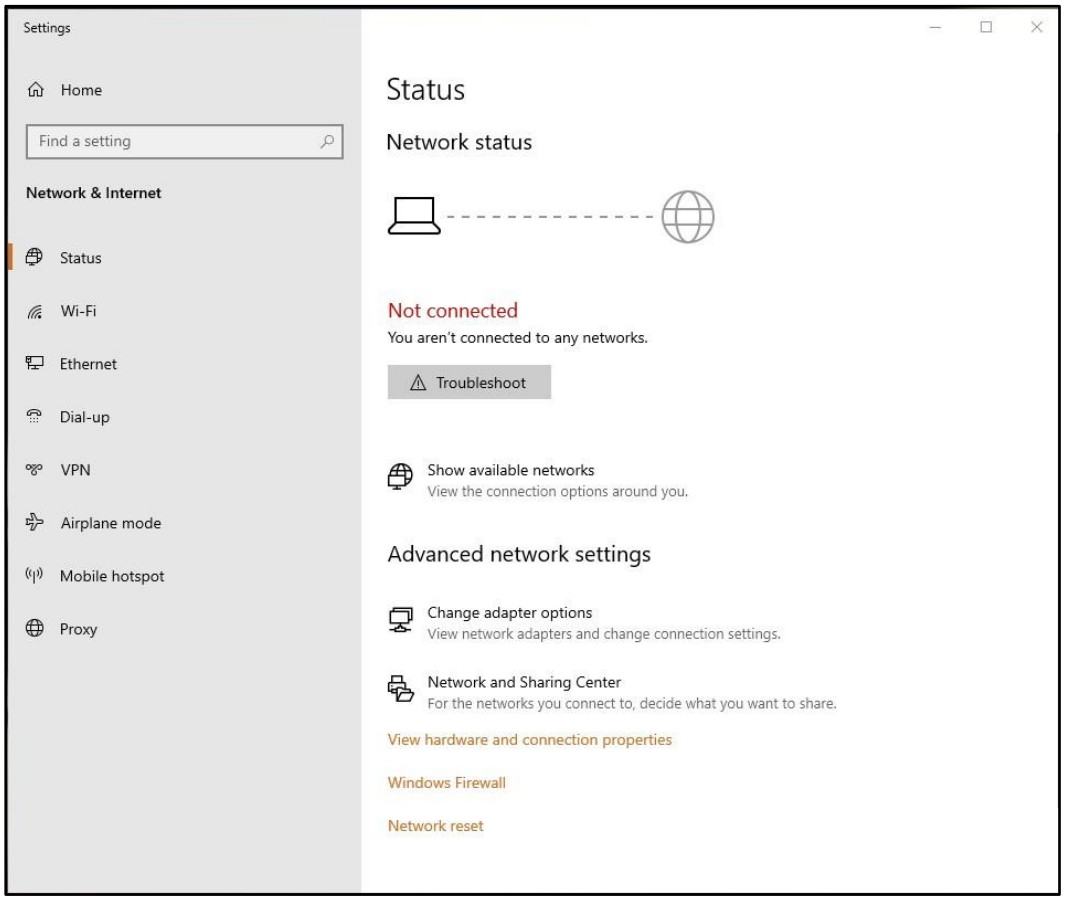

Fig. 59 Windows network status

- Click on "Change adapter options" to access the desired settings for the network card as shown in the following screenshot:

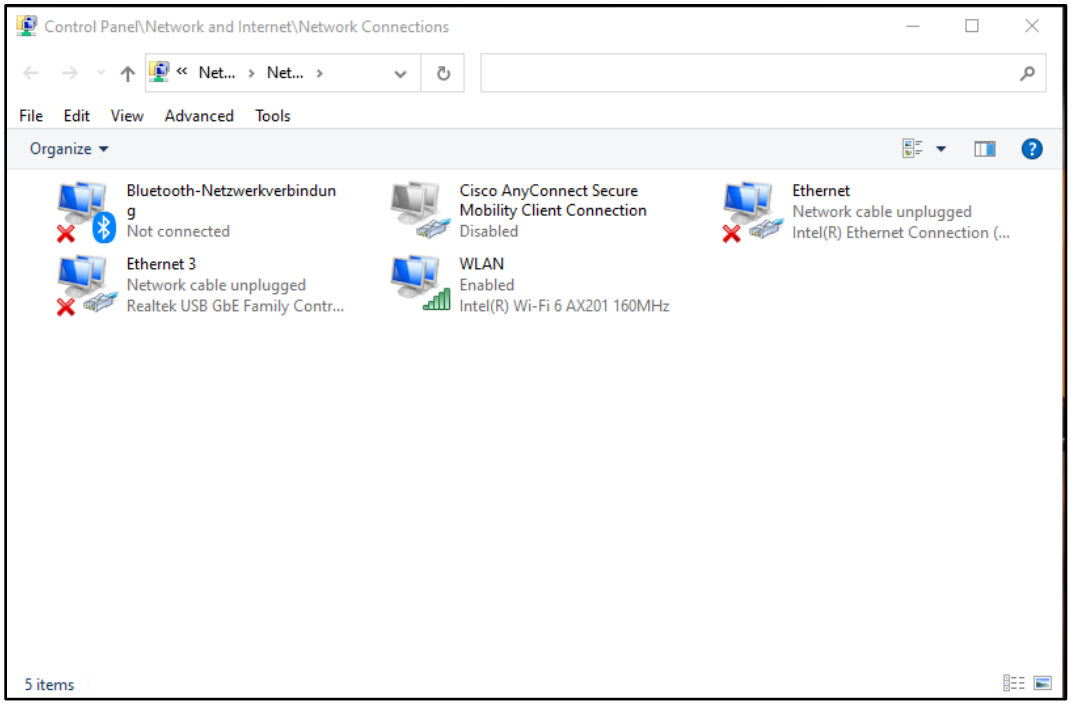

Fig. 60 Settings of the network adapters

- Here you select the network adapter of the network card, in this case the one labelled "Ethernet 3" and right click on it to see the options:

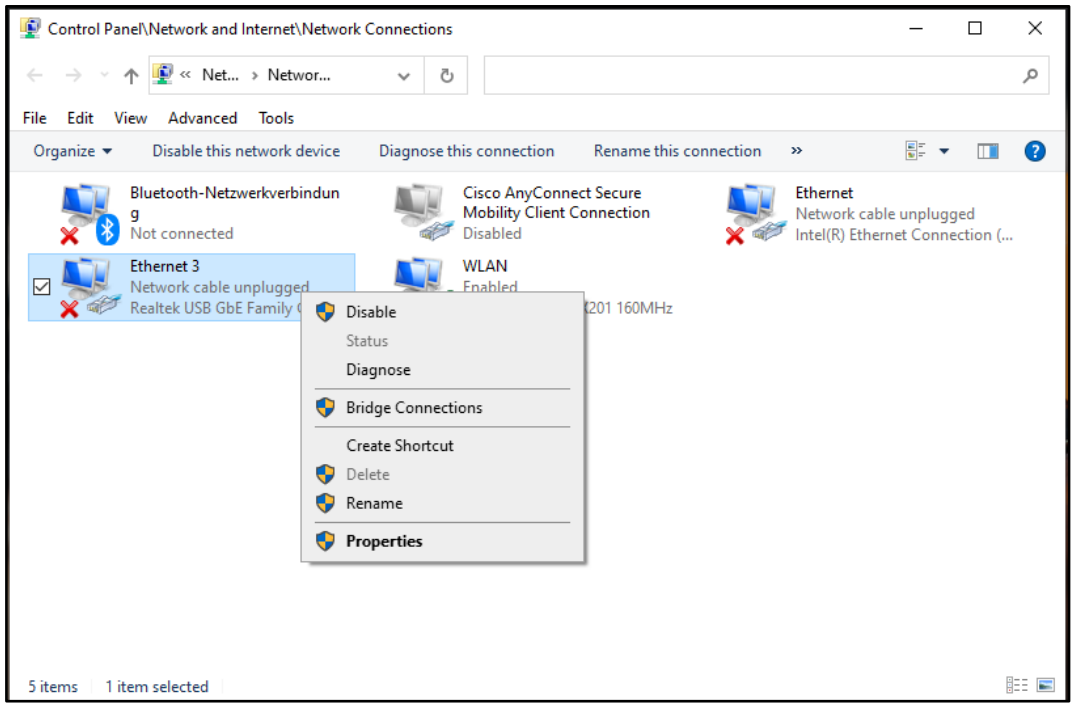

Fig. 61 Options for the network adapter

For the next step, you need Windows administrator privileges.

- Click on "Properties" in the context menu and then enter the Windows administrator password in the “User Account Control” dialog.

The properties of the network adapter are displayed:

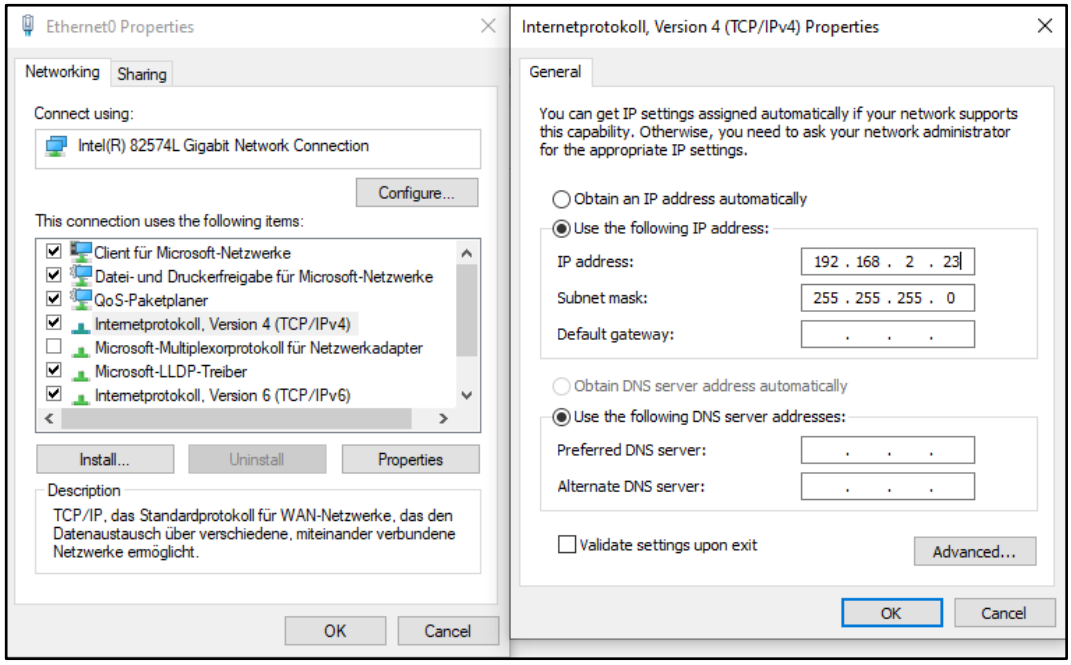

Fig. 62 IP address, default gateway and DNS server settings

- In the list on the left-hand side, double-click to open the "Internet Protocol, Version 4 (TCP/IPv4)" entry.

The dialog shown on the right-hand side of the above screenshot is where you configure the network. If, in the following, a change of the network address, the network settings or the IP address range is mentioned, then this refers to the configuration described here.

The subnet mask is always 255.255.255.0!

Default gateway and preferred DNS server always have '1' at the end and are in the used network (here 192.168.2.1). For the commissioning of the battery storage a setting of these two fields is not necessary, therefore they must be left empty.

- Assuming you want to reach a device in the address range 192.168.2.X, make the following settings:

IP address	192.168.2.23
Subnet mask	255.255.255.0

Table 18 Windows network settings

6.2 Commissioning the energy meter

This section describes commissioning of the "Carlo Gavazzi EM24DINAV53XE1X" energy meter. For further information, refer to the current documentation of the manufacturer Carlo Gavazzi.

After wiring the energy meter, the display shows CT RATIO. In this display mode, it is possible to enter the current transformer ratio on the device.

This input and all other configuration settings can be made directly on the energy meter. However, due to the simpler operation, these are made after knowledge of the factory IP settings of the energy meter via the configuration software "Universal Configuration Software (UCS)" of the company Carlo Gavazzi, which can be downloaded free of charge at http://www.productselection.net/Download/UK/ucs.zip. Please note the terms of use of the software and that it is the intellectual property of Carlo Gavazzi.

The IP address for factory settings can only be found out via the energy meter display.

- Use the joystick positions left/right to scroll through the menu until the network settings appear (IP, subnet, gateway, DNS).
- Write down the IP address, subnet mask, and gateway.

By default, Carlo Gavazzi uses the following settings, which may vary depending on the firmware of the energy meter:

IP address	192.168.1.20
Subnet mask	255.255.255.0
Gateway	192.168.1.1

Table 19 Network settings at the energy meter

- Make sure that the rotary switch of the energy meter is in position 1 or 2 before starting the configuration settings via the software. If necessary, set the switch accordingly.
- Change the IP address of your computer to 192.168.1.10 to connect to the energy meter. How to change the IP settings under Windows 10 can be found in the section 6.1 section.

Instead of the “10” at the end of the IP address, you can insert any other integer in the value range 2 to 254, except 20.

- Start the UCS configuration software on your commissioning computer.

The screenshot shows an overview of the UCS configuration software:

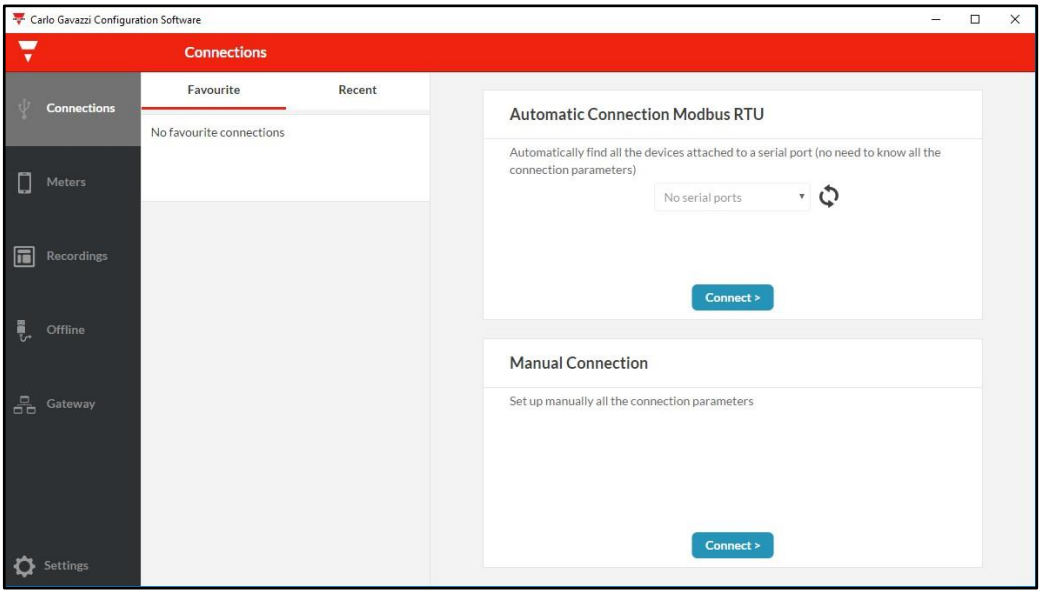

Fig. 63 Energy meter configuration – Main menu

- Under MANUAL CONNECTION, click CONNECT and the page with the connection settings is displayed:

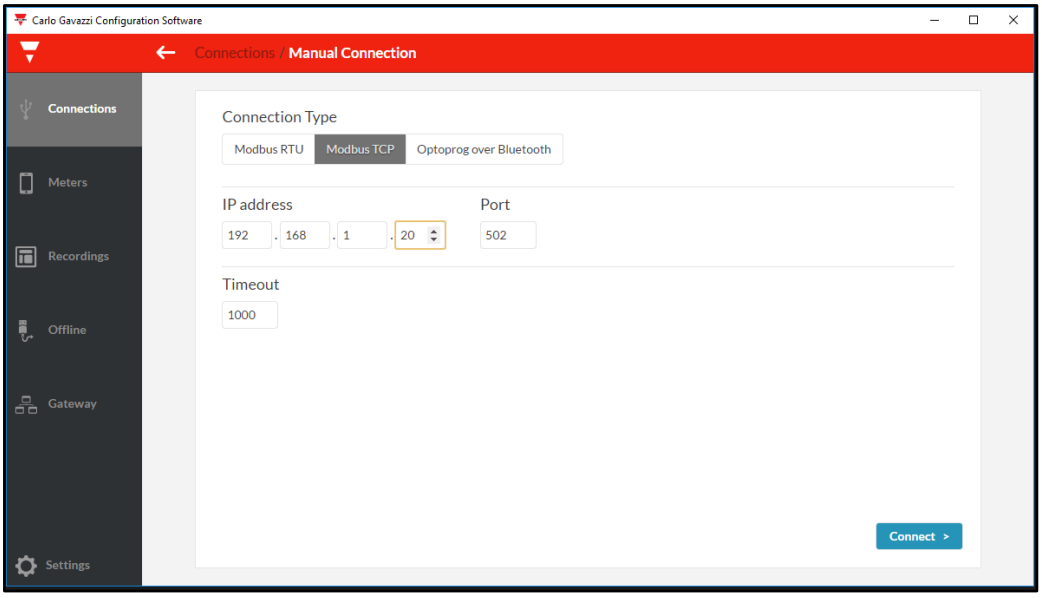

Fig. 64 Energy meter configuration – setting the IP address

- Click MODBUS TCP and set the IP address of the energy meter.
- Click CONNECT.

The energy meter is available after a short connection setup:

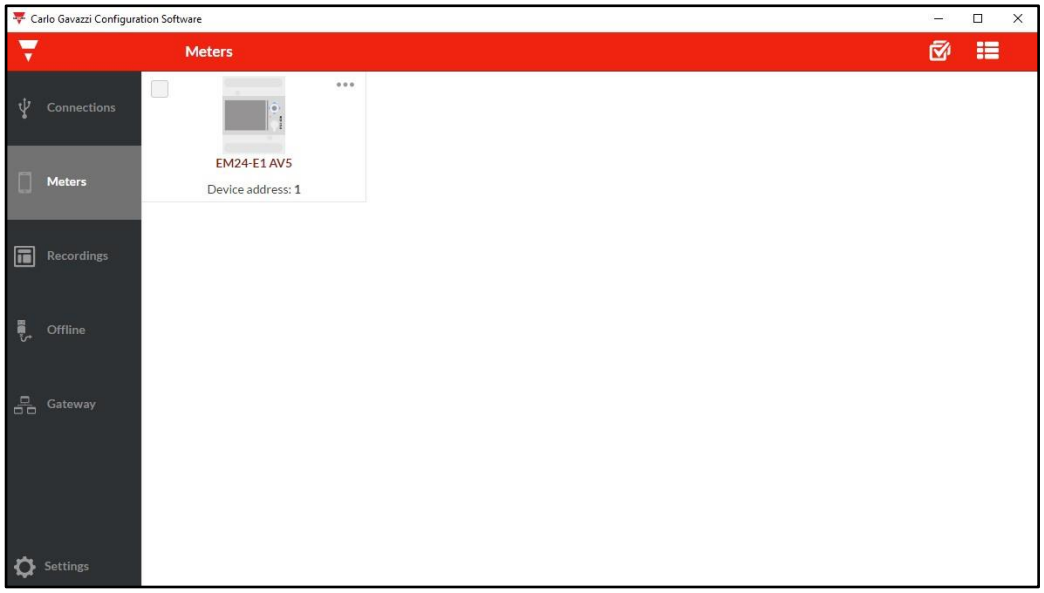

Fig. 65 Energy meter configuration – Selecting the energy meter

- Click on the energy meter you found.

An overview page with information about the energy meter is displayed:

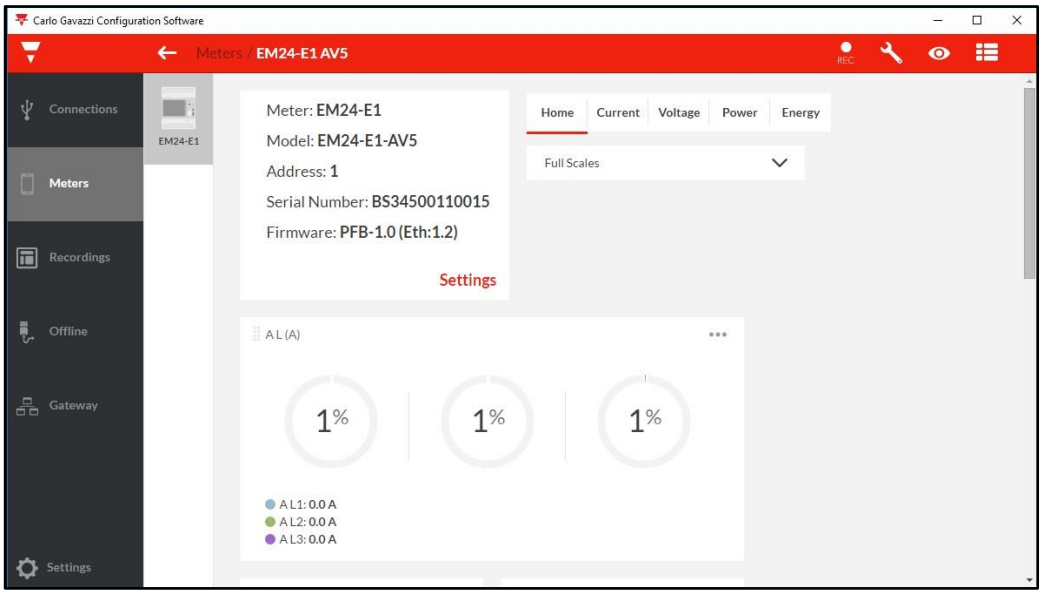

Fig. 66 Energy meter configuration – Device overview

- Click SETTINGS.

The page for inputting the current transformer ratio is displayed:

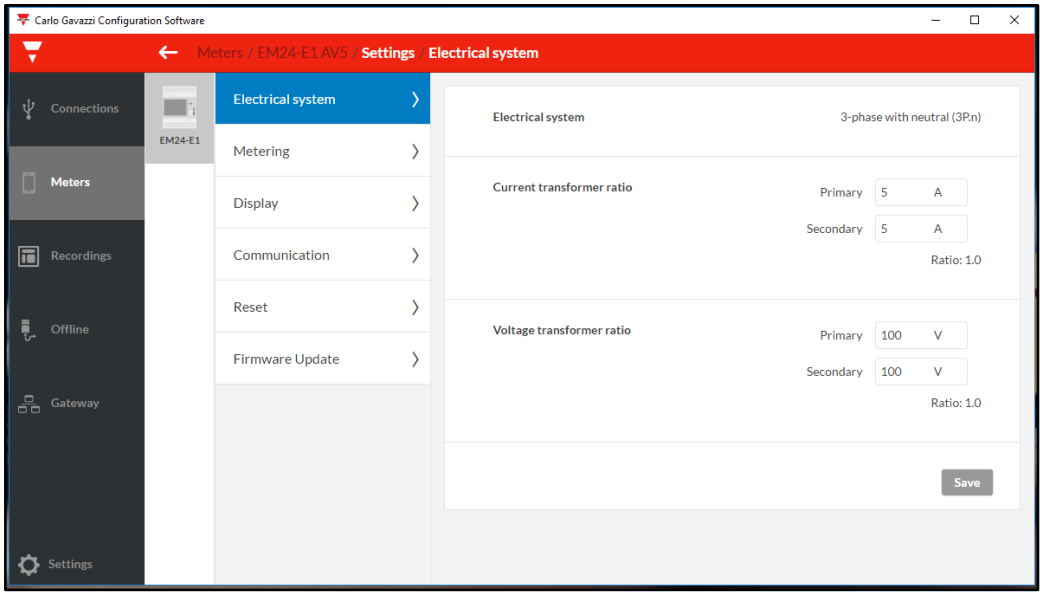

Fig. 67 UCS configuration software – entering the current transformer ratio

The current transformer ratio is to be set under the tab ELECTRICAL SYSTEM at CURRENT TRANSFORMER RATIO.

- Read the ratio at the current transformer.
- For example, if the current transformer has a ratio of 400/5 A, enter 400 A for the primary and 5 A for the secondary. This results in a current transformer ratio of 80.

No changes are to be made to VOLTAGE TRANSFORMER RATIO. Note, however, that RATIO has the value 1.0.

- Then select the COMMUNICATION tab.

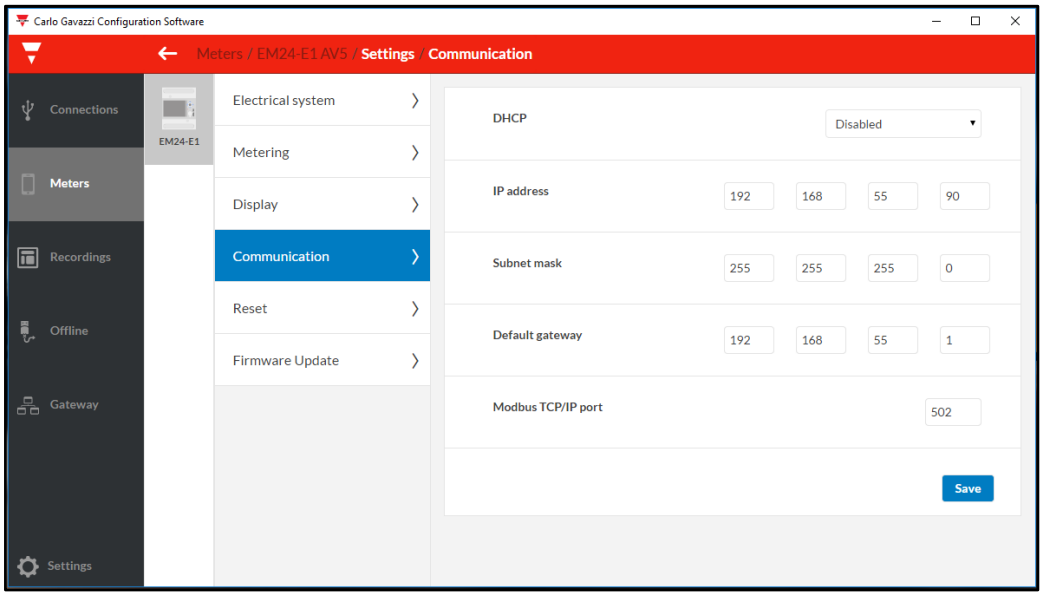

Fig. 68 Energy meter configuration – Network settings

- Here, set DHCP to DISABLED (if not already set).

- Make the following entries for IP ADDRESS, SUBNET MASK and DEFAULT GATEWAY:

IP ADDRESS	192.168.55.90
SUBNET MASK	255.255.255.0
DEFAULT GATEWAY	192.168.55.1

Table 20 Network settings UCS software

- Click SAVE to apply the settings.

The energy meter is now set up.

By sending a ping to the IP address of the energy meter, it is possible to assess whether the energy meter can be reached.

- To do this, change the IP address of your computer to **192.168.55.5.**
- In Windows 10, open the “Run” app by pressing the key combination "Windows + R".
- Enter "cmd". This will start the command prompt where you type "ping 192.168.55.90" and press Enter.

If the energy meter is reachable, Windows sends four data packets to the IP address and receives responses.

6.3 Filling in the commissioning report

Conduct all commissioning steps according to the INTILION commissioning report and fill in the results.

For information on INTILION web visualisation and test operation, see section 6.5.

According to DGUV regulation 3 (formerly BGV A3), the system must be commissioned in accordance with VDE 0100-600 when it is first put into operation. A copy of such a test report can be obtained from INTILION AG.

6.4 Switching on the battery storage

At the ControlShield, check the following settings:

- Check if the flap at the power circuit breaker **1QA1** is closed (automatic mode, see Fig. 13). If not, close the flap to switch to automatic mode.
- Check if all circuit breakers (1FB1, 2FC1, 5FC1, 5FC2 and 5FC3) switched on (see Fig. 14.). If necessary, switch them on.

Once the grid connection has been established (see section 5.12), the battery storage unit switches on automatically. The knob switch **5SF1** (see Fig. 12.) flashes with a frequency of 0.5 Hz.

NOTICE

- If the grid connection is not yet established, turn the knob switch **5S1** in the ControlShield to the right in order to start UPS operation.

Note that further settings of the battery storage can be made in this mode (see section 6.5), but that the battery storage must be connected to the final system test. The air conditioner also only operates when grid voltage is applied.

6.5 Settings in web visualisation, part 1

INTILION web visualisation enables you to conveniently configure the battery storage at your computer.

6.5.1 Logging into the web visualisation:

To access the web visualisation, set the IP address of the commissioning computer. The table shows the recommended settings:

IP ADDRESS	192.168.2.23
SUBNET MASK	255.255.255.0

Table 21 Network settings for web visualisation

- Now, connect the computer to port XF13 (customer interface, see Fig. 15) in the ControlShield for commissioning.
- In the web browser, enter the address https://192.168.2.2.
- In the login window, enter the following data:

Username	admin
Password	Intilion

Table 22 Login data für web visualisation

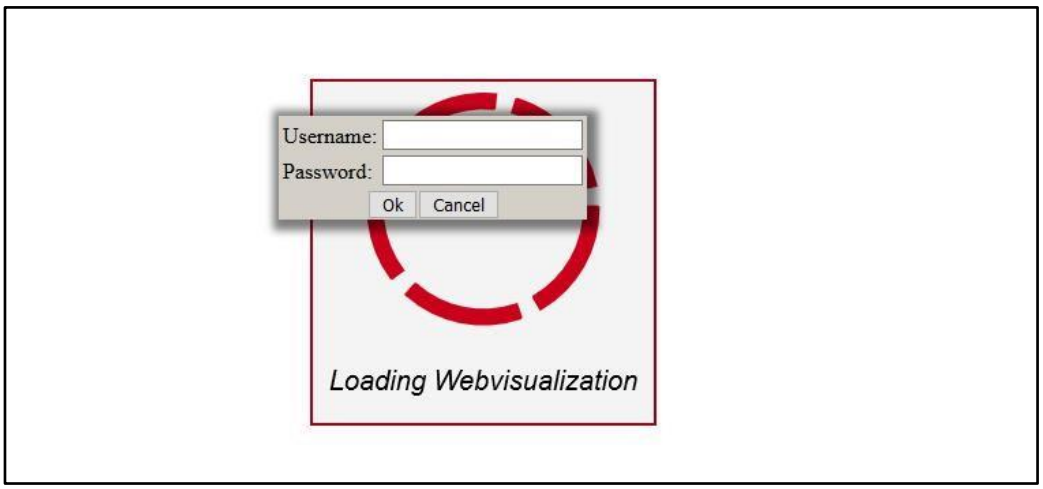

Fig. 69 Login window of the web visualisation

Now, the "INTILION web visualisation" is displayed. At the top right of the interface, the language versions German (DE) and English (EN) can be selected.

- Click the "Login" button and enter the following credentials:

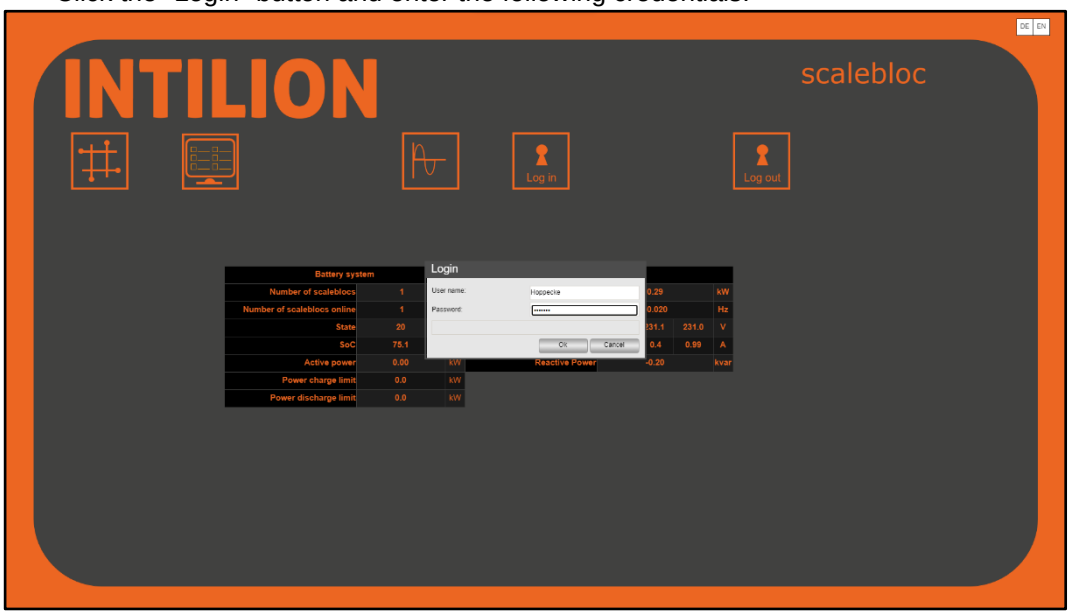

Fig. 70 INTILION web visualisation – logging in

User name	Hoppecke
Password	Service

Table 23 Login data for web visualisation

The user interface for the commissioning engineer is displayed:

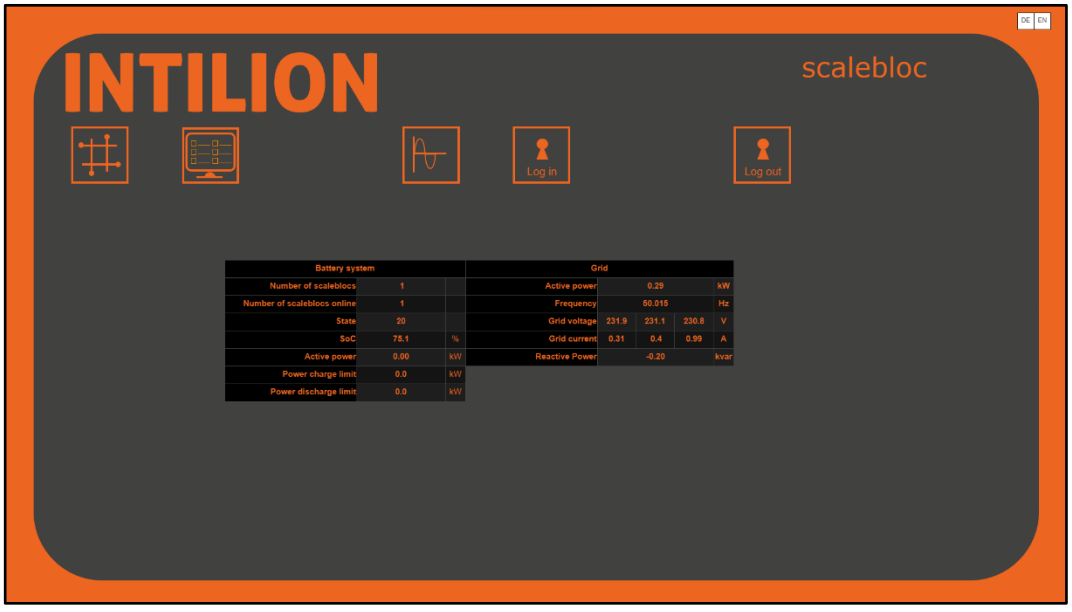

Fig. 71 INTILION web visualisation – user interface

- Click the "Configuration" button  to open the configuration settings.

6.5.2 Configuration settings

On this page, all necessary configurations for the commissioning of the battery storage can be made.

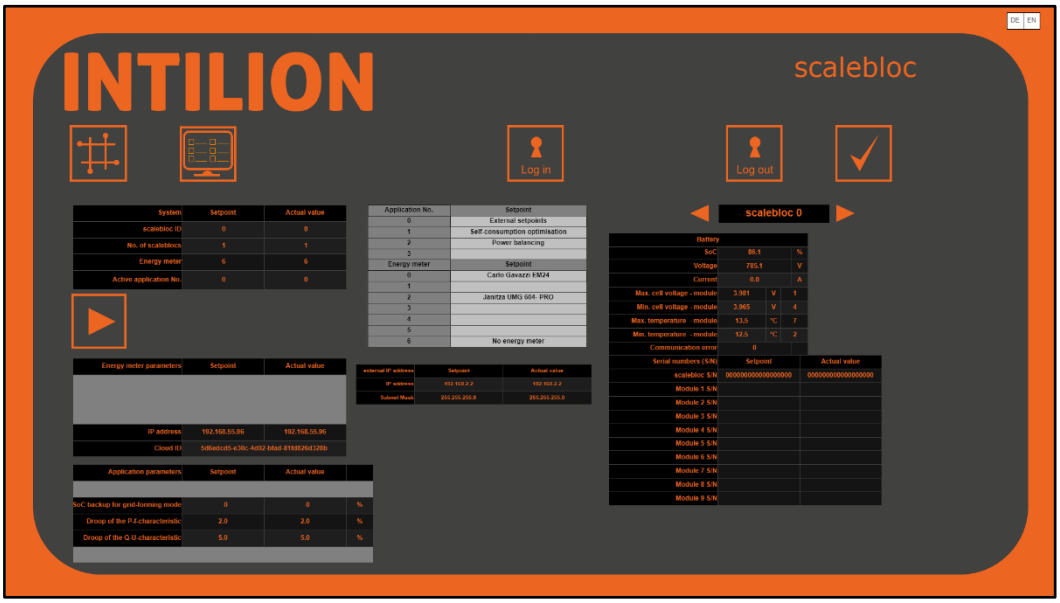

Fig. 72 INTILION web visualisation – configuration interface

In the centre of the configuration screen, there is a table with IP address and subnet mask:

- Here, you can edit the IP address and subnet mask, if necessary.

external IP address	Setpoint	Actual value
IP address	192.168.2.2	192.168.2.2
Subnet Mask	255.255.255.0	255.255.255.0

Fig. 73 INTILION web visualisation – configuration (detail central area)

At the top left, there is a table with a black background containing general data concerning the battery storage, for example, the number of INTILION | scaleblocs, if it is a master or slave system, the energy meter and the active application Information on this can be found in the adjacent table with a grey background.

- Enter the following values are into the "Setpoint" column:

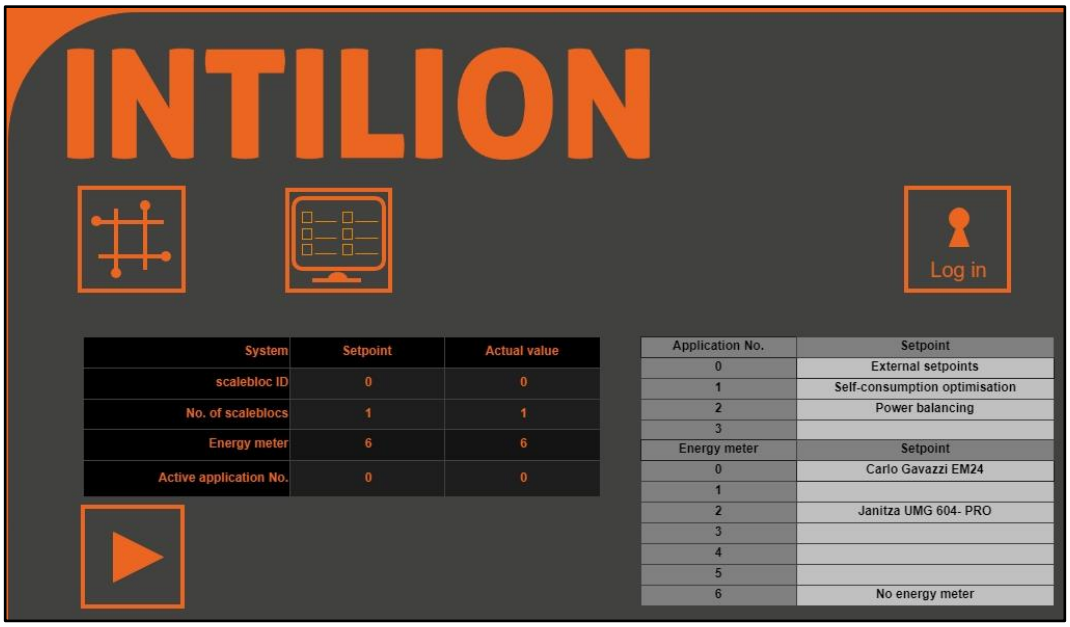

Fig. 74 INTILION web visualisation – configuration interface (upper left area)

scalebloc ID	Distinguishing master and slave: 0 = Master scalebloc 1, 2, 3 = 1–3 slave scaleblocs
No. of scaleblocs	The total number of installed battery storage units that are connected to each other via network. Possible values are: 1 = single master system 2, 3, 4 = full expansion: 1 master and up to 3 slaves[6].
Energy meter	Reference to the installed energy meter. Possible values are 0, 2 and 6. 0 = energy meter “Carlo Gavazzi EM24” 6 = no energy meter, instead external setpoint specification is used. Currently the system is compatible with “Carlo Gavazzi EM24” and “Janitza UMG 604 PRO”.
Active application No.	Enter the number of the application to be used. See section 6.7 for information on the applications.

Table 24 Configuration data INTILION | scalebloc

[6] Please note that HOPPECKE Service must be contacted when installing more than two INTILION | scaleblocs.

The only configuration option for slave systems is the „scalebloc ID“. Here, you specify the number of the slave system (1, 2 or 3). All other data concerning the slave system must be configured at the master system.

Fig. 75 INTILION web visualisation – configuring slave systems

- Concluding your input, click the "Play" button to apply the settings and automatically write them to the "Actual value" column.

6.5.3 Configuring the energy meter

On the central left of the "Configuration" screen, you can integrate an energy meter with connection to the INTILION Cloud.

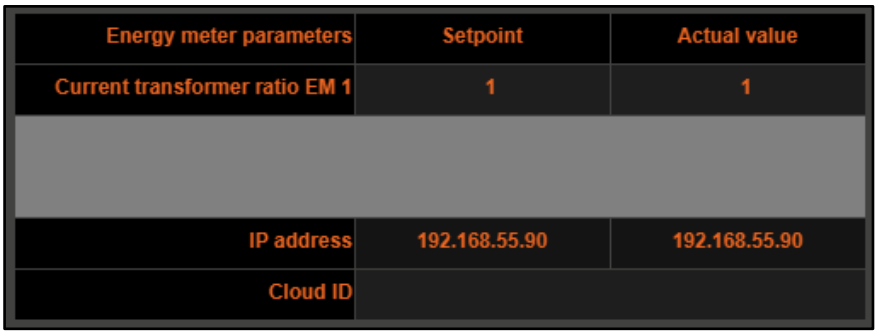

Fig. 76 INTILION web visualisation – detail (central left area)

The following settings must be made:

Current transformer ratio EM 1	Enter the current transformer ratio in the “Setpoint” field. The value “1” is the default. If the transformer ratio has already been configured during connection of the energy meter (see section 5.13), then value “1“ is left unchanged.
IP address	Enter the IP address of the energy meter in the “Setpoint” field. The default setting is 192.168.55.90, which was also assigned when the energy meter was commissioned by Carlo Gavazzi (see section 6.2). The energy meter can naturally be integrated into the customer network (for example, 192.168.2.nnn). Make sure to match this IP address to the IP address of the battery storage (see 6.5.2). Also ensure that the network with the energy meter is connected to port XF13 (see 3.1.4.4).
Cloud ID	Enter the Cloud ID specified by the HOPPECKE service (see section 1.5) in the field provided.

Table 25 Configuration of energy meter

- Click the "Play"  button to apply the settings and automatically write them to the "Actual value" column.

6.5.4 Entering serial numbers

Furthermore, the serial numbers of the battery modules of **all INTILION | scaleblocs** must be entered into the black highlighted table of the web visualisation.

As an alternative to manual entry, there is the option of using a barcode scanner to read in the serial numbers, for example, the NT-1228BL Bluetooth QR 2D barcode scanner can be used.

The following screenshot displays the relevant section of the web visualisation:

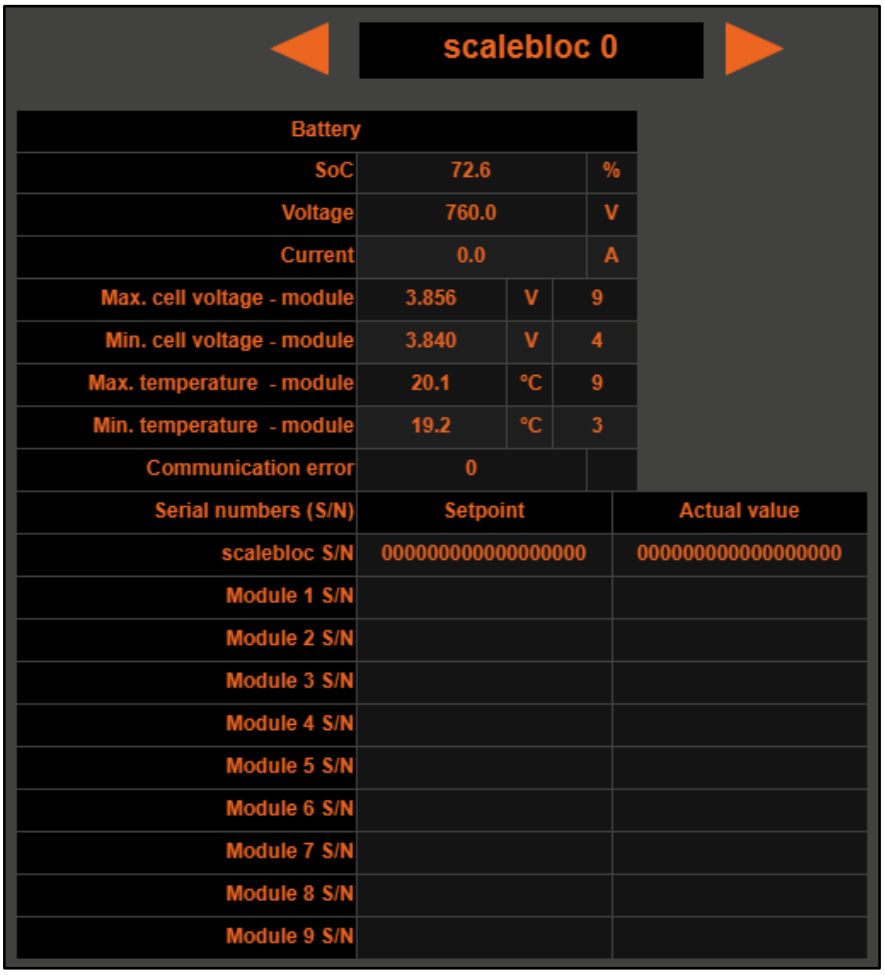

Fig. 77 INTILION web visualisation – configuring the master system

The serial number of INTILION | scalebloc is already entered – if this is not the case, it can be read from the nameplate. Furthermore, the nine serial numbers of the nine battery modules must be entered for each INTILION | scalebloc. The serial numbers are located at the front of the modules top right.

- Use the arrows to the left and right of "scalebloc 0" to switch between the individual INTILION | scaleblocs.
- "scalebloc 0" is the master. For "n" scaleblocs, you must enter n x 9 serial numbers.

- For ”scalebloc 1“ to ”scalebloc 3“ (slaves), the ”Cloud Component IDs“ must additionally be entered. You receive the correct data from HOPPECKE Service (see section 1.5).

Fig. 78 INTILION web visualisation – configuring the slave systems

- Use the "Play”  button to save all entered serial numbers and automatically write them to the "Actual value" column.

6.5.5 Noting battery characteristics

In addition, the serial number table (Fig. 77) shows the relevant battery values. All values (from "SoC" to "minimum module temperature – module") must be entered in the commissioning report.

Continue the commissioning first by mounting the cover plates (see section 6.6) before proceeding to the second part of the web visualisation settings (see section 6.7).

6.6 Mounting cover panels

Cover panels are mounted in front of the fire protection enclosures, the battery management system (BMS) and inverter(s).

6.6.1 Types of covers

The following illustrations show the cover panels for the different modules.

The fire enclosures use the cover panel with the gill plate and the Icotek grommets.

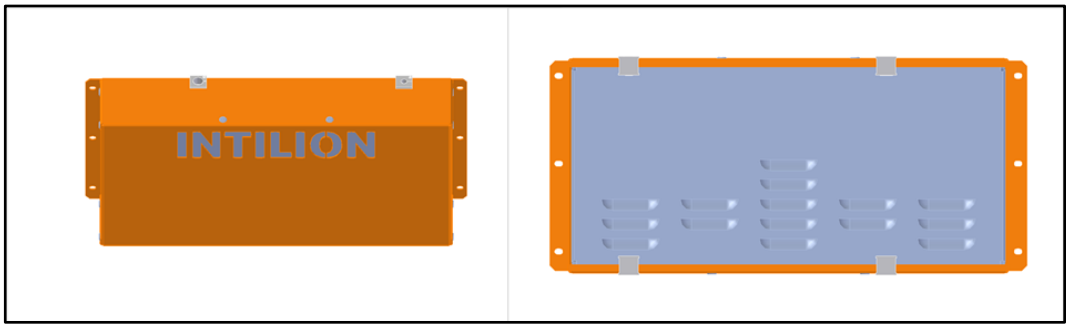

Fig. 79 Cover panel for fire protection enclosure

For the battery management system (BMS) and the inverter(s), the covers without gill plate are used.

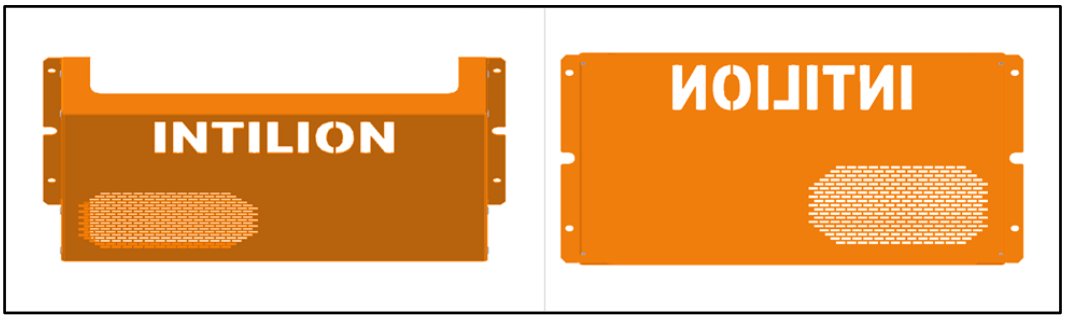

Fig. 80 Cover panel for BMS, inverter(s), and assembly space

Icotek KT13 grommets are used for the power cables and Icotek KT8 grommets are used for the communication/fan cables.

In the following, mounting one cover panel is described, the others are mounted accordingly.

No control line is connected to battery module 9 (see section 5.9). To seal the fire protection enclosure nevertheless, a dummy grommet (Icotek grommet without hole) is provided for the free recess in the cover panel. This grommet is included with INTILION | scalebloc.

- Place the Icotek KT13 or KT8 grommets around the appropriate cables.

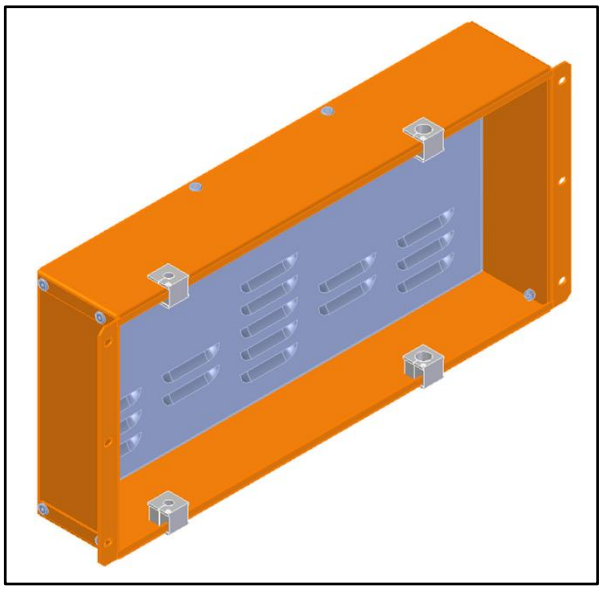

Fig. 81 Inserting the Icotek grommets into the cover for the fire protection enclosure

- Insert the Icotek grommets (coloured grey in the above graphic) into the recesses of the cover panel.
- Make sure that the Icotek grommets are placed correctly. The Icotek grommets must press against the fire enclosure with the flat side.
- Fasten the cover panel with **six** screws (1) to the fire protection enclosure (see following graphic). Tighten the screws with a tightening torque of 5 Nm.
- For the functioning of the fire protection concept, make sure that the cover panel lies flat at the module.

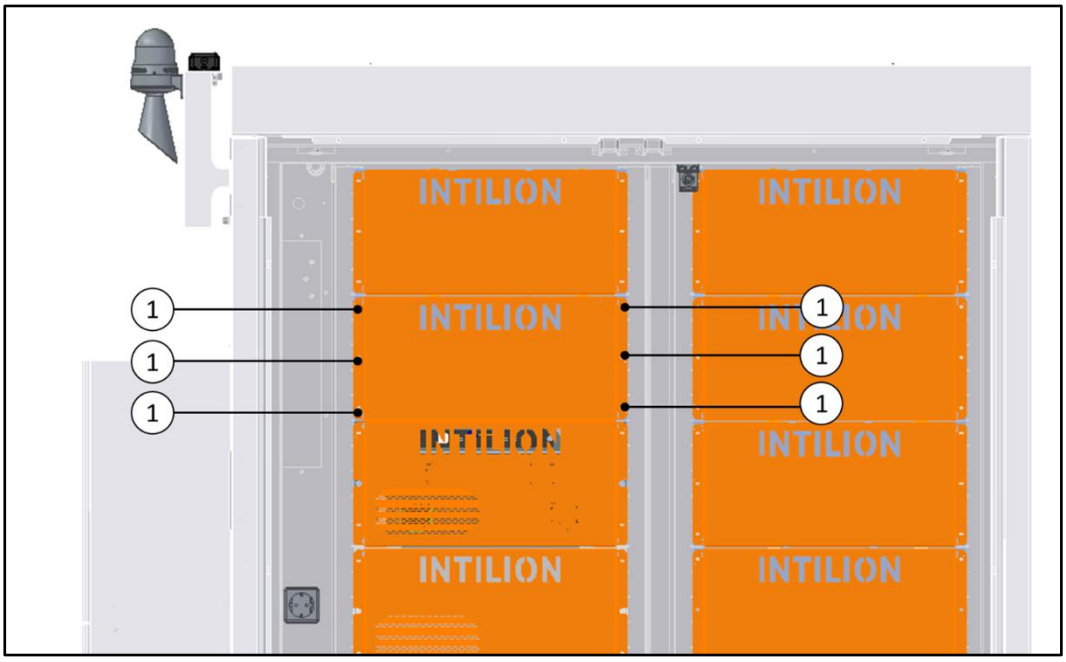

Fig. 82 Fastening the panel to the fire protection enclosure

6.7 Settings in web visualisation, part 2

6.7.1 Settings in grid-connected operation (GCO)

The following screenshot shows a table where you must make further application-specific settings.

Application parameters	Setpoint	Actual value	
Power control value	0.00	0.00	kW
SoC backup for grid-forming mode	0	0	%
Droop of the P-f-characteristic	2.0	2.0	%
Droop of the Q-U-characteristic	5.0	5.0	%

Fig. 83 INTILION web visualisation – application settings

Power control value	See section 6.7.1.2 and 6.7.1.3.
SoC backup for GFO	The "SoC backup for grid-forming operation" is the state of charge of the battery storage up to which energy can be provided in the applications of grid-parallel operation. When switching to grid-forming operation, a minimum SoC of the battery storage for the stand-alone grid is thus given at the beginning. The cross-application "SoC backup" can be set between 0 % and 100 %, the default value is 0 %.
Droop of the P-f and Q-U characteristic	These settings only apply to grid-forming operation (see section 6.7.2).

Table 26 Configuration GCO

- Use the "Play" button to save all settings and automatically write them to the "Actual value" column.

In the "external setpoint specification" application, the battery storage is controlled via the Modbus interface and the SoC backup is ignored. In the "self-consumption optimisation" and "peak shaving" applications without external control, the SoC backup is however taken into account.

6.7.1.1 Application external setpoint specification

In application 0 "External setpoints", no individual settings are necessary since the battery storage is controlled by an external energy management system or a higher-level controller via the Modbus TCP/IP interface (external setpoints). The corresponding data or Modbus list is listed in a separate document (see chapter 11).

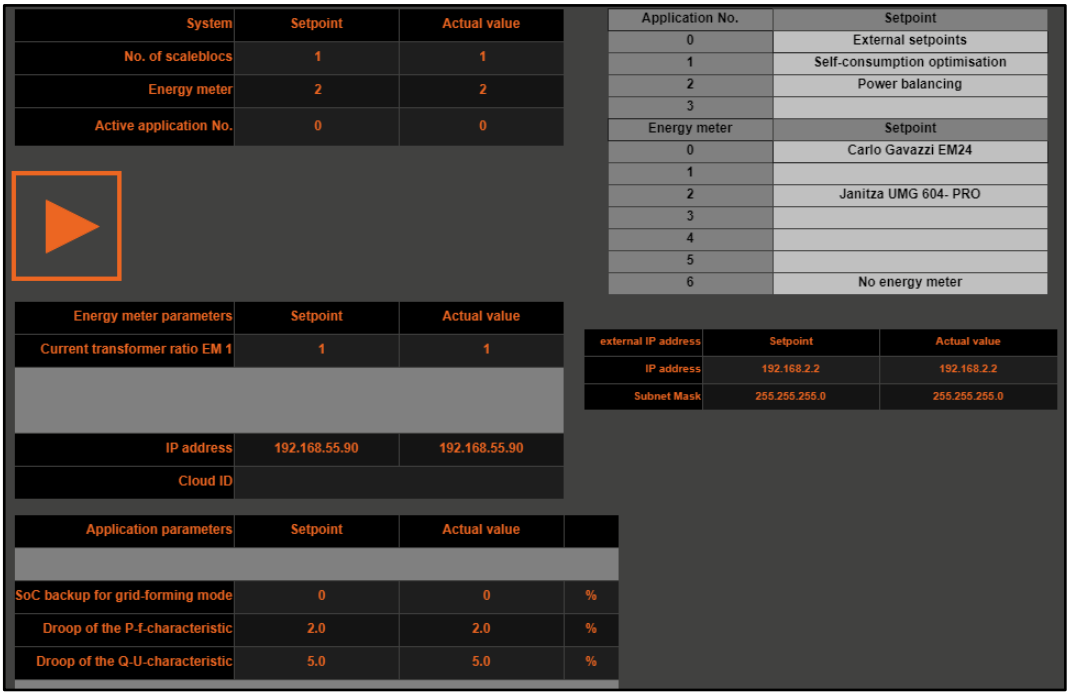

Fig. 84 INTILION web visualisation – external setpoint specification

6.7.1.2 Application self-consumption optimisation

Using a battery storage system, you can optimize the consumption of your self-produced energy. The battery storage stores surplus energy from the renewable energy system (charge) and discharges it in case of load peaks.

- Select application 1 "Self-consumption optimisation".

In the table on the lower left (see screenshot), you can see the “power control value” that is the threshold value for the battery storage at the grid connection point.

- Make sure to set the “power control value” to 0 kW (default value).

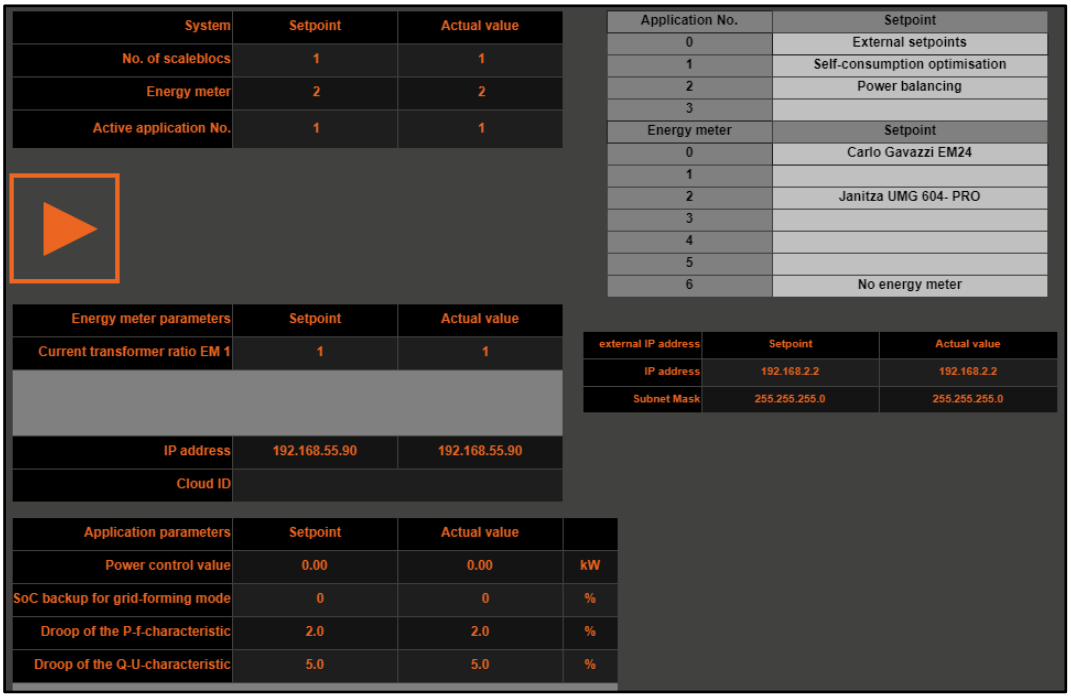

Fig. 85 INTILION web visualisation – self-consumption optimisation

6.7.1.3 Application peak shaving

By adjusting the power control value (threshold value) at the grid connection point, power balancing is possible, for example, in order not to exceed a certain power withdrawal from the grid for the load curve shown below.

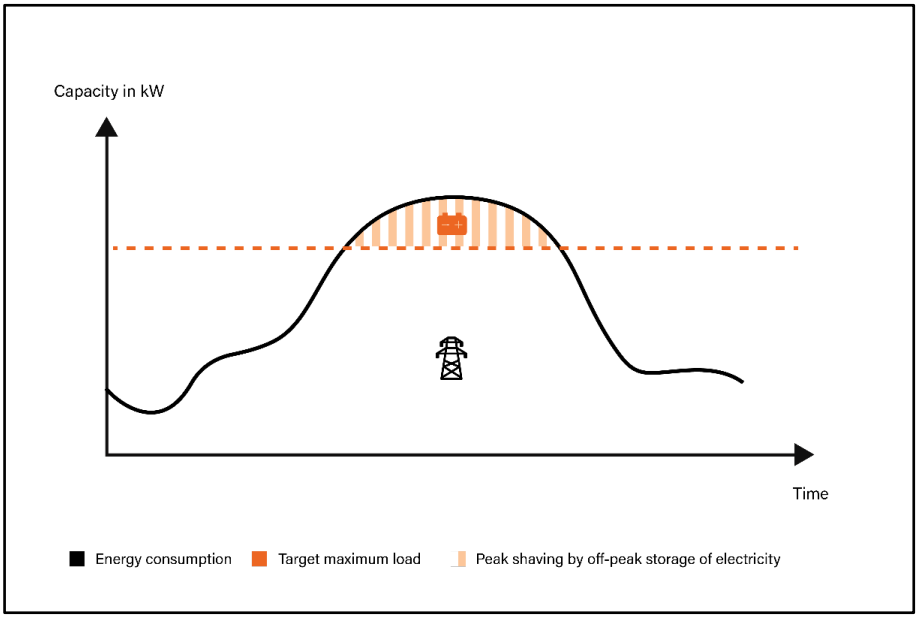

Fig. 86 Example of a load curve in the power balancing application

- Select application 2 "Power balancing".

In the table on the lower left (see screenshot below), you can see the “power control value” that is the threshold value for the battery storage at the grid connection point.

- Make sure to set the “power control value” to at least 5 kW (default value).

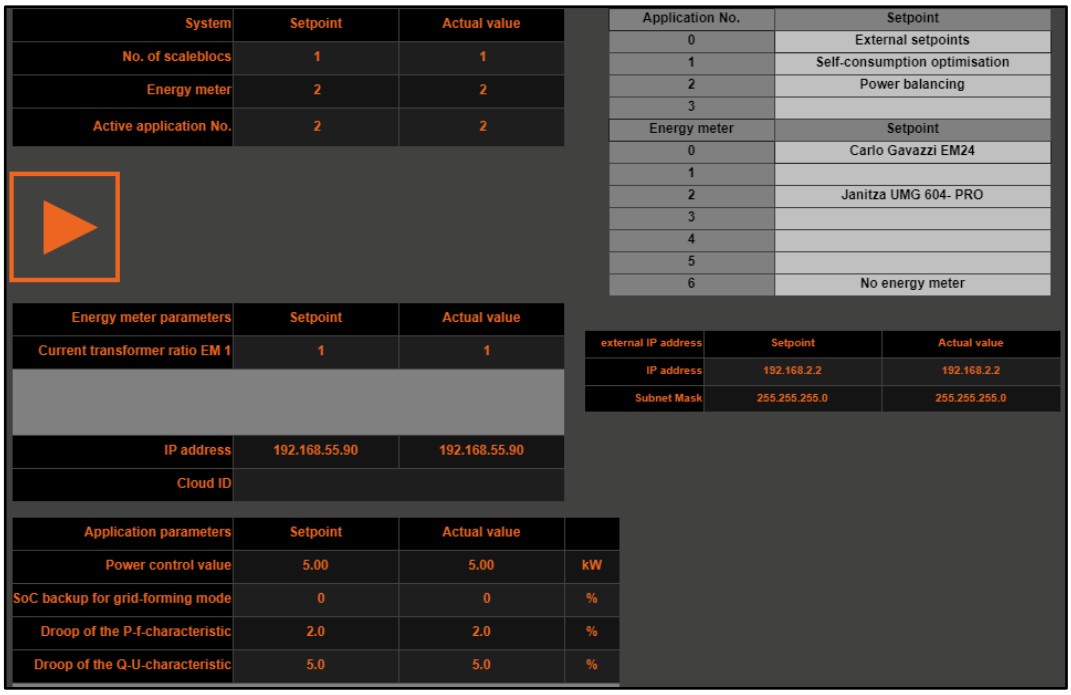

Fig. 87 INTILION web visualisation – power balancing

Analogous to self-consumption optimisation, the storage system is discharged when the threshold value is exceeded to counteract increased grid consumption. Below the threshold value, the storage system is charged again. The grid consumption is thus subject to balancing around the threshold value, considering the operating limits of the storage system.

NOTICE

The default value for the power control value must be observed:

Only positive values (grid consumption) may be selected for the intended operation.

Otherwise, the manufacturer's "Declaration of Conformity for Verification of Requirements According to VDE FNN Note "Connection and Operation of Storage Units on the Low-Voltage Grid"" of the battery storage unit loses its validity, and the operating regulations of INTILION AG would be violated.

It should be noted that this peak shaving is not based on 15-minute average power values, but on instantaneous values. The control time of the system is <1s, so that short-term load peaks are also intercepted. It should also be noted that direct load shedding, for example in the case of a discharged storage system, is not possible with this application.

If extended functions, such as the above-described balancing to 15-minute average power values or targeted load shedding are required by the customer, a higher-level control system or an energy management system (EMS) is usually necessary. INTILION | scalebloc is compatible with various commercially available EMS systems. Please contact INTILION AG for further information.

6.7.2 Settings in grid-forming operation (GFO)

The dependencies of active power P and frequency f as well as reactive power Q and voltage U in grid-forming operation result from the droop of the respective characteristic curve.

- The P-f characteristic describes the ratio of active power to frequency via its droop k_P. Values between 0.1 % and 2 % can be set, the default being 2 %.
- The Q-V characteristic describes the ratio of reactive power to voltage via its droop k_Q. Values between 2 % and 10 % can be set, the default value being 5 %.

Droop of the P-f-characteristic	2.0	2.0	%
Droop of the Q-U-characteristic	5.0	5.0	%

Fig. 88 Droop values of the characteristic curves

Example of the P-f characteristic with the pre-set droop of 2 %:

With the pre-set characteristic curve, the frequency is 50 Hz if the system is neither charging nor discharging. The droop of 2 % is related to the frequency and is set at the nominal active power of the battery storage. The following graphic shows an exemplary characteristic curve of INTILION | scalebloc power; at a nominal active power of ±50 kW, a frequency of 49 Hz or 51 Hz is set.

Analogous to this, the Q-V characteristic curve relates the voltage to the reactive power. Assuming a 230 V island network (L-N voltage) and a droop of 5 %, a nominal reactive power of ± 50 kvar (INTILION | scalebloc power) would result in a voltage of 218.5 V or 241.5 V.

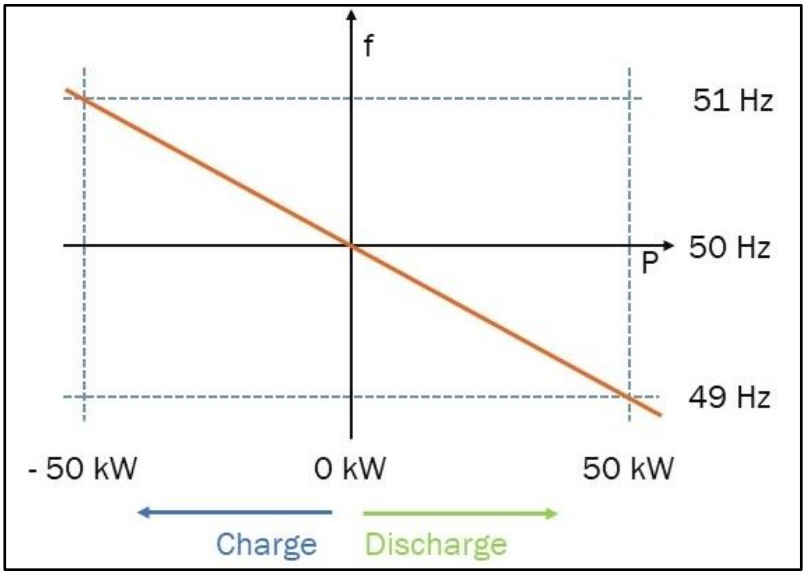

Fig. 89 Exemplary P-f-characteristic of INTILION | scalebloc power

Additional information on the characteristic curves and operation management can be found in section 7.3. Contact INTILION AG for further documentation on grid operation.

6.7.3 Running the system test

Commissioning the battery storage always ends with a test run of the system.

NOTICE

Attention, check before starting the system test!

If several INTILION | scaleblocs connected in parallel form a generation system with a maximum active power of more than 135 kW, the grid code of the inverter set at the factory in accordance with VDE-AR-N 4105 must be changed. To meet the grid connection conditions, the grid code must be set according to VDE-AR-N 4110.

- Contact INTILION AG to learn how to change the grid code.

- On the start page of the web visualisation (see Fig. 71) click the "Commissioning" button to get an overview of the last step of commissioning, the system test.

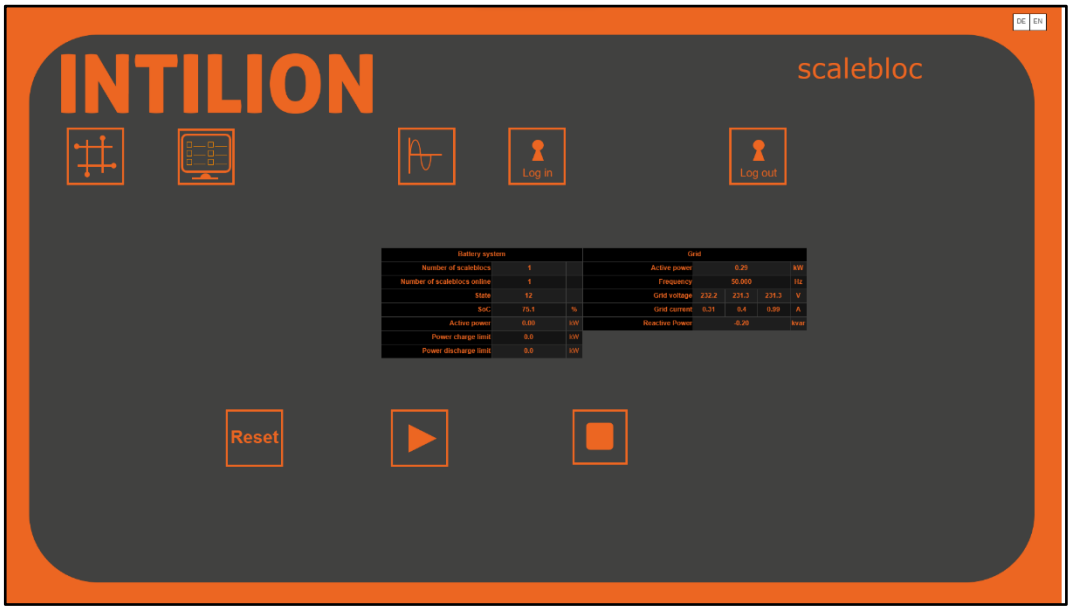

Fig. 90 INTILION web visualisation – system test

The system test forms the last step of commissioning.

- Only run the system test when all other steps have been performed according to the commissioning report.
- Make sure that all cover panels are mounted before the system test.

Note that the battery storage must be connected to the grid to run the system test.

- Click the “Play” button to start the system test.

The battery storage is charged for 30 min with 25 kW and then discharged for 30 min with 25 kW. In between, there are two-minute-breaks. After the discharging interval, the master scalebloc sends the starting signal for the commissioning system test to the next INTILION | scalebloc.

The internal sequence of the system test can be seen in the following table:

State	Description
0	Decision if temperature is over or under 10 °C
5	Storage cold: discharging with maximum possible power for 2 min. or 5.6 % SoC
10	Charging with 25 kW for 30 min. or 94.4 % SoC
20	Charging break 2 min.
30	Discharging with 25 kW for 30 min. or 8.9 % SoC
40	Charging break 2 min.
50	Charging up to 88.9 % SoC
60	Balancing to reach cell voltage difference < 25 mV

Table 27 Sequence of commissioning system test

Fig. 91 INTILION web visualisation – system test states

Afterwards, the battery storage is charged up to an SoC of 88.9 %. If the differential voltage between cell minimum and maximum is more than 25 mV, balancing is performed subsequently (this process can take up tot wo weeks, see also the beginning of this chapter).

NOTICE

System test in winter

A battery module temperature greater than 0 °C is a prerequisite for running the system test. When the grid voltage is applied and the control cabinet door is closed, the air conditioner starts heating the inside of the control cabinet.

If the temperature of the battery modules is lower than 10 °C (e. g. in case of a delayed start-up of the battery storage in winter), the battery is first discharged for two minutes as part of a system test.

Between 0 °C and 10 °C, the available discharge power increases linearly from 0 kW to the nominal power. Between 10 °C and 15 °C, the available charging power increases linearly from 0 kW to nominal power.

The system test automatically continues at suitable temperatures.

After running the system test, the battery storage automatically switches to the set application.

6.8 Contact Hoppecke Service

After completing all commissioning steps, contact HOPPECKE Service (see section 1.5) and send them the filled-in commissioning report so that they can create a customer account.

7 Operation

The battery storage unit is operated in the operating modes grid-connected operation (normal operation) and grid-forming operation (stand-alone grid).

Always keep the doors of the battery storage unit closed. If the doors are open for more than 30 minutes during operation, the battery storage unit switches to alarm mode. The state is signalled by a light and sound signal at 10-second intervals. In alarm mode, the set application is not executed.

For maintenance operations, deactivate this function by turning the **5SF2** knob switch in the ControlShield to the left, position “manual” (see Fig. 12).

DANGER

Security measures

- The battery storage unit may only be opened by persons who are qualified and/or instructed for the operating activities (see section 2.2).
- No unauthorized persons may be present at the battery storage unit.
- Do not remove or disable any safety and protective devices.
- No fire loads not included in the scope of delivery are to be stored in the battery storage.
- The battery storage system may only be operated within its specific operating limits.

- Check the battery storage once a month for externally visible damage.

7.1 Turning the system on and off

The following subsections are oriented to grid-connected operation, but also apply analogously to grid-forming operation. If the system is to start up in GFO, this must be selected via Modbus register 9004 or the dry contact. For more information, refer to section 7.2.

7.1.1 Switching on and starting

- Make sure that the power circuit breaker **1QA1** (see Fig. 13) is in automatic mode. This is true if the transparent flap is closed.
- Switch on all circuit breakers (1FB1, 2FC1, 5FC1, 5FC2 and 5FC3, see Fig. 14 and Fig. 17).
- If "external setpoint specification" is the selected application, then send a start signal ("1" in register 9000) via the Modbus TCP/IP interface (XF13, see Fig. 15).

If the applications "self-consumption optimisation" or "peak shaving" are set, the system detects the grid via the energy meter and starts automatically.

The status LED of knob switch **5SF2** (2 s ON and 0.5 s OFF, see Fig. 12) signals the "starting" operating state of the battery storage. If the LED is constantly lit, the battery storage unit is in “run/standby” operating state (system state 40).

7.1.2 Stopping and turning off

- Send a stop signal ("2" in register 9000) in the "External setpoint specification" application via the Modbus TCP/IP interface (XF13, see Fig. 15).

The status LED of knob switch **5SF2** (2 s ON and 0.5 s OFF, see Fig. 12) signals the operating state "stop" of the battery storage. If the applications "self-consumption optimisation" or "peak shaving" are selected, execute the next step directly.

- Turn knob switch **5SF2** to the centre position and then turn off the circuit breakers (1FB1, 2FC1, 5FC1, 5FC2 and 5FC3, see Fig. 14 and Fig. 17).

7.1.3 Resetting errors

When the alarm mode has been triggered (for example, if the doors have been open for more than 30 min), the system can be restarted by means of an error reset.

- To restart the battery storage (system reset), press the blue reset button in the ControlShield (**5SF3**, see Fig. 12).

7.2 Switching GCO and GFO

The switchover between grid-connected operation (GCO) and grid-forming operation (GFO), shown in the following graphic, is done either via the Modbus TCP/IP interface (see section 7.2.2) or the dry contact (digital input at XD14.5, see section 7.2.3).

The applications in grid-connected operation and their settings are described in section 6.7.1 section.

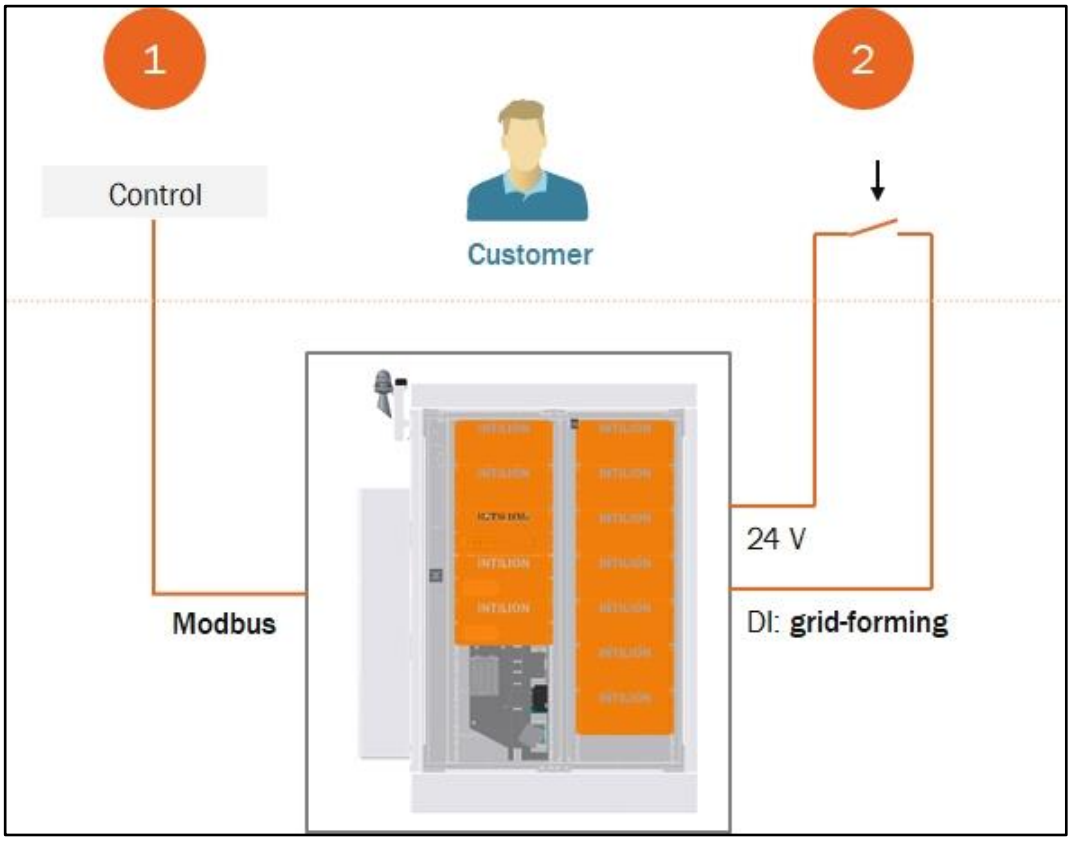

Fig. 92 Switching operating modes – Modbus and DI

Further information on the operating modes and how to switch between them is available from INTILION AG in a separate document on request.

In the initial state, the battery storage is in grid parallel operation (system state 40 – Run). The inverter is connected on the AC and DC sides, the contactors of the BMS and the circuit breaker of the ControlShield are closed.

The contactors of the BMS always remain switched on during the changeover of the operating modes.

The system states and Modbus registers mentioned in this section can be viewed in the separate Modbus list (see chapter 11).

NOTICE

Star point treatment in grid-forming operation

The neutral point is simulated in the GFO by the inverter and must be earthed by the customer. For more information, refer to the application rule VDE-AR-E 2510-2.

7.2.1 AC-DC voltage dependency

In the operating modes and when switching between them, the dependence between the maximum AC voltage of the grid and the DC voltage of the battery must be observed. The characteristic curve in the following graphic shows this relationship:

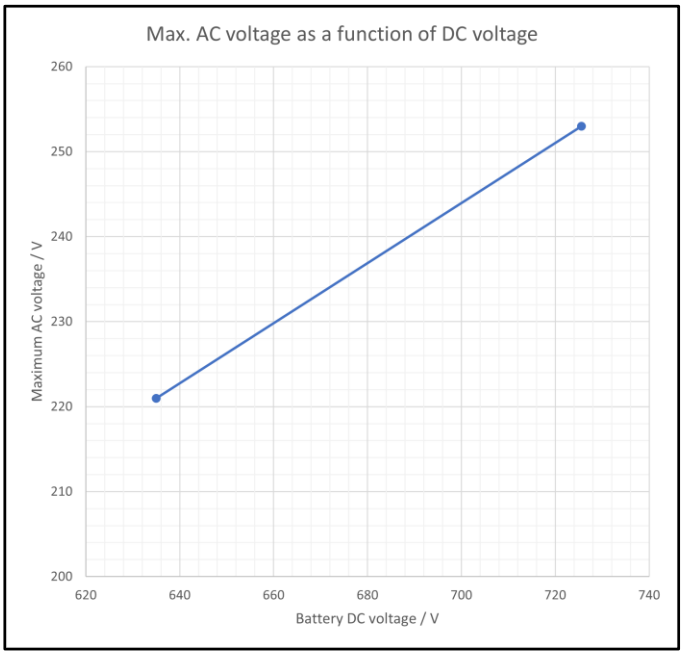

Fig. 93 Max. AC voltage as a function of DC voltage

Due to the physical behaviour of the inverter, the grid voltage must not exceed a respective maximum value for each value of the battery voltage. If the AC voltage is above the characteristic curve, a fault may occur in the battery storage unit.

For example, in the case of re-synchronisation of the battery storage when changing from GFO to GCO, the applied grid voltage should meet the requirement. To check compliance, the actual DC voltage of the battery must be read out via Modbus register 5053.

7.2.2 Switching via Modbus TCP/IP

The Modbus interface XF13 in the ControlShield (see Fig. 15) can be used to switch between grid-connected operation and grid-forming operation.

7.2.2.1 Changing from grid-connected to grid-forming

To switch from the GCO (system state 40) to the GFO, proceed as follows:

- Disconnect the battery storage unit from the public grid. This can be done intentionally or be caused by a grid failure.

  The power section of the inverter disconnects on the AC and DC sides (system states 20 and 30). The contactors of the BMS and the circuit breaker of the ControlShield remain closed.
- Send "1" to Modbus register 9004 to select the GFO.
- Send "2" into Modbus register 9000 to send a stop signal and activate the GFO.

NOTICE

Caution, danger of short circuit!

If the battery storage is not disconnected from the public grid, there is a risk of a short circuit with the built-up stand-alone grid of the battery storage when it returns.

- Secure the battery storage unit against reconnection to the public grid by disconnecting it from the grid in grid-forming operation with a suitable device.
- Send "1" to Modbus register 9000 to start the GFO.

First, the circuit breaker on the ControlShield opens (system state 130). Then the inverter starts to build up the stand-alone grid (DC and AC side connection). Then the circuit breaker of the ControlShield closes and disconnects the stand-alone grid at terminal XD11 (system state 140 – Run GFO, see Fig. 18).

7.2.2.2 Changing from grid-forming to grid-connected

To switch from the GFO (system state 140) to the GCO, proceed as follows:

NOTICE

Caution, danger of short circuit!

Do not reconnect the public grid for grid-parallel operation until grid-forming operation has stopped.

If the battery storage is not disconnected from the public grid, there is a risk of a short circuit with the built-up island grid of the battery storage when it returns.

- Secure the battery storage unit against reconnection to the public grid by disconnecting it from the grid in grid-forming mode using a device.
- Send a "2" to Modbus register 9004 to select the GCO.
- Send a "2" to Modbus register 9000 to stop the GFO and enable the GCO.

The power section of the inverter disconnects on the AC and DC sides (system state 20). The circuit breaker of the ControlShield remains closed.

- Switch on the public network.

The grid is connected and is applied to the inverter on the AC side.

- If the application "External setpoint specification" is set in the GCO, send a "1" to Modbus register 9000 to start GCO. If other applications are set, the GCO starts automatically.

The inverter connects DC and AC sides (system state 40 – Run GCO).

7.2.3 Switching via digital input

The customer's dry contact (at XD14.5) in the ControlShield can be used to switch between grid-connected operation (DI not switched) and grid forming operation (DI switched).

- To switch the digital input, connect 24 V (terminal 6 of terminal strip XD3) to DI1 (terminal 5 of terminal strip XD14, see Fig. 22).

The switching of the operating modes via the digital input can, for example, be realized automatically by a device with synchronisation relay (not included in the scope of delivery).

- Check that there is a "0" in the Modbus register 9004. Send a "0" if necessary.

7.2.3.1 Changing from grid-connected to grid-forming

To switch from the GCO (system state 40) to the GFO, proceed as follows:

- Disconnect the battery storage unit from the public grid. This can be done manually or due to a grid failure.

The power section of the inverter disconnects on the AC and DC sides (system state 20 and 30). The contactors of the BMS and the circuit breaker of the ControlShield remain closed.

NOTICE

Caution, danger of short circuit!

If the battery storage is not disconnected from the public grid, there is a risk of a short circuit with the built-up island grid of the battery storage when it returns.

- Secure the battery storage unit against reconnection to the public grid by disconnecting it from the grid in grid-forming mode using a device.
- Switch the Digital Input to change to the GFO.

First, the circuit breaker on the ControlShield opens (system state 130). Then the inverter starts to build up the stand-alone grid (DC and AC side connection). Then the circuit breaker of the ControlShield closes and disconnects the stand-alone grid at terminal XD11 (system state 140 – Run GFO).

In grid-forming operation, the DI must be switched permanently. As soon as the DI drops out, the changeover to grid-connected operation starts.

7.2.3.2 Changing from grid-forming to grid-connected

To switch from the GFO (system state 140) to the GCO, proceed as follows:

NOTICE

Caution, danger of short circuit!

Do not reconnect the public grid for grid-parallel operation until grid-forming operation has stopped.

If the battery storage is not disconnected from the public grid, there is a risk of a short circuit with the built-up island grid of the battery storage when it returns.

- Secure the battery storage unit against reconnection to the public grid by disconnecting it from the grid in grid-forming operation with a device.
- Disconnect the Digital Input to switch to the GCO.

NOTICE

Caution, danger of short circuit!

- Secure the disconnected digital input before switching it on again.

Otherwise, there is a risk of short-circuiting the stand-alone system set up in grid-forming operation with the public grid still connected during parallel grid operation and inadvertent switching of the digital input.

The power section of the inverter disconnects on the AC and DC sides (system state 20). The circuit breaker of the ControlShield remains closed.

- Switch on the public network.

The grid is connected and is applied to the inverter on the AC side.

- If the application "External setpoint specification" has been newly set in the GCO (for example, after system start), send "1" to Modbus register 9000 once to start GCO. This step is no longer necessary for subsequent changeover processes, since the "1" is now permanently written.

The inverter connects DC and AC sides (system state 40 – Run GCO).

7.3 Operational management in grid-forming operation

In grid-forming operation (GFO), frequency and voltage can be actively managed, and changes made to these variables. This makes it possible to adjust and control generation and load flows in a targeted manner, e. g., a photovoltaic inverter can be controlled by increasing the frequency.

Further information on the management of the grid-forming operation is provided by INTILION AG can provide this information in a separate document on request.

7.3.1 Frequency change (P-f characteristic)

In the GFO, the nominal frequency changes as a function of the instantaneous active power according to the P-f characteristic pre-set during commissioning (see section 6.7.2).

By setting the reference frequency (Modbus register 9006), the nominal frequency can be adjusted in a predefined range during operation and thus causes an additive increase or decrease of the frequency changes caused by the active power as an offset. The P-f characteristic curve thus shifts to the left and right with a frequency offset as shown in the graphic.

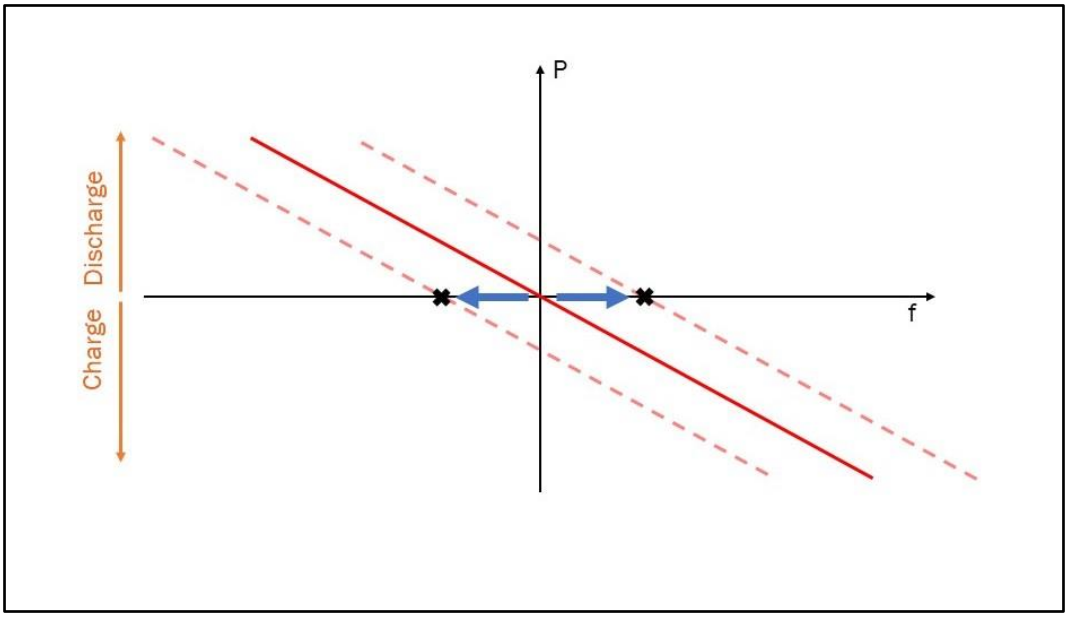

Fig. 94 P-f characteristic with frequency offset

In the same way, it is possible to increase or decrease the frequency during operation by specifying an active power setpoint (Modbus register 9001, to be understood as offset in grid-forming operation) in addition to the active power which is set by loads or generators. The P-f characteristic shifts up and down when an active power setpoint is specified (see following graphic).

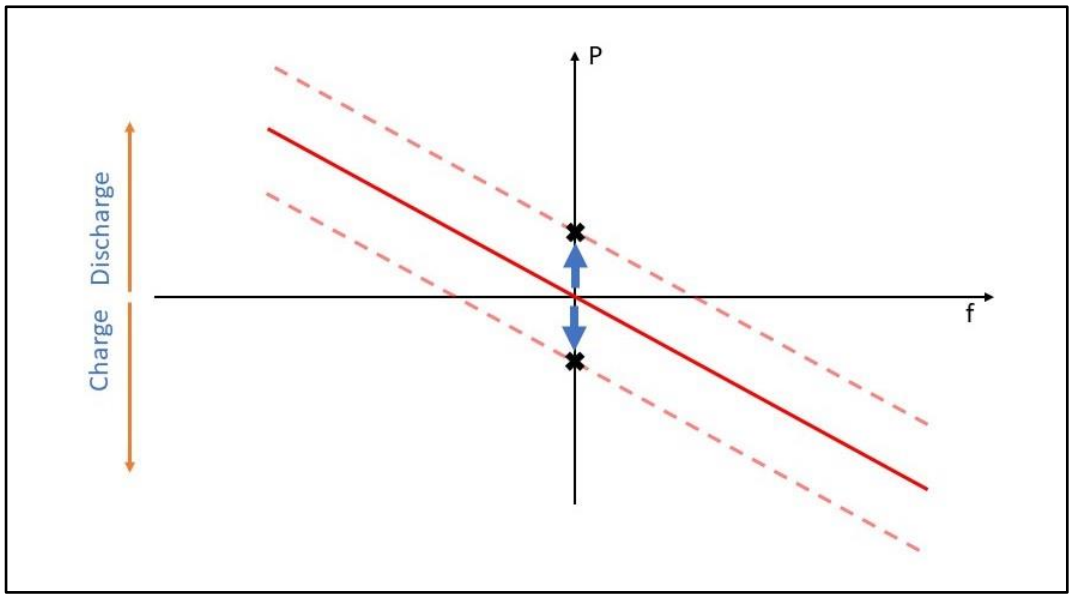

Fig. 95 P-f characteristic with active power setpoint value

This makes it possible, for example, to synchronize to an external network or to shift energy between two systems. Furthermore, the behaviour of loads and generators can be actively influenced.

7.3.2 Voltage change (Q-V characteristic)

In the GFO, the nominal voltage changes as a function of the instantaneous reactive power according to the Q-V characteristic pre-set during commissioning (see section 6.7.2).

By pre-setting the reference voltage (Modbus register 9005), the nominal voltage can be set in a predefined range during operation and thus causes an additive increase or decrease of the voltage changes caused by the reactive power as an offset.

In the same way, it is possible to increase or decrease the voltage during operation by specifying a reactive power setpoint (Modbus register 9002, to be understood as an offset in grid-forming operation) in addition to the reactive power that is generated by loads or generators.

Corresponding to the P-f characteristic from section 7.3.1 the Q-V characteristic shifts to the left and right in the case of a voltage offset, and up and down in the case of a reactive power setpoint.

This can be used, for example, to stabilize the voltage and synchronize to an external network.

8 Malfunction

In case of malfunctions, consult the error list (see chapter 11) or contact HOPPECKE Service (see section 1.5).

9 Maintenance

Conduct the prescribed maintenance work in time.

9.1 Safety measures during maintenance work

If it should be necessary to conduct work in the battery storage unit which raises dust (e. g. removal of dirt deposits), the smoke detector must be covered with a protective cap before starting the work.

After finishing the work, the protective cap must be removed without fail!

Observe the following points before and during the execution of maintenance work:

– Maintenance work may only be conducted by qualified personnel.

- Wear the personal protective equipment required for the job.
- Block access to the working area of the battery storage unit. Make sure that no unauthorized persons are in the working area of the battery storage unit.
- Make sure that all assemblies/components have cooled down to ambient temperature.
- Only work on low-mounted components in a squatting position, not in a bent-over position. Conduct work on high-mounted components in an upright, straight posture.
- Use a ladder if you cannot reach assemblies/components to be serviced from the ground. Do not use a lean-to ladder and ensure that the ladder is secure and stable.
- Immediately replace all assemblies/components that are not in perfect working order.
- Only use original spare parts.

Perform the following activities before recommissioning the battery storage unit:

- Check all previously loosened screw connections again for tightness.
- Check that all previously removed guards, cover panels, etc. are properly reinstalled and secured.
- Ensure that all tools, materials, and other equipment used have been removed from the work area.
- Clean the work area.
- Make sure that all safety devices of the battery storage unit are working properly again.
- After completing maintenance work, lock all doors of the battery storage unit.

9.2 Inspection and maintenance work

9.2.1 Maintenance intervals

Component	Maintenance	Reference to section
Annual		
Battery storage	Perform visual inspection, check screw connections	9.2.3.1
Battery modules	Visual inspection	9.2.3.2
Update the displayed SoH	According to description	9.2.3.3
Air conditioner	According to the specifications of INTILION AG	9.2.3.4
Smoke detector	According to the specifications of the supplier	9.2.3.5
Doors	According to description	9.2.3.6
Special maintenance intervals		
Air conditioner	According to description	9.2.4.1
Inverter	According to description	9.2.4.2
Electrical equipment	According to description	9.2.4.3

Table 28 Maintenance intervals

9.2.2 Preparatory measures

DANGER

There is a risk of electric shock when touching live parts.

Since batteries are present in the system and cannot be de-energized, a life-threatening DC voltage is always present in parts of the system.

The battery storage unit can only be de-energized on the grid side up to the battery management system (connections P+ and P-). The individual battery modules cannot be de-energized. Dangerous electrical voltages are always present at the power connections of the battery modules and at the B+ and B- connections of the battery management system.

Work on the electrical equipment may only be conducted by a qualified electrician with an WLE pass. This person is specially trained for working on electrical equipment and for working under voltage and can recognize and avoid hazards.

- Observe five safety rules:
  1. Unlock
  2. Secure against restarting
  3. Determine freedom from voltage
  4. Earth and short circuit
  5. Cover or fence off live parts

- Shut down the system.
- Make sure that the DC contactors are open. Confirm that there is no voltage between the P+ and P- poles of the BMS by measuring the voltage.
- Make sure that the circuit breakers are open.
- Secure the circuit breakers against reclosing and switch off the circuit breaker.

9.2.3 Maintenance – annual

9.2.3.1 Battery storage

Perform visual inspection

- Perform a visual inspection and check the battery storage for
  - mechanical damage
  - dirt deposits
  - unfamiliar sounds

If it is necessary to conduct work in the battery storage unit which raises dust (e. g. removal of dirt deposits), the smoke detector must be covered with a protective cap before starting the work.

After finishing the work, the protective cap must be removed without fail!

Remove dirt deposits

- Cover the smoke detector with a protective cap.
- Remove any dirt deposits that are present.
- Remove the protective cap.
- Report any damage to the operator at once.
- Check that the drainage of the condensate of the air conditioner is ensured.

Check screw connections

- Check all screw connections of the battery storage unit for tightness.
- Tighten loose screw connections firmly (screw tightening torque according to screw size and strength class).

UPS lead batteries of the ControlShield

- Check, for the first time after two years, the UPS lead batteries of the ControlShield in accordance with DIN EN 50272-2 and the manufacturer's specifications, replace the batteries if necessary.

Replacing the UPS lead-acid batteries is recommended after 5 years.

- Measurement of total voltage (≥ 25.5 V)
- Measurement of the surface temperature (only for sealed types, ≤ 30 °C)
- Visual inspection of the plug-in connections for tight fit
- Visual inspection for pole/plate growth
- Visual inspection for mechanical damage of the vessels
- Visual inspection for cleanliness of the battery system
- Visual inspection Connection cable (+/-) Supply cable Battery
- Visual inspection markings and markings
- Cleaning of the battery surface (normal signs of use)

9.2.3.2 Battery modules

- Perform a visual inspection and check the battery modules for
  - mechanical damage
  - corrosion
  - Markings on plus and minus pole
- Report any damage to the operator immediately.

9.2.3.3 Calibrating the SoH

Like the system test during initial commissioning, the SoH calibration can be started by clicking the "Commissioning"  button in the web visualisation (see section 6.5). If commissioning followed by the system test has already been completed once, the system “remembers” and automatically starts calibrating the SoH when the “Commissioning” button is clicked.

Make sure that the applied AC grid voltage is approx. 230 V so that the battery storage can be discharged to 5.6 % SoC (see section 7.2.1).

If 230 V grid voltage is not provided, then the SoH may not be (correctly) updated. The alert for SoH calibration is however reset nevertheless.

To update the SoH measured by the battery management system, a routine stored in the control program first charges the battery storage to an SoC of 93% and then discharges it to an SoC of 10%, with a charge and discharge power of 25 kW. In between the charging and discharging procedures, there is a 28-min-break.

The following table shows the internal states of the SoH calibration:

State	Description
0	Start of SoH calibration
10	Charging with 25 kW up to 97.8 % SoC
20	Charging interval 28 min. and balancing to reach cell voltage difference of < 25 mV
30	Discharging with 25 kW up to 5.6 % SoC
40	Charging interval 28 min.

Table 29 Sequence of SoH calibration

If the voltage differences of the cells are greater than 25 mV, the balancing process starts first after the charging process as in the initial commissioning (see chapter 6).

If the voltage difference between the cells exceeds 80 mV during operation, the battery storage unit issues the warning message "SoH calibration required – contact HO service". If this message occurs, contact HOPPECKE Service (see section 1.5) or conduct SoH calibration yourself.

Note that the battery storage is unavailable during SoH calibration or cell balancing.

9.2.3.4 Air conditioner

To maintain the performance of the air conditioner, clean the air filter regularly (at least every three months).

The intake air filter is located behind the front cover. To access the filter, first loosen the screw of the lower grille insert. Then swing it down and slide the filter mat out upwards.

The filter can now be cleaned, or a new filter can be inserted.

Notes on cleaning:

- Rinse the filter with warm water from the outlet side (inside) to the suction side (outside). Do not use corrosive agents.
- Allow the filter to drain after rinsing. Place it with one corner down to ensure complete drainage.

Except for cleaning or replacement of the air filter, the air conditioner does not require any maintenance activities.

9.2.3.5 Smoke detector

Since there is a direct connection to the optical and acoustic warning detector, but no central connection to a central fire alarm system, there are no specific requirements for maintenance. An annual test with smoke gas to trigger the warning detector is recommended.

9.2.3.6 Doors

- Check the sealing elements of the doors for wear.
- Replace the sealing elements when worn.

9.2.4 Special maintenance intervals

9.2.4.1 Air conditioner

- Clean the air filter of the air conditioner at least every 3 months.

9.2.4.2 Inverter

It is recommended to replace the cooling fan after six years of operation. This can be done by the customer or by the manufacturer. Please note that the replacement must be conducted by a qualified electrician and that the inverter must be disconnected on the AC and DC sides for this purpose (dismantled state).

9.2.4.3 Electrical equipment

DANGER

Danger to life due to electric shock!

Live components can cause fatal electric shock if touched.

Work on the electrical equipment may only be conducted by a qualified electrician with an WLE pass.

- Conduct the preparatory measures (see section 9.2.2).
- Perform the safety check according to the country-specific guidelines and standards.

9.2.5 Updating software from remote

In case of a software update the person responsible for the plant will be contacted by INTILION AG. A predefined period will be defined during which the software update will be installed.

Within this period, the person responsible for the system must be on site and must ensure the following:

- It is not allowed to run switching operations within the operator's electrical infrastructure on site up to the connection point of the network operator.
- The person responsible for the plant must be reachable by telephone.
- Fast access to the battery storage is guaranteed.
- The battery storage is in the state defined by INTILION AG.

Commissioning of the battery storage after completion of the update is only possible in the presence of the person responsible for the system and will be coordinated by him/her on site.

If you require further information on the maintenance of the battery storage unit, contact HOPPECKE Service (see section 1.5).

10 Decommissioning and disassembly

10.1 End of life

The end of life of the battery storage unit is reached when the SoH falls below the value of 70 %. The available charging and discharging power are set to 0; from this point on, charging and discharging are no longer possible.

10.2 Switching off the battery storage

NOTICE

Observe the safety instructions in section 4 if you want to switch off the battery storage only temporarily.

- Shut down the system (see also section 7.1.2). If possible, send a stop signal via the Modbus TCP/IP interface (XF13) for this purpose.

The status LED at the knob switch **5SF2** – 2 sec ON and 0.5 sec OFF – signals the operating state "Stop" of the battery storage (see Fig. 12).

- Switch off all circuit breakers (1FB1, 2FC1, 5FC1, 5FC2 and 5FC3, see section 3.1.4.3).
- Make sure that the DC contactors are open.
- Confirm that there is zero potential between the P+ and P- poles of the BMS by measuring the voltage.
- Disconnect the battery storage unit from the grid.

10.3 Hazards during disassembly

DANGER

There is a risk of electric shock when touching live parts.

Since batteries are present in the system and cannot be de-energized, a life-threatening DC voltage is always present in parts of the system.

The battery storage unit can only be de-energized on the grid side up to the battery management system (connections P+ and P-). The individual battery modules cannot be de-energized. Dangerous electrical voltages are always present at the power connections of the battery modules and at the B+ and B- connections of the battery management system.

Work on the electrical equipment may only be conducted by a qualified electrician with an WLE pass. This person is specially trained for working on electrical equipment and for working under voltage and can recognize and avoid hazards.

- Observe five safety rules:
  6. Unlock
  7. Secure against restarting
  8. Determine freedom from voltage
  9. Earth and short circuit
  10. Cover or fence off live parts

WARNING

Risk of injury

There is a risk of injury during disassembly.

- Close off the danger area.
- Keep unauthorized persons away from the danger area.
- Designate a person responsible for the disassembly activities.
- Allow work to be conducted only by instructed and authorized personnel.
- Wear protective work clothing, protective gloves, safety shoes and hard hat.

CAUTION

Risk of injury due to improper removal of the battery modules

Improper removal of the battery modules poses ergonomic hazards.

Proceed as follows when carrying and removing the battery modules.

- Choose a body position as close and frontal to the load as possible.
- Place your feet at least hip-width apart.
- Make sure you have good, complete foot-to-shoe earth contact.
- Use leg strength to lay down, lay down from the legs.
- Keep your back naturally straight, avoid a hollow back.
- Avoid jerky movements.
- Avoid twisting the spine.
- Carry the load as close to your body as possible.
- Carry the loads in the middle of the body or divided on both sides of the body.
- Carry heavy, awkward, or bulky loads in pairs.

Also note the following points when performing disassembly work:

- Make sure that all assemblies/components have cooled down to ambient temperature.
- Only work on low-mounted components in a squatting position, not in a bent-over position. Conduct work on high-mounted components in an upright, straight posture.
- Use a ladder if you cannot reach assemblies/components to be disassembled from the ground. Do not use a lean-to ladder and ensure that the ladder is secure and stable.

10.4 Disassembly work

⚠ PREPARATORY MEASURE: DISCHARGE BATTERY MODULES

In preparation for disassembly work and transport, the battery modules must first be discharged to a low SoC (see chapter 12) for safety reasons.

- Open the doors of the battery storage unit.

The doors can latch in two positions (90° and 120° opening angle). When closing the doors later, make sure to release the latching hooks first.

- Discharge the battery modules to an SoC in the lower range. To do this, contact HOPPECKE Service (see section 1.5).

10.4.1 Dismantling the panels

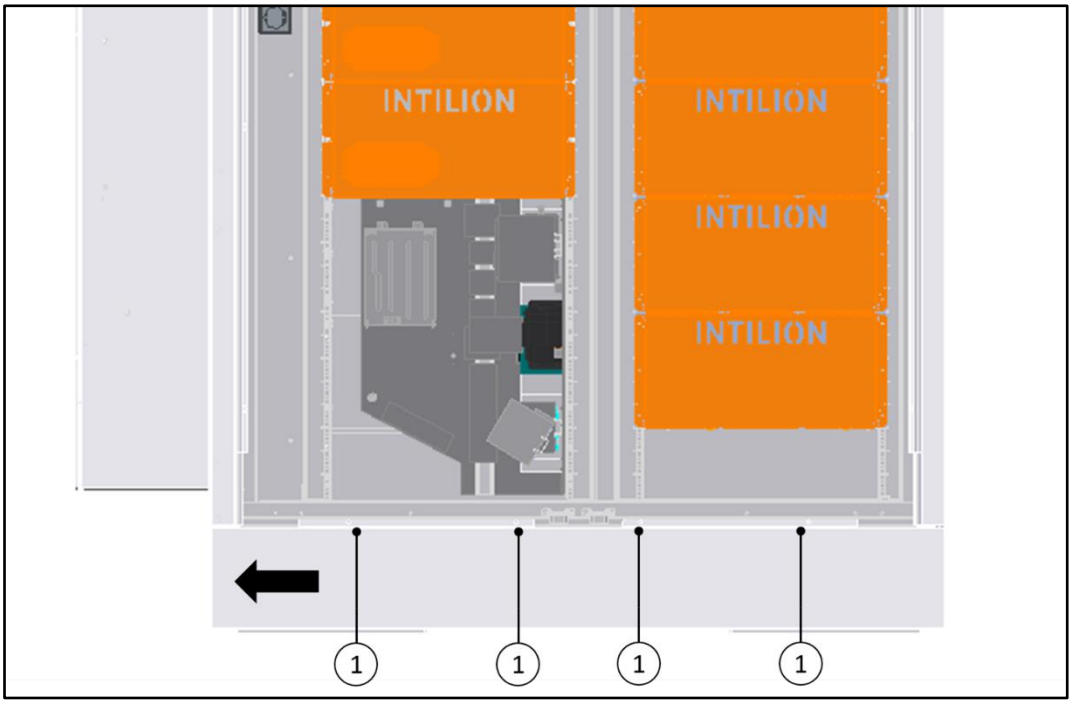

Fig. 96 Removing the front panel

- Remove the screws (1) on the front side.
- Slide the front panel approx. 10 mm in the direction of the arrow and remove it.
- Remove the side panels in the same way. Slide the side panels forward to the operating side for removal.

10.4.2 Dismantling communication, control, and power cables

- Disassemble the communication, control, and power cables.
- Loosen the screws of the Icotek frame and remove the cables.
- Remove the Icotek grommets from the cables.
- Disassemble the Icotek frame from the base plate (3).
- If necessary, remove the base plates (1) to (5).

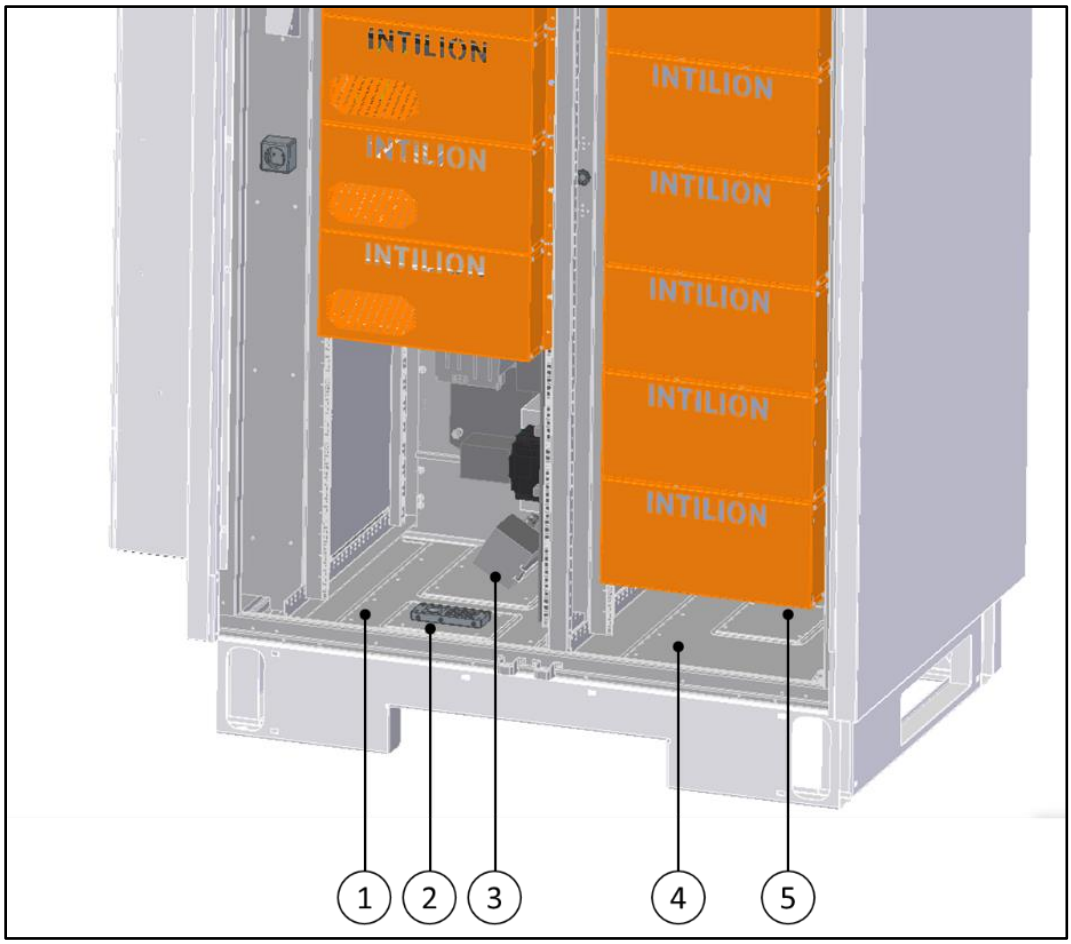

Fig. 97 Removing the base plates

10.4.3 Dismantling panels of the BMS and inverter

- Remove the four screws (1) and (2) respectively and remove the covers for the battery management system (BMS) and the inverter as shown in the illustration.

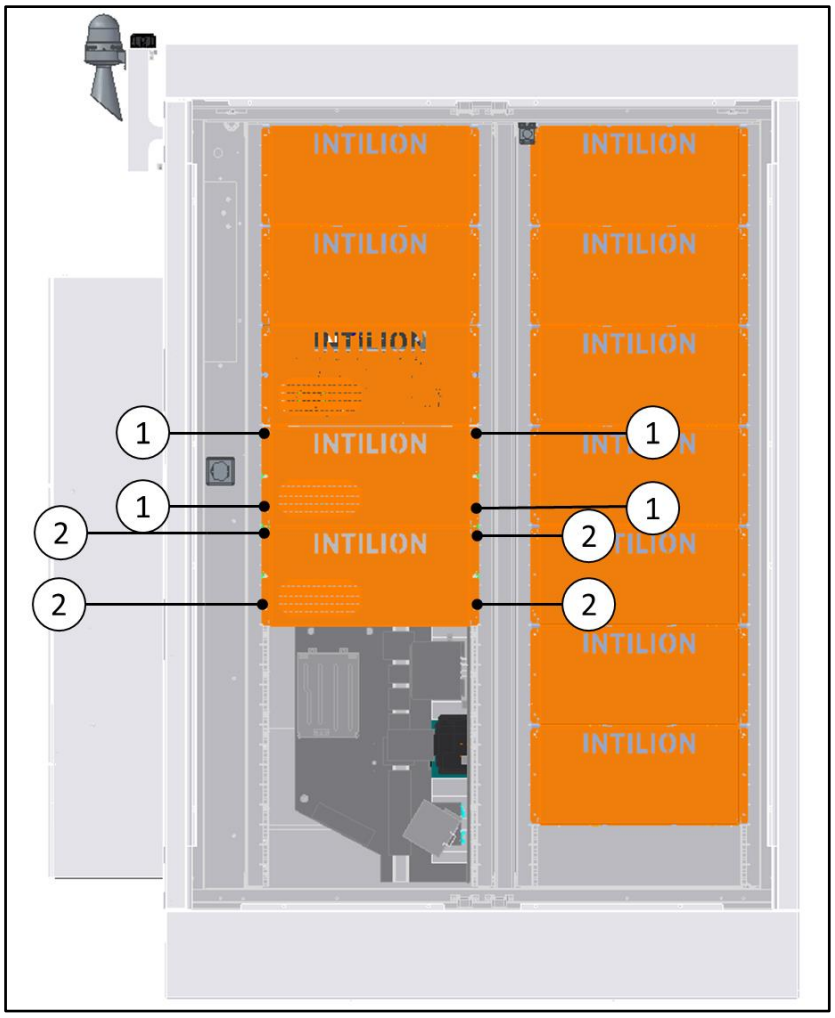

Fig. 98 Disassembling the panels for the BMS and the inverter

10.4.4 Dismantling the fire protection cover panels

The disassembly of one cover panel is described below. The other cover panels are disassembled in the same way.

- Remove the screws (1) and take off the cover panel.

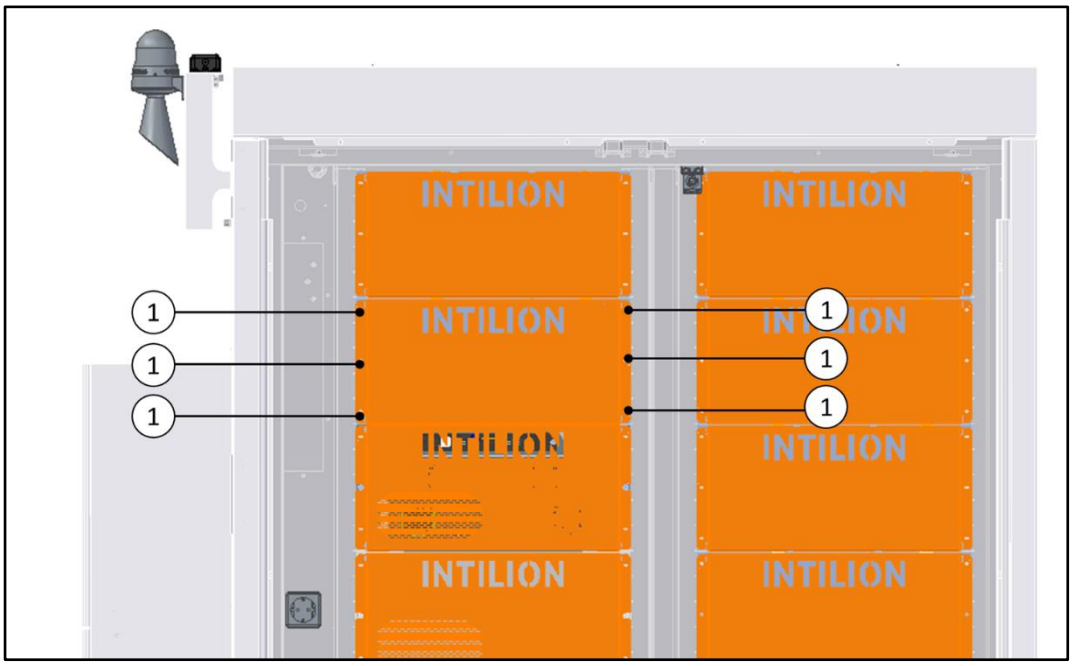

Fig. 99 Disassembly of the fire protection cover panels

- Repeat the process for all cover panels.

10.4.5 Dismantling the cables from the battery modules

DANGER

There is a risk of electric shock when touching live parts.

The individual battery modules cannot be switched voltage-free. Dangerous electrical DC voltages are always present at the power terminals of the battery modules.

- Proceed step by step during disassembly.
- When removing the safety caps on one battery module, make sure that the safety caps on all other battery modules are on their respective terminals.

- Push the safety caps (1) on the poles up or down (2) and remove them in the direction of the arrow (3) (see illustration).

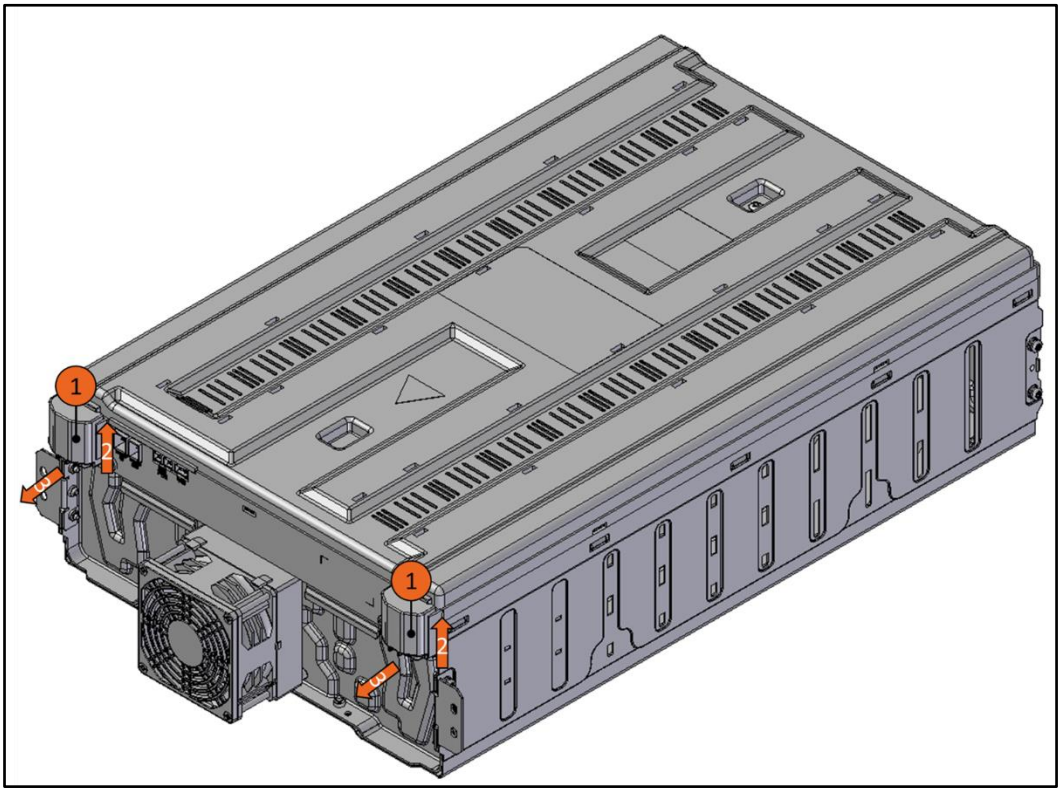

Fig. 100 Battery module – removing the safety caps

- Disassemble the cables.
- Replace the safety caps on the poles with the opening facing down.
- Disassemble the cables on all other battery modules in the same way.

10.4.6 Removing battery modules

WARNING

Risk of injury

There is a risk of crushing and impact when removing the battery modules.

- Use protective work clothing, protective gloves, safety shoes and a hard hat.
- Observe the documentation of the suppliers.

CAUTION

Risk of injury due to improper lifting of the battery modules

The battery modules are heavy. There are ergonomic hazards due to improper lifting of the battery modules.

- Lift the battery modules with care for your back (see also the note at the beginning of this section).
- Lift the battery modules only in pairs.

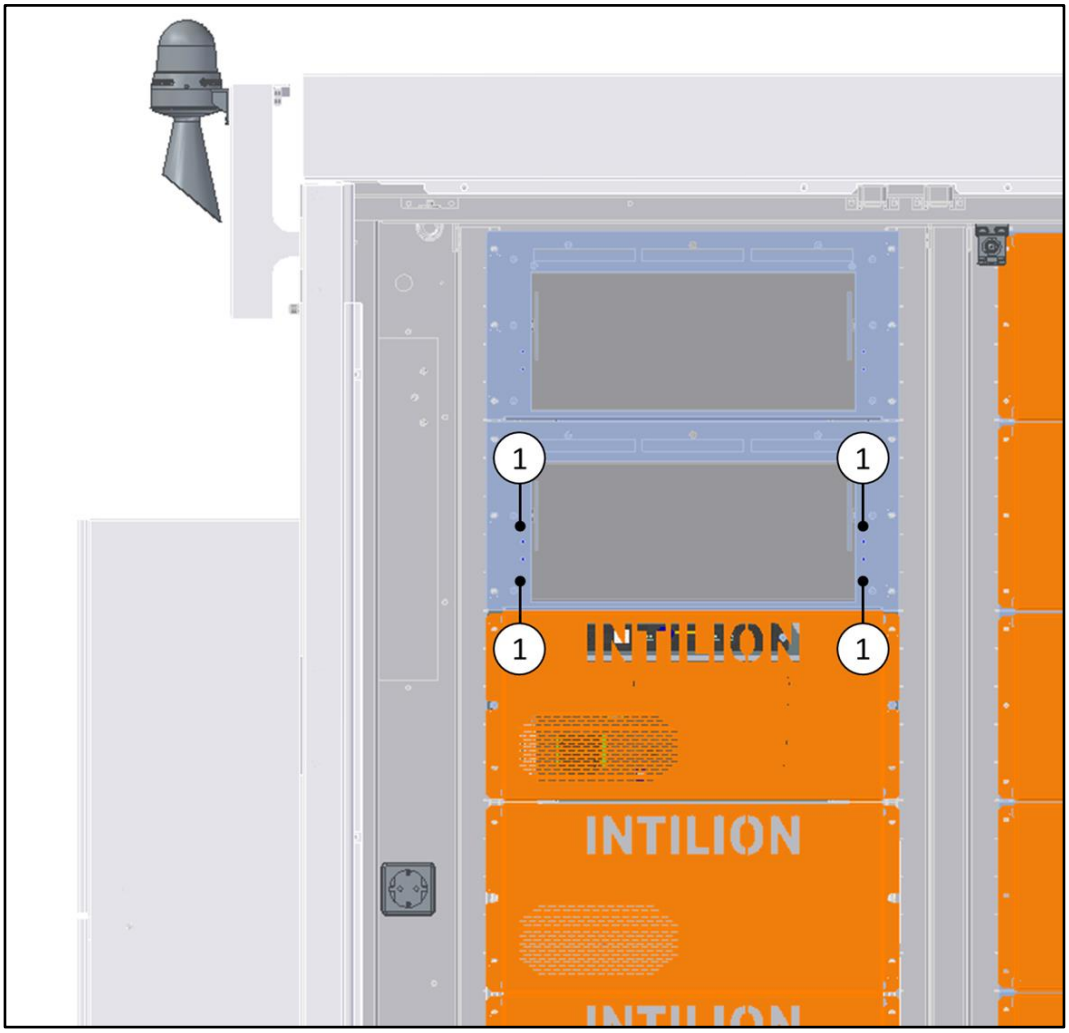

Fig. 101 Battery module – disassembly from the fire protection housing

- Remove the four screws (1) on each battery module.
- Remove the battery module from the fire protection enclosure.

NOTICE

The battery modules may only be stored and transported in the original packaging or in packaging that complies with the applicable guidelines.

The battery modules are dangerous goods. The transport regulations (e. g. for road transportation according to ADR) must be observed.

- After removal, stow the battery modules in the original carton or in suitable packaging. For the disposal of the battery modules, refer to section 10.5 referred to.

10.4.7 Dismantling the earth electrode

- Disconnect the earth electrode for the rack poles from position (1).

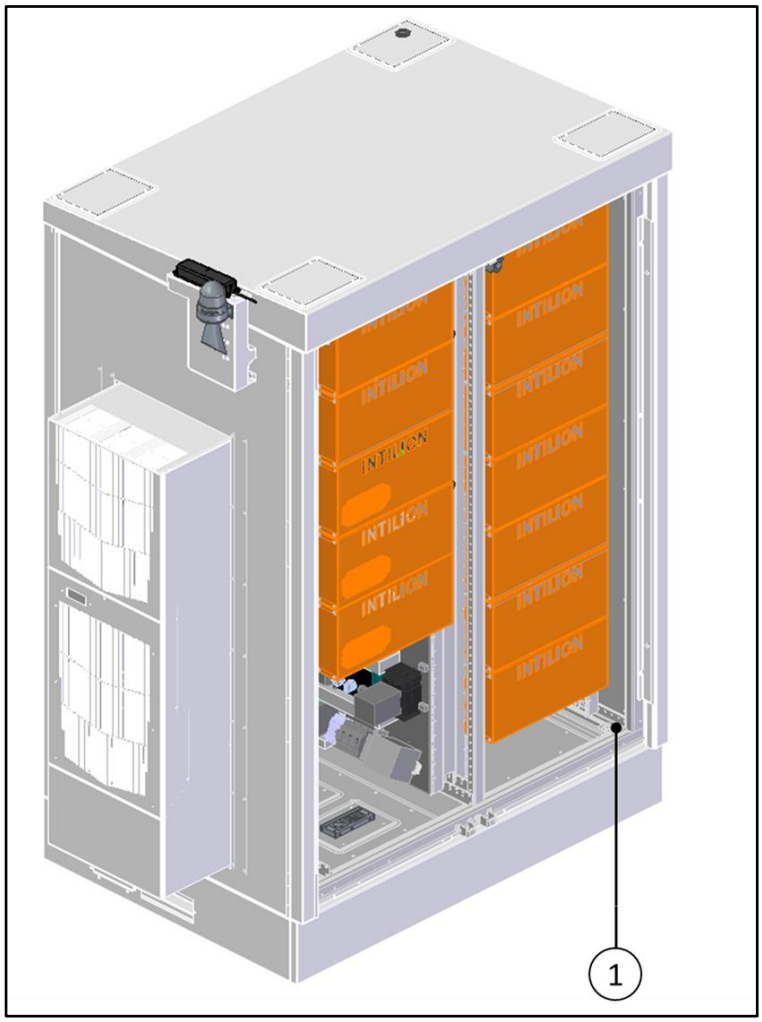

Fig. 102 Disassembly of the earth electrode for rack poles

- Disconnect the earth electrode for the rack rods from position (1).

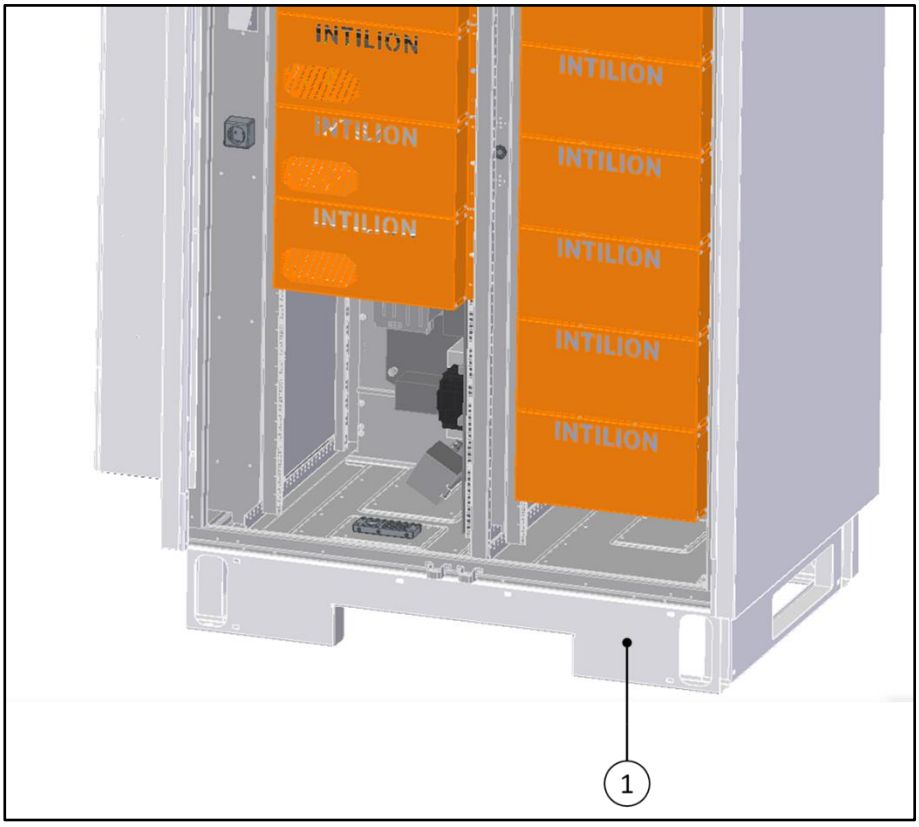

Fig. 103 Disassembly of the foundation earth electrode

- Disconnect the earthing point/foundation earth electrode provided in the foundation from the position (1) of the battery storage enclosure.

10.4.8 Preparing the battery storage for shipping

- Remove the fasteners that bolt the battery storage unit to the foundation.
- Check and make sure that the base plates are reattached.
- Insert the side panels and slide the side panels backward to the rear of the battery storage unit.

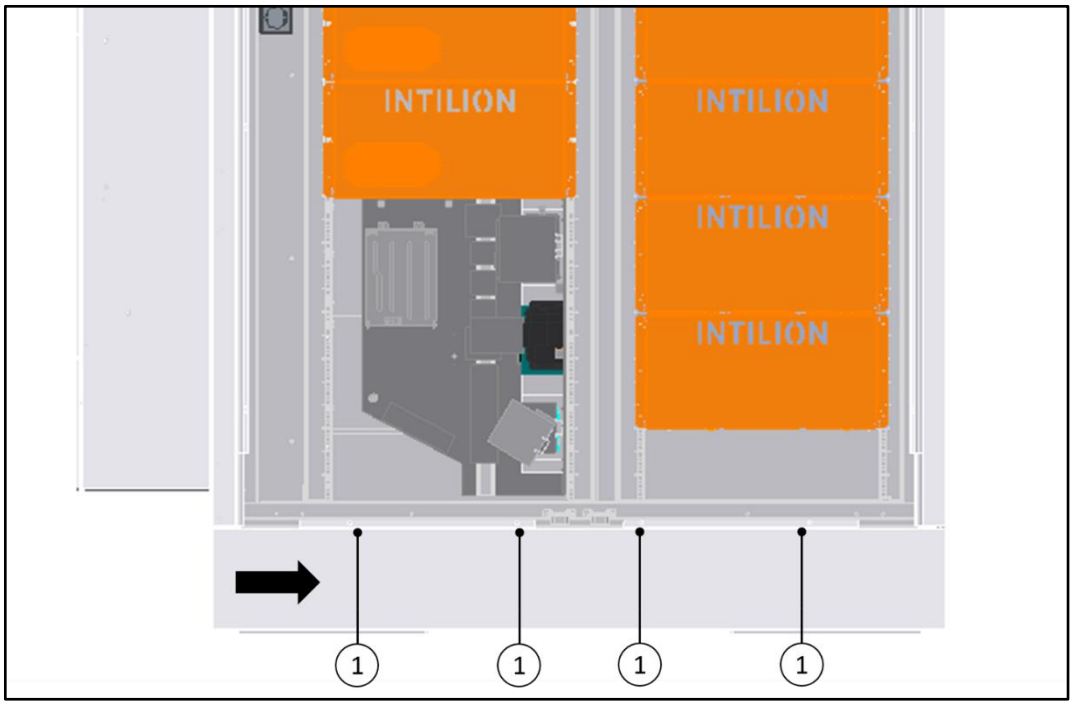

Fig. 104 Fastening the front panel

- Insert the front panel and push the front panel as far as it will go (approx. 10 mm) in the direction of the arrow.
- Fasten the front panel with the screws (1) previously removed.
- Close the doors of the battery storage unit. To do this, first lift the respective latching hook.

10.4.9 Shipping the battery storage

10.4.9.1 Safety

Observe the following safety instructions when transporting the battery storage unit or components:

- The battery storage unit or components may only be transported by appropriately qualified and instructed personnel (forklift/crane operator with certificate of competence) and in compliance with all safety instructions.
- When selecting suitable lifting devices and load handling attachments, always consider the weight of the heaviest component. If the battery storage unit is lifted at the attachment points, the lifting device must be designed so that it can support a weight of 1000 kg at a height of 3 m.

- Wear protective work clothing, safety shoes, protective gloves, and a hard hat during work.
- Always secure the transport route with an additional person.
- Keep the work area neat and tidy.
- Make sure that there are no persons in the travel path or under suspended loads.
- Do not use any piping or attachments as lifting points. Lifting lugs on components are only used to lift the individual components, not the entire battery storage unit. Only lift the battery storage unit at the points provided.
- Always lift the battery storage slowly and carefully to ensure stability and safety. Guide it through a rope to avoid swinging and turning.

10.4.9.2 Permitted aids for transportation

Shackles or hooks must be selected according to the transport weight of the battery storage unit and must only be attached to the attachment points provided for this purpose.

- Avoid contact of the supporting chains or ropes with the battery storage unit. If this is not possible, take appropriate precautions to prevent damage to the battery storage unit.
- Adjust the length of the carrying means so that the battery storage unit can be transported horizontally.

10.4.9.3 Attachment points

The four attachment points are located on the top of the battery storage unit under the covers (1).

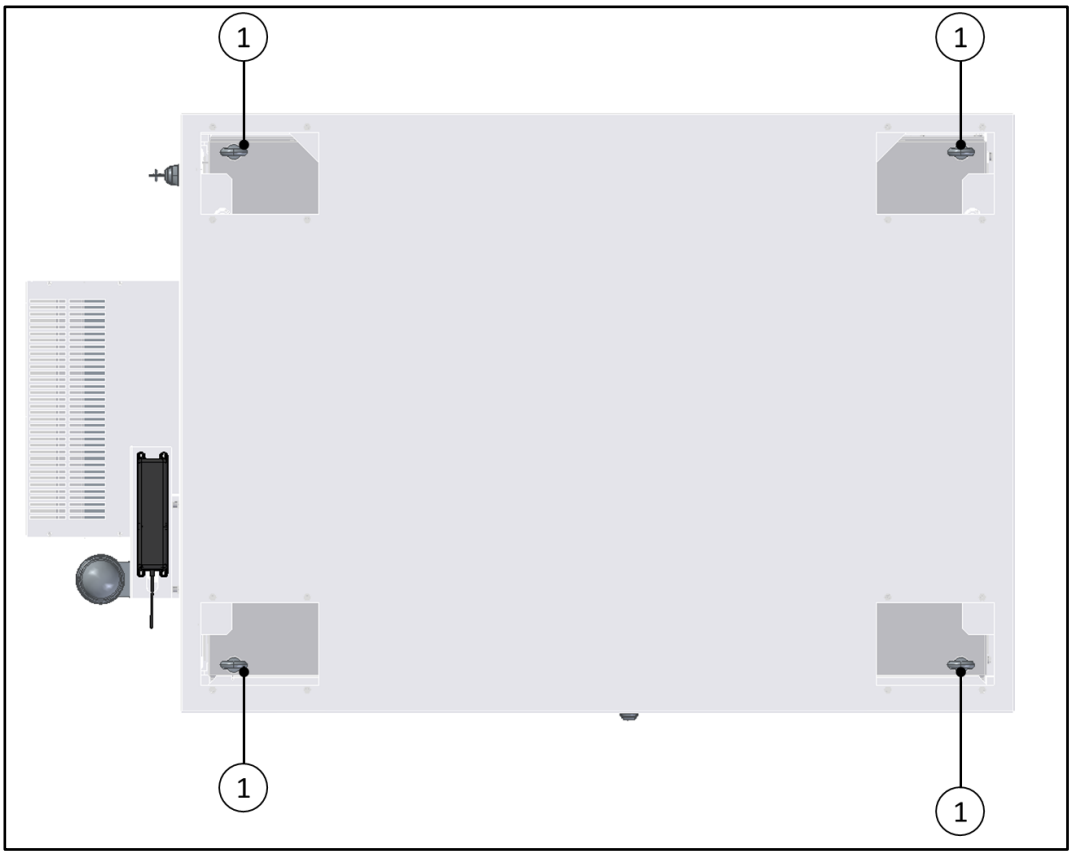

Fig. 105 Overview of the attachment points

- Remove the covers for the attachment points (1) and hang the shackles or hooks.

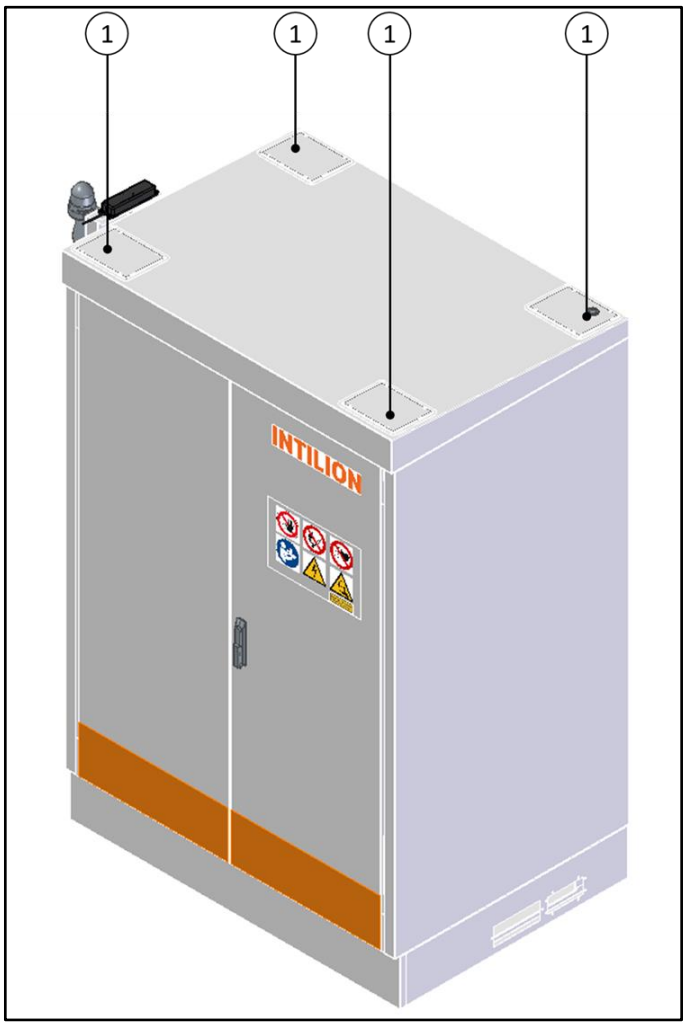

Fig. 106 Removing the covers of the attachment points

WARNING

Risk of injury!

Various hazards can occur when loading the battery storage unit.

If the battery storage unit is lifted at the attachment points, the lifting device must be designed to support a weight of 1000 kg at a height of 3 m.

- Wear protective work clothing, safety shoes, protective gloves, and a hard hat during work.
- Always secure the transport route with an additional person.
- Keep the work area neat and tidy.
- Make sure that there are no persons in the travel path or under suspended loads.
- Always lift the battery storage slowly and carefully to ensure stability and safety. Guide it through a rope to avoid swinging and turning.

- Move the battery storage.
- Remove the shackles or hooks and attach the covers for the attachment points.

10.5 Disposal

INTILION AG is obliged to take back the battery modules. INTILION AG will gladly make you an offer for the disposal of your battery modules.

- Have the battery modules disposed of either by a certified specialist company or by INTILION AG.

11 Applicable documents

The following documents are enclosed with these operating instructions:

- EU Declaration of Conformity
- Overview circuit diagram for INTILION | scalebloc variants (energy, power, power boost)
- Technical data sheet
- Commissioning report
- Modbus list
- Error list

12 Abbreviations

AC	Alternating Current
ACB	Air Circuit Breaker
ADR	European agreement concerning the international carriage of dangerous goods by road
BMS	Battery Management System
Cat	Category
CCCV	Constant Current Constant Voltage
Cmd	Command
COMM	Communication
DC	Direct Current
DGUV	German Social Accident Insurance
DI	Digital Input
DNS	Domain Name System
EM	Energy Meter
EMS	Energy Management System
En-FluRi	Energy Flow Direction Sensor
FNN	Network Technology/Network Operation Forum
GCO	Grid-Connected Operation
GFO	Grid-Forming Operation (stand-alone)
IP	Ingress Protection
IPC	Industrial PC
LED	Light-Emitting Diode
LTE	Long-Term Evolution
NC	Normally Closed (contact)
PFC	WAGO-Branded PLC
PGU	Power Generation Unit
PLC	Programmable Logic Controller
PPE	Personal Protective Equipment
ProdSG	German Product Safety Act
PWR	Power
RBMS	Rack Battery Management System
RCD	Residual Current Device
RCBO	Residual Current-Operated Circuit Breaker
SoC	State of Charge
SoH	State of Health
TAB	Technical Connection Conditions
TCP/IP	Transmission Control Protocol/Internet Protocol
TN-S	Terre Neutre Séparé (grid type)
UCS	Universal Configuration Software
UCTE	Union for the Co-ordination of Transmission of Electricity
UPS	Uninterruptable Power Supply
VDE	German Electrotechnology Association
WLE	Work on Live Equipment