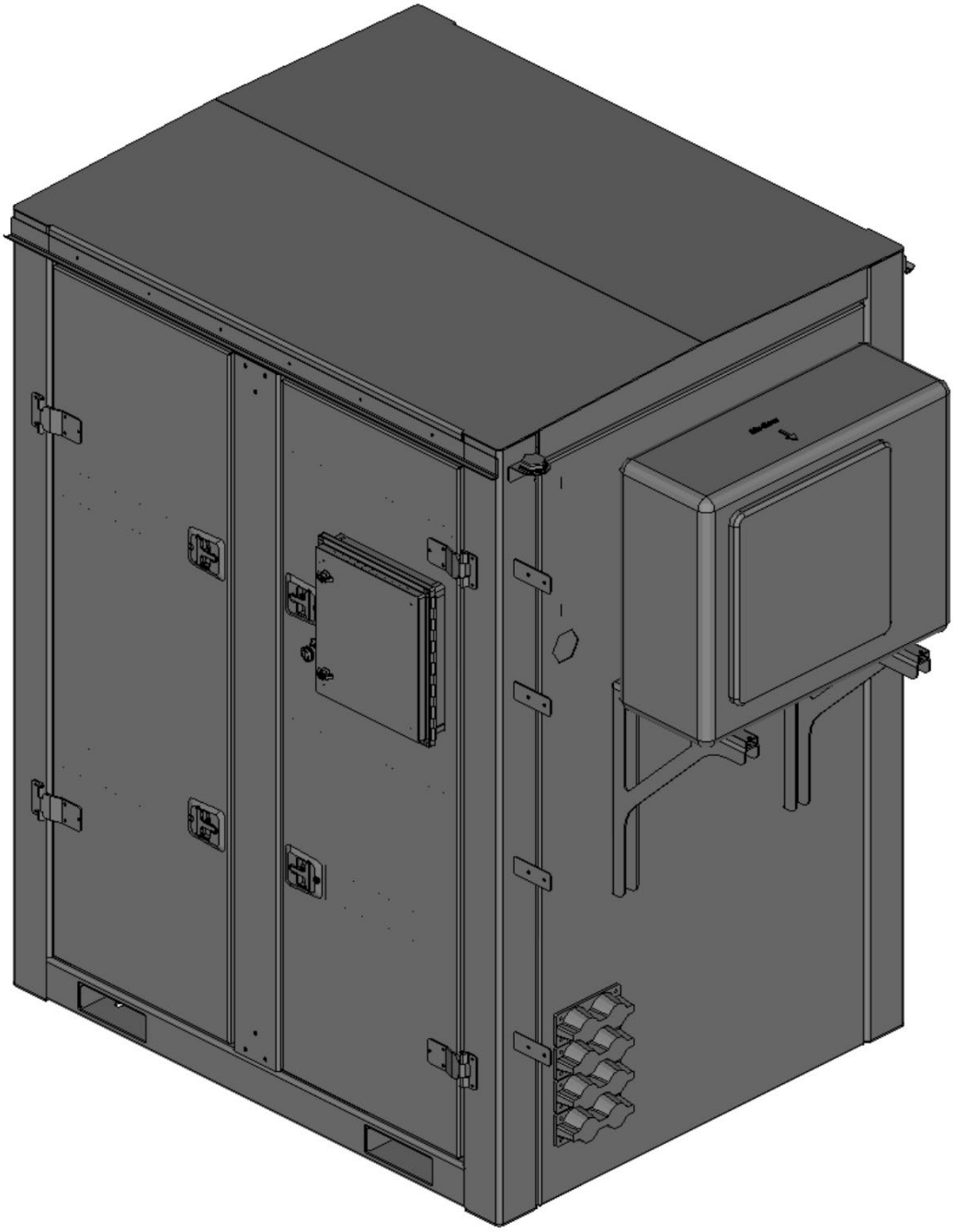
Mounting Instructions

BatteryPack FE | RTG Electrification System

Battery House



Contents

1 General notes

1.1 Information about these installation and operating instructions

This document facilitates safe and efficient handling and use of the equipment.

This document represents an equipment component and must be stored close to the equipment and always available to the personnel. The personnel must have carefully read and understood this document prior to starting any works. It is a basic requirement for safe working that all safety and procedural instructions contained in this document are complied with.

Local accident protection regulations and general safety guidelines for the application field of the device also apply.

Illustrations in this documentation are for basic comprehension and may deviate from the real design.

In addition, to these mounting instructions, the attached instructions for installed components also apply.

1.2 Limitation of liability

All information and instructions in this document have been compiled with due regard to the standards and regulations in force, the current state of technology, and the findings and experience we have accumulated over many years.

The manufacturer is not liable for damage resulting from:

- Failure to comply with this document
- Improper use
- Use by untrained personnel
- Unauthorized modifications
- Technical changes
- Use of unauthorized spare parts and accessories

The actual scope of delivery may differ from the explanations and illustrations described here for special variants, if additional order options are utilized, or due to the latest technical changes.

The obligations agreed upon in the delivery agreement and our General Terms of Business apply, as do the delivery conditions of the manufacturer and all regulations applicable at the time the contract was concluded.

All products are subject to technical modifications in the context of improvement of usage properties and further development.

1.3 Copyright

1.4 Spare parts

WARNING!

Safety risk due to wrong spare parts!

Wrong or faulty spare parts can impair safety and result in damage, malfunction or complete failure.

→ Use only original spare parts of the manufacturer!

Order spare parts from your contracted dealer or directly from the manufacturer.

Contact information for spare part orders: See the last page of these mounting instructions.

1.5 Warranty and guarantee

The terms of warranty and guarantee are listed in the General Terms of Business of the manufacturer.

1.6 Customer service

Our customer service is available for technical questions.

Contact information: See the last page of these mounting instructions.

Our employees are also always interested in new information and experiences from the field that can be valuable for the improvement of our products.

2 Safety advice

2.1 Explication of symbols

Safety and hazard information is identified in these mounting instructions by symbols. Safety instructions are initiated by signal words to indicate the degree of hazard. Always observe safety instructions and work carefully to avoid accidents, personal injury or property damage!

DANGER!

… indicates an immediately hazardous situation, which if not avoided, may result in death or serious injury.

DANGER!

… … indicates an immediately hazardous situation due to electricity, which if not avoided, may result in death or serious injury.

WARNING!

… indicates a possibly hazardous situation, which if not avoided, may result in death or serious injury.

WARNING!

… indicates a possibly hazardous situation due to electricity, which if not avoided, may result in death or serious injury.

CAUTION!

… indicates a possibly dangerous situation, which, if not avoided, may result in moderate or minor injury or property damage.

CAUTION!

Advice and recommendations:

… refers to useful advice and recommendations as well as information for an efficient and trouble-free operation.

2.2 Requirements to the personnel

2.2.1 Qualification

WARNING!

Risk of injury due to insufficient qualification!

Improper use can result in serious personal injury or property damage.

→ All works have to be carried out only by personnel who are qualified for the specific work!

The following qualifications have been mentioned in these mounting instructions for different areas of operation:

- **Trained personnel/operators**

  have been instructed by the operator about the tasks assigned to him/her and the possible hazards resulting from improper behaviour.

- **Qualified specialists**

  due to their specialized training, knowledge, and experience, as well as knowledge of applicable regulations, are capable of carrying out works assigned to them, while independently recognizing and avoiding possible risks.

  Personnel are considered qualified, e.g. for electrical commissioning, if they have successfully concluded training, for example, as electricians, master electricians, electrical engineers, or electrical technicians. Personnel are also considered qualified for electrical commissioning who have been employed correspondingly for several years, have been educated in theory and practice during that time, and whose electrical knowledge and skills have been tested.

  The operator of the electrical facility must document that the corresponding certification or other documentation of qualification are present or have been demonstrated.

- Only those persons are authorized as personnel who can be expected to perform their work reliably. People whose capacity for reaction is influenced e.g. by drugs, alcohol, or medications are not authorized.
- When selecting personnel, follow all age- and job-related guidelines applicable at the place of operation.

2.2.2 Unauthorized personnel

WARNING!

Danger due to unauthorized personnel!

Unauthorized personnel who do not meet the requirements described here do not understand the danger in the working area.

→ Keep unauthorized personnel away from the working area.

→ In case of doubt, address these persons and direct them away from the working area.

→ Stop work as long as unauthorized personnel is in the working area.

2.2.3 Instruction

Before commissioning, the personnel must be instructed by the operator. Record the instruction according to the following pattern in order to make the instruction traceable:

Date	Name	Type of instruction	Instruction given by	Signature:
2009-11-05	John Doe	First safety instruction for personnel	Jack Miller	

2.3 Personal protective equipment

Always wear **For all work, always wear**

Work safety clothing

Serves primarily as protection against being seized by moving machine parts. Work safety clothing must fit tightly with low resistance to tearing, close-fitting sleeves and no protruding parts.

Protective footwear

Used to protect from falling heavy parts and slipping on slippery floors.

For special tasks, wear

When carrying out particular tasks, special safety gear is required. The individual sections specify this gear in detail.

Protective gloves

To protect hands from friction, scrapes, stabbing, or deep wounds, as well as from contact with hot surfaces.

Protective helmet

For protection against falling and flying parts and materials.

Safety goggles

For eye protection against harmful effects from strong light, chemicals, dust, splinters or weather.

Ear protection

For protection against loud noises and to prevent acoustic trauma.

Breathing mask (FFP-3 — according to country-specific requirements)

For protection against materials, particles, and organisms.

2.4 Intended use

The equipment is exclusively designed and built for the intended use described here.

WARNING!

Danger due to improper use!

Any application that deviates from or goes beyond the intended use of the devices can result in a hazardous situation.

→ Strictly comply with all specifications in these mounting instructions.

→ Refrain from use that is not intended!

→ Pay attention to advice regarding non-intended use in chapter 2.5

Claims of any kind due to damage from non-intended use are excluded.

The operator is liable for all damage resulting from non-intended use.

Intended use

- Power supply system for Rubber Tired Gantry cranes (RTGs) in port applications, for use during block changing after leaving the conductor rail system.
- As long as the crane is being operated with the battery system, it is not allowed to hoist containers.

Electrical operating conditions

- The electrical installation must be properly protected according to the regulations in force on site

2.5 Non-intended use

Regarded as non-intended use are particularly the following kinds of use:

- Operation outside of the specified operating conditions (see chapter 3.4)
- Exceeding the power consumption
- Using accessories not supplied with the product
- Using tools that are not suitable for machining
- Use by persons who have not been instructed
- Use of spare parts that have not been approved by the manufacturer
- Use on other cranes/machines that are not RTG cranes.

Environmental conditions

Operating the battery system is allowed **exclusively** under the environmental conditions outlined in chapter “Technical specifications” (see chapter 3).

It is not allowed to operate the battery system in areas with highly flammable materials. Fire or explosion hazard!

2.6 Protective measures to be taken by the user

The equipment is used in an industrial setting. The operator of the device is thus subject to legal obligations for operational safety. In addition, to the safety guidelines in these mounting instructions, the safety, accident protection, and environmental protection regulations applicable to the place of operation of the unit must be followed. This particularly includes:

- Work on electrical components of the system may **only be carried out when disconnected from power**.
- The operator must inform him or herself about applicable workplace safety guidelines and identify any additional hazards that result from the special working conditions at the site of operation of the device. These must be implemented in the form of operating instructions for the use of the device.
- The operator must verify during the entire operating time of the device if the mounting instructions provided still correspond to the current state of regulations and adapt these instructions if necessary.
- The operator must clearly regulate and determine responsibilities for installation, operation, troubleshooting, and maintenance.
- The operator must ensure that all employees involved with the unit have read and understood these mounting instructions. He must furthermore train personnel at regular intervals and inform them of any hazards.
- The operator must provide personnel with all required safety gear (work safety clothing, protective footwear, ear protection, protective gloves, protective helmet, protective goggles, respirator mask)
- The operator must ensure that the doors of the battery house are locked and keep the key for battery houses in a safe place. "Safe" means that only explicitly authorized personnel may have access to the keys. The keys may only be issued to technical personnel as described in chapter 2.2.1 "Qualification".
- The operator must ensure that the area in front of the doors and the interior of the battery house are freely and safely accessible.

The operator is furthermore responsible for ensuring that the device is always in a technically trouble-free condition. The following thus applies:

- The operator must ensure that the maintenance schedule described in this document is followed.
- The operator must have all safety systems regularly inspected for functionality and completeness. Inspect once a year if possible, but at least as often as required by applicable national regulations.
- If the device or system has been modified, the safety systems must be inspected again and adapted to the changed conditions in such a way that the device or system is safe again.

2.7 5 safety rules for work on electrical installations

Carry out work on electrical installations only when disconnected from power. Follow these **5 safety rules** (see DIN VDE 0105-100:2009-10 / EN 50110-1:2004-11) before starting work:

1. Disconnect system from power using the isolation switch,
2. secure the isolation switch against reactivation,
3. confirm absence of power by measuring,
4. ground parts of the installation that need to be worked on,
5. cover or block off neighbouring parts still carrying electrical current.

WARNING!

Risk of electrical shock!

- Be aware that the orange color cables connected to battery are electrified.
- Only skilled persons (electrician) or persons instructed for electrical work are allowed to disconnect from power or to approve power reactivation after work has been done on an installation disconnected from power.

2.8 Specific hazards

The following section lists residual risks determined based on a risk assessment. Follow the safety instructions listed here and the warnings in the following sections of these mounting instructions in order to reduce health hazards and avoid dangerous situations.

- Follow the safety instructions listed here and the warnings in other sections of these installation instructions in order to reduce health hazards and avoid dangerous situations.

2.8.1 Battery Module

WARNING!

Risk of emission of dangerous substances!

The battery modules can tend to outgas hydrogen fluoride (Toxic).

- Only trained personnel may work on the battery modules
- Storage of the battery modules in accordance with national laws and regulations
- Corresponding notice (sticker) that there are battery modules inside the housing
- Separate / dispose of according to national laws and regulations

WARNING!

Risk of explosion!

The battery modules can tend to outgas hydrogen fluoride (Risk of explosion).

- Only trained personnel may work on the battery modules
- Storage of the battery modules in accordance with national laws and regulations
- Corresponding notice (sticker) that there are battery modules inside the housing
- Separate / dispose of according to national laws and regulations

WARNING!

Risk of fire!

The battery modules can tend to outgas hydrogen fluoride (Risk of explosion).

- Only trained personnel may work on the battery module.
- Storage of the battery modules in accordance with national laws and regulations
- If the battery modules heat up, they must be taken outside
- Corresponding notice (sticker) that there are battery modules inside the housing
- Separate / dispose of according to national laws and regulations

WARNING!

Risk of crushing!

When moving, lifting and installing the battery module, there is a risk of crushing the extremities.

- Only trained personnel may work on the battery module
- Wear personal protective equipment (PPE)
- Use load suspension points in the housing

WARNING!

Risk of shearing!

There is a risk of shearing when moving several parts towards each other.

- Only trained personnel may work on the battery module
- Wear personal protective equipment (PPE)
- Use load suspension points in the housing

WARNING!

Cutting or severing!

Cutting or severing by sharp edges.

- Only trained personnel may work on the battery module
- Wear personal protective equipment (PPE)

WARNING!

Avoid direct or indirect contact with the battery cell pack!

- Only trained personnel may work on the battery system
- Do not open the housing
- Attach warning notice (sticker) to the battery module housing

WARNING!

Risk of electric shock on the battery cell pack!

- Only trained personnel may work on the battery cell pack
- Do not open the housing
- Attach warning notice (sticker) to the battery module housing

WARNING!

Risk of short circuiting!

- Only trained personnel may work on the battery module
- Attach warning notice (sticker) to the battery module housing
- Do not open the housing
- Protection Class IP20
- Current monitoring by means of a Battery Management System (BMS)
- Insulated tools for working on electrical systems

WARNING!

Risk of chemical reaction due to damage to the battery cell pack!

- Only trained personnel may work on the battery module
- Corresponding notice (sticker) that there is battery system inside the housing

WARNING!

All other problems as a result of human error!

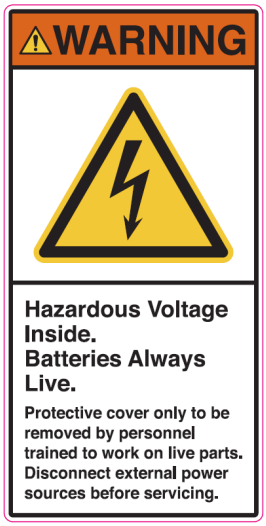
- Only trained personnel may work on the battery module
- Wear personal protective equipment (PPE)
- Use load suspension points in the housing

WARNING!

Burns from defective battery system!

- Only trained personnel may work on the battery system
- Corresponding notice (sticker) that there is battery system inside the housing

2.8.2 Electrical hazards and sources of danger



Danger of life due to electric shock!

Risk of injury due to falling or being cast-off after electric shock

Touching electrically life parts may result in death or serious injury due to electric shock. Furthermore, there's a risk of injury due to shock reactions, falling or being cast-off triggered by electric shock.

Work on these parts is dangerous:

- Main power supply, namely battery
- Parts carrying electrical current: Power cables, breaker, isolation switch, DC/DC converter, connectors, current/voltage collectors, devices and connections inside of switching cabinets, control devices, etc.
- Parts that are under voltage as an effect of a fault

Before working on the parts listed above:

- Generally, **switch off all circuit breakers** in the battery system
- Disconnect the isolation switch between battery system and DC/DC converter following the 5 safety rules and secure against reactivation. 5 safety rules see chapter 2.7
- Disconnect the fuses between DC/DC converter and DC bus following the 5 safety rules and secure against reactivation. 5 safety rules see chapter 2.7
- Disconnect the breaker between battery module 3 and module 4 following the 5 safety rules and secure against reactivation. 5 safety rules see chapter 2.7
- Disconnect the main power plug of the AC-Charger following the 5 safety rules and secure against reactivation. 5 safety rules see chapter 2.7
- Wait at least for 10 minutes to work on the installation. The capacitor from DC/DC converter has to be discharged.

While working:

- Use insulated tools.
- Measure the parts voltage first to make sure it's safe

Before reactivating power:

- Prior to each restart, test the insulation resistance according to locally applicable technical standards, directives, and laws.
- Carry out mandatory electrical tests typical of the country where the device is installed

Sustain electrical safety:

- Inspect and maintain electrical equipment regularly
- If you observe hazardous defects, immediately take measures to remedy the defects. Immediately inform the installation operator
- If it is not possible to remedy the hazardous defect, block off the relevant location or disconnect the electrical equipment from power and secure it against reactivation. Immediately inform the installation operator
- Immediately fix loose cables, immediately replace damaged cables
- Always replace blown fuses with fuses of equivalent rating

Fire hazard due to overload or sparking

Fire hazard is caused by overcharging the battery, overloading the cable, by electric arc, short-circuit or sparking. Sparks can be formed in case of failure of certain components in the system.

- Never overcharge battery. There is warning or fault tripped if battery voltage is over limit.
- Imperatively stay within allowed current values.
- Install electrical protection devices according to regulations.
- Avoid any other heating sources
- Avoid any short circuit
- Don't drop, hit, bend battery module
- Don't fill liquid into the battery modules

2.8.3 Mechanical hazards and sources of danger

Risk of injury due to crushing

There's crush hazard for skin and limbs when mounting or dismounting battery housings

Risk of injury due to impact!

- Installation must be carried out by instructed personnel only!
- While working on the battery system, use protective footwear, protective gloves and protective helmet and safety googles

Danger to life due to suspended loads!

Danger to life due to suspended loads!

When lifting loads, there is a danger of death from falling parts or those swinging out of control.

- Never step under suspended loads
- Move loads only under supervision
- Follow the specifications for the attachment points provided
- Do not attach to projecting machine parts or to eyes on installed components. Be sure the lifting accessories are firmly seated
- Use only authorized lifting gear and separate lifting accessories with sufficient load capacity
- Do not use torn or worn ropes or straps, discard them and replace them with new ones instead
- Do not attach ropes or straps to sharp corners and edges, and do not knot or twist them
- Set down loads before leaving the work area

2.8.4 Health hazard

Poisonous gases due to fire!

If the installation is on fire, plastic parts (PVC) and the battery cell would generate poisonous gases (HCl, etc.).

→ If on fire, immediately leave the battery house and RTG.

→ After inhalation: Fresh air, seek for medical assistance.

→ If there's fire, call the fire brigade

Poisonous electrolyte due to battery cell broken!

The battery module shall not be disassembled. Disassembling maybe generate internal short circuit in the cell, which may cause electrolyte leakage which contacts with skin or eyes.

→ After eye contact: Flush the eye gently with plenty of water (at least 15 min). Seek for medical assistance.

→ After ingestion of battery components: Drink plenty of water. Avoid vomiting. Seek for medical assistance. No trials for neutralization.

2.9 Actions in the event of accidents and faults

Measures in case of accidents:

- Shut down the system and secure it against unauthorized, unintentional, and/or erroneous activation.
- Secure the danger zone.
- Rescue personnel out of the danger area.
- Take first aid measures.
- Alarm the rescue services.
- Inform responsible parties at the place of operation.
- Make access ready for rescue vehicles.

Measures to be taken in case of malfunction:

- Shut down the system and secure it against unauthorized, unintentional, and/or erroneous activation
- Secure the work area against entry
- Involve qualified personnel for fault analysis
- If injury to persons and property damage can occur during breakdowns, Conductix-Wampfler must be informed immediately:

Conductix-Wampfler GmbH
Rheinstraße 27 + 33
79576 Weil am Rhein - Märkt
Germany

Phone: +49 (0) 7621 662-0
Fax: +49 (0) 7621 662-144
info.de@conductix.com
www.conductix.com

3 Technical specifications

3.1 Battery system

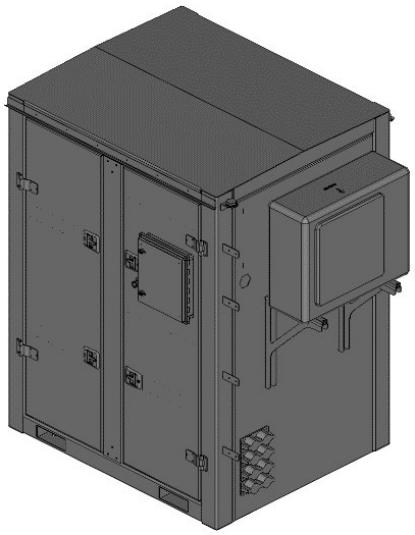
Capacity	100 Ah
Maximal energetical capacity	44 kWh*
Packing voltage	444 VDC
Total module number	6
Module voltage	74 VDC
Cell voltage	3.7 V
Rated power	44 kW
Ambient Temperature	0°C…+40°C

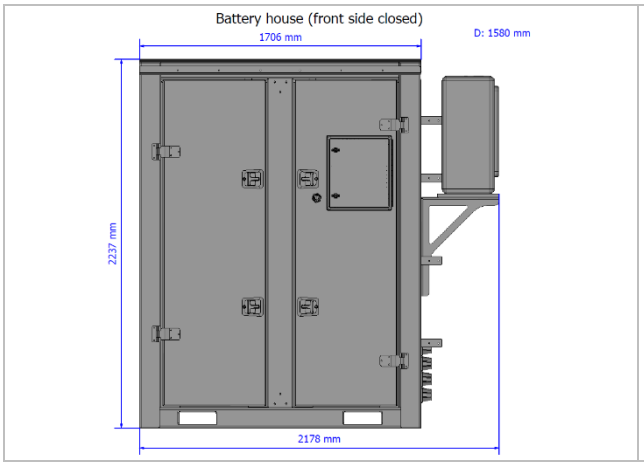
*Usable energy is less as per designed working parameters (SOC range)

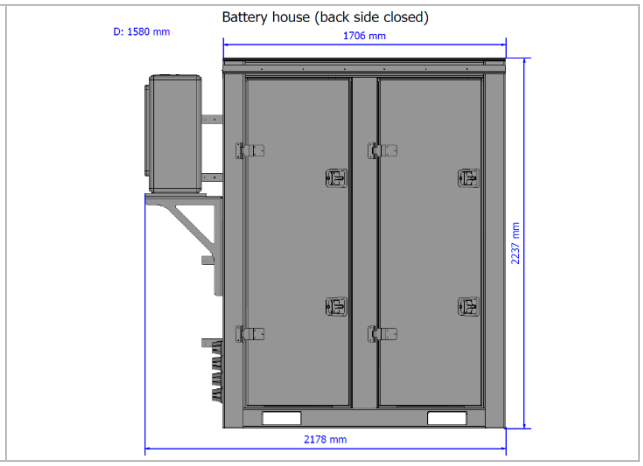
3.2 Battery house dimension

The battery house is mounted on the sill beam of the crane and connected to the crane control and its DC bus. The external dimensions may differ from the illustration shown, depending on the specification.

Weight	1920 kg

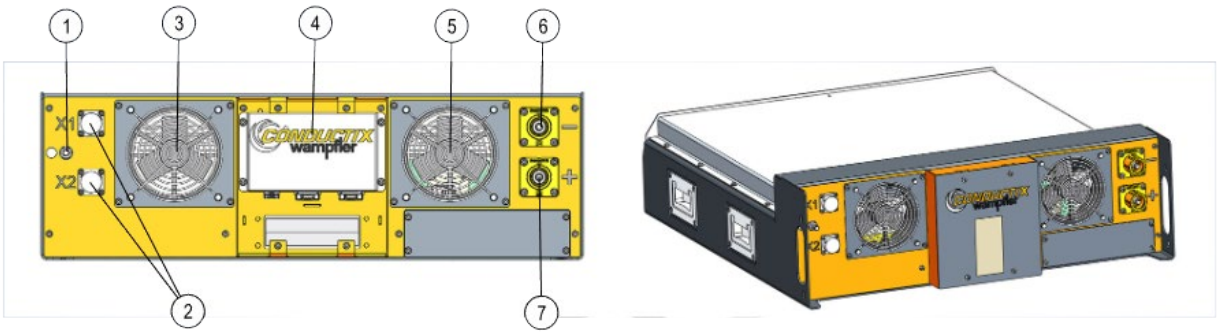






3.3 Battery module data

There are 6 battery modules in the battery house, mounted in a special rack and interconnected. X1 and X2 are for control and CAN communication plug. The battery modules are air-cooled and each has two 24VDC fans installed. Behind the central cover there is in each case a MMU (chapter 4.2.3)



1	PE connection
2	CAN plug/socket on battery module
3	MMU fan 1
4	MMU inside the battery module
5	MMU fan 2
6	MINUS (-)
7	PLUS (+)

Items	**Specification**
Nominal capacity	100Ah 1/3C CC-CV
Nominal voltage	74V
Charge cut-off voltage	83V
Discharge cut-off voltage	60V
Standard Charge current	33.3A
Standard charging method	1/3C (33.3A) CC to 4.15V. Temperature: 25±5°C
Max. charge current	Continuous[1] charge: 1C (100A) Pulse[2] charge (10s): 2.2C (220A)

Items	Specification
Max. discharge current	Continuous[1] discharge: 2.2C (220A) Pulse[2] discharge (30s): 2.5C (250A) Pulse[2] discharge (5s): 3C (300A)
Recommended SOC range	30% ~ 80%
Operating temperature range	Charging: 0°C ~ 45°C Discharging: -20°C ~ 0°C, (≤1C); 0°C ~ 45°C, (≤3C)
Storage: (60±25% R.H., SOC20%)	Store in -20°C ~ 25°C environment for 12 months, recoverable capacity ≥ 85%
	Store in -20°C ~ 35°C environment for 3 months, recoverable capacity ≥ 85%
	Store in -20°C ~ 45°C environment for 1 months, recoverable capacity ≥ 90%
	20 ± 5°C is the recommended storage temperature
Weight:	85 kg
Length:	650 mm
Width:	700 mm
Height:	198,5 mm

[1] Continuous – Complete charge or discharge

[2] Pulse – Maximum current for a specific short amount of time

3.4 Operating conditions of battery house

Designation	Value
Temperature range	0°C to +40°C
Relative humidity range	5-85%, non-condensing
Altitude above sea level	max. 1000m

3.5 Type plate

The type plate is located on the inside of the battery house door with the local operation panel (see chapter 4.2.2).

It contains important information about the battery house:

- Type
- Serial No.
- Nominal voltage
- Designation cell-package
- Year of manufacture
- Capacity
- Nominal energy
- Battery weight
- Total weight battery house
- Circuit diagram

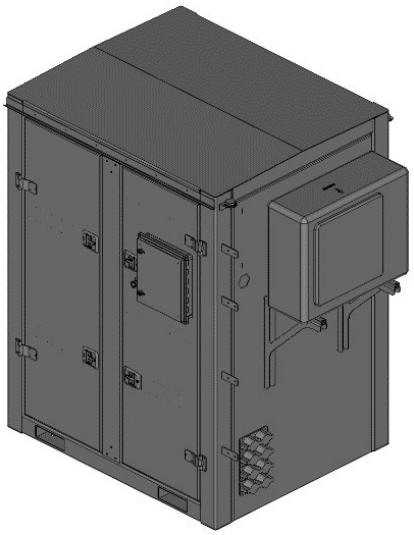
Advice and recommendations:

Always specify the information on the type plate with any questions about the battery house.

CAUTION!

4 Description and function

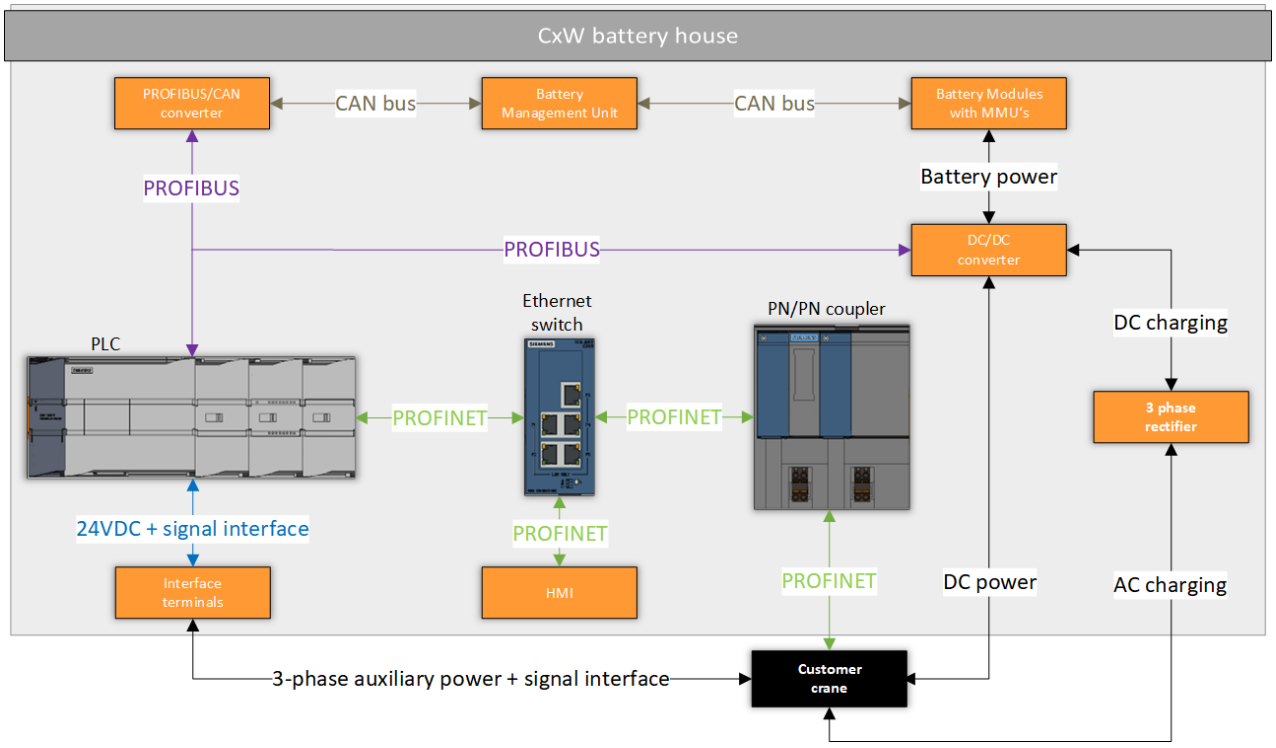
4.1 Short description



The FE-RTG will be powered by a Drive-In Unit and conductor rails or by a motor cable reel while operating within the container stacks. When it comes to the stack changes the cranes is powered by a battery power pack supplied by Conductix-Wampfler without any engine.

The battery housing is designed to be fixed on RTG (on the sill beam). Charging of battery pack happens when power grid is connected or via an external pluggable power supply. Communication to the crane is done via PROFINET.

The main components of the battery house system are shown in the schematic overview and are described in the chapter 4.2 and chapter 4.3.

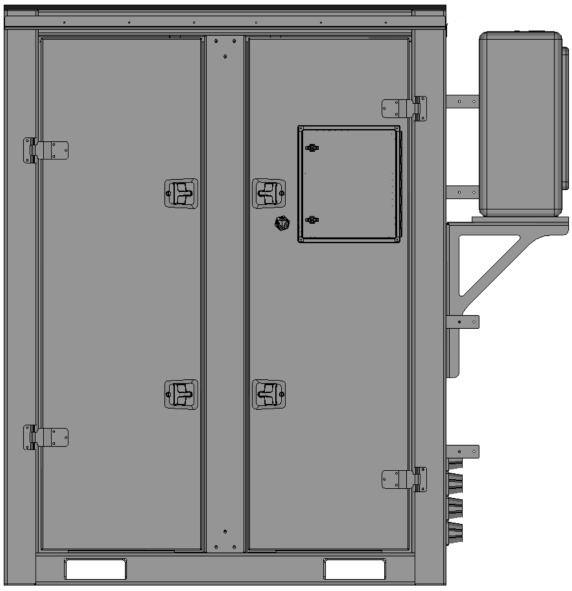


4.2 Main components

The following is an overview of the main components of the FE battery system. The pictures are for illustration purposes only.

4.2.1 Battery house (BH)

The battery house is the housing and protection from mechanical and environmental influences of the battery system components.



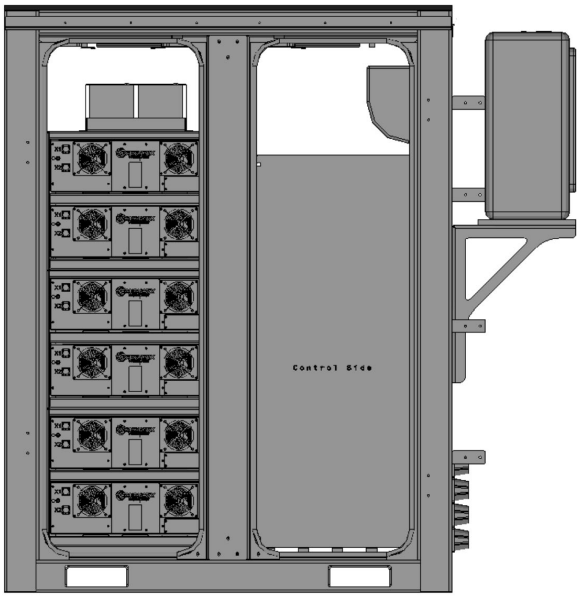
Battery house (exterior)

The battery house is designed based on the size of battery system as well as the local conditions of the crane.

There is a power connection between the battery house and E-House to connect the battery to the common DC bus.

In addition, the E-House provides an 3-phase auxiliary power supply to the battery house.

The battery house contains also the control circuit and PROFINET connection. The HMI as well as the local operation panel is located on the front door below a plastic cover.



Battery house (interior)

Battery modules, DC/DC converter, PLC, BMS (Battery Management System), HMI (Human Machine Interface), LOP (Local Operator Panel) and air conditioner are fully integrated into the battery house.

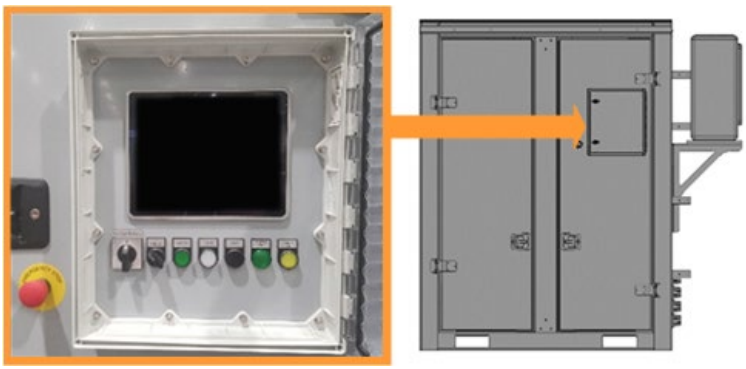
The mounting plates are located on both sides of the battery house and are equipped and wired with the necessary components.

The exact assembly depends on the selected components or options and is included in the order-specific circuit diagram.

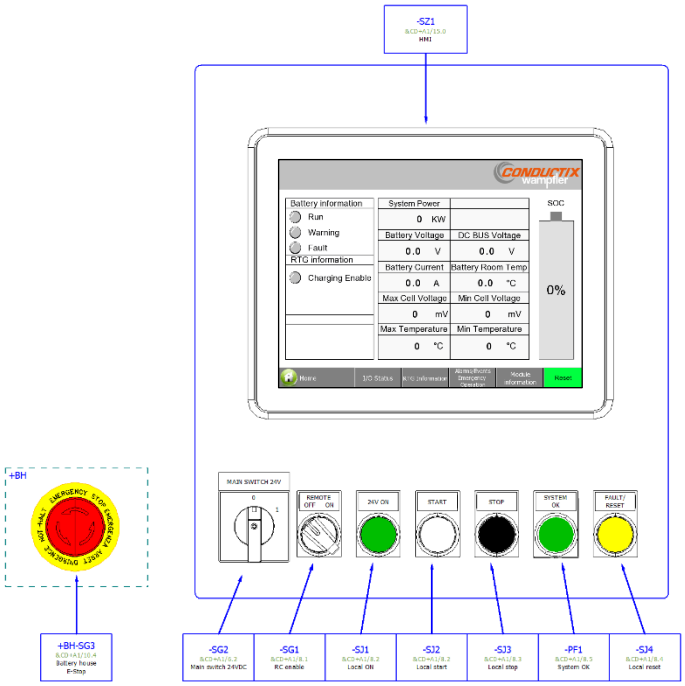
4.2.2 Local operation panel (LOP)

The local operation panel is located on the outside of a battery house door and includes a human machine interface (HMI) together with local switches and pushbuttons, which are protected from rainwater under a protective cover (further information is described in chapter 8.2).

Outside next to it is the yellow-red emergency stop button of the battery house.



Compliance with installation height (height above sea level, see chapter 3.4) and accessibility of the control units according to DIN EN 60204-1 and DIN EN 60204-32 must be ensured by the crane manufacturer.



"Human Machine Interface" (HMI)

The touch panel is used to visualize the battery house status and is connected with the PLC via PROFINET (chapter 4.2.7):

- Battery system control in case of maintenance
- Error messages
- Battery status

Local switches and pushbuttons

For local operation there are additional hardware buttons as well as an optional 24VDC switch (for more detailed description see table below).

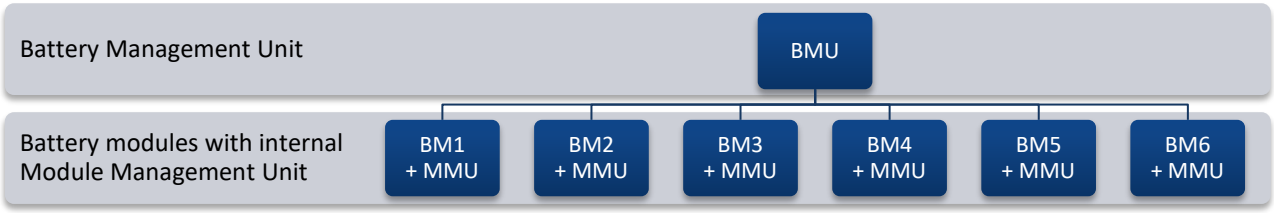
Battery house E-Stop button

The emergency stop button (yellow-red) outside the protective cover is wired in the emergency stop circuit of the battery house control and the customer's emergency stop circuit.

Device designation	Name	Function
-SG1	Remote OFF / ON	Switch local/remote control mode. ■ Switch On, remote control is valid ■ Switch Off, local control is valid
-SG2	Main switch 24VDC	Main switch for switching on and off the 24VDC supply  **CAUTION!** **Component damage due to switching off the Main Switch 24VDC in operation!** If the Main Switch 24VDC is switched off while the battery house is in operation, there is a risk of damage to electric components of the battery house. – Do never switch of the Main switch 24V unless the battery house is completely out of operation. – Before switching off the Main Switch 24VDC switch off the battery house completely (Local/Remote STOP).  **CAUTION!** **Battery damage due to deep discharge** *The main switch 24V must be switched off when the vehicle is at a longer standstill. Otherwise, the batteries could be damaged due to deep discharge and the vehicle can't get started anymore.*
-SJ1	Local ON	Pushbutton, 24VDC is switched on, hybrid system will NOT start up. (Main switch must be On -> SG2)
-SJ2	Local START	Pushbutton FE-RTG system starts up (24 VDC must be already On -> SJ1)
-SJ3	Local STOP	Pushbutton FE-RTG system stops. Switch off 24 VDC supply (press > 5s)
-PF1	System OK	Indicator light "System OK" (Blinking = "Warning")
-SJ4	Local Reset / Local Fault	Pushbutton, reset to PLC (Indicator light "Fault")
+BH-SG3	Battery house E-Stop	Battery house emergency stop circuit battery house and customer

4.2.3 Battery Management System (BMS)

The Battery Management System (BMS) is the core part and serves for monitoring and controlling of the battery modules. The total battery management system includes 1 Battery Management Unit (BMU) and 6 battery modules, each with an internal Module Management Unit (MMU).



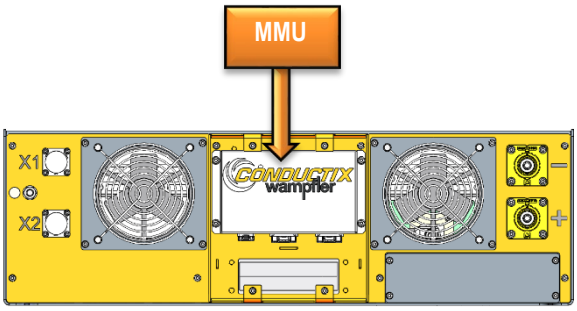
“Battery Management Unit” (BMU)

The BMU is located on the control mounting plate and is connected to the PLC (chapter 4.2.7). The BMU controls and communicates with each individual MMU via CAN bus.

“Battery Modules” (BM’s)

with internal “Module Management Unit” (MMU)

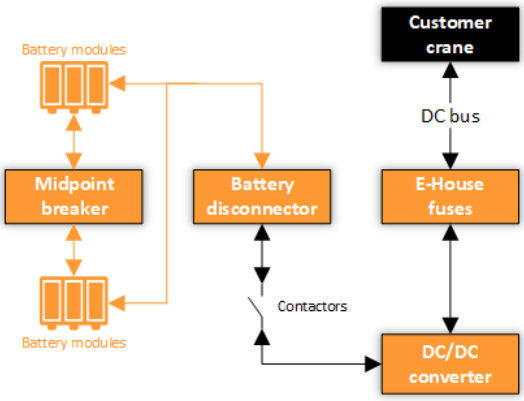
The 6 separate battery modules are located in a battery rack inside the battery house and are air-cooled by fans. Each battery module contains its own MMU, which is connected to the BMU by means of a connector with CAN bus. The power between the battery modules is enabled by orange cables with a connector.



The battery modules can be replaced separately by qualified specialists after prior consultation with Conductix-Wampfler.

4.2.4 DC protective devices

In the high DC area of the battery house there are protections for line and personal protection as well as for disconnecting the battery voltage for maintenance purposes.



The protective devices are to be adjusted in accordance with the documents (e.g. circuit diagram) or, in the case of replacement, the prescribed fuse sets are to be used.

Midpoint breaker

Between the six battery modules, connected with orange cables, there is the midpoint breaker, which interrupts the connection in case of a short circuit or overcurrent.

Battery disconnector

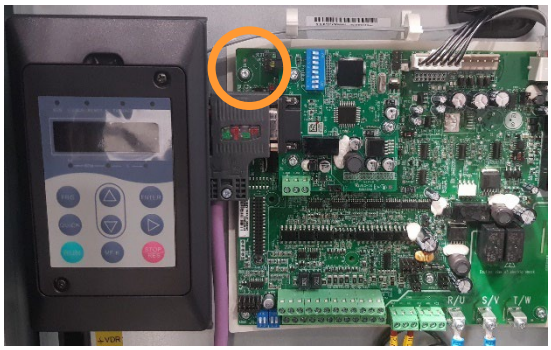
A disconnecting switch with fuses is located between the battery modules and the DC/DC converter. The disconnector can be used for maintenance purposes to disconnect the battery voltage in the battery house.

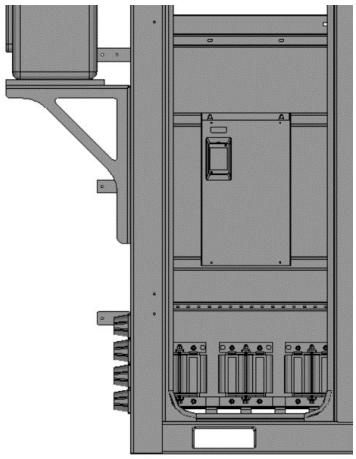
E-house fuses

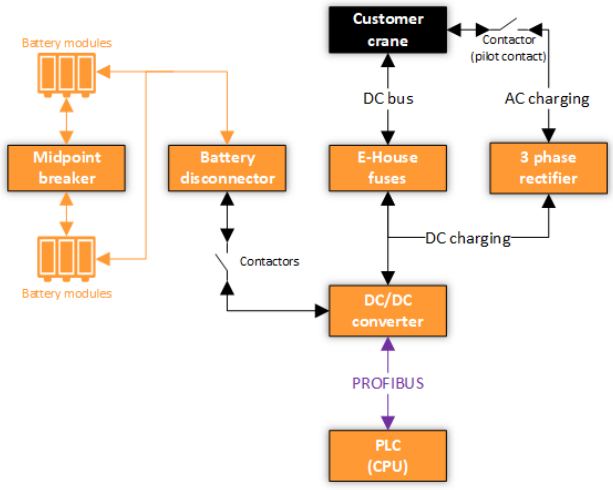
There is a fuse for PLUS and MINUS between the DC/DC converter and the connection interface of the DC bus from the customer.

4.2.5 DC/DC converter system

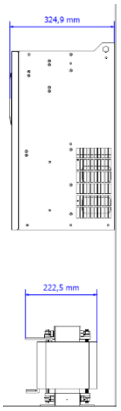
To charge and discharge the battery modules, there is one DC/DC converter between battery and DC bus. More precisely, the DC/DC converter is connected between the battery disconnector and the E-House fuses. The DC/DC converter thus controls the battery charging and communicates with the PLC via PROFIBUS (chapter 4.2.7). The PROFIBUS address is set on the board behind the cover via DIP switches and are defined in the order-specific circuit diagram. The DC/DC converter system also includes the appropriate DC reactors, which are located in close proximity on the floor of the battery house.

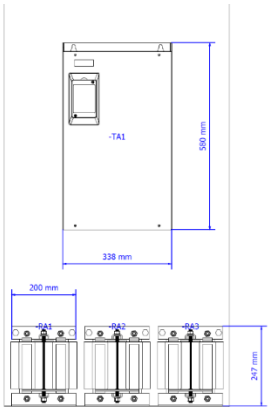


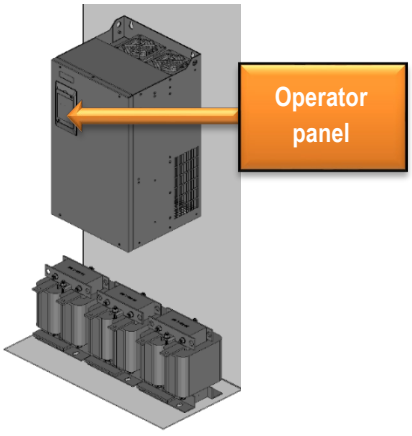




For maintenance or commissioning, the DC/DC converter has an operator panel to adjust parameters. During the operation, it shows the actual battery voltage or active faults. The parameters for the DC/DC converter will be adjusted from a service engineer when the battery house will be pre commissioned in the factory.



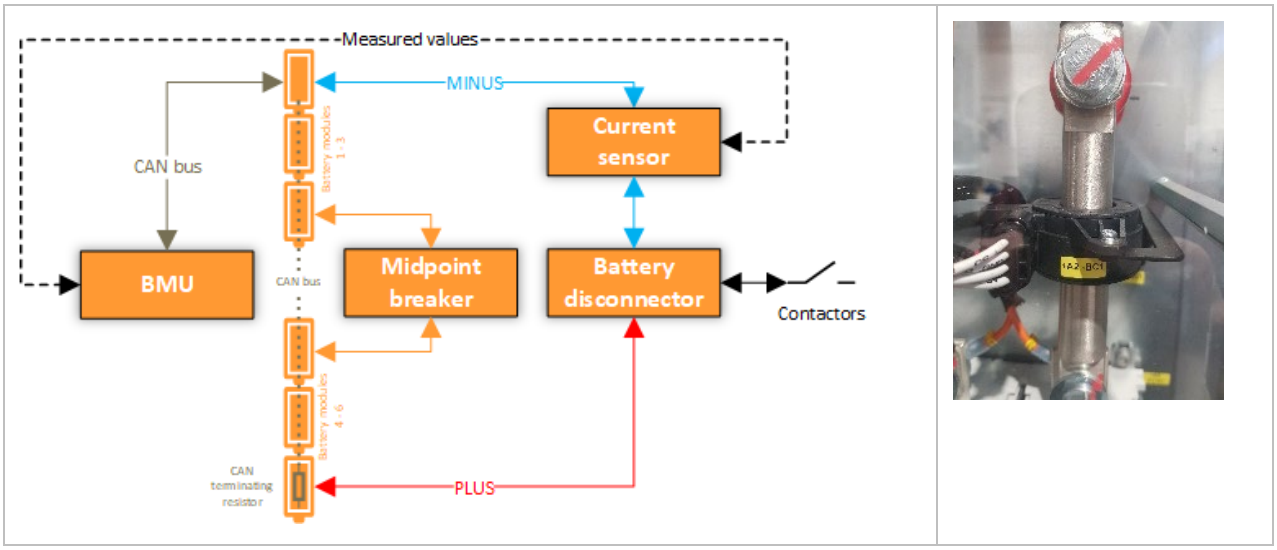




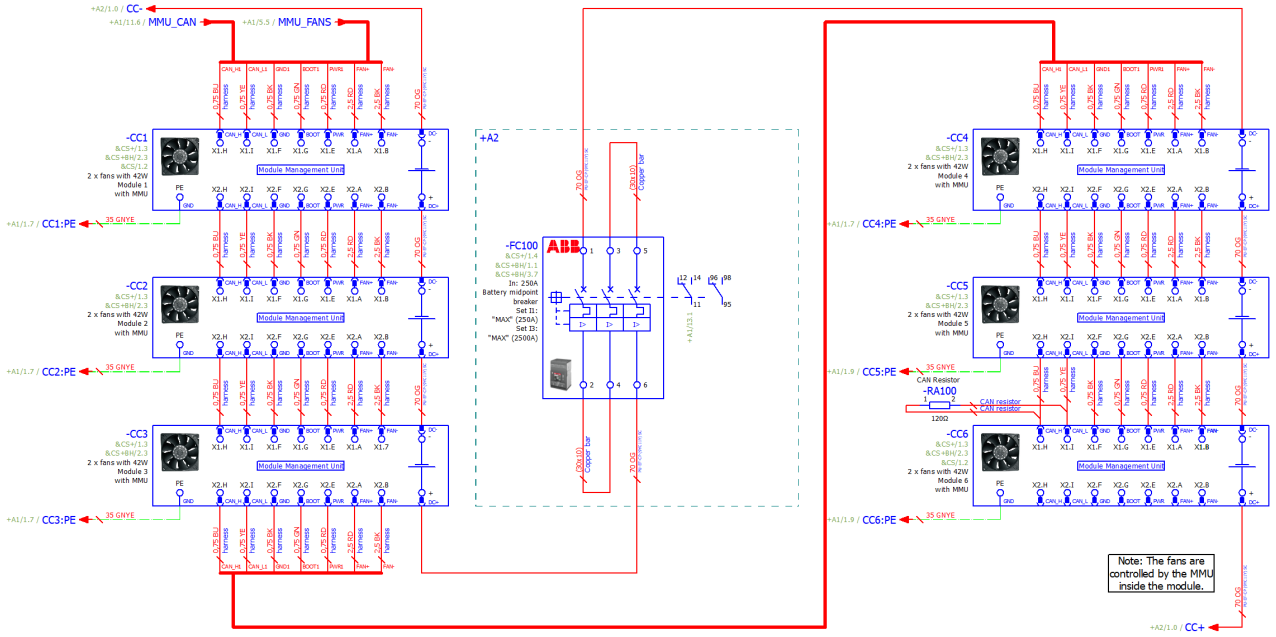
4.2.6 Current sensor

The individual battery modules are connected in series in the rack via connectors and communicate with the BMU via a CAN bus. Between the battery modules there is a midpoint breaker (chapter 0), which divides the voltage in the event of a fault or can disconnect for maintenance purposes.

In addition, there is a current sensor (-BC1) on the MINUS side of the battery modules to the battery disconnector, which is also wired to the BMU (chapter 4.2.3).



On the picture below you can see the schematic connection of the battery modules with the midpoint breaker in the circuit diagram, which is then led to the current sensor.



4.2.7 Programmable logic controller (PLC)

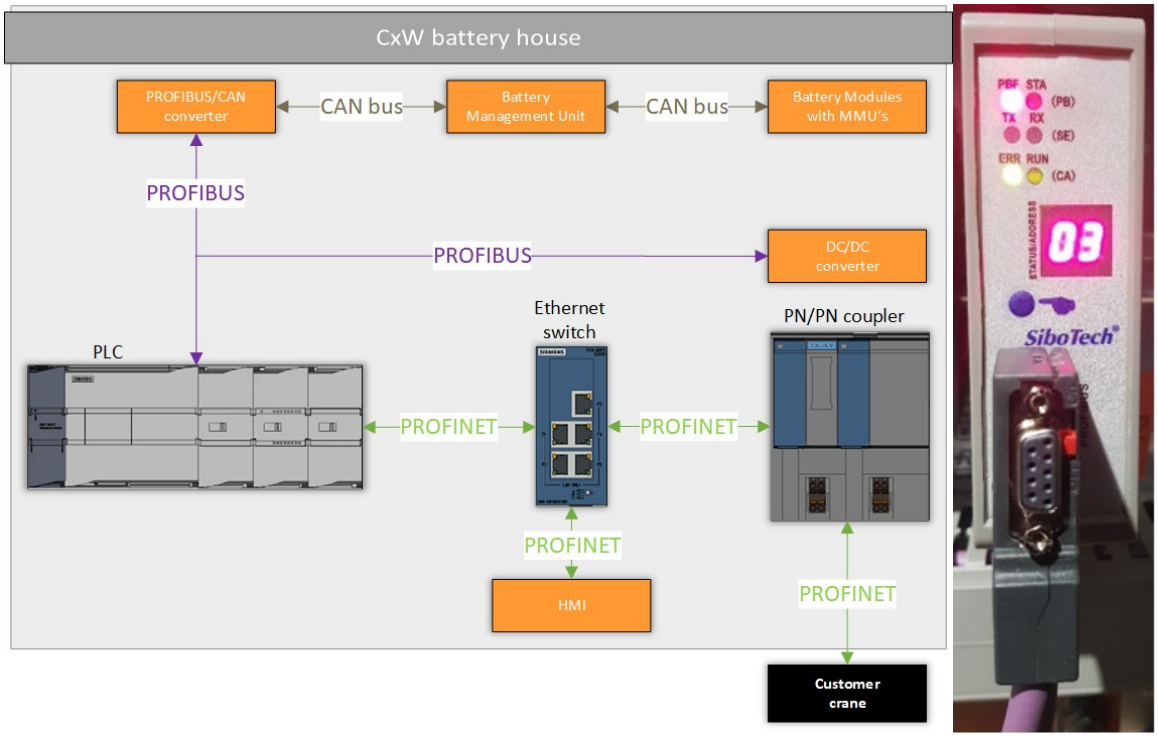
The PLC is located on the mounting plate and is the central main controller in the battery house. It consists of a DP master module with a PROFIBUS interface, a CPU with PROFINET interface and further input & output modules. The necessary software (PLC program) from Conductix-Wampfler is loaded on the CPU.

- The DP master module is connected via PROFIBUS to the DC/DC converter and a PROFIBUS/CAN converter (chapter 4.2.8), which communicates with the BMS via a CAN bus.
- The CPU is connected via PROFINET to an Ethernet switch and from there for example to the PN/PN coupler, the HMI and further components.
- The PN/PN coupler is the PROFINET interface to the customer crane (chapter 4.4.1).

4.2.8 PROFIBUS/CAN converter

For the communication between the PLC (PROFIBUS) and the battery system CAN bus a coupler device is necessary (see picture below).

With this device, the PROFIBUS address is shown on the display and the baud rate is set with DIP switches at the bottom of the device. Both setting values are defined in the order-specific circuit diagram.



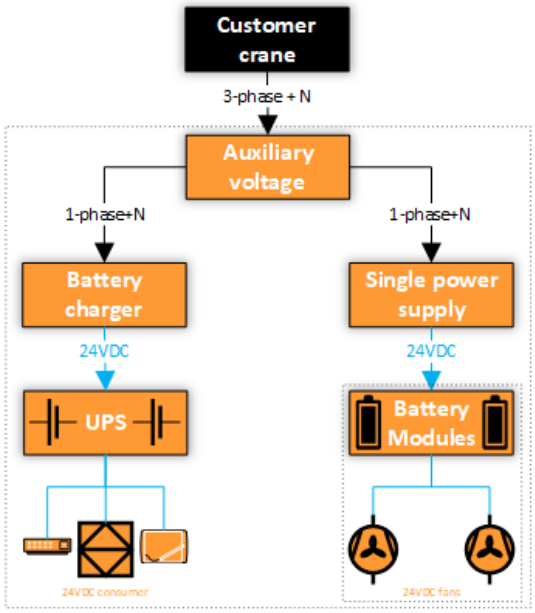
4.3 Further components

4.3.1 24VDC supplies

The 3-phase auxiliary voltage provided by the customer crane is also used to generate the 24VDC voltage supply for the devices inside the battery house.

These include components such as the PLC, HMI and relays on the one hand and the fans for cooling the battery modules on the other.

The basic 24VDC power supply is provided by a power supply unit and buffer batteries and a separate 24VDC power supply is provided by an additional power supply unit for the fans of the battery modules.



Battery charger

The battery charger is powered by the customer's 3-phase auxiliary power supply and generates a voltage of 24 VDC to charge the UPS batteries.

UPS-batteries

The two UPS batteries are located on the battery module support and supply the battery house control (PLC, HMI, etc.) with 24 VDC even if the 3-phase auxiliary voltage is interrupted for a short time.

Single power supply

Each battery module is air-cooled by 24VDC fans. Similar to the battery charger, power is supplied by an additional power supply unit with an interface terminal on the mounting plate.

4.3.2 AC charger (optional)

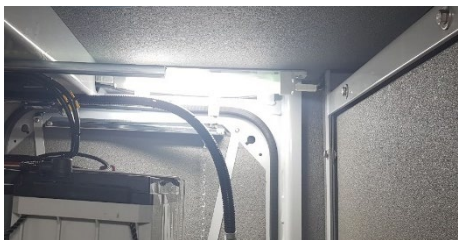
The battery house is optionally equipped with an AC charger so that the battery modules can also be charged via an external AC power source. The AC charger rectifies the AC voltage and thus supplies the battery pack directly (not via the crane DC power).

The corresponding components named in the table are located on the mounting plate (see circuit diagram).

-XD20	Feed-through terminal block Signal
-XD21	Feed-through terminal block Charging Power
-KF20	Contactor Charging Power ON
-TB1	Three phase bridge rectifier

4.3.3 Lighting

Inside the battery house there are four LED lights with separate door limit switch for maintenance purposes.



Maintenance lights

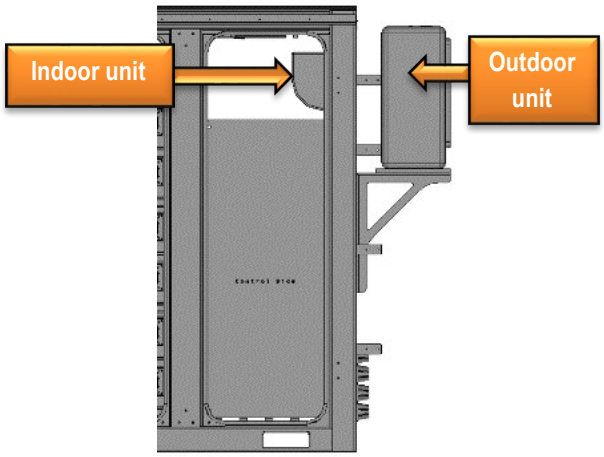
The LED lighting is located inside above each door opening of the battery house and is controlled via the door limit switches.

Door limit switches

The door limit switches are located at the top of each door and are wired in series. The separate 24VDC supply is provided by the customer so that the LED lighting is controlled as long as one of the battery house doors is open.

4.3.4 Air conditioner unit(s)

Depending on the ambient conditions and requirements, the internal temperature of the battery house is controlled with air conditioning unit(s). The voltage supply and connection interface is made in the battery house and the provision of the air conditioners is made by the customer in consultation. These are the following components:



Outdoor unit

Outside the battery house there is a support on which the external unit is mounted.

Indoor unit

Inside the battery house, space is also needed for the installation of the indoor unit, which is connected to the outdoor unit.

4.3.5 Temperature sensors

In the battery house there is an indoor temperature sensor near the BMU (chapter 4.2.3) and an outdoor temperature sensor on the support structure of the air conditioner unit bracket. Both are wired to the PLC (chapter 4.2.7)

4.3.6 Heater

Depending on the environmental conditions and requirements, it is optionally possible to install an additional heater close to the battery modules, which is switched on and off via a thermostat.

4.3.7 Service socket

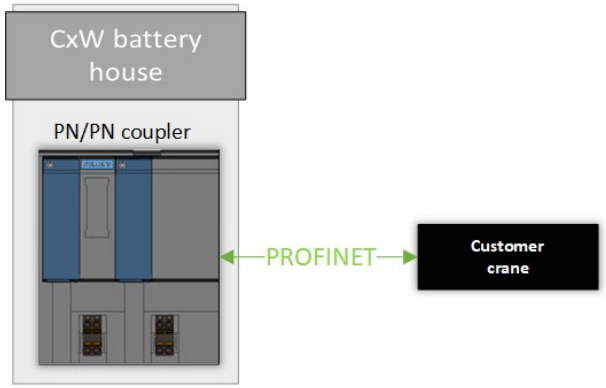
A country-specific service socket is optionally available in the battery house. This can be used to supply programming devices, notebooks or similar on site.

4.4 Electric interface

4.4.1 PROFINET interface

Communication between the battery house PLC and the customer takes place via a PN/PN coupler as standard. The PROFINET cable to the battery house is provided by the customer.

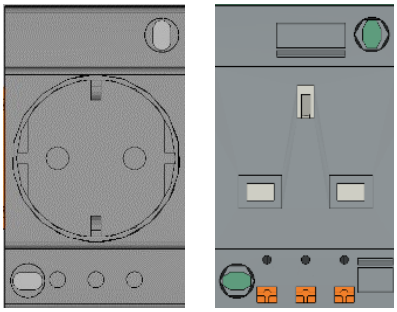
Recommendation (2x2x0,34mm²)C PROFINET cable

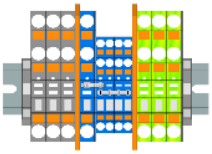


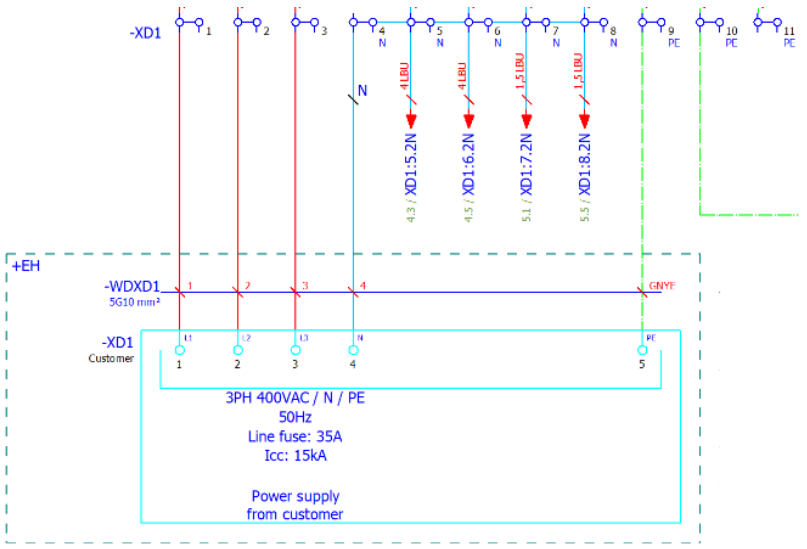
-KF42:X2P2/R PROFINET interface customer

4.4.2 3-phase-auxiliary voltage (-XD1)

The 3-phase auxiliary voltage is required for all consumers within the battery house and is connected to terminal XD1. The voltage level (400VAC/50Hz or 208VAC/60Hz) and the required cable cross-section depend on the specification and the options selected for the battery house. The customer is responsible for the appropriate line fuse of the battery house.



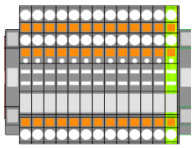
	**-XD1:1**	Phase L1
	-XD1:2	Phase L2
	-XD1:3	Phase L3
	-XD1:4	Neutral

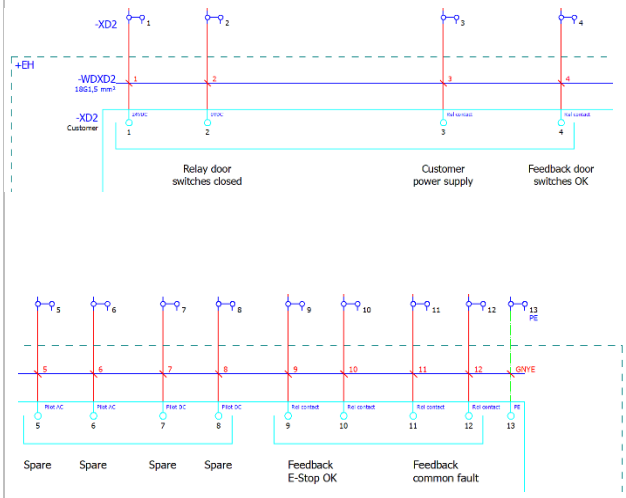
 -XD1 1 2 3 4 N 5 N 6 N 7 N 8 N 9 PE 10 PE 11 PE N 4 LBU 4 LBU 1,5 LBU 1,5 LBU 4.3 / -XD1:5.2N 4.5 / -XD1:6.2N 5.1 / -XD1:7.2N 5.5 / -XD1:8.2N +EH -WDXD1 5G10 mm² GNYE -XD1 Customer L1 L2 L3 N PE 1 2 3 4 5 3PH 400VAC / N / PE 50Hz Line fuse: 35A Icc: 15kA Power supply from customer	...	
	-XD1:6	PE

4.4.3 Signal interface (-XD2)

On the signal interface terminal the 24VDC from the customer for the door limit switches and its feedback, as well as the feedback signals from the battery house are connected.

Recommendation 18G1,5mm² cable

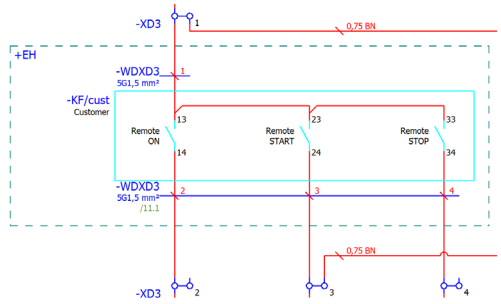
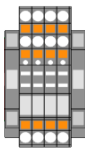




-XD2:1	Customer 24VDC for door limit switches
-XD2:2	Customer 0VDC for door limit switches
-XD2:3	First potential-free relay contact from the battery house: "Feedback door switches OK"
-XD2:4	Second potential-free relay contact from the battery house: "Feedback door switches OK"
-XD2:5	Spare
-XD2:6	Spare
-XD2:7	Spare
-XD2:8	Spare
-XD2:9	First potential-free relay contact from the battery house: "Feedback E-Stop OK"
-XD2:10	Second potential-free relay contact from the battery house: "Feedback E-Stop OK"
-XD2:11	First potential-free relay contact from the battery house: "Feedback common faut"
-XD2:12	Second potential-free relay contact from the battery house: "Feedback common faut"
-XD2:13	PE

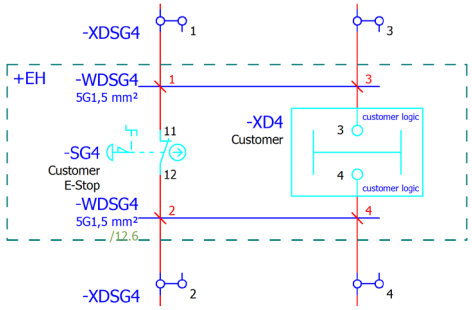
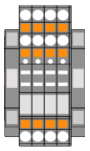
4.4.4 Remote interface (-XD3)

A 24VDC voltage is provided in the battery house for the remote control commands. Via relay contacts of the customer, the signal is forwarded to the PLC inputs accordingly.

Recommendation 5G1,5mm² cable 		**-XD3:1**	24VDC from battery house
		-XD3:2	Customer relay contact for PLC digital input “Remote mode 24V ON”
		-XD3:3	Customer relay contact for PLC digital input “Remote START”
		-XD3:4	Customer relay contact for PLC digital input “Remote STOP”

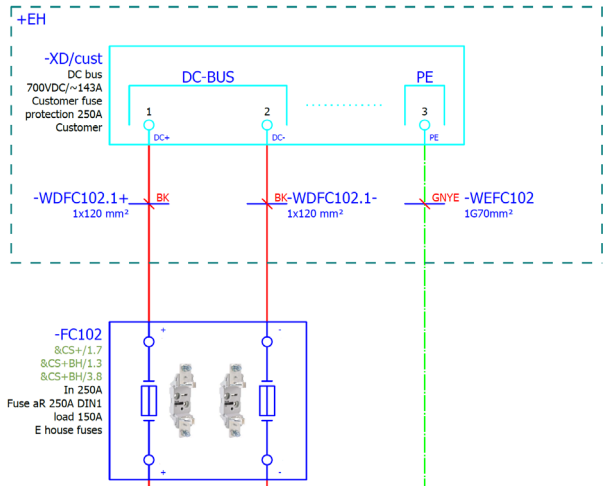
4.4.5 E-Stop interface (-XDSG4)

The emergency stop circuit of the E-House is an important part of the control system and is to be connected to terminal -XDSG4 and evaluated.

Recommendation 5G1,5mm² cable 		**-XDSG4:1**	First connection of the 24VDC NC contact of the emergency stop button from the customer.
		-XDSG4:2	Second connection of the 24VDC NC contact of the emergency stop button from the customer.
		-XDSG4:3	First connection point Potential-free feedback contact "E-Stop circuit OK"
		-XDSG4:2	Second connection point Potential-free feedback contact "E-Stop circuit OK"

4.4.6 DC bus interface

The customer cables from the DC bus are connected directly to the fuse provided in the battery house. The PE cable is routed to the central PE busbar in the battery house and connected. The dimensioning depends on the respective specification.

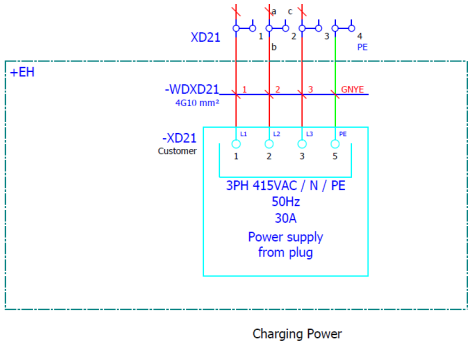


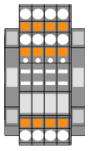
-FC102:+	DC-BUS-PLUS connection to the fuse
-FC102:-	DC-BUS-MINUS connection to the fuse
-WE1:X	PE connection to the central bus bar of the battery house

4.4.7 AC charger interface (-XD21)

The customer cables from the AC charger are connected to the terminal block.

Recommendation 4G10 mm² cable





-XD21:1	L1
-XD21:2	L2
-XD21:3	L3
-XD21:4	PE

5 Transport, storage, and packing

5.1 Transport

Wear the following protective gear during all work of installation:


Work safety clothing


Protective footwear


Protective gloves


Protective helmet

5.1.1 Safety instructions for transport

DANGER!

Danger of death due to suspended loads!

When lifting loads, there is a danger of death from falling parts or those swinging out of control.

→ Never step under suspended loads

→ Move loads only under supervision

→ Follow the specifications for the attachment points provided

→ Do not attach to projecting machine parts or to eyes on installed components. Be sure the lifting accessories are firmly seated

→ Use only authorized lifting gear and separate lifting accessories with sufficient load capacity

→ Do not use torn or worn ropes or straps, discard them and replace them with new ones instead

→ Do not attach ropes or straps to sharp corners and edges, and do not knot or twist them

→ Set down loads before leaving the work area

CAUTION!

Damage from improper transport!

Improper transport can result in substantial property damage.

→ Act with care when unloading the packaged units on delivery as well as during internal transport and observe the symbols and indications on the packaging.

→ Use only the attachment points provided.

→ Only remove packaging immediately before starting the installation.

5.1.2 Transport inspection

The individual packages must be packed according to the transport conditions to be expected. Check the shipment for completeness and transport damage immediately upon receipt.

If transport damage is externally visible, proceed as follows:

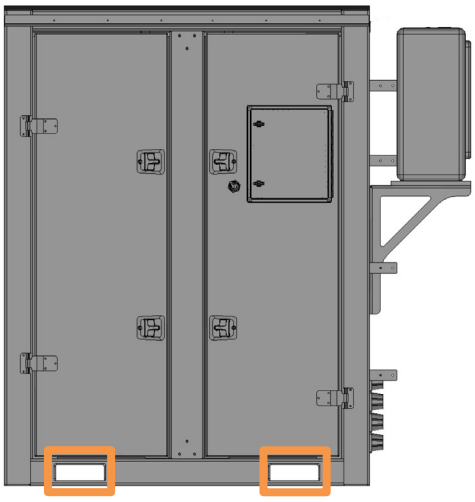
- Do not accept the shipment, or accept it only with reservations.
- Note the scope of damage on the transport documents or on the transporter's delivery note.
- Initiate a complaint.

CAUTION!

Claim every defect as soon as it is detected. Damage compensation claims may only be made within the applicable claim periods.

5.1.3 Lifting points

To load the battery house for transport, use a forklift truck and the showed lifting points provided.



5.1.4 Transportation battery house

1. Before transportation, the battery capacity should be at 15%～25%.
2. In the process of loading and unloading, should handle with care, it is strictly prohibited to throw, tumbling, and heavy weight.
3. During the transit, shipment to wooden cases, battery fill damping material, and the box body may not stack.
4. Should prevent violent vibration and impact during the transit, it is forbidden to squeeze, prevent the rain the sun, and upside down.
5. During the transit, the high voltage output port should assemble high-pressure shield, to avoid battery short circuit or high-pressure injuries.
6. Keep the temp. at -10°C～40°C range during in transit.
7. Products need to do factory check after the arrival of the goods, check the outer packing whether there is the transportation damage, if the customer signed, we do think our company product transportation process without damage. Any transport damage, please immediately contact the transport logistics identified and photographed together, take pictures and contact our Marketing Department to assist.

5.2 Storage of packed parts

CAUTION!

Under some circumstances, there may be instructions for storage on the packages which go beyond the requirements listed here. Follow them appropriately.

Store packages excluding battery module under the following conditions:

- Do not expose to aggressive media
- Storage temperature: -20 °C to +45 °C
- Relative humidity: max. 85 %
- When storing for more than 3 months, check the general condition of all parts and the packaging at regular intervals.

6 Installation

6.1 Safety

6.1.1 Personnel

- Only skilled personnel is allowed to carry out installation! At least 2 people.

Wear the following protective gear during all work of installation:


Work safety clothing


Protective footwear


Protective gloves


Protective helmet


Safety goggles

6.1.2 Safety advice

DANGER!

Danger to life due to suspended loads!

Loads falling or loads swinging sideways in an uncontrolled manner can lead to severe injuries or death.

→ Never step under suspended loads

→ Move loads only under supervision

→ Follow the specifications for the attachment points provided

→ Do not attach to projecting machine parts or to eyes on installed components. Be sure the lifting accessories are firmly seated

→ Use only authorized lifting gear and separate lifting accessories with sufficient load capacity

→ Do not use torn or worn ropes or straps, discard them and replace them with new ones instead

→ Do not attach ropes or straps to sharp corners and edges, and do not knot or twist them

→ Set down loads before leaving the work area

WARNING!

Risk of injury due to improper installation

Improper installation and initial commissioning can result in serious injury to person and property.

→ Before starting work, ensure sufficient space for assembly

→ Handle open, sharp-edges components carefully

→ Maintain order and cleanliness in the assembly area! Loosely stacked or scattered components and tools are sources of danger

→ Mount components properly. Comply with specified screw tightening torques

→ Secure components so that they cannot fall or tip over

Electric hazards

Danger of life due to electric shock!

Risk of injury due to falling or being cast-off after electric shock!

Touching electrically life parts may result in death or serious injury due to electric shock. Furthermore, there's a risk of injury due to shock reactions, falling or being cast-off triggered by electric shock.

Work on these parts is dangerous:

Main power supply

Parts carrying electrical current: Power feed, cables, connections, conductor rail, connectors, current collectors, devices and connections inside of switching cabinets, control devices, etc.

Parts that are under voltage as an effect of a fault

Before working on the parts listed above:

→ **Disconnect the battery system from power** following the 5 safety rules **and secure against reactivation.** 5 safety rules see chapter 2.7

While working:

→ Use insulated tools.

Before reactivating power:

→ Prior to each restart, test the insulation resistance according to locally applicable technical standards, directives, and laws.

→ Carry out mandatory electrical tests typical of the country where the device is installed

7 Commissioning

Personnel:

- Only skilled personnel (electrically) is allowed to carry out initial commissioning and commissioning after repair! The skilled personnel (electrically) must fulfill the requirements described in chapter 2.2.1.

Wear the following protective gear during all work for initial commissioning:


Work safety clothing


Protective footwear


Protective gloves


Protective helmet


Safety goggles

Danger of life due to electric shock!

Touching electrically life parts may result in death or serious injury due to electric shock.

Work on these parts is dangerous:

Main power supply

Parts carrying electrical current: Power feed, cables, connections, conductor rail, connectors, current collectors, devices and connections inside of switching cabinets, control devices, etc.

Parts that are under voltage as an effect of a fault

Before working on the parts listed above:

→ **Disconnect the battery system or AC charger from power** following the 5 safety rules **and secure against reactivation.** 5 safety rules see chapter 2.7

Fire hazard due to overload or sparking

Fire hazard is caused by overloading the cable, by electric arc, short-circuit or sparking. Sparks can be formed in case of failure of certain components in the system.

→ Imperatively stay within allowed current values

→ Install electrical protection devices according to regulations

WARNING!

Risk of injury due to improper commissioning!

Improperly performed commissioning can lead to dangerous situations for the personnel.

→ Before initial commissioning, carry out the tests in the test list of the manufacturer

→ Before each time the device is commissioned, test the insulation resistance. Doing so, follow locally applicable technical standards, directives, and law

→ Before each time the device is commissioned, make sure that all installation work is finished

→ Before each time the device is commissioned, make sure that all components are properly installed

8 Operation

8.1 Safety

8.1.1 Personnel

Only instructed personnel are allowed to operate the installation!

Wear the following protective gear during all tasks in the ongoing operation of the battery house:

Ear protection

8.1.2 Safety advice

WARNING!

Danger for unauthorized personnel!

Unauthorized personnel do not understand the danger in the working area.

→ Keep unauthorized personnel away from the working area.

→ In case of doubt, address these persons and direct them away from the working area.

→ Stop work as long as unauthorized personnel is in the working area.

Fire hazard due to overload or sparking!

Fire hazard is caused by overloading the cable, by electric arc, short-circuit or sparking. Sparks can be formed in case of failure of certain components in the system.

→ Imperatively stay within allowed current values

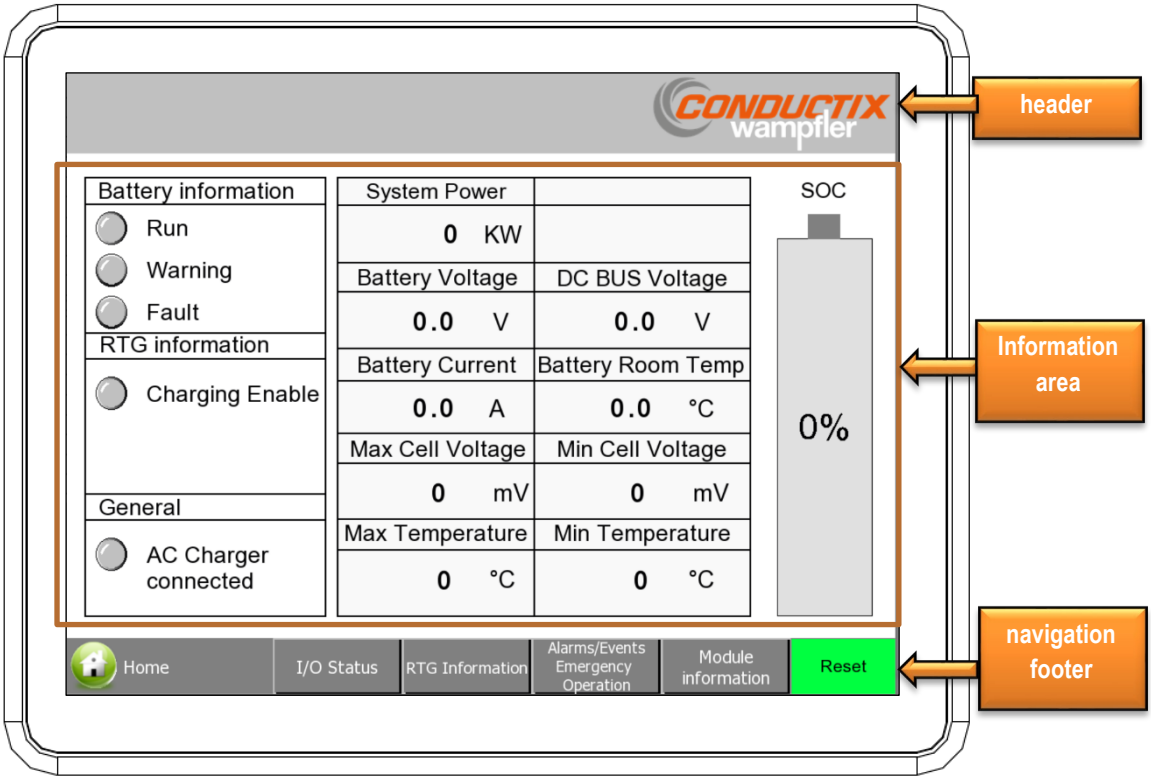
→ Install electrical protection devices according to regulations

8.2 HMI (touch panel)

The battery system is controlled via an HMI (touch panel) which is installed in the battery house door together with hardware switches (chapter 4.2.2).

8.2.1 Main menu: Home

The main menu shows the essential status values of the battery house in the information area. You can access the submenus via the navigation footer and return to the main menu via the home button at the bottom left.



Displayed values

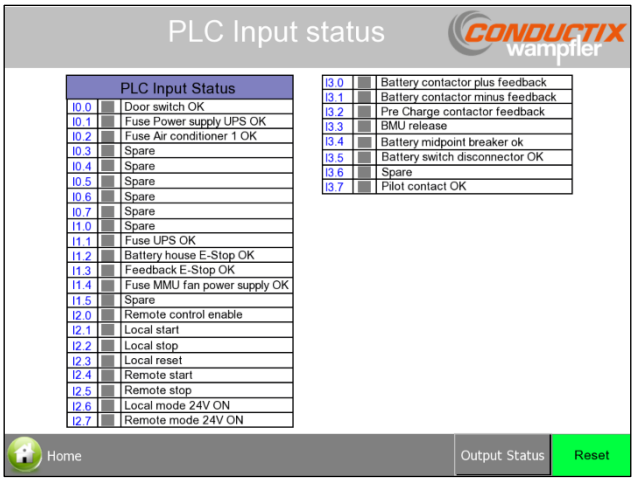
Value	Description	Unit
Time	Show restart/stop time delay (shown in header)	s
System power	Output power from battery system	kW
Battery voltage	Output voltage from battery system	V
Battery Current	Output current from battery system	A

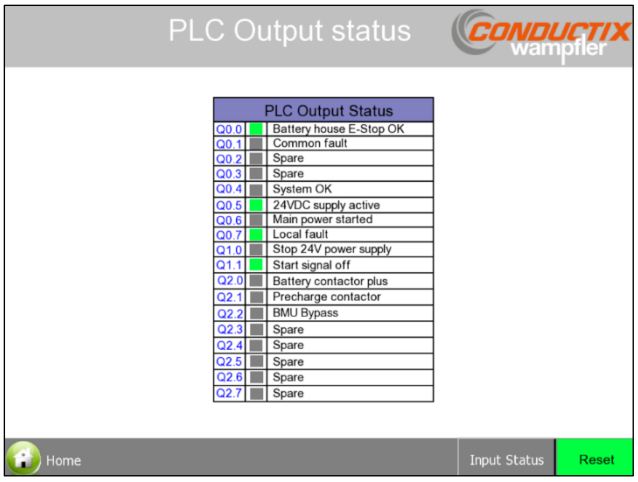
Value	Description	Unit
DC BUS Voltage	Voltage on DC-Link bus	V
Battery Room Temp	Shows the temperature inside battery house	°C
Min/Max Cell Voltage	Minimal or maximal voltage from one cell inside the battery pack	mV
Min/Max Temperature	Minimal or maximal temperature from one cell inside the battery pack	°C
SOC	“State of Charge” of the battery system	%

8.2.2 Sub menu: PLC I/O status

The “PLC I/O status” sub menu can be used, for example, to read feedback signals from circuit breakers and contactors as well as control output signals from the PLC itself.

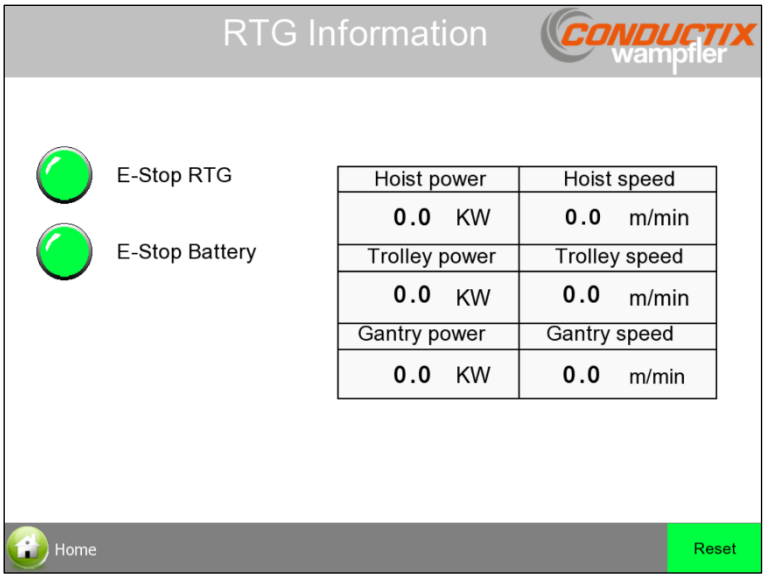
It can be switched between “Input status” and “Output status” in the navigation footer. A green box stands for a “TRUE” signal at the PLC input or output (further information about the PLC in chapter 4.2.7).





8.2.3 Sub menu: RTG information

The sub menu “RTG information” displays the current values of the different drives as well as the state of the E-Stop-Buttons on the battery house and the E-House (RTG).



8.2.4 Sub menu: Alarms/Events Emergency operation

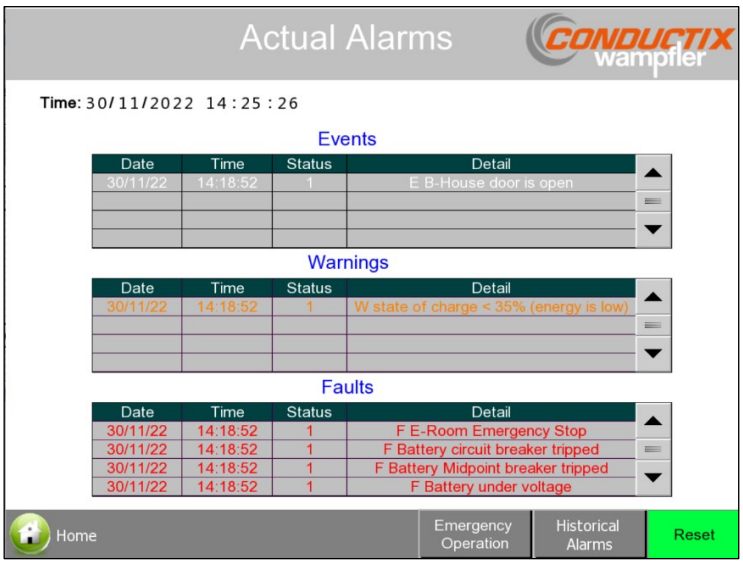
The alarms are distinguished between:

- **Events**: Information about the active functions / incoming control commands of the battery house
- **Warnings**: Information about the status of the battery house, possible malfunction
- **Faults**: Critical faults of the battery house, investigation by service engineer required, must be acknowledged through “Reset”.

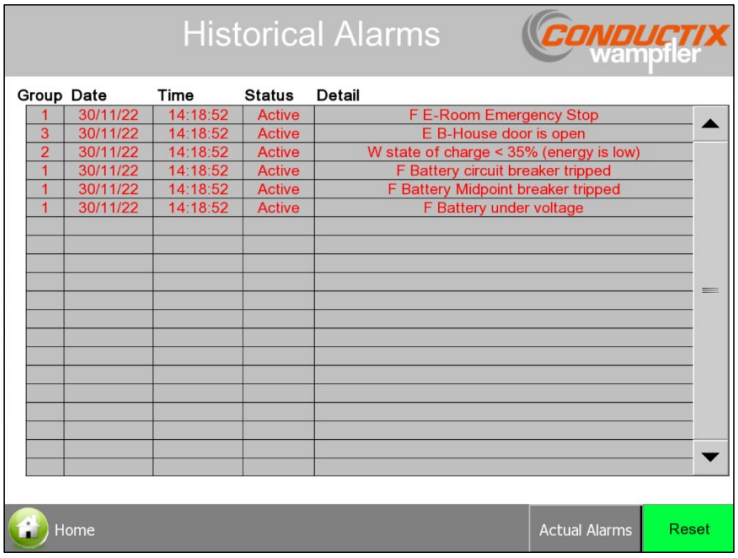
For detailed description of the faults, warnings, events, see chapter 1.210.2.

8.2.4.1 Actual alarms

From the “Actual Alarms” sub menu you can access the list of historical alarms (see chapter 8.2.4.2) or start emergency operation (see chapter 0).

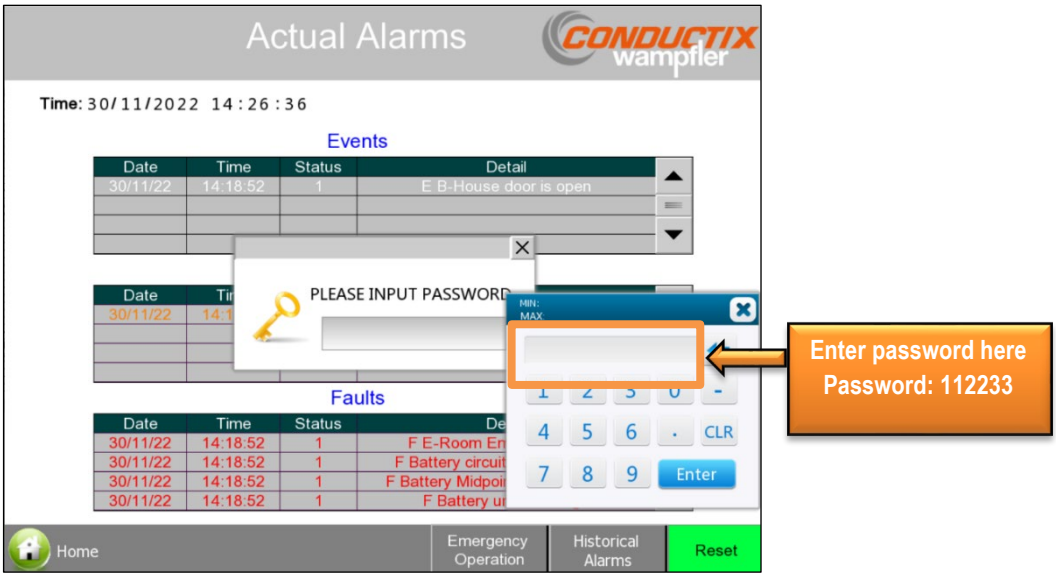


8.2.4.2 Historical alarms

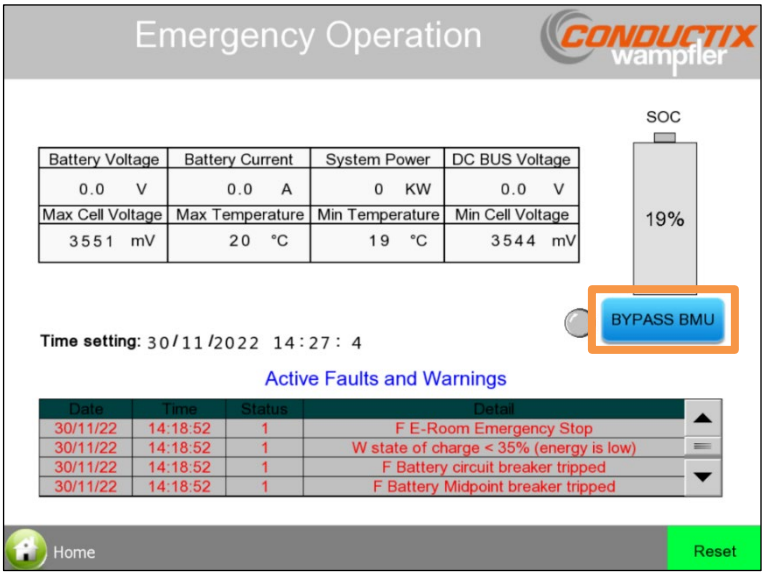


8.2.4.3 Emergency operation

Emergency operation can be started from the „Actual Alarms“ sub menu. A password must be entered to start emergency operation.



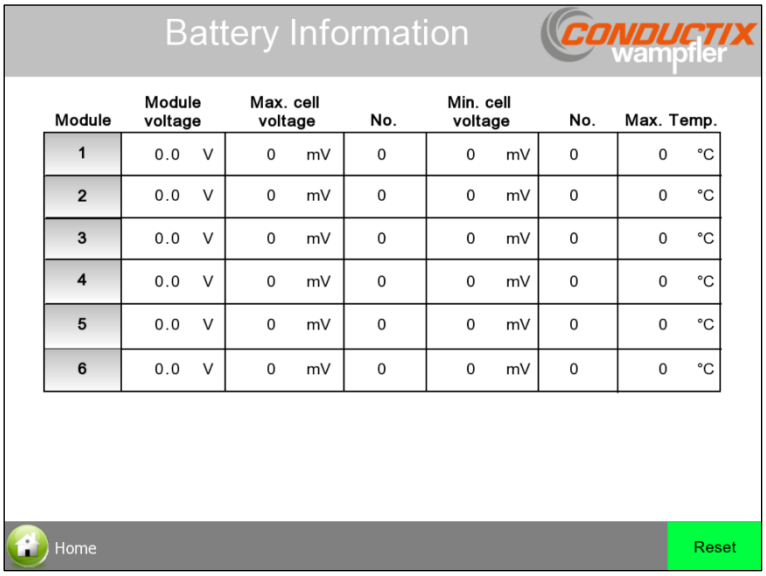
Once the password has been entered it is possible to Bypass the BMU.



“Bypass BMU” can be activated if the battery package or a battery cell have an overvoltage/undervoltage fault (F Battery system under voltage, F Battery system over voltage, F Cell under voltage, F Cell over voltage). The DC contactors are then no longer controlled by the BMU. After repairing the BMU (e.g. through a firmware update) or a manual charge/discharge of the batteries, the function will be automatically reset after 5 minutes, or in case of an undervoltage alarm when the battery current is more than 50 A (battery charging is active), or in case of an overvoltage alarm when the battery current is less than –50 A (battery discharging is active), or when no battery package or battery cell overvoltage/undervoltage fault is active.

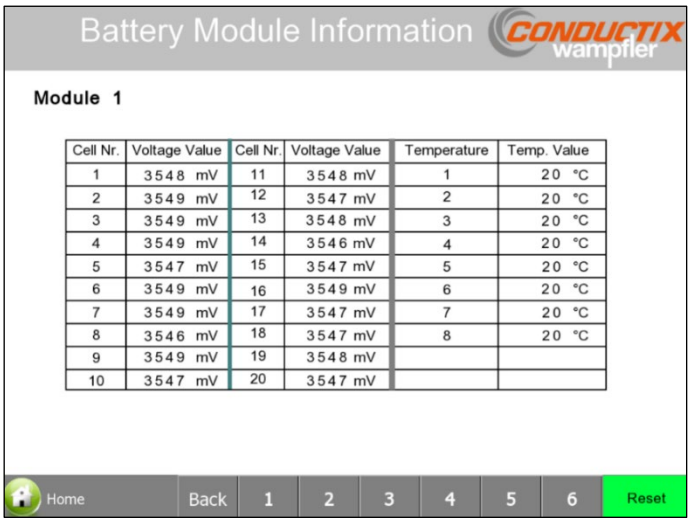
8.2.5 Sub menu: Battery information

The battery information shows general information about the state of the individual battery modules.



Column	Description
Module	Soft-Buttons (detailed module information)
Module voltage	Total voltage of each battery module
Max. cell voltage	Max. cell voltage of the battery module
No.	Cell number of the displayed max. voltage
Min. cell voltage	Min. cell voltage of the battery module
No.	Cell number of the displayed min. voltage
Max Temperature	Max. temperature of each battery module

If detailed information about a battery module is needed, each module line (1-6) can be pressed to open a window with detailed module information. In the detailed window Battery module information, you get the complete values for the selected battery module. Further modules can be selected via the footer or the "BACK" button can be used to return to the overview window.



Cell Nr.	Voltage Value	Cell Nr.	Voltage Value	Temperature	Temp. Value
1	3548 mV	11	3548 mV	1	20 °C
2	3549 mV	12	3547 mV	2	20 °C
3	3549 mV	13	3548 mV	3	20 °C
4	3549 mV	14	3546 mV	4	20 °C
5	3547 mV	15	3547 mV	5	20 °C
6	3549 mV	16	3549 mV	6	20 °C
7	3549 mV	17	3547 mV	7	20 °C
8	3546 mV	18	3547 mV	8	20 °C
9	3549 mV	19	3548 mV		
10	3547 mV	20	3547 mV		

9 Servicing and maintenance

9.1 Safety

Only skilled personnel is allowed to carry out servicing and maintenance!

Wear the following protective gear during all work of servicing and maintenance:


Work safety clothing


Protective footwear


Protective gloves


Protective helmet


Safety goggles

Danger of life due to electric shock!

Touching electrically life parts may result in death or serious injury due to electric shock.

Working on these parts is dangerous:

Main power supply

Parts carrying electrical current: Power feed, cables, connections, conductor rail, connectors, current collectors, devices and connections inside of battery house, control devices, etc.

Parts that are under voltage as an effect of a fault

Before working on the parts listed above:

› **Disconnect the battery system from power** following the 5 safety rules **and secure against reactivation.** 5 safety rules see chapter 2.7


WARNING!

Danger of injury due to improperly executed maintenance tasks!

Improper maintenance can result in serious injury and property damage. Loosely stacked or scattered components and tools are sources of danger. Persons might stumble over it, parts might tip over or fall down.

→ Before starting work, ensure sufficient space for assembly.

→ Maintain order and cleanliness in the assembly area!

→ If components have been removed, be careful to install them properly.

→ For specific battery warnings please refer to chapter 2.8.


WARNING!

Injury hazard due to disabled safety devices!

→ Never disable safety devices

9.2 Battery system maintenance

9.2.1 Daily check

Battery status would be shown in touch panel. Each value should be within normal range as below table. Any one data is abnormal, a warning or fault would be released. If it happens, please refer to 'clearing fault' part.

Item	Rated value	Normal Range
Module voltage	74 VDC	60 VDC – 83 VDC
Max Cell voltage	3.75 V	3.4-4.1 V
Min Cell voltage	3.75 V	3.4-4.1 V
Temperature	25°C	0-45°C

9.2.2 Regularly maintenance

The operator must ensure that inspection and maintenance intervals described are complied with.

Regular check (Every three-months)	Battery Management System (BMS)	■ Check BMS power supply if it's 24V
	Connectors on modules	■ Check voltage connector if there is a burning, pitting, signs such as oxidation, deformation ■ Check communication connector if there is a burning, pitting, signs such as oxidation, deformation If so, need to do the repair or replacement timely. Battery system is not allowed to operate any more.
	Insulation	■ Check the insulation resistance between battery pack positive and pack frame if it's less than 5 MΩ. ■ Check the insulation resistance between battery pack negative and pack frame if it's less than 5 MΩ. If so, contact with supplier. Note: before check insulation resistance, it's a must to disconnect battery pack from whole system (including voltage circuit and communication circuit)

	Module outside appearance	■ Check modules if there is deformation ■ Check module surface appearance if there is oxidation, scratches If so, do corresponding processing, such as simple repair, contact with manufacture, painting repair, etc. according to the actual damage
Module fixation (Every one-year)	■ Check the screw connection to make sure all modules are mounted tightly in the battery rack due to permanent vibration on the crane Note: maintenance engineer needs to remove the front panel of each module to access those screws.	
Emergency stop button (at least every one-year)	■ Check that the emergency stop button is working (battery house is switched off and the error is displayed on the panel).	
Air conditioner unit(s)	■ As the provision of the air conditioner unit(s) is made by the customer, the corresponding maintenance intervals defined by the manufacturer must be complied with.	

10 Clearing faults

10.1 Safety

WARNING!

Risk of injury due to improper fault clearance!

Improper fault clearance can result in serious injury and property damage.

→ Contact the manufacturer in case of faults

→ Allow fault clearance to be carried out only by personnel from or authorized by the manufacturer.

The faults that have occurred in practice are, as far as known by Conductix-Wampfler, listed in the following table and complemented by measures for remedy. Faults may only be cleared by qualified, skilled personnel.

Danger of life due to electric shock!

Touching electrically life parts may result in death or serious injury due to electric shock.

Work on these parts is dangerous:

Main power supply

Parts carrying electrical current: Power feed, cables, connections, conductor rail, connectors, current collectors, devices and connections inside of switching cabinets, control devices, etc.

Parts that are under voltage as an effect of a fault

Before working on the parts listed above:

→ **Disconnect the battery system or charging station from power** following the 5 safety rules **and secure against reactivation.** 5 safety rules see chapter 2.7

Wear the following protective gear during all work of fault clearance:

Work safety clothing

Protective footwear

Protective gloves

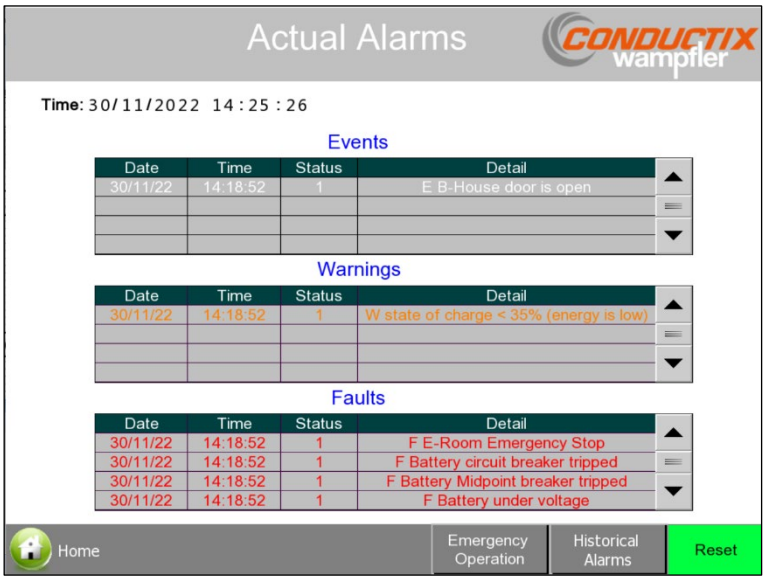
Protective helmet

10.2 Alarm lists:

In the sub menu "Actual alarms" (see chapter 8.2.4) the alarms are divided into events, warnings and faults:

- **Alarm**: RTG is stopped
- **Warning**: limited operation of RTG
- **Event**: no effect on RTG operation

A list can be found in the following subchapters.



10.2.1 Events

Event Text	Causes
E DCDC converter is running	DC/DC converter (-TA1) is running without faults.
E Batteries are charging	Battery charging is active
E Batteries are discharging	Battery discharging is active
E Battery contactor plus feedback is active	DC-Contactor (-QA11) “battery contactor +” is activated
E Battery contactor minus feedback is active	DC-Contactor (-QA12) “battery contactor -” is activated
E Battery contactor precharge feedback is active	DC-Contactor (-QA13) “Precharge contactor” is activated
E Stop command from E-House PLC is active	Start command via software interface from E-House is active

Event Text	Causes
E Start command from E-House PLC is active	Stop command via software interface from E-House is active
E Local start command is active	LOP local START(–SJ2) is active
E Local stop command is active	LOP local STOP (–SJ3) is active
E B-House door is open	Minimum one of the doors of the battery house is open (door limit switches -BG1 … -BG4)
E 1 minute delay for restart is active	After stopping the system, a restart of the system is blocked for 1 minute. Within this time, system start is disabled
E 10s delay for stopping system is active	System will be stopped 10s after stop-command was detected
E Remote stop is active	Remote stop signal from RTG is active
E Remote start command is active	Remote start signal from RTG is active
E Remote power 24V ON command is active	Remote 24VDC ON from RTG is active
E Local Reset command is active	LOP local RESET (-SJ4) is active
E Remote control is enabled	LOP remote control (-SG1) is active
E Charging from Busbar is enabled	RTG released battery charging via busbar
E AC charger is connected	AC charger is plugged in

10.2.2 Warnings

10.2.2.1 W Air condition fuse tripped

Causes	Troubleshooting
Air conditioner 1 is broken	Change air conditioner 1 -EC1
Air conditioner overloaded	Check air condition 1 -EC1
Short circuit in fan	Check circuit breaker -FC5

10.2.2.2 W UPS power supply fuse tripped

Causes	Troubleshooting
Short circuit in 2x12VDC batteries	Check wiring and circuit breaker (-FC11) of 2x12 VDC batteries (-CC11 and -CC12)
12 VDC battery is broken	Replace 2x12 VDC batteries (-CC11 and -CC12)

10.2.2.3 W Battery module fan fuse tripped

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes	Troubleshooting
Battery module fan(s) is/are broken, or circuit breaker tripped	Check battery module fans Check circuit breaker -FC6
Single power supply module is broken	Check/replace single power supply module (-TB2)
Wiring issue	Check the wiring single power supply module (-TB2)

10.2.2.4 W B-Room Temperature High

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(battery house temperature > 35°C)*	Troubleshooting
Air condition is broken	Check air condition -EC1 and EC1.1
Circuit breaker Air condition tripped	Check circuit breaker -FC5
Battery house temperature sensor defect	Battery house temperature sensor has to be changed
Ambient temperature is not according to specification	Check ambient temperature

10.2.2.5 W B-Room Temperature Low

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(battery house temperature < -15°C)*	**Troubleshooting**
Air condition is broken	Check air condition -EC1 and EC1.1
Circuit breaker Air condition tripped	Check circuit breaker -FC5
Battery house temperature sensor defect	Battery house temperature sensor has to be changed
Ambient temperature is not according to specification	Check ambient temperature

10.2.2.6 W RTG communication

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ delay time 10s)*	**Troubleshooting**
Ethernet cable in ethernet switch or E-House is not connected	1. Ethernet cable must be connected to the port of the Ethernet switch (-KF41) and the corresponding LED light on the port should be on/blinking. 2. Check Ethernet cables and PROFINET-plugs
Ethernet cable is broken	Replace Ethernet cable

10.2.2.7 W Battery over voltage

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ Battery package voltage > 492V)*	**Troubleshooting**
Battery package is overcharged	1. Stop battery charging. Check on battery house HMI if SOC value is between 20 % and 80 %. 2. When SOC > 80 % start to discharge batteries until battery package voltage is <492 VDC and max. cell voltage is < 4,1 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.2.8 W Battery under voltage

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ Battery package voltage < 408V)*	**Troubleshooting**
Battery package is undercharged	1. Stop battery discharging. Check on battery house HMI if SOC value is between 20 % and 80 %. 2. When SOC < 20 % start to charge batteries until battery package voltage is > 408 VDC and min. cell voltage is > 3,4 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.2.9 W Cell over voltage

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ Cell voltage > 4,1V)*	**Troubleshooting**
Battery cell is overcharged	1. Stop battery charging. Check on battery house HMI (-SZ1) if SOC value is between 20% and 80%. 2. When SOC > 80% start to discharge batteries until battery package voltage is < 492 VDC and max. Cell voltage is < 4,1 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.2.10 W Cell under voltage

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ Cell voltage > 3,4V)*	**Troubleshooting**
Battery cell is undercharged	1. Stop battery discharging. Check on battery house HMI (-SZ1) if SOC value is between 20% and 80%. 2. When SOC < 20% start to charge batteries until battery package voltage is > 408 VDC and min. Cell voltage is > 3,4 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.2.11 W Battery charging over current

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ Battery current > 550A)*	**Troubleshooting**
Short circuit	Check power cables and current sensor Check DC-DC fault

10.2.2.12 W Battery discharging over current

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ Battery current > 750A)*	**Troubleshooting**
Short circuit DC-DC internal problem	Check power cable and current sensor Check DC-DC fault

10.2.2.13 W Battery over temperature

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ Max. battery temperature > 45°)*	**Troubleshooting**
Air conditioner is broken, or circuit breaker tripped	Check air condition -EC1 and EC1.1 Check circuit breaker -FC5
Cooling fans are not running	Check battery module fans at the battery modules
Temperature sensor cable disconnect	Check temperature sensor –BT1 (temperature battery house) and cable connection
Temperature sensors in battery modules are broken	Check if temperature max. values of all battery modules are approximately in the same range. When values are abnormal, contact Conductix-Wampfler service
Ambient temperature is not according to specification	Check ambient temperature

10.2.2.14 W Battery under temperature

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ Min. battery temperature < -10°C discharging, < 5°C charging)*	**Troubleshooting**
Air conditioner is broken, or circuit breaker tripped	Check air condition -EC1 and EC1.1 Check circuit breaker -FC5
Cooling fans are not running	Check battery module fans at the battery modules
Temperature sensor cable disconnect	Check temperature sensor –BT1 (temperature battery house) and cable connection
Temperature sensors in battery modules are broken	Check if temperature max. values of all battery modules are approximately in the same range. When values are abnormal, contact Conductix-Wampfler service
Ambient temperature is not according to specification	Check ambient temperature

10.2.2.15 W Battery unbalanced

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ cell voltage difference > 0,30 V)*	**Troubleshooting**
BMU is broken	Contact Conductix-Wampfler service
BMS cable disconnect	Check cable connection
Battery module is broken	Contact Conductix-Wampfler service

10.2.2.16 W Battery low insulation

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes	**Troubleshooting**
Low insulation resistance	Contact Conductix-Wampfler service
High humidity	Check air conditioner

10.2.2.17 W Battery communication

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ delay time: 6s)*	**Troubleshooting**
BMU is broken	Contact Conductix-Wampfler service
MMU is broken	Contact Conductix-Wampfler service
Profibus DP/CAN Bus gateway is not working	Check DIP switch, address and LED status of the PB/CAN gateway (see chapter 4.2.8 and circuit diagram)
CAN Bus cable disconnected	Check the CAN bus cables
Battery module is broken	Contact Conductix-Wampfler service

10.2.2.18 W DCDC converter communication

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes *(→ delay time: 3s)*	**Troubleshooting**
PROFIBUS cable disconnect or End resistor of PROFIBUS plug is in a wrong position	Check PROFIBUS communication cables
	Check end resistor position on DC/DC converter -TA1 (Position Off), on DP-Master -KE2 (Position On) and PB/CAN gateway-KE11 (Position Off)
	Check LED status on PB/CAN gateway (see chapter 4.2.8 (LED’s must be green)
DIP-Switch setting on Communication card of DC/DC converter is in a wrong position	Check setting of DIP-Switch on DC/DC converter -TA1 (according circuit diagram chapter 4.2.5)
Communication card of DC/DC-Converter is broken	Contact Conductix-Wampfler service

10.2.2.19 W BMS bypass operation active

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes	**Troubleshooting**
BMS Bypass operation has been activated	See chapter 8.2.4

10.2.2.20 W State of charge < 35% (low)

A signal is sent to the RTG via the crane interface to reduce its power to max. 50%.
(signal “Maximum_Available_Power”, see I/O list for software interface)

Causes	**Troubleshooting**
SOC status is too low	Activate ‘Bypass SOC’ to charge batteries (chapter 8.2.4)
Charging via Cable reel/conductor rail is not working	Check cable reel/conductor rail

10.2.3 Faults

10.2.3.1 F B-Room Temperature High

Causes *(→ delay time 20s / temperature > 45°C)*	**Troubleshooting**
Air conditioner is broken, or circuit breaker tripped	Check air condition -EC1 (EC1.1) Check circuit breaker -FC5
Cooling fans are not running	Check battery module fans at the battery modules
Temperature sensor cable connect	Cooling fans are not running
Ambient temperature is not according to specification	Check ambient temperature

10.2.3.2 F B-Room Temperature Low

Causes *(→ delay time 20s / temperature < -35°C)*	**Troubleshooting**
Air conditioner is broken, or circuit breaker tripped	Check air condition -EC1 (EC1.1) Check circuit breaker -FC5
Cooling fans are not running	Check battery module fans at the battery modules
Temperature sensor cable connect	Cooling fans are not running
Ambient temperature is not according to specification	Check ambient temperature

10.2.3.3 F B-House Emergency Stop

Causes	**Troubleshooting**
Emergency stop button battery house is pressed	When the danger is eliminated, unlock Emergency stop button on battery house (-SG3), and press reset
Wiring issue	Check Terminal -XDSG3 (see circuit diagram) and the wiring of the E-Stop (-SG3, see circuit diagram)

10.2.3.4 F E-Room Emergency Stop

Causes	Troubleshooting
Emergency stop button E-House is pressed	When the danger is eliminated, unlock Emergency stop button of the E-House, check the battery house E-stop and press reset
Wiring issue	Check Terminal -XDSG4 (see circuit diagram) and customer cable for the interface

10.2.3.5 F Emergency Stop general

Causes	Troubleshooting
E-Stop in E-House or battery house is pressed	When the danger is eliminated, unlock Emergency stop button in E-House and / or battery house (-SG3), and press reset

10.2.3.6 F RTG communication

Causes *(→ timeout 250s)*	Troubleshooting
Ethernet cable in ethernet switch or E-House is not connected	1. Ethernet cable must be connected to the port of the Ethernet switch (-KF41) and the corresponding LED light on the port should be on/blinking. 2. Check Ethernet cables and PROFINET-plugs
Ethernet cable is broken	Replace Ethernet cable

10.2.3.7 F Battery over voltage

Causes *(→ Battery package voltage > 498V)*	**Troubleshooting**
Battery package is overcharged	1. Stop battery charging. Check on battery house HMI if SOC value is between 20 % and 80 %. 2. When SOC > 80 % start to discharge batteries until battery package voltage is <492 VDC and max. Cell voltage is < 4,1 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.3.8 F Battery under voltage

Causes *(→ Battery package voltage < 372V)*	**Troubleshooting**
Battery cell is undercharged	1. Stop battery discharging. Check on battery house HMI (-SZ1) if SOC value is between 20% and 80%. 2. When SOC < 20% start to charge batteries until battery package voltage is > 408 VDC and min. Cell voltage is > 3,4 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.3.9 F Cell over voltage

Causes *(→ cell voltage > 4,15V)*	**Troubleshooting**
Battery cell is overcharged	1. Stop battery charging. Check on battery house HMI (-SZ1) if SOC value is between 20% and 80%. 2. When SOC > 80% start to discharge batteries until battery package voltage is < 492 VDC and max. Cell voltage is < 4,1 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.3.10 F Cell under voltage

Causes *(→ cell voltage > 3,1V)*	**Troubleshooting**
Battery package is undercharged	1. Stop battery discharging. Check on battery house HMI if SOC value is between 20 % and 80 %. 2. When SOC < 20 % start to charge batteries until battery package voltage is >408 VDC. and min. Cell voltage is > 3,4 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.3.11 F Battery charging over current

Causes *(→ battery current > 570A)*	**Troubleshooting**
Short circuit	Check power cable for damages Check current sensor Check DC-DC fault

10.2.3.12 F Battery discharging over current

Causes *(→ battery current > 790A)*	**Troubleshooting**
Short circuit DC-DC internal problem	Check power cable and current sensor Check DC-DC fault

10.2.3.13 F Battery over temperature

Causes *(→ max. battery temperature > 55°C)*	**Troubleshooting**
Air conditioner is broken, or circuit breaker tripped	Check air condition -EC1 and EC1.1 Check circuit breaker -FC5
Cooling fans are not running	Check battery module fans at the battery modules Check circuit breaker -FC6
Temperature sensor cable disconnect	Check temperature sensor –BT1 (temperature battery house) and cable connection
Temperature sensors in battery modules are broken	Check if temperature max. values of all battery modules are approximately in the same range. When values are abnormal, contact Conductix-Wampfler service
Ambient temperature is not according to specification	Check ambient temperature

10.2.3.14 F Battery under temperature

Causes *(→ Min. battery temperature < -20°C discharging, < 0°C charging)*	**Troubleshooting**
Air conditioner is broken, or circuit breaker tripped	Check air condition -EC1 and EC1.1 Check circuit breaker -FC5
Cooling fans are not running	Check battery module fans at the battery modules Check circuit breaker -FC6
Temperature sensor cable disconnect	Check temperature sensor –BT1 (temperature battery house) and cable connection
Temperature sensors in battery modules are broken	Check if temperature max. values of all battery modules are approximately in the same range. When values are abnormal, contact Conductix-Wampfler service
Ambient temperature is not according to specification	Check ambient temperature

10.2.3.15 F Battery unbalanced

Causes *(→ cell voltage difference > 0,50 V)*	**Troubleshooting**
BMU is broken	Contact Conductix-Wampfler service
BMS cable connect	Check cable connect
Battery module is broken	Contact Conductix-Wampfler service

10.2.3.16 F Battery low insulation

Causes	**Troubleshooting**
Low insulation resistance	Contact Conductix-Wampfler service
High humidity	Check air conditioner

10.2.3.17 F Battery grounding

Causes *(→ delay time 4s)*	**Troubleshooting**
Bad or loose grounding connection	Check grounding of battery modules

10.2.3.18 F Battery voltage too high

Causes *(→ delay time 3s, Battery package voltage > 498V or max. cell voltage > 4.18 VDC)*	**Troubleshooting**
Battery package is overcharged	1. Stop battery charging. Check on battery house HMI if SOC value is between 20 % and 80 %. 2. When SOC > 80 % start to discharge batteries until battery package voltage is <498 VDC and max. Cell voltage is < 4,18 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.3.19 F Battery voltage too low

Causes *(→ delay time 3s, Battery package voltage < 360V or max. cell voltage < 3.01 VDC)*	**Troubleshooting**
Battery cell is undercharged	1. Stop battery discharging. Check on battery house HMI (-SZ1) if SOC value is between 20% and 80%. 2. When SOC < 20% start to charge batteries until battery package voltage is > 360 VDC and min. Cell voltage is > 3,01 VDC.
Wiring issue	Check sensor cable connect on MMU
MMU, BMU, Battery module or Battery cell is defect	Contact Conductix-Wampfler service

10.2.3.20 F Battery communication

Causes *(→ delay time 10s)*	**Troubleshooting**
BMU is broken	Contact Conductix-Wampfler service
MMU is broken	Contact Conductix-Wampfler service
Profibus DP/CAN Bus gateway is not working	Check DIP switch, address and LED status of the PB/CAN gateway (see chapter 4.2.8 and circuit diagram)
CAN Bus cable disconnected	Check the CAN bus cables
Battery module is broken	Contact Conductix-Wampfler service

10.2.3.21 F DCDC converter

Causes	**Troubleshooting**
Protection is tripped	Check -FC101 and –FC102
DC/DC-Converter fault	Check Operator panel of DC/DC-Converter –TA1, if an Error is shown
DC/DC-Converter is broken	Contact Conductix-Wampfler service

10.2.3.22 F DCDC communication

Causes *(→ delay time 6s)*	**Troubleshooting**
PROFIBUS cable disconnect or End resistor of PROFIBUS plug is in a wrong position	Check PROFIBUS communication cables
	Check end resistor position on DC/DC converter -TA1 (Position Off), on DP-Master -KE2 (Position On) and PB/CAN gateway-KE11 (Position Off)
	Check LED status on PB/CAN gateway (see chapter 4.2.8 (LED's must be green)
DIP-Switch setting on Communication card of DC/DC converter is in a wrong position	Check setting of DIP-Switch on DC/DC converter -TA1 (according to circuit diagram chapter 4.2.5)
Communication card of DC/DC-Converter is broken	Contact Conductix-Wampfler service

10.2.3.23 F Battery Plus contactor

Causes	**Troubleshooting**
DC/DC-Converter is not working	1. Check Operator panel of DC/DC-Converter –TA1, if an Error is shown 2. Check J10 on main board (must be in top position) 3. Contact Conductix-Wampfler service
BMU is not working	Switch off and on –FC17 (for 24 VDC power supply of BMU) Contact Conductix-Wampfler service
DC-contactor is broken	Change DC-Contactor –QA11 Contact Conductix-Wampfler service
Wiring is broken	Check wiring of -QA11 Contact Conductix-Wampfler service

10.2.3.24 F Battery Minus contactor

Causes	Troubleshooting
BMU is not working	Switch off and on –FC17 (for 24 VDC power supply of BMU) Contact Conductix-Wampfler service
DC-contactor is broken	Change DC-Contactor –QA12 Contact Conductix-Wampfler service
Wiring is broken	Check wiring of -QA12 Contact Conductix-Wampfler service

10.2.3.25 F Battery Precharge contactor

Causes	Troubleshooting
BMU is not working	Switch off and on –FC17 (for 24 VDC power supply of BMU) Contact Conductix-Wampfler service
DC-contactor is broken	Change DC-Contactor –QA10 Contact Conductix-Wampfler service
Wiring is broken	Check wiring of -QA10 Contact Conductix-Wampfler service

10.2.3.26 F Battery Midpoint breaker tripped

Causes	Troubleshooting
Overcurrent batteries	1. Check battery module connections -CC1 to -CC6 2. Check Alarms/Warnings on HMI -SZ1 of the battery house 3. Check setting of -FC100 (see circuit diagram)

10.2.3.27 F Battery circuit breaker tripped

Causes	Troubleshooting
Short circuit DC/DC-Converter Overcurrent DC/DC-Converter	1. Check wiring between DC/DC-Converter -TA1 and –FC101 2. Check Operator panel of DC/DC-Converter –TA1, if an Error is shown 3. Check fuses of -F101 (see circuit diagram)

10.2.3.28 F No release from BMU

Causes	Troubleshooting
BMU is not working	Switch off and on -FC17 (24 VDC for BMU)
Relay -KF12 is broken	Check relay -KF12

10.2.3.29 F loading of battery not active

Causes *(→ delay time 210s, SOC < 20%, charging current < 15A)*	**Troubleshooting**
Charging via Cable reel/conductor rail is not working	Check cable reel/conductor rail

10.2.3.30 F state of charge < 20% (energy is empty)

Causes	Troubleshooting
SOC status is too low	Activate ‘Bypass SOC’ to charge batteries (chapter 8.2.4)
Cable reel/conductor rail is not working	Check cable reel/conductor rail

11 Disassembly and disposal

11.1 Safety

Personnel:

- May only be carried out by skilled personnel. At least 2 people

Wear the following protective gear during all work of disassembly and disposal:


Work safety clothing


Protective footwear


Protective gloves


Protective helmet


Safety goggles


Respiratory protection mask

Danger of life due to electric shock!

Touching electrically life parts may result in death or serious injury due to electric shock.

Work on these parts is dangerous:

Main power supply

Parts carrying electrical current: Power feed, cables, connections, conductor rail, connectors, current collectors, devices and connections inside of switching cabinets, control devices, etc.

Parts that are under voltage as an effect of a fault

Before working on the parts listed above:

→ **Disconnect the battery system or AC charger from power** following the 5 safety rules **and secure against reactivation.** 5 safety rules see chapter 2.7.

Danger of injury due to improper disassembly!

Stored energy, sharp components, points, and edges on and in the device or the tools needed can cause injury.

→ Before starting work, ensure sufficient space.

→ Handle open, sharp-edges components carefully.

→ Maintain order and cleanliness in the work area!

→ Dismount components properly.

→ Involve the manufacturer in case of any unclear points.

11.2 Disposal

Unless return and disposal arrangements have been agreed, send the dismantled components to recycling. Depending on the country-specific laws, the batteries must be disposed of accordingly:

- Take metals to recycling
- Take plastic elements to recycling
- Dispose of remaining components on the basis of their material composition
- Note the safety data sheet (see chapter 12).

CAUTION!

Environmental damage due to improper disposal!

Electrical waste, electronic components, lubricants and other auxiliary materials are subject to hazardous waste disposal regulations and may only be disposed of by authorized specialists.

Local community officials or special disposal companies can provide information about environmentally appropriate disposal.

12 Additional documentation

- Project specific circuit diagram
- Spare part list
- Safety data sheet (SDS0581-0002)
- Specification of battery module
- Mechanical drawings
- IO-List for Software-Interface
- Test protocols
- Air conditioning unit (provided by customer)

13 Contact details

To contact your nearest sales office, please refer to: www.conductix.com/contact-search

Conductix-Wampfler GmbH
Rheinstraße 27 + 33
79576 Weil am Rhein - Märkt
Germany

Phone: +49 (0) 7621 662-0
Fax: +49 (0) 7621 662-144
info.de@conductix.com
www.conductix.com

Importer for the United Kingdom:

Conductix-Wampfler Ltd.
1, Michigan Avenue
Salford M50 2GY
United Kingdom

Phone: +44 161 8480161
Fax: +44 161 8737017
info.uk@conductix.com
www.conductix.com