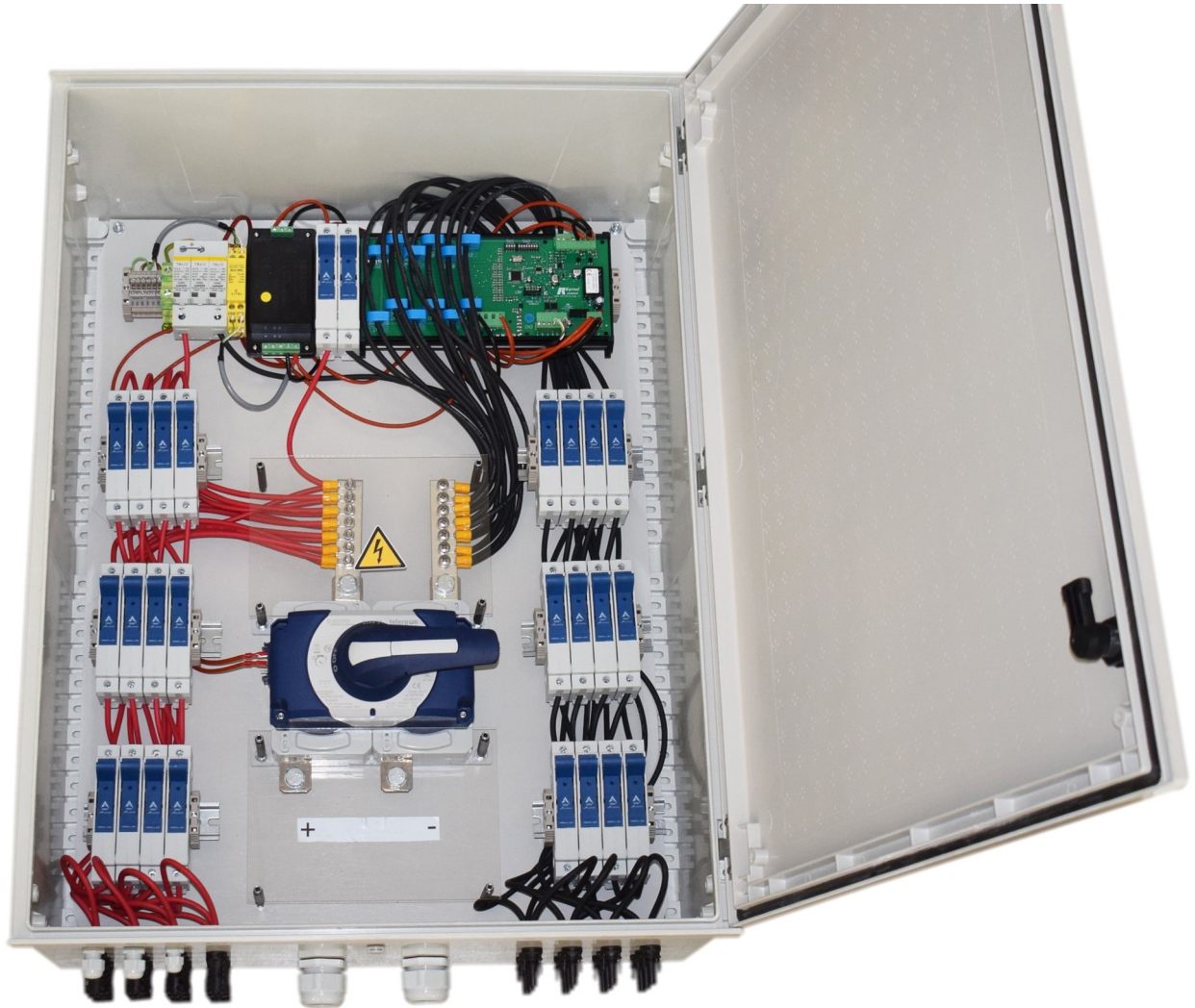


ITSMB



String Monitoring Box Installation and Operation Manual



rev. 3.5
13 May 2024

INDEX

1 BEFORE TO START.....4

1.1 Before to Start.....4

1.2 Principal Naming Convention.....4

2 GENERAL NOTES.....5

3 SAFETY INSTRUCTION.....5

4 OVERVIEW.....7

4.1 Block Diagram.....7

5 INSTALLATION.....7

5.1 Symbols legend.....7

5.2 Internal Structure with SMU ST0HS1625.....8

5.3 Internal Numbering of Fuses.....9

5.4 Bottom View.....10

5.5 Example: Electrical diagram.....11

5.6 Example : Front Panel Layout.....11

5.7 Example : Bottom Connections.....12

5.8 Example : Routine Test Report.....12

5.9 Staubli MC4 Connectors.....13

5.10 Fixing Instructions.....14

 5.10.1 Fixing using the brackets horizontally.....14

 5.10.2 Fixing using the brackets vertically.....15

6 OPERATION AND MAINTENANCE.....16

6.1 Connector : CN4.....16

6.2 Dip-switches.....16

6.3 RS485 Communication cable.....17

7 MOTOR OPTION (TLG_0404R).....18

7.1 Operation and LEDs Status.....18

7.2 I/O Connections.....18

7.3 DIP-SWITCHES.....19

7.4 Communication.....19

7.5 Memory.....19

8 TECHNICAL DATA.....21

8.1 String Monitoring Box Parameters.....21

8.2 Mechanics Characteristics.....22

8.3 Dimensions and Weight.....22

9 MAINTENANCE.....22

10 ORDER CODES.....23



Warning : Qualified Technical Personnel

All work must be carried out by qualified personnel. Operations could be dangerous to you and other people using this equipment. For safety reasons, all installation and wiring connections must be made by qualified technical personnel only.

Use installation tools suitable for system voltages. Protective gloves should be used against electrical hazards.

During its installation and operation, the personal safety regulations in force in the system for which the product is intended are mandatory.

It is recommended not to wear loose clothing or other clothing or accessories that could come into contact with the components of the SMB, especially the metal parts.



General Warning

*It is mandatory to read this user manual in its entirety before proceeding with the installation, use and maintenance of this equipment by qualified technical personnel.
Follow scrupulously all indication reported in this manual.*

This equipment is manufactured in compliance with current safety standards, therefore it is recommended that you use all of these devices and make sure that their use does not cause damage or injury.

*This electrical panel must only be used for the purpose for which it was expressly designed.
Any other use is to be considered improper and therefore dangerous.*

*Disconnect the equipment in case of malfunction.
Before performing any maintenance operation, disconnect the equipment.
Do not handle or manipulate the panels in the presence of water, rain or condensation.
See the instructions on the disconnection of the equipment.*

All electrical installations must be carried out in accordance with local building codes and local authority requirements.

It's mandatory to install SMB in the environment conditions indicated on technical characteristics, which were design requirements, for its right operation.

Any connection work must be done with the equipment unplugged. The disconnection from the main switch and the isolation of the input circuits from the photovoltaic modules does not guarantee the total absence of dangerous voltages inside the SMB. To access the conductive parts of the equipment safely, it is essential to isolate it from the inverter line (outputs), from the direct current lines of the solar panels (inputs) and from the external power supply line of the electronic equipment (if any).



Maintenance

Always use a suitable voltage sensing device to confirm that the power is off before installing or working with the panel.

Local, state and national regulations and safety practices for this type of equipment must be observed.

Only authorized personnel can access the panel. All maintenance and technical assistance work must be carried out by authorized "Specialised Personnel".

All inspections and tests must be performed with controls and equipment de-energized, disconnected and isolated from accidental contact with live parts, and all plant safety procedures must be followed.

Remember that for any manipulation inside the SMB all the warnings and safety measures indicated in the previous points must be considered.

1 BEFORE TO START

1.1 Before to Start

- Examine all components before connecting. Internal connections must be carefully inspected before installation.
- Check cable connections and check the fixing of the non-active parts whose function is the protection against direct contacts of the active parts.
- General cleaning: Remove any internal objects (wire pieces, screws, nuts, wires...), insects, dust and dirt.
- Do not install the panel near any flammable or corrosive substance.
- Check the correct tightening torque of the electrical connections to avoid bad contacts. **Incorrect tightening or low wire cross section may cause fire and shock hazard as well as shorten the life of this product.**

SMB's work with direct voltage which can reach up to 1500V. Its manipulation is highly dangerous, which can cause severe burns and even death if are not taken preventive measures or is handled by unqualified personnel.

1.2 Principal Naming Convention

IT	SMB	08 160	H	V	D	M
Italy	STRING MONITORING BOX	Channels-Ampere	Hall Sensors	Vertical or Horizontal	Double Fuses	Motor

NOTES

- V : Vertical(V) or Horizontal(O)
- Double Fuses : Fuses on both the positives of the strings and the negatives

(for further information on the SMB CODES see chapter 10)

2 GENERAL NOTES







Thank you for choosing this PV String Monitoring Box (simply called "SMB" in the following of this manual).

This String Monitoring Box is a highly reliable product.

This manual mainly includes product description, installation, safe operation, troubleshooting and other important information of the String Monitoring Box. Please carefully read this manual before you operate on the String Monitoring Box.





3 SAFETY INSTRUCTION

Introduce the safety instructions of operation and maintenance on the SMB.

Icon	Meaning	Description
	DANGER	Indicates a very dangerous situation which, if not avoided, will result in death or serious injury.
	WARNING	Indicates a dangerous situation which, if not avoided, will result in death or serious injury.
	CAUTION	Indicates a dangerous situation which, if not avoided, will result in minor or moderate injury
	INSTRUCTION	Indicates important supplementary information and / or provides skills that can be used to help you solve a problem or save time.
	HIGH VOLTAGE	The product works with high voltages. Everyone works on the product should only be performed as described in this document.
	EARTH GROUND	This symbol indicates the location of the grounding terminal, which must be firmly connected to the earth via the PE (protective earth) cable to ensure operational safety.

*The information contained in this document may change without notice.
Therefore, please check our website (www.solarbox.it) regularly
and always download the latest version available.*

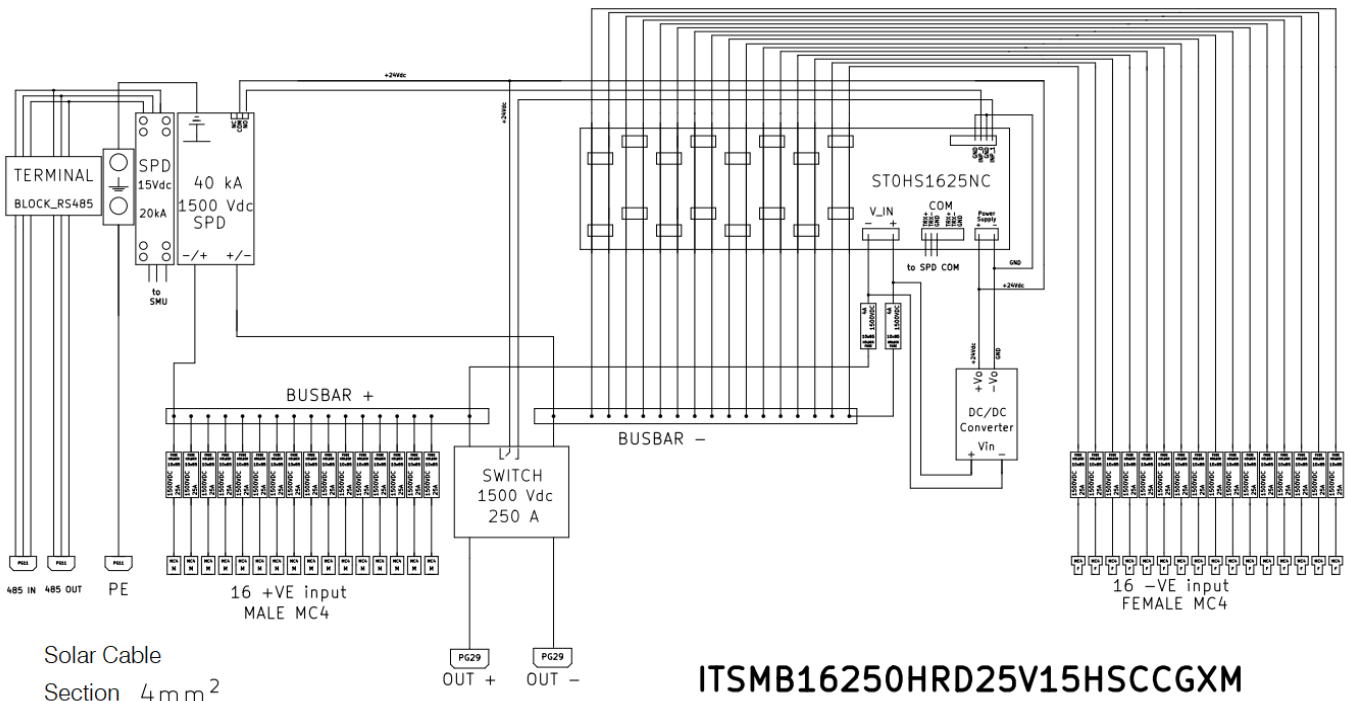
Important Safety Instructions

	<p>DANGER</p>	<ul style="list-style-type: none"> - Do not touch the terminals or conductors connected to PV modules or PV inverters, which could cause death by electric shock! - Contact with wiring terminals inside the device can cause death by electric shock! - SMB works with direct voltage which can reach up to 1500 V. Its handling is highly dangerous, which can cause severe burns and even death if preventive measures are not taken or it is handled by unqualified personnel.
	<p>WARNING</p>	<ul style="list-style-type: none"> - Make sure the DC and AC sources are both disconnected and the device shell is securely grounded to avoid electric shock when servicing or installing the device. - Please check all input and output wire terminals in case of high DC voltage and make sure there is no voltage before electrical connection to avoid electric shock! - Do not touch the live parts of the input and output sides to avoid electric shock when checking or maintaining the device
	<p>CAUTION</p>	<ul style="list-style-type: none"> - Although the SMB is certified according to international safety standards, it becomes hot during operation. Do not touch the hot parts of the device during operation. - All wiring and operation must comply with the requirements of the relevant local standards of the device. - Check the device and make sure there are no problems with the installation before putting it into operation! - Be careful to move the SMB in case of a fall due to the weight of the device! - Although the device is IP66 protection class and can be applied outdoors, do not install the device in humid places or in direct sunlight as it is also an electronic device. - Connect the wires to the positive and negative marked positions of the device to avoid the risk of short circuit, ensure personal safety and keep the device in normal operation. - Pay attention to all wiring and safety instructions for the SMB. - Heavy device, please move carefully!
	<p>INSTRUCTION</p>	<p>The product nameplate contains important information about the device, including model name, lot number, etc. If there is any problem or malfunction of the device during operation, customers can contact us directly and communicate the product serial number and the problem encountered: our assistance staff will do their best to help you promptly. Please keep the identification plate intact.</p>

4 OVERVIEW

Introduce the mechanical structure, schematic diagram, etc. of the SMB.

4.1 Block Diagram



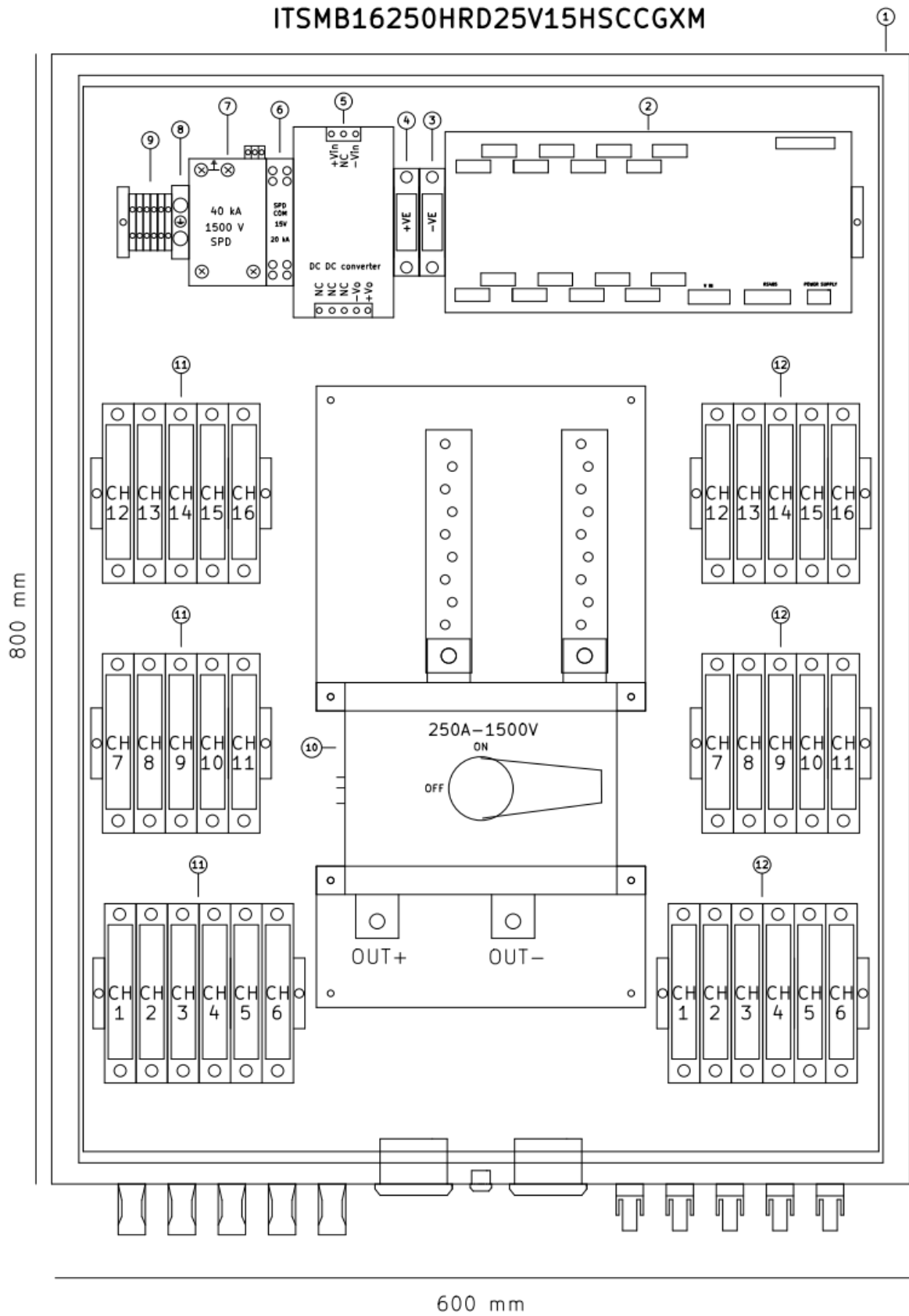
5 INSTALLATION

Introduce the installation, wiring steps and safety instructions of the SMB.

5.1 Symbols legend

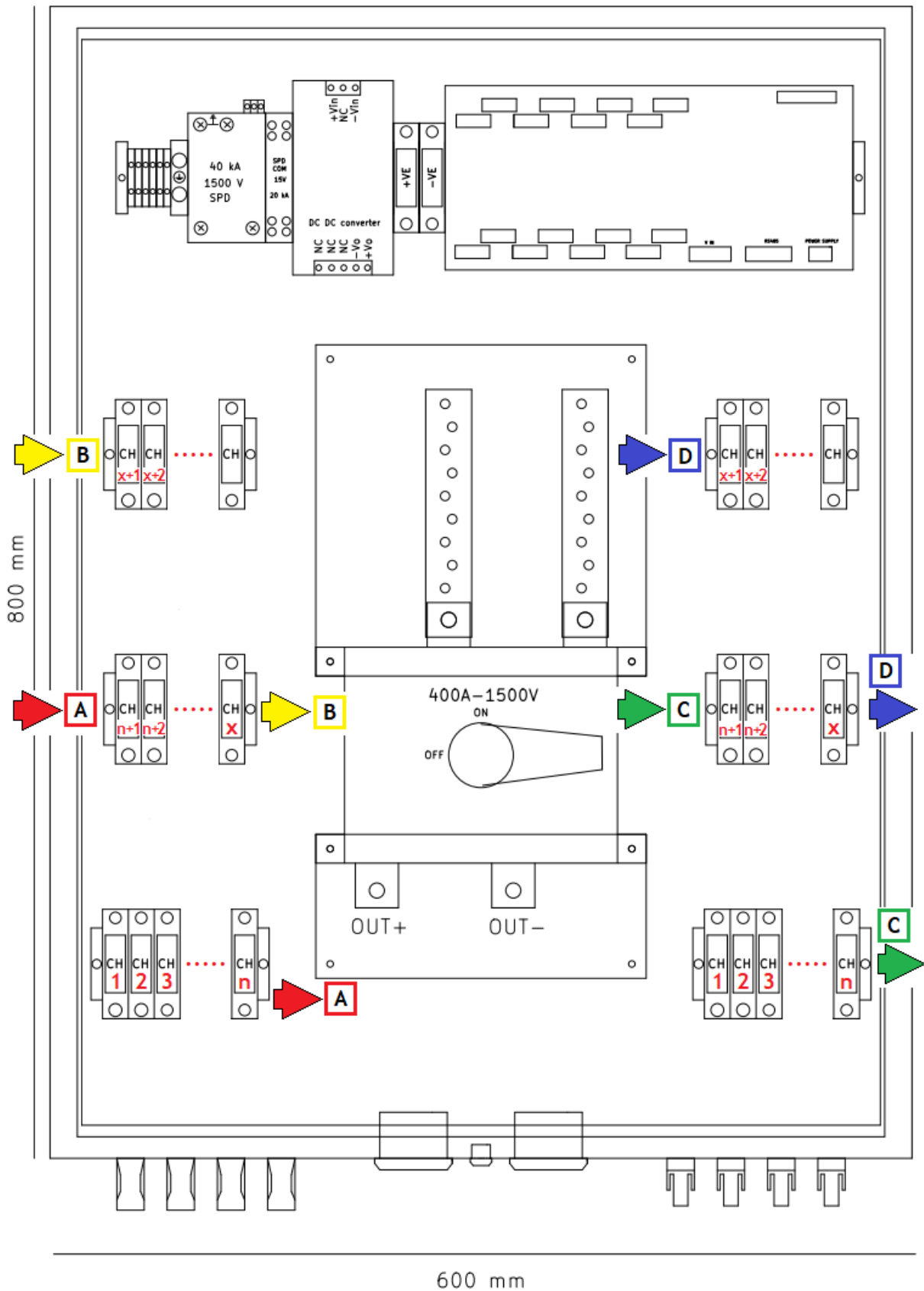
N°	DESCRIPTION
1	ENCLOSER 800x600x300
2	SMU ST0HS1625NC
3	FUSE HOLDER -VE 10X85 1500V 4A
4	FUSE HOLDER +VE 10X85 1500V 4A
5	DC DC CONVERTER
6	SPD COMMUNICATIONS PORT 15V 20 kA
7	SPD 1500V 40 kA
8	TERMINAL BLOCK PE
9	TERMINAL BLOCK COMMUNICATION RS485
10	SWITCH DISCONNECTOR 250A 1500V
11	FUSE HOLDER +VE 10x85 1500V 25A
12	FUSE HOLDER -VE 10x85 1500V 25A

5.2 Internal Structure with SMU ST0HS1625



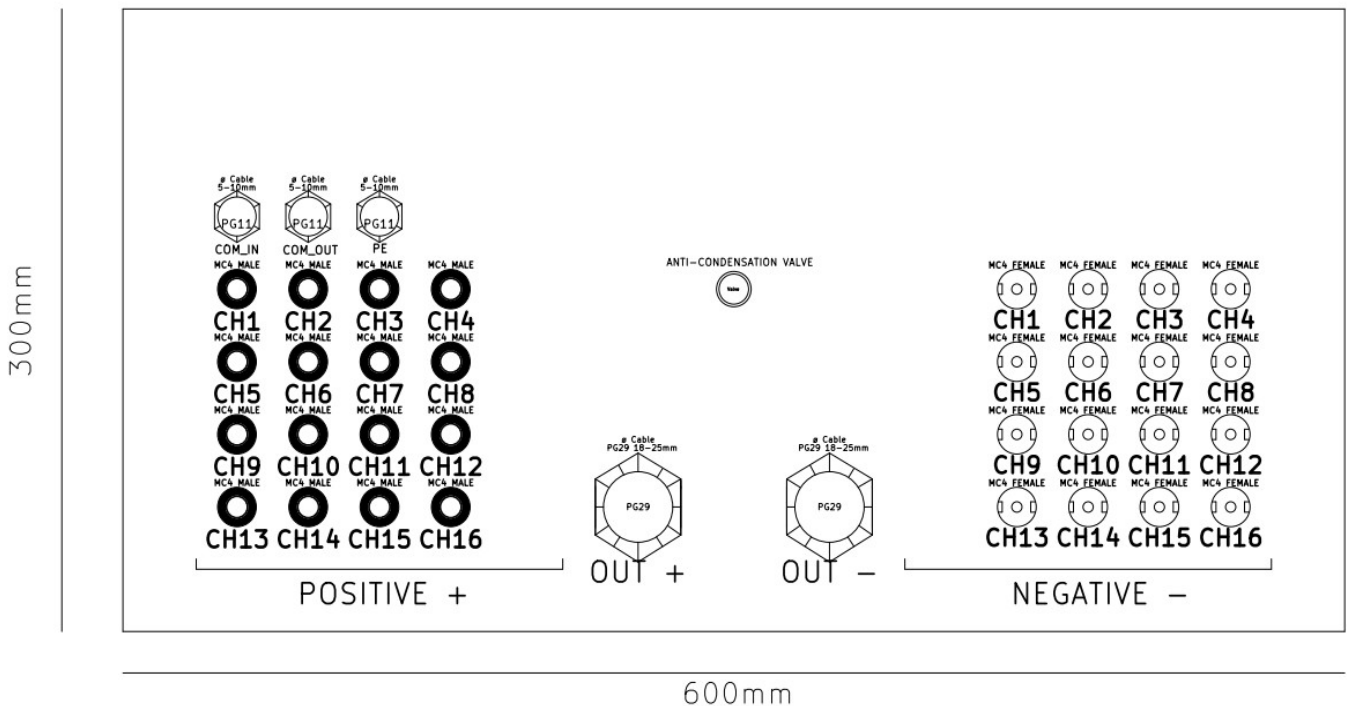
5.3 Internal Numbering of Fuses


ITSMB16400HRD15V10HSCCFXM



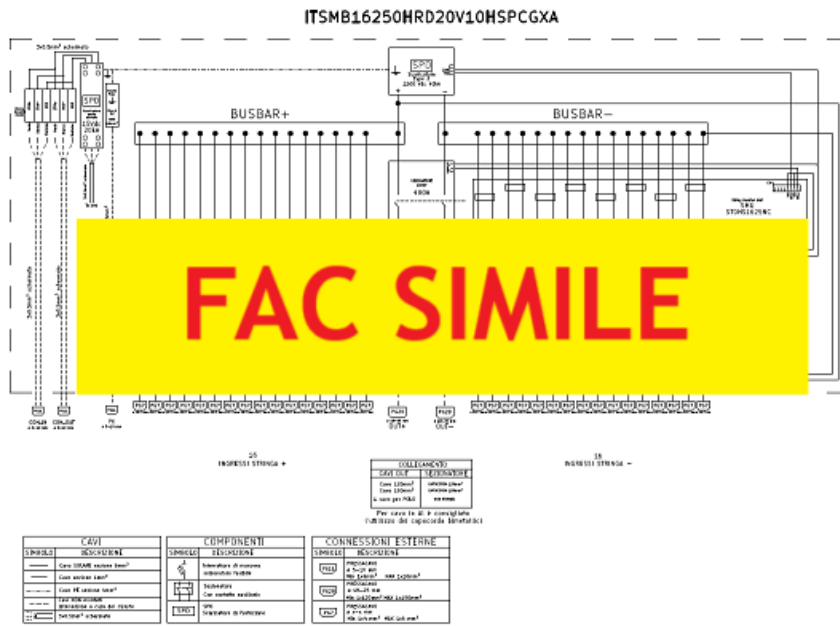
5.4 Bottom View

ITSMB16250HRD25V15HSCCGXM

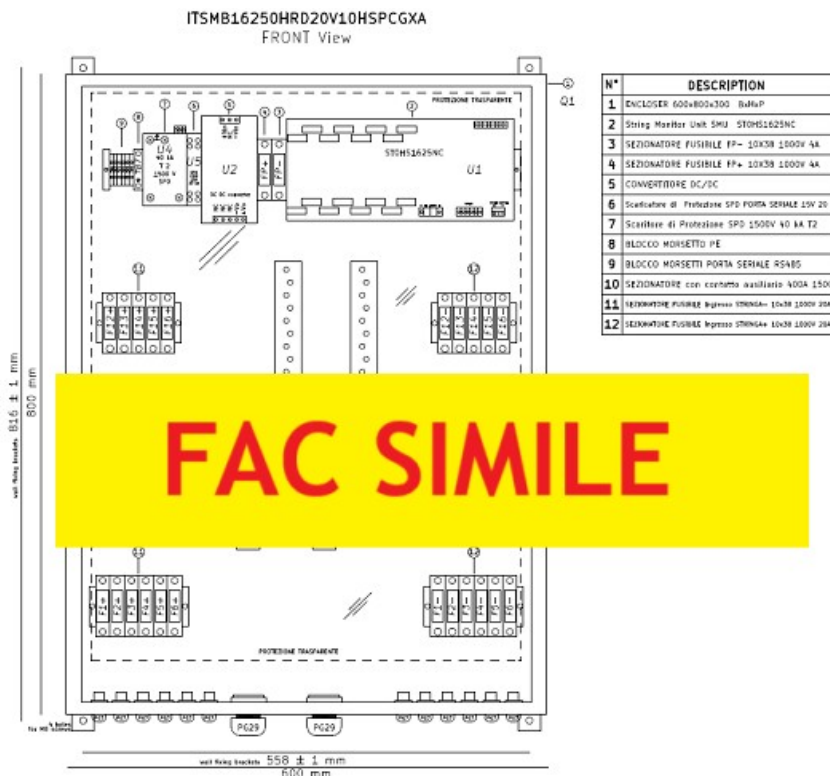


	<p>IMPORTANT</p>	<p>Each box will be accompanied by the following documentation :</p> <ul style="list-style-type: none"> • electrical diagram • front panel layout • bottom connections • documentation relating to assembly <p>Furthermore, the testing certificate will be provided for each panel.</p> <p>In accordance with the "IEC 62790 chapter 4.2" standard, in the panel there is a label with the following information :</p> <ol style="list-style-type: none"> 1. Name and mark of origin of the manufacturer (SolarBox) 2. Identification of the type / product code 3. CE mark and lot 4. Polarity <p style="text-align: center;"><u>THE LABEL MUST NEVER BE REMOVED</u> <u>under penalty of invalidation of the guarantee</u></p>
---	-------------------------	--

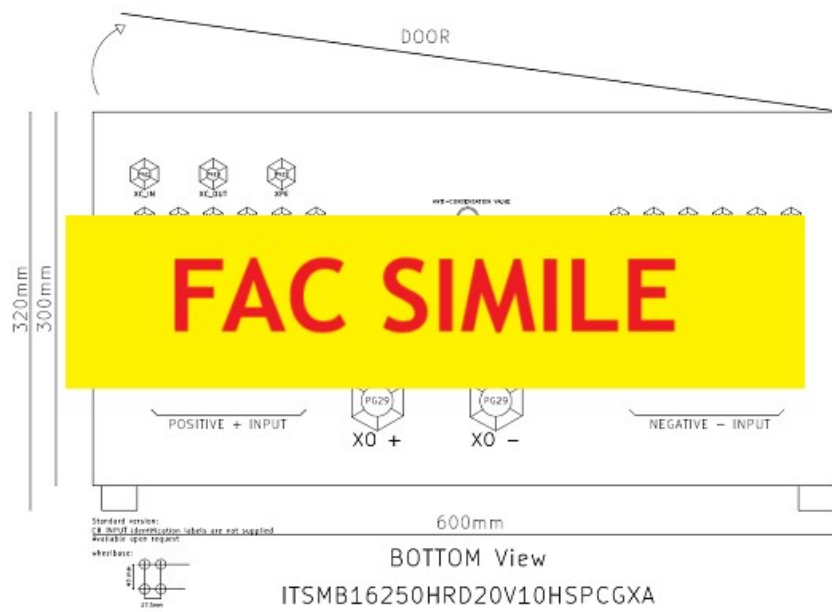
5.5 Example: Electrical diagram



5.6 Example : Front Panel Layout



5.7 Example : Bottom Connections



5.8 Example : Routine Test Report



Routine Test Report

Codice BOX :



Numero Commessa :

Numero Seriale :



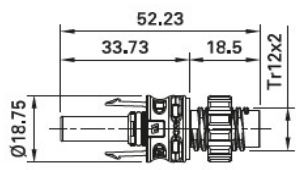
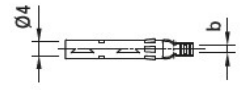


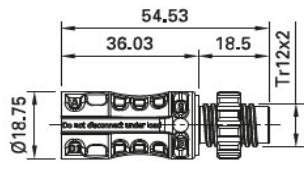

No.	Gruppo	Contenuto del test	IEC 62790-2020 Sezione	Risultato del Test	Operatore del Test
1	A	Marcatura, informazione, documentazione	5.4 Tab.8	√	
2	C	Requisiti costruttivi	5.4 Tab.10	√	
3	D	Prove meccaniche	5.4 Tab.11	√	
4	E	Sequenza di prova I	5.4 Tab.12	√	
5		Collaudo completo del BOX Collaudo completo di INPUT, OUTPUT, PE		√	

FAC SIMILE

5.9 Staubli MC4 Connectors

	IMPORTANT	STAUBLI MC4 Male connectors and FLEX-SOL cables ARE NOT supplied . Recommended connectors and cables must be purchased separately and wiring properly.
	IMPORTANT	We are not responsible for the consequences resulting from the use of non-original spare parts and / or non-compliant products that do not comply with the instructions written in this manual.

Cables and Connectors

FEMALE Connector	FEMALE: MC4 PV-ADB4-EVO 2/6-UR Connected to the Box : NEGATIVE -
<p>PV-ADB4-EVO 2</p>    	
MALE Connector	MALE: MC4 PV-ADS4-EVO 2/6-UR Connected to the Box : POSITIVE +
<p>PV-ADS4-EVO 2</p>    	

IMPORTANT

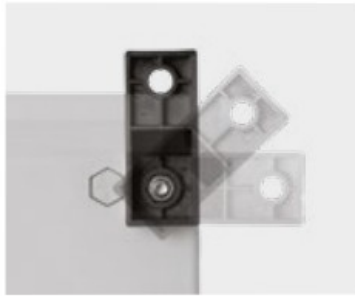
**In accordance with the "IEC 62790 - chapter 4.2" standard :
Before connecting/disconnecting any MC4, disconnect the equipment. Check that there is no voltage!**



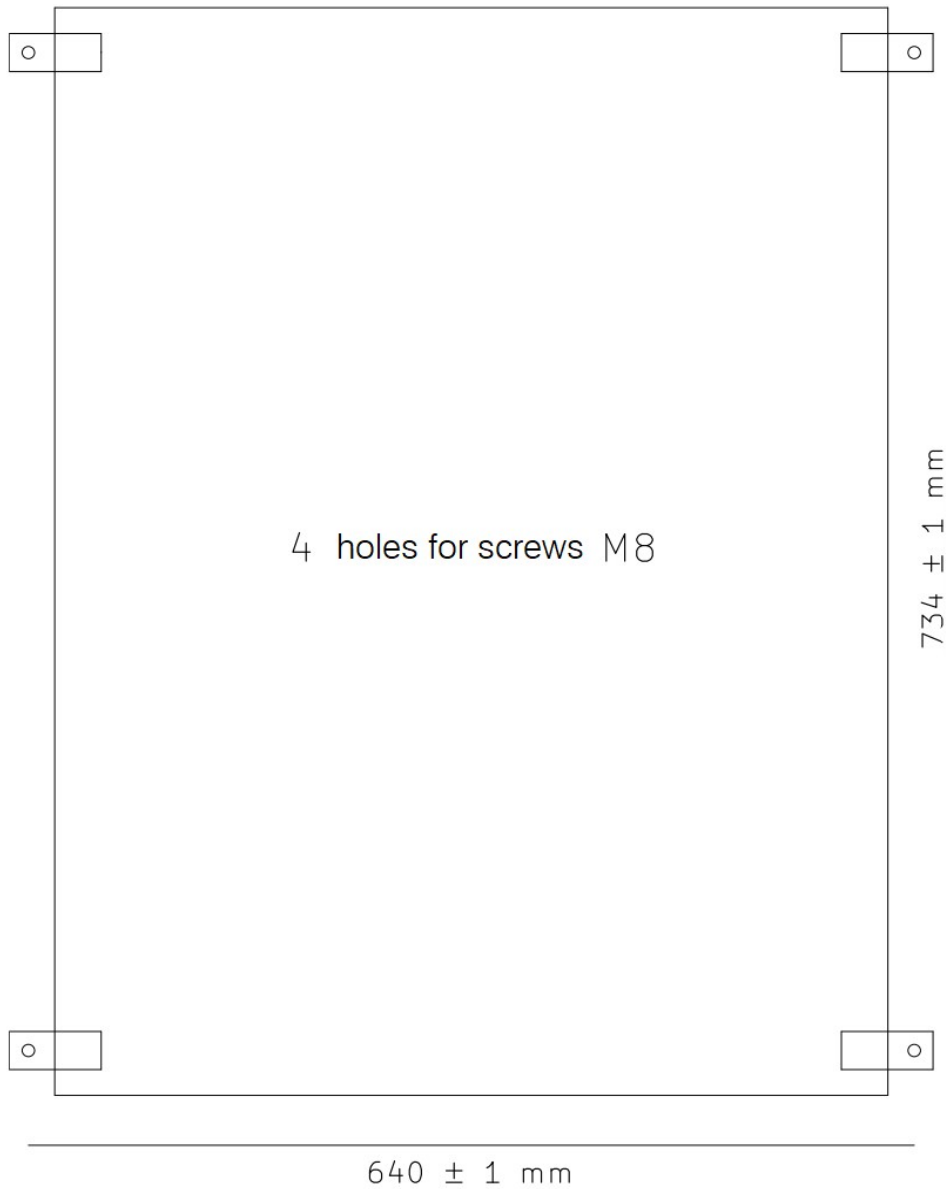
5.10 Fixing Instructions

IMPORTANT : Brackets are included (Screws and dowels NO)

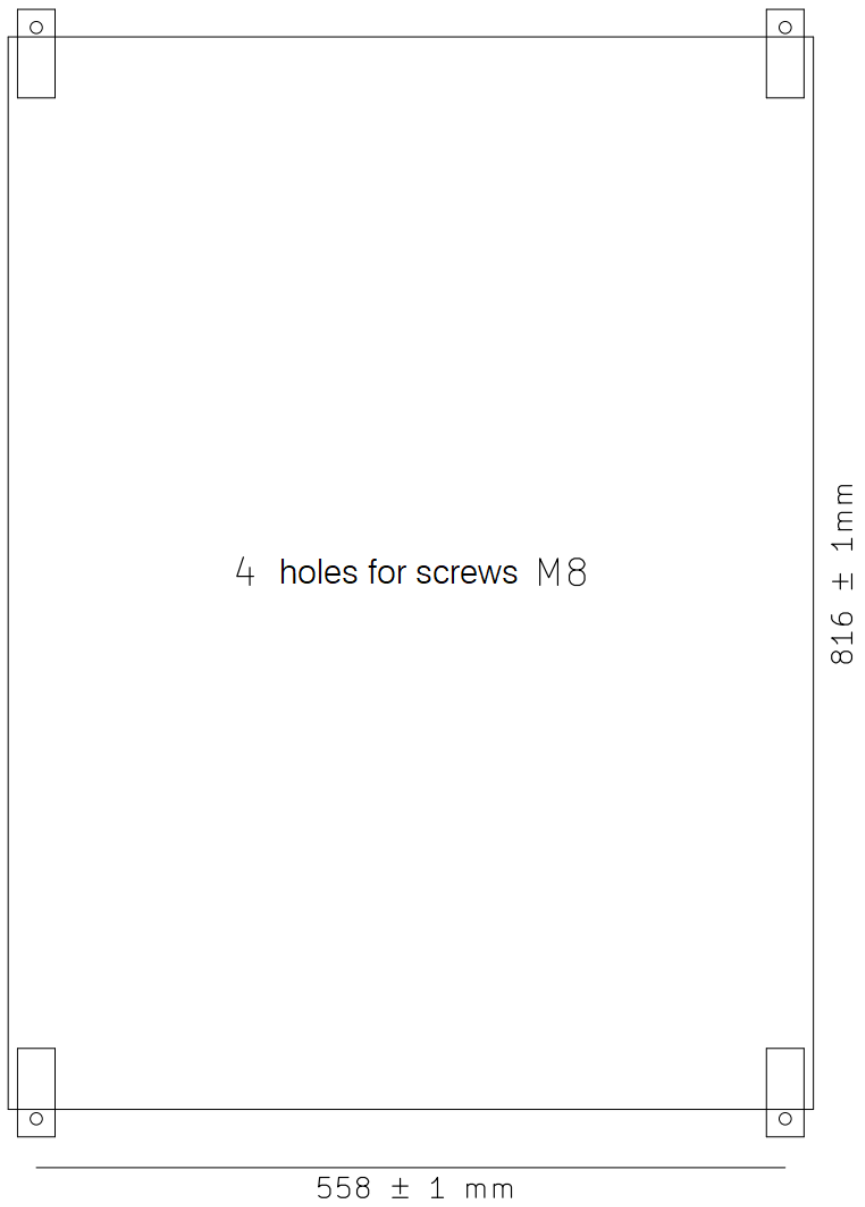
Wall mounting



5.10.1 Fixing using the brackets horizontally



5.10.2 Fixing using the brackets vertically



6 OPERATION AND MAINTENANCE

Introduce how to configure the SMU

IMPORTANT : Configure SMU before connecting the SMB

6.1 Connector : CN4

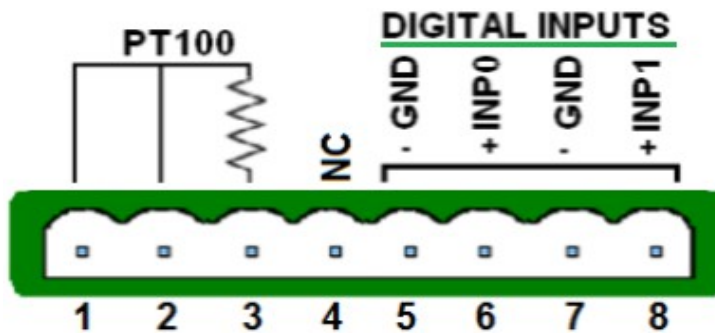
To know when a switch (for example the general one) is ON or OFF, there are two digital inputs PNP 24 Vdc on terminal block CN4. Each digital input status is indicated also by a led status on board. You need to use the pins 5, 6, 7 and 8. Inside the memory map the bits from 0 to 1 of register 30001 are the digital input status.

INP 1

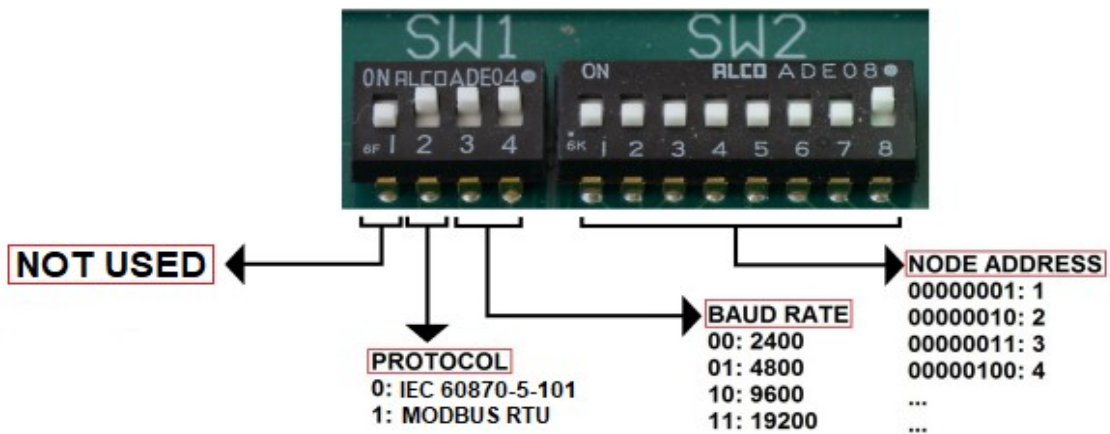
- = 1 if the switch is CLOSED there is voltage at the output of the panel
- = 0 if the switch is OPEN and there is NO voltage at the output of the panel

INP 0

- = 1 when the SPD [40 KA] is activated (for example if it was struck by lightning)

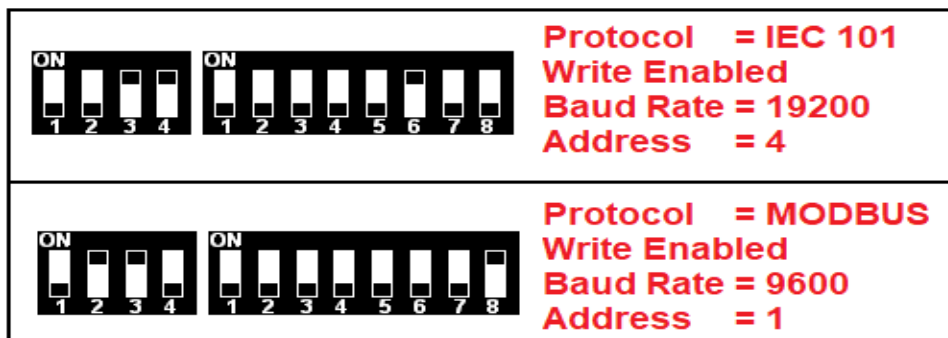


6.2 Dip-switches



Note : Parity = NO_PARITY ; Bit = 8 ; Stop = 1

Some dip-switches examples :



6.3 RS485 Communication cable

Everything about the RS485 connection, must meet certain features :

Maximum cable length

it must be no longer than 1,2 Km (it means the entire line length, and not the connection between two nodes)

Maximum number of slaves

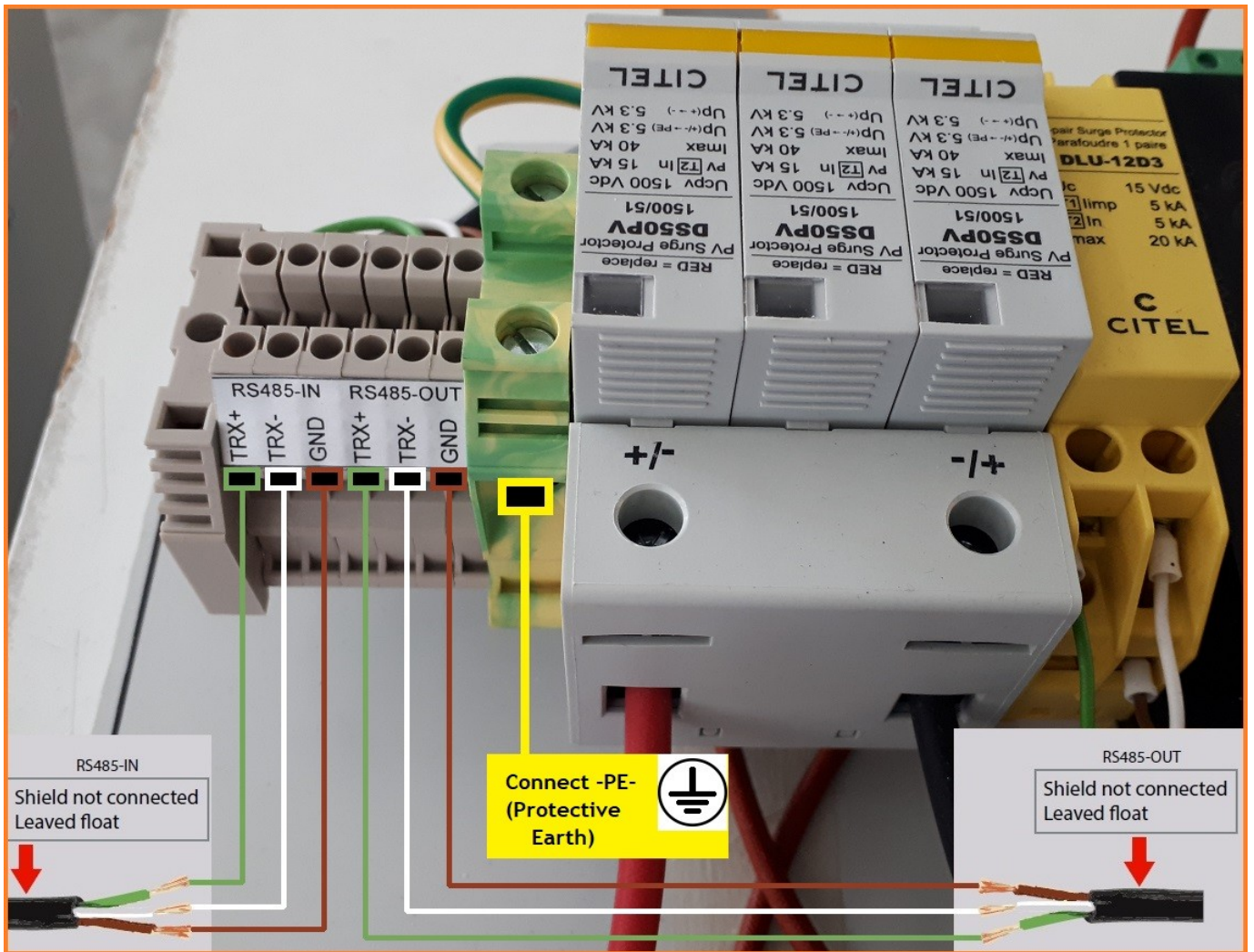
it's possible connect up to a maximum of one hundred slaves

Technical characteristics of the cable to use

It must be a three-wire cable 3 x 0.75 mm

How to do the RS485 connection

The RS485 connection must be a three wires connection (TX+, TX- and GND) with a shielded cable. The cable shield must be leaved float, it means that the shield must be not connected neither one side nor the other one.



7 MOTOR OPTION (TLG_0404R)

SMB CODES											Type of Connectors					
<u>IT</u>	<u>SMB</u>	<u>12</u>	<u>250</u>	<u>H</u>	<u>R</u>	<u>D</u>	<u>10</u>	<u>V</u>	<u>15</u>	<u>M</u>	<u>S</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>

This chapter is about :
How to pilot the switch = MOTOR [M]

How to pilot the Switch
 M = Motor ←
 H = Handle
 E = External Handle
 X = No Switch

7.1 Operation and LEDs Status

If the PC/PLC communicates with the TLG_0404R, the 2 LEDs flash rapidly SIMULTANEOUSLY.

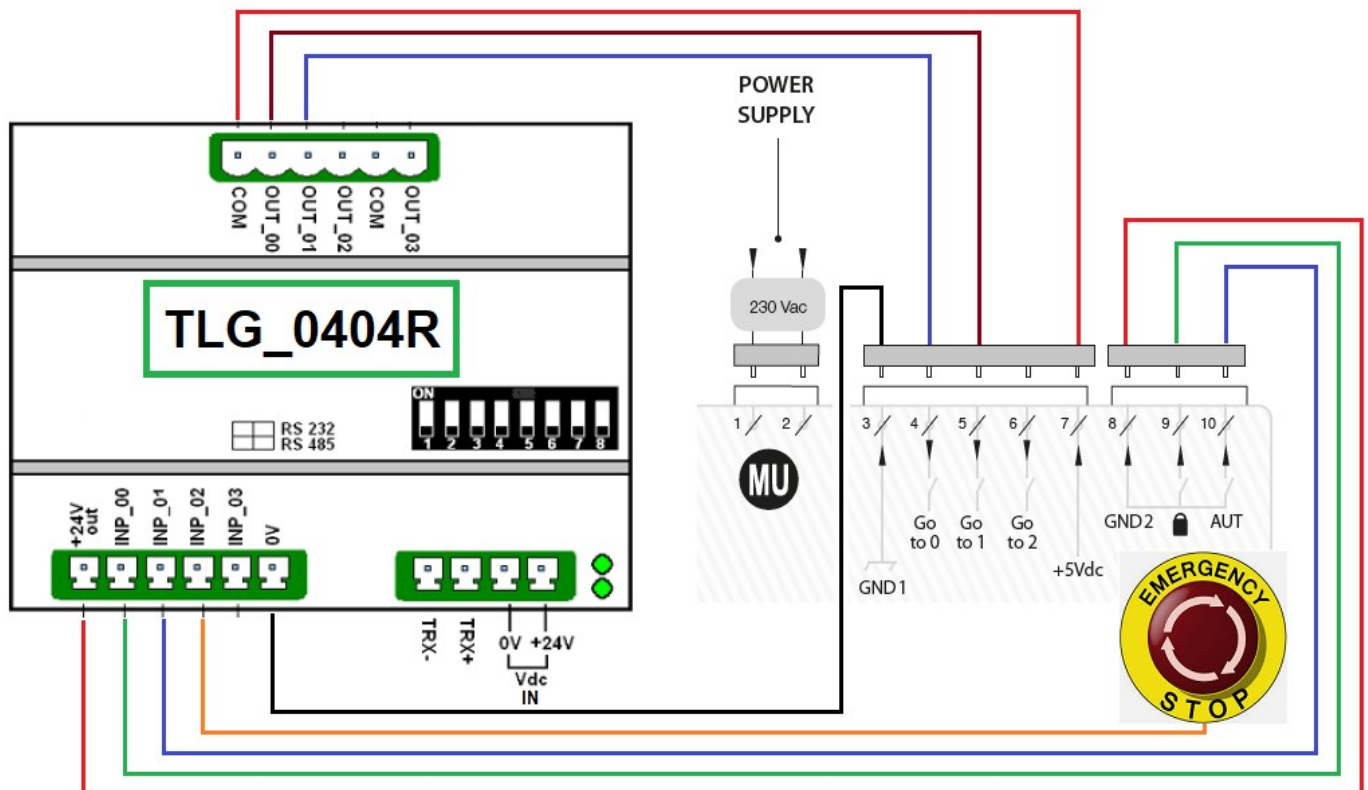
If the EMERGENCY IS ACTIVE (INP.02 = 0) :

- **TURN OFF THE SWITCH**
- The 2 LEDs flash 1 second ON and 1 second OFF SIMULTANEOUSLY
- Does not accept ON and OFF commands

If the EMERGENCY IS NOT ACTIVE (INP.02 = 1) :

- **ACTIVATE THE SWITCH**
- Slow flashing (1 second ON and 1 second OFF) ALTERNATE
- Accepts the ON and OFF commands if: EMERGENCY IS NOT ACTIVE (INP.02=1) and THERE ISN'T the Handle (INP.01=1)

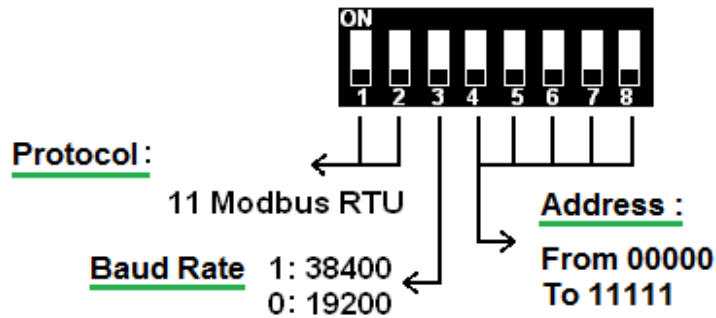
7.2 I/O Connections





7.3 DIP-SWITCHES

You can configure for each TLG_0404R its own node address, baud rate and protocol, through the 8 suitable dip-switches (see hardware characteristics and the following figure).



7.4 Communication

The serial communication occurs only via RS 485. It will be necessary to set the Protocol and Baud Rate (19200 / 38400, N, 8, 1) on the external device.

With the dip-switches 1 and 2 you select the COMMUNICATION PROTOCOL and with the dip-switch 3 you choose the BAUD RATE; according to the protocol set with the dip-switches, you need to select the corresponding protocol (within the PC/PLC project) in the COM used between PC/PLC and expansions. Also in this case it's necessary to open the PC/PLC project to select the correct protocol :

7.5 Memory

The TLG_0404R has some internal 16 bit memory locations (word) called “REGISTER”. Because each REGISTER is composed by 16 bits, its maximum value will be 65535.

MODBUS Register	Description
30001	STATUS Indicates the current status ! <u>To be read after a switching command (40001)</u> (0 = OFF ; 1 = ON)
30002	INPUTS The first 3 bits represent the status of the digital inputs : INP.00 = Bit 0 = Padlock

MODBUS Register	Description
	<div data-bbox="454 215 1396 936" data-label="Image"> </div> <div data-bbox="384 994 1465 1055" data-label="Text"> <p>This padlock is used to LOCK the SWITCH in the position in which it is located. It can be inserted when THERE IS NO HANDLE.</p> </div> <div data-bbox="384 1086 1061 1182" data-label="Text"> <p>When inserted : (INP.00 = Bit 0 = 1 >> LOCK)</p> <ul style="list-style-type: none"> • it will no longer be possible to insert the handle • it no longer accepts serial commands </div> <div data-bbox="384 1216 1465 1312" data-label="Text"> <p>INP.01 = Bit 1 = Handle (Manual / Automatic)</p> <ul style="list-style-type: none"> • If THERE IS the Handle: Bit 1=0 (Manual) does NOT take commands from the PLC. • If THERE ISN'T the Handle: Bit 1=1 (Automatic) </div> <div data-bbox="384 1346 1465 1442" data-label="Text"> <p>INP.02 = Bit 2 = Emergency Button</p> <ul style="list-style-type: none"> • Emergency Button PRESSED : Bit 2 = 0 does NOT take commands from the PLC. • Emergency Button NOT PRESSED : Bit 2 = 1 </div> <div data-bbox="384 1476 1465 1597" data-label="Text"> <p>Accepts the ON and OFF commands if :</p> <ol style="list-style-type: none"> 5. The padlock is NOT inserted (INP.00 = 1) 6. THERE ISN'T the Handle (INP.01 = 1) 7. EMERGENCY IS NOT ACTIVE (INP.02 = 1) </div>
<p>40001</p>	<p>COMMANDS</p> <p>it is possible to execute the following commands by writing in the DATA the value indicated in HEXADECIMAL : <u>ONLY IF EMERGENCY BUTTON = OFF</u></p> <p>0xAC00 = SWITCH OFF 0xAC01 = SWITCH ON</p> <p>IT IS RECOMMENDED to give the command and check the status after 1 second. If it has not been executed, re-send the command.</p>

ITSMB

MODBUS Register	Description
40002	<p>SERIAL COM ACTIVATION TIME The expansion has a time called "<i>SERIAL COM Activation Time</i>", i.e. a waiting time within which, if an output of the expansion is high and within the fixed time isn't received by the module another command that puts high that output, it's brought to zero.</p> <p>This system mainly represents a security, because in the case in which the expansion was connected to a PLC / PC and for some reason the communication between the two devices is interrupted, the outputs of the expansion after a time "X" would be placed at 0. The PLC / PC, therefore, sends in continuation a command strings to the outputs expansions. This time is set in 1/10 of a second.</p> <p>0 = DISABLED. The OUTPUTS are independent 10 = If it does not communicate, after 1 second the OUTPUTS go to 0</p>

ATTENTION

TLG_0404R is designed to work with the Telergon motorized kit :
 UM-S2A230Z

8 TECHNICAL DATA

8.1 String Monitoring Box Parameters

SMB PARAMETERS	
Model Name	ITSMB
Rated DC Voltage	1500 V with precision better than 0,5 %
Input Strings	8
Max. Input Current	25
Range of measurement	0 ... 200
Communication Protocol	RS485 / RS487 (Modbus RTU or IEC 60870-5-101)
Input/output Connection	MC4
Conductor Cross Section	See paragraph 4.3 and 4.4
Range Current Sense	1 to 25 Amps
Current Reading Accuracy	+/- 1 %
Current Reading Typology	Hall effect sensors
Terminal Type	MC4

8.2 Mechanics Characteristics

MECHANICS CHARACTERISTICS	
Operating Temperature	-30 °C to 70 °C
Operating Altitude	2000 mt
Operating Humidity	From 10 % to 90 % (non-condensing)
Protection Degree	IP66
SPD Protection	SPD T2 1500 V - 40 KA
SPD Communication Port	SPD "1-pair" 15 V - 20 KA
Weight	See table depending models
Dimensions	See table depending models

8.3 Dimensions and Weight

Dimensions and Weight			
Model	Dimensions [mm] (W x H x D)	Net Weight of the BOX only [Kg]	Complete Packaging Weight [Kg]
ITSMB08160...	600 x 800 x 300	11.96 Kg	c.a. 26 Kg

9 MAINTENANCE



Maintenance

All the installation and wiring connections should be performed only by qualified technical personnel. Only authorized personnel can access the panel. All maintenance and technical assistance work must be carried out by authorized "Specialized Personnel".

Please ensure the DC and AC sources are both disconnected, and the shell of device is securely grounded to avoid electric shock during maintenance or installation of the device.

All inspections and tests must be performed with controls and equipment de-energized, disconnected and isolated from accidental contact with live parts, and all plant safety procedures must be followed.

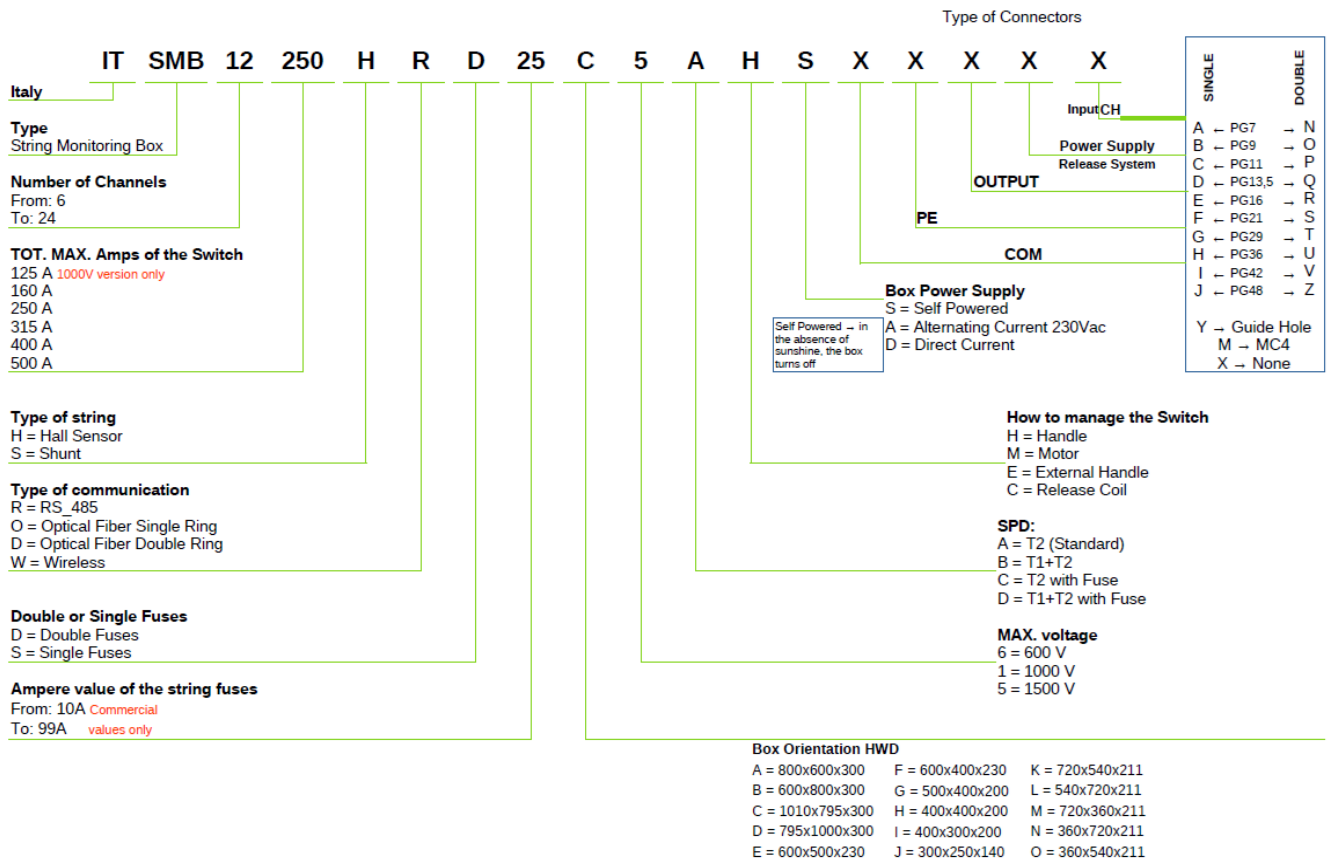
Please do not touch the live parts of the input and output sides to avoid electric shock when checking or maintaining the device.

Before carrying out maintenance, disconnect all cables from the panel.

Check periodically (by qualified personnel) tightening torque on screws. Re-tighten if it is necessary

10 ORDER CODES

SMB CODES



Manual Management

Please keep this user manual with other related documents, and make sure it is on hand for quick reference.

The manual must always be available for consultation inside the electrical panel and stored properly.

The manual is subject to changes and corrections because of the updates of the product. The actual purchased product shall prevail. Users can get the latest manual from our sales channel or our official website.

Please read this user manual carefully before undertaking the installation.

The manufacturer reserves the right to refuse warranty claims for equipment damage if the user fails to install the equipment as per the instructions in this manual.

Follow scrupulously all indication reported in this manual.