

# CURRENT & VOLTAGE RELAY TESTING

- ▶ **PTE-100-C**
- ▶ **PTE-100-C PLUS**
- ▶ **PTE-100-C PRO**



**SMC**

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



## PTE-100-C / PLUS / PRO



PTE-100-C Pro



PTE-100-C Plus



PTE-100-C

### Single-phase current and voltage relay test equipment up to 250 A

The PTE-100-C and the Plus and Pro versions were designed as powerful, rugged and flexible tools for the wide diversity of maintenance jobs in substations and transformation centers. Both feature a 1000-VA voltage regulator and highly accurate digital instruments that provide the quality and effectiveness required for in-field testing of power-demanding electromechanical relays, as well as static, digital and the most sophisticated multi-functional numerical relays where precision and ease of use are essential. Digital chronometer, auto-range ammeter and voltmeter, as well as four adjustable current output taps, AC and DC voltage outputs, auxiliary DC source, automatic overload and thermal protections, PC communications and a comprehensive set of external measurement functions are just a few of the most outstanding features that we have packaged for you in a compact, robust and lightweight piece of equipment that is being used by industry professionals in more than 55 countries worldwide.

Besides the 1000-VA output featured by the three models, the Plus and Pro versions include an independent AC voltage source that can be adjusted in amplitude, frequency and phase angle to further extend the comprehensive number of protection relay types that can be tested. Existing PTE-100-C units can be easily upgraded to a Plus or a Pro by just installing the optional PTE-FCL or PTE-FCN modules respectively into the unit's lid in a few minutes.

The PTE-100-C's design is mainly appreciated for its unbeatable manual testing characteristics. However, a number of software products for Windows® is available to attain a certain degree of automation and assistance in the testing and reporting tasks. Apart from the standard RS-232 communications port, every test set in the PTE range features the EuroSMC's exclusive BUS-PTE® integration bus that allows them to be interconnected to further extend their applications field.

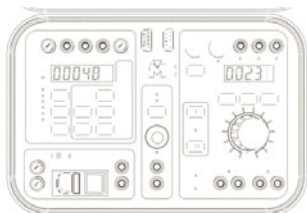
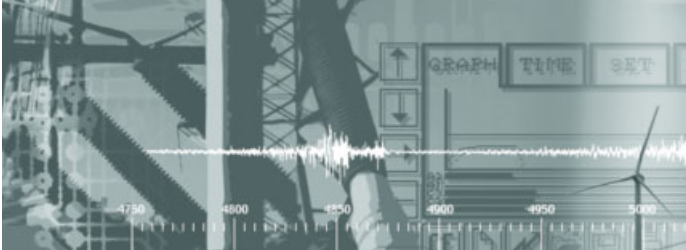
### VERSATILITY

Due to their outstanding output power, comprehensive set of test functions and compact size, these products are a must-have for maintenance work in any plant, substation or transformation center. The PTE-100-C and the Plus and Pro versions are also appreciated as unbeatable instruments in laboratories and specialized training sites where the diversity of tasks require a wide range of current, voltage, frequency and phase angle control applications.

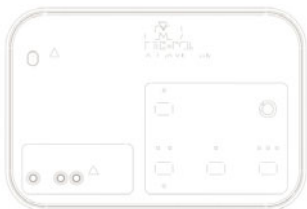
Not only is it possible to test any protective relay, but also to determine a CT's saturation point with voltages up to 250V, and to evaluate the output quality of an autonomous oil-based power generator.

Instantaneous overcurrent protections up to 250A can be tested from the primary side, and auxiliary DC power can be supplied to small three-phase circuit breakers during the test process.

The built-in digital programmable chronometer can measure positive and negative pulses, or time the activity of a normally open or closed contact with no voltage or charged up to 250V, with a 1-millisecond accuracy.



PTE-100-C base unit



PTE-FCL option



PTE-FCN Option

## EASY TO USE

All the controls and displays are intuitively located and ergonomically designed. The thick regulation knob provides an accurate and smooth adjustment of the test quantities. Four current ranges deliver the available 1000 VA power regardless the working scale, and allow for fine adjustment and distortion-free injection even on the biggest electromechanical loads.

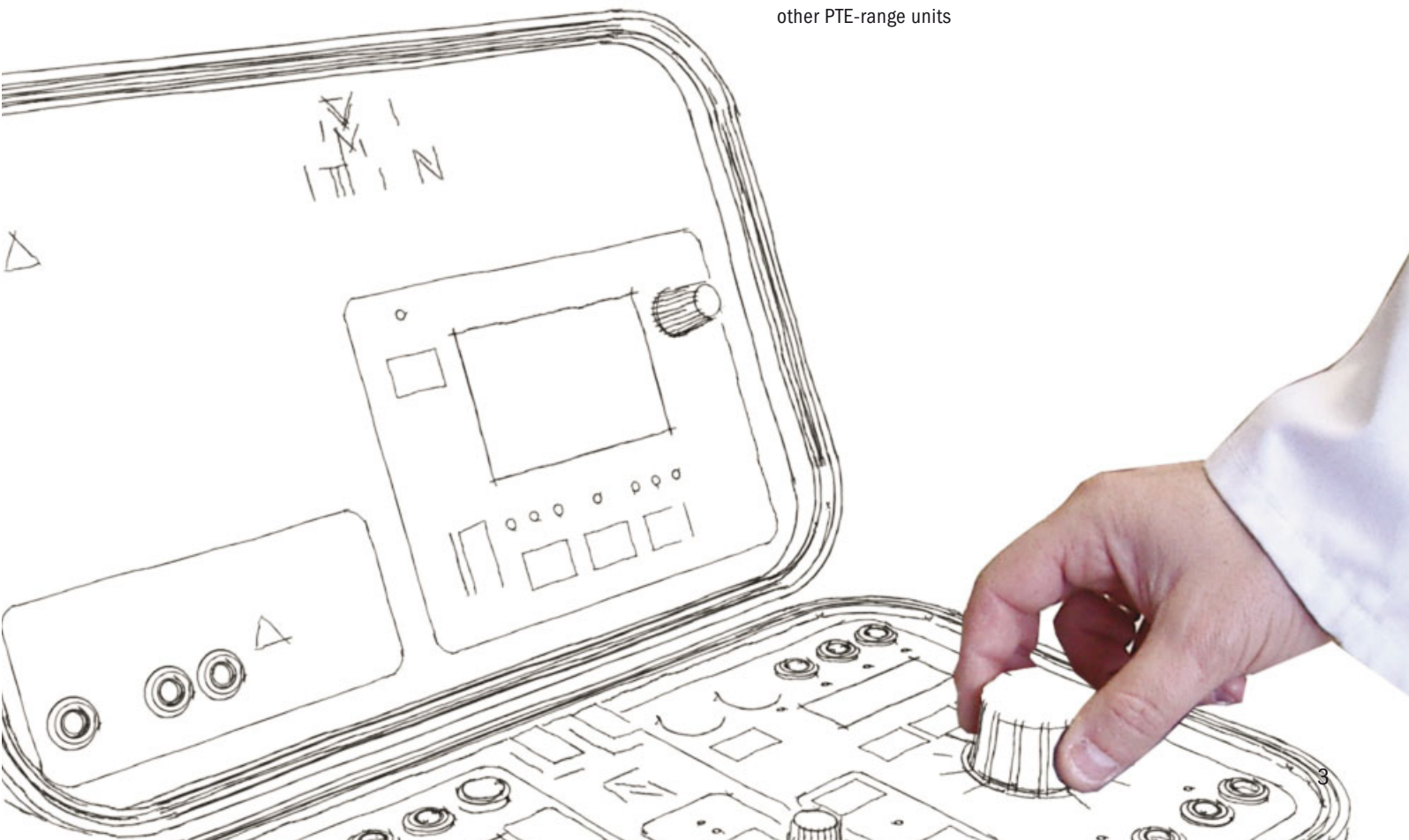
The test set is protected with automatically resettable overload and thermal trips, and the tested device can also be protected against accidental mistakes like excessive current or too long injection time.

The auxiliary DC supply provides an independent, continuous 0-250 V regulation and is short-circuitable.

The “preset” function allows the adjustment of the test current previous to the actual injection, which saves time and avoids stressing the relay’s input at high current test values.

## APPLICATIONS OVERVIEW

- Single-phase testing of AC and DC current or voltage protective relays
- Testing of MCBs with two or more poles
- Knee-point (saturation) analysis on current transformers
- Directional current or voltage relay testing (Plus and Pro versions)
- Synchronization relay testing (Plus and Pro versions)
- Frequency relay testing (Plus and Pro versions)
- Reclosing relay testing (PTE-FCE option required)
- Differential and three-phase relay testing when combined with other PTE-range units



# PTE-100-C / PLUS / PRO

TESTABLE IEEE RELAYING FUNCTIONS		PTE-100-C	PLUS/PRO
2	Time-delay starting relay	✓	✓
21	Distance 1 $\emptyset$		✓
24	Volts / Hertz		✓
25	Synchronizing		✓
27	AC / DC Undervoltage	✓	✓
32	1 $\emptyset$ directional power		✓
37 / 76	DC Under / overvoltage	✓	✓
40	Loss of field	✓	✓
46	Reverse phase		✓
46N	Negative Sequence Overcurrent	✓	✓
47	Reverse phase voltage		✓
49	Thermal relay	✓	✓
50	Instantaneous Overcurrent Relay	✓	✓
51	Timed Overcurrent Relay	✓	✓
59	Overvoltage Relay	✓	✓
64	Ground detection relay	✓	✓
67	Directional overcurrent relay		✓
67N	Ground directional overcurrent relay		✓
78	Phase angle / Out of step relay		✓
79	Reclosing relay	✓	✓
81	Frequency relay		✓
82	DC reclosing relay	✓	✓
91	Directional voltage relay		✓
92	Directional voltage & power relay		✓
94	Tripping relay	✓	✓



Ergonomically designed control panel for accurate and fast testing



Adjustable voltage: 0-140 V, 40-70 Hz, 0-359,9 $^{\circ}$

Dry- or energized contact detection up to 250 V

Multifunctional displays (time, measurements, settings...)

Electronically protected 0-250 Vdc auxiliary source

6 programmable timer start / stop modes

Adjustable test current & time limits

Electronic 1000-VA output ON/OFF switch

Adjustable 0-250 VAC / 4A voltage output

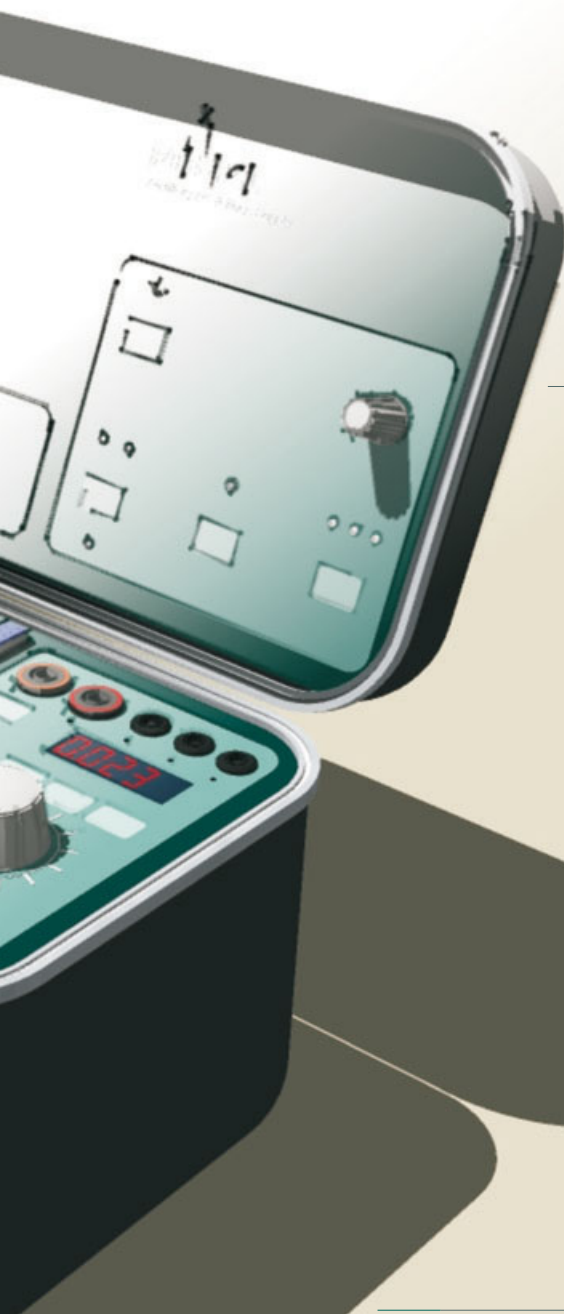
Fixed 110 VAC / 0.3A auxiliary voltage output



Digital 1-millisecond programmable chronometer and comprehensive set of measurement and test control functions.



The PTE-100-C Pro's independent voltage module provides the necessary voltage injection for directional relays and generator or motor protections. This module can also be purchased separately and installed in the PTE-100-C's lid in a few minutes.



Frequency reference selection

Multi-function knob (amplitude, angle, frequency)

Fine / coarse adjustment selection

Voltage, frequency and phase angle display

RS-232 and BUS-PTE communications

250, 50, 25 and 5 A, 1000-VA output taps

Digital auto-range current and voltage display

0-250 VAC / 4A voltage output

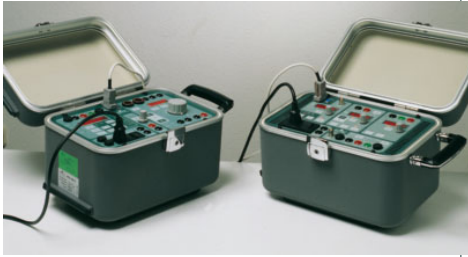
0-350 VDC / 2,8 A voltage output

Only with the PTE-100-C PRO

Only with the PTE-100-C PLUS and PRO

Also with the PTE-100-C

# PTE-100-C / PLUS / PRO



PTE-100-C and PTE-100-V interconnected

## INTERCONNECTION FEATURE

The PTE-100-C can be linked to any other members of the PTE family by means of the EuroSMC's exclusive PTE BUS. This modular architecture provides an elegant and cost-effective way of composing a highly interoperable test platform right when you need it, whereas the individual units can be used separately for simpler test and maintenance jobs. For example, complex distance protections and many other three-phase relays can be tested by interconnecting the PTE-100-C and the three-channel PTE-300-V unit.

## MEASUREMENT FUNCTIONS SET

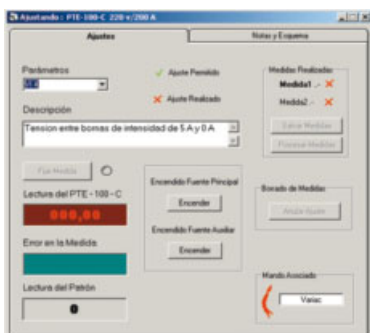
- **Ammeter:** external current measurement up to 10 AAC can be measured between the common power output tap and the OUT 1 output tap.
- **Voltmeter (Vmon):** external voltage measurement up to 300VAC/400 VDC (up to 1,000V with the PTE-FCH option), can be measured at the monitor input. As a secondary measurement displays the mains AC Voltage. The Vtap function displays the AC Voltage at the used current tap.
- **Frequency (Fmon):** external frequency measurement between 20 and 2000 Hz, with a maximum resolution of 0.01 Hz, and also displays the mains frequency.
- **Phase Angle meter:** measurement of the phase angle, in 0-360° notation with 0.1° resolution, of the connected load impedance angle, angle between the injected current and an external voltage, and between external current and voltage.
- **Impedance ( $\Omega$ ):** measures the impedance connected to the current injection circuit and also provides a four-wire impedance measurement, with 0.001 $\Omega$  resolution.
- **Apparent power (VA):** power consumed throughout the current injection circuit, and also as the product of  $V \times I$ .

## SPECIAL CONTROL FUNCTIONS

- **Percentage mode (%):** this function enables to display in the ammeter the regulation as a percentage of a given nominal current, to better trace those timing curves with current values in terms of percentage.
- **Instantaneous current mode (I<sub>max</sub>):** this function stores and displays the maximum injected current or peak mode in the ammeter, for those very short tripping times in instantaneous overcurrent testing.
- **Current Limit (I<sub>lim</sub>):** useful function to set a maximum limit of current delivered by the equipment, to protect the tested devices which are very sensitive to overloads.
- **Time Limit (T<sub>lim</sub>):** Using this function the operator can limit the maximum injection time, as a countdown timer or pulse mode, mainly for those applications where high current is injected for a very short time, to protect the tested device or for threshold time reasons of the specific test.
- **Pre-set:** This function allows preselecting the injection current value before the actual injection, with the unit in off status, avoiding the overload of the relay mainly at high current test values.

## FAA-CAL: Closed-case adjustment and calibration reporting

FAA-CAL will download and save the connected equipment's settings automatically if no previous records of that unit are found in the computer. This provides a backup copy of the present adjustments in case the operator makes any mistake. The program guides the operator throughout the adjustment process and a report can be generated at the end. Reference instrumentation is required to enter the measured data into the equipment under calibration.



FAA-CAL

## OPTIONAL ACCESSORIES

### PTE-FCC: Load option

PTE-FCC consists of a set of resistors and one capacitor. By connecting one or more resistors in series with the current injection circuit, the adjustment accuracy and the quality of the waveform increase when working with low-impedance receptors. Current-to-voltage angles up to nearly 90 degrees can also be achieved when combining the capacitor and the resistors. Resistance values and duty cycles are listed in the following chart:

Value ( $\Omega \pm 5\%$ )	RESISTOR SET	
	Max, current (A)	
	Continuous	1 min.
0.5	20	30
1	10	15
2	5	7.5
25	1.6	2
50	0.8	1
100	0.4	0.5

### PTE-FCB: In-field MCB testing

Provides a convenient DIN bracket and adjustments for the testing of low voltage thermo-magnetic MCB protections with one or more poles up to 250AAC.

### PTE-FCE: External timer start / stop

Allows the built-in timer to be used independently when testing reclosers and for other electrical event time measurements. Dry contact activity is monitored at the timer start and timer stop connections. The accessory is powered from the fixed 110VAC supply in the test set.

### PTE-FCF: 0-120 VAC regulation for the fixed 110VAC output

The PTE-FCF provides adjustable 0-120VAC voltage when connected to the fixed 110VAC auxiliary output featured by every PTE-range test set. The maximum sustainable current is 0.3A.

### PTE-FCL: Adjustable voltage, frequency and phase angle source

Supplied as standard in the PTE-100-C PLUS, this independent voltage source can be easily installed in the lid of any PTE-100-C in a few minutes. The high-quality, electronically generated output from the PTE-FCL option is a perfect complement to the powerful current output when testing directional, frequency or synchronizing relays. Voltage: 0-140VAC; frequency: 40.0-70.0 Hz; phase angle: 0-359.9°.

### PTE-FCN: Adjustable voltage, frequency and phase angle source

Supplied as standard in the PTE-100-C Pro, this module is identical to the PTE-FCL and includes a multifunction LCD display that shows the adjusted voltage, frequency and phase angle. As the PTE-100-C's measurement functions are no longer needed, this module can also be used with other test sets in the PTE range, like the PTE 50 CE electronic injection set.

### PTE-FCH

Adapter for external voltage measurement up to 1000V.

### Sturdy ABS transport case with wheels

You can trust your valuable test equipment to this specially-prepared case with compartments for the unit, the test leads and other accessories.

PTE-FCC



PTE-FCB



PTE-FCE



PTE-FCF



Transport case with wheels

# PTE-100-C / PLUS / PRO



## TECHNICAL CHARACTERISTICS

### 1000 VA OUTPUT

OUTPUT	NO-LOAD VOLTAGE	FULL-LOAD VOLTAGE	MAXIMUM CURRENT	DUTY CYCLE
0-5 A	200V	163V	5.5A	1 min. ON / 15 min OFF
0-25A	40V	33V	27.5A	1 min. ON / 15 min OFF
0-50A	20V	16V	55A	1 min. ON / 15 min OFF
0-100A	10V	7.6V	110A	1 min. ON / 15 min OFF
	10V	6.6V	150A	10 seg. ON / 5 min. OFF
	10V	4.2V	210A	5 seg. ON / 5 min. OFF
0-250V AC	10V	4.2V	250A	3 seg. ON / 5 min. OFF
	285V	220V	4A	10 min. ON / 15 min. OFF
0-350V CC	292V	270V	2.8A	5 min. ON / 15 min. OFF

### AUXILIARY VOLTAGE OUTPUT

	OUT 3	OUT 4
VOLTAGE	0 - 250Vdc	110Vac
MAXIMUM CURRENT	1A	0.3A

### DIGITAL CHRONOMETER

Range:	Time mode: 0.001 - 99999 s. (autorange). Cycle mode: 000.1 a 9999.9 Cycle (of the power supply frequency).
Accuracy:	±0.003% of Reading ±1 dig.
Start:	Upon activation / deactivation of output
Stop:	Upon activation / deactivation of input monitor.

### MEASUREMENT FUNCTIONS

	CURRENT (Aac)	VOLTAGE (Vac)	VOLTAGE (Vdc)	FREQUENCY (Hz)
MINIMUM	0.0070	0.1	0.1	20.000
MAXIMUM	299.9	300.0*	400.0*	2000.0
ACCURACY (10% to 100%)	±1% R ±1 dig.	±1% R ±1 dig.	±1% R ±1 dig.	±0.003 ±1 dig.
RESOLUTION	0.001	0.1	0.1	0.01
	VOLTAGE AT OUTPUT (Vac)	PHASE ANGLE (degrees)	POWER (VA)	IMPEDANCE (Ω)
MINIMUM	0.01	000.0	0.01	0.001
MAXIMUM	199.9	359.9	999.9	999.9
ACCURACY (10% to 100%)	±1% R ±1 dig.	±2° ±1 dig.	±2% R ±1 dig.	±2% R ±1 dig.
RESOLUTION	0.01	0.1°	0.01	0.001

\* Up to 1,000V with the PTE-FCH option

### SIGNAL MONITOR

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

### GENERAL

Temperature:	Operation: 0-50° C Storage: -20° - 70° C
Power supply:	230 Vac ± 10% / 50-60 Hz 115 Vac ± 10% / 50-60 Hz. (specify)
Dimensions:	200 mm x 300 mm x 200 mm (8" x 12" x 8")
Weight:	PTE-100-C: 13.5 Kg. (30 lb.) PTE-100-C PLUS/PRO: 15.5 Kg. (35 lb.)

### VARIABLE VOLTAGE CHANNEL (PLUS, PRO)

Range:	0 - 140 Vac.
Power:	30VA (70 - 140 Vac)
Max Current:	0.45 A (0 - 70 Vac)
Adjustment:	Coarse: 10V / Fine: 0.1V
Load regulation:	<1% (@ 0 - full load, cos φ = 1)
Line regulation:	<0.5%
Distortion:	<0.5% @ 50Hz
Switching noise:	<0.2% Fe. (0.75Vpp) @ 0-140 Vac
Frequency:	Range: 40 - 70Hz Resolution: Coarse: 1Hz / Fine: 0.1Hz Selectable references: Supply/Internal frequency generator
Phase angle:	Range: 0 - 359.9° Regulation: Coarse: 10° / Fine: 0.1° Referred to BUS-PTE

### STANDARD ACCESSORIES

AC power cord
2 16-mm <sup>2</sup> high-current cables
8 crocodile clips
8 2.5-mm <sup>2</sup> test leads
2 adapter plugs (6 mm to 4 mm))
RS-232 and PTE-BUS cables
Spare fuses
Instructions manual
Lightweight bag
FAA-CAL calibration software
AC power cord (PLUS, PRO)
2 x output adjustment leads (PLUS)
Earth wire (PLUS, PRO)

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