

Shaping the power of the future

Installation Guide

PowerShaper 2.0

Grid tied energy storage system



System safety and environmental precautions

Product warranty becomes invalid if following precautions are not followed during handling, storage, installation, commissioning and operation of Pixii energy storage systems.

General precautions



Although this system incorporates protective circuits and other security features, it may still be destroyed, damaged, work poorly or shorten its lifetime if exposed to improper handling during transportation, installation or operation. Always handle the system with care, use proper lifting techniques, do not roll, climb or drill holes in the cabinet or enclosure.



Opening the equipment may cause serious injury even when the AC power is disconnected. Dangerous voltage may be present inside, as system can be still running from batteries or capacitors may still be charged.

Environmental precautions



Some devices can reach high temperatures during normal operation. It is very important to ensure that airflow through equipment is not blocked, filters are in good condition and fans can rotate freely. If other equipment is installed in close proximity, secure that inlets and outlets are not blocked.



Electronic devices installed in the energy storage system are designed for indoor environment with pollution degree 2. When installed in an outdoor enclosure (open or closed loop heat management system), it is important to ensure, that the enclosure is closed and sealed during normal operation, to avoid external air with increased level of humidity and dust from entering. In addition, in open loop systems, filters maintenance must be properly planned. In case of indoor systems, operating environment must be of pollution degree 2, without increased level of dust and humidity.



Installer is responsible to protect system against current surges, over-voltages, etc. caused by lightning, electrostatic discharges, etc. To avoid system damage, it is mandatory to always install proper SPDs.

Installation precautions



Read carefully user documentation before installation and using this equipment. Follow all commands, always use recommended tools and torque values as described. Commissioning and configuration of equipment should be done only by Pixii personnel or by other authorized and qualified persons.



For safety reason, before you start installation, ensure all external power sources are disconnected, as well as internal battery and load fuses/breakers. To avoid injuries caused by high leakage/touch current you must always start installation by connecting earthing wire (PE), before you connect other AC input wires (phases, neutral).

If system contains batteries, they represent major energy hazard. To avoid short circuit on batteries, do not operate with full metallic tools close to battery poles. Be careful also about other objects (rings, watches, necklaces, etc.).



All Pixii devices are certified according to international safety, environmental and EMC standards. If any other devices will be installed inside this product, it might influence parameters and violate original approvals. Installer is responsible that during installation environmental properties of this device are not impaired and installation is according to local regulations.

Battery safety and environmental precautions

For safety reasons, installers are responsible for familiarizing themselves with the contents of battery installation manual and all warnings before performing installation. Failure to observe the precautions described in this section can cause serious injury to persons or damage to property.

General precautions

The voltage of this battery module is strong enough to cause electric shock.

- Do not disassemble the battery module.
- Do not touch the battery module with wet hands.
- Do not expose the battery module to moisture or liquids.
- Keep the battery module away from children and animals.



The battery module may explode.

- Do not subject the battery module to strong impacts.
- Do not crush or puncture the battery module.
- Do not dispose of the battery module in a fire.



Keep the battery module away from open flame or ignition sources.

- Do not expose the battery module to temperatures in excess of 60°C.
- Do not place the battery module near a heat source, such as a fireplace.
- Do not expose the battery module to direct sunlight.
- Do not allow the battery connectors to touch conductive objects such as wires.



Risks of damage to the battery module.

- Do not allow the battery module to get in contact with liquids.
- Do not subject the battery module to high pressures.
- Do not place any objects on top of the battery module.



Environmental precautions

The battery module may leak corrosive electrolyte. Avoid contact with the leaking liquid or gas. Electrolyte is corrosive and contact may cause skin irritation and chemical burns.



The battery module should not be disposed of with household waste at the end of its working life.



The battery module should be disposed of at a proper facility for environmentally safe recycling



Installation precautions

Read the battery installation manual before installing and operating the battery module.

- Disconnect the charging source prior to connecting or disconnecting battery terminals.
- Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance.



Wear appropriate personal protective equipment when dealing with the battery module.

- Remove watches, rings, or other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.



The battery module is heavy enough to cause severe injury.



Response to emergency situations

While the battery module comprises multiple battery cells that are designed to prevent hazards resulting from failures, Pixii can not guarantee their absolute safety.

In the event that hazardous quantities of electrolyte are released, or in case of smoke, or fire, leave the battery room and contact the fire brigade.

Leaking batteries

If the battery module leaks electrolyte, avoid contact with the leaking liquid or gas. Electrolyte is corrosive and contact may cause skin irritation and chemical burns. If one is exposed to the leaked substance, do these actions:

Inhalation:

Evacuate the contaminated area, and seek medical attention immediately.

Eye contact:

Rinse eyes with flowing water for 15 minutes, and seek medical attention immediately.

Skin contact:

Wash the affected area thoroughly with soap and water, and seek medical attention immediately.

Ingestion:

Induce vomiting, and seek medical attention immediately

Rinse mouth and wash around the mouth with water.

Burns:

If burns are caused, treat them accordingly. Likewise, immediate medical attention shall be obtained.

Fire

In case of a fire, make sure that an ABC or carbon dioxide extinguisher is nearby. If a fire breaks out where the battery module is installed, do these actions:

1. Extinguish the fire before the battery module catches fire.
2. If the battery module has caught fire, do not try to extinguish the fire. Evacuate people immediately.



!!! Warning !!!

The battery module may catch fire when heated above 150°C.

If the battery catches fire, it will produce noxious and poisonous gases. Do not approach.

Wet batteries

If the battery module is wet or submerged in water, do not try to access it. Contact Pixii or your distributor for technical assistance.

Damaged batteries

Damaged batteries are dangerous and must be handled with extreme caution. They are not fit for use and may pose a danger to people or property. If the battery module seems to be damaged, pack it in its original container, and then return it to Pixii or your distributor.



!!! Caution !!!

Damaged batteries may leak electrolyte or produce flammable gas. If you suspect such damage, immediately contact Pixii for advice and information.

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Revision	Date	Comment
1.0	08.06.2022	Initial
2.0	15.12.2022	
3.0	20.02.2023	
4.0	12.06.2023	Implementation of Shoto batteries, ACU temperature settings, update of mechanical specifications, replacement of FC2 breaker for ACU, update of supported energy meters, added earthing variant B, Input cable update
4.1	12.07.2023	Update of protective bonding Variant A
4.2	11.09.2023	Update of supported AC meter list, added torque information for shoto batteries, update of chapter 5, 4.4.1 and 4.10.

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1 Introduction

This document describe step by step installation, commissioning and start-up of energy storage system. Read it carefully and follow all recommendations to be sure system is running in correct environment under good conditions and installation reached all safety requirements.

1.1 Recommended tools and torque

	Tool
W	Wrench
PZ2	Pozidriv screwdriver
Flat	Flat screwdriver
T-W	Torque wrench
T-PZ2	Torque Pozidriv screwdriver
TX	Torque Torx screwdriver

	Type & Size	Torque
T1	Terminal block (WDU2.5, WPE2.5, WSI4)	0,4Nm
T2	AC Mains input terminals (6-25mm ²)	12,0Nm
	AC Mains input terminals (35-95mm ²)	22,0Nm
T3	Polarium batteries (DC cables)	15Nm
T4	Shoto batteries (DC cables)	6Nm
T5	M5 self tapping screw	5,7Nm
T6	M6 self tapping screw	9,8Nm
T7	M8 hex screws	24,0Nm
T8	M10 hex screw	47,0Nm

Table 1. Recommended tools and torques

1.2 Thermal management system (TMS)

Cabinet thermal management system provides appropriate thermal conditions inside the cabinet. Solution is integrated on the cabinet door with controlled air flow inside the cabinet.

There are two options – Fan Filter or Hybrid Air Condition & HEX solution.

1.2.1 Fan filter

Fan filter TMS using free cooling principle which is open loop system. Outside cold air is pulled into the cabinet through the inlet filter and hot air is pushed out through the outlet filter. Inlet filter with two fans is installed at the bottom and outlet filter at the top of the door. This principle provides overpressure in the cabinet. Input and output air is filtered from dust or other particles. The filter must be changed when the cabinet is no longer able to maintain the required temperature level. Filter change interval depends on different factors as pollution, heat dissipation, thermal requirements or solar load.

The advantage of free cooling is large amount of exchanged air which is giving very high cooling performance at low power consumption. The temperature inside the cabinet is always higher than ambient (outside) temperature. With moderate ambient temperatures or low power dissipation the fans will be running at low speed. As the ambient temperature or internal power dissipation increases the fan speed will increase.

Fan filter solution also provides additional air recuperation mounted inside the door, helping to spread the air evenly in the cabinet. It secures similar temperature around the batteries.

Cabinet is equipped with 2x 500W AC powered heaters for lower temperature conditions securing adequate battery temperature.

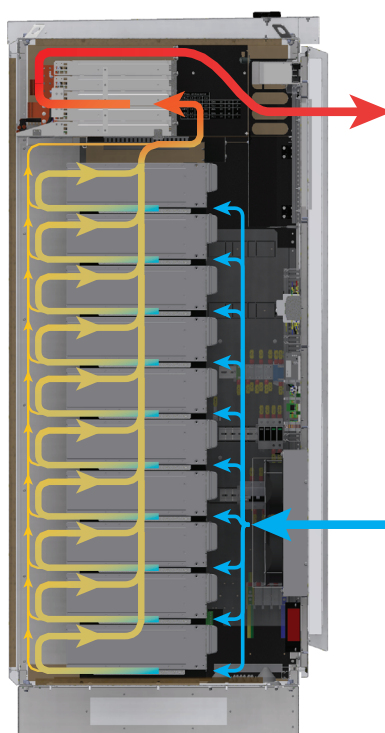


Figure 1.1 Fan filter air flow diagram (side view)

1.2.2 Air Conditioner with Heat Exchanger

The HC series Air Conditioner with Heat Exchanger is a cooling product developed for cabinets. It is applicable for the scenarios where internal equipment of the cabinet emits a large quantity of heat and needs to be isolated from the outdoor environment completely. The unit integrates the heat pipe exchanger with air conditioner. When the external ambient temperature is lower than the cabinet inner temperature, the heat pipe exchanger takes precedence to work, and realize reduce heat-dissipating consumption.

The operating principle of Air Conditioner with Heat Exchanger is shown in *Figure 1.2*. The heat exchange system and air conditioner share the same indoor/outdoor fans.

The heat exchanger and the compressor of the Air Conditioner with Heat Exchanger adopt grading interlocking control. The heat exchanger is defined as the first level heat dissipation and the compressor is defined as the second level cooling. According to the cabinet internal/external temperatures, dividing into four working modes: internal fan running, heat exchanger running, air conditioner running and both running.

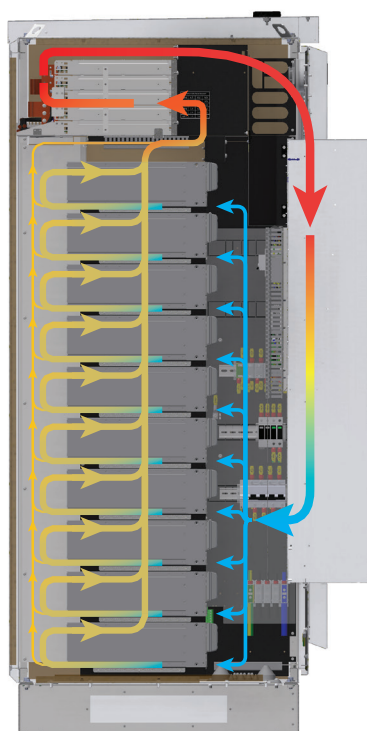


Figure 1.2 Air condition air flow diagram (side view)

NOTE:

The air conditioner shall be kept vertically strictly in accordance with the instructions on the package during transportation, storage and use.

Default settings

Aircon is pre-set from factory to the temperature 25°C +/-3°C. If this setting is not acceptable for conditions on site, set appropriate temperatures following instructions in the *User manual HC Series Air Conditioner with Heat Exchanger*.

1.3 Installation block diagram

1.3.1 Behind the meter

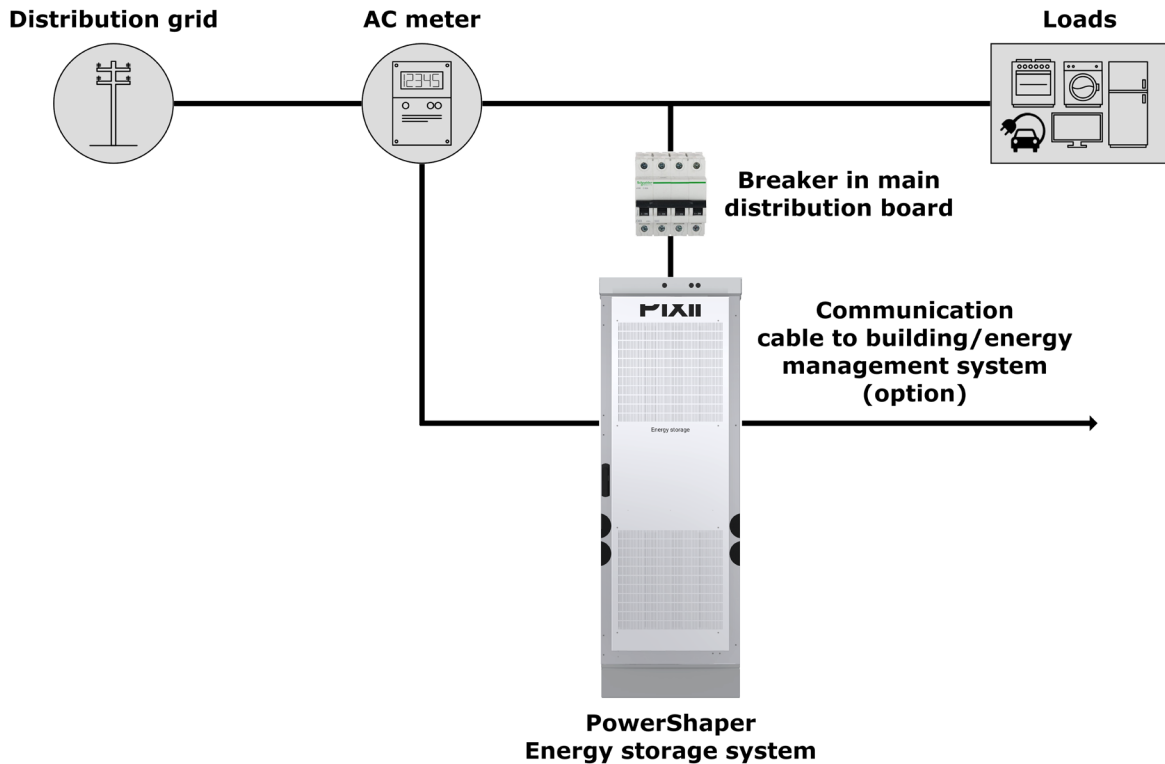


Figure 1.3 Single line installation block diagram - behind the meter

1.3.2 In front of the meter

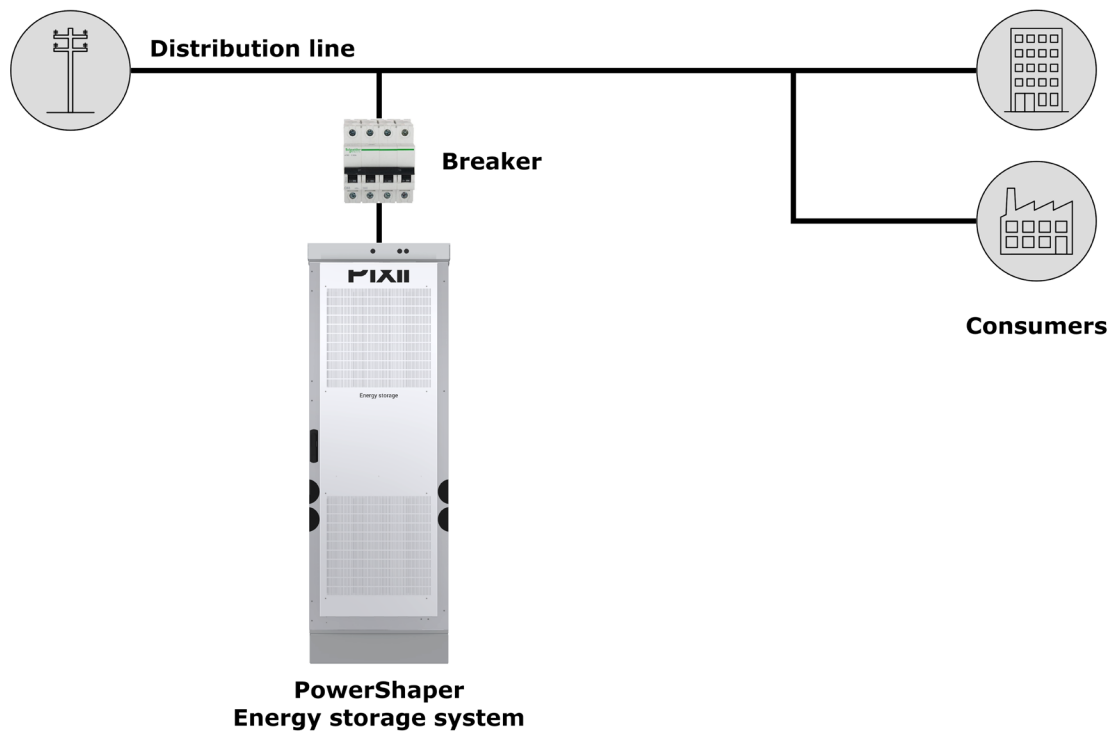


Figure 1.4 Single line installation block diagram - in front of the meter

1.4 System ratings

1.4.1 Electrical specifications

The PowerShaper consist of modular converters, each of them providing transformers with Reinforced insulation between AC side and the DC side.

AC Mains Type	TN	IT
Max. Active Power (charge and discharge)	50kW ^{1,4} /40kW ^{2,3}	40kW ^{1,2,3,4}
Max. Apparent Power (charge and discharge)	50kVA ^{1,4} /40kVA ^{2,3}	40kVA ^{1,2,3,4}
AC voltage	400/230V, 3Ph+N+PE	230V, 3Ph+PE
Max. AC current	83Arms, 3Ph+N+PE	115Arms, 3Ph+PE
Nominal AC current	72Arms, 3Ph+N+PE	100Arms, 3Ph+PE
Frequency range	45Hz to 66Hz	
Cos φ range	0.5 inductively to 0.5 capacitively	
Protective class	Class I	
Overvoltage category	OVC III	
Max. short circuit current	10kA	
Type of short-circuit protective device	MCB	
Max. Energy	48kWh ¹ /103.2kWh ² /120kWh ³ /51kWh ⁴	
Max. DC voltage	44V to 58V	
Max. DC current	1000A	800A

Type of the battery	¹ Polarium SLB48-100	² Polarium SLB48-250	³ Polarium SLB48-300	⁴ Shoto SDA10-48100
Nominal capacity	100Ah	250Ah	300Ah	100Ah
Nominal energy	4.8kWh	12.9kWh	15kWh	5.12kWh
Operating voltage	39V-54.75V	35V-58.8V	35V-58.8V	40V-57.7V
Max. charge/discharge current	100A			

Voltage fluctuations and flicker:

	P _{st}	P _{lt}	Z
Measured using Z _{test}	0,645	0,603	0,013Ω+j0,002Ω
Maximum permissible network impedance, Z _{max}	-	-	0,093Ω+j0,093Ω

Table 2. Electrical specifications

1.4.2 Environmental specifications

Type of cabinet	with Fan-Filter	with Air condition
Operating temperatures	-20°C to +45°C	-20°C to +50°C
Humidity	5% to 95% RH (non-condensing)	
Storage and transportation temperatures	-30°C to +60°C	
Storage and transportation humidity	5% to 95% RH (non-condensing)	
Storage (less than 12 months)	State of Charge (SoC): 25%	
Acoustic noise (maximum)	<50dBA at 1m distance	
Maximum altitude	2000m	
Ingress protection rating	IP55	
Impact rating	IK09	
Pollution degree	3	
Wet locations	Yes	
Current (inrush)	25A _{peak}	
Maximum output fault current	200A _{peak} /1ms	
Inverter topology	Isolated	
Env. cat. (IEC 62040-1:2017)	Indoor, conditioned	Outdoor
Env. cat. (IEC 62040-1:2013)	Outdoor	
Env. cat. (IEC 62368-1)	Outdoor	
Env. cat. (IEC 60950-1)	Outdoor	
Env. cat. (IEC 62477-1)	Indoor, conditioned	Outdoor
Env. cat. (AS 4777.2:2020)	Indoor, conditioned	Outdoor*

Table 3. Environmental specifications

* The Outdoor system rated up to only 50°C must be protected from solar radiation

1.4.3 Mechanical specifications

Fan filter system

Height	2115mm
Width	706mm
Depth	932mm
Weight (without modules and batteries)	220kg
Module	2 kg
Shoto 3U battery	43 kg
Polarium 3U battery	38 kg
Polarium 4U battery (250Ah)	64 kg
Polarium 4U battery (300Ah)	76 kg

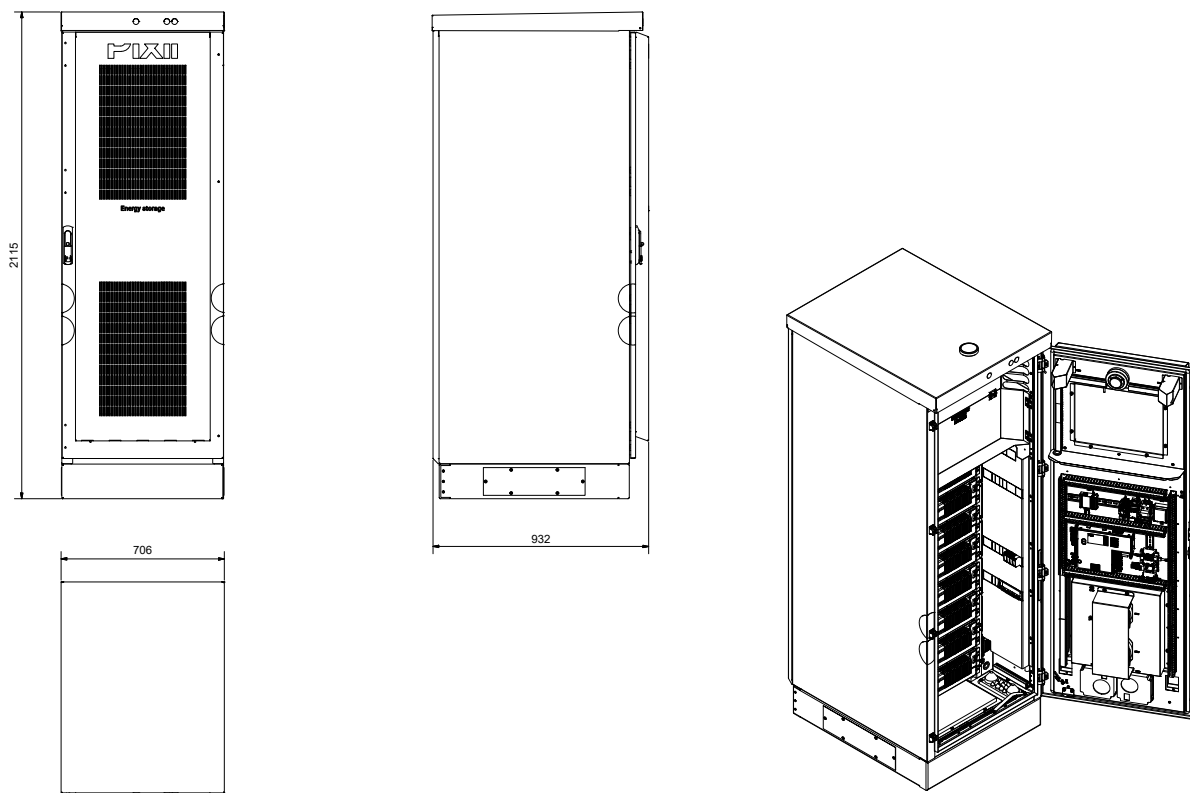


Figure 1.5 Fan filter system dimensions

Air condition system

Height	2115mm
Width	706mm
Depth	1064mm
Weight (without modules and batteries)	265kg
Module	2 kg
Shoto 3U battery	43 kg
Polarium 3U battery	38 kg
Polarium 4U battery (250Ah)	64 kg
Polarium 4U battery (300Ah)	76 kg

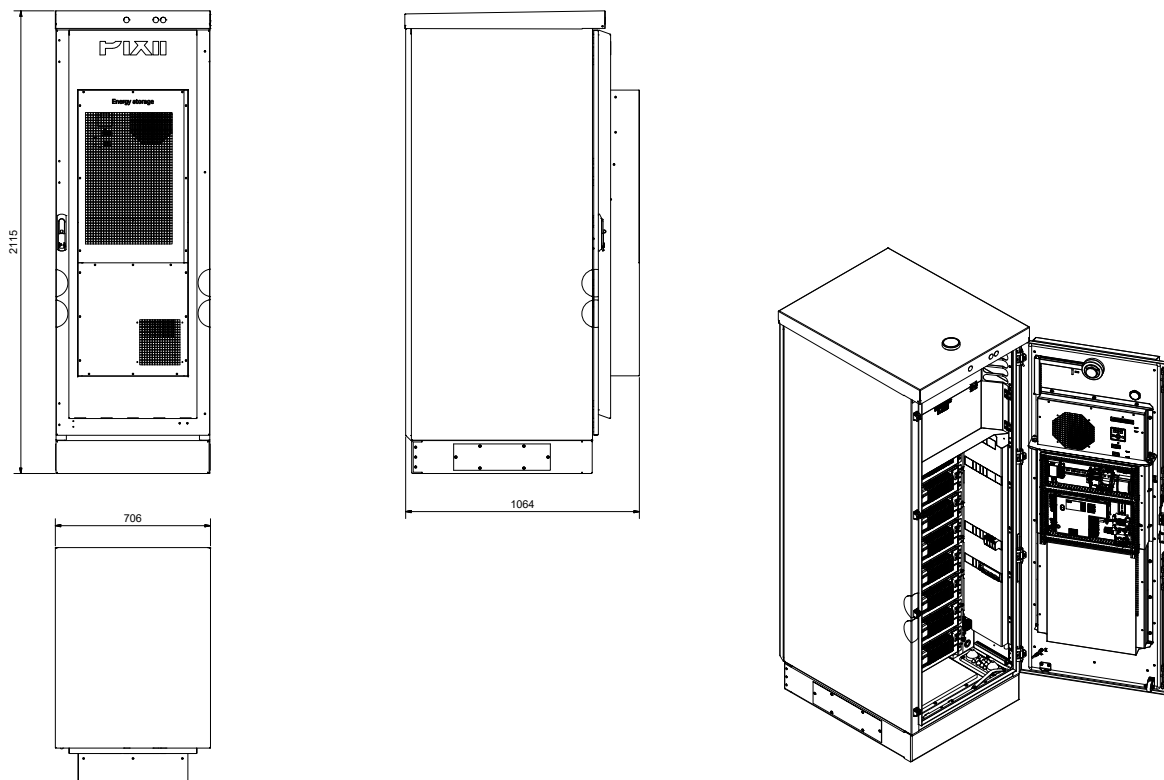


Figure 1.6 Air condition system dimensions

1.4.4 Fuse list

	Type	Manufacturer	Manufacturer part number
-FC1	100A 4-pole C-curve	Schneider	A9N18480 A9N18374 (AS/NZS 60898.1:2004)
-FC2	10A 2-pole B-curve (Fan-filter)	Schneider	A9F03210 A9F53210 (AS/NZS 60898.1:2004)
	10A 2-pole C-curve (ACU)	Schneider	A9F04210 A9F44210 (AS/NZS 60898.1:2004)
-FC13	10A 6.4x32mm fast 10kA	Littelfuse	AHC-10-R
-FC14	10A 6.4x32mm fast 10kA	Littelfuse	AHC-10-R
-FC20	10A 6.4x32mm fast 10kA	Bussmann	ABC-10-R
-FC21	10A 6.4x32mm fast 10kA	Bussmann	ABC-10-R
F201	0,5A 5x20mm slow	Littelfuse	0477.500MXP
F202	3,15A 5x20mm slow	Littelfuse	04773.15MXP
F203	3,15A 5x20mm slow	Littelfuse	04773.15MXP

Table 4. Spare part list

NOTE:

Please consult replacement of any fuse or circuit breaker with Pixii first.

1.5 Anti-islanding

The PowerShaper incorporates both passive and active anti-islanding functionality. The passive methods included are under/over voltage, under/over frequency and rate of change of frequency detection. The active anti-islanding functionality uses the frequency shift method based on feedback from frequency variation in combination with a small reactive power perturbation. The active anti-islanding function may be disabled for grid codes not accepting such means of islanding detection.

2 Preparing installation site

2.1 Pre-installation steps

1. Organize installation site

- Mounting base strong enough to carry weight of fully equipped system (approx. 950kg)
- Clearances for cabinet access

	Minimum distance		Suggested distance	
	Fan Filter Cabinet	Cabinet with AC	Fan Filter Cabinet	Cabinet with AC
Front	80cm		100cm	
Rear	5cm		25cm	
Top	30cm		90cm	
Sides	25cm		60cm	
Between cabinets (multi-cabinet installation)	5cm	20cm	25cm	35cm

Table 5. Distances and clearances

NOTE:

It is strictly required to follow local regulations if separation distances larger than the table above are required.

NOTE:

If the energy storage system is installed indoor, automatic sprinkler system is highly recommended and sometimes required. Local regulations must be adhered to.

2. Prepare installation tools

- Use insulated tools suitable for electrical installations
- Recommended tools list is in chapter “Tool” on page 8

3. Prepare AC Mains supply

- Correct type of AC Mains supply (TN-S/ IT/TT)
- Correct rating of AC input cables and external fuses
- AC Mains supply meter

2.2 Recommended upstream breaker and input cable

To reach stable system operation, it is very important to use proper input cable and upstream breaker. Recommended values for different types of networks can be found in table below.

AC Mains Type	Number of Power Shelves	Maximum current	Upstream breaker	Input cable
230/400Vac 3-phase, TN-S network 5-wire system	5	83A	100A C-curve	35mm ² - 50mm ² (CU or AL)
230/400Vac 3-phase, TT network 4-wire system				
230Vac 3-phase, IT/TT network 4-wire system	4	115A	125A C-curve	

Table 6. Recommended upstream breaker and input cable

!!! WARNING !!!

System is designed to operate on 1-phase or 3-phase networks. It is strictly forbidden to connect multiple single-phases to the system.

CAUTION:

For TT-networks, the installation of an RCD is required.

NOTE:

If different number of power shelves or breaker with lower rating needs to be used from any reason, discuss possibilities with Pixii.

NOTE:

Breaking capacity of input breaker installed in system is 10kA, upstream breaker breaking capacity must correspond to AC grid conditions at the point of installation.

NOTE:

Cable type, upstream breaker and RCD depends on local conditions and regulations.

2.3 Mains input metering

To secure correct operation, system must have actual readings from mains input AC meter. Therefore compatible meter must be installed on site. Measured values are important to perform autonomous operation functionality such as peak shaving and others. Pixii system has support for communicating with 2 different types of meters.

NOTE:

Measured data are used at the customer's own risk. The distribution company or Pixii is not responsible for any losses resulting from its use, including losses due to errors or omissions in the data.

2.3.1 AMS energy meter

AMS meter allows for monitoring consumption and production down to a few second intervals through the HAN-port (M-Bus) according to Norwegian HAN-port specification. The HAN-port is closed by default. Contact your local network company to open it. Before opening the HAN-port, the network company will first ask some questions related to securing the gate for privacy reasons. For connecting to the HAN-port a standard Ethernet cable with RJ45 connectors is required. Maximum practical distance at highest speed is 350 meters.

Supported AC Meters

- Aidon
- Kamstrup
- Nuri

2.3.2 Industrial grade energy meter

The Pixii system has support for an energy meters from different manufacturers. Depending on type of the meter, external measuring transformers may be required. Currently, communication via Modbus/RTU (RS485) is supported. This means that a cable (2-wire at least) needs to be connected from the meter to the controller in the system. Maximum practical distance is 300 meters.

Supported AC Meters

- Phoenix Contact:
 - » EEM-EM357
 - » EEM-EM355
 - » EEM-MA370-R
 - » EEM-MA371-R
- Schneider:
 - » iEM 31xx series
 - » iEM 32xx series
 - » iEM 33xx series
- Acuvim II series | Accuenergy (Modbus/TCP available)
- Janitza:
 - » B23 312-10J
 - » B24 312-10J
 - » UMG series

2.4 Demand response modes (DRM)

The PowerShaper supports all Demand Response Modes specified in AS/NZS 4777.2 with the responses shown in the table below.

Mode	Response	Enabled by shorting pins	
DRM 0	Disconnect the system from the grid	5	6
DRM 1	Active Power consumption limited to 0%	1	6
DRM 2	Active Power consumption limited to 50%	2	6
DRM 3	Active Power consumption limited to 75% Reactive Power set to max sourcing (capacitively)	3	6
DRM 4	Increase power consumption	4	6
DRM 5	Active Power generation limited to 0%	1	5
DRM 6	Active Power generation limited to 50%	2	5
DRM 7	Active Power generation limited to 75% Reactive Power set to max sinking (inductively)	3	5
DRM 8	Increase power generation	4	5

Table 7. Demand response modes

In order to activate the different Demand Response Modes, a Demand Response Enabling Device (DRED) as described in AS/NZS 4777.2 must be connected to the DRM-port of the PowerShaper. The DRM-port (-TF2) of the PowerShaper is utilized as an RJ45-connector -X22 located in the bottom of the cabinet as indicated by the picture below.

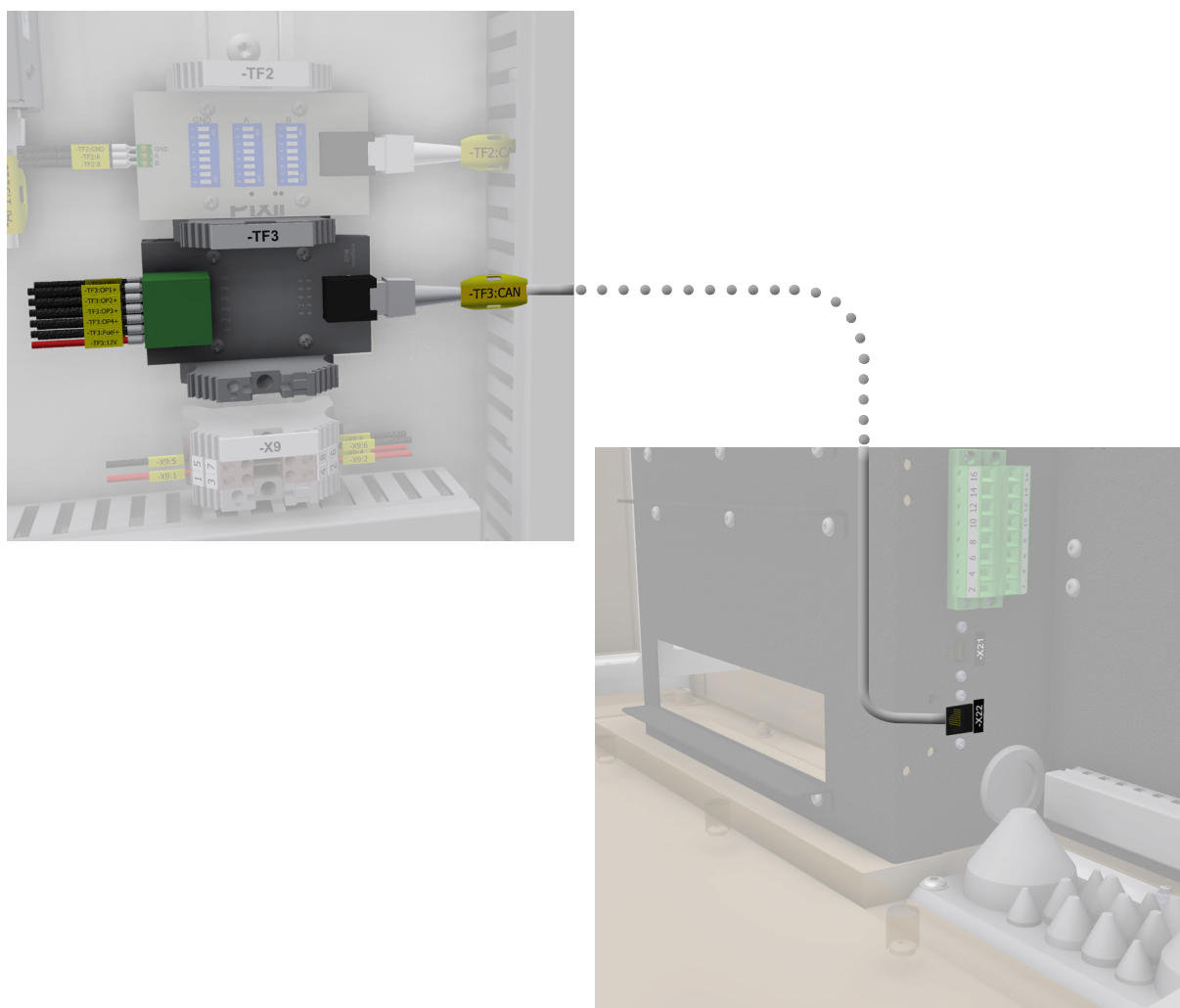


Figure 2.2 DRM interface

3.3 Fixing the cabinet

- Unscrew 2x M6 nuts on front bottom roof side (see *Figure 3.4*).
- Lift up roof, disconnect antenna cable (if present) and remove cabinet roof (see *Figure 3.5*).
- Fix chains or straps (minimum length 1 meter) to all lifting lugs (see *Figure 3.6*), securely lift and move system to the desired position.
- Use 4x M10 screw to fix cabinet to ground, correct torque depends on type of screws and material of mounting base.
- Put back cabinet roof, connect antenna cables (if present) and fix roof to cabinet with 2x M6 nuts.

!!! WARNING !!!

Do not use any other technique to lift the cabinet because of imminent damage.

Never lift cabinet with opened door.

Do not lift cabinet with installed modules and batteries.

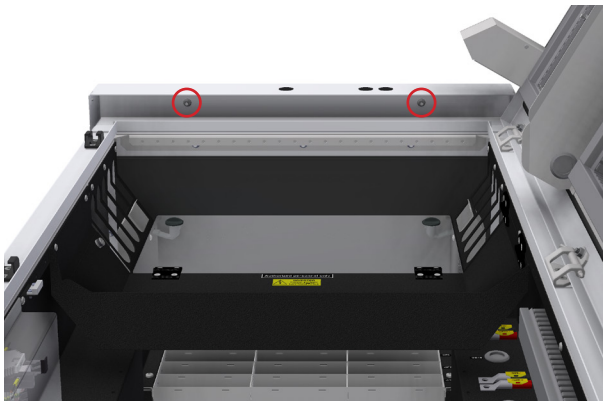


Figure 3.4 Unmount cabinet roof

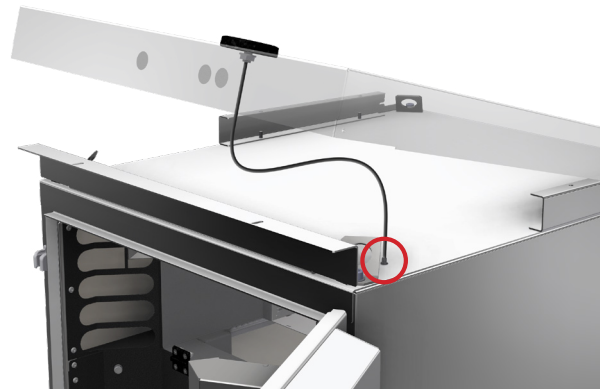


Figure 3.5 Disconnect antenna cable

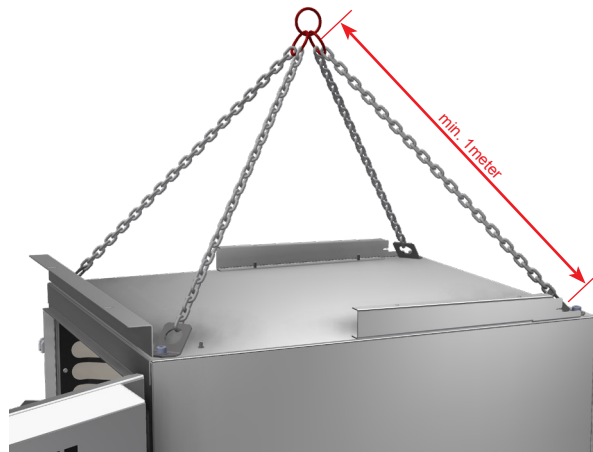


Figure 3.6 Cabinet lifting

3.4 Removing the humidity stoppers

To secure correct function of Fan filters, it is necessary to remove 2x humidity stopper foils from inlet/outlet filters (marked in red).

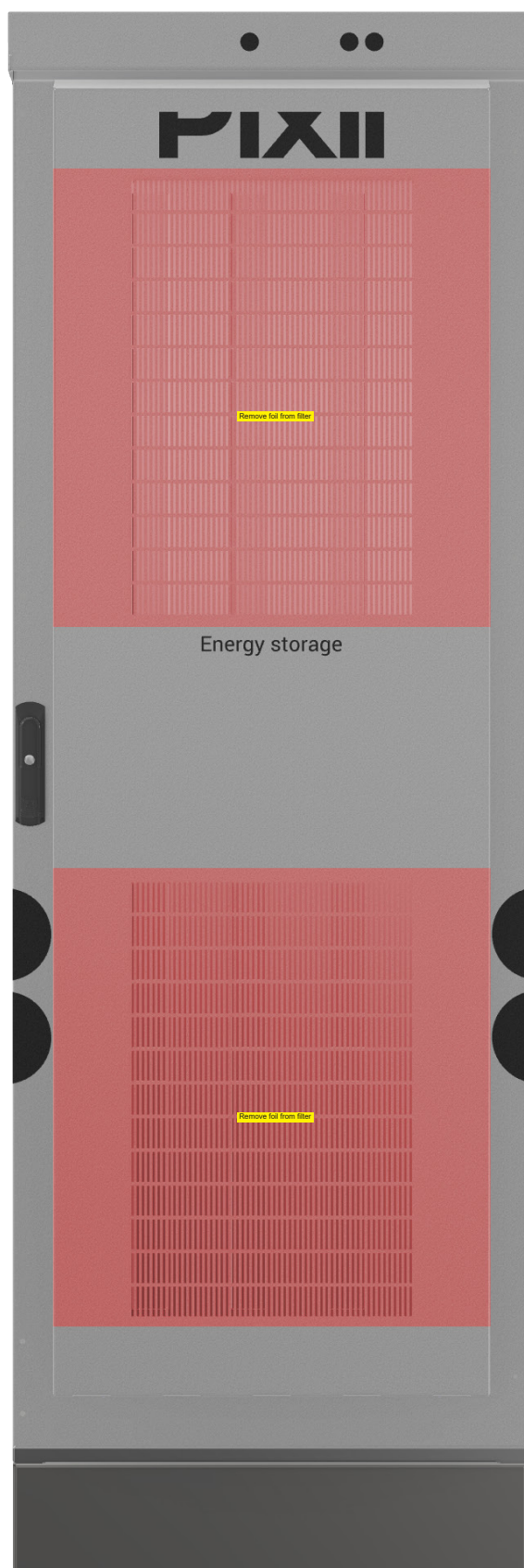


Figure 3.7 Humidity stoppers

4 Electrical installation

For safety reason, before you start installation, ensure all external power sources are disconnected, as well as internal battery and load fuses/breakers. To avoid injuries caused by high leakage/touch current you must always start installation by connecting earthing wire (PE), before you connect other AC input wires (phases, neutral).

4.1 Preparation

Remove plastic cover (highlighted in yellow) by releasing 5x M5x10 torx screws.



Figure 4.1 Removing the plastic cover

NOTE:

Keep fixings and cover at safe place, as you need them later!

4.2 Protective bonding

It is necessary to interconnect cabinet chassis with main earthing point, to ensure equal potential throughout the installation thus preventing a hazardous potential difference occurring between such parts in the event of a fault.

Connect bonding cable from main earthing point to the bonding point on the bottom of the cabinet with M6 lug.

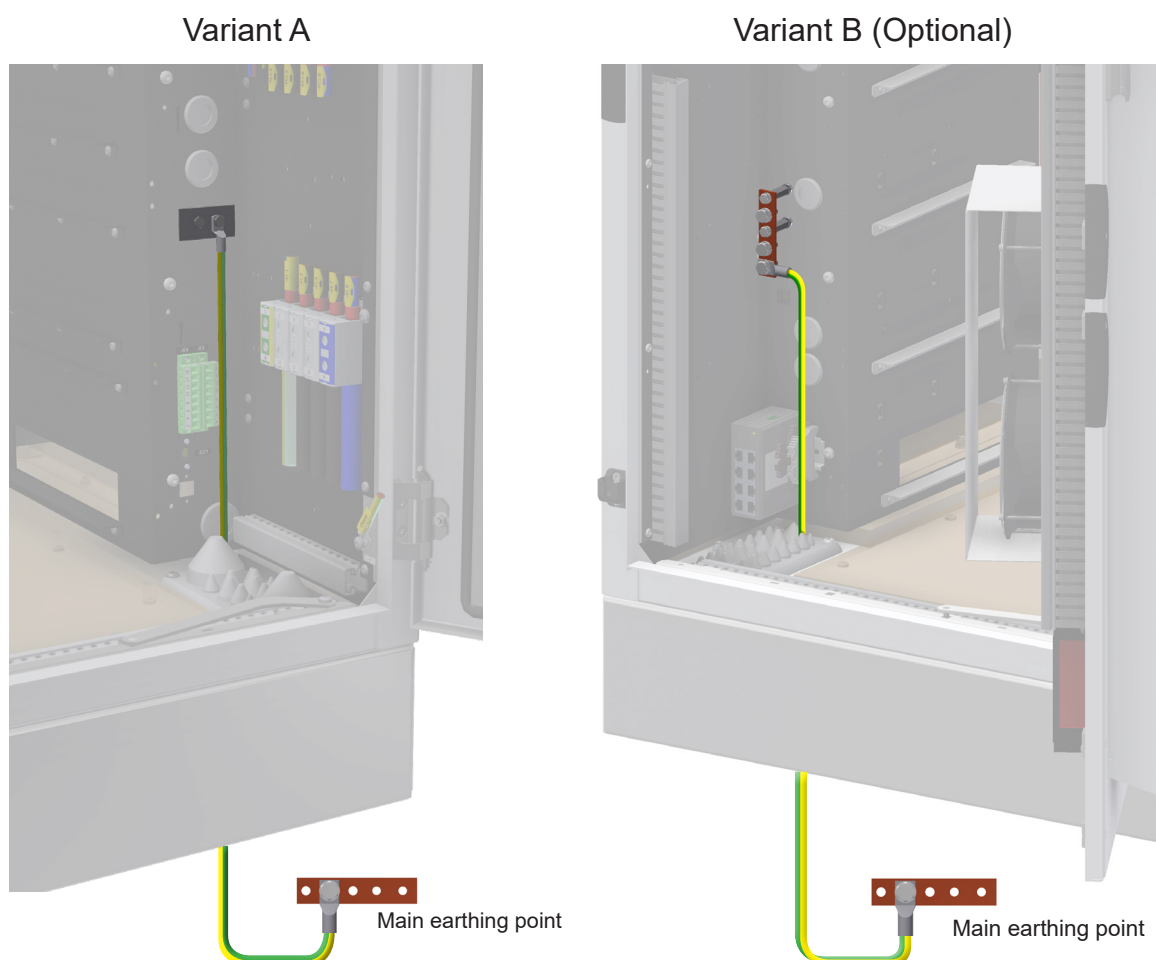


Figure 4.2 Protective bonding

NOTE:

Connect the bonding cable to the earthing busbar (Variant B) if the access to the bonding point in Variant A is limited. If the earthing busbar is not installed, it is necessary to order it separately.

NOTE:

Do NOT interconnect bonding busbars in multiple cabinets in multicabinet installation. Connect separate bonding cable to each cabinet in multicabinet installation.

4.3 IT/TT (230Vac) network

Standard system is designed for TN-S network. It could also be connected to IT/TT network, but then AC Mains distribution must be replaced. Follow next steps to correct replacement.

4.3.1 Removing TN-S (230/400Vac) distribution

1. Remove plastic cover by releasing 4x M6 torx screws.
2. Disconnect all cables from top of the terminals -X2.
3. Disconnect all cables (-FC1:2, -FC1:, -FC1:6, -FC1:8) from bottom of breakers -FC1.

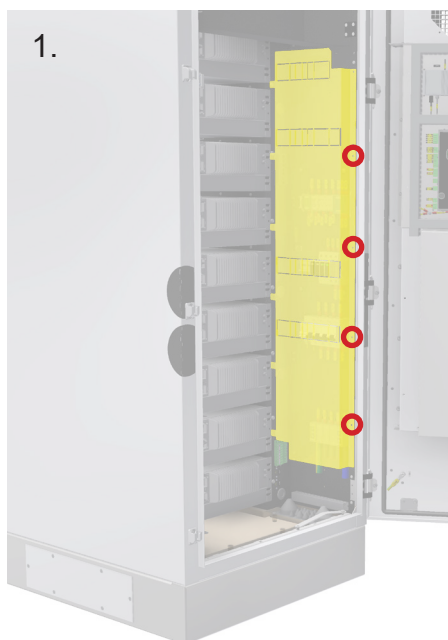


Figure 4.3 Removing the cover



Figure 4.4 Disconnecting cables from terminals -X2

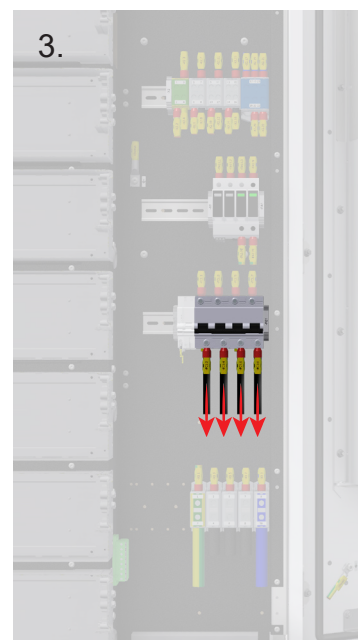


Figure 4.5 Disconnecting cables from breakers -FC1

4. Disconnect all wires (2x-FC1:C1, 2x-FC1:C2, -FC1:11, -FC1:14) from MX trip.
5. Disconnect wires (-FA1:11, -FA1:12) from bottom of SPD -FA1.
6. Disconnect PE cable (-FA1:PE) from bottom of SPD -FA1.

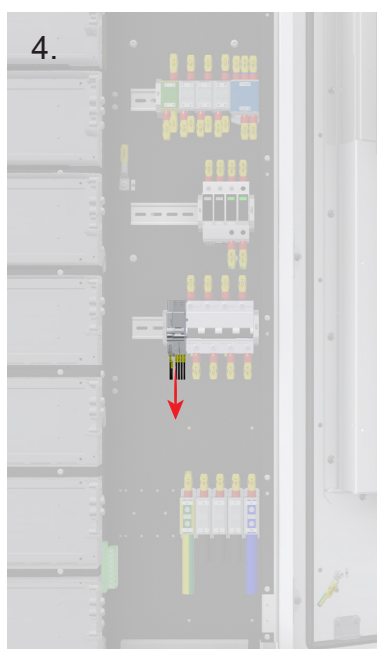


Figure 4.6 Disconnecting wires from MX trip



Figure 4.7 Disconnecting wires from SPD -FA1

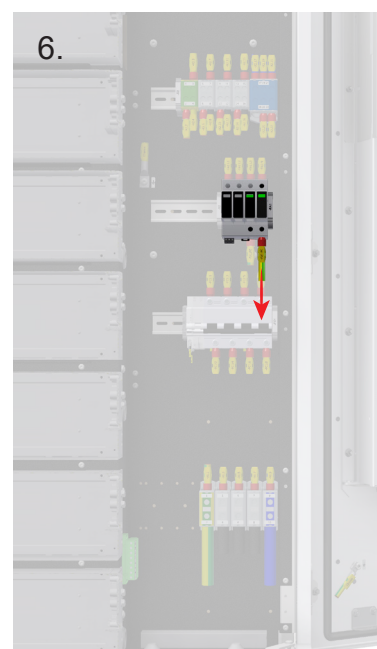


Figure 4.8 Disconnecting PE cable from SPD -FA1

7. Disconnect PE cable (-CHASSIS) from bottom of terminal -X2:2.
8. Release and remove distribution kit panel by loosening 4x M6 torx screws. from MX trip.

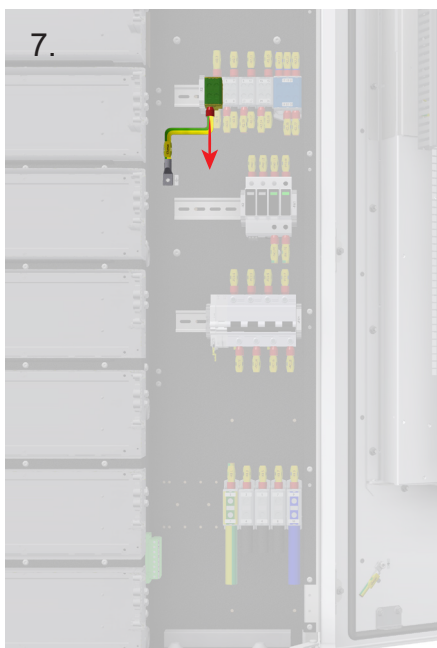


Figure 4.9 Disconnecting PE cable from -X2:2

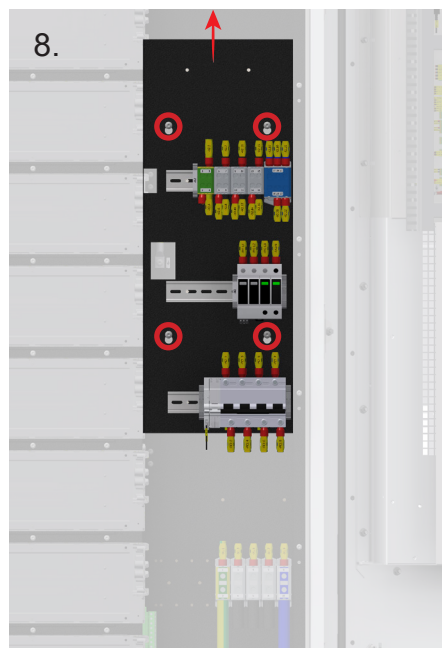


Figure 4.10 Removing distribution kit panel

4.3.2 Installing IT/TT (230Vac) distribution

NOTE:

All cables/wires are marked with terminal name and connection point number to avoid wrong connection. Use correct torque depending on terminal type.

1. Insert distribution into system and fix it with 4x M6 torx screws.
2. Connect PE cable (-CHASSIS) to chassis.
3. Connect PE cable (-FA1:PE) to bottom of SPD -FA1.

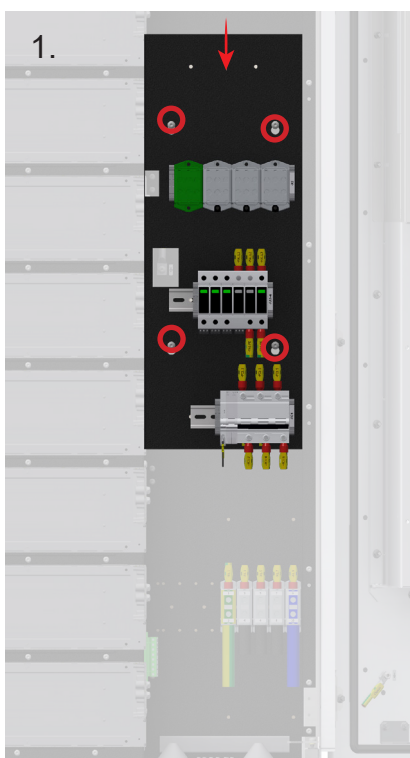


Figure 4.11 Mounting distribution kit panel

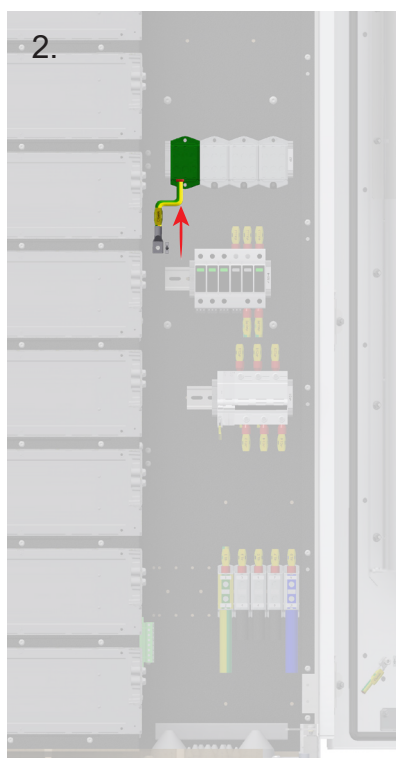


Figure 4.12 Connecting PE cable to chassis

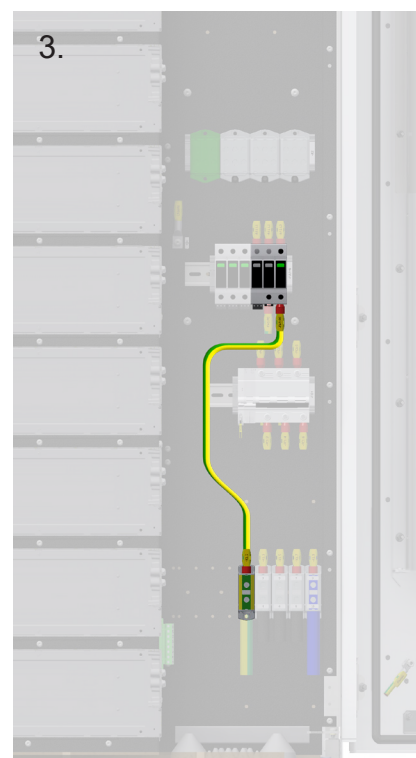


Figure 4.13 Connecting PE cable to SPD -FA1

4. Connect all wires (2x-FC1:C1, 2x-FC1:C2, -FC1:11, -FC1:14) to MX trip.
5. Connect wire -FA1:11 to bottom of SPD -FA1 and wire -FA1:12 to the bottom of the SPD -FA4:12.
6. Connect all cables (-FC1:2, -FC1:4, -FC1:6, -FC1:8) to the bottom of breakers -FC1.
7. Connect all cables to the top of the terminals -X2, according to the cable marking.
8. Adjust openings in the plastic cover and mount it back.

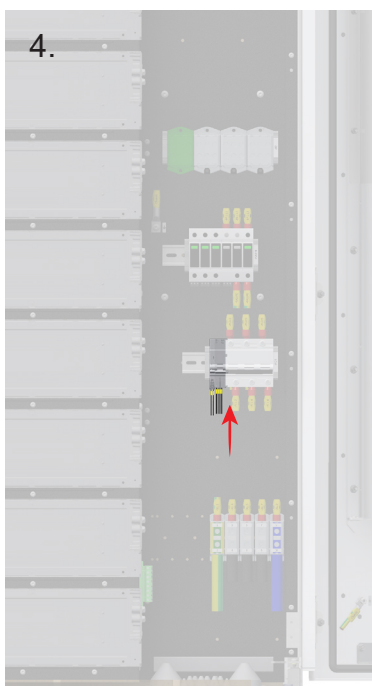


Figure 4.14 Connecting wires to the MX trip

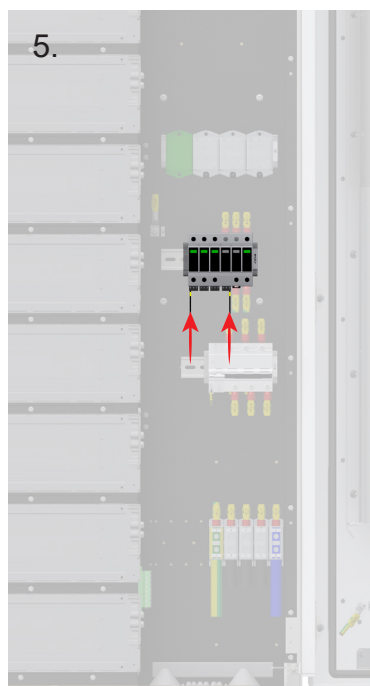


Figure 4.15 Connecting wires to the SPD -FA1

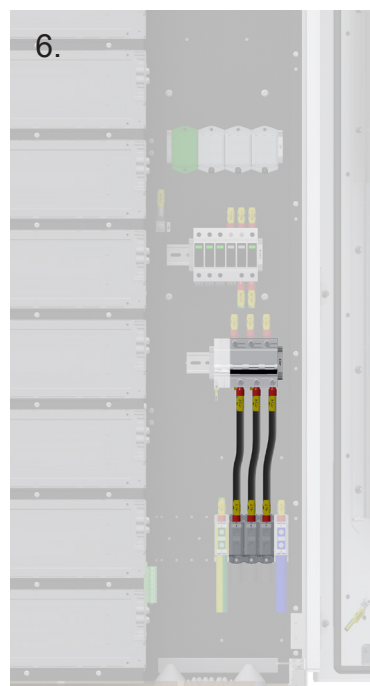


Figure 4.16 Connecting cables to the breaker -FC1

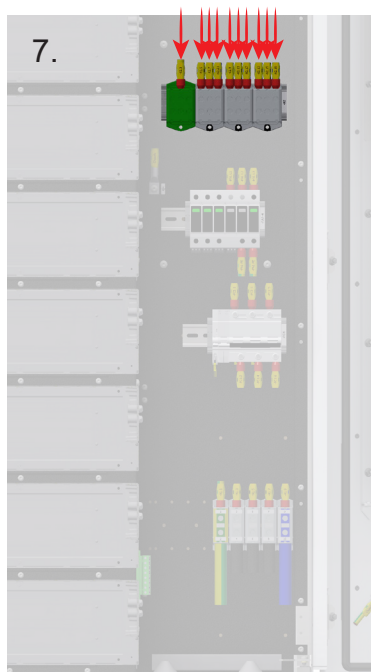


Figure 4.17 Connecting cables to the terminal -X2



Figure 4.18 Mounting plastic cover

4.4 AC Mains Connection

4.4.1 TN-S / TT (230/400Vac) network

- Connect PE wire to terminals X1. Use torque T2.
 - Conductor (CU, AL) 6mm² - 95mm².
- Connect phase wires (L1, L2, L3) and neutral wire (N) to terminals X1 (see *Figure 4.19*). Use torque T2.
 - Conductor (CU, AL) 6mm² - 95mm².

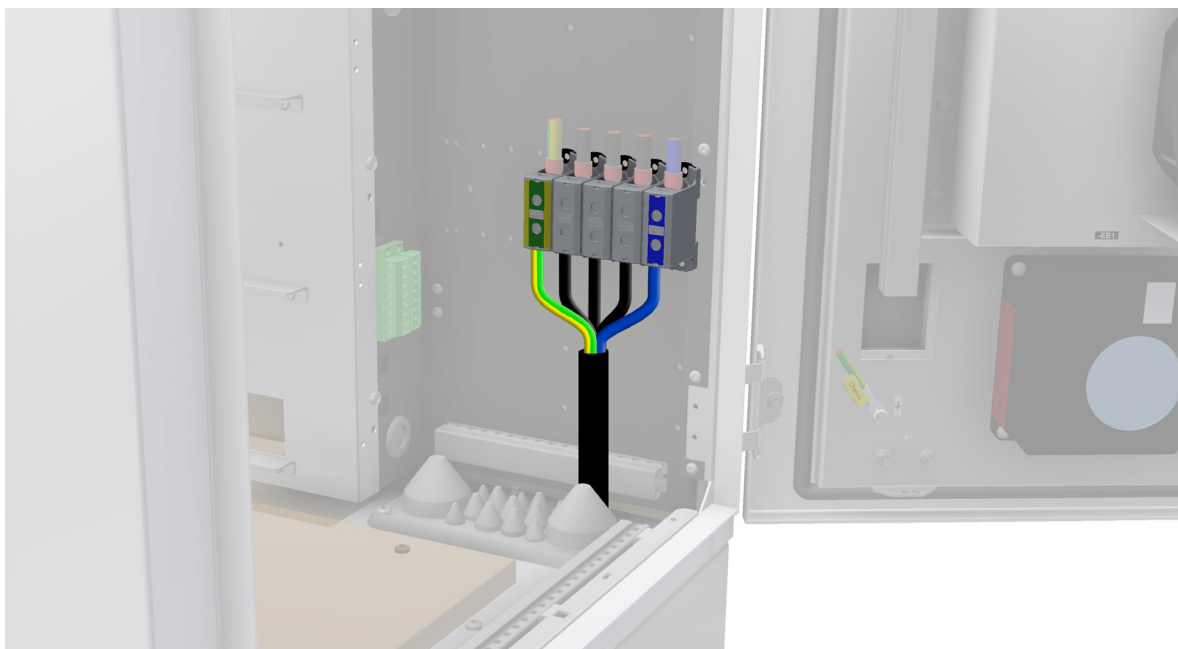


Figure 4.19 AC mains cable - TN-S / TT (230/400Vac) network

4.4.2 IT/TT (230Vac) network

- Connect PE wire to terminals X1. Use torque T2.
 - Conductor (CU, AL) 6mm² - 95mm².
- Connect phase wires (L1, L2, L3) to terminals X1 (see *Figure 4.20*). Use torque T2.
 - Conductor (CU, AL) 6mm² - 95mm².

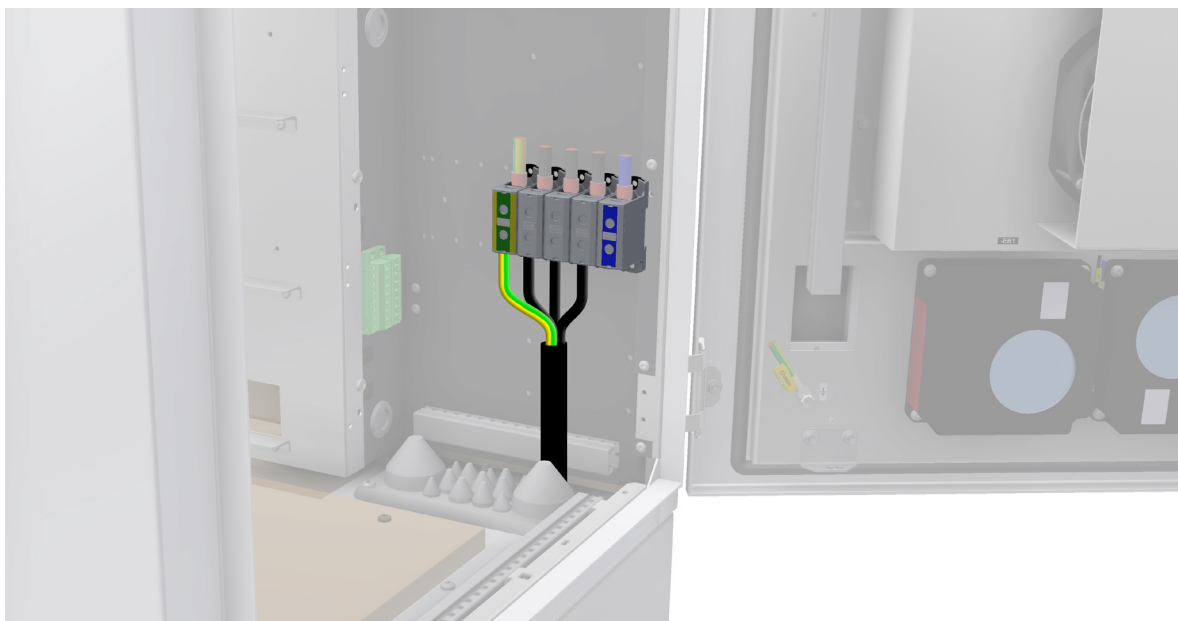


Figure 4.20 IT/TT (230Vac) network

4.5 Emergency disconnect switch

Pixii system contains emergency trip device, which in case of emergency can disconnect whole system from the grid. For correct function, external switch with normally open contact and 230Vac backup power supply is required. Connect phase wire to terminal -X4:2 and neutral wire to terminal -X4:4. If 230Vac will be present on terminal -X4, system will disconnect. Placement of external emergency switch depends on local regulations.

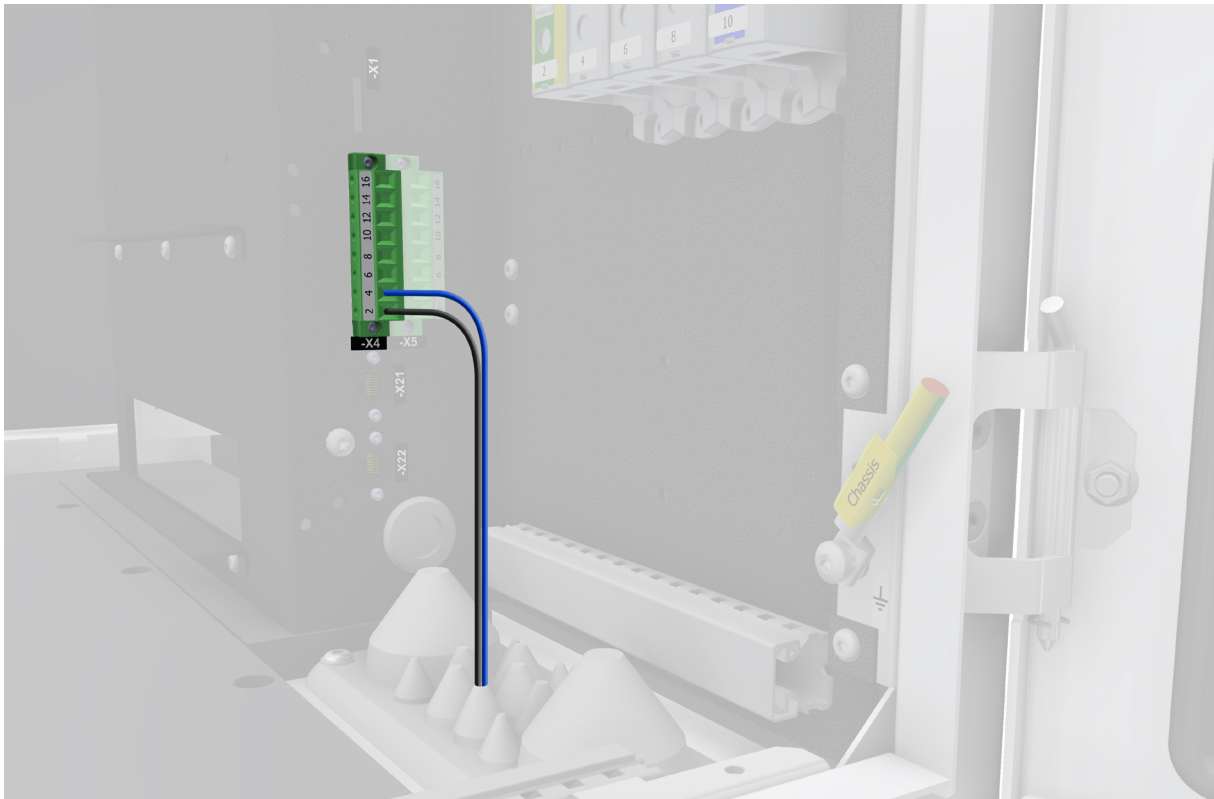


Figure 4.21 Emergency disconnect switch terminals

4.6 Customer spare terminals

On the bottom of the cabinet are located customer spare terminals -X5, which are connected directly to the terminals -X6 on the door, near the Gateway control unit. They can be used as extension of various Gateway functions.

Interconnect Gateway with the terminals -X6, then simply connect cable(s) to the terminal -X:5 on the bottom of the cabinet.



Figure 4.22 Customer spare terminals connection

4.7 Customer alarm connection

Pixii controller is equipped with 2 configurable relays for customer alarm functions. All relays contacts are accessible on connector terminals -X4:6 - -X4:16.

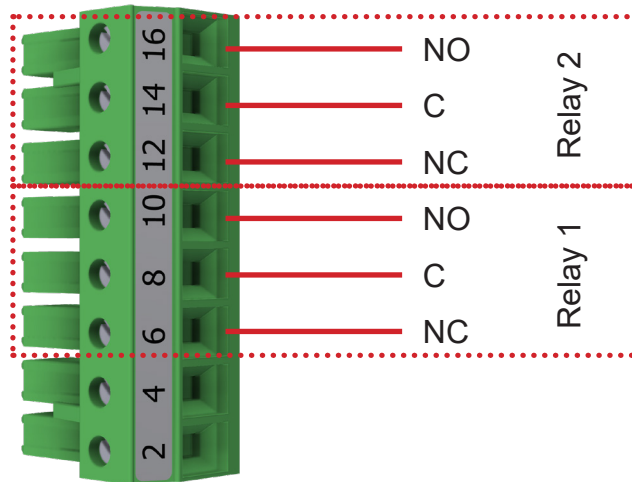
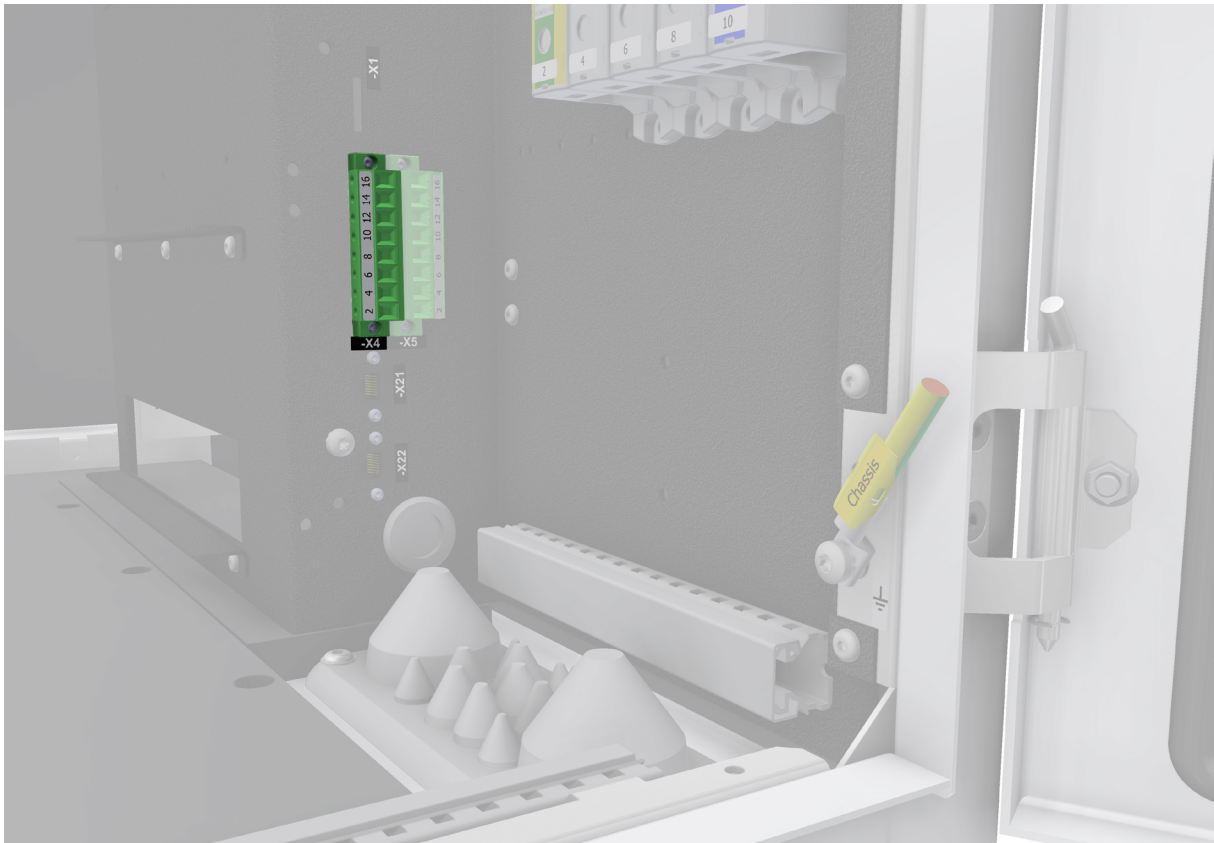


Figure 4.23 Customer alarm connector terminals

All relays are configurable through the software. It could be added different alarm/warning to each of them. For more informations, see document DN 14070 (14070_Pixii PowerShaper Notifications).

For multicabinet solution, alarm relays could be connected together in series, to signalize as a one alarm for the group of cabinet, or it could be connected separately to signalize alarm for each cabinet in the group.

4.7.1 Separate alarm

Connect each cabinet to the customer alarm box to ensure finding specific failure.

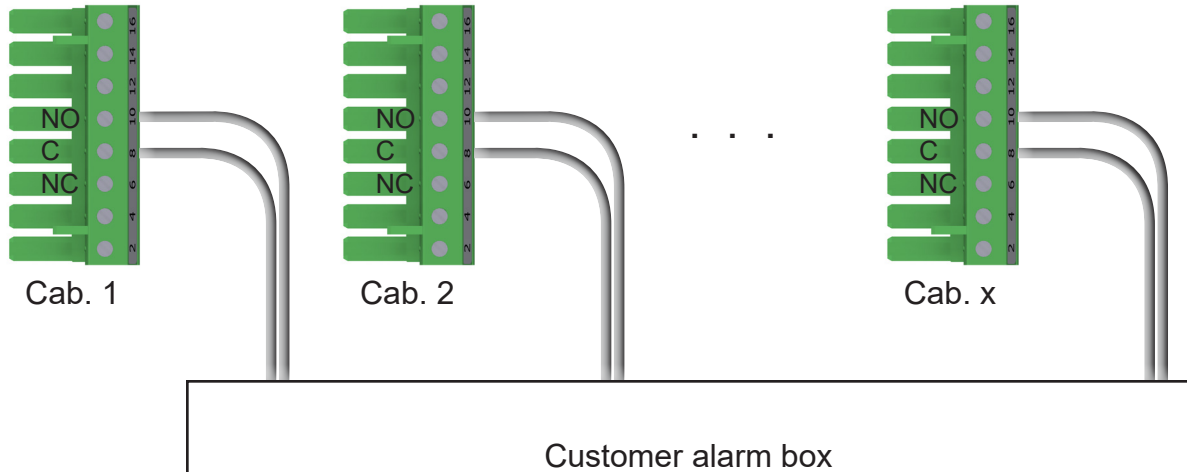


Figure 4.24 Separate alarm

4.7.2 Common alarm

Interconnect cabinets in series and then connect to the customer alarm box. This configuration will be signaling the alarm for whole arrangement.

Alternative 1 (Serial connection of NC-C)

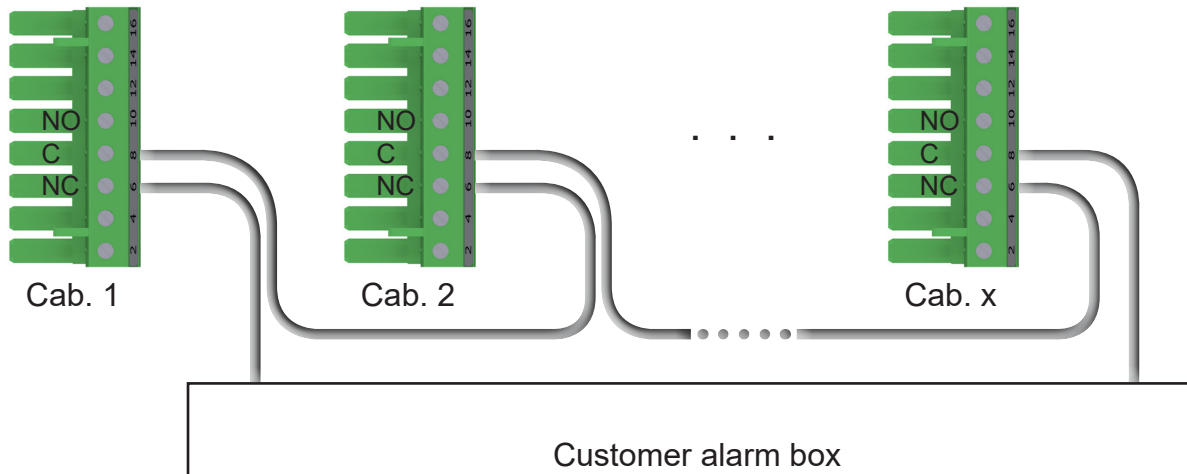


Figure 4.25 Common alarm (Serial)

Alternative 2 (Parallel connection NO-C)

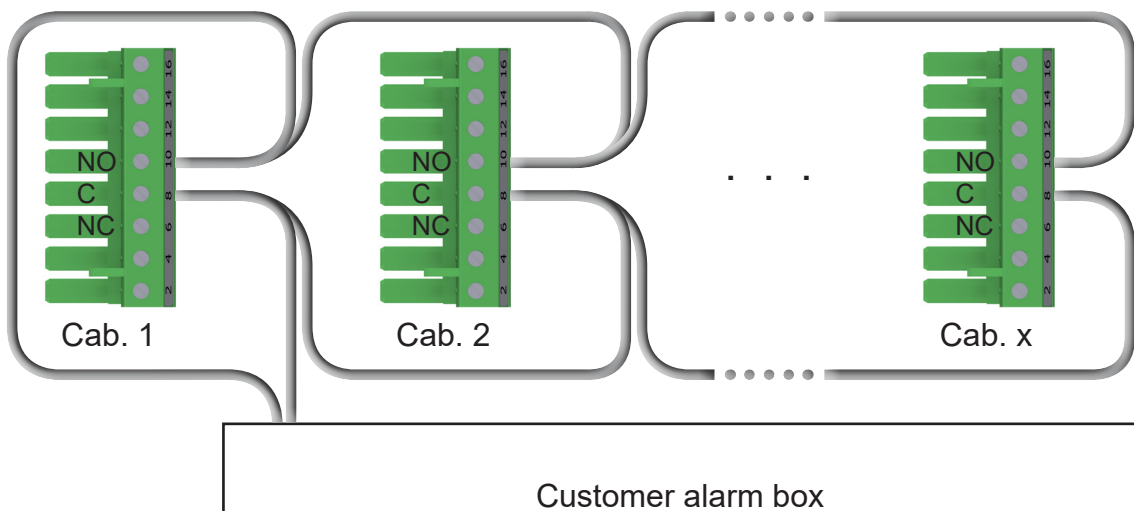


Figure 4.26 Common alarm (Parallel)

4.8 External communication

Pixii system is fully configurable through web interface. Therefore a network connection to controller is required. This can be done in different ways, depending on what type of network is present on site. The system has a Wi-Fi Access Point that can be activated to access the web interface for configuration and monitoring when at the site. System is also equipped with 4G router that can be used to connect system to Internet. Test report enclosed in system contains the installer login information.

4.8.1 Wi-Fi Access Point

The Wi-Fi Access Point is disabled by default. It may be enabled or disabled by pressing the button found at the upper right hand side (marked by "PB1").

Enable

- Press the button for a duration of between 50ms and maximum of 2 seconds.
- The green led will then blink 2 seconds on and 0.5 seconds off.

Disable

- Press the button for a duration of between 50ms and maximum of 2 seconds.
- The green led will then be lit steady.

The SSID and password are printed on the right side of the controller.

The web page is accessible at <https://10.42.0.1>.

4.8.2 4G router connection

4G router is pre-configured and equipped with activated SIM card. No additional electrical connection is needed.

4.8.3 Ethernet connection

- Route RJ45 network cable from customer switch to cabinet plinth.
- Use left cable entry to enter the cabinet.
- Connect ethernet cable to the connector -X20.

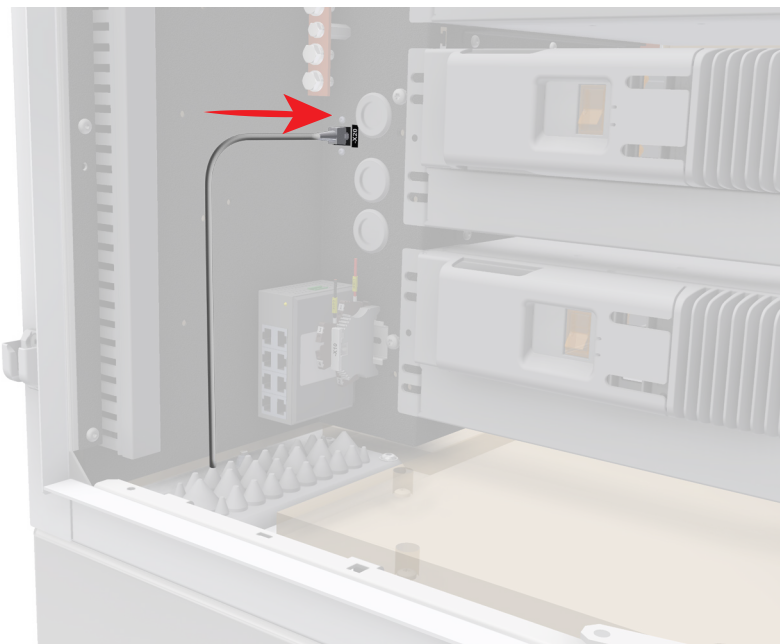


Figure 4.27 Network cable connection

NOTE:

If only ethernet ports to be used, 4G router must be disconnected. For more information, see Configuration guide - PowerShaper Internet Communication Requirements (DN 13942).

4.9 AC meter connection

AC meters from various manufacturers can be used during installation. In next chapters will be described most common ways how to connect it to Pixii system.

4.9.1 AMS energy meter

Pixii controller is not equipped with M-Bus port, therefore USB to M-Bus converter (optional kit) needs to be used. Connect it to free USB port on Pixii controller and connect Ethernet cable to RJ45 connector on converter. On meter side are 2 possible options for connecting communication cable. If only Pixii controller will be connected to AC meter, connect Ethernet cable directly to RJ45 connector on meter. Otherwise connect short cable with RJ45 splitter to AC meter and then to splitter connect Ethernet cable from Pixii controller. For more information, see installation guide DN 14754 (14754_Installation guide - HAN to USB converter).

4.9.2 Industrial grade energy meter

Modbus/RTU

All supported AC meters are equipped with RS485 port for communication. Therefore 2-wire bus must be wired between meter and Pixii controller. Use the customer spare terminals -X5/-X6 extension function. Connect AC meter to the terminals -X5, and controller serial port to the terminals -X6. For more information, see chapter "4.6 Customer spare terminals" on page 30.

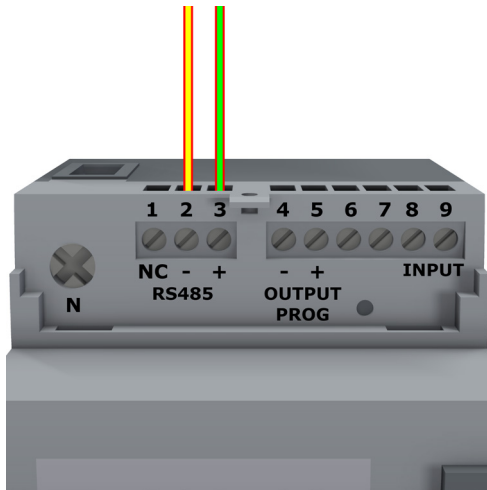


Figure 4.28 Industrial AC meter connection

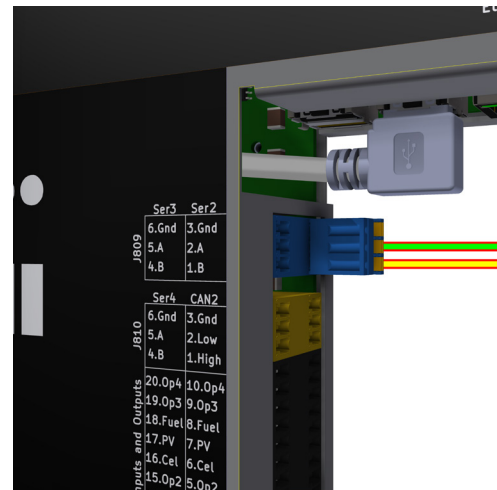


Figure 4.29 Controller serial port connection

Modbus/TCP

All supported AC meters are equipped with RJ45 port for communication. Therefore ethernet cable must be connected between the meter and the switch. Pixii controller must be connected with ethernet cable to the same switch as the meter to ensure the correct communication.

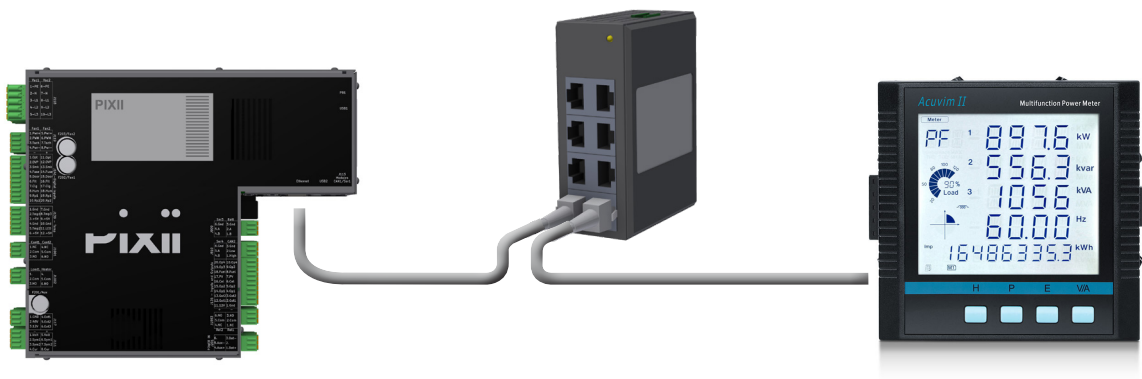


Figure 4.30 Modbus/TCP connection

NOTE:

Pictures above are showing only examples of AC meters.

4.10 Installing batteries

4.10.1 Polarium

NOTE:

Mount back bottom cover plate before installing the batteries. See chapter “3.2 Bottom cover plate” on page 21.

Cabinets are default prepared for 3U batteries (up to 10pcs) from factory, with 148mm spacing between battery supports. It is possible to use 4U batteries (up to 8pcs) as well, but the battery support brackets spacing must be adjusted to 187mm. Bottom battery position is the same for both options.

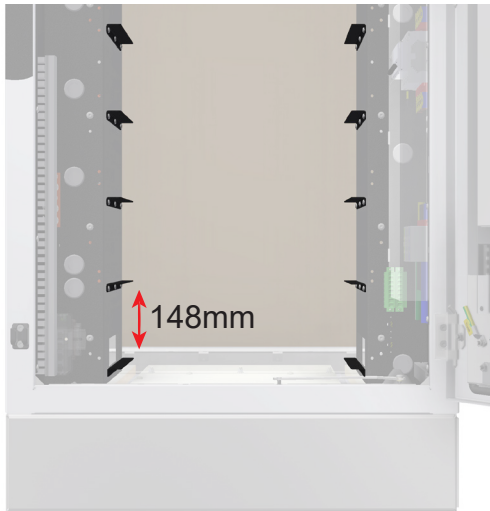


Figure 4.31 3U battery option



Figure 4.32 4U battery option

NOTE:

Flip battery mounting brackets (ears) when using 4U batteries. See picture Figure 4.33.

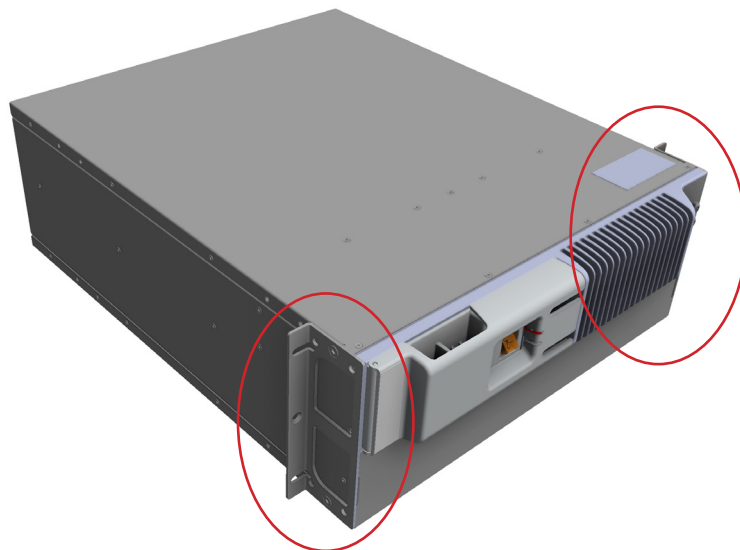


Figure 4.33 Flipped mounting brackets on 4U battery

Using different models of battery modules together is not permitted. Be very careful during installation, because of the high weight of the battery. It's strictly recommended, that batteries are installed by 2 persons. Batteries must be installed in order from bottom to top (see *Figure 4.34*). Place each battery back side at the rails and slowly slide them in correct position. Fix each battery with at least 2x M6 (depending on the accessible holes on the mounting brackets) self tapping screws (see *Figure 4.35*), using torque T6.

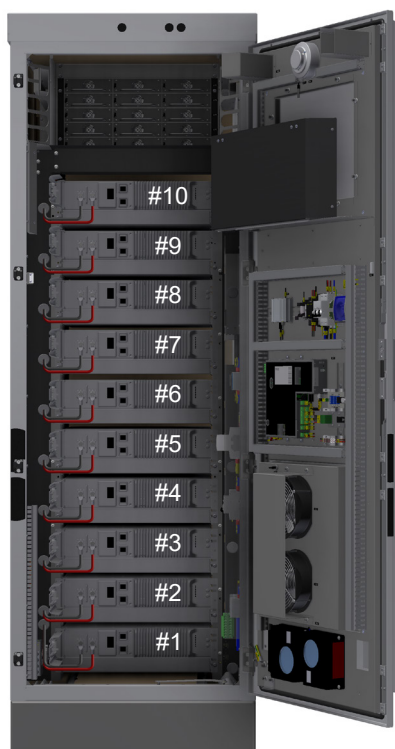


Figure 4.34 Battery positions

NOTE:

Self tapping screws are used also for grounding the batteries.

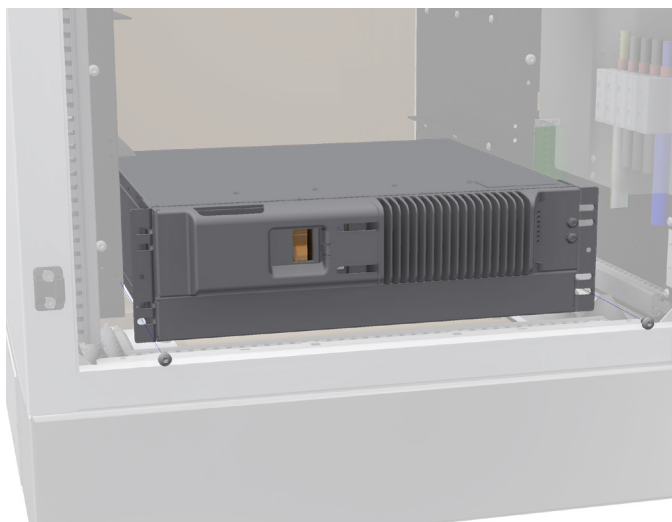


Figure 4.35 Battery installation

NOTE:

Empty battery positions, if any, must be covered by blank panels to obtain correct air flow inside the cabinet.

NOTE:

Use attached self tapping screws (**from cabinet enclosure items**) for fixing batteries to the battery shelves.

Battery connection

Each battery module contains an internal Battery Management System (BMS) and a breaker to secure safe operation. Before connecting the batteries, check once again that all batteries are the same type. If the check was successful, start connecting the batteries.

1. Connect each battery module to those adjacent to it using an intra-rack RJ45 communication cable. For connection use Modbus ports on batteries (see *Figure 4.36*).
2. Interconnect connector -X21 with the bottom battery Modbus port using attached RJ45 communication cable (see *Figure 4.36*).
3. Fix cables to avoid contact with fans, heaters and other equipment mounted on door if needed.
4. Connect the positive cable (red, marked -GB1:+) to the bottom battery positive terminal.
5. Connect the negative cable (black, marked -GB1:-) to the bottom battery negative terminal.
6. Repeat step 4 and 5 to connect all other batteries installed in the system (see *Figure 4.37*).

NOTE:

Do NOT power ON batteries at this stage of installation.

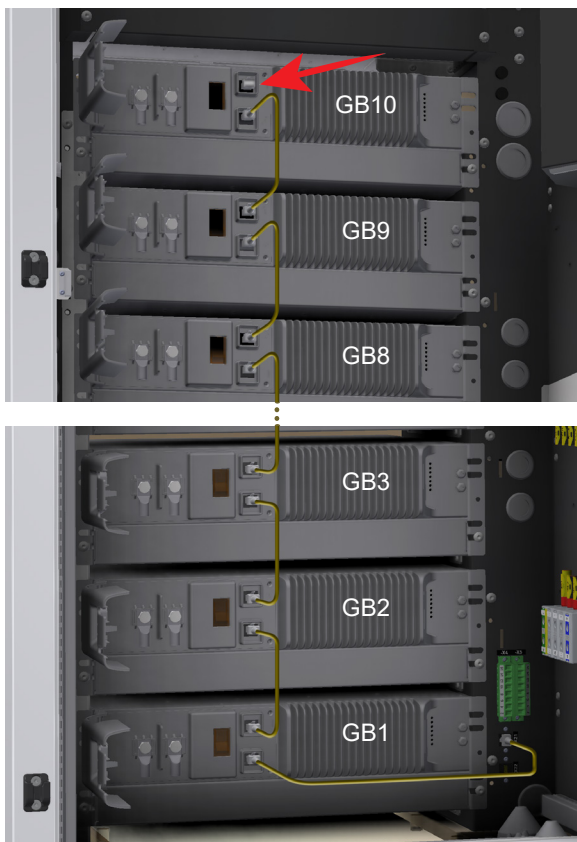


Figure 4.36 Battery communication cables

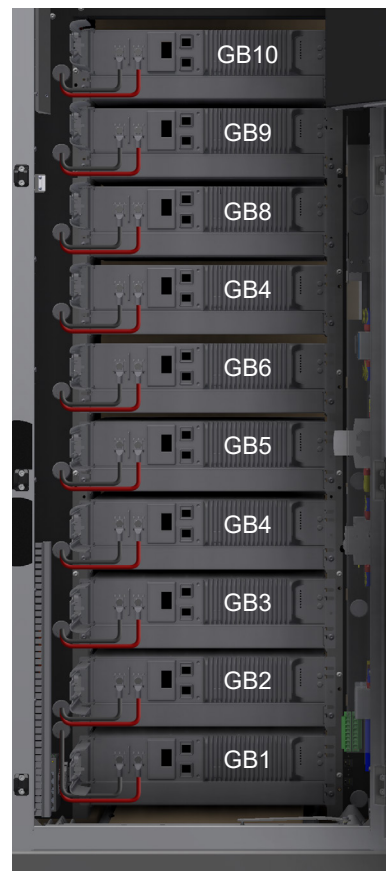


Figure 4.37 Battery cables

NOTE:

For connection of DC battery cables use appropriate torque T3 from chapter “1.1 Recommended tools and torque” on page 8, or follow manufacturer installation documentation.

NOTE:

Insert termination plug to the last unused Modbus port. See details in *Figure 4.36*

NOTE:

Ensure, that battery cables are NOT in/NOT colliding with air gap between the batteries. It could cause overheating problems.

4.10.2 Shoto

NOTE:

Mount back bottom cover plate before installing the batteries. See chapter “3.2 Bottom cover plate” on page 21.

Cabinets are default prepared for 3U batteries (up to 10pcs) from factory, with 148mm spacing between battery supports.

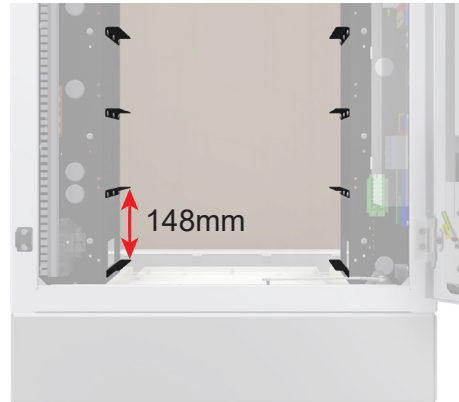


Figure 4.38 3U battery option

Using different models of battery modules together is not permitted. Be very careful during installation, because of the high weight of the battery. It's strictly recommended, that batteries are installed by 2 persons. Batteries must be installed in order from bottom to top (see Figure 4.39). Place each battery back side at the rails and slowly slide them in correct position. Fix each battery with at least 2x M6 (depending on the accessible holes on the mounting brackets) self tapping screws (see Figure 4.40), using torque T6.



Figure 4.39 Battery positions

NOTE:

Self tapping screws are used also for grounding the batteries.

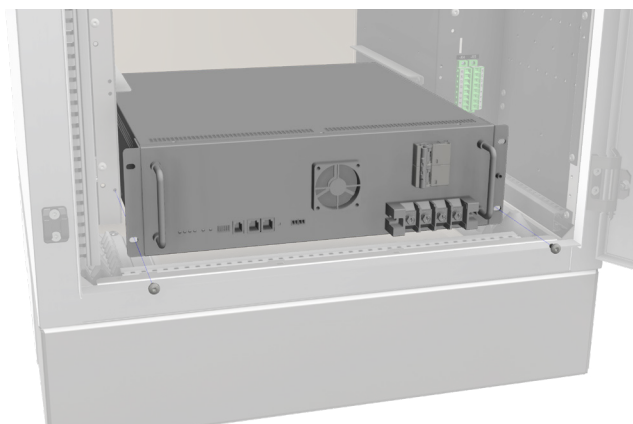


Figure 4.40 Battery installation

NOTE:

Empty battery positions, if any, must be covered by blank panels to obtain correct air flow inside the cabinet.

NOTE:

Use attached self tapping screws (**from cabinet enclosure items**) for fixing batteries to the battery shelves.

Battery connection

Each battery module contains an internal Battery Management System (BMS) and a breaker to secure safe operation. Before connecting the batteries, check once again that all batteries are the same type. If the check was successful, start connecting the batteries.

1. Connect each battery module to those adjacent to it using an intra-rack RJ45 communication cable. For connection use Modbus ports on batteries (see *Figure 4.41*).
2. Interconnect connector -X21 with the bottom battery Modbus port using attached RJ45 communication cable (see *Figure 4.41*).
3. Fix cables to avoid contact with fans, heaters and other equipment mounted on door if needed.
4. Connect the positive cable (red, marked -GB1:+) to the bottom battery positive terminal.
5. Connect the negative cable (black, marked -GB1:-) to the bottom battery negative terminal.
6. Repeat step 4 and 5 to connect all other batteries installed in the system (see *Figure 4.42*).

NOTE:

Do NOT power ON batteries at this stage of installation.

NOTE:

If pre-assembled battery cables are NOT long enough, pull them gently while holding the cable gland in its position.

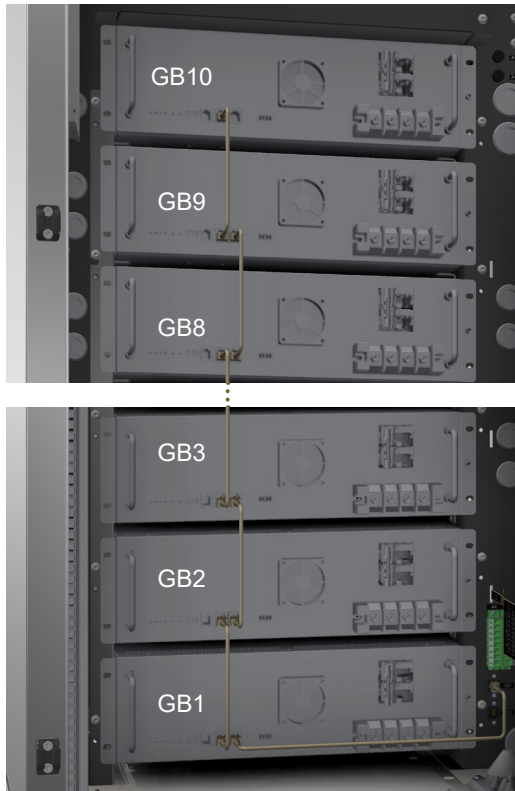


Figure 4.41 Battery communication cables

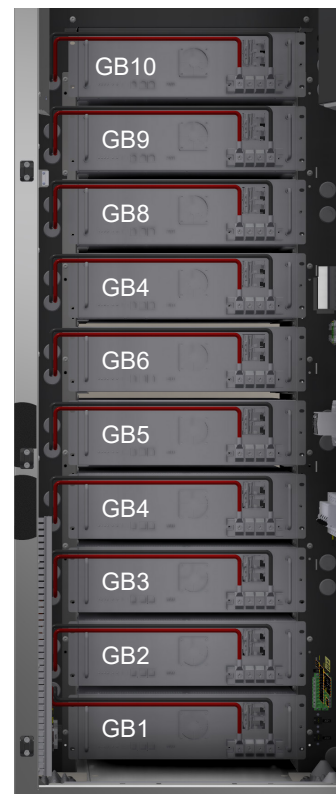


Figure 4.42 Battery cables

NOTE:

For connection of DC battery cables use appropriate torque T4 from chapter “1.1 Recommended tools and torque” on page 8, or follow manufacturer installation documentation.

NOTE:

Use outside battery terminals to connect battery cables, the most left for positive red cables and the most right for negative black cables.

NOTE:

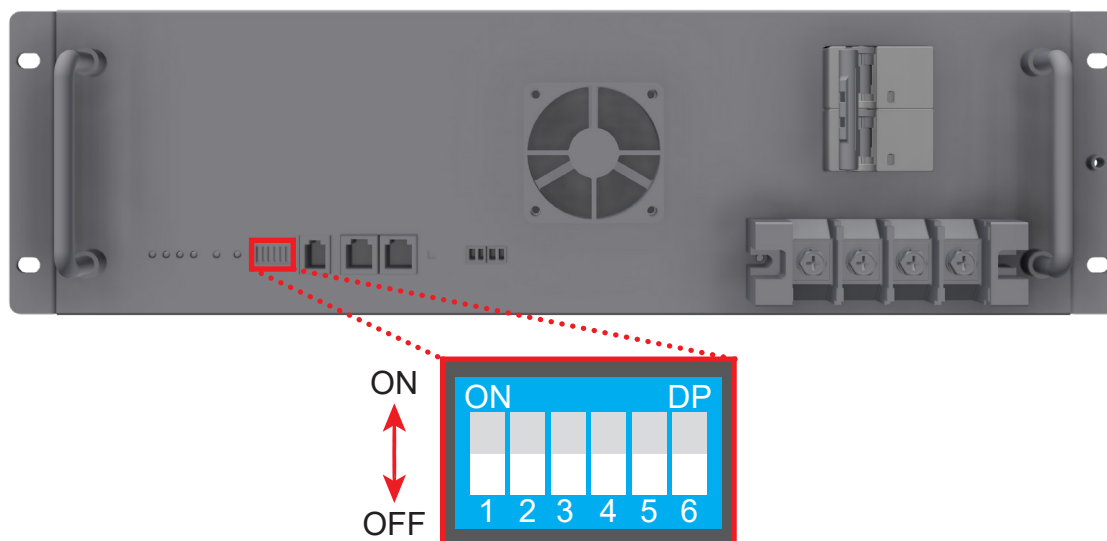
Ensure, that battery cables are NOT colliding with battery breakers above the battery terminals.

NOTE:

Ensure, that battery cables are NOT in/NOT colliding with air gap between the batteries. It could cause overheating problems.

Configuration

For the correct function of Shoto batteries, set the dial switch on the front panel of each battery. There are 4 numerals (1-4) to set the code which can be used to address the battery. The code is assigned as follows:



Address NO	Code switch 1	Code switch 2	Code switch 3	Code switch 4
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

Table 8. Code switch address

NOTE:

Start addressing the batteries from first battery #1 at the bottom and continue to the top.

NOTE:

After complete installation of batteries, do NOT forget to mount all covers back.

4.11 Battery Com converter

Proper configuration of converter (-TF2) is necessary to secure the correct communication with various type of batteries. Follow the tables below to set the DIP switches in the right positions.

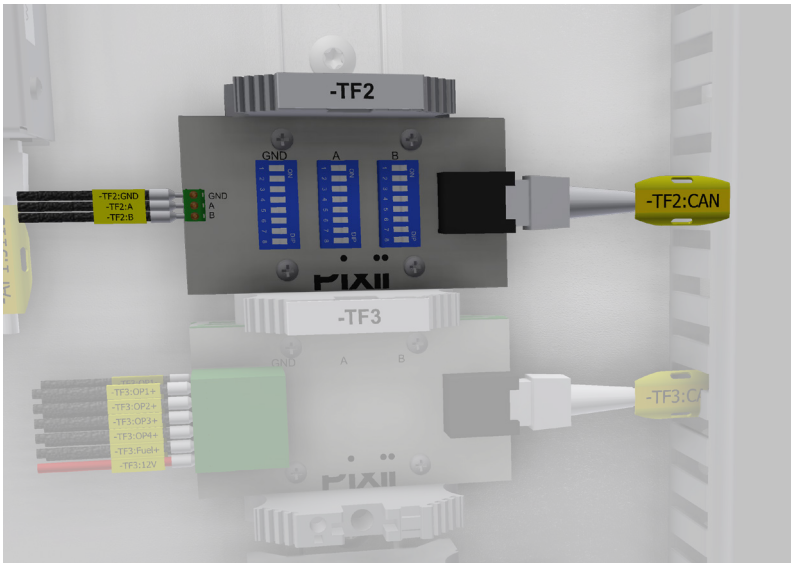


Figure 4.43 Battery Com converter (-TF2)

	GND	A	B
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	OFF	OFF
4	OFF	OFF	OFF
5	OFF	OFF	OFF
6	OFF	OFF	OFF
7	OFF	ON	OFF
8	ON	OFF	OFF

Table 11. Shoto batteries configuration table

	GND	A	B
1	OFF	OFF	OFF
2	OFF	OFF	OFF
3	OFF	OFF	OFF
4	OFF	ON	OFF
5	OFF	OFF	ON
6	ON	OFF	OFF
7	OFF	OFF	OFF
8	OFF	OFF	OFF

Table 10. Polarium batteries configuration table

4.12 Plinth covers

To prevent access to cabling under the cabinet, unpack the two plinth covers from the enclosed items and fix each of them with six screws to cabinet plinth (see *Figure 4.44*).

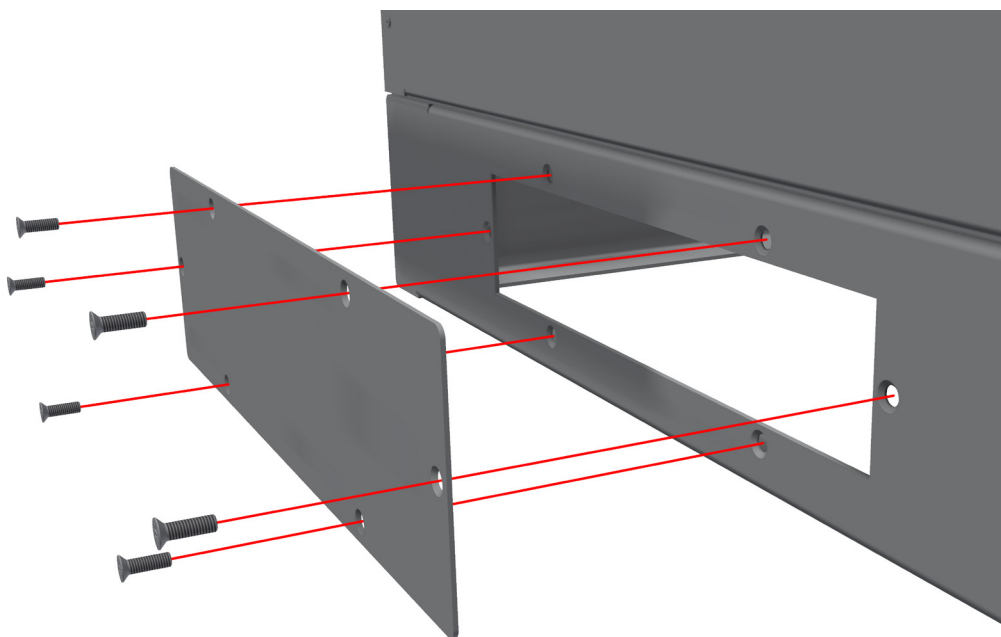


Figure 4.44 Plinth covers

4.13 Power modules

The last step in the system installation is to install Pixii modules. Each power shelf contains 3 positions for modules. Each position is wired to different phase, starting with L1 from the left. To secure correct 3-phase operation, all 3 modules must be installed in every used shelf. The controller will identify the position of each inserted module, therefore it is not critical in which order the modules are inserted or removed. There is a label located next to the power shelves describing the module positions. It is recommended to start inserting modules from shelf -UF1 position 1.1.

4.13.1 Installing module

1. Place the module in the shelf and slide in.
2. Using the module handle, push firmly until the unit is properly connected and the ratchet on the left side lock the module in position.

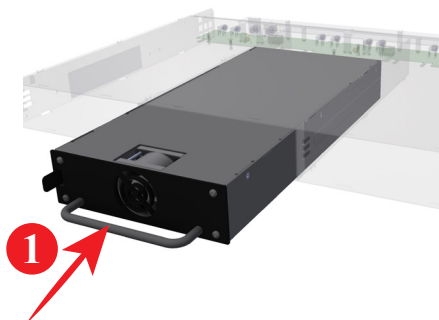


Figure 4.45 Slide the module in

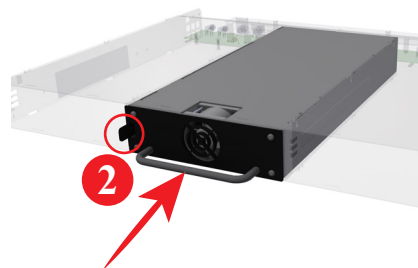


Figure 4.46 Push firmly until the ratchet lock the module

NOTE:

If the module does not fit easily, do not use that power shelf and contact supplier for repair.

4.13.2 Removing module

1. Push the ratchet on the left side to unlock the module.
2. Pull out the module using the handle while holding the ratchet.
3. Replace with a new module or blind panel.

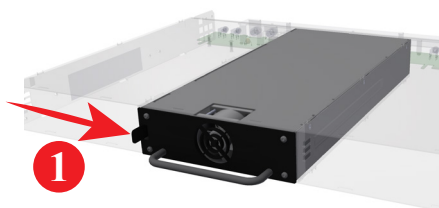


Figure 4.47 Unlock the ratchet

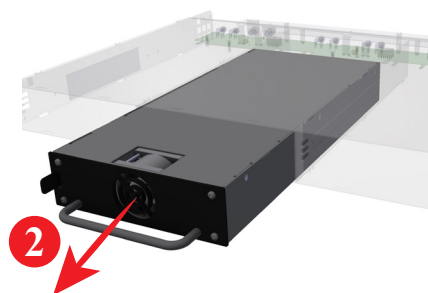


Figure 4.48 Pull the module out

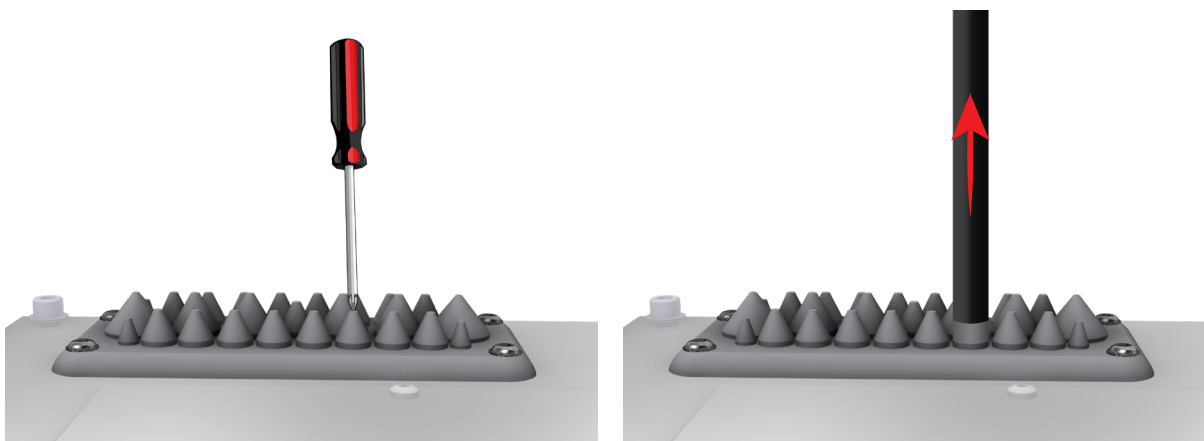
WARNING:

Do NOT touch connectors on the module rear side, there is risk of electric shock because of accumulated energy inside.

NOTE:

Empty positions must be covered with blank panels to obtain correct airflow.

4.14 Cable glands



Make a small hole into the membrane using a screwdriver or cut the top of the cone using side cutter.

Push the cable through the guide hole.

4.15 System label

Pixii system is marked with 2 system labels. One label is located on the outside of the cabinet (right hand side seen from the front), and one is located inside the cabinet on the cabinet door. After connecting system to AC network, type of network needs to be clearly marked on both labels. Use permanent marker to do this. If system is connected to TN-S network, mark two red squares, in case of IT/TT network mark two blue squares.

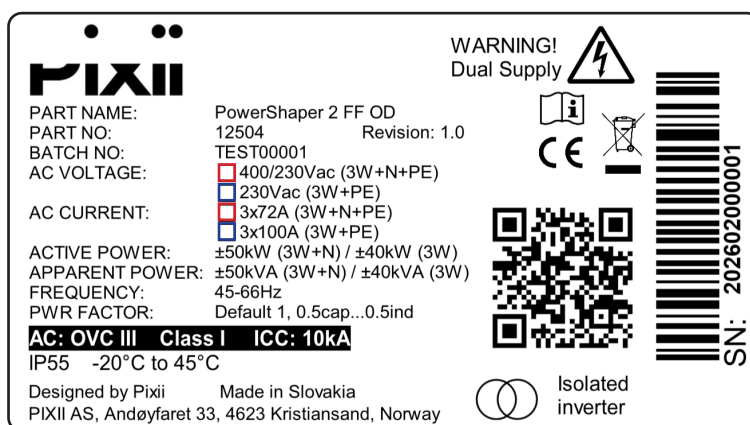


Figure 4.49 System label

4.16 Finalization

After successful installation, mount plastic cover back following steps in chapter “4.1 Preparation” on page 24.

5 Multicabinet connection

Using an additional Multi-cabinet switch kit (PN 13601) is possible to connect more cabinets together.

5.1 Installing the multi cabinet kit

1. Mount 8-port ethernet switch into the master cabinet, to the DIN rail located on the bottom left of the cabinet.
2. Connect pre-assembled terminals (-X10) with switch terminals, using attached cables (0.5sqmm, red, black, L=0.3m).
 - Insert one end of the red cable into the terminal -X10:1, and the other one into the positive pin of the green terminal.
 - Insert one end of the black cable into the terminal -X10:3, and the other one into the negative pin of the green terminal.
3. Interconnect ethernet switch with connector -X20, using attached ethernet cable.

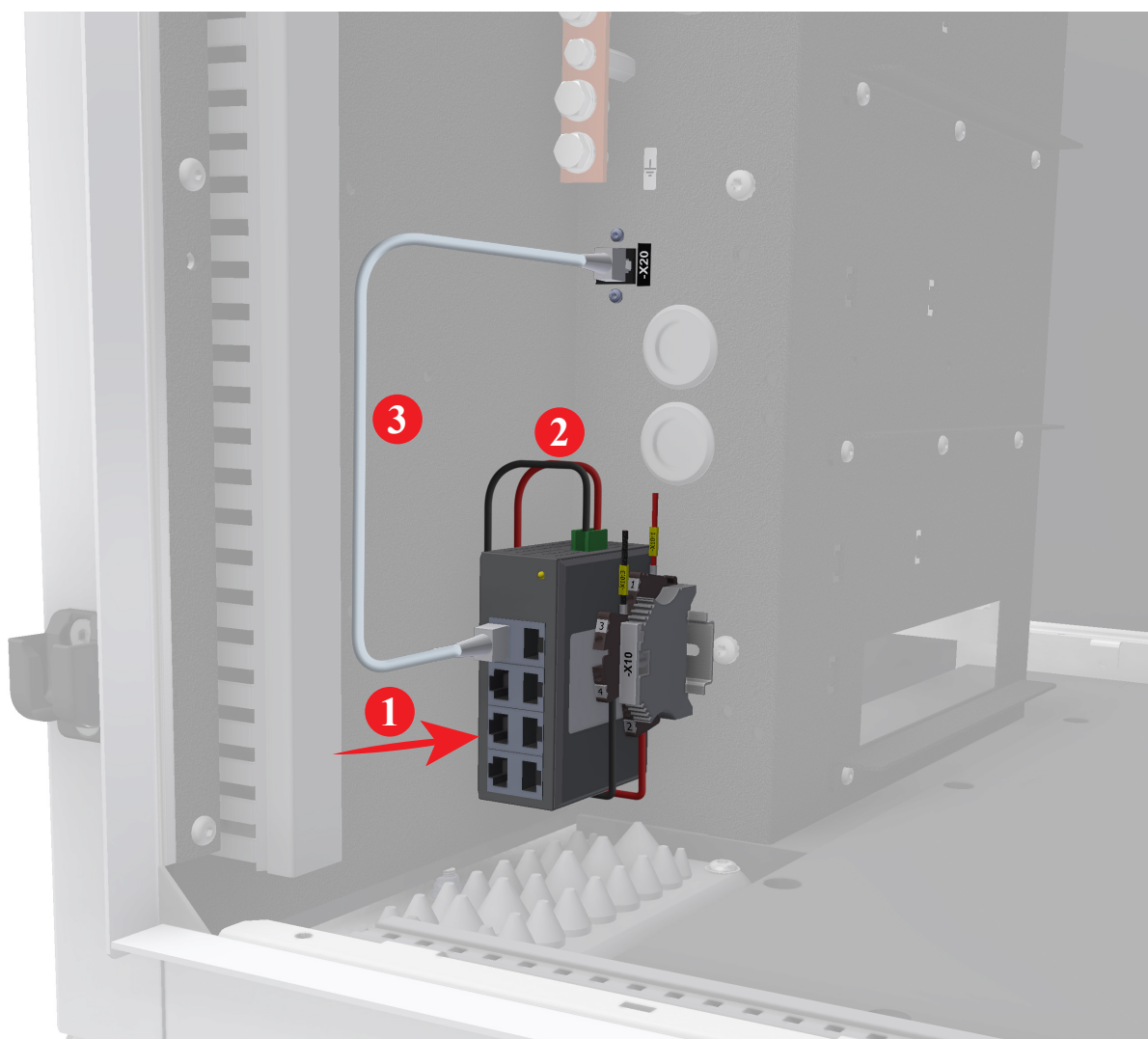


Figure 5.1 Installation of multi cabinet kit

5.2 Connecting the cabinets

Connect Gateways from all client cabinets to the ethernet switch located in master cabinet.

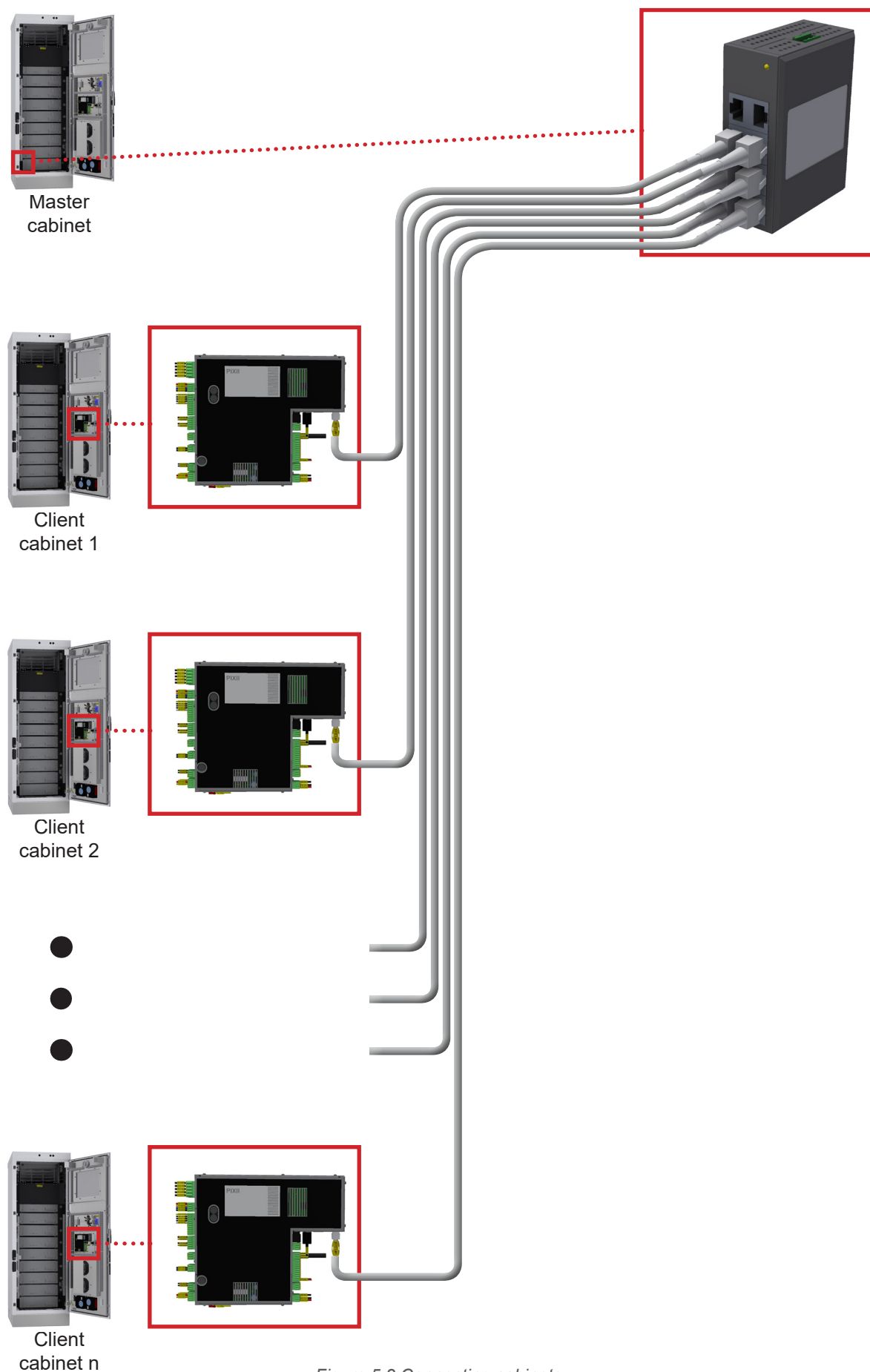


Figure 5.2 Connecting cabinets

5.3 Site with local network / internet

1. Remove power cable from 4G router in all cabinets.



Figure 5.3 Removing power cable from 4G router

2. Connect local network / internet cable to the switch in master cabinet.

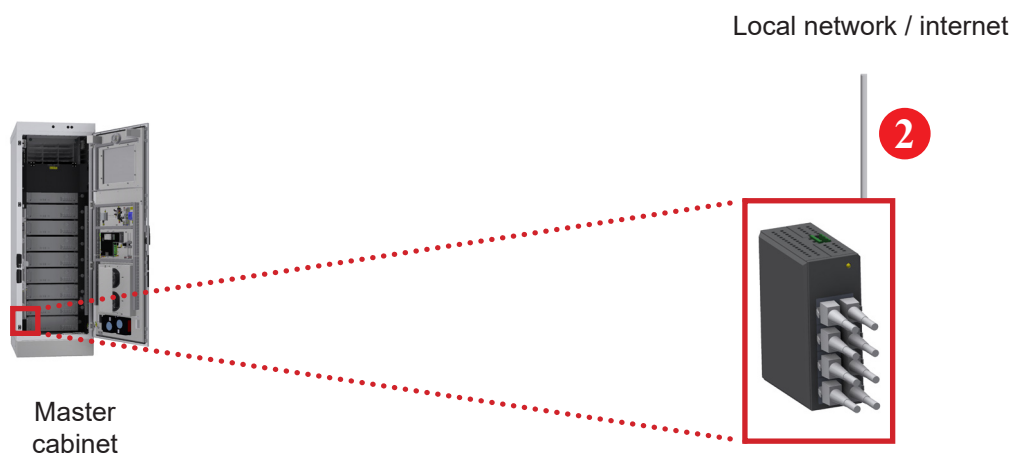


Figure 5.4 Connecting the local network / internet

5.4 Site without local network / internet

1. Remove power cables from all 4G routers in all client cabinets.

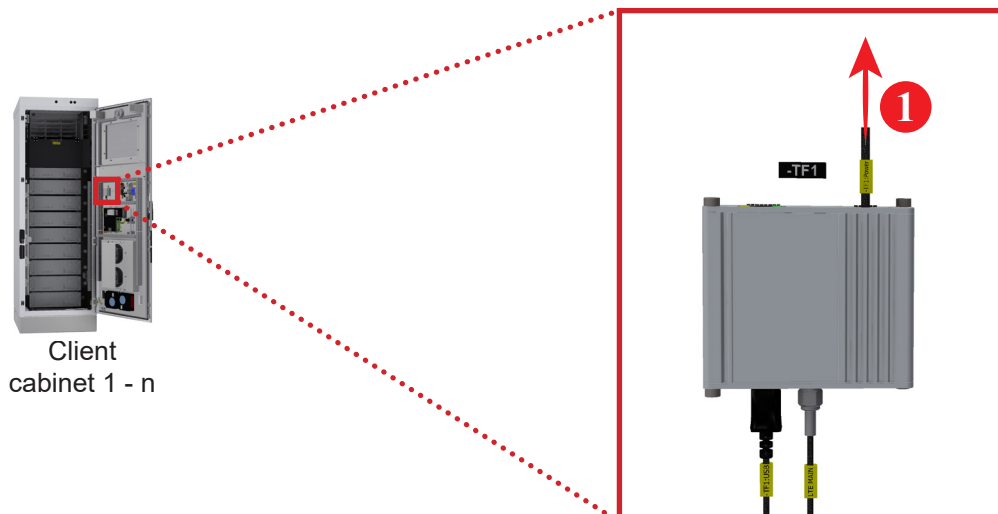


Figure 5.5 Removing the power cable

2. Remove USB cable from 4G router in master cabinet.

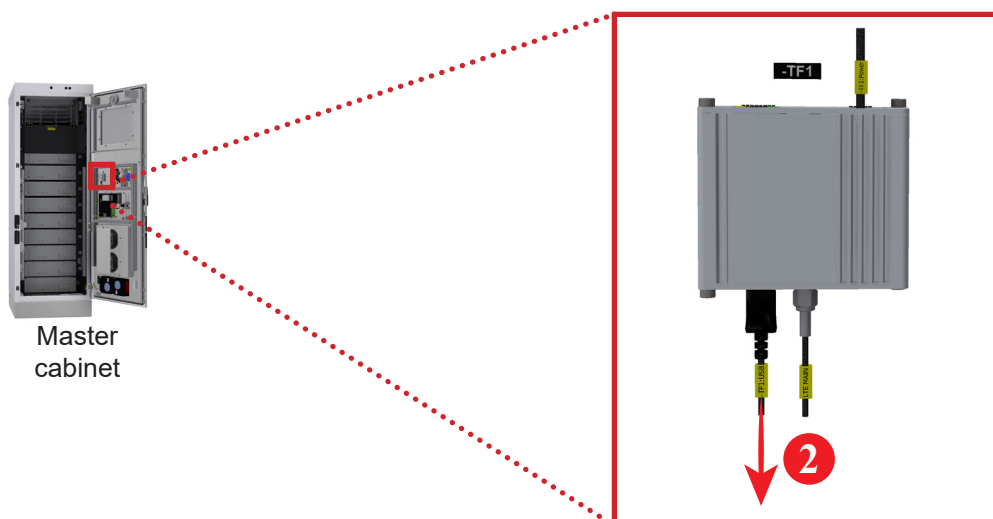


Figure 5.6 Removing the USB cable

3. Connect 4G router to the switch using ethernet cable in master cabinet.

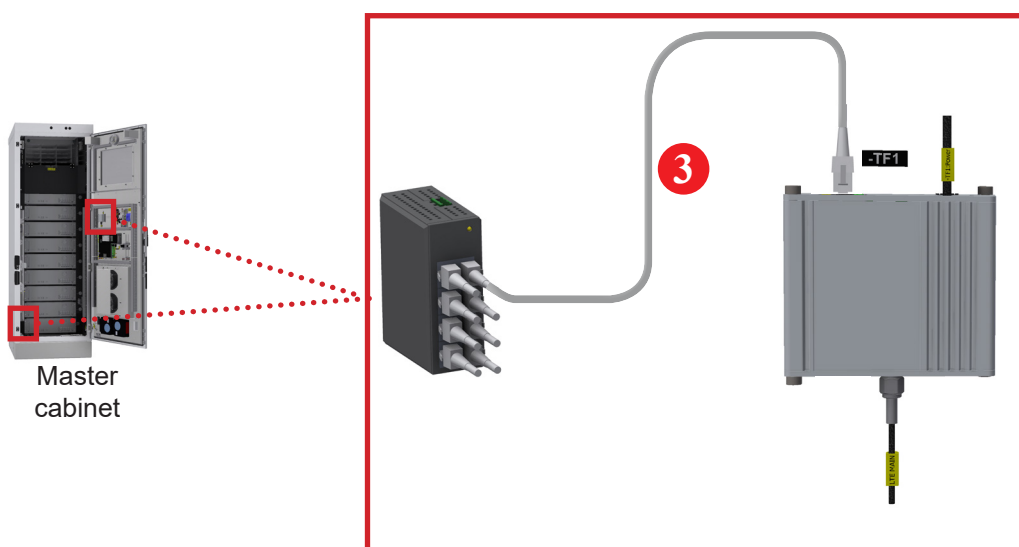


Figure 5.7 Connecting the 4G router

6 Commissioning procedure

For proper commissioning of the system, see separate procedure DN 14606 (14606 - Commissioning procedure - Power cabinets).

7 Maintenance

To ensure that the system lifetime will be reached, regular inspections of the system are required. To be within warranty terms of the product the owner must follow the complete maintenance procedure. This procedure can be adapted based on local conditions and regulations. Pixii recommends a complete system maintenance at least once a year, except for filters and air condition unit that may need more frequent inspection based on local environmental conditions.

Only authorized and qualified persons are allowed to perform system maintenance. These persons must be familiar with the system and must follow all precautions described in this manual. Below is a non-exhaustive list of points for general consideration. Do not limit the evaluation to only those points.

NOTE:

For repair and replacement use only original Pixii parts and in accordance with technical specification provided by Pixii. Use of non-original parts may void the warranty provided by Pixii.

7.1 System

- Remove all objects around cabinet that can block air flow.
- Check for physical damage on the cabinet body. Repair scratches with paint. If the cabinet body has severe damage, like deformation or holes, the system should immediately be taken out of operation and replaced with a new cabinet.
- Check the door hinges and apply oil or grease if needed.
- Check that the door gasket has no visible damage.
- Check that all cabinet entry points are correctly sealed and there is no possibility of water and dust entering the cabinet.
- Check the batteries, look for possible leakage and mechanical damage.
- Check that all accessible cables are not mechanically damaged.
- Check that the mains input cable well tightened (Torque table is in chapter “1.1 Recommended tools and torque” on page 8).

7.2 Air condition unit

To ensure the normal operation of the air conditioner, please perform regular maintenances.

After the air conditioner is power on, check whether the air conditioner enter the normal interface, without alarm. And then perform the self testing and check whether the whole process is normal.

WARNING:

All the maintenances shall be performed by qualified professionals. Please disconnect the power and signal cables of the air conditioner before any maintenance and do not reconnect them until the maintenance is completed.

Check item	Step description	Maintenance cycle
Wiring	Visually check if the wiring is loose	12 months
Fan abnormalities	Turn the fan to check if it is smooth and if there is any abnormal noise	12 months
Drainage pipe	Visually check if the drainage mouth is blocked	6 months
Condenser	Check the cleanness of the condenser and clean it with compressed air	6 months

Table 9. Air condition maintenance

7.3 Fan-filter cabinet

- Check that the fans are running without any abnormal noise.
- Disassemble outlet filter frame and visually check filter from both sides.
- Disassemble inlet filter box and visually check filter from both sides.

7.3.1 Replacing the filters

To secure correct function of Fan filters, it is necessary to remove all dirty/damaged filters from inlet/outlet.

7.3.2 Outlet filter

1. Remove 8x M6 Nuts to release filter holders.
2. Remove filter and replace with new one.

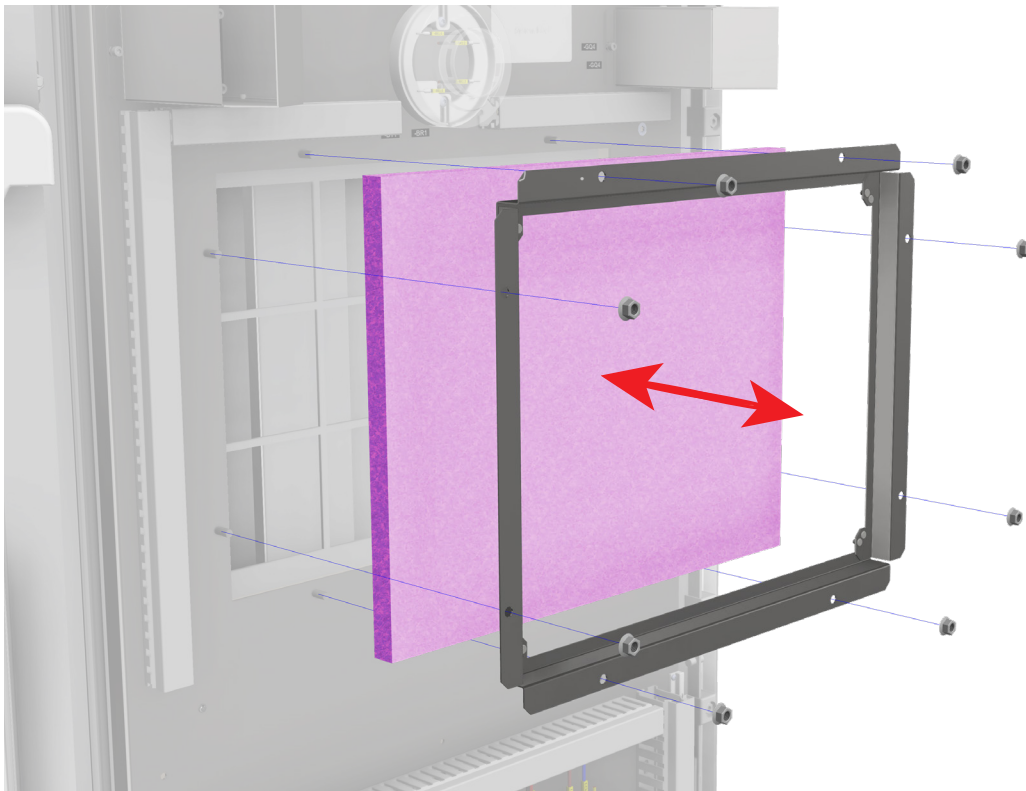


Figure 7.1 Outlet filter removal

3. Fix back all filter holders with 8x M6 Nuts from first step.

7.3.3 Inlet filter

1. Remove 4x M6 Nuts to release filter frame.
2. Remove filter and replace with new one.

NOTE:

Make sure that the orientation of the new inlet filter is correct.

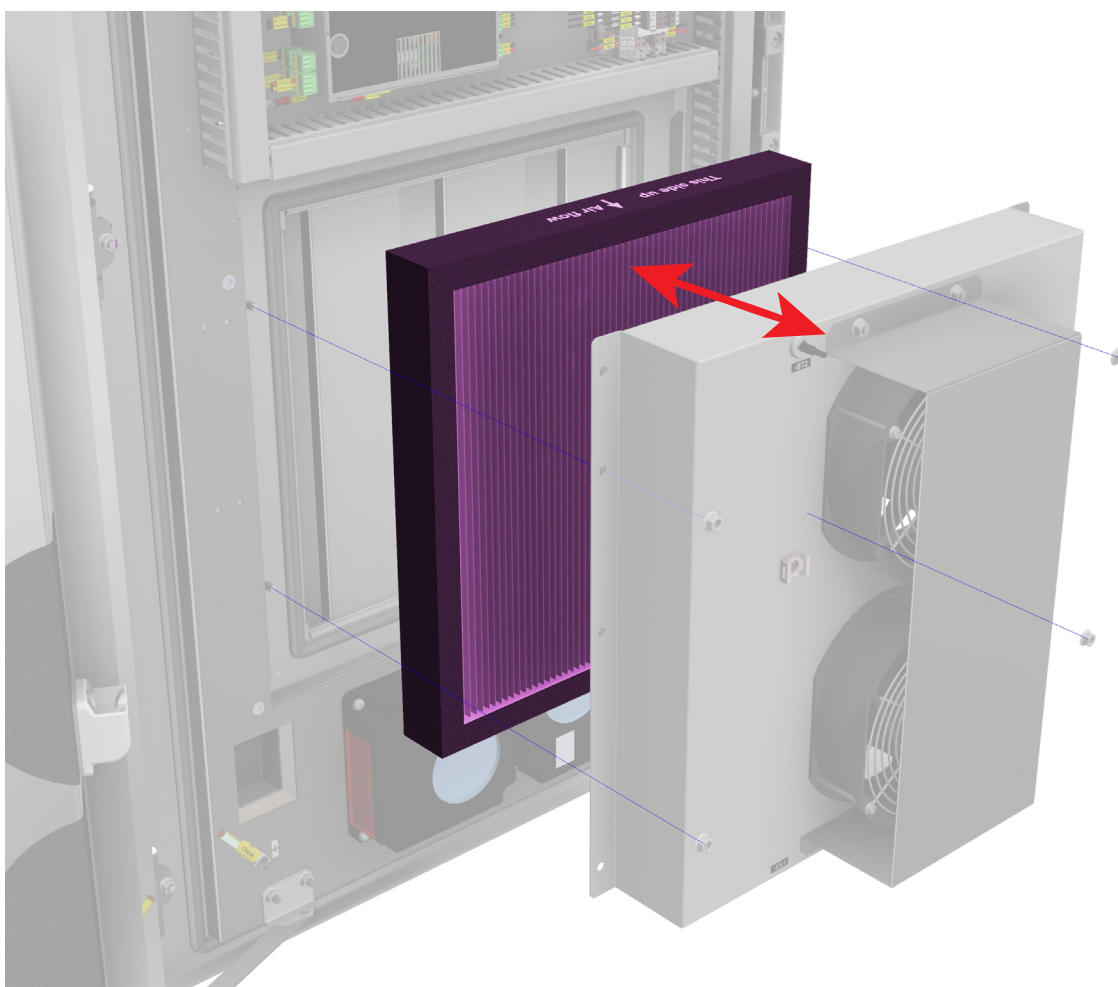


Figure 7.2 Inlet filter removal

3. Fix back filter frame with 4x M6 Nuts from first step.

NOTE:

Gap between filter frame and the door plate is not a fault. Do NOT tighten screws too strong to reduce the gap.

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PIXII