UP 2015 - Box for outdoor installations

This document describes the outdoor installations of the UP 2015, the Remote Terminal Unit for telecontrol and supervision of Medium Voltage distribution network; it provides functional and construction requirements for the provision.

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Revision	Data	List of modifications
00	02.11.2015	First version

INDEX

0 Acronyms

CPE	Customer Premises Equipment
DFPI	Directional Fault Passage Indicator
IC	Customer Interface device
LVCB	Low Voltage Circuit Breaker
LVI	Line Voltage Indicator
PSBC	Power Supply Battery Charger
RGDAT	directional fault passage and voltage loss indicator
RGDM	directional fault passage indicator with measuring acquisition
Recloser	Pole-mounted switch breaker with integrated control module
RTU	Remote Terminal Unit for the remote control of the secondary substations
SD	Switch Disconnector
SG	Switchgear
TB	Terminal Board
UE	Processing Unit of the RTU

1 Introduction

This document describes the outdoor box for the Remote Terminal Unit (refer to the GSTR001/1 specification), designed for pole-mounting applications. This is an outdoor adaptation of the existing indoor equipment, which is able to control/monitor the switchgears such as: the pole-mounted Switch Disconnectors (SDs), the unified Reclosers, or the Low Voltage Circuit Breakers (LVCBs).

What is described in this specification is therefore finalized in order to maintain the maximum compatibility between the existing indoor equipment (batteries, power supply, and UE) and provide proven solutions which are suitable for pole installations (interface with the UE via terminals, layouts of the terminals in order to interface them with the new equipment, etc..).

2 List of components, product family or solutions to which the GS applies

Two versions of the outdoor container can be provided, the standard version - OS-UP-, and the extended version- OXL-UP-, each associated to a different product family code.

Solution	Product family code	Description
OS-UP		Outdoor apparatus for teleoperation for pole-mounted switchgears- standard version (Figure 1)
OXL-UP		Outdoor apparatus for the teleoperation of pole-mounted switchgears- XL version (Figure 2)

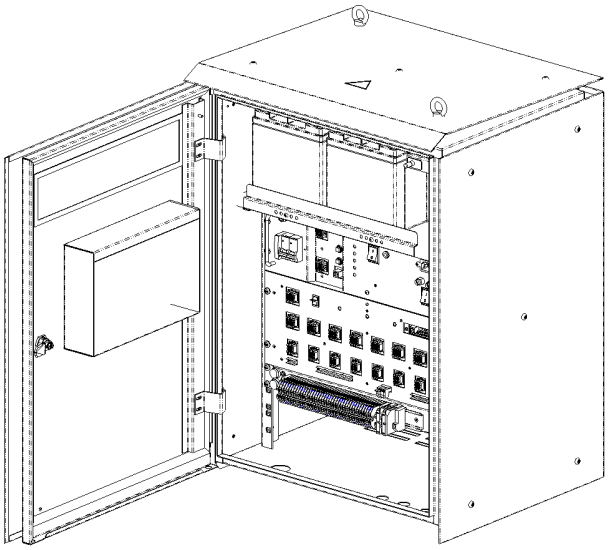


Figure 1 - OS-UP

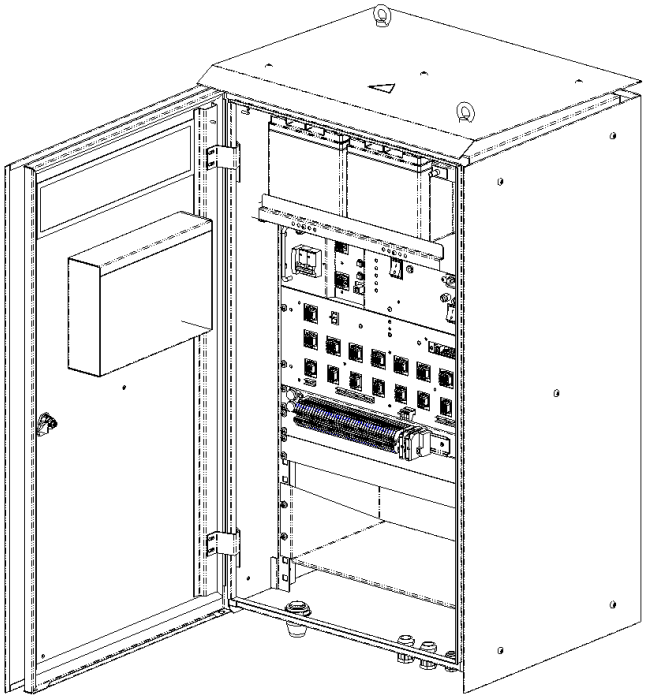


Figure 2 – OXL-UP

Accessories	Solution	Description	Supplied
PSBC	OS-UP/ OXL-UP	Power supply/ battery charger of the RTU, switchgears and auxiliary devices (modem, router, etc.)	Yes
UE8	OS-UP/ OXL-UP	Apparatus for teleoperation for 8 switchgears	Yes
Terminal Board (TB)	OS-UP/ OXL-UP	Terminal board, either for the power supply of other devices, or for the local commands of the SG.	Yes
Thermoregulation system	OS-UP/ OXL-UP	Anti-condensing/heating system	Yes
Additional shelf	OXL-UP	Additional shelf for placement of auxiliary devices	Yes
Batteries	OS-UP/ OXL-UP	Batteries in compliance with the global specifications on batteries for secondary stations	No
SG-TB cable	OS-UP/ OXL-UP	Cable for the connection between the SGs and the TBs	Yes
FPI-TB cable	OS-UP/ OXL-UP	Cable for the connection between the FPI connector and the TB	Yes
GSM/GPRS Modem	OS-UP/ OXL-UP	DCE for the remote connection	No
PSBC-TB cable	OS-UP/ OXL-UP	Cable for the connection between the PSBC and the TB	Yes

3 Applicable laws, reference standards and list of replaced standards

IEC 60068-2-6:2007	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)
IEC 60068-2-64:2008	Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance
GSTR001/1	Remote Terminal Unit for secondary substations (UP 2015)

4 Construction characteristics

Section 4.1 will describe the construction characteristics, which are common to both the technical solutions OS-UP and OXL-UP. Sections 4.2 and 4.3 will provide the construction characteristics specific for each of the two solutions, standard and XL, respectively.

4.1 Common features

Both the cabinet containers (standard and extended versions) described in these specifications, are a variation of the box for indoor installation, as described in the GSTR001/2 specification. The container base must be provided with holes to pass the cables.

The cable glands used for the entrance on the bottom side of the container (included in the supply) must be sized in order to allow the cables listed below to be run through them:

- Power supply which must have a diameter equal to 16 mm;
- Cable for the connection to the SD, which must have a diameter equal to 20 mm;
- Antenna cable: jack must have a diameter equal to 9 mm;
- The ground earth should be pass through bolt

The base of the container (Figure 3) must also be provided with a hole with a diameter of 35 mm, sealed with a cable glands for the RGDAT sensors. The internal diameter is equal to 21.5mm.

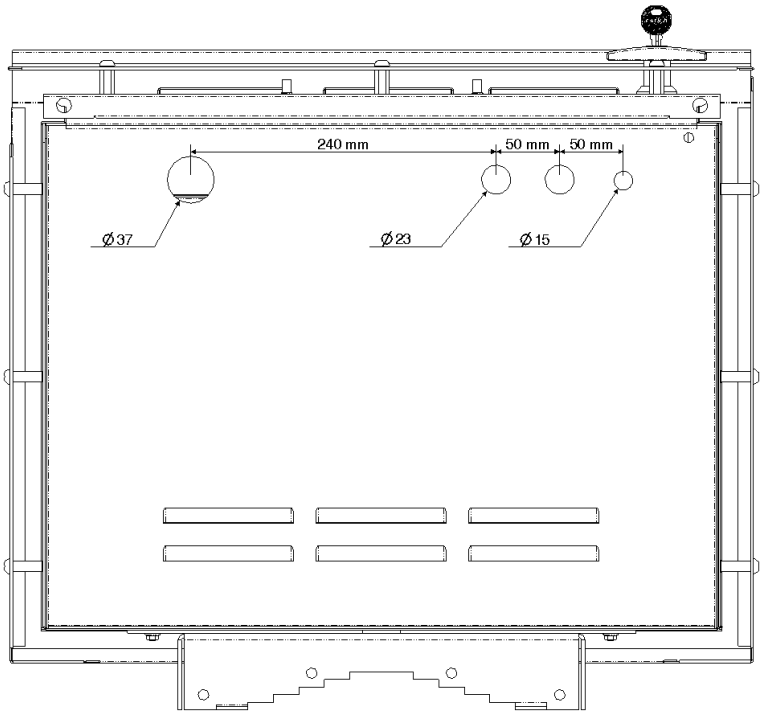


Figure 3 – Layout of the container base

All of the external surfaces of the cabinet container must ensure an effective and prolonged anti-corrosion effect. In particular, the metal parts must be made of non-corrosive material or having been subject to the process of hot dip galvanization, in compliance with the ISO 1461 standard.

The cabinet container must have IP54 or higher, and must also be used in environments of climatic category type C5-M "Very High" (coastal areas with high salinity), in compliance with standards ISO 9223 and EN ISO 12944-2.

In the case the container is submitted to a hot dip galvanizing process, the minimum thickness of the coating must be equal to 100 μm or, alternatively, the cabinet must have been previously subjected to a cataphoresis treatment.

The content of the cabinet container (UE panel, PSBC, and any other devices) will be mounted on a 19" standardized rack frame. The box must be accessible from the front, and the rack frame must be of the unified multi-hole type.

The rack frame should allow the insertion of devices with a depth up to 280mm.

The batteries will be inserted on the shelf (Figure 4) positioned on the upper side of the container (space of 5U).

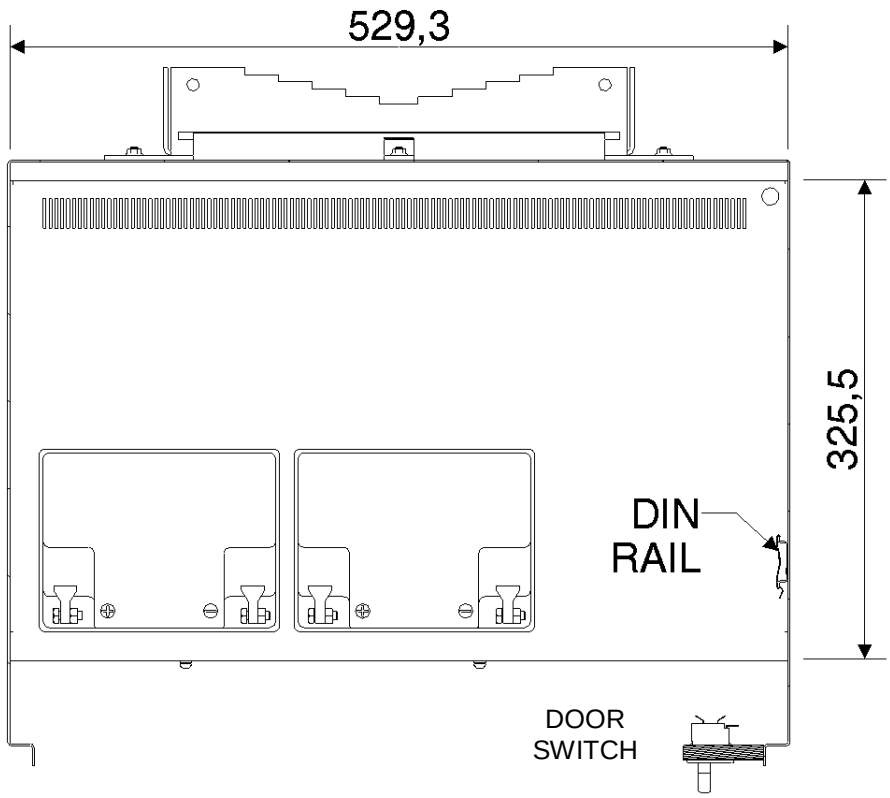


Figure 4– Horizontal section – batteries shelf

On the right side of the container (Figure 4), corresponding to the battery cover, a (type omega) DIN rail must be installed (Figure 5), which must be equipped with 2 clips and a circuit breaker which connect the secondary TV in order to simplify commissioning and maintenance. The other side of the circuit breaker will be pre-wired to the expected loads (PSBC, heater, etc ..). The breaker must leave the factory in position OFF.

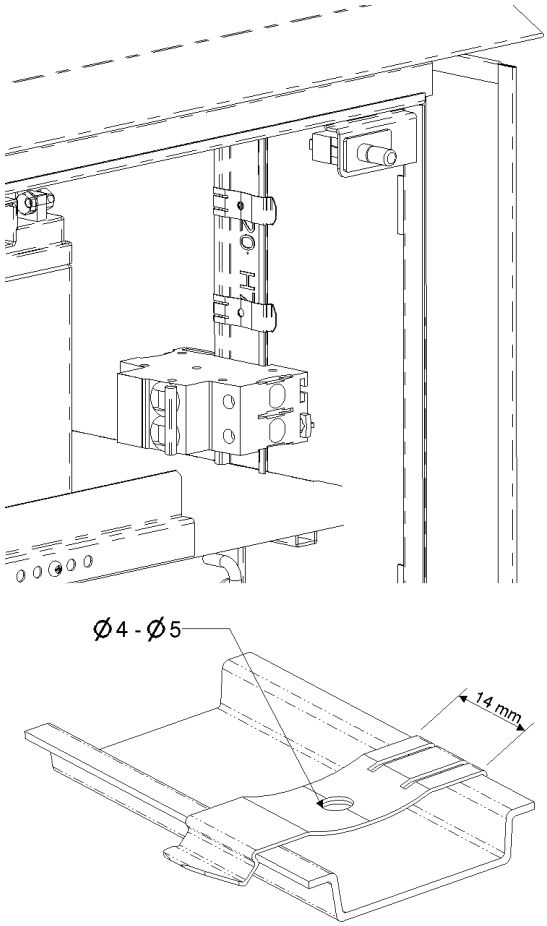


Figure 5 – DIN rail with circuit breaker and applied clip (detail).

The grounding braids (of a section equal to 16 mm^2), for the connection of the grounding bolts (Figure 6) of the individual panels with the grounding bolt which is placed on the container are included in the supply.

The metal container must be provided with a grounding bolt for the connection of either the +24 V_{DC} power supply or the eventual exposed-conductive-parts.

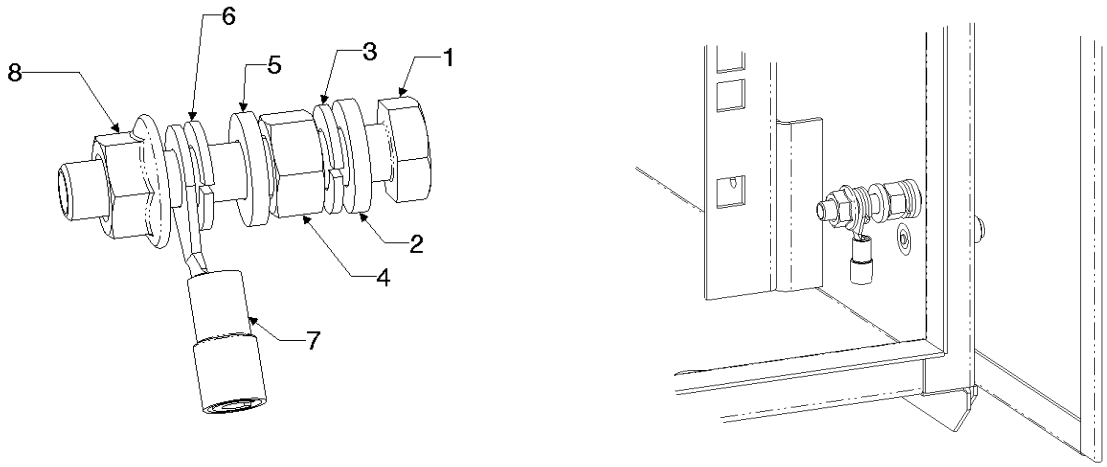


Figure 6 - Grounding bolt

The container must be equipped with lifting eyebolts for the facilitation of transport and installation of the RTU.

The container must be provided with adequate solutions in order to limit the risk of overheating, due to the direct solar radiation (such as air inlets/outlets, reflector panels or ventilated wall chambers).

The panel must project beyond the front door. The access door must allow for the insertion/removal of all of the equipment housed in the container. Once the door is closed, it must be locked with a security lock with a key (see Figure 7).

The cabinet container must be provided with a system which allows the rainwater to runoff (such as an inclined panel, as it is shown on the top of Figure 9).

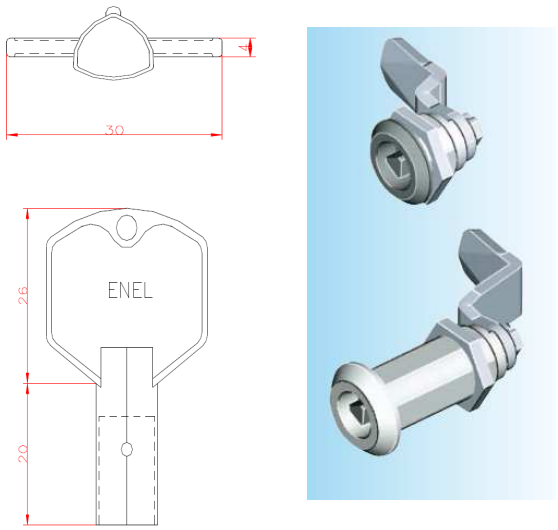


Figure 7 – Standard Enel Key with a triangle of 6,5mm and examples of metallic door locks to be used.

The internal side of the front door must allow to house either an RGDAT or an RGDM. For this reason the door must have an adequate profile (as to the depth) in order to allow the devices to be housed, without any contact or interference upon door closing, and cables wiring. The maximum size to be considered for the RGDAT/RGDM is: *LxHxW: 300x200x70 [mm].*

For the RGDAT/RGDM mounting pattern, refer to the diagram which is provided in Figure 8.

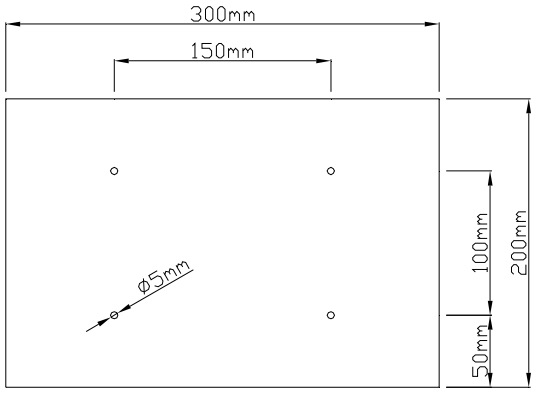


Figure 8 – Mounting pattern of the RGDAT/RGDM

A contact must be provided which must communicate the door opening to the RTU, through a connection to the “Door Opening” Remote Signal.

The air inlets must be equipped with an anti-insect net.

All of the cables leading from either the SD, which is mounted on the top of the pole, or the antenna, run along the pole, toward the base of the RTU container, and are mechanically protected by a fiberglass channel (Figure 9).

In order to avoid water infiltrations inside the container, a coiled sheath, opportunely curved, protects the last section of the cables, from the end of the fiberglass channel, toward the RTU container.

An entrance must be provided for the cables of the SD, the 100 V_{CA} power supply derived from the transformer, the antenna, and all of the eventual spare RMs and RSs.

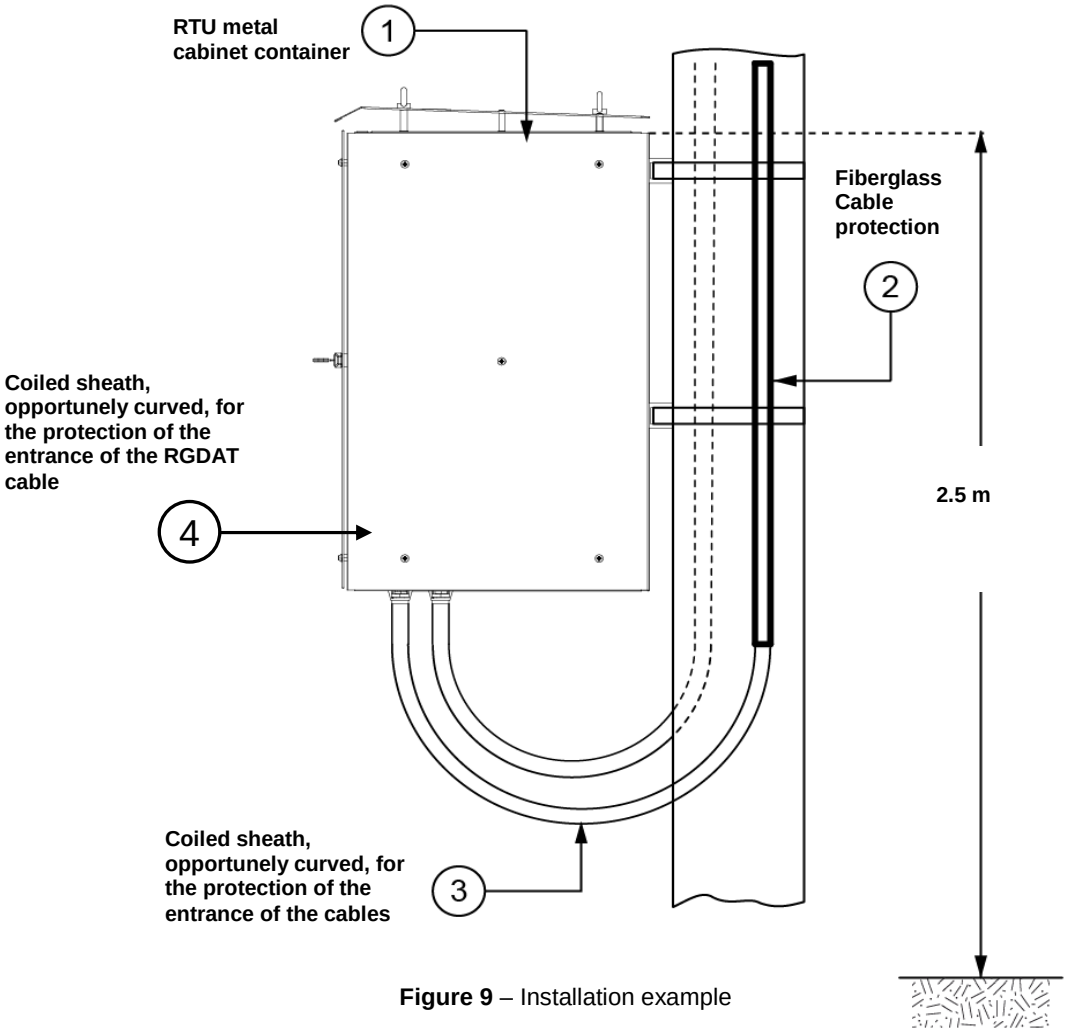


Figure 9 – Installation example

4.2 Outdoor box – Standard version

The standard version of the outdoor cabinet container must be suitable to house devices with total height of 15U. The size of the standard version of the outdoor cabinet container is reported in Figure 10, Figure 11, Figure 12.

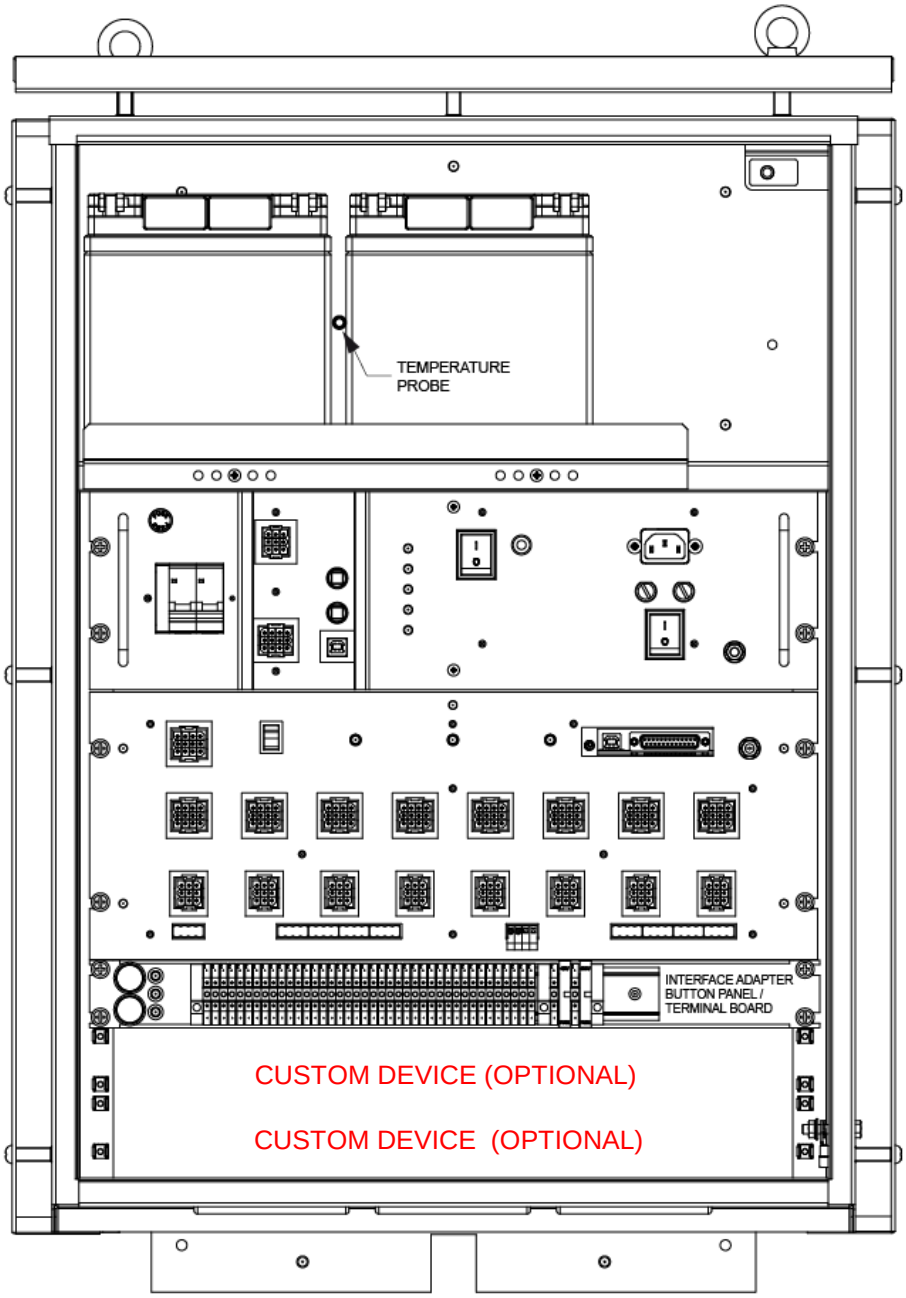


Figure 10 – Front view of the Standard version of the outdoor cabinet container.

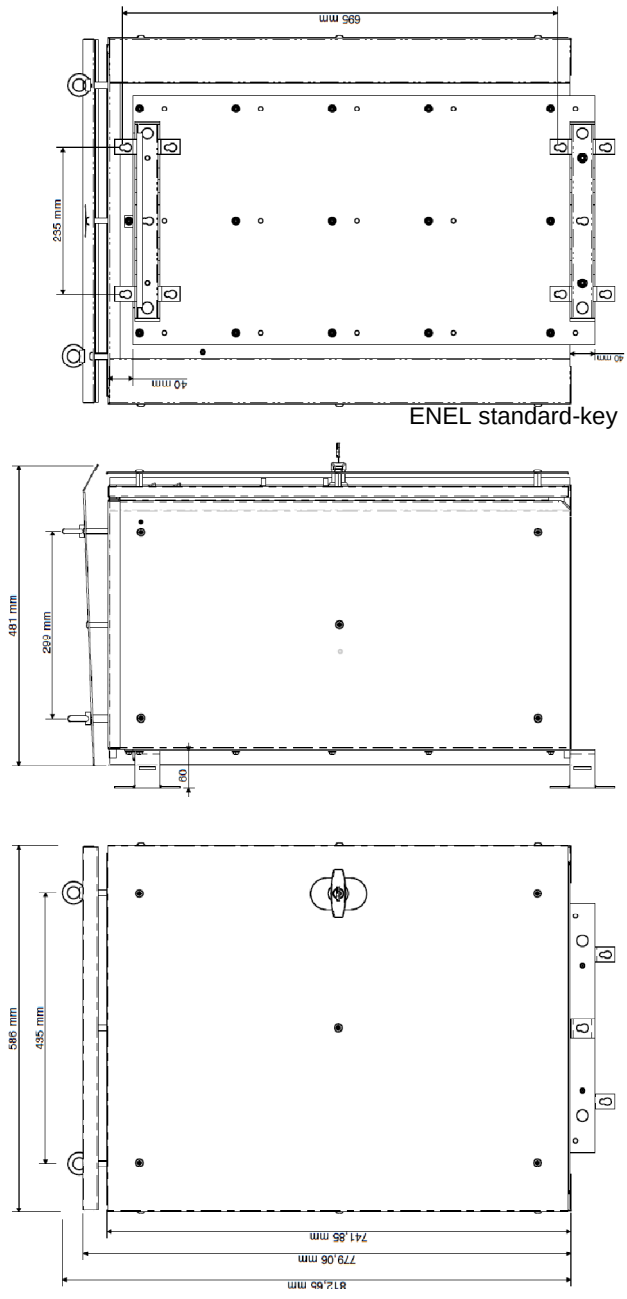


Figure 11 – Standard version of the Outdoor Cabinet container- Front/Left Side

The front door must be hinged on a side, and equipped with a door-lock compliant with the ENEL standard key, (see Figure 7).

With reference to battery compartment, the horizontal plane must be provided with a small edge to avoid the batteries slipping out from the front (see Figure 12 and Figure 13).

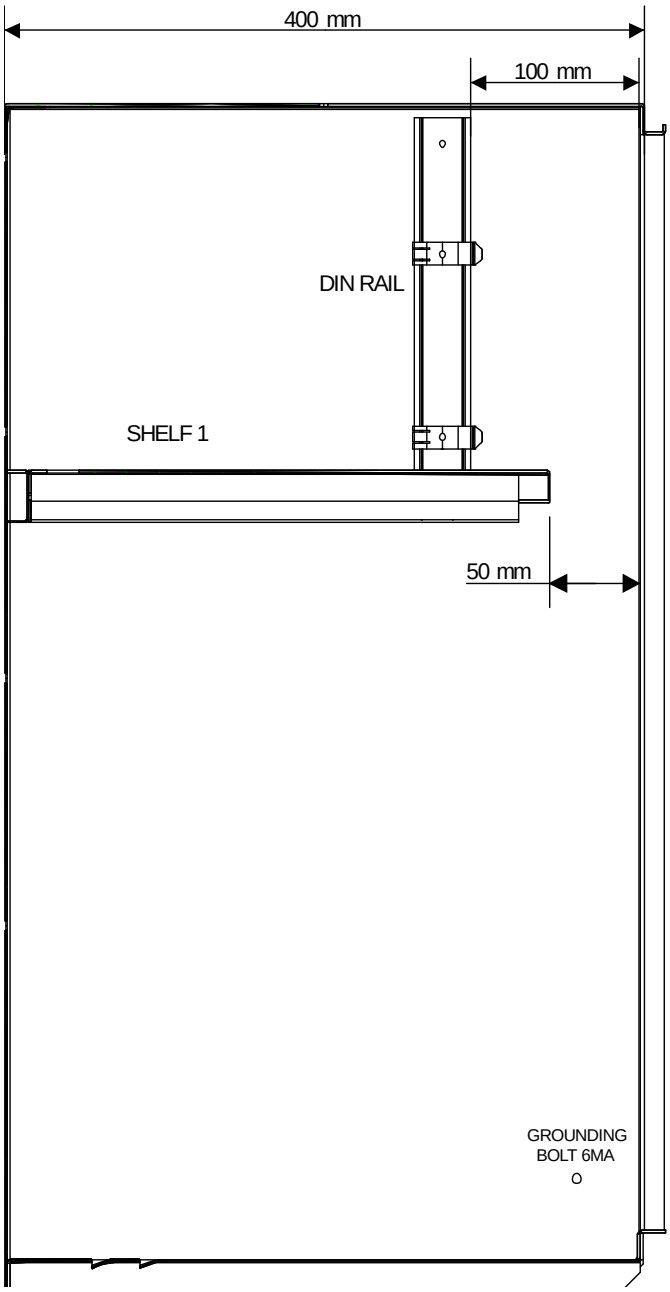


Figure 12 – Standard version of the Outdoor Cabinet container-Side view

4.3 Extended (XL) version of the Outdoor Cabinet container.

The extended version of the outdoor cabinet container differs from the standard version for the greater vertical space (Figure 13), an overall height equal to 20U.

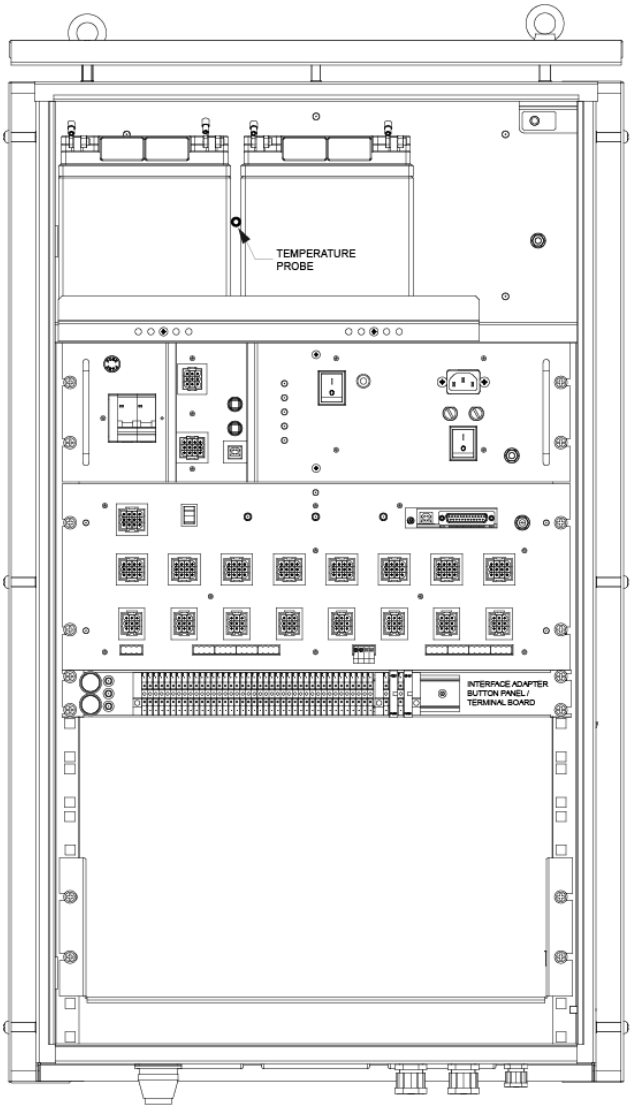


Figure 13 – XL version of the Outdoor Cabinet container– front view

Moreover, in this configuration, the box must be equipped with an additional shelf (Figure 14), which is useful to house other supplementary equipment. The fixing support must have a height of 3U.

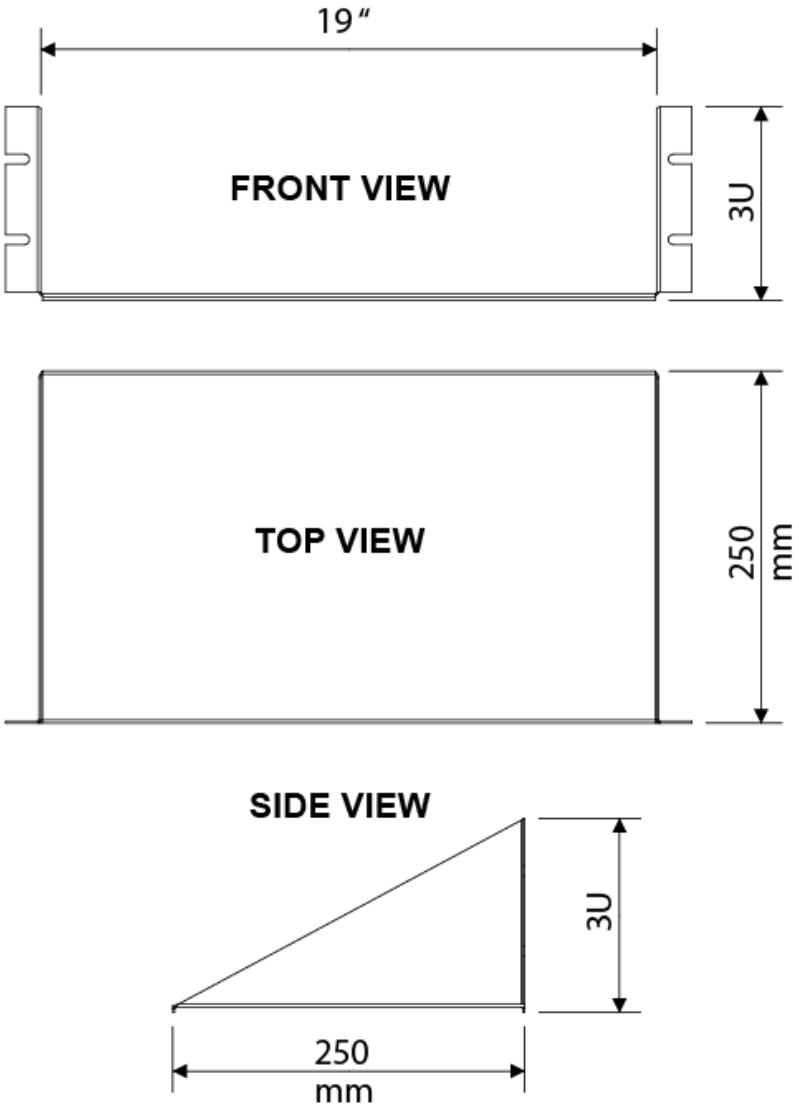


Figure 14 – Shelf for the XL version

5 EQUIPMENT TO BE PLACED INTO THE CONTAINER

The equipment which must be placed into the container are those which are compliant with the GSTR001/1 specification.

The UE which is referred to throughout this specification represents the 8-channel "basic" version, namely UE8.

As a function of the particular installation, different equipment can be realized: containing all of, or a subset, of the following components:

- Power supply/Battery charger (PSBC)
- UE8
- Custom devices
- Terminal boards for the interface with the switchgears and the RGDAT/RGDM, and the power supply terminal boards
- Batteries
- Communication module
- Other apparatus to be installed on the additional shelf (this shelf is present in the XL version only)

5.1 PSBC

The power supply to be installed is the one which is described in the specification GSTR001/1. The assembly will take place on the 19" rack with the screws and cage bolts included in the supply. The overal height is equal to 3U.

5.2 UE8

The UE8 to be installed is the one which is described into the GSTR001/1specification. The assembly will take place on the 19" rack with the screws and cage bolts included in the supply. The overall height is equal to 4U.

5.3 Custom devices

Must be allocate one or more custom devices on the 19'' rack with the screws and cage bolts included in the supply. The overall height is equal to 2U.

5.4 Terminal board

Only part of the 8 channels on the UE will be utilized. The interface among the UE and switchgear, RGDAT/RGDM and power supply terminal boards will be realized as follows:

• Channel 1: SG and DFPI connectors, leading from the RTU, will be made available on the pre-wired terminal board.

• Channels 2, 3,..,8: SG and DFPI connectors of the UE are available for a direct connection.

The terminal board must be assembled on a 19'' rack (with an overall height equal to 1U, where possible) with the screws and cage bolts included in the supply.

The technical solution, as well as the layout of the terminals provided with a fuse holder, must be compliant with the one shown in Figure 15, in order to contain the overall height within 1U. Figure 15 also demonstrates the trimmers (which are housed on the same bracket) for the adjustment of the thresholds of the temperature, and the humidity for the thermoregulation system.

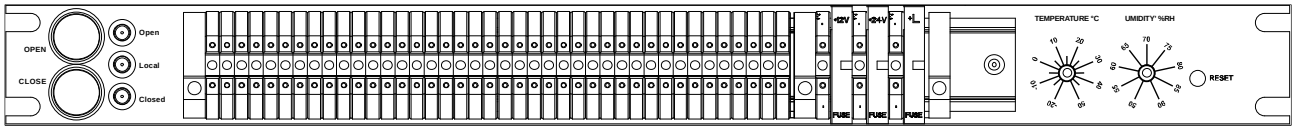


Figure 15 – Terminal board, example of solution.

The 3 LEDs at the left side of Figure 15, which indicate the open or closed position of the SG, and the local control configuration, respectively, must be available on the terminal board.

The board must permit the opening and closing of the SG, through a pair of buttons (green for the opening, red for the closure) which will be active only if the RTU is under local control. Under local control, the L+ signal provided on the terminal board has the high level, + 24V.

Figure 16 shows the detail of the terminals for the connection of the power supplies and the distribution to other devices. The positive terminals of the power supplies (nr.1 at 12V and nr. 1 at 24V) will be equipped with fuse holders and 2.5 A fuses, on the load side. The terminals must be connected in parallel via a comb-type busbar or pre-wired jumpers.

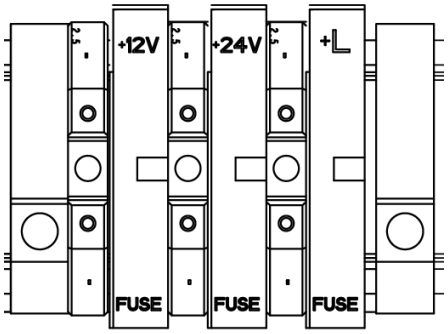


Figure 16 – Schematic diagram of the supply terminals

All of the terminals of this board must be provided with a screw tightening, for all of the cables with a section equal to 1,5mm^2. The connections to the battery poles, red for the positive and black for the negative, must have: a section ≥ 3mm^2 (2x1,5 mm^2), a length ≥ 80cm and, on the battery side, a collar label indicating the respective polarity and ring terminal connector for screw size M8 assembled in factory

The wiring between the connectors of channel 1 on the UE and the terminal board will be via two cables, which are included in the supply.

Each terminal must allow for the facilitate identification of the associated respective signal , following the naming of them which is adopted in the GSTR001/1 specification, as demonstrated in the following Table 1, Table 2, and Figure 17. The name may be stated on the board itself in alternative.

IMS	**Function**		**Peripheral Unit**
1	+M	Motor power supply (+24 V_{DC})	1
1	+M	Motor power supply (+24 V_{DC})	1
2	-M	Motor power supply (-24 V_{DC})	2
2	-M	Motor power supply (-24 V_{DC})	2
3	+A	Commands power supply (+24 V_{DC})	3
4	-A	Commands power supply (-24 V_{DC})	4
5	89CX	Closing command	5
6	89AX	Opening command	6
7	89ccx	Signal closing position switch-disconnector	7
8	89cax	Signal opening position switch-disconnector	8

Table 1– Pin out of the SG terminals

Terminal of the Interface board	Function		Pin of the FPI connector on the UE
1	COM RS	(+24 V_{DC}) Power supply and Commmon	1
2	51S	Overcurrent tripping	2
3	RS	RS Spare	3
4	TM	Measurement input (pole 1)	4
5	67S	Zero sequence directional tripping	5
6	TM	Measurement input (pole 2)	6
7	COM DO	Common Digital Output	7
8	DO	Digital Output	8
9	-	Power supply (-24 V_{DC})	9

Table 2 – Pin out of the FPI terminals

Nevertheless, NOT pre-wired terminals must be provided in order to connect an additional SG/DFPI channel.

The following items must be provided in the supply:

- Nr. 1 11-wire cable, called the "SG-TB cable", provided with:
  - the "SG" male 12-socket connector, on one end, compliant with the GSTR001/1 specification;
  - pre-wired cables on the terminal board, on the other end.
- Nr. 1 9-wire cable, called the “FPI-TB”, provided with:
  - the DFPI 9-socket male connector, on one end, compliant with the GSTR001/1 specification;
  - pre-wired cables on the terminal board, on the other end.

Any other cables of the above mentioned types can be requested and supplied as individual accessories.

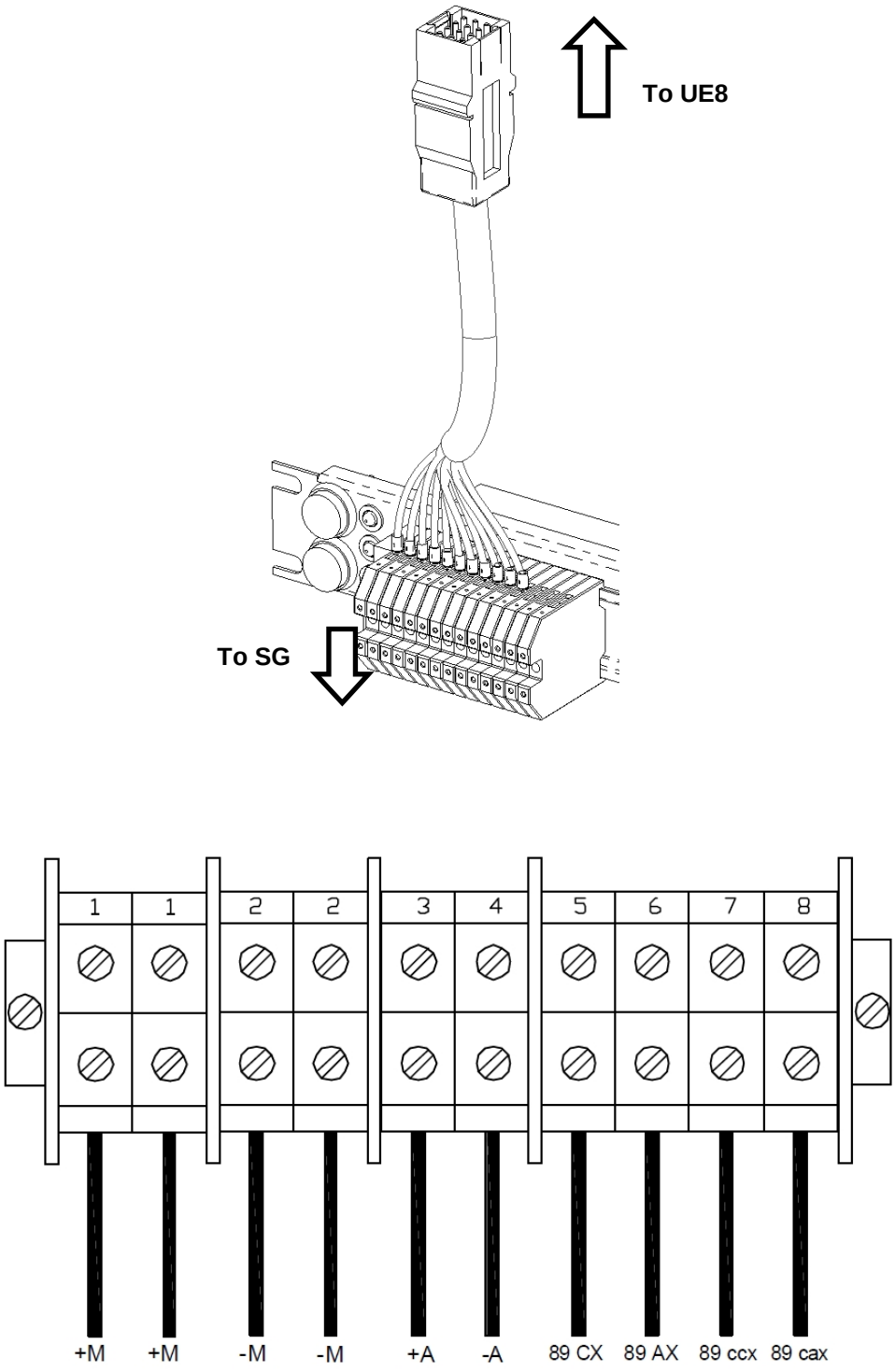


Figure 17 – Pre-wiring of the terminal board, in detail.

5.5 Batteries

The batteries must be compliant with the global specifications on batteries for secondary stations, and they will be housed inside an appropriate compartment.

5.6 Communication module

This module is an integrated device, which can be constituted by either a GSM/GPRS modem or a CPE device which is connected to either the UE8, or other Router interfaces, via the standard serial interface. The device allows to connect the RTU to the Central System, through various possible communication networks.

The module is powered through the 12 V_{DC} output, purposely provided for and derived from the terminal board.

6 Thermoregulation system

A system must be provided for the thermoregulation of the RTU, in order to guarantee an outdoor operating temperature in the range -20°C ÷ 55°C.

Alternative proposals, which differ from the two solutions described below, will be admitted, though they must be agreed upon in advance with ENEL.

6.1 SOLUTION WITH ANTI-CONDENSATION HEATER AND TEMPERATURE CONTROLLER

A (100 V_{AC}) 50W sized anti-condensation heater is provided, which is housed as low as possible within the container, and protected by a grill in order to avoid accidental contact with the conductors.

Moreover, a temperature controller (see diagram in Figure 18) must be housed in the cabinet container, which includes both humidity and temperature probes, which controls the anti-condensation heater, in order to guarantee standard climatic conditions within the container.

Using trimmers placed on the terminal board, the temperature and humidity threshold levels may be varied within the given ranges which are listed below:

Temperature: -20°C ÷+ 55°C;

Relative Humidity: 50 ÷90%.

In the event of failure or short-circuit of the anti-condensation heater (blown fuse), a warning alarm must be generated by the UE, which will in turn send it to the Center, using a spare RS.

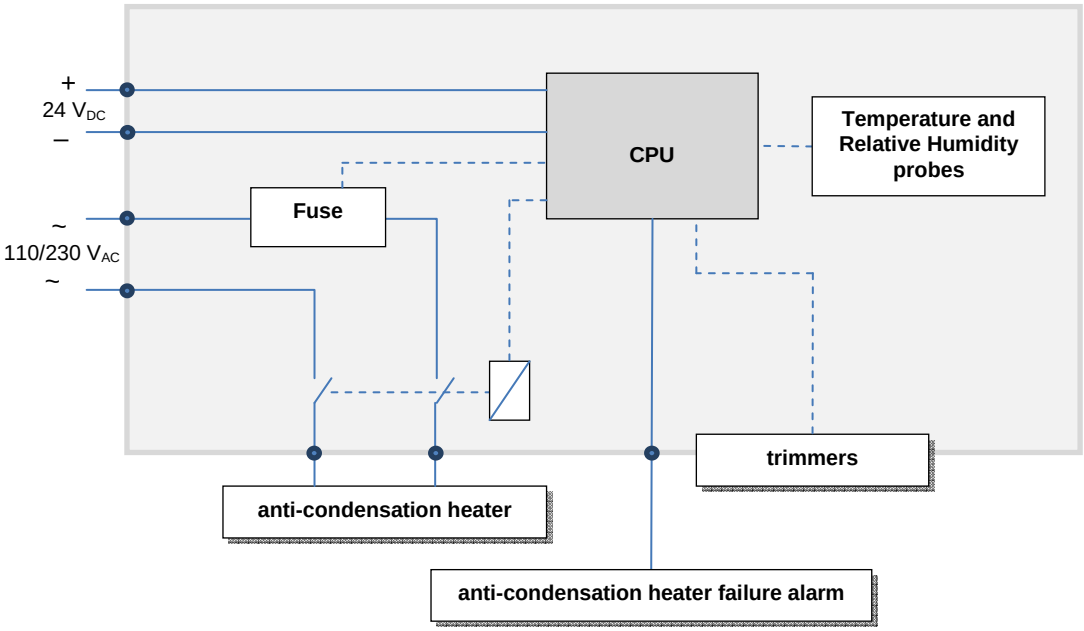


Figure 18 – Anti-condensation heater and temperature controller

6.2 SOLUTION WITH HEATER

If the controller is mounted in a watertight cell, it could occur that the variations of the relative humidity of the external ambient cannot be compensated. In this case, the heater can only control the temperature, through a thermostat, which is able to maintain the temperature of the watertight cell

above the pre-set minimum operating threshold of the RTU. The power of the heater may exceed 50W, though the overall consumption must be less than 200 VA.

In this case, a temperature probe, which is positioned opportunely, may detect the failure of the thermoregulation system. The probe is configured so that an alarm is generated (acquired on the spare RS 8) whereas the internal temperature is out of the normal operating range.

7 TESTING AND INSPECTION

In addition to the tests prescribed in the GSTR001/1, with relation to the RTU and the PSCCB, the following tests must be executed:

- type tests, with the aim to verify the perfect compliance of a production specimen with the technical specifications detailed in the present document;
- acceptance tests, with the aim to verify the essential characteristics of each specimen of the supply.

7.1 Type tests

The supplier must maintain and provide ENEL with access to the documentation which attests to the successful execution of the type tests.

7.1.1 Visual inspection

It is mandatory to verify the absence of visible manufacturing defects, the accuracy of construction, the compliance of the dimensions of the cabinet container with those indicated in the present specification, as well as the prescribed IP degree of protection.

7.1.2 Verification of all of the functionalities

All of the functionalities of either the thermoregulation system or of the terminal board controls must be verified.

7.1.3 Mechanical tests

The tests to be executed on the cabinet container, as well as the methodology of the execution of these tests, are described within the standards recalled in the following Table 3

(Sinusoidal) Vibration	lower frequency 10 Hz upper frequency 500 Hz acceleration amplitude 10 m/s2 displacement amplitude 0,075 mm	EN 60068-2-6
Vibration, broad-band random (digital control) and guidance		EN 60068-2-64

Table 3- Mechanical test

This test must be executed with all of the supplied panels mounted inside.

7.2 Acceptance tests

From the overall set of type tests, a subset of tests will be selected (i.e. the functionality of the thermoregulation system), useful for the acceptance of each specimen of the supply.

For each specimen supplied, a certificate must be provided, which attests to the success in the execution of the acceptance test.

8 POLE FASTENING SYSTEM

The pole fastening system, as well as the number of holes and their dimensions, must be defined by the constructor. This in order to guarantee the stability of the entire structure due to an overload equal to twice the equipment weight, for either the standard or the extended versions.

It must be possible to fix the container to the pole (Figure 19 – Pole installation) at approximately 2.5 m above the ground, so that the front panel door must be accessible by using a ladder set up on the pole.

Given that the pole diameter must have a range between 30 and 50 cm, it is recommended that a fastening system be constituted of a stainless steel band with clip.

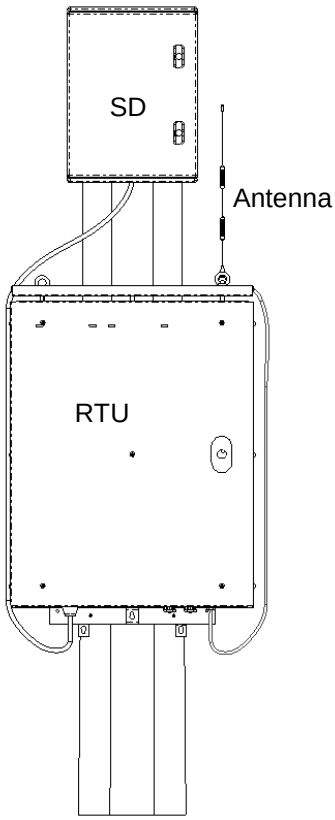


Figure 19 – Pole installation

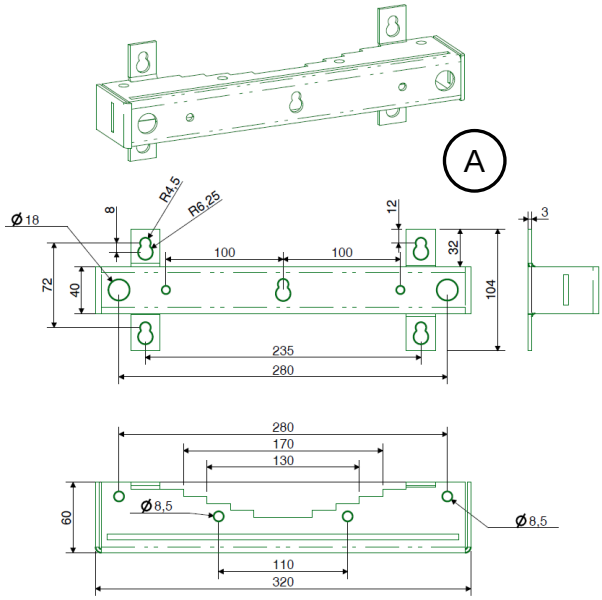
Components used for the proper assembly of the RTU are described in Figure 21; All the external components or hanging accessories must ensure effective and prolonged anti-corrosion properties according to the same requirements stated in the previous chapter 4.1.

The hanging systems must be engineered so as to withstand the weight of the RTU fully equipped and, in any case, no less than 120kg

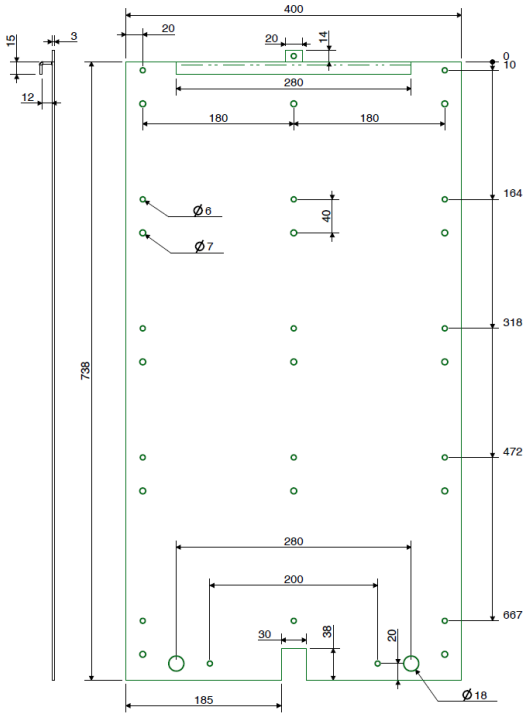
A plate (B) is mounted at the rear of the RTU, with the upper edge curved in order to allow the RTU to be hooked the RTU on the support (A). This last must be fixed in advance to the pole with metal clamps.

8.1 Mounting kit for poles with a squared section

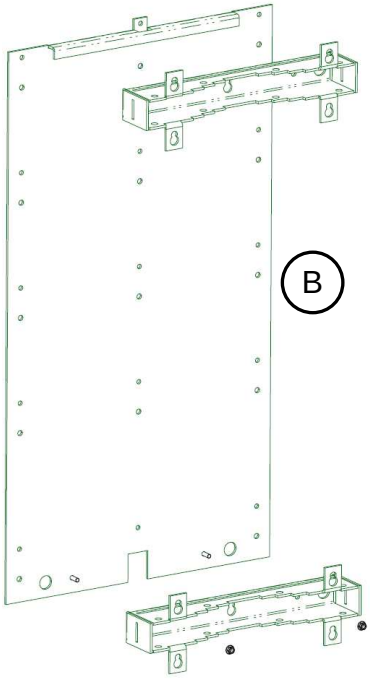
In case of poles having a squared section, an optional kit (C) must be engineered to be adopted as an additional accessory in the countries where these kind of poles are frequently used (see **Figure 20** part C). This Kit includes all the necessary bolts, screws and everything necessary to guarantee a proper installation.



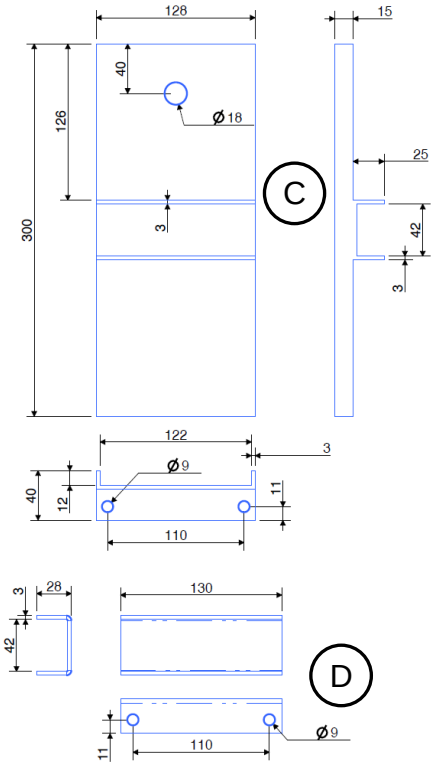
A) Support



B) RTU rear plate



Upper support must be fixed to the pole. Lower support must be fixed to the plate



C) Square pole kit

Figure 20 – RTU pole mounting kit

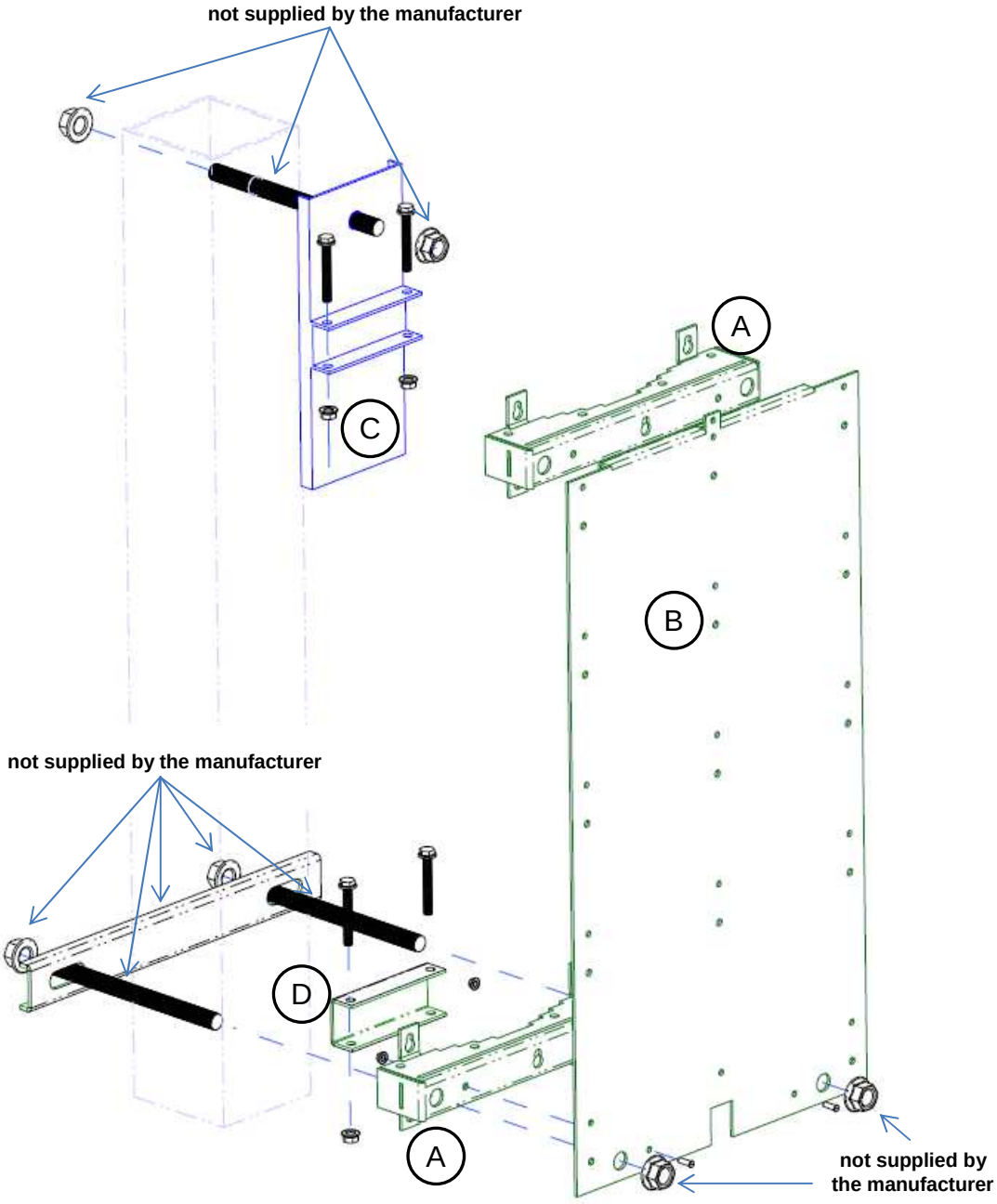


Figure 21 – Square pole mounting example

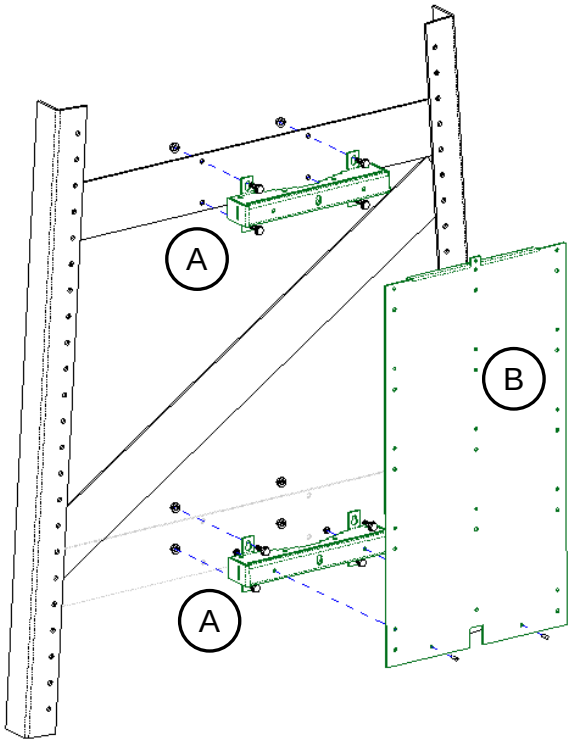


Figure 22- Pylon mounting example

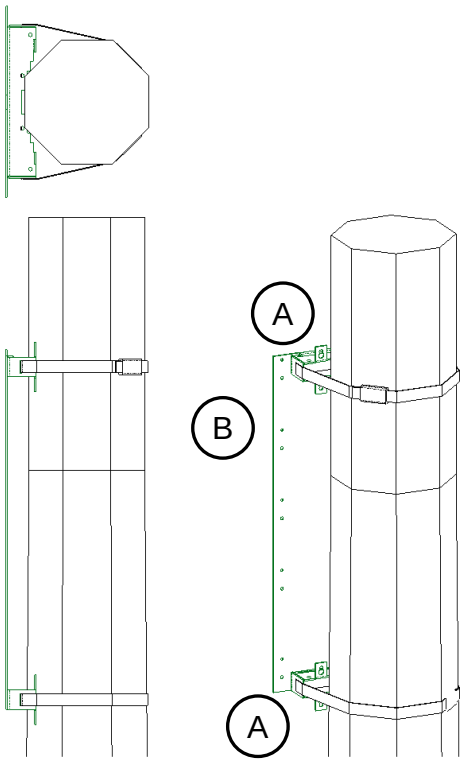


Figure 23 – Pole mounting example

9 Ambient operating Conditions

The apparatus provided must be in compliance with the operating conditions listed below:

- Ambient temperature limit in the range of -10 ÷ 55 °C;
- Atmospheric pressure in the range of 70 ÷ 106 kPa;
- Humidity limit of 93% at the max ambient temperature;
- Storage temperature in the range of -25 ÷ 70 °C.

10 Equipment documentation

The provider must produce detailed documentation of the operation, configuration and maintenance of the equipment, accompanied by either the wiring and topographic diagrams, or the lists of components. These documentation must be provided electronically.