



SINGLE PHASE RELAY TEST EQUIPMENT

User's Manual



PTE-50-CE Pro

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PACKING LIST

| | |
|---|---|
| 1 | PTE-50-CE main unit. |
| 1 | PTE-FCN module installed inside the main unit's cover ¹ . |
| 1 | Software CD-ROM |
| 1 | Nylon cover. |
| 1 | Schuko type power supply cord. |
| 4 | Test leads 2.5 mm ² section (2 red and 2 black). |
| 2 | Test leads 6 mm ² section (1 red and 1 black). |
| 1 | RS-232 communications cable. |
| 1 | PTE BUS interconnection cable. |
| 1 | BNC / 4-mm cable for external timer start signal. |
| 2 | Clips up to 50 A (1 red and 1 black). |
| 4 | Clips up to 10 A (2 red and 2 black). |
| 1 | Set of spare fuses |
| 1 | Case key set. |
| 1 | Warranty statement and register form. |
| 1 | Measurements Certificate. |
| 1 | This User's Manual. |
| | Equipment with 230 V ac voltage supply: 2 Fuses 5x20 2 A, included in the ON/OFF switch block. |
| | Equipment with 115 V ac voltage supply: 2 Fuses 5x20 4 A, included in the ON/OFF switch block. |

¹ Refer to section PTE-FCN VOLTAGE MODULE for details.

1. INTRODUCTION

The PTE-50-CE Pro is designed as a Portable Single phase unit that allows the user to test, as stand alone unit or in combination with others, all type of protective relays.

Extremely compact and rugged, this unit incorporates the latest in the modern microprocessor technology to achieve unbeatable output characteristics in terms of power, accuracy, low distortion, and dynamic capability. This technology allows the unit to perform, without any external accessories, various specific functions very often used in the relay testing.

All the output signals are digitally generated, amplified and controlled by the internal IGM (Intelligent Generation Module) in terms of amplitude, phase and frequency. A high accuracy and stability are obtained in the output waveforms, which are absolutely independent of the main supply.

Contained in an aluminum IP-65 case, with a membrane keyboard that allows full manual control, and a RS-232 com port for computer control, the PTE-50-CE Pro offers the best features currently available for on site manual or automatic relay testing.

1.1. MAIN FUNCTIONAL FEATURES

a) TIME MEASUREMENT

Used to measure the relay's operation time. The **digital timer** which is incorporated in the PTE-50-CE Pro has a **resolution of 1 ms** and contains all the necessary controls to select the starting and stopping of the timer whether it is external or internal, or when using the monitor signal or via PTE-BUS.

b) AVAILABLE REFERENCES

The power output has **three different references** available:

- o The main supply phase (*Line*).
- o The PTE BUS (BUS).
- o The *External Phase Reference* (current or voltage).

c) POWER OUTPUTS

The main **current / voltage output** provides **up to 50 A** in four ranges or **up to 150 V** in two ranges interchangeably, and has **dynamic capability**. The output **regulation** can work **independently or linked in a three phase system**, when PTE units are working together interconnected through the PTE BUS, any combination of dynamic steps to 2nd values, can be selected in amplitudes and phase angles for any type of fault simulation.

The PTE-FCN auxiliary voltage module is described at the end of this manual.

d) EXTERNAL REFERENCE INPUT

The PTE-50-CE Pro can be synchronized in frequency and phase to any external **0.1 - 25 A** AC current or **5 - 300 V** AC voltage signals.

e) SIGNAL MONITOR

The *Signal Monitor* input detects the relay's operation and works with dry contacts or with voltage signals from 5 to 250 V ac or dc.

f) RS-232 COMMs PORT

This port allows connection of an external computer for:

- o Software-based unit's calibration.
- o Automatic testing.

g) PTE BUS

Allows the interconnection with any other unit of the PTE RANGE.

h) EXTERNAL TIMER CONTROL OUTPUT

Delivers a pulse signal, dry contact type, of 20 ms duration. This can be used to start an external timer, for timing measurements. This signal is produced every time one of the power outputs changes its status, or the *Step* key is activated for amplitude step or phase step.

i) UNIT PROTECTION

The PTE-50-CE Pro is electronically protected against overload, short-circuit and over temperature. These alarms are indicated on the *Front Panel*.

1.2. APPLICATIONS

AS STAND ALONE TESTING UNIT:

- o Synchronizing relays.
- o Multifunction generator protection Relays.
- o Harmonics relays.
- o Over current relays (up to 50 A).
- o Inverse time over current relays.
- o Definite time over current relays.
- o Earth and neutral (including harmonics filtering).
- o Voltage controlled relays.
- o Directional relays.
- o Differential relays.
- o Single phase distance relays.
- o Directional power relays (single and three phase).
- o Maximum and minimum voltage relays.
- o Dynamic test. Fault simulation.

COMBINED WITH A SINGLE OR THREE-PHASE CURRENT OR VOLTAGE INJECTOR:

- o Three-phase distance relays.

- o In general all types of relays which require 3 voltages and 3 currents to function correctly.

MISCELLANEOUS:

Due to its good characteristics of accuracy and stability, the PTE-50-CE Pro can test transducers, energy meters and measuring instruments within the following ranges:

- o Single phase current up to 50 A
- o Single phase voltage up to 150 V.
- o Harmonics selection, 1st to 7th harmonic.
- o Phase angle from 0° to 359.9°.

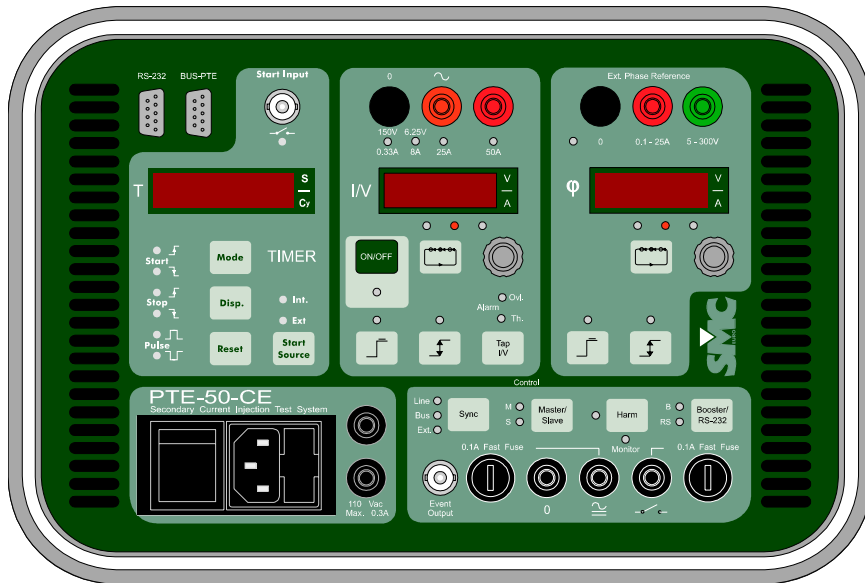


Figure 1: PTE-50-CE Pro unit's front panel

2. OPERATIONAL PRINCIPLE

2.1. GENERAL

A general overview of the operational basic principles on which the PTE-50-CE Pro is based, is provided in this section.

The PTE-50-CE Pro's main unit features three functional blocks:

- o Front Panel.
- o Intelligent Generator Module (IGM).
- o Power Supply.

2.2. FRONT PANEL CONTROLS

The front panel allows the user to communicate with the power output section of the unit in a manual way, or using a software program. To achieve this, it has the following sections:

Displays and LED indicators: indicate the various selections made by the operator and the status of the unit:

- o **Press key controls:** this is a membrane keyboard with acoustic feedback, in which the various different functions available in the unit are selected.
- o **Multi-turn control knobs:** these rotary pulse generators are used to adjust the unit's output in terms of current or voltage level and phase angle.
- o **Monitor taps:** these input taps detect status changes in the external signals (dry or voltage contacts) provided by the tested device.

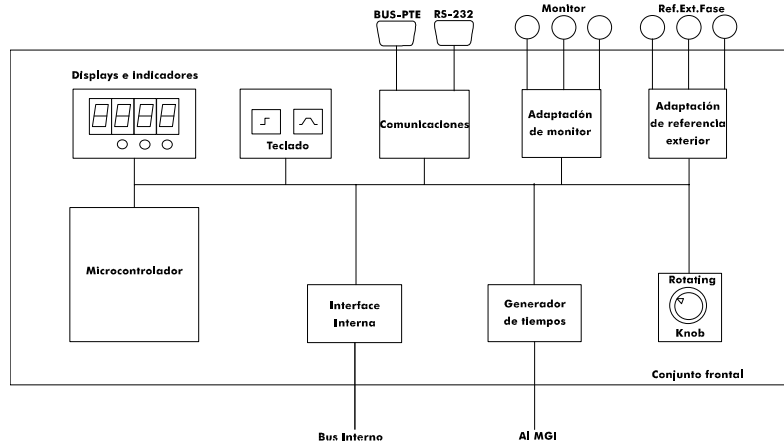


Figure 2: Front Panel Block

- **External Reference Input:** contains the circuits to synchronize the unit to external phase and frequency signals.
- **Communications:** the RS-232 port allows communicating to an external PC for special functions like unit's calibration. The BUS-PTE connector allows the linkage of the PTE-50-CE Pro to other PTE-type units and to an external PC for remote control.
- **Output taps:** these are the taps of the auxiliary voltage supply of 110 V ac, the power output taps, and the tap to start an external timer.
- **Microcontroller:** it is one of the most important parts of the unit, which as its name indicates, controls or establishes the flow of information between all the functional blocks previously mentioned.

2.3. INTELLIGENT GENERATOR MODULE

Essentially, the IGM is a linear power amplifier, controlled by its internal microprocessor. It produces the sinusoidal signal in the frequency and the phase selected. This is amplified and adapted by a transformer in the selected output

range. This generator also feedback's the output level in voltage, current, and phase, to the generation stage, thus achieving a high accuracy output.

As shown in the block drawing and in the front panel control functions, a microprocessor is in charge of supervising all the functions of the generator modules. They receive the output measurements and make the corrections necessary in amplitude and phase to obtain the desired accuracy. Also they store the calibration parameters, and use them to correct the selections made from the *Front Panel*.

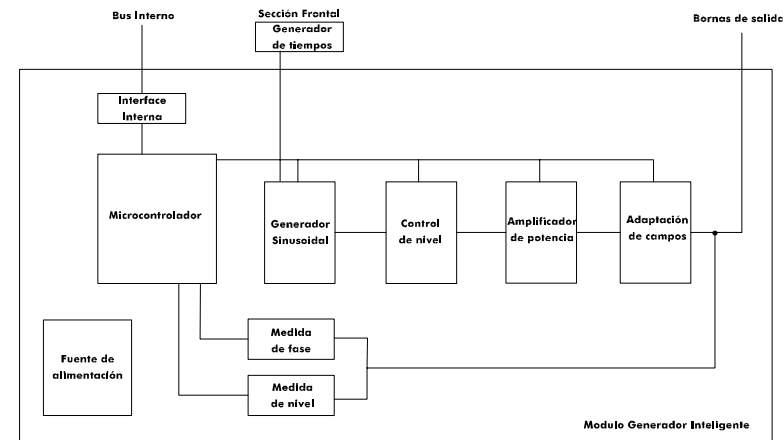


Figure 3: Intelligent Generator Module

2.4. POWER SUPPLY

This section contains the transformers and switching power supplies which supply and energizes the *front panel block* and *IGM*.

3. CONTROLS DESCRIPTION

This section describes one by one and in detail all of the controls, indicators, displays, and connection taps on the front panel of the PTE-50-CE Pro. As well as the functions, marked indications and where they are located will be shown in the figures.

To understand this clearly, sections will describe the controls, by sections, their physical position on the front panel. The different types of controls that you can find are classified as follows:

- KEY CONTROLS: this refers to the press key and rotating knobs. The description is of the use and where they are located.
- DISPLAY AND VISUAL INDICATORS: this refers to the LED indicators and the selection displays. The description is of the use and where they are located.
- CONNECTORS (TAPS): this refers to all taps (input and output), connectors, etc., which are contained in the PTE-50-CE Pro.
- This section describes all the connectors that are incorporated in the unit. All of them meet international safety standards and are easily identified with their corresponding identification marks on the front panel.

3.1. MAIN SUPPLY SECTION

3.1.1. MAIN VOLTAGE SUPPLY

The unit is supplied with SCHUKO type plug 2 poles with earth.

Also incorporated in the connector is a filter to avoid perturbations from the main supply.

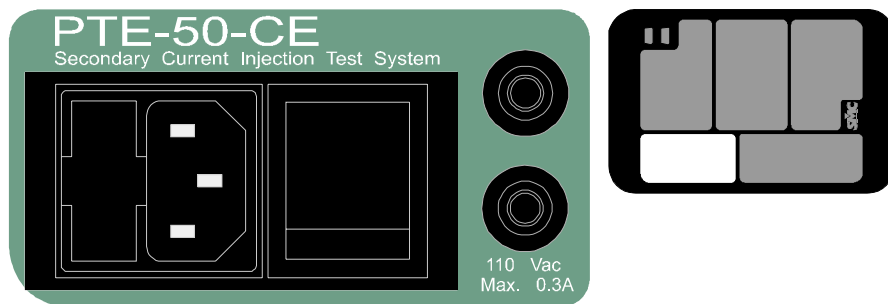


Figure 4: Voltage supply Connector

This is situated on the bottom left hand side of the unit and includes the following:

- Power supply with 2 poles and earth.
- Power supply fuse holder: to reach these fuses, the cover must be lifted as indicated in the drawing.
- There are two fuses: the lower one is the active fuse and the one located above is the spare fuse.

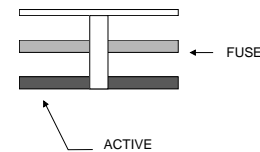
The fuse is a standard 5 x 20mm, normal fuse with a value of 2 A. (For equipment of a voltage supply of 230V. For equipment using a voltage supply of 115V the fuse value is 4 A.)

- Power supply switch: it has 2 positions, ON/OFF. The unit is disconnected when the red mark of the switch is visible.

FIXED 110 V c.a. VOLTAGE SUPPLY

This output is located in the lower central section to the right of the power supply switch. It consists of 2 black, 4 mm taps.

This output is always active when the unit is switched on. The taps have a distance of 19 mm which is the standard two-pole plug size.



3.2. TIMER SECTION: CHRONOMETER

The *Timer* is located on the left-hand side of the unit and clearly marked from the rest of the unit. It contains all the necessary controls for various timing functions, which are explained below.

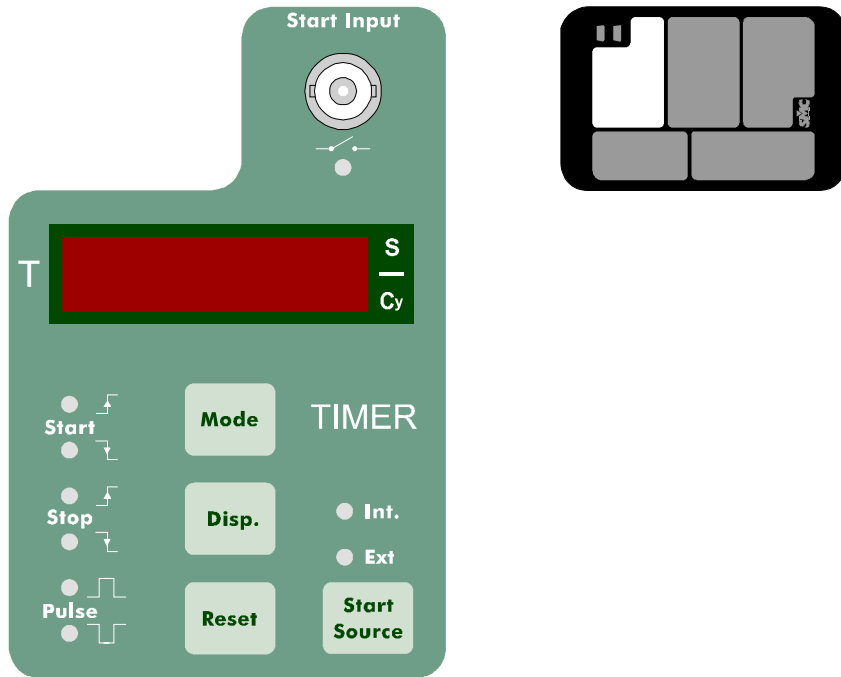


Figure 5: *Timer Section*

3.2.1. CONTROL KEYS AND KNOBS: *Selecting the function mode*

This section describes how to select the timer mode for the starting/stopping of the timer, the timer reading, and how to reset it. The keyboard for the timer is as follows:

Mode

This key works in a sequential way, that is to say by pressing this key; the LED's will indicate the different selection combinations. There are 6 different possibilities to choose from, see 3.2.2.

Disp.

This key works in a sequential way, each time this key is pressed, the reading in Display 1 located on the left-hand side will change. This will display seconds or the number of frequency cycles in alternating current.

Reset

Each time this key is pressed the timer will reset to 0, allowing the operator to perform the next test. If the timer is not reset, all the outputs and displays will remain on hold and blocked.

Start Source

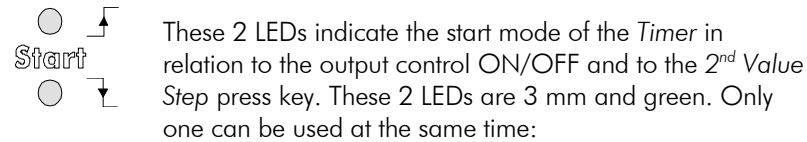
This key allows the selection of the Timer whether it is internal or external. Each time this key is pressed the selection will change from one to another. There are 2 VISUAL LED's associated with this key.

3.2.2. VISUAL INDICATORS AND DISPLAYS

o Function mode indication

There are 6 green LED's of 3 mm. When these are lit they indicate mode function the equipment has. These LEDs are associated with the Mode key:

a) START Mode indicators:



When the upper LED is lit, it indicates that the *Timer* will start when:

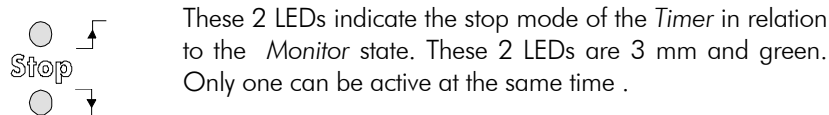
- o The output control is activated (ON)
- o When there is a *Step to 2nd Value*.
- o When a contact is closed at the input of the external timer.
- o When this LED is flashing it indicates that the *Timer* is in BUS mode, meaning that it will start when there is a positive event in the BUS.

When the lower LED is lit, it indicates that the *Timer* will start when:

- o The output control is deactivated (OFF)
- o When a *Step to 2nd Value* is deactivated.
- o When a contact is open at the input of the external timer.

When this LED is flashing it indicates that the *Timer* is in BUS mode, meaning that it will start when there is a negative event in the BUS.

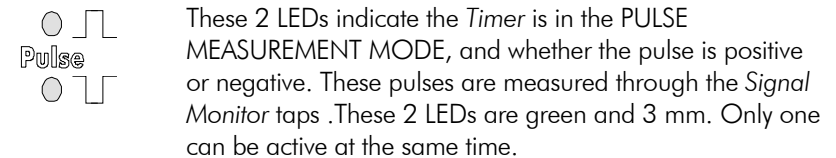
b) Stop Mode Indicators



- o When the upper LED is lit, it indicates that the *Timer* will stop when the *Signal Monitor* is activated. When this LED is flashing it indicates that the *Timer* is in BUS mode, meaning that the *Timer* will stop when there is a positive event in the BUS.
- o When the lower LED is lit, it indicates that the *Timer* will stop when the *Signal Monitor* is deactivated.
- o When this LED is flashing it indicates that the *Timer* is in BUS mode, meaning that the *Timer* will stop when there is a negative event in the BUS.

They are controlled by the MODE key.

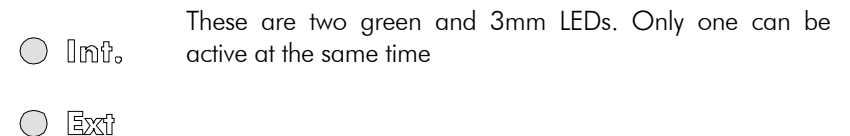
a) PULSE Mode Indicators



- o When the upper LED is lit, it indicates the *Timer* will read an active or positive pulse measurement.
- o When the lower LED is lit, it indicates the *Timer* will read a non-active or negative pulse measurement.

Both of these LEDs are controlled by the Mode key and can only be active when the *Timer* is in the EXTERNAL Mode.

o TIMER SIGNAL indicators



When the **Int.** LED is lit, the timer will start /stop with internal signals from the unit, such as:

- o Activating ON/OFF in any channel.
- o Activating a *Step to 2nd Value* in any channel.

When the EXT LED is lit, the start signals are produced externally, and introduced in the *Monitor 2* located above the *Timer* display. At the same time the *Timer* should be set in the PULSE mode in *Monitor 1*.

- o **Timer Display**



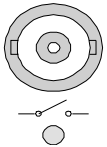
The timer reading has 5 digit, 7 segment LEDs and 0.3 inches in height. There are two possible readings. On the right hand side they are 3 indicators that indicate the timed reading. They are:

- o **S:** time in SECONDS
- o **Cy:** indicates the NUMBER OF FREQUENCY CYCLES IN ALTERNATING CURRENT.

The *Timer* display can only make 1 stop and start event, and cannot be used again until the *Reset* key is pressed.

3.2.3. CONNECTORS: Monitor Signal

Start Input This BNC connector is associated with a 3 mm, yellow LED. This input allows only a dry contact, voltage free. When the input is closed the LED will light up indicating the *Monitor* is active.



3.3. POWER OUTPUTS

The equipment has an output and phase channels. In each one of them can be selected the desired output level as well as the phase angle.

This section is situated in the central section of the unit, and is clearly identified. All the controls, indicators, etc. contained in this part of the unit will be explained.

3.3.1. OUTPUT SECTION

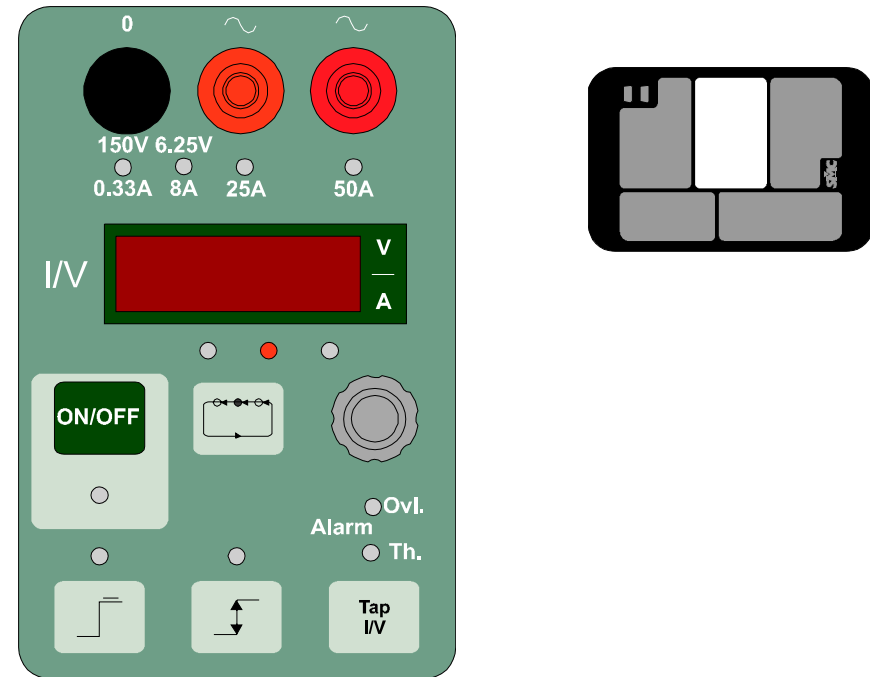


Figure 6: Selection of the OUTPUTS

o CONTROL KNOBS AND PRESS KEYS

a) Selecting the digit to be used.



This key works in a sequential way and it is associated with 3 LEDs located above this press key. This allows the operator to select the output in a fine or course regulation, by changing the digit to be adjusted.

The following resolutions can be obtained:

- o 1 digit.
- o 10 digits.
- o 100 digits.

When pressing this key for more than 2 seconds, it will block the rotating pulse generator, not allowing any modifications to the level selected

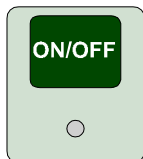
b) Rotating Control Knob



This is a rotating pulse generator and has step by step sensation. The values can be increased or decreased by turning this control knob clockwise or anti-clockwise by one digit per step, according to the selected digit weight as described previously. This knob has no end and can be controlled at any speed. However if the control knob is turned very fast the value will change at a maximum rate of 1 digit per second.

However if the control knob is turned very fast the value will change at a maximum rate of 1 digit per second.

c) Output Selection ON/OFF



When this key is pressed the output will turn on and the LED situated below will light up.

When it is pressed again it will disconnect this output and the LED will be off.

d) Selecting the 2nd value



When this key is pressed it allows the selection of a 2nd value and it is shown in the display. This selection does not cancel the value already selected in the output at the moment. To distinguish the actual value from the 2nd value selected, the LED over the key lit when the 2nd value is displayed.

e) Activating the 2nd value



This key works in a sequential way. When pressed the output value changes to the 2nd value, when it is pressed again it will return to the 1st value.

When this key and the similar key in the phase section are pressed at the same time for more than 2 seconds this function if both sections becomes synchronized. To cancel you must repeat this process.

c) Selecting the output range and output selection



This key has two function modes:

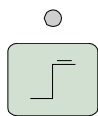
1. Selection of the output type: this key serves to select the output type desired, that is voltage (V) or current (I). When turning on the unit it will be in current output. To change this output to voltage you must press this key for more than 2 seconds. To change this output back to current, repeat the process.
2. Output range selection: this key also serves to select the output range, in voltage and current. This key works in a sequential way: each time it is pressed it will change the output range. There are 2 ranges in voltage and 4 ranges in current. They are:

- Current:
 - 0 - 0.33 A
 - 0 - 8 A
 - 0 - 25 A
 - 0 - 50 A
- Voltage:
 - 0 - 6.25 V
 - 0 - 150 V

This key is associated with the 4 red LEDs with the ranges marked and the display in this section

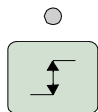
○ VISUAL AND DISPLAY INDICATORS

a) LED Indicator for 2nd Value selection



This is a 3 mm, red LED that is situated over the corresponding key. When this LED is lit, it indicates that it is in the *2nd Value Selection* mode and that this value is shown in the display..

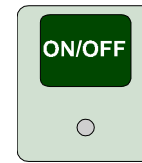
b) LED indicator when 2nd value is activated.



This is a 3 mm, red LED that is situated over its corresponding press key. It has two states:

- Not lit: indicates that the phase angle in the output is the first value
 - Lit: indicates that the phase angle in the output has changed To the second value.

c) LED Indicator when the 2nd value is activated



This is a 3 mm, red LED that is situated below its corresponding press key. It has two states:

- Not lit: indicates that the output is (OFF)
- Lit: indicates that the output is (ON)

This LED is also associated with the OUTPUT ON/OFF. In whichever case the LED shows the REAL STATE of the output. It also can be controlled internally by the equipment (E.g.: Alarm).

d) Digit selection Indicators



These three, 3 mm LEDs (red), indicate the digit selection for regulation. Only one will be lit and it indicates the digit above it to be regulated. These are situated above the press key.



e) Level selection display



The display is made up of 4 digits of 7 segments, red in color and 0.3 inches in height, which shows the selected values and the corresponding units to the selected parameter with three indicators located to the right side of the display.

There are two different parameters available:

- current (A).
- voltage (V)

In current and voltage, depending on the selected range, the decimal point will adjust automatically. The V and A indicators will light up automatically when selected.

When the value in the display begins to flash, it indicates that the value selected and is not in the output.

f) Output range selection indicators



There are four red LEDs of 3 mm located below the output taps. These indicate the selected output range, in both voltage or current.

To selected the desired output current or voltage, is made by pressing the TAP I/V key

g) Alarm Indicators



There are two, 3 mm LEDs (red) which indicate the status of the two alarms for the output of PTE-50-CE Pro.

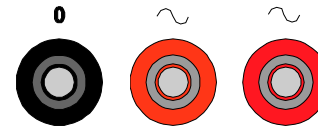
They are as follows:

- o Ovl: this LED indicates an overload in the output, whether it is current or voltage. When it is lit, the output will cut off and the display will begin to flash for 5 seconds. During this time it is possible to reset the output by pressing the ON/OFF button.
- o Th: this LED indicates an internal thermal overload, (temperature overload). When this alarm is on, the LED will light up, and the output will cut off. While this LED is on it is not possible to work with the unit and the operator must wait until the internal temperature lows.



When the thermal alarm is lit, turn off the unit for at least 1/2 hour.

o TAPS: Output taps



These taps are situated in the upper central part of the unit and consist of 3, 4 mm female connectors up to 50 A. The first ones are used for the voltage and current outputs and the third one is used only for current, in the 50 A range. With the unit two testing cables are supplied, which are used with these taps.

3.3.2. PHASE ANGLE SECTION

This is situated to the right of the unit and is perfectly identified. It contains all the control knobs, keys, and LEDs necessary for the operator to use the functions in this section.

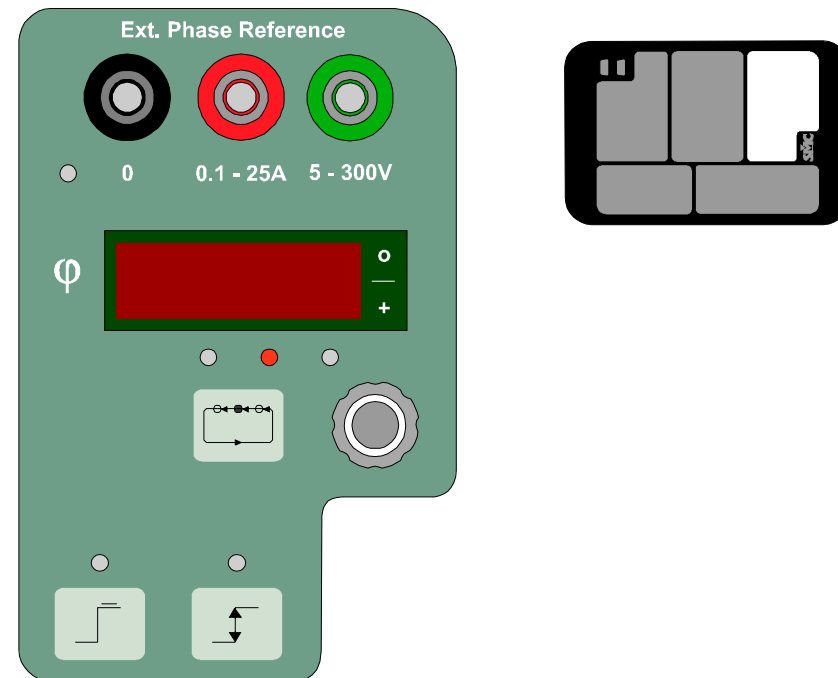


Figure 7: Phase Angle Selection

o CONTROL KNOBS AND PRESS KEYS

a) selecting the digit to be used

This key works in a sequential way and it is associated with 3 LEDs located above this press key. This allows the operator to select the output in a fine or course regulation, by changing the digit to be adjusted.

The following resolutions can be obtained:

- o 1 digit.
- o 10 digits.
- o 100 digits.

When pressing this key for more than 2 seconds, it will block the rotating pulse generator, not allowing any modifications to the phase angle selected.

b) Rotating control knob



This is a rotating pulse generator and has step by step sensation. The values can be increased or decreased by turning this control knob clockwise or anti-clockwise by one digit per step, according to the selected digit weight as described previously. This knob has no end and can be controlled at any speed.

However if the control knob is turned very fast the value will change at a maximum rate of 1 digit per second.

d) 2nd value selection



When this key is pressed it allows the selection of a 2nd phase angle and it is shown in the display. This selection does not cancel the angle already selected in the output at the moment. To distinguish the actual angle from the 2nd value selected, the LED over the key lit when the 2nd value is displayed.

e) Activating 2nd value



This key works in a sequential way. When pressed the phase angle in the output changes to the 2nd value, when it is pressed again it will return to the 1st value.

When this key and the similar key in the phase section are pressed at the same time for more than 2 seconds this function if both sections becomes synchronized. To cancel you must repeat this process.

o VISUAL INDICATORS Y DISPLAY

a) LED Indicator for the 2nd value selection

This is a 3 mm, red LED that is situated over the corresponding key. When this LED is lit, it indicates that it is in the 2nd Value Selection mode and that this value is shown in the display.

b) LED Indicator when the 2nd value is activated

This is a 3 mm, red LED that is situated over its corresponding press key. It has two states:

- o Not lit: indicates that the phase angle in the output is the first value
- o Lit: indicates that the phase angle in the output has changed to the second value.

c) Digit selection indicator

These three, 3 mm LEDs (red), indicate the digit selection for regulation. Only one will be lit and it indicates the digit above it to be regulated.

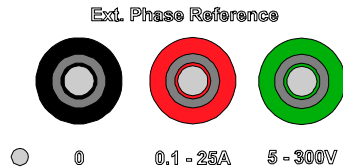
d) Phase selection Display



The display is made up of 4 digits of 7 segments, red in color and 0.3 inches in height, which shows the selected values.

o INPUT TAPS

a) External reference input taps



These taps are situated in the upper right hand side of the unit and consist of 3 female taps, 4mm diameter, which allow input up to 25 A.

These Taps are to receive an external reference to the equipment in frequency or phase, which enables the PTE-50-CE Pro to be referenced to them. These taps admit two types of signals:

- o Voltage: Connected between the black tap (0) and the red tap (5-300V). Input levels between 5V and 300V and frequency between 40 and 200 Hz are admitted
- o Current: Connected between the black tap (0) and the green (0.1-25 A). Input levels between 0.1 and 25A 5V and 300V and frequency between 40 and 70 Hz are admitted.



Extreme care must be taken not to connect voltage in the current taps, as these inputs are of low impedance (shunt) and can cause damage to outside voltage source by short circuit.

3.4. POWER OUTPUT APPLICATION

3.4.1. Use

Taking note that the output channel, of PTE-50-CE Pro, can supply a maximum of 100 VA.. This means that the output tap we have a voltage value that cannot be exceeded:

| Tap | Maximum voltage |
|--------|---|
| 0.33 A | 150 V |
| 8 A | Booster OFF 6.25 V Booster ON 12.5 V |
| 25 A | Booster OFF 2 V Booster ON 4 V |
| 50 A | Booster OFF 1 V Booster ON 2 V |

In fact, the only electrical parameter with a real physical sense, by itself, is voltage. We cannot define a current supply in terms of current capacity only, but we need to define the maximum load that can be connected to the taps, to reach the current limit.

Suppose we have the burden of a relay (15 VA) at the nominal current (5 A). We can calculate its internal impedance using the *Ohm's Law*:

$$VA_{LOAD} = I_{LOAD} \times V_{LOAD} \Rightarrow V_{LOAD} = VA_{LOAD} / I_{LOAD} = 15/5 = 3 \text{ V}$$

$$Z_{LOAD} = V_{LOAD} / I_{LOAD} = 3/5 = 0.6 \text{ A}$$

This means that if you want to inject 5 A in this relay a 3 V voltage is needed, so a 15 VA power from the injection equipment.

3.4.2. CONNECTING IN PARALLEL WITH OTHER EQUIPMENT

If we want to connect various PTE-50-CE Pro outputs to obtain a higher output in parallel, it is necessary that the outputs are connected as shown below:

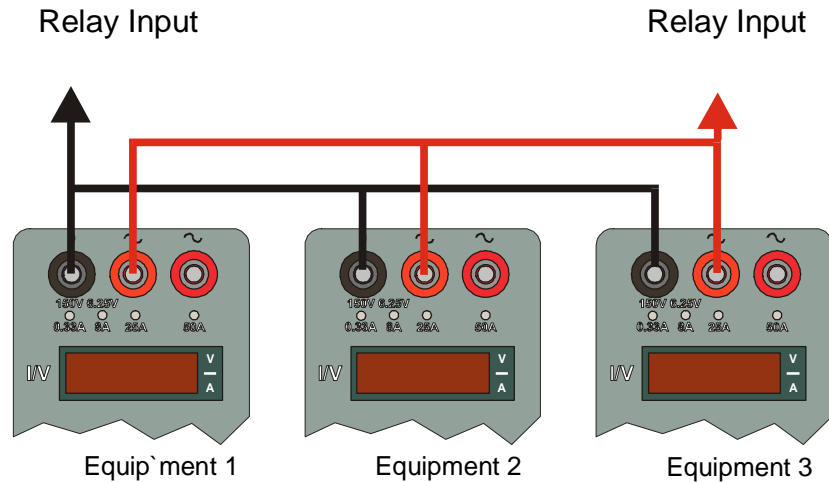
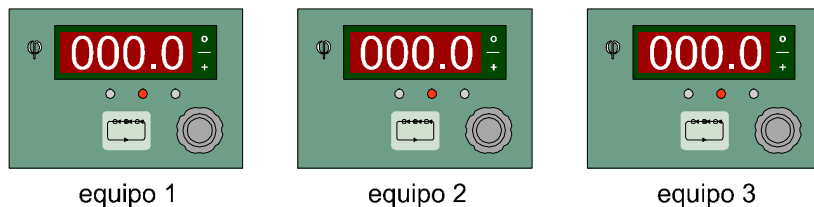


Figure 8: Connecting in parallel various PTE-50-CE Pro units

Remember that the current outputs, to be added correctly, must have the same phase angle, for instance:



We can select the same or different levels in the outputs but, to achieve the maximum power, we recommend to use them with the same levels (for instance, if we want to inject 60 A, we would set 20 A in each channel).

To use the three power outputs as one, we will select the *Master-Slave-Slave configuration*, and then we just have to turn the channel 1 output on.

Note: Of course, we can connect only two channels. It will depend on the power required.

3.4.3. EXAMPLE

Suppose we want to inject 65 A to a relay using the three channels in parallel. After making the connections, we will select:

CH₁ → Amplitude: 22 A Phase angle: 0.0°

CH₂ → Amplitude: 22 A Phase angle: 0.0°

CH₃ → Amplitude: 21 A Phase angle: 0.0°

Now we can have 300 VA as maximum, so the current we can get from the equipment will depend on the connected load. As we don't know this impedance load of the relay, we will calculate the maximum load that can be connected to the taps injecting 65 A:

$$VA_{\text{OUTPUT}} = I_{\text{OUTPUT}} \times V_{\text{OUTPUT}}$$

$$Z_{\text{LOAD}} = V_{\text{OUTPUT}} / I_{\text{OUTPUT}} \Rightarrow VA_{\text{OUTPUT}} = I_{\text{OUTPUT}}^2 \times Z_{\text{LOAD}}$$

Then if we are looking for the maximum load at 65 A:

$$Z_{\text{MAXIMUM LOAD}} = VA_{\text{MAXIMUM OUTPUT}} / I_{\text{OUTPUT}}^2 = 300/65^2 = 0.071 \Omega$$

If we connect a relay with higher impedance than 0.071 Ω (considering PTE-50-CE ProT as an ideal generator), it will be an overload for the PTE-50-CE ProT. The equipment will stop the injection, indicating the *Overload Alarm*.

3.5. CONTROL SECTION

This part of the equipment refers to the general control. The unit contains several necessary controls to perform the following functions:

- Using RS-232.
- SYNCHRONIZE selection.
- HARMONICS selection.
- BOOSTER activation.
- EVENT Output.
- Monitor signals.

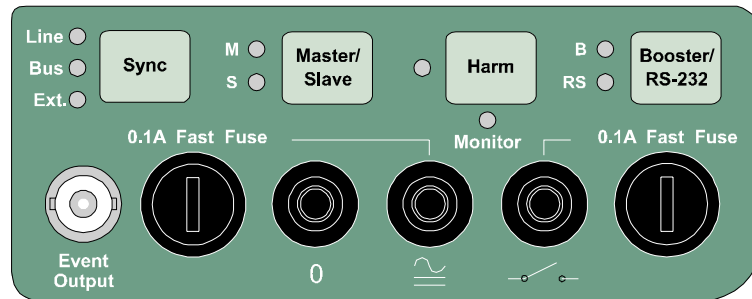
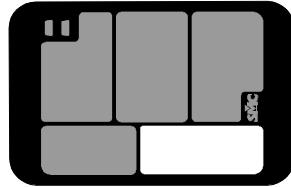


Figure 9: General Control Section

3.5.1. CONTROL KEYS

- **BOOSTER / RS-232**

This press key has 2 functions, they are:

- a) **Activating the BOOSTER mode:**

**Booster/
RS-232**

The BOOSTER key has two modes, ACTIVATED and DEACTIVATED. When the unit is turned on is in the DEACTIVATED mode. When it is activated, the maximum voltage is double in each output range. This function is automatically deactivated if it is not necessary. When the Booster is activated the LED marked B will be lit.

- b) RS-232 Serial Port Control

This press key controls the RS-232 COM port activation to communicate the unit to a PC. Continue to press the key until the LED above this key indicates it is active.

- **HARMONIC Selection Control**

Harm

The press key is marked *Harm*. This key enables to select the fundamental frequency reference desired.

As other press keys, each time one of these keys is pressed the harmonic will change up to the 7th harmonic, so you can select: **1st, 2nd, 3rd, 4th, 5th, 6th and 7th.**

- **MASTER/SLAVE Key**

**Master/
Slave**

The press key marked *Master/Slave*. This key enables to select the function of each equipment connected via the Each time the key is pressed the following can be selected

- **Independent.** The equipment when first turned on and in a normal state is in independent mode, and does not affect any equipment connected via the BUS PTE. The 2 LEDs associated with this key are not lit.
- **Master.** When the equipment is selected as the Master is the unit that controls the system. The indicator LED, Mo will be lit. There can only be one unit selected as the Master.

Changes and control setting made on the Master unit will be reflected in the units, which are in the Slave mode.

- **Slave.** When the equipment is selected in the Slave mode, is controlled by the unit selected as Master, and changes and controls are taken from the Master unit. Changes made in the slave do not affect other units even when connected via the BUS

- **SYNCHRONIZING CONTROL KEY**



This key controls the different references available in the PTE-50-CE Pro. Each time this key is pressed a different synchronized reference is selected.

3.5.2. VISUAL INDICATORS

RS-232 port indicator



This is a 3 mm LED (red). When it lit, indicates that the serial port RS-232 is active so it can send or receive information

BOOSTER mode Indicator



This is a 3 mm LED (red), marked with B. When it lit, indicates that the Booster is active.

SYNCHRONIZING REFERENCE indicators



They are three, 3 mm red leds. Only one is on at the same time.

- **Line:** the reference is the main voltage supply.
- **Bus:** the reference is another PTE unit connected via BUS-PTE. Normally the PTE-300-V or PTE-100-V. If the led is flashing there is no reference in the BUS.
- **Ext:** the selected reference is taken from another instrument or equipment connected in the external reference tap. If the led is flashing there is no valid reference.

MASTER/SLAVE mode Indicators



These are 2, 3 mm green and red LEDs. One green and the other red. Only one LED can be lit at the same time or when in independent mode neither are lit.

M: The equipment is in Master mode

S: The equipment is in Slave mode

Both Unlit: The equipment is in independent mode

Monitor state indicator



This is a 3 mm red LED, located above the *Monitor* taps. When it is on, indicates that the *Monitor* is ACTIVATED. When it is off, indicates the *Monitor* is DEACTIVATED.

3.5.3. CONNECTORS and FUSES

- **Voltage supply**

PTE-50-CE Pro has channel fuses that protects the *Power Module*. These fuses can be broken in different circumstances (like high transients in the outputs).

When this happens, one of the power outputs half-cycle is lost. That's why the values you check in you ammeter differ from the ones displayed in the equipment.

To change the fuse you must do the following:

- Disconnect the main supply.
- Open carefully the *Front Panel*: extract the four screws and take care of not disconnecting any other cables inside the equipment.
- Check the correspondent fuses and change the broken one. The fuses are 6.3 A (fast type) are supplied with the equipment
- Close carefully the *Front Panel*.
- Connect the main supply and test again the channel outputs.

When you want to test the equipment outputs, remember that below 3% of the tap, there is no feedback (neither in amplitude nor in phase angle), so you can get errors. Then you must perform this kind of test with values over 3% of the chosen tap

○ **Monitor input taps**

These taps are located in the lower right hand part of the unit and consist of three, 4 mm female connectors. These taps receive the input signals to the unit.

- Black tap (0): this is the common tap.
- Red tap: any DC or AC voltage between 5 and 250 V can be connected between the common tap (0) and this one. The presence of voltage will activate the *Monitor*.
- Green tap: between this tap and the common a DRY CONTACT can be connected. A close contact will activate the *Monitor*.

The *Monitor* signal fuses are situated to the left and to the right of the monitor taps. The fuse on the left protects the voltage-input tap and the fuse on the right protects the free contact input tap. To remove the fuse, turn the cap anti-clockwise. These are fast fuses, 5x20 mm, 0.1 A.

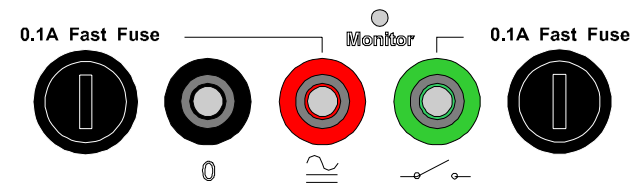


Figure 10: *Monitor input taps*

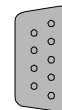
○ **Auxiliary output to start an external timer**



This is a BNC connector that delivers a “close contact” signal of 20 ms duration, with the main objective to start an external timer. This output will be active each time one of the following occurs:

- When the ON/OFF Key of the Unit is pressed, activating or deactivating the power output
- When the *step to 2nd value* is pressed either in level or in phase.
- **RS-232 Connector**

RS-232



This communication connector serial port RS-232 is a CANON connector of 9 pins, located in the upper left part of the unit. Its pin out is as follows:

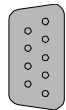
Where:

| | |
|-----|------------------------|
| NC | Not connected |
| GND | Earth ground |
| RX | Input DATA |
| TX | Transmission DATA |
| RTS | Output – Send |
| CTS | Input ready to receive |

The unit is supplied with a connecting cable ready to connect directly to this output, to any type of computer or serial input printer.

○ BUS-PTE Connector

BUS-PTE



This communication connector serial port RS-232 is a CANON connector of 9 pins, located in the upper left part of the unit. With this serial port it is possible to connect various equipment in the PTE Range to establish a common frequency and phase reference. Also it controls the equipment configured as Master /Slave

Also connecting to a PTE-12 enables the PTE-50-CE Pro to work with a computer for automatic software testing.

4. USE AND DESCRIPTIONS

Throughout this section a detailed description of the use and procedures for the PTE-50-CE Pro will be given. This unit has been designed to be used as a portable three-phase unit to test any kind of relays, as a stand-alone unit or interconnected to other auxiliary units. All the functions that are incorporated in this unit were designed to easily test the relays. This is achieved, as all functions are located on the front panel in a MANUAL mode, which before required test units, which were programmable by an external computer.

Furthermore, the PTE-50-CE Pro, and thanks to the BUS-PTE, can be easily interconnected to other units in the PTE range, making the specific functions for relay testing, much more simple and effective.

4.1. TIME MEASUREMENT

The timer is normally activated by a power output, despite it is current or voltage. For this reason, when it is stopped by a "STOP" signal, it holds the actual measurement in the display.

The resolution of this timer is 0.001 s, which is sufficient to

test almost any protection relay.

4.1.1. SIGNAL MONITOR

It is here where the timer receives the signals from the relay being tested and this is shown in the VISUAL LED indicator marked MONITOR.

The *Signal Monitor* is ACTIVATED in the following conditions:

- When there is a VOLTAGE PRESENCE between the common tap and the voltage tap (red). This voltage can be between 5 to 250 V in ac or dc. This input is protected with a fuse clearly marked. (≡).
- When there is a CLOSED FREE CONTACT between the common tap and the contact tap (green). This input is protected with a fuse clearly marked on the front panel.

In both of these conditions, when the *Signal Monitor* is active a red LED will light up.



When connecting the monitor signal to the free contact tap (green) be sure that it is really free from voltage as the protection fuse will blow immediately

4.1.2. TIMER MODE SELECTION

The timer mode is selected with the Mode key and the following modes can be selected:

Mode 1:

- Start: By the injection of current or voltage.
- Stop: When the *Signal Monitor* is activated.

Mode 2:

- Start: By the injection of current or voltage.
- Stop: When the *Signal Monitor* is deactivated.

Mode 3:

- Start: By output disconnection.
- Stop: When the *Signal Monitor* is activated.

Mode 4:

- **Start:** By output disconnection.
- **Stop:** When the *Signal Monitor* is deactivated.

Mode 5: *Positive Pulse. (Only EXT. Mode)*

- **Start:** When the *Signal Monitor* is activated.
- **Stop:** When the *Signal Monitor* is deactivated.

Mode 6: *Negative Pulse (Only EXT. Mode)*

- **Start:** When the *Signal Monitor* is deactivated.
- **Stop:** When the *Signal Monitor* is activated.

The different modes are indicated by their corresponding VISUAL LEDs.

If a mode is changed while the timer is operating the test must be repeated.

4.2. LEVEL SELECTION: POWER OUTPUT

This section describes the correct use of the PTE-50-CE Pro power outputs. The output can be selected in current up to 50 A or in voltage up to 150 V. The power outputs can be synchronized to three available references as it is explained in this section, as well. Because the three output channels are similar, only one will be explained. .

4.2.1. POWER-ON STATUS

When the unit is turned on, the following values and selections are made:

1. Output mode: current.
2. Selected range: 25 A.
3. Selected value: 00.00 A.
4. Output status: OFF.
5. Reference: Line.

4.2.2. OUTPUT MODE SELECTION (I/V)

As mentioned before, the PTE-50-CE Pro can be used as a current or voltage source. When the unit is turned on it will be in the current mode. The voltage output is achieved in the following way:

- Press the *TAP I/V* key for more than 2 seconds. The display will change its units to V (Volts) and the output range will automatically change to 150V (0.33 A). The values selected from now on will be in volts.
- To return to the current mode press the same key again for more than 2 seconds.

4.2.3. OUTPUT RANGE SELECTION

The following output ranges are available:

- Current mode: 0.33 / 8 / 25 / 50 A.
- Voltage mode: 6.25 / 150 V.

To select any of these ranges press the *TAP I/V* key. The display will automatically change. In case we have selected a value and this is greater than the new selected range, the value will set to the maximum value in the selected range.

The active range is that which has its corresponding LED lit.

NOTE: *To change to the 50 A range, you must do the same, but you have to connect the cables to the 50 A taps. In case you have changed to this 50 A range and the cables remain in the 25 A taps, the actual values injected to the relay will be half the displayed values.*

4.2.4. REFERENCE SOURCE SELECTION

When the unit is turned on, it is synchronized to the MAIN VOLTAGE SUPPLY. This is indicated with the LINE LED on. If you want to change this reference you must do the following:

1) Press the SYNC key. The unit will pass to the reference BUS-PTE, which is indicated by the corresponding LED marked BUS. This implies that the reference is the BUS-PTE, with any other unit of the PTE range. If the units are not interconnected (BUS-PTE is not connected or there is no *Reference Master*

selected) the LED indicator will flash slowly indicating that there is no reference. If there is no reference in the BUS and the output is turned on, the unit will synchronize automatically to the last valid reference (LINE).

2) Press again the SYNC key. The unit will pass to *External Reference*, which is indicated by the corresponding LED marked EXT. This implies that the reference is now the signal connected to the *External Phase Reference Input*, introduced in the taps *Ext. Phase Reference*. If there is no signal in these taps the LED EXT will flash slowly indicating that there is no reference or that it is not suitable.

If there is no reference and the output is turned ON, it will synchronize to the last valid reference. The same occurs if there is a valid external reference and it disappears.

3) Press again the SYNC key. The unit will pass to the LINE reference, which is indicated by the corresponding LED marked LINE. This implies that the reference is the main voltage supply.

These changes can be made while the output is ON.

4.2.5. REGULATING AND SELECTION OF OUTPUT VALUES

This is achieved by turning the rotating knob and the digit selector key. The actual value selected is shown on the display, whether the output is ON or OFF. The selected value shown in the display remains the same when the output is ON. If the value selected is higher than allowed in the range chosen, the rotating knobs continues turning, but the value cannot be increased.

The unit **does not feedback values less than 3 % of the end of the selected range**. In this case the phase and the magnitude values cannot be guaranteed. The following table clarifies this:

| Selected Range | 3% of the Range without feedback | Feedback |
|----------------|----------------------------------|----------------|
| 0.33 A | 0 - 0.01 A | 0.01 - 0.33 A |
| 8 A | 0 - 0.24 A | 0.24 - 8 A |
| 25 A | 0 - 0.75 A | 0.75 - 25A |
| 50 A | 0 - 1.5 A | 1.5 - 50 A |
| 150 V | 0 - 4.5 V | 4.5 - 150 V |
| 6.25 V | 0 - 0.187 V | 0.187 - 6.25 V |

In this case, if you increase the level with the output ON, overload alarms may be produced, due to transitory, disconnecting the corresponding channel.

4.2.6. OUTPUT CONTROL: ON/OFF AND ALARMS

The power output status is controlled by the ON/OFF key, and is active when the corresponding LED is lit. To turn off this output simply press the key again.

This output is protected by 2 types of electronic protection, which are indicated by the corresponding LEDs marked, OVERLOAD (OVL) and/or THERMAL (TH).

When either of these are active (lit), the power output is immediately turned off and the LED ON/OFF will turn off.


When the overload alarm is lit, it is due to an overload of the maximum power values allowed in the output. In some cases it may be due to fast transitory that the unit cannot feedback properly, such as a sudden step from a very low output value to another one very high. To start again, simply press the output key ON to activate the output. If the cause of this overload has been rectified the unit will function as normal, if the overload remains the unit will turn off again.

When the thermal alarm is lit, it is because the internal temperature has reached the allowable limit. When this occurs, you must turn off the unit. When this alarm LED is lit, the unit cannot be used, and there will be no output. When the unit has cooled down to a lower temperature the LED will go off and the unit can be used.


4.2.7. DYNAMIC TESTS: STEP TO A 2ND VALUE

The PTE-50-CE Pro allows the operator to make dynamic tests, by allowing jumps (steps) from one value to another, whether it is from higher to lower or vice versa. This is very useful, for example, when performing dynamic characteristic tests. This is achieved as follows:




Press the key . In the display will appear the reading “0000” or the 2nd value previously recorded. Select with the rotating knob the desired value to acts as 2nd value.



Press the key . In the display will appear the reading “0000” or the 2nd value previously recorded. Select with the rotating knob the desired value to acts as 2nd value.

IMPORTANT: When the unit is in this situation the displayed value cannot be changed even if the rotating knobs are turned.



When this key  is pressed again, the step will be the opposite, that is from the 2nd value to the 1st one. At the same time, there is a signal sent to *Event Output*.. The LED will go off indicating the output is at the 1st value.

NOTE: You can select a 2nd value even when the corresponding output is on. In this situation, though the display is not showing the actual output value, this remains in the output.

4.3. PHASE ANGLE SECTION

This section describes in detail the use of the phase shifter incorporated in the PTE-50-CE Pro, as well as the *External Phase and Frequency Reference*.

The display in this section is indicated in degrees (0-359.9) between the output and the chosen reference (Freq. Ext., Line, Bus) in a ANTI-CLOCKWISE sense as follows.

4.3.1. PHASE ANGLE DIRECTION

The PTE-50-CE Pro allows two phase angle senses: AMERICAN or EUROPEAN (ordered by the client). Whatever it is selected, the initial unit status will be a balanced three phase system, turning ANTI-CLOCKWISE.

a) EUROPEAN DIRECTION:

The display shows, in hexadecimal degrees (0-359.9), the phase angle between the OUTPUT and the selected reference source (Freq., EXT, LINE and BUS), considered positive when this is ANTI-CLOCKWISE, that is:

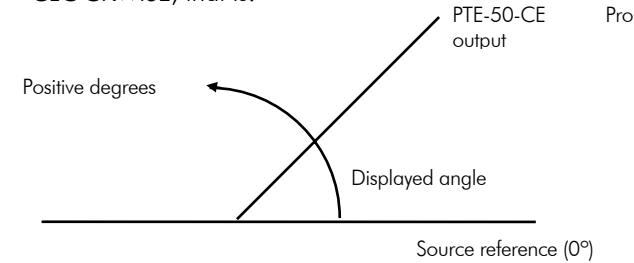


Figure 11: Phase Angle Selection (European)

b) AMERICAN DIRECTION:

The display shows, in degrees (0-359.9), the phase angle between the OUTPUT and the selected reference source (Freq., EXT, LINE and BUS), considered positive when this is CLOCWISE, that is:

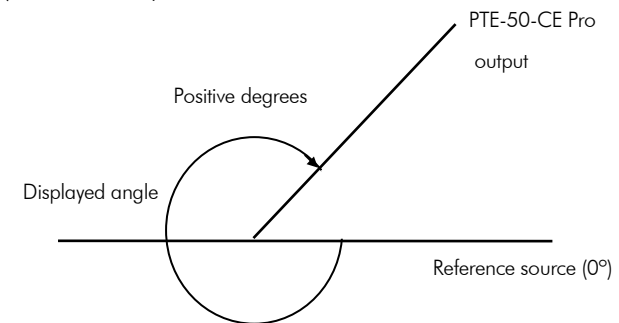


Figure 12: Phase Angle Selection (American)

4.3.2. DYNAMIC TEST: STEP TO A 2ND VALUE

The PTE-50-CE Pro allows the operator to make dynamic tests, by allowing jumps (steps) from one value to another, whether it is from higher to lower or

vice versa. This is very useful, for example, when testing out-of-step generator protective relays. This is achieved as follows:



Press the key . In the display will appear the reading “0000” or the 2nd value previously recorded. Select with the rotating knob the desired value to acts as 2nd value.

Press again the key . The display will show the actual value that is the 1st value. Turn on the output if this is off.



Press the key . This will produce instantaneously the step from the actual value to the 2nd selected value. At the same time there is a signal sent to *Start Chrono* output, to start an external timer if desired. Furthermore, the LED located above this press key indicates that the 2nd value is in the output.

IMPORTANT: When the unit is in this situation the displayed phase angle cannot be changed even if the rotating knobs are turned.



When this key is pressed again, the step will be the opposite, that is from the 2nd value to the 1st one. At the same time, there is a signal sent to *Start Chrono* output. The LED will go off indicating the output is at the 1st value.

NOTE: You can select a 2nd value even when the corresponding output is on. In this situation, though the display is not showing the actual output value, this remains in the output.

4.3.3. USE OF THE EXTERNAL REFERENCE INPUT

The *External Reference* input admits two types of signal: current (from 0.1 A up to 25 A) or voltage (from 5 V up to 300 V), with frequencies between 40 and 70 Hz. This input is very useful as it allows the unit to work in a differential mode respect to the signal inputs. Because of the wide range of input values in both voltage and current, it is capable to work with various types of supply generators for a signal reference.

The current input should be connected to the black tap marked “0” and the green tap marked 0.1 - 25 A. The voltage input should be connected to the black tap marked “0” and the red tap marked 5 - 300 V.



NOTE: The current input has low impedance SHUNT detector. NEVER connect a voltage signal to this tap, as it is equivalent to short-circuit. It may cause serious damage to the external voltage supply if it is not protected.

When *External Reference* is selected as reference source in the unit (Ext.), if it is valid, the LED located to the left hand of (0) tap will light up.

In case this reference signal is not proper, the unit will be synchronized to the last valid reference.

4.4. GENERAL CONTROL SECTION

The general control section is intended to acts as an interface between the unit and other PTE units, extern printer, computer, and detects the answer from the under testing relay through the Signal Monitor. All these functions are described below.

4.4.1. SIGNAL MONITOR

It is designed to receive the signals from the relay being tested and the status is shown in the LED indicator marked “MONITOR”.

The *Signal Monitor* is activated (LED monitor lights up) in one of the following conditions:

When there is a voltage between the common tap (black) and the voltage tap (red). This voltage can be between 5 to 250 V, ac or dc. This input tap is protected with a fuse clearly marked on the front panel.

When there is a closed, voltage free, contact between the common tap (black) and the contact tap (green). This input tap is protected with a fuse clearly marked on the front panel.



NOTE: Be sure that, when connecting a signal to the green tap, it is voltage free. Otherwise, the protection fuse will break immediately

4.5. COMMUNICATIONS IN THE BUS-PTE

4.5.1. EVENTS IN THE BUS-PTE

The PTE range equipment has been designed in such a way that the test equipment can be interconnected via the BUS-PTE connector, thus forming a stronger system when testing. The equipment not only can receive commands by software, but can also send information about its own status through determined signals, called EVENTS. Activation and deactivation of the Signal Monitor, Output On or Off, a Step to 2nd Value in amplitude and/or Phase, etc., are some examples of these mentioned EVENTS

In a PTE-50-CE Pro, these events can be:

a) Positive events:

- Monitor active in a PTE equipment.
- Output active in a PTE equipment.
- An output value step to a second level, higher in value than the first one.
- Phase angle step to a second level, higher in value than the first one.

b) Negative events:

- Monitor becomes non-active in a PTE equipment.
- Equipment output is cut off.
- An output value step to a second level, lower in value than the first one.
- Phase angle step to a second level, lower in value than the first one.

In any case, the documentation supplied with a PTE equipment, gives information about the particular events transmitted to the BUS-PTE by the particular unit.

4.5.2. EVENTS TRANSMITTED BY A PTE-50-CE Pro

A PTE-50-CE Pro sends to the BUS-PTE the following events:

a) Positive events:

- Output ON.
- Step to 2nd Value (voltage/current), higher than the actual.
- Step to 2nd Value (phase angle), higher than the actual.
- Signal Monitor active.

b) Negative events:

- Output OFF.
- Step to 2nd Value (voltage/current), lower than the actual.
- Step to 2nd Value (phase angle), lower than the actual.
- Signal Monitor deactivate.

4.6. SPECIAL FUNCTIONS

4.6.3. AUTO OFF

In case this function is selected, the output channels ON will be automatically turned off when the *Signal Monitor* is activated (For instance: relay trip).

The PTE-50-CE Pro has this function active.

4.6.4. FAILURE DETECTION

The PTE-50-CE Pro incorporates a self-check function that is active every time the unit is turned ON. If a failure is detected in one or more of the controlled parameters, a message appears in the displays in the following manner:

| ABCD ⇒ Level Display | | | | | | | | |
|----------------------|----------|--------------|------------|----------------|------------|----------|-----------|-----------|
| EFGH ⇒ Phase Display | | | | | | | | |
| | A | B | C | D | E | F | G | H |
| 0 | | No error | No error | No error | No error | No error | No error | No error |
| 1 | | LINE failure | RadF Temp. | --- | +12VA high | +5V high | +12V high | +28V high |
| 2 | | Fus. 625 | Int Temp. | PIIClk Failure | +12VA low | +5V low | +12V low | +28V low |
| 3 | | 1+2 | 1+2 | --- | +12VA null | +5V null | +12V null | +28V null |
| 4 | | Fus. 150 | OVL | Trf Temp. | -12VA high | No error | -12V high | -28V high |
| 5 | | 1+4 | 1+4 | --- | 1+4 | +5V low | 1+4 | 1+4 |
| 6 | | 2+4 | 2+4 | 2+4 | 2+4 | +5V null | 2+4 | 2+4 |
| 7 | Always 0 | 1+2+4 | 1+2+4 | --- | 3+4 | No error | 3+4 | 3+4 |
| 8 | | Fus. 300 | OVL | RadA Temp. | -12VA low | +5V high | -12V low | -28V low |
| 9 | | 1+8 | 1+8 | --- | 1+8 | +5V low | 1+8 | 1+8 |
| A | | 2+8 | 2+8 | 2+8 | 2+8 | +5V null | 2+8 | 2+8 |
| B | | 1+2+8 | 1+2+8 | --- | 3+8 | No error | 3+8 | 3+8 |
| C | | 4+8 | 4+8 | 4+8 | -12VA null | +5V high | -12V null | -28V null |
| D | | 1+4+8 | 1+4+8 | --- | 1+C | +5V low | 1+C | 1+C |
| E | | 2+4+8 | 2+4+8 | 2+4+8 | 2+C | +5V null | 2+C | 2+C |
| F | 1+2+4+8 | 1+2+4+8 | --- | 3+C | | 3+C | 3+C | |

Notes:

---: This code will never be shown.

xxx: Basic error code.

1+2: This code must be interpreted as the occurrence of basic errors 1 and 2 simultaneously

5. SPECIFICATIONS

The PTE-50-CE Pro contains the following outputs and features:

- One independent power output up to 50 A in current mode and 150 V in voltage mode, with angle phase regulation between 0° and 360°.
- Timer, 1 ms resolution, with different options to start and stop the time measurement.
- Harmonics generator, independent in each channel, up to the 7th harmonic.

5.1. POWER GENERATORS

a) An independent power output up to 50 A in current mode and 150 V in voltage mode, with angle phase regulation between 0° and 360°. They have the following technical characteristics:

- Amplitude indicator: 4 digits display LED.
- Available ranges:

Current Mode:

- 0 - 0.330 A Regulation resolution: 0.001 / 0.01 / 0.1 A
- 0 - 8.000 A Regulation resolution: 0.001 / 0.01 / 0.1 A
- 0 - 25.00 A Regulation resolution: 0.01 / 0.1 / 1 A
- 0 - 50.00 A Regulation resolution: 0.01 / 0.1 / 1 A

Voltage Mode:

- 0 - 6.250 V Regulation resolution: 0.001 / 0.01 / 0.1 V
- 0 - 150.0 V Regulation resolution: 0.1 / 1 / 10 V
- Accuracy: better than 1 % of the selected value between 10 % and 100 % of the selected range.
- Power: 100 VA continuously.
- Protection: overload and thermal.

- o Output mode: floating, completely isolated of the rest and the ground.
- o Output distortion:
 - Typical: < 0.5 %
 - Maximum: 1 %
 - Phase angle regulation: 0 - 359.9°.
- o Phase angle regulation resolution:
 - Selectable between: 0.1 / 1 / 10 °.
 - Accuracy: $\pm 0.5^\circ$ of the selected value.

b) The following functions are available, through suitable front panel controls:

- o Selection of 2nd value (fault value while the actual value remains in the output).
- o Push-button to step to the above value mentioned.
- o This feature exists for amplitudes and phase angles, independent or linked.

One of the output channels is available to be configured as *Master* of the other two, that can be configured as *Slave* or *Independent*. Every change made in the *Master* channel will be effective in the *Slave* channels, at all levels.

5.2. INTERNAL TIMER

The unit has a **digital** built-in timer with the following technical characteristics:

- o Indication display: 5 digit LED type.
- o Available ranges (autorange):
 - a 99.999 s
 - 100.00 a 999.99 s
 - 1000.0 a 9999.9 s
 - 10000 a 99999 s
- o Resolution: 0.001 s
- o Accuracy: ± 0.02 % of the value displayed ± 0.001 s

- o Operation modes:
 - START by:
 - a) Internal signal:
 - Any output ON/OFF.
 - Any step or change to 2nd value.
 - b) External signal:
 - Normally open contact in the monitor.
 - Normally close contact in the monitor.

Duration measurement: Duration of positive and negative signals in the monitor is available.

5.3. HARMONICS GENERATOR

The unit has the possibility to select, from the front panel controls, up to the 7th harmonic of the fundamental reference frequency on each output channel, in a completely independent way one of each other, despite it is in current or voltage mode.

5.4. EXTERNAL REFERENCE INPUT

The unit has available an external reference input, capable to receive voltage or current signals, from any external source, in the following ranges:

- o Voltage input: between 5 and 300 V.
- o Current input: between 0.1 and 25 A.
- o Frequency range: between 40 and 70 Hz.

5.5. SIGNAL MONITORS

The unit has two signal monitors:

- One is available to start the timer from any external dry contact signal.
- Another works with dry contacts and live voltage signals from 5 to 250 V ac. ○ dc to stop the timer.

5.6. AVAILABLE REFERENCES

The equipment power output has the possibility to be referenced to the following synchronizing sources:

- Communication BUS.
- Voltage Supply of the unit.
- External Reference Input.

5.7. CASE

The unit is contained in aluminum case that, when closed, offers an IP-65 protection.

THE PTE-FCN VOLTAGE MODULE

The PTE-50-CE Pro includes the PTE-FCN module, an electronically controlled independent voltage channel that allows you to test overcurrent, distance, synchronism, frequency and many other types of relays easily.

DESCRIPTION

Powering the PTE-FCN

The PTE-FCN module can only be powered from the PTE-50-CE's built-in 110VAC auxiliary output, "Out 4". This is due to the fact that we use switching amplifiers where the output is NOT isolated from the power input.



To power the PTE-FCN module, use the included bipolar cord to connect the module exclusively to the 110VAC auxiliary output "Out 4" built into the PTE-50-CE. Using any other AC supply can permanently damage the unit and will invalidate the warranty.

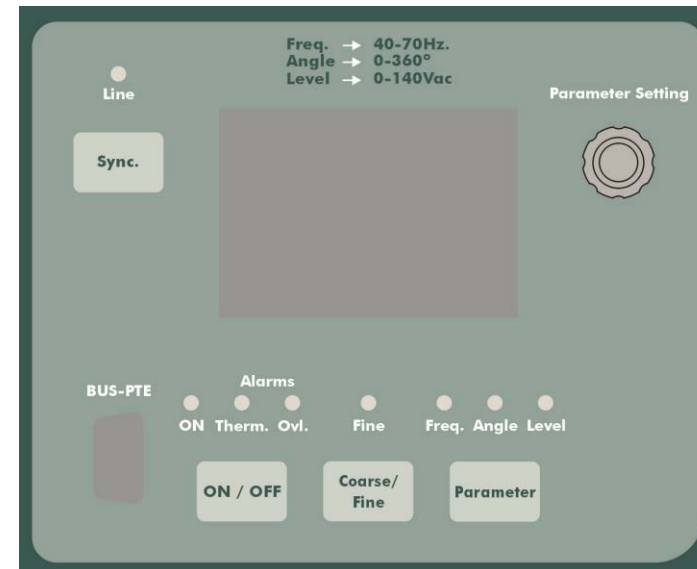
Power output

Output from the module is located at the black/red 4-mm, 25A rated female connectors at the lower left corner. Remember, the output is NOT isolated from the input. Always ground the unit using the yellow EARTH connector.



Adjusted voltage Level, Frequency and Phase Angle at the PTE-FCN's output are shown at the built-in LCD display.

BUTTONS AND LEDS



The PTE-FCN's output is can be adjusted by means of a single rotary knob and four control buttons, used as follows:



Press this button to switch the output ON and OFF. The associated red LED will indicate the present output state.



Press this button to toggle the module's phase reference from "Line" (i.e. the PTE-50-CE's 50 or 60-Hz AC supply line) to its internal wave generator, whose frequency you can change as described next.

When Line is selected as the synch reference, the LCD display shows the phase angle between this voltage and the reference used by the main PTE-50-CE unit.

When Line is deselected, the LCD display shows the adjustable output voltage's frequency, which is generated by the PTE-FCN module and, therefore, is no longer referenced

to the main unit's current or voltage outputs.



The rotary knob adjusts the parameter that you have previously selected here. If *Synch* is set to "Line", the frequency is fixed so you can only regulate *Phase Angle* and *Level*. If *Synch* is not "Line", the internal frequency generator is used as reference, so you can only regulate *Frequency* and *Level*.



Select the rotary knob's adjustment resolution here, according to these Fine and Coarse step values:

| Parameter | Fine | Coarse |
|-----------|--------|--------|
| Level | 0.1 V | 10 V |
| Frequency | 0.1 Hz | 1 Hz |
| Phase | 0.1 ° | 10 ° |



Alarm indicators

The PTE-FCN module is protected against overheating and overcurrent by means of these automatic LED-signalled *Therm* and *Ovl.* alarms respectively.

The thermal protection operates when temperature builds up inside the module excessively, and is automatically cleared when it cools down.

The overload protection operates when the module cannot maintain the adjusted voltage across the connected load, or when the AC supply drops more than 10%.

In both cases, the module's output is suspended and cannot be resumed until the faulty condition is cleared.

INTERNAL PROTECTIONS

The module's output will also be suspended if the supply level falls below a minimum level. At even lower supply levels the module would automatically reset itself.

POWER-UP STATE

Upon connection to the supply source, the unit will have these settings:

- Output: OFF.
- Voltage Level: 0.
- Frequency: 50.0 Hz.
- Phase Angle: 0.0 °.
- Synchronizing reference: Line (same one as PTE-50-CE's).
- Adjustment resolution: Coarse.

Working with the PTE-FCN module

1. **Power Supply:** Use the supplied bipolar cord to take 110VAC from the PTE-50-CE PRO's "Out 4" auxiliary output into the PTE-FCN's power input.
2. **Ground:** Use the supplied yellow/green cord to connect the yellow GROUND tap in the PTE-FCN module to the main unit's chassis.
3. **BUS-PTE:** Link the main unit and the PTE-FCN module by connecting the supplied communications cable to their respective BUS-PTE connectors. This will provide the necessary phase angle reference to the PTE-FCN module.
4. Turn the main unit on; the PTE-FCN module will turn itself on automatically.
5. On the PTE-50-CE, press and hold the "Sync" key until the "Bus" LED starts blinking. The LED next to the selected reference input (Line or Ext. Ref) should be lit as well (refer to section "Reference Source Selection" in page #43 for details on this). The PTE-FCN module will now use the same frequency and phase reference as the PTE-50-CE unit.

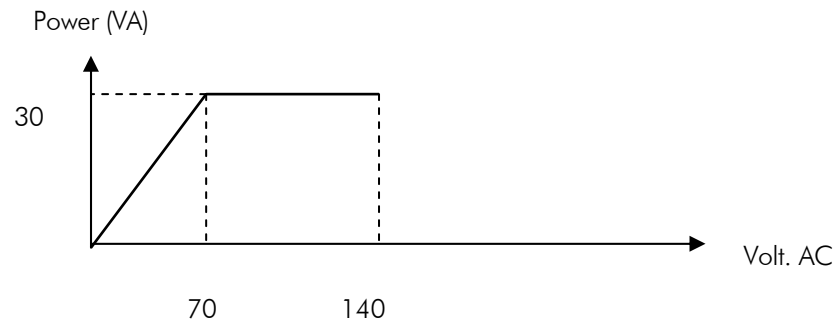
Adjusting the LCD screen's contrast

Press the adjustment knob for 3 seconds to enter the LCD contrast adjustment mode; then, rotate the knob to adapt the contrast to the surrounding light conditions. To return to the normal adjustment mode, press the knob again for 3 seconds and release it. This display will automatically compensate the effect of small temperature variations in the contrast before you need to readjust it again.

The PTE-50-CE Pro 'remembers' the LCD's contrast adjustment from one work session to the next.

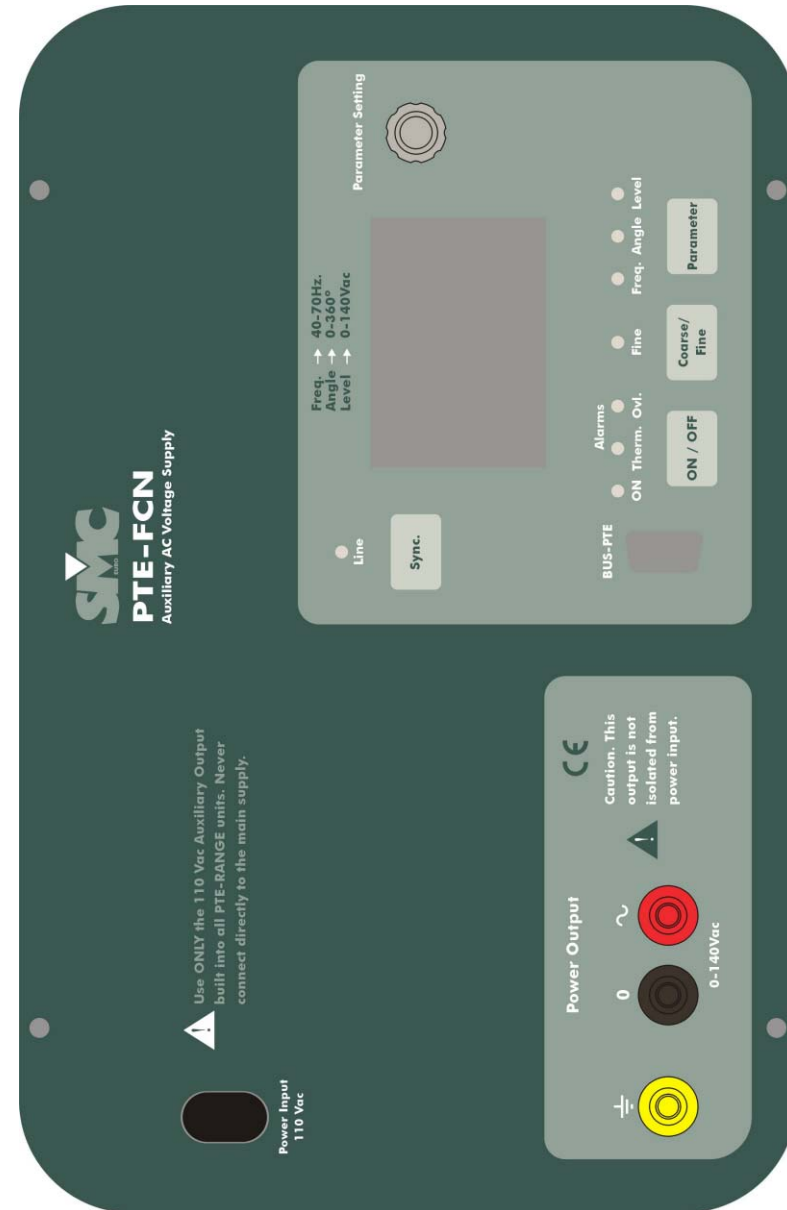
PTE-FCN TECHNICAL CHARACTERISTICS

| | |
|--|-----------------------|
| Power supply | 110 Vac \pm 10 % |
| Output voltage regulation | 0.0 – 140.0 Vac |
| Voltage adjustment resolution / accuracy | 0.1 Vac / \pm 0.1 V |
| Output frequency range | 40.0 – 70.0 Hz |
| Frequency adjustment resolution / accuracy | 0.1 Hz / \pm 0.1 Hz |
| Phase angle adjustment range | 0 – 359.9 ° |
| Phase angle adjustment resolution / accuracy | 0.1° / \pm 0.1° |
| Output Power (70 – 140 Vac)* | 30 VA |
| Max Current (0 – 70 Vac)* | 0.42 Aac |
| Output mode | Ground-isolated |
| Protections | Thermal and overload |



* Output power / output voltage characteristic curve.

PTE-FCN FRONT PANEL



6. AFTER SALES SERVICE AND WARRANTY

6.1. WARRANTY

This is an expression of trust that our products obtain, based on the reliability and functionality standards that our customers expect.

The warranty covers the free replacement or repair of defective components for one year in the terms specified in the supplied warranty statement and registration card.

Damages resulting from improper handling of the product, use outside the scope and limits of the product's specifications, negligence, installation not in accordance with the standards or warnings listed in the Instructions Manual and servicing or manipulation by unauthorized persons are not covered by the warranty.

6.2. CUSTOMER SUPPORT

EUROSMC guarantees the supply of materials and components for its products up to 3 years after discontinuation. This support is extendable to 5 years for technical service.

6.3. OTHER EUROSMC PRODUCTS

Portable Relay Test Equipment and Software

Primary injection units up to 20,000 A

Digital portable three-phase circuit breaker analyzer

Digital handheld chronometer.

Digital handheld phase angle meter

Digital Portable microhmeter up to 100 A Test current.

Test systems for automatic miniature circuit breakers.

Voltage and current regulation equipment.

Step & Touch Voltage measurement equipment