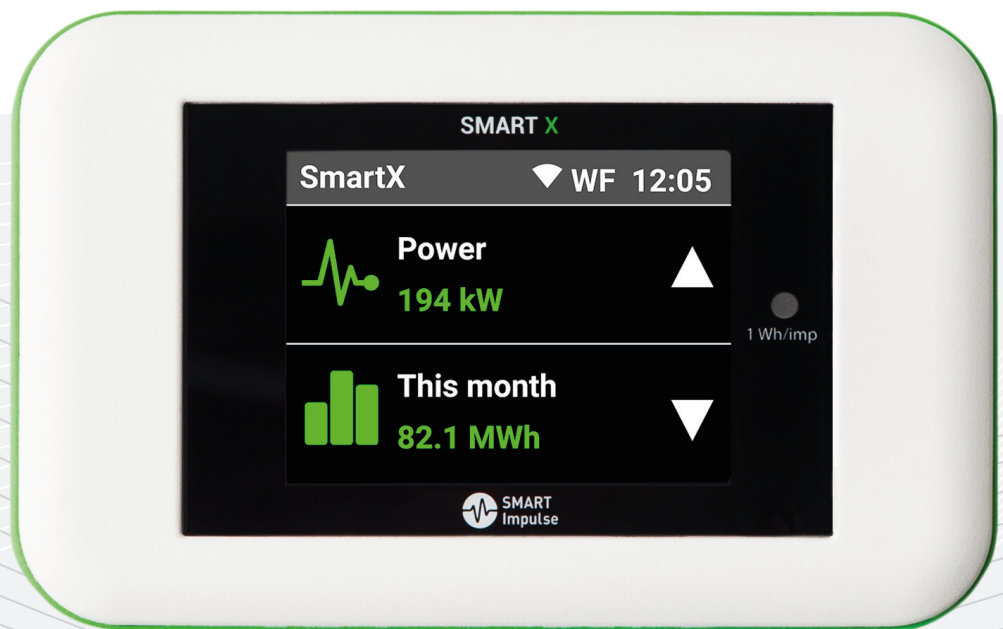




SMART X[®]

User Manual



A three-phase power consumption data logger for commercial buildings with breakdown by end-use.

English

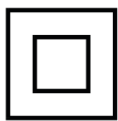
INTRODUCTION

Smart X® is a device that analyses and identifies the power consumption of each type of equipment in a building, from only one measuring point.

In addition to standard information about the quality of energy, Smart X also provides a percentage breakdown of electricity consumption by type of equipment or by end-use.

Data measured is retrieved from Smart Impulse servers in real time via an Internet connection, or at the end of the measurement period when returning equipment to Smart Impulse.

Symbols used



Class II: device fully protected by reinforced insulation (according to EN 61010-1).



Warning: potential electric shock



Warning: instructions must be consulted each time this symbol appears.



Compliance of the product with European CE directives

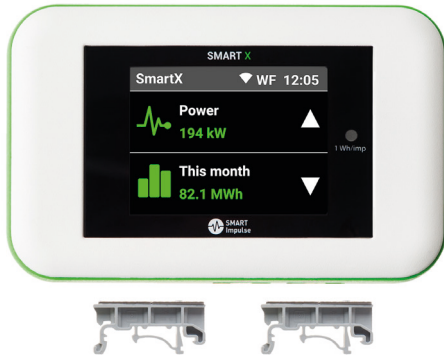


WARNING

- Read these instructions carefully before installing Smart X and its accessories. The manufacturer will not be held liable for failure to follow the instructions in the manual available at www.smart-impulse.com/techdoc/
- The safety of the facilities and buildings where Smart X is installed remains the responsibility of the assemblers of those systems.
- Only qualified and authorized personnel are allowed to work on or to install/dismiss the product and its accessories. Smart X and its accessories must only be handled when wearing personal protective equipment that is appropriate to protect against (including but without limitation) electric shocks and falling objects.
- Any installation of Smart X hardware and/or accessories that does not comply with the specifications of this Installation Manual, or with local regulations regarding electrical installations, will cancel its warranty and may compromise the safety of the hardware itself, and other equipment and individuals in proximity.
- For your safety, the installation must be powered off before proceeding with all operations involving the product and/or its accessories. The product is not to be repaired by the user.
- Use only the accessories provided with Smart X, approved or specified by Smart Impulse (including the battery, all leads, sensors and fuses).
- Using an inappropriate battery can damage or explode the device. The battery must be recycled or scrapped according to applicable regulations.
- Smart X can be installed on facilities of Installation Category III, corresponding to the origin of a building's electricity supply and its proximity, for voltage not exceeding 300 VAC compared to the earth (possible overvoltage 4000 VAC according to standard EN 60664-1). See the table in Appendix page 14.
- The product must imperatively be installed with the power connectors (IN/OUT) facing down. All accessories must be connected.

Contents

Smart X comes with all of these accessories:



Smart X

The Smart X is the device that analyses electricity consumption. It is magnetic and comes with 2 DIN rail adapters.



Current Sensors

Accurate and flexible, these 'ART' current sensors measure the 3 phases and are universal (length 3m or 6m; adhesive bases and clamping clips included).

Depending on version, a current adapter for linking each sensor to the Smart X can be supplied. Also available in 'ATO' version, 1m



Three-phase Lead

1.5m long, it carries out electric protection and power to the Smart X and measure of the three-phase voltage.

- Available in 2 versions:
- With magnetic connectors (CAT III 300V, by default if available in your country)
 - With wiring terminals (CAT III 300V, accessory available on demand)



Single-Phase Lead

2m long, it powers Smart X via an type-C* electric socket and measures single-phase voltage.

CAT II 300V

**Single-phase lead only available for countries with type-C electric socket.*



Bridge Lead

30 cm long, it allows Smart X devices to share power supply (max. 3 devices).

TABLE OF CONTENTS

1.	Introduction	2
	Symbols Used	2
	Warning	2
	Contents	3
2.	Description	5
3.	Instructions	6
	Mounting	6
	Current measurement	6
	Supply and voltage measurement	7
	Network wiring	7
	Communication	8
	Validating installation	8
	Touch Screen	9
4.	Characteristics	10
	Mechanical	10
	Power Supply	10
	Weather Conditions	10
	Electrical Characteristics.....	10
	Standards	10
	Communication	11
	Data	11
5.	Precautions for safety & upkeep	12
	Maintenance	13
	Upkeep	13
6.	Appendices	14
	Compliance information	14
	Measurement category rating	15

DESCRIPTION

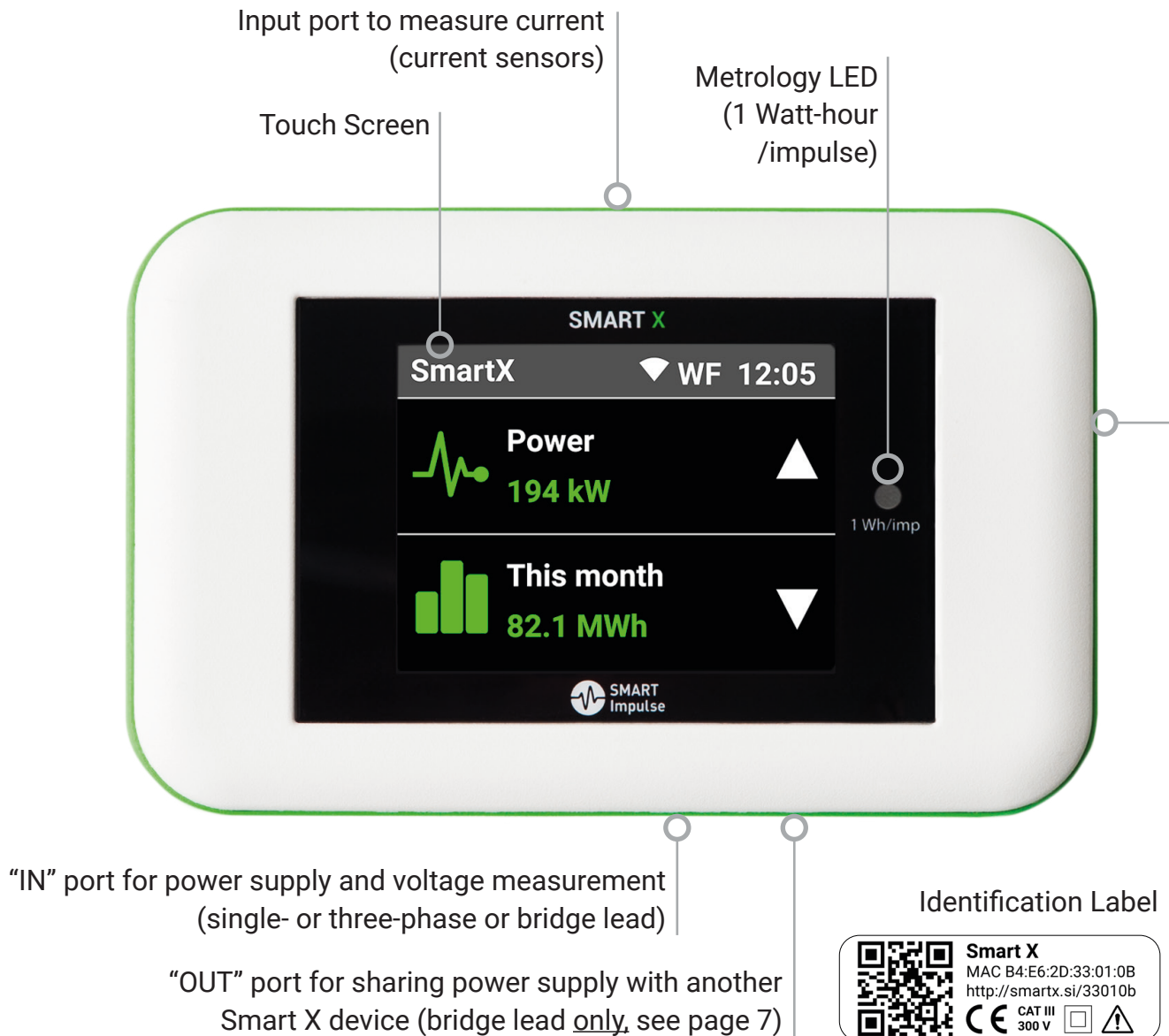
Smart X has three input/output connecting ports.

Voltage probes:

- 1 "IN" port to connect the single-phase lead, the three-phase lead or the bridge lead (power supply and voltage measurement)
- 1 "OUT" port to connect exclusively the bridge lead to share power supply between Smart X.

Current probes:

- 1 input port to connect current sensors (current measurement)



View from below



View from above

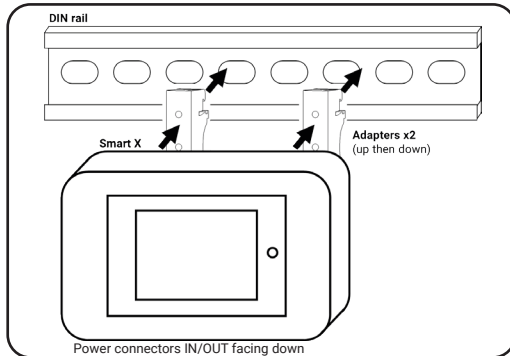


INSTRUCTIONS

Mounting

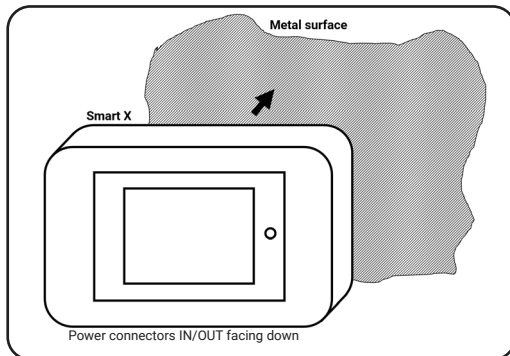


Smart X and its accessories must be installed in a room with restricted access and respect one of the two configurations below (power connectors IN/OUT facing down).



Mounting on DIN rail

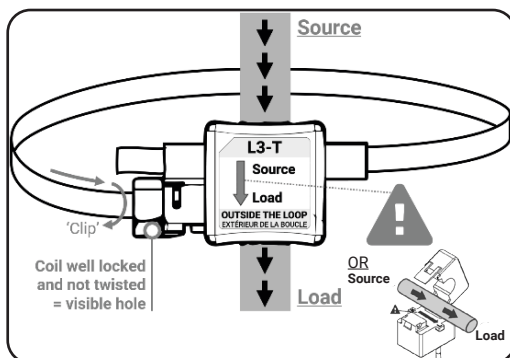
Fix magnetic DIN rail adapters to the back of the Smart X as shown, then fix the ensemble to the DIN rail, starting with the top of the rail first, then the bottom of the rail.



Mounting on a metallic surface

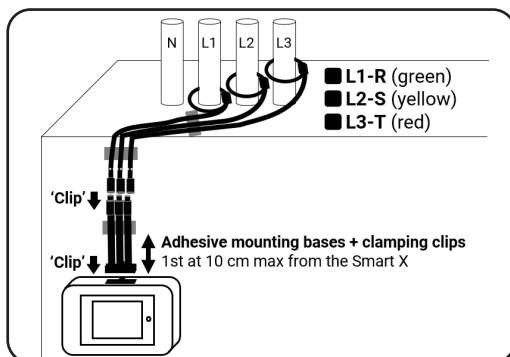
Smart X is magnetic and can be mounted on any metallic surface.

Current measurement



Position of Sensors on the low voltage network

For each phase of the installation to be measured (eg: main incomer, specific circuit), encircle all the insulated conductors thanks to the openable coils, **by imperatively respecting the direction of the sensors (coloured arrow outside the loop, pointing from the source to the measured load) and the order of the phases.**



Connect the current adapter to the Smart X then connect each coil to the adapter while respecting the color matching (version without adapter: Connect directly the sensors to the Smart X) until you hear the connection 'clip' and install the adhesive bases provided along the cables to position the cables in a neat way (1st at 10cm max from the Smart X).

Observations:

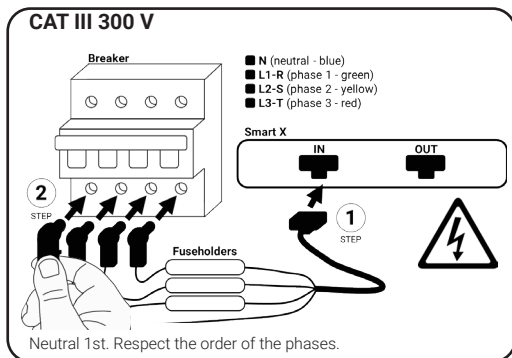
- To ensure high-quality measurement, the sensor loops must **encircle only the conductor(s) to be measured, be spaced from each other** (by fixing them if necessary) and **not be intertwined**. **Each coil must be correctly locked and not twisted**. Once the installation validated by Smart Impulse, white clamps can 'seal' the sensors.
- If all conductors are not accessible, it is possible to encircle only a part of them. The number of conductors measured for each phase must be the same. Imperatively inform Smart Impulse.
- If the electrical panel supplies a capacitor bank or has downstream power generation units, it is absolutely necessary to measure each of these points independently.
- To disconnect a sensor from the current adapter, press the locking clip and pull while holding the plastic part of the connector on the adapter side. To disconnect the current adapter from the Smart X (off mode), press the locking clip using an insulated flat screwdriver.

INSTRUCTIONS

Supply and voltage measurement



WARNING : Connect first the lead (three-phase or single-phase*) to the 'IN' port of the Smart X, then to the network. 'OUT' port is strictly dedicated to sharing power supply between Smart X (bridge lead). For your safety, the installation must be powered off before proceeding with all operations involving the product and its accessories. Check beforehand the state of the probe. Voltage probes are strictly dedicated to alternating current.



Via an existing circuit breaker

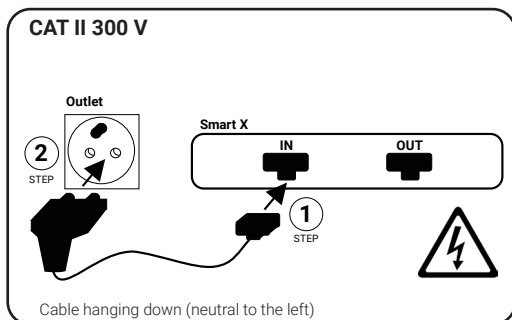
(Preferred connection mode for optimum measurement accuracy)

First connect the three-phase lead to the Smart X ("IN" port), then insert the magnetic connectors* **onto the screws downstream of the closest low voltage modular circuit breaker** (accessible through orifices)** **while imperatively respecting the positioning of the neutral (to connect first) and the order of the phases.**

Observations:

- The voltage of circuit breakers in the same electric panel being the same, please connect to the modular three-phase circuit breaker that is easiest to access.
- If the panel only provides single-phase circuit breakers, connect the neutral and phase 1 of the three-phase lead to the circuit breaker and connect phases 2 and 3 to the neutral.
- Delta networks (Δ): connect the neutral from the three-phase lead (blue lead) to the circuit breaker's phase 2.

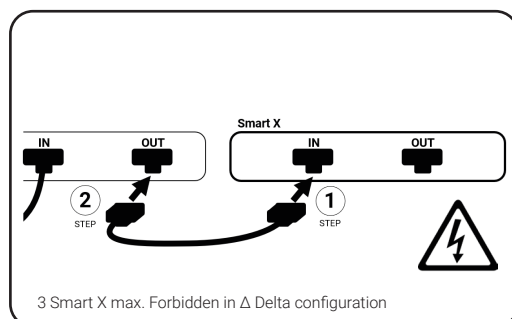
* If available in your country. ** Three-phase lead with wiring terminals to be connected downstream the circuit breaker.



Via a 2-pole socket

(In this case, voltage of non-measured phases will be estimated)

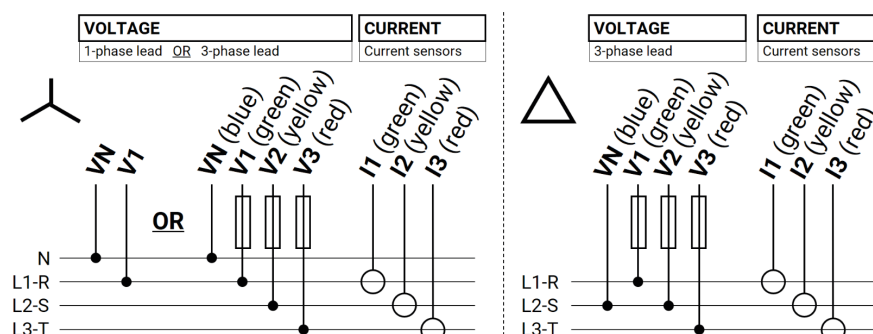
To measure without opening the electrical panel, first connect the single-phase lead* to the Smart X ("IN" entry port), then connect it to a 2-pole socket (cable hanging down).



Via another Smart X

For easy installation, Smart X devices in the same electrical panel can share the same power supply. In this case, first connect the bridge lead to the Smart X that has no power ("IN" port), then connect it to the Smart X already installed and powered ("OUT" port, for bridge lead only, 3 Smart X max, forbidden in single-phase and delta configurations).

Network wiring



INSTRUCTIONS

Communication



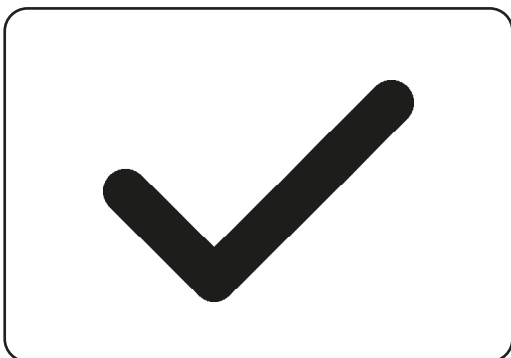
Data measured is retrieved from Smart Impulse servers in real time via an Internet connection, or at the end of the measurement period when returning equipment to Smart Impulse.

The first option needs the Smart X to be connected to a Wifi network with specific configuration to get access to the Internet and be able to transfer the data.

Outgoing connection needed to transfer the data:

- ICMP protocol to 8.8.8.8 (ping), DNS
- TCP protocol to 178.33.106.9, port 443* (HTTPS - TLS 1.2)
- *Port 80 (HTTP) for Smart X delivered by Smart Impulse before September 2024.
- UDP protocol to time.google.com port 123 (NTP).

Validating Installation



Remote Validation

Once installation is complete and has been checked (direction of sensors, order of phases, coherence of data appearing on screen), call the Help Desk on +44 (0) 330 684 6080 to validate the installation.

Validation Form

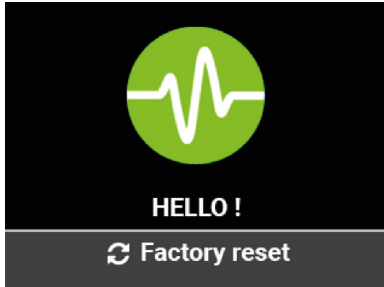
Within 24h of installation, please send the Installation Validation Form (available at <http://doc.smart-impulse.com>) to technique@smart-impulse.com with the photos required below. Installation is only validated after receiving these documents.

Required photos: Smart X meter, current sensors, power supply connection, Wide shot of room after installation.

INSTRUCTIONS

Touch Screen

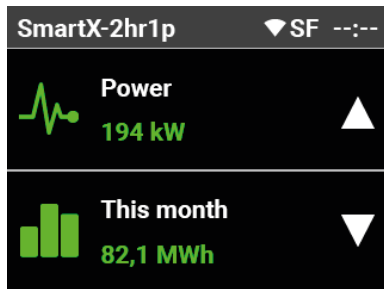
Installation



Starting Smart X

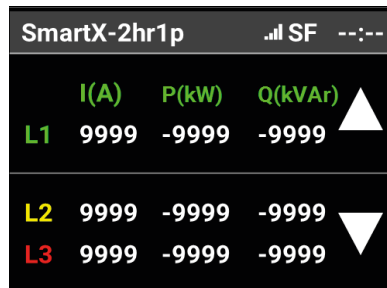
While the meter is starting, touch the screen to reset factory default settings

In-use



Consumption

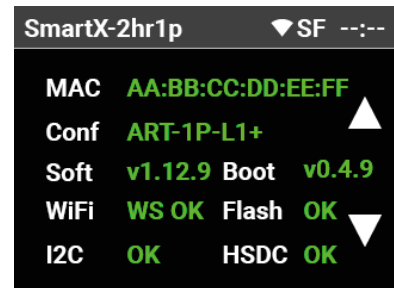
This screen displays instantaneous power and consumption for the month in progress.



	I(A)	P(kW)	Q(kVAr)	
L1	9999	-9999	-9999	▲
L2	9999	-9999	-9999	▼
L3	9999	-9999	-9999	▼

Details

This screen displays the current and active / reactive power values measured for each phase.



MAC	AA:BB:CC:DD:EE:FF	▲	
Conf	ART-1P-L1+	▲	
Soft	v1.12.9	Boot v0.4.9	
WiFi	WS OK	Flash OK	▼
I2C	OK	HSDC OK	▼

System

This screen displays the state of the Smart X and of its peripherals.

The Smart X screen switches off (screensaver mode) automatically. Simply touch the screen to activate.

CHARACTERISTICS

Mechanical

Dimensions	117 x 73 x 27 mm (7 DIN modules), protection rating IP20
Mass	192 g not including accessories
Mounting	Magnetic for metallic surface or DIN rail with adapters supplied

Power Supply

Source	Built-in 2W Single-phase supply
Voltage	100 - 240 VAC
Frequency	47 ~ 63 Hz
Typical current consumed	45 mA at 110 VAC (6 VA) 30 mA at 230 VAC (7 VA)

Weather Conditions

Use	Indoors, From 0 to 2 000 metres altitude From 5 °C to 40 °C; 10 % to 80 % relative humidity
Storage	Indoors, From 0 to 10 000 meters altitude From 5 °C to 40 °C ; 10 % to 80 % relative humidity

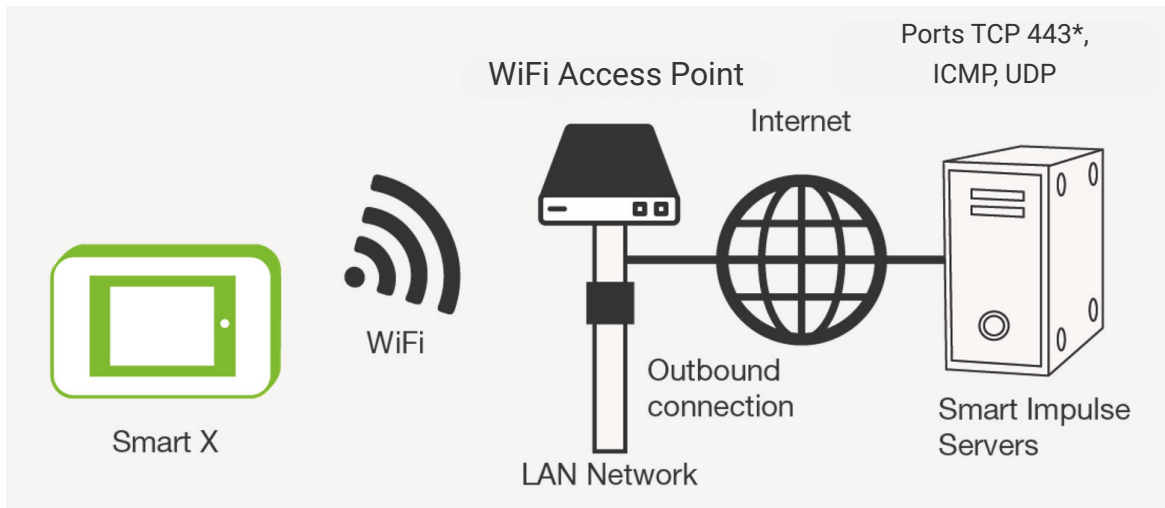
Electrical Characteristics

Voltage probe	Smart X + three-phase lead with wiring terminals or magnetic connectors: CAT III 300 V (building's LV* network) Smart X + single-phase lead: CAT II 300 V (LV* network load). Single-phase with 2 leads or three-phase with 3 to 4 leads. Fuse protection 3AG FF 500 mA, breaking capacity of 50 kA min. Input Impedance 330 kΩ (kohm) per phase * LV: Low-Voltage. <input type="checkbox"/> Protection rating II, Pollution degree II, Measurement category 3.
Current probe	Three-phase measurement with 3 cables ATO Sensors: from 0 to 125 A, max. diam. 16 mm ART Sensors: at 50 Hz, max. 2 750 A per phase, max. diam. 125 mm at 60 Hz, max. 2 300 A per phase, max. diam. 125 mm Signals from 0 mVp to 500 mVp, tolerable overload 2 Vp
Frequency	50 Hz ± 0,5 Hz or 60 Hz ± 0,5 Hz

CHARACTERISTICS

Communication

Data Transmission	Encrypted transmission in AES via HTTPS* protocol Volume of data transmitted < 500 MB/month by Smart X
WiFi	2400 MHz ~ 2483.5 MHz 802.11n
Max. output power	20.0 dBm
Local Storage	< 1 month
Outbound Connections	ICMP Protocol to 8.8.8.8 (ping) TCP Protocol towards smartx.smart-impulse.com (178.33.106.9), port 443* (HTTPS - TLS 1.2) *Port 80 (HTTP) for Smart X delivered by Smart Impulse before September 2024. UDP Protocol towards time.google.com port 123 (NTP)



Data

Data Transmitted	Total power (load curve) accessible in real time Power and consumption by equipment type available as of D+1 Time-step: 10 minutes as default setting (configurable)
Access to data	Website with private access to consumption visualisation interfaces and for exporting data (Excel, CSV or JSON formats) https://dashboard.smart-impulse.com/ or Public web API* or FTP push for data integration: https://dashboard.smart-impulse.com/api/doc/ * Application Programming Interface: to send data to a third party

PRECAUTIONS FOR SAFETY & UPKEEP

- This Installation Manual contains important information and instructions to ensure proper functioning, please read all of the instructions before using the product for the first time.
- Smart Impulse will not be responsible for any loss or injury resulting from improper handling of the device or for not respecting the safety instructions.
- For your safety, the installation must be powered off before proceeding with all operations involving the product and/or its accessories.
- It is prohibited to use the product with any accessories other than those supplied or certified by Smart Impulse. To replace defective accessories, please contact Smart Impulse.
- It is prohibited to change or transform the product arbitrarily. Never open or disassemble the product. The inside of the Smart X has no part that requires configuration or maintenance on your behalf. The product is not to be repaired by the user.
- Any maintenance, configuration or repair works must only be carried out by a qualified technician or a specialized laboratory with perfect knowledge of the potential risks and requirements that apply.
- The power lead used to connect the product must be located in close proximity to the product and be easy to access.
- This product is not a toy and must be kept away from children. Please place the product out of the reach of children. Do not leave the packaging materials unattended.
- Impacts, collisions or falls, even minor, can damage the product.
- If you have any remaining questions after reading this Installation Manual, please contact
- Smart Impulse or another specialist.
- This product is only to be used in an enclosed and dry area; it must not be exposed to moisture or get wet. Never place the product in proximity of a bathtub, shower or other similar sanitary installations. Risk of fatal electric shock.
- This product must not be exposed to extreme temperatures, to direct sunlight or to strong vibrations.
- Use of the product in the presence of dust, gas, steam or inflammable solvents is prohibited due to risk of explosion and/or fire.
- Never use the product in a vehicle.
- Respect the safety instructions and user manuals of all other devices and equipment connected to the product.
- Never pull on the power cord to unplug. After having equipped yourself with the necessary personal protective gear, pull out the plug by holding the lateral surfaces provided for this purpose and pull out the plug from the front outlet. Never handle the product with hands or tools that are moist or wet.
- Do not use the product if it is covered. In the event of connected loads with higher power values, there is a risk of the product overheating and, where applicable, causing a fire.
- The product is switched off only when you unplug it from the electric socket.
- Use the product only in places with moderate temperatures; no tropical climates.

- Never connect the product to the network's voltage immediately after moving it from a cold room to a hot room (for example, during transportation). Condensation could appear as a result and can damage the device or provoke an electric shock. Wait until the device is at room temperature before plugging in. Wait for any condensation to evaporate (this can take several hours). Only once this is done can the device be connected to the network voltage and switched on.
- Do not use the product if it is defective. Risk of fatal electric shock!
- If the product presents defects, first unplug the power supply lead from the network point to which it is connected on all poles (disconnect the automatic circuit breaker or unscrew the fuse, then switch off the corresponding differential circuit breaker). Unplug the product from the electric socket.
- Do not continue to use the product, but give it to a special laboratory or discard while respecting environmental protection rules.
- Safe operating of the product is no longer possible when:
 - visible damage can be seen,
 - the product does not work at all or is not working correctly (thick smoke or smell of burning, audible crackling sounds, discoloration of the product or adjacent surfaces),
 - the product has been stored in adverse conditions, or
 - the product has suffered difficult transportation conditions.
- In the event of cleaning or extended non-use (storage, for example), switch the product off, unplug the power lead from the electric socket. Keep the product in a dry, cool room and out of the reach of children.
- Never spill liquids on or near the product. This could cause a fire hazard or potentially fatal electric shock. If liquid has been spilled on the device, immediately cut off the mains power supply to the socket to which the product is connected (fuse/automatic circuit breaker/differential circuit breaker of the circuit used) on all poles. Only after this has been done can you unplug the product from the electric socket and contact a specialist.
Do not use the device anymore.

Maintenance

- In the event a filament of a fuse melts, only a qualified and authorized personnel who has the appropriate, individual, protective gear can open the fuseholder and perform the replacement of the fuse, in accordance with local rules regarding electrical installations, and by using replacement fuses exclusively supplied by Smart Impulse. **You must imperatively disconnect the power lead from the electric power supply or disconnect the circuit breaker upstream before opening the fuse holder using a tool, so that you change the fuse with the power off.**

Upkeep

- Smart X requires no specific servicing.
- To clean the device, use a soft, dry cloth. Cleaning should only be performed by a qualified and certified technician with perfect knowledge of the risks involved and the applicable requirements.

APPENDIX: COMPLIANCE INFORMATION

FCC Compliance Information



The Smart X has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that any changes or modifications not expressly approved by Smart Impulse could void the user's authority to operate the equipment under Federal Communications Commission's rules.

The Smart X contains transmitter module FCC ID: 2AC7Z-ESPWROOM02D.

Industry Canada (IC) Compliance Notice



The Smart X complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

The Smart X contains transmitter module ESP-WROOM-02D (21098-ESPWROOM02D).

Le Smart X est conforme aux normes d'exemption de licence RSS d'Industry Canada. Son fonctionnement est soumis aux deux conditions suivantes : (1) cet appareil ne doit pas causer d'interférence et (2) cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

Le Smart X contient le module transmetteur ESP-WROOM-02D (21098-ESPWROOM02D).

JAPAN Compliance



R 201-171000

当該機器には電波法に基づく、技術基準適合証明等を受けた特定無線設備を装着している。

The Smart X contains specified radio equipment that has been certified to the Technical Regulation Conformity Certification under the Radio Law.

DGT Warning Statement

Article 12 : Without permission, any company, firm or user shall not alter the frequency, increase the power, or change the characteristics and functions of the original design of the certified lower power frequency electric machinery.

Article 14 : The application of low power frequency electric machineries shall not affect the navigation safety nor interfere a legal communication, if an interference is found, the service will be suspended until improvement is made and the interference no longer exists.

第十二條

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條

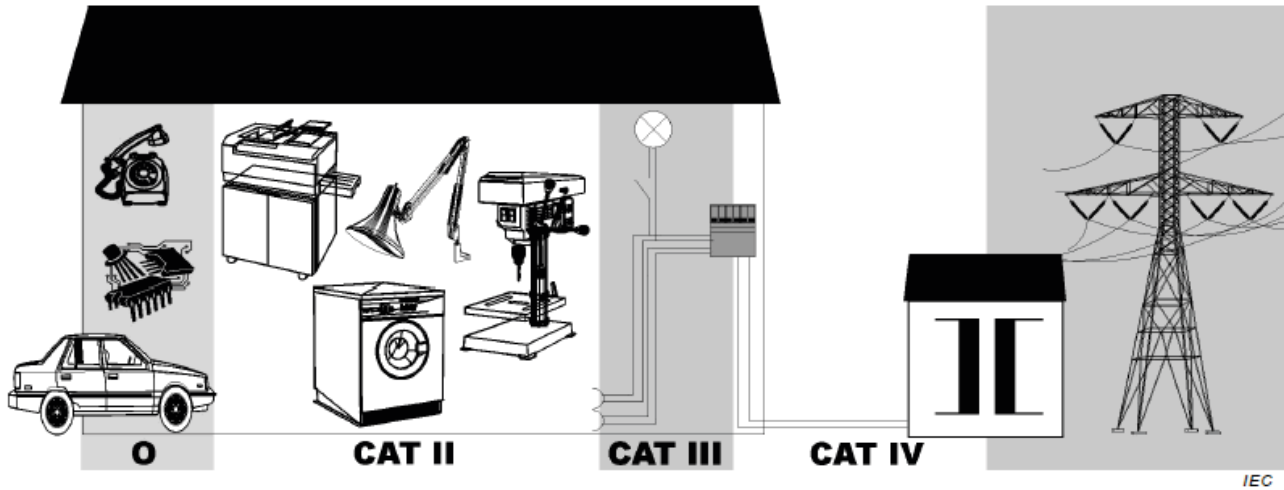
低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信法規定作業之無線電通信。

低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

APPENDIX: MEASUREMENT CATEGORY RATING

Extracted from Annex F of EN 61010-031:2015



Key

- O Other circuits that are not directly connected to mains
- CAT II MEASUREMENT CATEGORY II
- CAT III MEASUREMENT CATEGORY III
- CAT IV MEASUREMENT CATEGORY IV

Figure F.1 – Example to identify the locations of MEASUREMENT CATEGORIES

Table F.1 – Characteristics of MEASUREMENT CATEGORIES

MEASUREMENT CATEGORY	Short-circuit current ^a (typical) kA	Location in the building installation
II	< 10	Circuits connected to mains socket outlets and similar points in the mains installation
III	< 50	Mains distribution parts of the building
IV	> 50	Source of the mains installation in the building

^a The values of loop impedances (installation impedances) do not take into account the resistance of the test leads and impedances internal to the measuring equipment. These short-circuit currents vary, depending on the characteristics of the installation.

