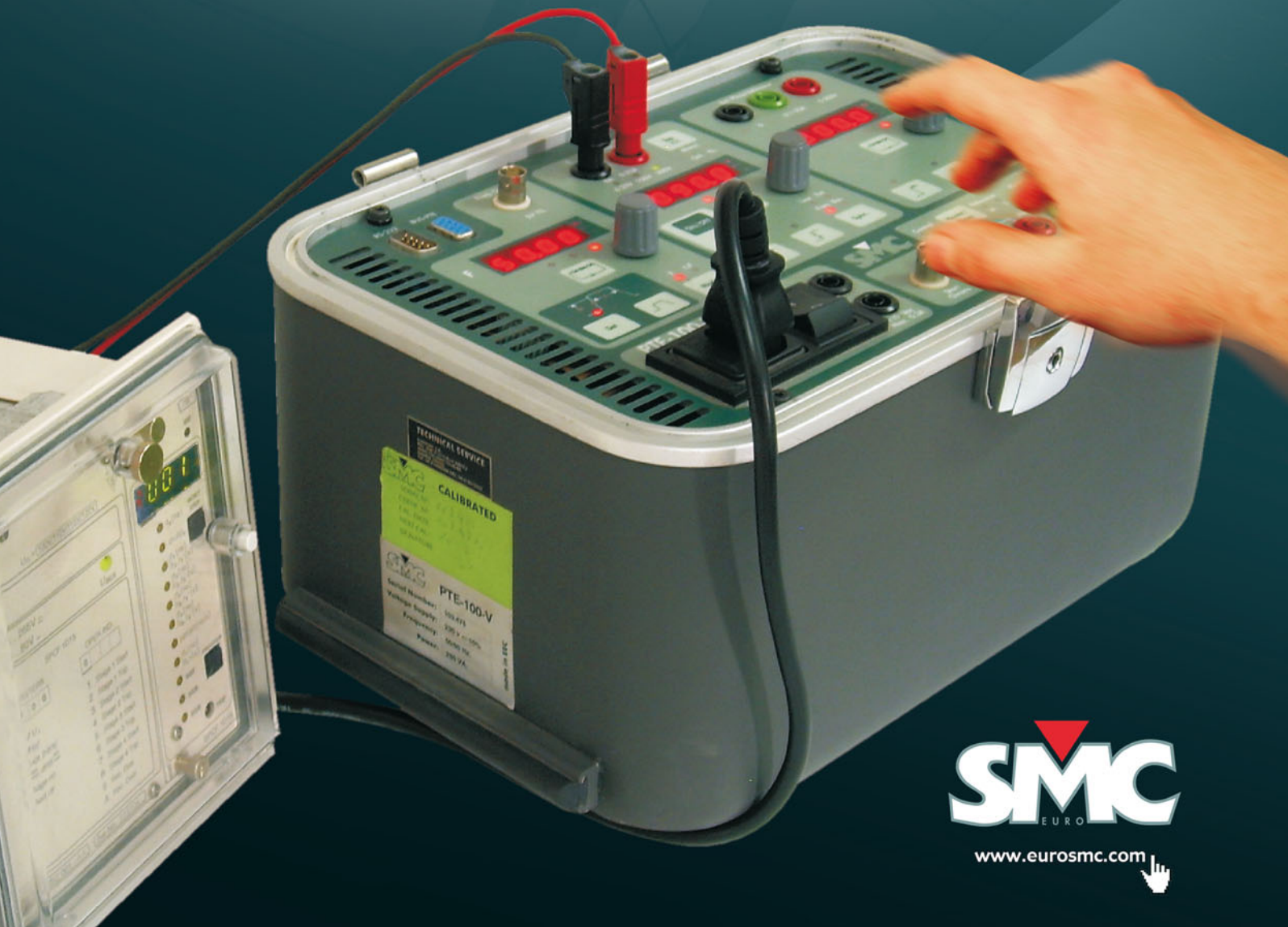


# MANUAL AND PC-CONTROLLED RELAY TEST EQUIPMENT

- ▶ **PTE-50-CET**
- ▶ **PTE-300-V**
- ▶ **PTE-50-CE / Pro**
- ▶ **PTE-100-V**



**SMC**  
EURO

[www.eurosmc.com](http://www.eurosmc.com)

## ELECTRONIC PTE RANGE

Protective relay test sets with direct on-board control and computer-based test automation

### THE ELECTRONIC PTE TEST EQUIPMENT RANGE

The electronic PTE test equipment range has been designed for maximum efficiency and simplicity when testing protective relays in the field. These universal, rugged and powerful units provide the required accuracy and performance to test any electromechanical, static, or numerical relay. Output waveforms are digitally synthesized, and completely isolated from the mains supply. The signal is then electronically amplified to attain up to 50 A or 300 V with an effective power of 100 VA.

### FLEXIBILITY

The range includes four products: the PTE-300-V, with three output channels, and the smaller PTE-100-V, with one channel only, are mainly designed for voltage-related protections like generator, motor and synchronizing relays. The other two (PTE-50-CET and the one-channel version PTE-50-CE) are specially powerful in current-based testing.

Each output channel in these units can be switched between current and voltage injection by just pressing a button. Amplitude and phase angle can also be adjusted independently in each channel. One of the biggest advantages in the PTE sets is their ability to communicate to each other, in order to use all their output channels simultaneously. You can purchase several simple units for the most frequent testing and, when time arrives for more demanding tasks, interconnect two or three according to the application's requirements. This is a cost-effective solution when you need more than one test set.

Furthermore, the PTE units can also be used in combination with equipment from other manufacturers, thanks to their built-in external synchronization input.

Need computer-generated reports? Not only does the PTE range feature the best manual control board in the market, but also the possibility to operate automatically under the control of optional software from a standard computer. This capability is especially useful when a great number of different protections must be tested periodically. Relay types and test routines are stored in a custom-defined database, so that you only need to double-click on each installed relay's entry to perform the complete test process and to save and produce a report in a fully unattended manner. The automatic testing software can also control combinations of several PTE units as if it was a single device.

### POWER

Behind the 100-VA output power in the PTE channels, you will find a generous duty cycle and a great number of test resources. For example, several channels can be controlled from a single button, even if they belong to various interconnected units, thanks to the master/slave function. And you can refer the phase angle of each channel or the base frequency of the harmonics function to an incoming signal from an external generator, or setup ROCOF frequency ramps in less than one minute without a computer.

The PTEs feature an idle power mode to save energy and keep the amplifiers cool when testing low impedance relays. Each output channel provides an independent neutral, which enables the interconnection of two or more channels in series or in parallel with absolute freedom. The optional PTE-SER plug allows the injection of up to 50A with a compliance voltage of up to 60V in the PTE-50-CET.

### OUTPUT CHARACTERISTICS

	PTE-50-CE	PTE-50-CE Pro	PTE-50-CET	PTE-100-V	PTE-300-V
Output channels	1	2	3	1	3
Current per channel	0-50 A		3 x 0-50 A	0-8 A	3 x 0-8 A
Voltage per channel	0-150 V	0-150 V, 0-140 V	3 x 0-150V	0-300 V	3 x 0-300 V
Frequency	1° - 7° harm.	1° - 7° harm., 40-70 Hz	1° - 7° harm.	40-420 Hz	
Chronometer	Yes			No	



PTE-50-CET



PTE-300-V

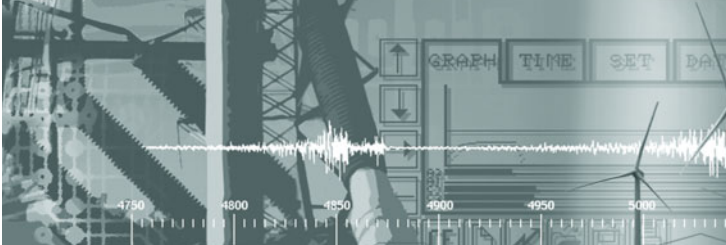


PTE-50-CE

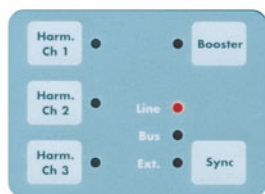


PTE-100-V





Digital timer



Harmonics selector



Current / voltage channel

## ASSISTED MANUAL CONTROL

The comprehensive and well-designed control board in the PTE units provides fast and accurate operation for the simplest one-shot testing to the most complex dynamic fault simulation. The board's design and the studied position of each control and button is uniform and coherent, so that all the units are operated in the same way. The three-channel versions feature a master/slave function that allows to control and adjust two or three channels simultaneously from channel #1. You just adjust the pre-fault and fault quantities, launch the simulation and note the reading from the chronometer.

### Dynamic simulation

Each channel can store two sets of amplitude (voltage or current) and phase angle parameters in memory. You can then step into fault state from zero or from non-fault values. You can also edit and playback digitized transients in COMTRADE format from an external PC using optional software.

### Control BUS

The EuroSMC's exclusive PTE BUS, supplied as standard equipment, allows the interconnection of up to five PTE units in order to use all their output channels simultaneously. Phase and frequency synchronization signals, as well as output control messages, timer start/stop commands and trip signal detection messages, are transmitted by this high-speed bus in real time. Any unit can be set as master or slave in the system's operational hierarchy.

The PTE BUS integrates the resources of each individual unit into a single virtual system that can be operated from the master unit or from an external computer.

### Digital Instrumentation

All the instruments are digital, including the chronometer, the frequency generator and the injection measurement displays. Quantities are adjusted with contact-free digital encoders on high-contrast LED indicators. The adjustment speed and resolution is easily controlled by selecting the digit to be modified. The chronometer features six start/stop modes selectable by pressing a button, and can be set to display milliseconds or cycles of the working frequency. The frequency generation module features a fully programmable ramp for ROCOF testing and a direct adjustment method with two modes: absolute frequency and delta (incremental) mode referred to an external signal's frequency.



### UNO

(PTE-50-CE + PTE-100-V)

Complete single-phase system with chronometer, frequency generator and two reversible channels (50 A + 300 V, 50 A + 8 A, 150 V + 300 V or 150 V + 8 A)

### OTRO

(PTE-50-CET + PTE-100-V)

4-channel system with chronometer and frequency generator (3 x 50 A + 300 V, 150 A + 300 V, 3 x 150 V + 8 A, 450 V + 8 A etc.)

### TRES

(PTE-50-CET + PTE-300-V)

Complete three-phase system with up to 6 current or 6 voltage channels (3 x 50 A + 3 x 300 V, 150 A + 900 V, 3 x 50 A + 3 x 8 A, 3 x 50 A + 900 V, etc.)



## ELECTRONIC PTE RANGE



Lightweight nylon bag

### Selectable frequency and phase angle reference

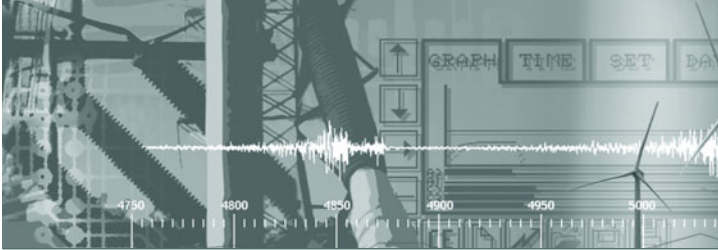
The frequency and phase reference for the generation of the sinusoidal output can be chosen from various sources by just pushing a toggle button. You can select, for example, an internal frequency generator, the supply's line, an external signal at the synch input or the active source in another PTE unit connected to the bus.

### INTEGRAL PROTECTION

Output amplifiers are safeguarded against overheating and overload by electronic protections that resume the output automatically when the trouble is cleared out. Furthermore, the complete isolation between amplifiers prevent accidental damages from being propagated between channels, so that the healthy channels in the unit can still be used while the damaged module is repaired.



PTE-300-V



**PTE-FCN optional voltage source**

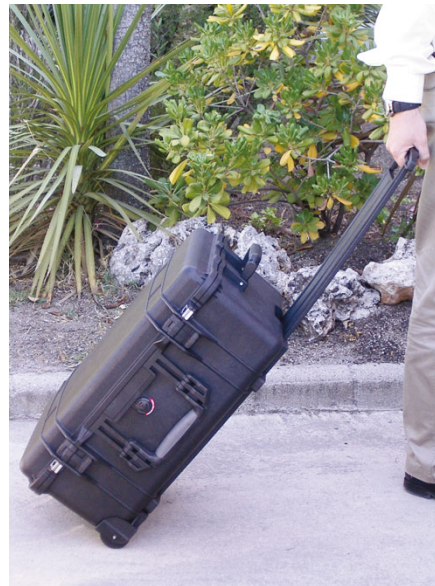
### PTE-50-CE PRO

Any test set in the PTE range can be upgraded with an additional voltage source, the PTE-FCN option. This electronic, independent source can be adjusted in amplitude, frequency, and phase angle. It comes installed as standard with the 'Pro' versions of the PTE sets, but it can also be purchased separately and mounted by the user inside the unit's lid in a few minutes.

The PTE-FCN will dramatically increase the relay types that can be tested, usually avoiding unnecessary investment in three-phase equipment. The PTE-50-CE Pro, for example, is an unbeatable single-phase test set for directional, frequency, synchronisation and generator protection relays.

- Current / voltage reversible channels
- 100 VA power per channel
- Up to 50 A and up to 300 V per channel
- Manual, direct or automatic, pc-controlled operation
- Multi-unit bus architecture with centralized control
- External signal synchronization input
- Electronic protection against overload and overheating
- Supply-independent digitally generated waveform
- Automatic generation of 2nd to 7th harmonics
- Digital multimode chronometer
- Programmable frequency ramp
- Serial and parallel interconnection of channels
- Up to 150 A and 900 V single-phase injection

- Depending on model
- In three-channel models



### APPLICATIONS OVERVIEW

(See Compatibility Chart on the next page)

- Single- and three-phase testing of electromechanical, static and numerical protective relays
- Motor protection testing
- Differential protections testing
- Generator protection testing
- Reclosing and synchronization relay testing
- Low-voltage protections testing at line levels
- Impedance relay testing
- Directional protection testing
- COMTRADE transient playback
- Automatic relay testing and reporting



# ELECTRONIC PTE RANGE

## TESTABLE IEEE RELAYING FUNCTIONS

IEEE No.	Protective device	PTE-50-CE	PTE-100-V	PTE-300-V	PTE-50-CET	UNO	PTE-100-V PTE-100-C	PTE-300-V PTE-50-CE	PTE-300-V PTE-100-C	PTE-50-CET PTE-100-V	TRES
2	Timing relay	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
21	Distance 1Ø	Pro		✓	✓	✓	✓	✓	✓	✓	✓
21	Distance (open delta)			✓	✓	✓	✓	✓	✓	✓	✓
21	Distance 3Ø			✓		✓	✓	✓	✓	✓	✓
24	Volts / Herz	Pro	✓	✓	□	✓	✓	✓	✓	✓	✓
25	Synchronization	Pro	✓	✓	✓	✓	✓	✓	✓	✓	✓
27	Undervoltage AC / DC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
32	Directional power 1Ø	□	□	✓	✓	✓	✓	✓	✓	✓	✓
32	Directional power 3Ø							■	■	✓	✓
37/76	Under- and Overvoltage DC						✓		✓		
40	Loss of field	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
46	Reverse phase sequence	Pro		✓	✓	✓	✓	✓	✓	✓	✓
46N	Negative sequence overcurrent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
47	Reverse phase voltage	Pro		✓	✓	✓	✓	✓	✓	✓	✓
49	Thermal relay	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
50	Instantaneous overcurrent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
51	Timed overcurrent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
55	Power factor relay	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
59	Overvoltage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
60	Voltage balance	Pro		✓	✓			✓	✓	✓	✓
64	Neutral detection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
67	Directional overcurrent	Pro		✓	✓	✓	✓	✓	✓	✓	✓
67N	Directional neutral overcurrent	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
78	Angle / out of step	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
79	Reclosing relay	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
81	Frequency relay	Pro	✓	✓	□	✓	✓	✓	✓	✓	✓
82	DC reclosers.						✓		✓		
85	Carrier or pilot wire protection	■	✓	✓	✓	✓	✓	✓	✓	✓	✓
87	Differential protection	■	■	✓	✓	✓	✓	✓	✓	✓	✓
91	Directional voltage	■	■	✓	✓	✓	✓	✓	✓	✓	✓
92	Directional power and voltage	■	■	✓	✓	✓	✓	✓	✓	✓	✓
94	Tripping relay	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

□ Options required    Pro: with the PTE-FCN module    ■ Partially tested



PTE-30-CH



PTE-FCG



PTE-12



PTE-GPS



PTE-SER



## OPTIONAL ACCESSORIES

The PTE-FCG battery simulator can be used externally or fitted inside the lead of the three-channel models. It provides a 60W supply of 48, 125 or 250 VDC to energize any electronic or numerical relay during the tests.

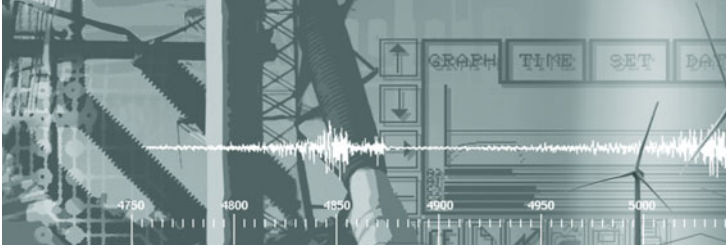
The PTE-12 interface allows the integration of a personal computer in the PTE-BUS for software based operation of the PTE equipment. It also implements the PTE-COM command interpreter that enables the user to build his own automation applications using popular programming languages like Visual Basic® or C++, as well as any scripting language featuring RS-232 communications control.

The PTE-GPS receiver enables the synchronization of two test sets located at any distance in order to initiate a software-based test simultaneously with an accuracy of 1 microsecond.

The PTE-SER set of connectors allows the interconnection of two or three channels in series in the PTE-50-CET when currents of up to 50 A are required on extremely high burdens, with compliance voltages up to 60 V.

The PTE-30-CH handheld chronometer can complement the PTE-300-V and PTE-100-V models for time-based testing if no other PTE unit with a built-in chronometer is available. It features the same functions as the built-in version and can measure the time of any electrical event in dry contacts or voltages up to 250Vac/dc with an accuracy of 1 ms.

The PTE-FCN module, featured as standard in the PTE-50-CE Pro, provides an additional voltage, frequency and phase angle adjustable source, remarkably increasing the relay types that can be tested. It can be purchased separately and installed inside the unit's lid in a few minutes.



## SOFTWARE APPLICATIONS

The PTE range of relay testing equipment offer the best of both worlds: a powerful, yet easy to use control panel and the capability to communicate with a computer to do the testing and the reporting automatically, by means of optional software applications:

### ROOTS

ROOTS (Relay Object-Oriented Test Software) provides the best solution to the testing of today's multifunctional IEDs by performing accurate fault calculation, sequential test execution, and reporting automatically.

ROOTS is an optional product for computer-based operation of EuroSMC relay test sets. ROOTS is developed using the latest Microsoft.NET® technology and is available for 32-bit and 64-bit Windows XP, Vista and Windows 7 platforms. ROOTS storage files are self-contained databases where relay data, characteristics, custom formulas, test routines and report definitions are saved according to a simple hierarchy that is flexible and easy to understand, with a modular architecture. Relays can be defined as templates by using equations instead of fixed values for the device's characteristics and definitions. Relay characteristics can be defined in ROOTS from scratch or imported from RIO files. Test procedures defined within ROOTS can be directly executed on a connected EuroSMC test set.

For every functional module of the device under test - Distance, Overcurrent, Differential module, RIO, etc - multiple tests can be attached from a wide choice of test types (click sequence, search, reclose, CB failure, SOTF, fuse fail, etc) including scheme-oriented tests.

ROOTS features a powerful interactive graphical editor for geometrical definitions of protective characteristics and zones. Lines and curves can be drawn in free hand mode, imported from a templates library and / or adjusted using numerical values and coordinates.

ROOTS implements a friendly, easy to use interface, for the quick and accurate configuration of all equipment features, device settings, test modules, test results and reports. The test report can be easily customized and exported according to user needs.

ROOTS users are covered by EuroSMC's lifetime update warranty, which provides free, unlimited access to new releases and software modules of ROOTS.

### EuroFAULT

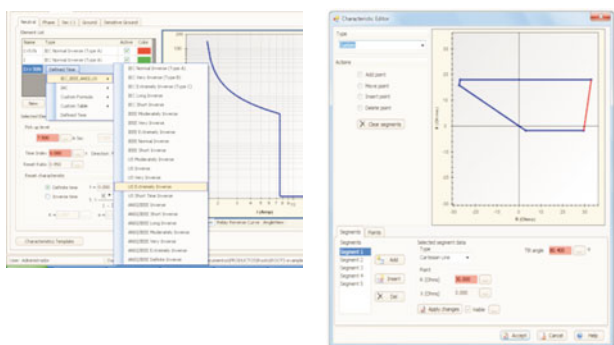
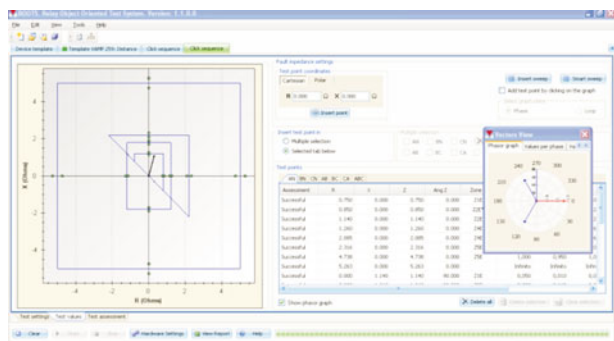
If you have oscillographic recordings of faults and transients in digital COMTRADE format, you can play them back into your relay with EuroFAULT.

You only need to open the file from the program, assign the voltage and current components to the available channels in your PTE unit or combination and click on PLAYBACK.

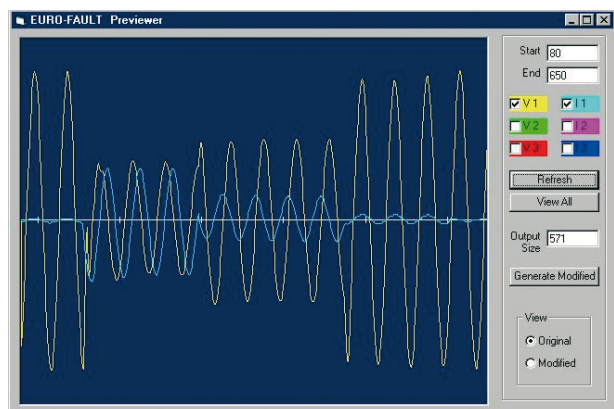
### PTE-COM

PTE-COM is the command language used by software applications to control the PTE equipment from a computer. The PTE-COM commands, interpreted by the PTE-12 interface during the software-controlled test process, are available to the users for the development of their own custom applications and test automation procedures, if needed.

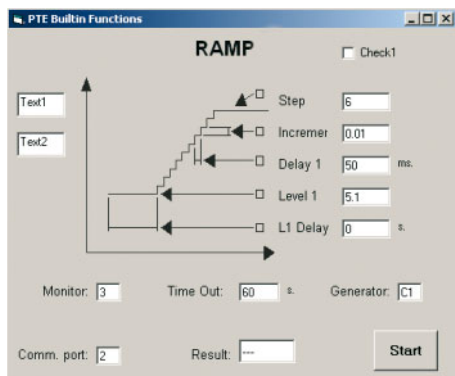
Remember that you will need the PTE-12 interface to control the PTE units from a computer, regardless the software application used.



ROOTS



EuroFAULT



PTE-COM sample application

SPECIFICATIONS

REVERSIBLE OUTPUT CHANNELS

	PTE-50-CET	PTE-50-CE	PTE-300-V	PTE-100-V
Number of channels	3	1	3	1
Interconnections	Serial or parallel		Serial or parallel	
Current ranges	0-0.330 A / 0-8.000A / 0-25.00A / 0-50.00A		0-0.330A / 0-8.000A	
Voltage ranges	0-6.25V / 0-150.0V		0-6.25V / 0-150 V / 0-300V	
Harmonics generated	1st - 7th automatic in each channel		Manual, up to 420 Hz	
Phase angle	0-359.9°			
Frequency range	Parametric: 40.00-420.0 Hz		Transient: 0.5-5000 Hz	
Power per channel	100 VA			
Accuracy	±0.5%			
Distortion	1% máx.			

DIGITAL CHRONOMETER (PTE-50-CET, PTE-50-CE)

Range	0.001 - 99999 s. o 0.1 - 9999.9 cycles
Accuracy	±0.003% of reading ±1 digit
Start modes	Output ON or OFF Pre-fault / fault state switching PTE BUS event External START signal
Stop modes	NO or NC contact Voltage ON / OFF PTE BUS event

FREQUENCY GENERATOR (PTE-300-V, PTE-100-V)

	Modo normal	Modo diferencial
Range	40-420 Hz	0.001-10 Hz
Resolution	0.01 / 0.1 / 1 Hz	0.001 / 0.01 / 0.1 Hz
Accuracy	1 digit ±0.003 Hz	1 digit ±0.001 Hz
Ramp limits	0.1 - 10.0 Hz/s.	-
Ramp lapses	0.1 - 10.0 s.	-

TRIP MONITOR

Dry contact input	Open circuit voltage: 10.2 Vdc
	Short circuit current: 25 mA
Voltage input	Fuse protected
	5 - 250 Vac/dc
	Impedance: 19 kΩ Fuse protected

PTE-FCN OPTION

Output power	30 VA (70 - 140 Vac)
Voltage output	0 - 140 Vac (res.: 0.1V)
Max. current	0.45 A (0 - 70 Vac)
Phase angle	0 - 359.9° (res.: 0.1°, Vout> 5V)
Frequency	40 - 70 Hz (res.: 0.1 Hz)
Phase reference	AC supply or internal generator

EXTERNAL REFERENCE INPUT

	Voltage input	Current input
Input impedance	47 kΩ	25 mΩ
Signal range	5 - 300 Vac	0.1 - 25 Aac
Frequency range	40 - 70 Hz	

GENERAL

	PTE-50-CET	PTE-300-V	PTE-50-CE	PTE-100-V
Weight	25 Kg / 55.1 lb.	22 Kg. / 48.5 lb.	13.5 Kg. / 29.7 lb.	13.5 Kg. / 29.7 lb.
Dimensions (mm) inches	442 x 327 x 200 17.4 x 12.8 x 7.8 in		300 x 200 x 200 11.8 x 7.8 x 7.8	
Auxiliary voltage output	110 Vca / 0.3 A máx.			
Supply power	230 / 110 Vca ±10%			
Temperature range	Storage : -20 to 70°C / -4° F - 158° F / Operation: 0 to 50°C / 32°F - 122° F			

STANDARD ACCESSORIES

Complete 2-m / 6,5 ft. test lead set
1.5-m / 4,9 ft. power cord
4-mm terminal adapters
4-mm crocodile clip set
RS-232 communications cable
PTE BUS interconnection cable
Set of replacement fuses
Coaxial BNC to 4-mm connection cable
Nylon bag for test set and accessories
Calibration software
User manual in English
Certificate of calibration

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