

PX 110 - PX 120

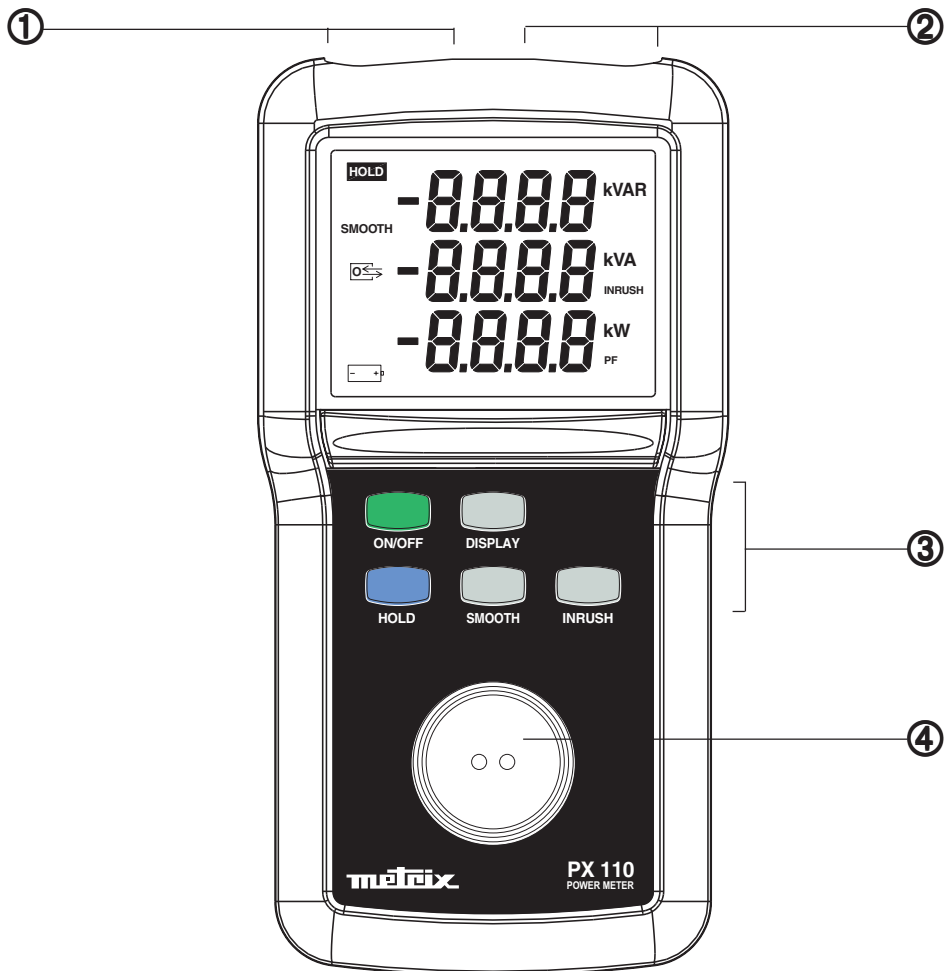
**PUISSANCEMÈTRE
POWER METER
WATTMETER
WATTOMETRI
VATÍMETROS**

metrix

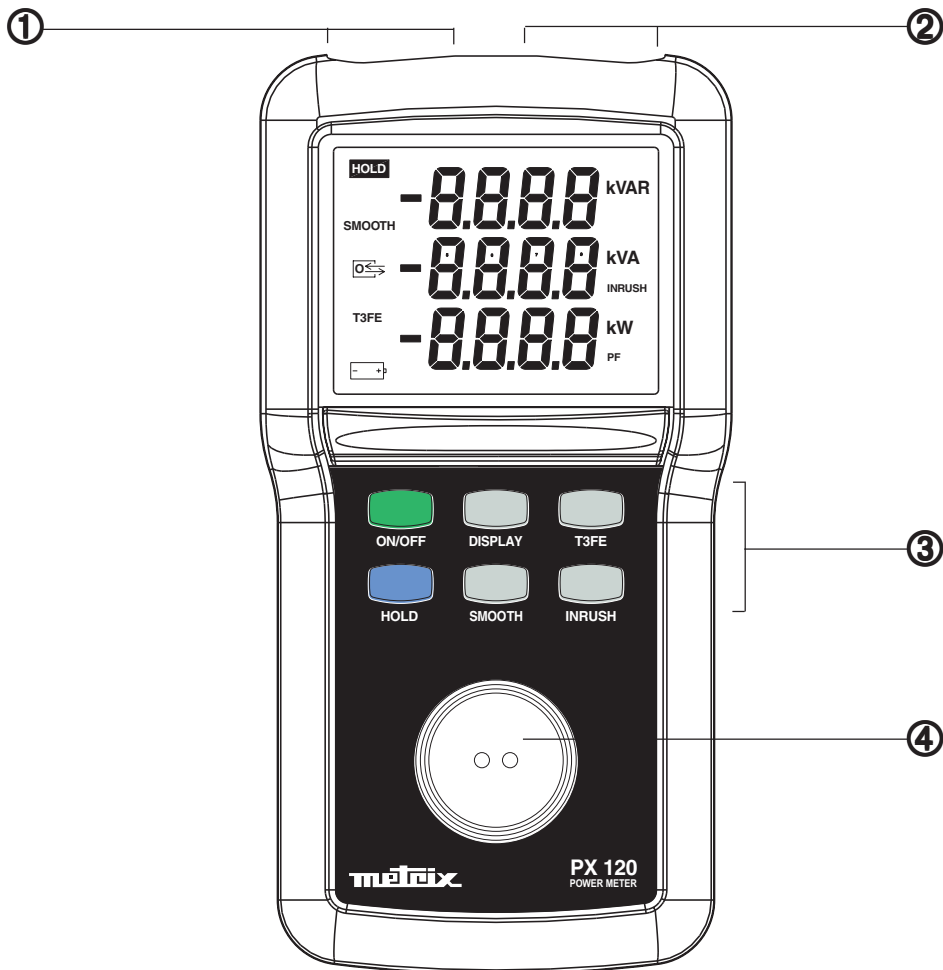
PX 110 - PX 120

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Se reporter au § 2. Description

See § 2. Description

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1. GENERAL INSTRUCTIONS

Thank you for purchasing this **PX 110** or **PX 120 wattmeter**.

This instrument complies with the NF EN 61010 Ed. 95 safety standard concerning electronic measurement instruments. For your own safety and to prevent damage to the instrument, it is essential to respect the instructions given in this manual. The contents of this manual must not be reproduced in any form without our consent.

1.1 Precautions and safety measures

1.1.1 Before using

- * This instrument can be used for testing category-III installations, with voltages which never exceed 600 V (AC or DC) in relation to the earth.
- * Definition of installation categories (see publication IEC 664-1):
 - CAT I: Category I circuits are circuits protected by low level transient over-voltage limiters
Example: protected electronic circuits
 - CAT II: CAT II circuits are household appliance or similar power circuits, which may carry medium-level transient over-voltages.
Example: household appliance and portable tool power supplies
 - CAT III: CAT III circuits are high-power appliance power circuits, which may carry high-level transient over-voltages.
Example: industrial machinery or instrument power supplies
 - CAT IV: CAT IV circuits are circuits which can carry very substantial transient over-voltages.
Example: power feeder
- * To use this instrument, the user must comply with the usual safety rules in order to:
 - ensure protection against electric currents,
 - protect the instrument against incorrect operations.
- * For your safety, only use the leads and the fuse delivered with the instrument: they comply with the norm EN 61010-1 + A1 + A2, Ed. 95. Before using, always check that they are in perfect working order.

1.1.2 When using the instrument

- * Never exceed the protection limit values indicated in the specifications for each type of measurement.
- * When the instrument is connected to the measurement circuits, do not touch any unused terminals.
- * When repairing TVs or measuring on power switching circuits, there may be high-amplitude voltage surges on the measuring points which can damage the instrument. These surges can be attenuated by using a filtering probe.

1.1.3 Symbols

The following symbols are used:



ATTENTION: Consult the manual.

Incorrect use may damage the instrument and endanger the user.



This appliance is protected by dual insulation or reinforced insulation. It does not have to be connected to an earth protection terminal for electrical safety.

1.1.4 Instructions

- * Before opening the instrument, disconnect it from all sources of electrical current and from the measuring circuits; make sure that you are not charged with static electricity, which could irreparably damage the instrument's internal elements.
- * The fuses must be replaced by models identical to those fitted originally.
- * Adjustments, maintenance or repair work on the instrument must only be carried out by qualified personnel. A **“qualified person”** is someone who is familiar with the installation, the construction, the application and the dangers at hand. This person is authorized to power up and power down the installation and equipment, in compliance with safety regulations.
- * In the event of faults or abnormal constraints, cut off the power to the instrument and do not allow anyone to use it until it has been checked.
- * It is advisable to remove the batteries if the instrument is not going to be used for a long time.

1.2 Protective systems

This instrument is equipped with systems to protect it:

- * 1 fuse protects the input for the current measurements,
- * the external moulding of the casing ensures that it is dustproof and waterproof in the operating position.

1.3 Guarantee

This equipment is guaranteed against any material or manufacturing defects, in accordance with the general conditions of sale.

During the warranty period (1 year), the instrument can only be repaired by the manufacturer, who reserves the right to repair the instrument or to exchange all or part of it. If the equipment is returned to the manufacturer, the outgoing transport costs are borne by the customer.

The warranty is not applicable in the following cases:

1. improper use of the equipment or use of it in conjunction with incompatible equipment;
2. modifications to the equipment without the explicit authorisation of the manufacturer's technical department;
3. work carried out on the instrument by a person not approved by the manufacturer;
4. adaptation for a specific application, not included in the definition of the equipment or the user's manual;
5. knocks, falls or flooding.

1.4 Repair and metrological verification

Information and address details available on request:
Tel. (33) (0)2.31.64.51.53 - Fax (33) (0)2.31.64.51.09

1.5 Unpacking - Repacking

All the equipment was checked mechanically and electronically before shipment. Every precaution was taken to ensure that you receive the instrument undamaged.

It is a good idea however to check quickly to detect any damage that may have occurred during transport.

If there is any damage, immediately notify the transporter of the customary reservations.

Caution! *If you ship this instrument on elsewhere, use preferably the original packaging and indicate the reasons for reshipment as clearly as possible in a note enclosed with the equipment.*

Note: *Our products are patented in FRANCE and ABROAD. Our logos are registered trade marks.
We reserve the right to modify the characteristics and prices should technological advances make it necessary.*

2. DESCRIPTION OF THE INSTRUMENT

The **PX 110 and PX 120 wattmeters** can be used to measure AC and DC power levels, voltages and currents. They have been designed specifically for general and technical colleges, installers and maintenance departments.

The PX 110 is a single-phase only wattmeter, while the PX 120 provides the possibility of measuring three-phase power levels, but only three-phase with 3 balanced wires (T3FE); both models enable measurement in all four quadrants.

These wattmeters give priority to reliability, robustness, safety, simplicity of use and rapidity of implementation (automatic range change).

The two models have a two-way communication interface (optical head).

The two models measure:

- AC voltages from 500 mV to 600 V rms,
- DC voltages from 500 mV to 600 V,
- AC currents from 10 mA to 10 A,
- DC currents from 10 mA to 10 A,
- DC power levels up to 6 kW,
- AC active power levels up to 6 kW,
- AC reactive power levels up to 6 kVAR,
- AC apparent power levels up to 6 kVA
- the power factor.

The measurement range concerning the fundamental frequency is 40 to 70 Hz.

The bandwidth is 1 kHz (harmonics).

The AC and DC components are not dissociable (RMS values).

2.1 Casing (see the diagrams at the beginning of this operating manual)

- ① **Safety sockets** for input of the currents to be measured
- ② **Safety sockets** for input of the voltages to be measured
- ③ **Control keys** (5 for the PX 110 and 6 for the PX120)
 - ON / OFF** Activation / shutdown
 - DISPLAY** Gives access to the various screens by successive presses
 - T3FE** Gives access to measurement of the power and PF (power factor) in three-phase mode with balanced wires , **only on the PX 120** (short press)
 - HOLD** Used to freeze the display of the values (short press)
 - SMOOTH** Enables filtering of the values measured (short press)
 - INRUSH** If pressed briefly, enables acquisition of the peak startup current for a motor. The RMS current value measured is maintained until a higher value is measured or until you exit from the function.
- ④ Housing of the optical communication head

On the back of the instrument, there are:

- The access hatch for replacing the batteries (see § 7.1)
- The stand enabling the instrument to be set up in a tilted position.
- The mains power supply option which is connected in place of the battery hatch.

2.2 Display

The liquid crystal display allows the display of numeric values and the symbol of the corresponding unit, as well as the symbols of the different functions.

2.2.1 Digital display

This is made up of 3 display blocks (4 digits, 9,999 counts, 3 decimals and 1 sign “-”) each with a specific assignment depending on the function and measurement mode selected.

If the measurement capacity is exceeded, it is indicated by **OL** in the centre of the corresponding numeric display.

Upper display:

First screen: Displays the value of the voltage in **V**

Second screen: Displays the value of the reactive power in **VAR** or **kVAR**

Middle display:

First screen: Displays the value of the current in **A**

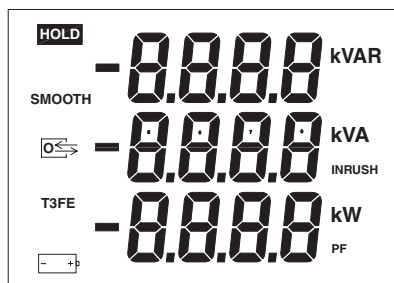
Second screen: Displays the value of the apparent power in **VA** or **kVA**

Lower display:



First screen: Displays the value of the active power in **W** or **kW**

Second screen: Displays the value of the power factor

PF: Indicates that the numeric value displayed in the power factor



2.2.2 Display of the function symbols

HOLD	Indicates use of the corresponding key (see § 2.1)
SMOOTH	Indicates use of the corresponding key (see § 2.1)
	Indicates that communication is activated (see § 3.6)
T3FE	Indicates use of the corresponding key for three-phase/balanced wires measurement (only on PX 120)
	Indicates that the remaining battery charge life is < 4 hours
INRUSH	Indicates use of the corresponding key for peak start-up current measurement (see § 2.3)

2.3. INRUSH function

This function can be used to follow rapid, damped sinusoidal evolution of the current by measuring the successive RMS values calculated over a half-period and updated over a half-period.

The applications are:

- Measurement of motor start-up currents
- Correct definition of fuses and circuit breakers (signal amplitude-time relationship)
- Stress on components by current overload

The field of application is limited to industrial frequencies (40 Hz... 70 Hz).

3. IMPLEMENTATION - FUNCTIONAL CHARACTERISTICS

The instrument is activated and shut down by pressing the **ON/OFF** key (long press for shutdown); it shuts down automatically if it is not used for 10 minutes.

Input and output in each of the functions is performed by successive brief presses in the keys concerned.

When the instrument is switched on, all the segments are lit up for 1 second.



Do not connect any voltages exceeding 600 V in relation to the earth

3.1. Reference conditions

The functional characteristics are guaranteed in the following reference ranges:

- Temperature: +23°C ± 3°C
- Humidity: 45% to 80% RH
- Supply voltage: 9 V ± 0.1V
- Frequency range: DC, 50 Hz ± 3 Hz sinusoidal (THD < 0.1%)
- DC magnetic field: < 40 A/m (earth field)
- No external AC magnetic field
- No electrical field

Note: *There are reference conditions specific to each function: these will be indicated in the characteristics of each function.*

3.2 Voltage measurements \approx (V)

1. Press the **ON/OFF** key: the first screen appears
2. Connect the measurement leads to the instrument's voltage measurement terminals (on the right), complying with the polarities indicated: red lead on the "+" terminal and black lead on the "COM" terminal.
3. Connect the assembly to the voltage source to be measured, making sure if possible that this voltage does not exceed the maximum acceptable limits (see table below).
The upper digital display indicates the value of the voltage and the corresponding unit (V).

3.2.1 Specific reference conditions

DC: AC component < 0.1% of the DC signal

AC: Sinusoidal signal (THD < 0.1%)

3.2.2 Characteristics

Display range	600 V (1)
Measuring range	0.5...600 V
Accuracy for AC	0.5% of reading ± 2 counts
Accuracy for DC	1% of reading ± 3 counts
Resolution	0.1 V
Display stability	5 cts in normal mode - 2 cts in SMOOTH mode
Repeatability of the measurement	0.2% typical
Display response time	500 ms in normal mode - 3 s in SMOOTH mode
Input impedance	1 M Ω

(1) Above 600 V +3%, the display indicates "OL".

3.3 Current measurements \approx (A)

1. Press the **ON/OFF** key: the first screen appears
2. Connect the measurement leads to the instrument's current measurement terminals (on the left), complying with the polarities indicated: red lead on the "+" terminal and black lead on the "COM" terminal.



If the "Voltage" terminals are not connected, current measurement is possible but the frequency taken by default is 50 Hz

3. Set up as shown in the diagram below, making sure if possible that the maximum acceptable limits are not exceeded (see table below).

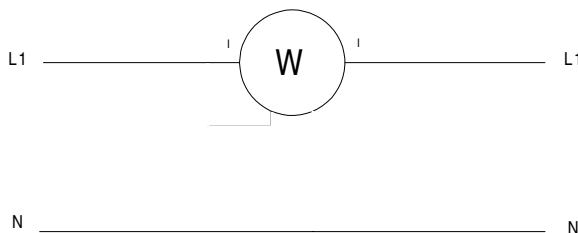


Fig 3.3.1 Single-phase connection diagram

Note: Range switching is automatic.

3.3.1 Specific reference conditions

DC: AC component 0.1% of the DC signal

AC: Sinusoidal signal (THD < 0.1%)

3.3.2 Characteristics in normal and SMOOTH modes

Display range	2 A	10 A (1)
Measuring range	10 mA...1.999 A	2.00...9.99 A
Accuracy for AC	0.7% of reading ± 5 cts +1 mA	0.7% of reading ± 5 cts
Accuracy for DC	1.5% of reading ± 5 cts +1 mA	1.5% of reading ± 5 cts
Resolution	1 mA	10 mA
Detection threshold	5 mA	50 mA
Display stability	5 cts in normal mode 5 cts in normal mode	2 cts in SMOOTH mode 2 cts in SMOOTH mode
Response time of the digital display	500 ms in normal mode 3 s in SMOOTH mode	

(1) Above 10 A +3%, the display indicates "OL".

3.3.3 Characteristics in INRUSH mode

Display range	A
Measuring range	5 A...65 A (40 ms) (1)
Max. current for acceleration 1s	30 A
Max. current for acceleration 8s	24 A
Max. current for acceleration 20s	20 A
Accuracy	10% of reading ± 2 counts
Resolution	100 mA
Measurement method	RMS value over half-period

(1) Above 65 A, the display indicates "OL".

3.4 Power measurements \approx

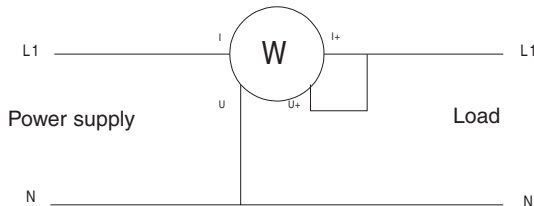


Fig 4.4.1 Single-phase connection diagram

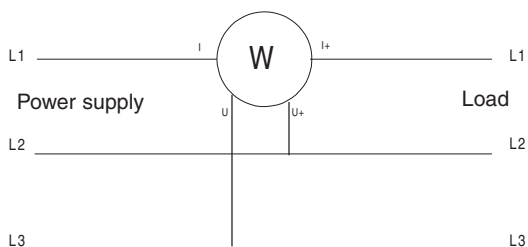


Fig 4.4.2 Three-phase/balanced wires (T3FE) connection diagram (PX 120 only)

■ Common characteristics of power measurements

The active and reactive power measurements are signed, whereas the apparent power measurement is not.

The display indicates “OL” if the voltage or current is in “OL”.

3.4.1 Specific reference conditions

DC: AC component < 0.1% of the DC signal

AC: - Sinusoidal signals

- PF = 1

- Frequency: 50 Hz

3.4.2 Active power measurements

1. Press the **ON/OFF** key: the first screen appears
2. Connect the measurement leads to the instrument's current measurement terminals (on the left), complying with the polarities indicated: red lead on the “+” terminal and black lead on the “COM” terminal.

Connect the measurement leads to the instrument's voltage measurement terminals (on the right), complying with the polarities indicated: red lead on the “+” terminal and black lead on the “COM” terminal.

Set up as indicated in the connection diagrams in Fig.4.4.1 (single phase) or Fig.4.4.2 (balanced three-phase, T3FE only PX 120), depending on the case, making sure if possible that the maximum acceptable limits are not exceeded (see table below). Range switching is automatic.

■ Single-phase characteristics

Display range	1000 W	6 kW
Measuring range	10.00 W...999.9 W	1000 W...5999 kW
Accuracy at 50Hz for PF ≥ 0.8	1.5% of reading ±2 cts	1.5% of reading ±2 cts
Accuracy with DC	2.5% of reading ±5 cts	2.5% of reading ±5 cts
Resolution	0.1W	1 W

■ Three-phase characteristics

Display range	1000 W	6 kW
Specified measuring range	10.00 W - 999,9 W	1000 W – 5999 W
Accuracy at 50Hz for PF ≥ 0.8	3% of reading ±2 cts	3% of reading ±2 cts
Resolution	0.1W	1 W

Note: With three-phase, the measurement of the active power is only performed on the fundamental components, so it is only valid for sinusoidal signals.

3.4.3 Apparent power measurements

1. Press the **ON/OFF** key: the first screen appears
2. Connect the measurement leads to the instrument's current measurement terminals (on the left), complying with the polarities indicated: red lead on the "+" terminal and black lead on the "COM" terminal.
Connect the measurement leads to the instrument's voltage measurement terminals (on the right), complying with the polarities indicated: red lead on the "+" terminal and black lead on the "COM" terminal.
3. Set up as indicated in the connection diagrams in Fig.4.4.1 (single phase) or Fig.4.4.2 (balanced three-phase, T3FE only PX 120), depending on the case, making sure if possible that the maximum acceptable limits are not exceeded (see table below).
Range switching is automatic.
4. The upper digital display indicates the value of the voltage and the corresponding unit (**V**).
The middle digital display indicates the value of the current and the corresponding unit (**A**).
The lower digital display indicates the active power (**W**)
Press the **DISPLAY** key to display the 2nd screen:
The middle digital display indicates the value of the apparent power and the corresponding unit (**VA**).

■ Characteristics

Display range	1000 VA	6 kVA
Measuring range	10.0 VA...999.9 VA	1000 VA...5999 kVA
Accuracy at 50 Hz	1,5% of reading ± 2 cts	1% of reading ± 2 cts
Resolution	0.1 VA	1 VA

3.4.4 Reactive power measurements

1. Press the **ON/OFF** key: the first screen appears.
2. Connect the measurement leads to the instrument's current measurement terminals (on the left), complying with the polarities indicated: red lead on the "+" terminal and black lead on the "COM" terminal.
Connect the measurement leads to the instrument's voltage measurement terminals (on the right), complying with the polarities indicated: red lead on the "+" terminal and black lead on the "COM" terminal.
3. Set up as indicated in the connection diagrams in Fig.4.4.1 (single phase) or Fig.4.4.2 (balanced three-phase, T3FE only PX 120), depending on the case, making sure if possible that the maximum acceptable limits are not exceeded (see table below).
Range switching is automatic.
4. The upper digital display indicates the value of the voltage and the corresponding unit (**V**).
The middle digital display indicates the value of the current and the corresponding unit (**A**).
The lower digital display indicates the active power (**W**)
Press the **DISPLAY** key to display the 2nd screen:
- the upper digital display indicates the value of the reactive power and the corresponding unit (**VAR**).

■ Single-phase characteristics

Display range	1000 VA	6 kVA
Measuring range	10.0 VA...999.9 VA	1000 VA...5999 kVA
Accuracy at 50 Hz for $\cos \varphi = 0.6$	2%% of reading ± 2 cts	2% of reading ± 2 cts
Resolution	0.1 VA	1 VA

The measurement is only accurate for sinusoidal signals

■ Three-phase characteristics

Range	1000 VA	6 kVA
Specified measurement range	10.0 VA...999.9 VA	1000 VA...5999 kVA
Accuracy at 50 Hz for $\sin \phi \geq 0.6$	3% of reading ± 2 cts	3% of reading ± 2 cts
Resolution	0.1 VAR	1 VAR

The three-phase measurement includes the harmonic and inter-harmonic powers up to 1 kHz

3.4.5 Measurement of the power factor (PF)

1. Press the **ON/OFF** key: the first screen appears.
2. Connect the measurement leads to the instrument's current measurement terminals (on the left), complying with the polarities indicated: red lead on the "+" terminal and black lead on the "COM" terminal.
Connect the measurement leads to the instrument's voltage measurement terminals (on the right), complying with the polarities indicated: red lead on the "+" terminal and black lead on the "COM" terminal.
3. Set up as indicated in the connection diagrams in Fig.4.4.1 or Fig.4.4.2 (T3FE only PX 120), depending on the case, making sure if possible that the maximum acceptable limits are not exceeded (see table below). Range switching is automatic.
4. Press the **DISPLAY** key to display the 2nd screen:
- the lower display indicates the power factor and the symbol **PF** is displayed.

■ Characteristics

Display range	1.00		
Measuring range	0.00 - 0.20	0.21 - 0.50	0.51 - 1.00
Accuracy	10% ± 2 cts	5% ± 2 cts	3% ± 2 cts
Resolution	0.01		

Note 1: *The power factor display is limited to ≤ 1.00 and remains undetermined " - - - " when $S < 5$ VA or $S = OL$.*

Note 2: *The power factor measurement is not a signed measurement.*

3.5 Communication (option)

The wattmeters are equipped with a two-way RS 232C communication channel.

Communication takes place via an optical head and the following functions are available:

- Calibration of the instrument in the factory or at a Manumasure branch.
- With operating software (available as an option) installed on a PC, it is possible to read and record the wattmeter measurements; depending on the operating mode, you can:
 - view one or two of six parameters on the PC screen,
 - print out the contents of the screen,
 - transfer measurement files into an Excel file and store them.

■ Characteristics

- 1 start bit
- 8 data bits
- no parity
- 1 stop bit
- 9600 bauds.

These parameters are not configurable.

3.6 Mains power supply (option)

The PX110 and PX 120 wattmeters are equipped with a mains power supply adapter EN 61010-1 600V Cat III 6.9 VA as an option.

The battery hatch can be removed and replaced with an adapter connected to the AC mains network.

■ Connection

The adapter hatch is fitted and then locked on the PX 110/120, with the measurement lead disconnected.

The plug of the unit is connected to a "Europe"-type wall mains socket with the lead underneath.

■ Precaution for use


Remove the batteries from the PX110/120 before using the adapter.

4. GENERAL SPECIFICATIONS

4.1 Dimensions and weight

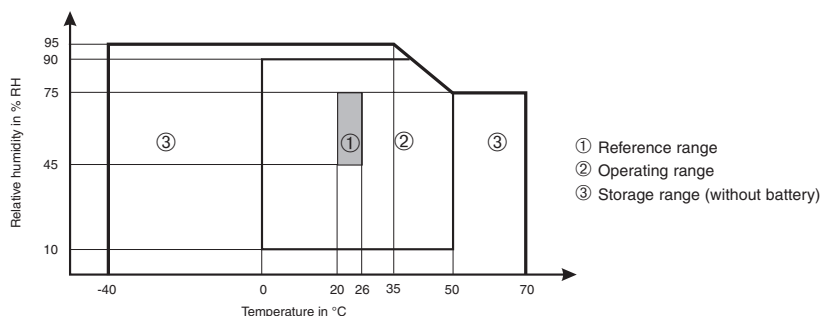
- 211 x 108 x 60 mm
- Approx. 835 g

4.2 Power supply

- Six 1.5 V alkaline batteries (type 6LR6) or 6 NiCd 1.2 V batteries (14.5 x 50 mm) or 230 V mains power supply (option)
- Average battery charge life: 40 hours with batteries
- Battery charge indicator :
 - Fixed: < 1 hour, change battery
- Automatic shutdown after 10 minutes without action on the keys and for $S < 1 \text{ VA}$, $U < 0.5 \text{ V}$ or $I < 5 \text{ mA}$, in constant measurement (restart by pressing the **ON** key)

4.3 Environmental parameters

■ Climatic conditions



Note: The operating range (2) is reduced to 40°C with the mains adapter accessory.

■ Altitude

- Operation: $\leq 2,000$ m
- Storage $\leq 10,000$ m

- **Impermeability:** protection index IP 54 (according to EN 60529, ed. 2000)
(IP2X electrical protection for the terminals)

4.4 Compliance with norms

■ Electrical safety

(as per EN 61010-1 ed. 95)

- Dual insulation:
- Installation category: III
- Pollution level: 2
- Rated voltage: 600 V

■ Electromagnetic compatibility (EN 61326-1 éd.98)

■ Electrostatic discharge (IEC 61000-4-2)

- 4 kV contact, 8 kV air
- aptitude criterion A, industrial site

■ Electromagnetic field (IEC 61000-4-3)

- 10 V/m
- aptitude criterion A, industrial site

■ Bursts (IEC 61000-4-4)

- 2 kV Level III
- aptitude criterion B, industrial site

■ Shock wave (IEC 61000-4-5)

- 1 kV differential mode, 2 kV common mode
- aptitude criterion A, industrial site

■ Conducted interference (IEC 61000-4-6)

- 3 V
- aptitude criterion A, industrial site

■ Mechanical resistance

- Operating position: any
- Free fall: 1 m (test as per IEC 68-2-32)
- Impacts: 100 g (test as per IEC 68-2-27)
- Vibrations: 0.15 mm (test as per IEC 68-2-6)

■ Auto-extinguishability

- Housing: V0
- Display window: V0

4.5 Variations in operating range

Influence parameter	Operating range	Parameters influenced	Typical error
Frequency	40 to 70 Hz	Current Voltage Active power. $0.5 < PF < 1$ Active power. $0.2 < PF < 0.5$ Reactive power. $0.5 < PF < 0.8$ P(T3FE) $0.6 \leq PF \leq 1$ Q(T3FE) $0.6 \leq PF \leq 0.8$ Apparent power	0.1% 0.1% 1.5% 2% 2% 2% 2% 0.5%
Harmonics		Current (THD = 40%) Voltage (THD = 20%) Voltage	0,2% 0,5% 0,2% 0,5% 0,2% 0,2%
PF	$0.5 < PF < 0.8$	P P(T3FE)	1% 2%
PF	$0.2 < PF < 0.5$	P P(T3FE)	2% +2 W 4% +4 W
PF	$0.5 \leq \sin \phi < 0.6$	Q Q(T3FE)	1% 1%
Temperature	0 to 50°C	Current Voltage Power	300 ppm/10°C 200 ppm/10°C 300 ppm/10°C
Relative humidity	10...95% RH	Current Voltage Power	0,7% 0,7% 0,7%
Battery voltage	6.5 to 10 V	Current Voltage Power	0,04% 0,04% 0,1%
Common mode		Current	0,2% for U = 230V 50 Hz

Note: The term Power covers the active power P and its associated values Q, S and PF.

5. ACCESSORIES

5.1 Delivered with the wattmeters PX 110 / PX 120

- 2 sets of safety leads
- 1 set of leads with touch prods
- Six 1.5 V batteries
- 1 operating manual

5.2 Delivered as options

Operating software (box + optical head)	HX0013
Set of 6 NiCd 1.2 V batteries, size 14.5 x 50 mm	HX0014
Set of six LR6-AA alkaline batteries	HX0020
Set of fuses	HX0019
Set of two 20 A leads (red/black) 2 m long for the voltage or current circuit	HX2004
Set of 2 touch prods (red/black)	HA2045A
Wattmeter switcher	HX0011
Multi-ratio AC transformer (10, 15 and 30 A)	HX0012
Mains power supply adapter	HX0021

6. MAINTENANCE



Only use specified spare parts for maintenance purposes. The manufacturer cannot accept any responsibility for accidents occurring following repairs carried out outside its after-sales department or approved maintenance network.

6.1 Replacing the batteries

Disconnect the leads from the instrument



- Press the **OFF** key
- Unscrew the “quarter-turn screw” located at the top of the battery and fuse access hatch (on the back of the instrument) and remove the hatch by pulling the stand.
- Replace the 6 batteries located on either side of the opening with 6LR6-type 1.5 V alkaline batteries, taking care to comply with the polarities indicated on the printed circuit.
- Reinstall the hatch and lock the quarter-turn screw.

6.2 Replacing the fuse

Disconnect the leads from the instrument



- Press the **OFF** key
- Proceed as indicated in § 6.1 for replacement of the batteries.
- Replace the fuse with a 10 A fuse of the same type (10 A - 200 kA-600 V AC- 20 kA DC - 10 x 38).
- Reinstall the hatch and lock the quarter-turn screw.

6.2 Storage

If the wattmeter is not used for a period of more than 60 days, remove the batteries and store them separately.

6.3 Cleaning



Disconnect the leads from the instrument and press the OFF key

- Clean the unit with a cloth slightly moistened with soapy water. Clean off with a damp cloth. Then dry quickly with a cloth or pulsed air.

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