on-site tester calibrator
CALYS 5

CE
ISO 9001

The digital tester calibrator CALYS 5 is designed for maintenance and calibration of physical quantities either on-site or in labs.
It can:
- Measure
  - temperatures,
  - resistances,
  - DC voltages and currents.
- Simulate thermocouples and RTDs.
- Simulate resistances.
- Output DC voltage and current signals.

Two instruments in one
- tester, calibrator
- stand alone logger

Memory reading on the display or via analog output

Interchangeable battery, quick charge: 3 hours

10 hours lifetime

200 000 points in simulation

Multilanguage

functions

The CALYS 5 is designed for checking equipment in telemetry loops, such as sensors, transmitters, positioners, converters, controllers.
Delivered with elastomeric enclosure, the CALYS 5 is self-contained thanks to rechargeable battery pack. It can operate on mains without battery discharge.
It includes an alphanumeric display and a very comprehensive 24-key keypad allowing easy programming and processing thanks to help messages available in several languages.
It can store up to 1000 measurements in one or more bursts.

DC voltage, DC current, resistance

Measurement .....
Measurement range up to 120% of range.
• Voltage, input resistance:
> 1000 MΩ over 50 mV and 500 mV ranges,
10 MΩ over 5 V and 50 V ranges.
Normal mode rejection level > 70 dB at 50/60 Hz.
Common mode rejection level > 120 dB in DC and AC 50 Hz.
Max. permissible common mode voltage: 250 V rms.
• Current, voltage drop < 1.6 V
• Current, 24 V DC may power a loop including a passive transmitter.
• Resistance, measuring current:
1 mA over 500 Ω range,
0.1 mA over 5000 Ω range.
3-wire balanced circuit.

Emission/simulation .....
• Voltage, nominal load resistance ≥ 100 kΩ.
Source resistance < 0.2 Ω.
• Resistance, nominal current In for the announced accuracy: 1 mA (500 Ω range) or 0.1 mA (5 000 Ω range). Permissible measuring current: 0.5 In to 3 In.

Range	Measurement			Emission/Simulation			
	Resolution	Accuracy (1) 90 days	Accuracy (1) 1 year	Emission range	Resolution	Accuracy (1) 90 days	Accuracy (1) 1 year
50 mV	10 µV	0.05 % + 10 µV	0.1 % + 10 µV				
500 mV	100 µV	0.05 % + 100 µV	0.1 % + 100 µV	- 30 to + 220 mV	1 µV	0.03 % + 4 µV	0.05 % + 18 µV
5 V	1 mV	0.05 % + 1 mV	0.1 % + 1 mV	- 300 to + 2 200 mV	10 µV	0.02 % + 20 µV	0.05 % + 40 µV
50 V	10 mV	0.05 % + 10 mV	0.1 % + 10 mV	- 2 to + 22 V	100 µV	0.02 % + 0.2 mV	0.04 % + 0.4 mV
50 mA	10 µA	0.05 % + 10 µA	0.1 % + 10 µA	0.1 to + 24 mA	0.1 µA	0.02 % + 0.3 µA	0.04 % + 0.5 µA
500 Ω	100 mΩ	0.05 % + 100 mΩ	0.1 % + 0.1 Ω	26 to 501 Ω	1 mΩ	0.02 % + 10 mΩ	0.04 % + 20 mΩ
5 000 Ω	1 Ω	0.05 % + 1 Ω	0.1 % + 1 Ω	260 to 5 010 Ω	10 mΩ	0.02 % + 150 mΩ	0.04 % +250 mΩ

(1) In ± (% rdg + n digits) at 23 ± 1°C.

Temperature by thermocouples

Sensor	Measurement				Simulation		
	Measurement range	Resolution	Accuracy (1) 90 days	Accuracy (1) 1 year	Simulation range (2)	Accuracy (1) 90 days	Accuracy (1) 1 year
K (NiCr/NiAl)	- 250 to - 200°C - 200 to - 100°C - 100 to + 1 372°C	0.5°C 0.2°C 0.1°C	0.05 % + 1°C 0.05 % + 0.4°C 0.05 % + 0.2°C	0.1 % + 1.5°C 0.1 % + 0.6°C 0.1 % + 0.3°C	- 240 to - 200°C - 200 to 0°C 0 to + 1372°C	1°C 0.15 % + 0.1°C 0.03 % + 0.1°C	2°C 0.3 % + 0.2°C 0.05 %+ 0.2°C
T (Cu/CuNi)	- 250 to + 200°C - 200 to - 100°C - 100 to + 400°C	0.5°C 0.2°C 0.1°C	0.05 % + 1°C 0.05 % + 0.4°C 0.05 % + 0.2°C	0.1 % + 1.5°C 0.1 % + 0.6°C 0.1 % + 0.3°C	- 240 to - 200°C - 200 to 0°C 0 to + 400°C	1°C 0.15 % + 0.1°C 0.03 % + 0.1°C	2°C 0.3 % + 0.2°C 0.05 %+ 0.2°C
J (Fe/CuNi)	- 209 to - 120°C - 120 to + 1 020°C	0.2°C 0.1°C	0.05 % + 0.4°C 0.05 % + 0.2°C	0.1 % + 0.6°C 0.1 % + 0.3°C	- 210 to 0°C 0 to + 1200°C	0.15 % + 0.1°C 0.04 % + 0.1°C	0.3 % + 0.2°C 0.08 % + 0.2°C
E (NiCr/CuNi)	- 250 to - 200°C - 200 to - 100°C - 100 to + 755°C	0.5°C 0.2°C 0.1°C	0.05 % + 1°C 0.05 % + 0.4°C 0.05 % + 0.2°C	0.1 % + 1.5°C 0.1 % + 0.6°C 0.1 % + 0.3°C	- 240 to - 200°C - 200 to 0°C 0 to + 1000°C	1°C 0.1 % + 0.1°C 0.03 % + 0.1°C	2°C 0.2 % + 0.2°C 0.05 %+ 0.2°C
N (NiCrSi/NiSi)	- 240 to - 200°C - 200 to + 400°C + 400 to + 1 300°C	1°C 0.5°C 0.1°C	0.05 % + 1°C 0.05 % + 0.4°C 0.05 % + 0.2°C	0.1 % + 1.5°C 0.1 % + 0.6°C 0.1 % + 0.3°C	- 240 to - 200°C - 200 to 0°C 0 to + 1300°C	1.5°C 0.15 % + 0.2°C 0.03 % + 0.2°C	3°C 0.3 % + 0.4°C 0.05 %+ 0.4°C
U (Cu/CuNi DIN)	- 200 to - 100°C - 100 to + 600°C	0.2°C 0.1°C	0.05 % + 0.4°C 0.05 % + 0.2°C	0.1 % + 0.6°C 0.1 % + 0.3°C	- 200 to 0°C 0 to + 600°C	0.1 % + 0.1°C 0.02 % + 0.1°C	0.2 % + 0.2°C 0.04 % + 0.2°C
L (Fe/CuNi DIN)	- 200 to - 40°C - 40 to + 900°C	0.2°C 0.1°C	0.05 % + 0.4°C 0.05 % + 0.2°C	0.1 % + 0.6°C 0.1 % + 0.3°C	- 200 to 0°C 0 to + 900°C	0.1 % + 0.1°C 0.03 % + 0.1°C	0.2 % + 0.2°C 0.05 %+ 0.2°C
S (Pt10%Rh/Pt)	- 50 to + 450°C + 450 to + 1 767°C	1°C 0.5°C	0.05 % + 2°C 0.05 % + 1°C	0.1 %+ 3 °C 0.1 % + 1.5°C	- 50 to + 1 768°C	1°C	2°C
R (Pt13%Rh/Pt)	- 50 to + 450°C + 450 to + 1 767°C	1°C 0.5°C	0.05 % + 2°C 0.05 % + 1°C	0.1 %+ 3 °C 0.1 % + 1.5°C	- 50 to + 1 768°C	0.8°C	1.5°C
B (Pt13%Rh/ Pt16%Rh)	- 400 to + 900°C + 900 to + 1 820°C	1°C 0.5°C	0.05 % + 2°C 0.05 % + 1°C	0.1 %+ 3 °C 0.1 % + 1.5°C	0 to + 1 820°C	1°C	2°C
C (W5%Rh/ W26%Rh)	- 20 to + 300°C + 300 to + 1 830°C + 1 830 to + 2 320°C	0.5°C 0.2°C 0.5°C	0.05 % + 1°C 0.05 % + 0.5°C 0.05 % + 1°C	0.1 % + 1 °C 0.1 % + 0.8°C 0.1 % + 1 °C	- 20 to 0°C 0 to + 400°C + 400 to + 2 300°C	0.3°C 0.3 % + 0.3°C 0.06 % + 0.3°C	0.5°C 0.05 %+ 0.5°C 0.1 %+ 0.5°C

(1) In ± (% rdg + n°C) at 23 ± 1°C.
(2) For a 0.1°C resolution.
The listed accuracies are guaranteed for a 0°C reference junction. Using the internal reference junction, except thermocouple B, add an uncertainty of 0.2°C. When measuring, the inherent temperature error of the sensor used must also be taken into account.

Temperature by RTDs

Temperature			Measurement			Simulation	
Probe	Measurement range	Accuracy (1) 90 days	Accuracy (1) 1 year	Covered range	Accuracy (1) 90 days	Accuracy (1) 1 year
Pt 100 Ω	- 220 to + 1 200°C	0.05 % + 0.3°C	0.1 % + 0.4°C	- 180 to + 1 200°C	0.02 % + 0.1 °C	0.04 % + 0.2°C
Pt 200 Ω	- 220 to + 550°C	0.05 % + 0.2°C	0.1 % + 0.3°C	- 210 to + 405°C	0.02 % + 0.05°C	0.04 % + 0.1°C
Pt 500 Ω	- 220 to + 1 200°C	0.05 % + 0.5°C	0.1 % + 0.7°C	- 120 to + 1 200°C	0.02 % + 0.2 °C	0.04 % + 0.3°C
Pt 1000 Ω	- 220 to + 1 200°C	0.05 % + 0.3°C	0.1 % + 0.4°C	- 180 to + 1 200°C	0.02 % + 0.1 °C	0.04 % + 0.2°C
Ni 100 Ω	- 59 to + 180°C	0.05 % + 0.3°C	0.1 % + 0.4°C	- 60 to + 180°C	0.02 % + 0.1 °C	0.04 % + 0.2°C
Ni 200 Ω	- 59 to + 180°C	0.05 % + 0.2°C	0.1 % + 0.3°C	- 60 to + 180°C	0.02 % + 0.05°C	0.04 % + 0.1°C
Ni 500 Ω	- 59 to + 180°C	0.05 % + 0.5°C	0.1 % + 0.7°C	- 60 to + 180°C	0.02 % + 0.2 °C	0.04 % + 0.3°C
Ni 1 000 Ω	- 59 to + 180°C	0.05 % + 0.3°C	0.1 % + 0.4°C	- 60 to + 180°C	0.02 % + 0.1 °C	0.04 % + 0.2°C

(1) In ± (% rdg + n°C) at 23 ± 1°C. The accuracy is given for a temperature sensor connected in 3-wire balanced circuit. The inherent temperature error of the sensor used must also be taken into account.

Measurement
Resolution: 0.1°C.
Measuring current:
• Pt 100, 200 and Ni 100, 200: 1 mA.
• Pt 500, 1000 and Ni 500, 1000: 0.1 mA.

Simulation
Resolution: 0.01°C.
Usable nominal current In:
• Pt 100, 200 and Ni 100, 200: 1 mA.
• Pt 500, 1000 and Ni 500, 1000: 0.1 mA.

Permissible measuring current: from 0.5 In to 3 In.
Response time < 90 ms.

additional functions

Temperatures in measurement and simulation functions can be expressed either in °C or °F.

Measurement trigger
Automatic or keypad key; burst triggering can be programmed from 1 to 1000 successive measurements with a time interval from 0.5 to 3 400 s.

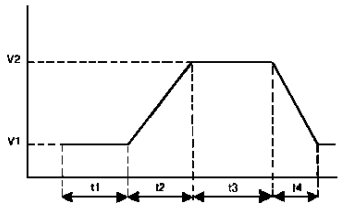
Autoranging with voltage and resistance functions

Relative measurements
The unit reads the deviation regarding a value measured and stored as a reference. L = M-R with L value read, M value measured with the chosen function and range and R reference value.

Display according to a conversion law
The unit reads the function L = aM + b with L value read, M value measured with the chosen function and range; a and b are defined by the unit on the basis of the desired L1 and L2 values for the corresponding values of M1 and M2, the data having previously been entered on the keypad.

Step generator
The emission signal can vary per step, those amplitude and positive or negative directions are defined using the keypad.

Ramp generator
The emission signal can vary continuously between two predetermined values, after programming values of level v1 and v2, times t1 to t4 and number of n successive cycles.



Storage of emission values
100 simulation values can be programmed and stored in non-volatile memory. They can be recalled using the keypad.

Measurement memory
It can store the number, function, range and value of the last 1000 measurements or n bursts of p measurements (E.g.: 250 bursts of one measurement).
The unit computes the average and determines the maximum and minimum of the values for each burst.

Recalling measurements
The values can be:
• either recalled using the keypad and read on the display,
• or converted into 4-20 mA or 0-1 V analog signals available on the unit terminals; the time interval between outputs of 2 consecutive measurements is selected by program.

general specifications

Display
One line of 16-backlit characters.

Operating conditions
Reference range: 23 ± 1°C, relative humidity 45 to 75%.
Operating normal range: 0 to 50°C, RH: 20 to 75%.
Operating limit range: - 10 to + 55°C, RH: 10 to 80%.

Standards
Platinum probe according to DIN-IEC Publication 475 (NFC 42-330 and DIN 43760).
Thermocouple according to IEC Publication 584-1 (NFC 42-321) or DIN 43710.

Power requirements
Removable NiMH battery pack, 5 accumulators, quick charge in 3 h.
Life: > 10 h.
Mains block: 12 V/400 mA.
External charger: 220 V, 50/60 Hz.
Output: 12 V DC.

Feature
ABS casing with elastomer enclosure.
Dimensions: 260 mm x 144 mm x 60 mm.
24-key keypad control.
Weight < 1.5 kg.

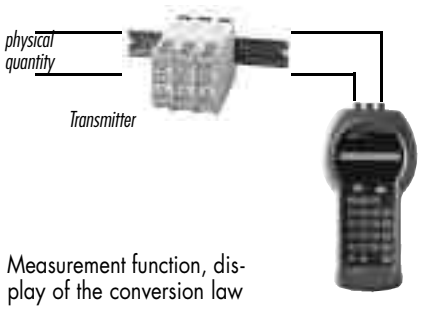
Languages
French, English, German, Swedish, Italian, Spanish, and Dutch.

CALYS 5 solutions

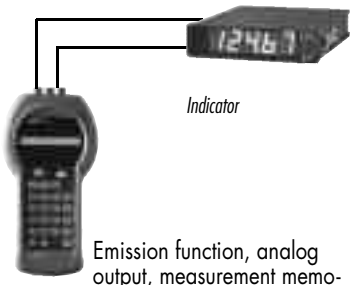
Industrial process

• For adjusting parameters of an industrial process.

Well-adapted to the measurement of transmitters and/or industrial process conditioners, the CALYS 5, connected to the 0-10 V or 4-20 mA transmitter output in 2- or 4-wire circuit, displays the physical measurement according to the conversion law previously entered on the keypad.
These measurements can be stored and converted into analog signals for testing the DPM associated to the transmitter.



Measurement function, display of the conversion law

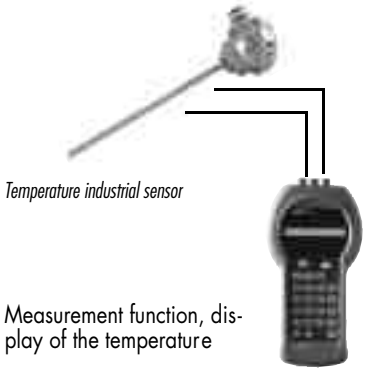


Emission function, analog output, measurement memory, 4-20 mA

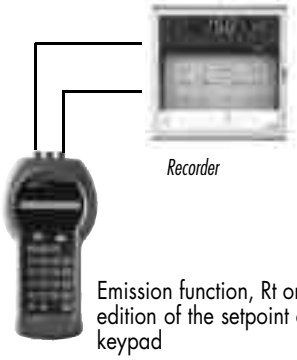
Maintenance

• For removing all doubts on operation of a component from a measurement chain.

The CALYS 5 tests the industrial sensor from the measurement chain and displays the process measurement.
In the same way, the CALYS 5 simulates a resistance or a thermocouple to test the correct deviation of a recorder.



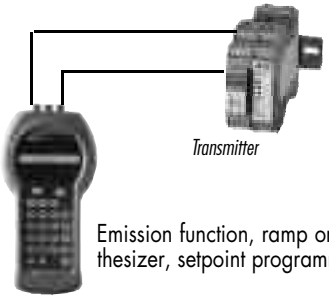
Measurement function, display of the temperature



Emission function, Rt or Tc, edition of the setpoint on the keypad

• For simulation of valve opening to characterize the alarm thresholds.

The CALYS 5 outputs a ramp in the transmitter function in step by step mode. The alarms are displayed on the monitoring system.



Emission function, ramp or synthesizer, setpoint programming

For transmitter tests with calibration reports, measurement storage and processing software, ask for the CALYS 10 which is the additional solution.

ordering instructions

All-purpose tester calibrator CALYS 5

Accessories

Battery pack	AN 6010
Set of 5 leads	ACL 9310
Cigar lighter lead	ATL 306

B.P. 182 - F 91006 EVRY Cedex
Tel. 33 1 69 36 50 60
Fax 33 1 60 77 82 97
Email: export@aoip.com

The above characteristics are subject to modification

multifunction calibrator
CALYS 10

The calibrator CALYS 10 is designed to meet all the growing requirements of the calibration and maintenance departments, either on site or in laboratories.
Built in with a protective housing and with a quick charge battery, it can control, verify and calibrate all the instruments entering in the process in industrial areas.

- **Simultaneous measurement and emission**
- **Temperature and process signals**
- **Pressure: - 1 bar up to 1000 bar**
- **Automatic transmitter test**
- **Data storage**
- **On site automatic calibration**

Application

Thanks to its ergonomic shape, its battery lifetime, the CALYS 10 is particularly designed for the control and calibration and on site maintenance for controllers, valves, panel meters, recorders and all the instruments involved into the process loop.

If the industrial environment is its best place, it can also be used in laboratory, R&D department, production services.
Its dual display eases the controller and transmitter test, generating onto the input and measuring the output signal of the transmitter.

Description

User friendly, it also has a large number of functions:
- Dc current measurement and emission
- Dc voltage measurement and emission
- Temperature (RTD and thermocouples) measurement and simulation
- Resistance measurement and simulation
- Pressure with external modules.

The measurement and emission are performed independently and simultaneously. The dual display makes the calibration tests easy.

The CALYS 10 offers also the possibility to linearise signals with a large choice of units, to trigger measurements, to perform relative measurements, generation of ramps, increments and memorised values.
A built-in RS 232 interface is in standard for communication with a PC.
Its software, the LCL CAL 10 allows the user to configure the calibrator and to create calibration procedures, to download data from the CALYS 10 and to print out calibration report or measurement curves.

It is useful to program calibration procedure, as well as to print out the calibration certificates.

Its NiMh battery allows an intensive use and a quick charge in less than 3 hours.
Thanks to its belt, it can be used in "hands free" position.

functions

Measurement and emission are simultaneous and independent.

DC voltage, DC current, resistance

Measurement

Input	Measuring range	Resolution	90 days accuracy	1 year accuracy	Remarks
mV	- 60 to + 60 mV - 600 to + 600 mV	1 µV 10 µV	0.02 %+ 5 µV 0.02 % + 30 µV	0.04 % + 7 µV 0.04 % + 50 µV	I > 1 000 MΩ
V	- 6 to + 6 V - 60 to + 60 V	0.1 mV 1 mv	0.02 % + 0.3 mV 0.02 %+ 3 mV	0.04 % + 0.5 mV 0.04 % + 5 mV	I > 10 MΩ
mA	- 60 to + 60 mA	1 µA	0.02 % + 3 µA	0.04 % + 5 µA	Voltage drop < 1.2 V
Ω	0 to + 600 Ω 0 to + 6 kΩ	10 mΩ 0.1 mΩ	0.02 % + 30 mΩ 0.02 % + 0.3 Ω	0.04 % + 50 mΩ 0.04 % + 0.5 Ω	Current 1 mA Current 0.1 mA

Accuracies are given in ± (% rdg + n digits) at 23 ± 5°C.

Emission - simulation

Output	Emission range	Resolution	90 days accuracy	1 year accuracy	Remarks
mV	- 10 to + 50 mV - 100 to + 500 mV	1 µV 10µV	0.025 % + 5 µV 0.025 % + 30 µV	0.04 % + 7 µV 0.04 % + 50 µV	
V	- 1 to + 5 V - 1 to + 50 v	0.1 mV 1 mV	0.025 % +0.3 mV 0.025 % +3 mV	0.04 % + 0.5 mV 0.04 % + 5 mV	
mA	0 to 24 mA	1 µA	0.025 % + 3 µA	0.04 % + 5 µA	Voltage 30 V
Ω	0 to 500 Ω 0 to 5 000 Ω	0.01 Ω 0.1 Ω	0.025 % +0.03 Ω 0.025 % +0.3 Ω	0.04 % + 0.05 Ω 0.04 % + 0.5 Ω	Current≤ 5 mA Current ≤ 0,5 mA

Temperature by RTD

With 2, 3 or 4 wires.
In measurement resolution of 0.01°C.

Accuracy are given in ± (% rdg + n°C) at 23 ± 5°C.

Probe	Measurement			Simulation			
	Measurement range	90 days accuracy	1 year accuracy	Covered range	Resolution	90 days accuracy	1 year accuracy
Pt 50	- 220 to + 1 200°C	0.03 %+ 0.15°C	0.05 %+ 0.3°C	- 220 to + 1 200°C	0.05°C	0.04 %+ 0.15°C	0.05 %+ 0.3°C
Pt 100 (1)	- 220 to + 1 200°C	0.03 %+ 0.1°C	0.06 % + 0.2°C	- 220 to + 1 200°C	0.02°C	0.04 %+ 0.1°C	0.06 % + 0.2°C
JPt 100 (2)	- 200 to + 510°C	0.03 %+ 0.1°C	0.06 % + 0.2°C	- 200 to + 510°C	0.02°C	0.04 %+ 0.1°C	0.06 % + 0.2°C
Pt 100 (3)	- 210 to + 850°C	0,03 %+ 0.1°C	0.06 % + 0.2°C	- 210 to + 850°C	0.02°C	0.04 %+ 0.1°C	0,06 % + 0,2°C
Pt 200	- 220 to + 600°C	0.03 %+ 0.1°C	0.05 %+ 0.2°C	- 220 to + 410°C	0.02°C	0.03 %+ 0.1°C	0.05 % + 0.2°C
Pt 500	- 220 to + 1 200°C	0.03 %+ 0.15°C	0.05 %+ 0.3°C	- 220 to + 1 200°C	0.05°C	0.04 %+ 0.15°C	0.05 % + 0.3°C
Pt 1000	- 220 to + 1 200°C	0.03 %+ 0.1°C	0.06 % + 0.2°C	- 220 to + 1 200°C	0.02°C	0.04 %+ 0.1°C	0.06 % + 0.2°C
Ni 100	- 60 to + 180°C	0.1°C	0.17°C	- 60 to + 180°C	0.02°C	0.1°C	0.17°C
Ni 120	- 40 to + 205°C	0.08°C	0.15°C	- 40 to + 205°C	0.02°C	0.08°C	0.15°C
Ni 1000	- 60 to + 180°C	0.1°C	0.17°C	- 60 to + 180°C	0.02°C	0.1°C	0.17°C
Cu 10 (4)	- 70 to + 150°C	0.9°C	1.5°C	- 70 to + 150°C	0.2°C	0.9°C	1.5°C
Cu 50	- 50 to + 150°C	0.2°C	0.4°C	- 50 to + 150°C	0.05°C	0.2°C	0.4°C

(1) $\alpha = 3851$; (2) $\alpha = 3916$
(3) $\alpha = 3926$; (4) $\alpha = 427$

Temperature by thermocouples

Accuracies are given at 23 ± 5°C. Resolution in simulation is 0.1°C.

Sensor	Measurement				Simulation		
	Measurement range	Resolution	90 days accuracy	1 year accuracy	Simulation range	90 days accuracy	1 year accuracy
K	- 250 to - 200°C - 200 to - 120°C - 120 to - 50°C - 50 to + 1 372°C	0.2°C 0.1°C 0.1°C 0.1°C	1.3°C 0.4°C 0.2°C 0.03 %+ 0.1°C	2.2°C 0.7°C 0.3°C 0.05 %+ 0.2°C	- 240 to - 200°C - 200 to - 120°C - 120 to - 50°C - 50 to + 1 232°C + 1 232 to + 1 372°C	1.3°C 0.4°C 0.2°C 0.03 %+ 0.1°C 1.3°C	2.2°C 0.7°C 0.3°C 0.05 %+ 0.2°C 2.1°C
T	- 250 to - 200°C - 200 to - 100°C - 100 to + 400°C	0.2°C 0.1°C 0.1°C	1.0°C 0.4°C 0.2°C	1.7°C 0.6°C 0.3°C	- 240 to - 200°C - 200 to - 100°C - 100 to + 400°C	1.0°C 0.4°C 0.2°C	1.7°C 0.6°C 0.3°C
J	- 210 to - 150°C - 150 to + 800°C + 800 to + 1 200°C	0.1°C 0.1°C 0.1°C	0.4°C 0.2°C 0.8°C	0.6°C 0.4°C 1.3°C	- 210 to - 150°C - 150 to + 870°C + 870 to + 1 200°C	0.4°C 0.2°C 0.8°C	0.6°C 0.4°C 1.3°C
E	- 250 to - 180°C - 180 to + 700°C + 700 to + 1 000°C	0.1°C 0.1°C 0.1°C	0.7°C 0.2°C 0.6°C	1.2°C 0.4°C 1.0°C	- 240 to - 180°C - 180 to + 660°C + 660 to + 1 000°C	0.7°C 0.2°C 0.6°C	1.2°C 0.4°C 1.0°C
N	- 240 to - 190°C - 190 to - 120°C - 120 to + 900°C + 900 to + 1 300°C	0.2°C 0.1°C 0.1°C 0.1°C	1.4°C 0.5°C 0.3°C 0.4°C	2.2°C 0.8°C 0.5°C 0.7°C	- 240 to - 190°C - 190 to - 120°C - 120 to + 900°C + 900 to + 1 300°C	1.4°C 0.5°C 0.3°C 0.4°C	2.2°C 0.8°C 0.5°C 0.7°C
U	- 200 to - 100°C - 100 to + 600°C	0.1°C 0.1°C	0.3°C 0.2°C	0.5°C 0.3°C	- 200 to - 100°C - 100 to + 600°C	0.3°C 0.2°C	0.5°C 0.3°C
L	- 200 to + 900°C	0.1°C	0.25°C	0.4°C	- 200 to + 855°C + 855 to + 900°C	0.25°C 0.6°C	0.4°C 1.0°C
S	- 50 to + 150°C + 150 to + 550°C + 550 to + 1 768°C	0.5°C 0.2°C 0.1°C	1.2°C 0.7°C 0.8°C	1.8°C 1.0°C 1.3°C	- 50 to + 150°C + 150 to + 550°C + 550 to + 1 768°C	1.2°C 0.7°C 0.8°C	1.8°C 1.0°C 1.3°C
R	- 50 to + 150°C + 150 to + 450°C + 450 to + 1 768°C	0.5°C 0.2°C 0.1°C	1.4°C 0.7°C 0.7°C	2.2°C 1.0°C 1.3°C	- 50 to + 150°C + 150 to + 450°C + 450 to + 1 768°C	1.4°C 0.7°C 0.7°C	2.2°C 1.0°C 1.3°C
B	+ 400 to + 900°C + 900 to + 1 820°C	0.2°C 0.1°C	1.3°C 0.7°C	1.8°C 1.2°C	0 to + 900°C + 900 to + 1 820°C	1.3°C 0.7°C	1.8°C 1.2°C
C	- 20 to + 600°C + 600 to + 2 000°C + 2 000 to + 2 320°C	0.1°C 0.1°C 0.1°C	0.4°C 1.0°C 1.4°C	0.6°C 1.8°C 2.5°C	- 20 to + 600°C + 600 to + 2 000°C + 2 000 to + 2 320°C	0.4°C 1.0°C 1.4°C	0.6°C 1.8°C 2.5°C
Pl	- 100 to + 700°C + 700 to + 1 400°C	0.1°C 0.1°C	0.25°C 0.5°C	0.4°C 1.0°C	- 100 to + 700°C + 700 to + 1 232°C + 1 232 to + 1 395°C	0.25°C 0.5°C 1.5°C	0.4°C 0.8°C 2.4°C
Mo	0 to + 400°C + 400 to + 1 100°C + 1 100 to + 1 375°C	0.1°C 0.1°C 0.1°C	0.2°C 0.3°C 0.8°C	0.4°C 0.5°C 1.3°C	0 to + 400°C + 400 to + 1 000°C + 1 000 to + 1 375°C	0.25°C 0.4°C 0.8°C	0.5°C 0.7°C 1.3°C

Pressure measurement

Performed by a digital pressure sensor
Ranges: 0-1 bar, 0-3 bar, 0-10 bar, 0-30 bar, 0-100 bar, 0-300 bar and 0-1 000 bar.

Resolution: 0.01% of full scale.
Accuracy:
- 0.05% of full scale between 10 and 40°C,
- 0.1% of full scale between - 10 to + 10°C and from 40 to 80°C.

Supply: 8-28 V.

additional functions

- Temperature units: °C, °F, °K.
- Scaling/ linearisation: display of Y=f(x). This scaling can be designed using from 2 to 10 couples of points.
- 9 languages
French, English, German, Spanish, Dutch, Polish, Italian, Czech, Swedish.

Measurement mode

• Relative measurement
The value R is the reference measured by the CALYS 10.
Then the CALYS 10 will display D the gap between a measured value M and the value R.
D = M-R.
• Triggered measurements
- Manual acquisition
- Burst of measurement
- Threshold programming. From this threshold, all the values will be stored.
• Measurement Memory
Up to 1000 values in 128 burst can be stored. These values can be displayed on the screen with statistical values: Min, max and average.

Emission mode

• Curve simulation
Thanks to 100 memorised values, a curve can be generated to control valves, panel meters controllers.
• Increment generation
Steps are generated after programming of the amplitude, rising time and levelled time.
• Ramp
Amplitude, rising and falling time, level time are programmed to create ramps up and down.
A hold function can freeze the ramp at any moment.

Transmitter tests

These tests can be performed on all type of transmitters (temperature, current, voltage, resistance, pressure, ...). After programming of the several parameters such as signal on the IN and OUT, accuracy of the transmitter, setpoint, the input signal is simulated from the calibrator and the output (most of the time a 4-20mA or 0-10V) signal is measured by the calibrator, linearised. Then a comparison between the input and the output is performed.
A report is generated on the screen and can be edited using the LCL CAL 10 software.
12 procedures can be written and downloaded into the calibrator.

• Pressure transmitters
Thanks to a manometer type HM 28 (up to 70 bar) or pressure sensor (up to 1000 bar) and a pump, a pressure is generated. The process signal is read on the output of the transmitter and a report can be printed with a pass or fail result.

• Temperature transmitter
The temperature is generated on the input and the process signal coming from the output of the transmitter is measured. The CALYS 10 compares the input and the output, giving the pass or fail signal at the end of the test.

Panel meter test

This test is same as for transmitter but the values displayed on the indicator are entered in the calibrator through the keyboard. Results are stored, can be computerised then a report can be printed.

Calibration of temperature probes and chains

The CALYS 10 has the ability to drive temperature generators (dry-blocks or baths) If the used temperature generator is calibrated then it can be considered as a standard.
Then using the CALYS10, the calibration of a temperature probe or a chain (probe + thermometer) can be performed easily and automatically.
The CALYS 10 drives the oven or the bath, controls the temperature setpoints and stores the temperature measured by the probe.
A calibration certificate can be edited with all the data, taking into account corrections from the calibration certificate of the bath.

general specifications

Display

Graphic backlight display.

Operating conditions

0 to 50°C.
10 to 80% of relative humidity.

Waterproof: IP 41.

RS 232 connection.

Power requirements

NiMh battery, 5 elements.
Quick charge (less than 3 hours).
Lifetime: 10 hours.
Charger: 12V/400mA.

Feature

Overall dimensions: 260 x 144 x 60 mm.
Weight: < 1.5kg.

The instrument is supplied with ABS protective casing, a transport carrying case with the charger, the "hands free" belt.

configuration and exploitation software

LCL CAL 10 is used on a computer connecting the RS 232 connection. It is used under Windows.
LCL CAL 10 is useful to save time writing procedure for scaling, for calibration, to define ramps, steps on a computer and downloading them to the calibrator.
It can be used to recall and display under curve or histogram the stored data, or to apply them calculations off line, and to edit calibration test certificates.

accessories

• Digital pressure sensor:
0 - 1 bar
0 - 3 bar
0 - 10 bar
0 - 30 bar
0 - 100 bar
0 - 300 bar
0 - 1000 bar.

• RS232/RS485 adapter for pressure sensor.

ordering instructions

Multifunction calibrator	CALYS 10
Software	LCL CAL 10

Accessories

Battery pack	AN 6010
Set of 5 leads	AN 5875
RS232 9 pts male/9 pts female cable	ACL9310
RS 485/RS 232 adapter	Consult us
Pressure sensor	Consult us

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The above characteristics are subject to modification

cable fault locator
ISOPALM+

This instrument is designed to identify and locate with high precision faults as insulation faults and break on the wires.
Thanks to the other measurement functions of the ISOPALM+: loop resistance, megohmmeter, voltmeter and capacitance meter, the location is really easy.
ISOPALM+ stores into its memory a database of 4 cable parts allowing measurement onto heterogeneous cable and homogeneous cables.

- **Break on the wires fault**
- **Multifunction**
- **Rugged case**

functions

Insulation fault location
Types of faults:
- Fault between 2 wires on a same pair,
- Fault on 2 wires on different pairs,
- Fault between 1 wire and the ground.

Methods used:
Murray and Fabe (Küpfmuller): possibility to measure with one healthy wire or 2 healthy wires (one called "auxiliary").
Accuracy: 0.2% of the faulty wire resistance. + 0.002 Ω in the reference conditions.

Location of break on the wires
Type of faults:
- 1 broken wire
- 1 broken pair

Using Sauty method (capacitance ratio or capacitance measurement).

Insulation measurement
Range from 0 to 1000 MΩ.
Resolution variable from 0.1 MΩ.
Test voltage: 150 V with current limitation for safety reasons.
Accuracy: 4% rdg up to 50 MΩ.

Capacitance measurement
Range: 0.1 up to 2 µF.
Accuracy: 1% rdg.

Loop resistance measurement
Range: 0 to 10,000 MΩ.
Accuracy: 0.5% rdg + 0.2 Ω.

DC/AC voltage measurements
- Ranges

DC voltage: 0 to 100 V
0 to 300 V
AC voltage: 0 to 100 V RMS
0 to 300 V RMS

- Resolutions: 0.1 V up to 100 V
1 V outside this value.
- Accuracy: 1% rdg + 0.5 V

complementary functions

Rejection
It is possible to choose between two types of DC signal rejection: 50/60 Hz or 16 2/3/50 Hz.

Filter
If the measurements are disturbed by low frequency voltages (from 1 to 10 Hz) an internal filter may be set up to improve the results.

Language
Choice between: English, French, Spanish, Dutch.

general specifications

Display .....
Digital display 4 lines of 16 characters.

Protection .....
• Protection against accidental overload up to 400 V rms on all ranges (100 V rms on measuring loop resistance).
• The device automatically discharges the line capacitances when the measuring is ended.
• The unit automatically switches off when 30 min has elapsed since the last key press.
Safety: CEI 1010-1, CAT II Pol.2 300V.

Operating conditions .....
Normal operating range: 0 to 50°C with relative humidity 20 to 80% non condensing.
Storage and transport range: - 30 to + 50°C.

Power supply .....
4 x R6 or LR6, 1.5 V type batteries.
Autonomy: 50 h on insulation measurement or location with 150 V.
50 h on measuring loop resistance.

Presentation.....
Plastic housing in a buckle bag for easy carrying and using.
Dimensions: 195 x 100 x 45 mm.
Weight: 0.5 kg.

Accessories supplied with the unit .....
- Carrying case
- Measuring leads and "crocodile" type clamps.

optional accessory

Remote looping device ATL 101P.....
Remote looping device ATL 101P has been designed to remote control opening and closing of the loop directly by only one operator from the ISOPALM+.
- Power supply: 9 V battery, type LR61 or 6LF22.
- Autonomy: more than 3000 hours.
- Operating limit range: -10 to + 50°C (10 to 80% HR).
- Max. distance 30 Km.

ordering instructions

Cable fault locator	ISOPALMP

Option .....

Remote looping device	ATL101P

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on site micro-ohmmeter OM 10

The OM 10 micro-ohmmeter is used for four-wire resistance measurement from low values (resolution 10 µΩ) up to 50 kΩ, with an excellent accuracy. It includes thermal emfs compensation and temperature compensation. It can also measure DC and AC voltages and ambient temperature.

- **Easy to use**
- **High resolution: 10 µΩ**
- **Resistance and voltage measurements**
- **Temperature compensation and measurement**

Applications

On site, in workshop or laboratory the main applications are listed below:
- Cable resistance and resistivity measurements
- Inductive resistance measurements (motors, transformers, etc...)
- Contact resistance measurements (connectors, switches, relays, quality of joints ...)
- Metallisation and earth bonding measurements
- Test and measurement of electrical components: resistors, fuses, thermistors, heating elements, PCB trade etc...
- Surface state, resistance of mechanical bonds and materials test.

general specifications

Display of measurement value with unit and of ambient temperature.
Indication of measurement range, type of current, possible temperature compensation.
50,000 counts (4 1/2 digits) LCD 13 mm high (0.5").

Range, current waveform, temperature compensation and trigger selected by keyboard.

Four-wire measurements with automatic compensation for thermal electromotive forces (emfs) and automatic ambient temperature compensation.

Measurement current

User can choose two waveforms of current:
- continuous (dc) for inductive resistance measurements (permanent current)
- pulsed in the other cases: current shutoff between measurements (advantage: low heatrise of resistance in test and low consumption).

Measurement time

in DC: 0.5 s,
in pulsed: 1 s.

Protection

- Electronic protection up to 250 V on input (430 V in voltage measurement)
- Electronic protection against break-off currents when measuring an inductive resistance.

Calibration

No need to open the instrument for recalibration; just connect a standard resistance and enter its value through the keypad.

Operating conditions

Nominal operating temperature and humidity: 0 to + 50°C, 20 to 75% RH.
Maximum operating temperature and humidity: - 10 to + 55°C, 10 to 80% RH.
Maximum storage and transport temperature: - 30 to + 60°C.

Protection according to IP41.

Power supply
Internal battery pack Ni-Cd: 1.7 AH. Battery life (typical use) > 10 h. An external mains charger is delivered as standard with the instrument. It allows either battery charging or permanent mains use.

Presentation
Rugged ABS case for site or bench usage. Dimensions: 120 x 65 x 245 mm.
Weight: 1.1 kg.
Delivered in carrying case with mains adaptor.

functions

Resistance measurement
From very low values (resolution 10 µΩ) up to 50 kΩ with:
- Measurement and automatic compensation for thermal electromotive forces (emfs)
- Measurement and compensation (user choice) of ambient temperature.
With temperature compensation, OM 10 displays the theorical value at 20°C of a copper or aluminium resistance (other metals on request). Ambient temperature is measured with a sensor built in the instrument and displayed.

DC + AC voltage measurement

Range	Resolution	Measurement current	Voltage drop	Accuracy (1)
500 mΩ	10 µΩ	100 mA	50 mV	0.05% + 50 µΩ
5 Ω	0.1 mΩ	10 mA	50 mV	0.05% + 0.5 mΩ
50 Ω	1 mΩ	10 mA	500 mV	0.05% + 5 mΩ
500 Ω	10 mΩ	1 mA	500 mV	0.05% + 50 mΩ
5 kΩ	0.1 Ω	0.1 mA	500 mV	0.05% + 0.5 Ω
50 kΩ	1 Ω	0.01 mA	500 mV	0.05% + 5 Ω
400 V	1 V			1 % + 1 V
- 10 to 60°C	0.1°C			1.5°C

(1) The accuracy is given as ±(% of reading + n) over 1 year at 23 ± 5°C.

accessories

(For detailed information, please refer to special datasheet).

Are included as standard: Mains charger for charging batteries and use on mains and carrying case.

Optional extras:
- Kelvin lead set AN 5806
A pair of measurement leads each with a Kelvin clip (maximum opening 1.2 cm)
- Kelvin test probes AMT 003
A pair of measurement leads each with a dual probe - concentric - (diameter of body 6 mm)
- Hard carrying case.

The ACL 310 is a heavy duty hard case made of terflan. This case has a storage compartment for test leads.

ordering instructions

Micro-ohmmeter	OM 10

Accessories

Kelvin lead set	AN 5806
Kelvin test probes	AMT 003
Hard carrying case	ACL 310

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MICROHMMETER

OM 16:
On-site microhmmeter

OM16 milliohmmeter / microhmmeter is firstly a designed for outdoor uses instrument but also in workshop , and maintenance departments.
Easy to use, it performs measurements on inductive and non-inductive resistances with a DC current.
Its large interactive display informs in real time the operator about the type of measurement, range, calculation conditions (resistance calculated according to a reference temperature), thresholds status and values.

Designed for hard conditions:.
- Hard case (Pélicase® type).
- Plastic washable keyboard.
- Key-locked measurement plugs.

Why choosing an OM 16

- 4 wires measurement to provide highest accuracy
- Automatic measurement in non inductive resistance mode. :automatic triggering when continuity is established between the two points :a single operator can perform measurements.
- EMF parasites are measured before each measurement
- Permanent measurement current for inductive loads (coils, transformers, motors windings).
- DC measurement current for non-inductive resistances (earth bonding, coating, contact resistances) with auto power off of the current.
- Display of temperature compensated resistance value:

Resistance is automatically calculated by the instrument taking into account**: *measurement value, ambient temperature, metal temperature coefficient, reference temperature***
All parameters are programmable. (Ambient temperature can be programmed or measured thanks to the temperature sensor)

- 2 programmable thresholds with LED indication and display on the screen, light or loud beeper.
- Memory: 1 000 measurements identified by numbers.
  Memory reading on the display, or via software or printer.
- Powered by NiMh batteries, quick charge

TECHNICAL CHARACTERISTICS

Range	Resolution	Accuracy (1 year) 23°C ± 5°C	Measuring current	Voltage drop
5 mΩ	0,1 µΩ	0,05% + 0,5 µΩ	10 A	50 mV
25 mΩ	1 µΩ	0,05 % + 3 µΩ	10 A	250 mV
250 mΩ	10 µΩ	0,05 % + 30 µΩ	10 A	2,5 V
2500 mΩ	0,1 mΩ	0,05% + 0,3 mΩ	1A	2,5 V
25 Ω	1 mΩ	0,05 % + 3 mΩ	100 mA	2,5 V
250 Ω	10 mΩ	0,05% + 30 mΩ	10 mA	2,5 V
2 500 Ω	100 mΩ	0,05% + 300 mΩ	1 mA	2,5 V

Accuracy given in % of reading + fixed value at 23°C ± 5°C

OM 16: ON-SITE MICROHMMETER

Temperature compensation
Manually keyed or measured by Pt100.
Resolution: 0,1°C, accuracy ± 0,5°C.
Sensor connected on the keyboard or through a cable.

Climatic environment according to CEI359
- Reference domain: 23 ± 5°C (RH :45 to 75% w/o condensing).
- Temperature Coefficient from 0 to 18°C and from 28 to 50°C: <10% of accuracy/°C.
- Functioning reference domain: 0 to 50°C (RH: 20 to 75% w/o condensing).
- Limit functioning domain: - 10°C to + 55°C (RH: 10 to 80% w/o condensing).
- Storage temperature limits: - 40°C to + 60°C.

Environment
- Dimensions: 270 x 250 x 180 mm.
- Weight: 4Kg.
- Chocks and vibrations: EN61010-1.
- IP53 according to EN60529.

Battery system
- Batteries: NI/MH 8,5 AH.
- Charging time: 5H.
- Power supply: from 92 to 256 V (45 to 400 Hz).
- 5000 measurements at 10A

Safety
- According to EN 61010-1. Category II, pollution 2.
- 60 V

EMC
Radiant Emission:
EN 55022, class B; EN 61000-3-2; EN 61000-3-3
Immunity:
- EN 61000-4-2
- EN 61000-4-3
- EN 61000-4-5
- EN 61000-4-6
- EN 61000-4-11
- EN 61000-4-4

Measurement plugs
2 circular locking connectors.
Protection up to 250V.
Fuse protection.

RS232 Interface for printer, computer, trigger

- **ACCESSORIES**

- Large Kelvin clip: **AMT 006**
  Opening: 30 mm; cable of 5 m.

- Small Kelvin clip : **AMT012**
  Opening: 12 mm; cable of 5 m.

- Compact test probe: **AMT011**
  Length: 125 mm, cable of 5 m.
  Diameter of rod: 4 mm.

-Test probe: **AMT005**
  Length: 215 mm; cable of 5 m.
  Diameter of rod: 3 mm.

-Trigger test probe: **AMT013**
  Length: 215 mm; cable of 5 m.
  Diameter of rod: 3 mm.

Clamps and test probes are sold by unit

-Temperature sensor: **AMT014**
  Pt 100; Accuracy: ± 0,5°C.

-Cable for AMT 014: **AMT015**
  Length 2m.

-Exploitation software: **LOG OM**

- **PRINTERS**

PX 58: Battery model
Paper larger 58mm
CX 85: DC power model
Paper larger 85mm
(Serial cable supplied In standard with printers).

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Accréditation n° 2.1525 Température n° 2.1524 Electricité-magnétisme

programmable micro-ohmmeter OM 21

OM21 micro-ohmmeter is used for four-wire resistance measurement of very low values (with a resolution of 0.1 Ω) up to 20 kΩ, with an excellent accuracy.

It can be powered from mains or from rechargeable batteries.

The instrument is calibrated electronically, with no internal adjustment needed.

- **High resolution: 0.1 µΩ**
- **Programmable by RS232 or IEEE 488 link**
- **High accuracy: 0.03%**
- **Choice of current waveforms**
- **Storage and analysis of 1 000 measurements**

Applications

• Cable resistance and resistivity measurements
- High resolution (0.1 µΩ),
- Compensation for sample temperature and thermal emfs,
- Display in Ω/km.

• Metallisation and ground continuity measurements
- GAM-EG13 standards,
- Pulsed or alternate current (10 A),
- Automatic compensation for thermal emfs.

• Contact resistance measurements (connectors, switches, relays)
- Standard NFC 93050, DIN/IEC,
- Maximum measurement Voltage limited to 20 or 50 mV,
- Automatic compensation for thermal emfs.

• Inductive resistance measurement (motors, transformers, etc.)
- Total protection against overvoltages
- Direct current,
- Compensation for thermal emfs and for sample temperature,
- Automatic calculation of winding heating.

• Measurement of heat-sensitive devices (thermistors, temperature-sensitive components)
- Single-shot, pulsed current, very low power delivered.

general specifications

Display

26 000 counts, 16-segment illuminated LCD, 11.5 mm high, alphanumeric characters for messages, measurement indication includes value and unit of measurement.
Incorrect connections or measurements going beyond range are indicated by an error message.

Manual or automatic range change.

Manual or automatic measurement triggering, with measurement rate programmable from one measurement per second to one per hour.

Four-wire measurement.

Measurement current

• Amplitude selection (from 100 µA to 10 A,
• Waveform selection
  - continuous,
  - alternate pulses,
  - positive pulses,
• With each type of current, measurements can be single-shot or repetitive (pos-

sibility to select the repetition rate),
• Current may also be supplied from an external source.

Measurement time
< 1 second in continuous mode,
< 1.5 second in pulsed mode,
< 2 seconds in alternating pulsed mode.

Protection
• Electronic protection against break-off currents when measuring an inductive resistance,
• Possibility of limiting the voltage across the resistor terminals to 20 or 50 mV.

Environment
Nominal operating range: 0 to 50°C, 20 to 75% relative humidity.
Operating range limits: -10 to 55°C, 10 to 80% relative humidity.

Power supply
• 110/220 VAC ± 10%, 50/60 Hz,
• optional battery with built-in charger.

Presentation
Bench unit with optional rack mounting kit.
Dimensions: 225 x 88 x 300 mm.
Weight: 2 to 3 kg depending on options.

functions

The instrument measures very low value resistances in a four-wire terminal.
It has eight measurement ranges. For the same current, the range can be changed manually or automatically.
The user has a choice of three current values for each measurement range, except for the extreme ranges.

Temperature coefficient < 10% of the accuracy per degree Celsius.

Automatic compensation for thermal electromotive forces (emfs)

Range	Resolution	Measurement current	Voltage drop	Accuracy (1)
2 mΩ	0.1 µΩ	10 A	20 mV	0.05% + 0.3 µΩ
20 mΩ	1 µΩ	10 A	200 mV	0.05% + 2 µΩ
20 mΩ	1 µΩ	1 A	20 mV	0.05% + 3 µΩ
200 mΩ	10 µΩ	10 A	2 V	0.05% + 10 µΩ
200 mΩ	10 µΩ	1 A	200 mV	0.05% + 20 µΩ
200 mΩ	10 µΩ	100 mA	20 mV	0.03% + 30 µΩ
2 Ω	100 µΩ	1 A	2 V	0.05% + 100 µΩ
2 Ω	100 µΩ	100 mA	200 mV	0.03% + 200 µΩ
2 Ω	100 µΩ	10 mA	20 mV	0.03% + 300 µΩ
20 Ω	1 mΩ	100 mA	2 V	0.03% + 1 mΩ
20 Ω	1 mΩ	10 mA	200 mV	0.03% + 2 mΩ
20 Ω	1 mΩ	1 mA	20 mV	0.03% + 3 mΩ
200 Ω	10 mΩ	10 mA	2 V	0.03% + 10 mΩ
200 Ω	10 mΩ	1 mA	200 mV	0.03% + 20 mΩ
200 Ω	10 mΩ	100 µA	20 mV	0.03% + 30 mΩ
2 kΩ	100 mΩ	1 mA	2 V	0.03 % + 100 mΩ
	100 mΩ	100 µA	200 mV	0.03 % + 200 mΩ
20 kΩ	1 Ω	100 µA	2 V	0.03% + 1 Ω

(1) The accuracy is given as ± (% of the reading + counts).The count corresponds to the value of the last figure displayed, i.e. to the resolution on this range. The accuracy is given over 90 days at 23±1°C.

additional functions

Automatic temperature compensation of the element measured for temperatures between 0°C and 100°C
The instrument calculates the resistance value at 20°C.
Element temperature is:
- either programmed,
- or is measured by a platinum resistance probe (Pt100).
Metal type, or its temperature coefficient, is indicated on the OM.

Relative measurements
The instrument can display:
• either D = M-R,
• or D = (M-R)/R (i.e. direct read-out in %)
(D = reading display, M = value measured, R = stored reference value).

Memory
Up to 1 000 measurements can be stored, along with their mean, minimum or maximum, and can be read back on the read-out or through digital or analog interfaces.

Two programmable thresholds
With output on two relays (1 A/220 V AC).

Floating analog output
0 to 2.5 V (load ≥ 2.5 kΩ, 10 mV resolution).
An image can be constructed of all or part of the measured values: the origin and extent of the measurements can be programmed to get a "zoom" effect.
The measurement values stored in the memory can be extracted and output in the form of analog voltages.

Calculations
OM21 can calculate automatically the heat-up of a motor or transformer. Similarly it can calculate the resistance per km of single core or multi-core cables.

RS 232C and IEEE 488-2 interfaces
The standard RS 232C and optional IEEE 488-2 interfaces make it possible, by computer, to:
• program the instrument completely,
• analyse the measurements (curve plot, printout, etc.)
• calibrate the instrument.

software

The PC software allows programming of the OM21 or 22 from a compatible PC. It is menu-driven, with the operator completely guided by a question and answer system.
A second function of the software is to manipulate the stored readings; transfer into the PC memory or onto a disk in a file which can be used for spreadsheets; presentation of the readings in the form of tables or graphs.

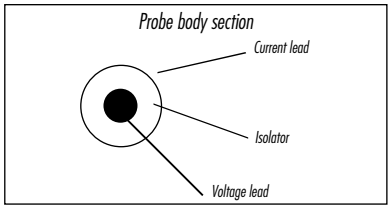
Labview driver
This driver, delivered, on request, free of charge with IEEE version, allows to connect OM with Labview, to command the microhmmeter (OM 21 or 22 with IEEE) from a PC and to process the data.

accessories

KELVIN lead set - AN 5806
A pair of measurement leads, each with a KELVIN clip, 1.20 m of wire and two 4 mm plugs. The KELVIN clip can be used for four-wire measurement because there is a perfect galvanic isolation between the current input and the voltage connector.
Gold-plated contacts.
Maximum opening: 1.2 cm.
Maximum current: 10 A.

Large Kelvin clip - AMT 004
One measurement lead with a large Kelvin clip.
Length of wire: 3 m.
Equipped of two 4 mm security banana plugs.
Maximum opening of clip: 3 cm.
Maximum current: 10 A.

Kelvin test probe - AMT 003
One measurement lead with a dual probe (concentric).
Length of rod: 85 mm.
Diameter of rod: 8 mm.
Length of wire: 3 m.
Equipped of two 4 mm security banana plugs.
Maximum current: 10 A.



Carrying case - AN 6901
A soft carrying case designed for storage and transport of all bench type instruments (OM 21, 22).
Dimensions: 31 x 26 x 14 mm.

Clamping device - 2381
With the help of the clamping device type 2381 and a microhmmeter, the ohmic resistances of test cables and samples of materials in the shape of cords or strips can be measured. Fields of application include production monitoring, quality assurance and general test measurements. The 2381 consists of a robust, warp-resistant, light-metal rail with one movable and one rig clamping device. It allows the measurement of samples 1000 mm long. The clamping device is designed to accommodate cable cross-sections of 0.1 mm^2 to approx. 100 mm^2. It is equipped with a wire guide 2388.
Dimensions: 170 x 2100 x 250 mm.
Weight: 25 kg.

Rack mounting kit - AN 5884
This kit allows rack mounting of bench instruments. It includes 2 brackets (AN 5883) and a 19" rack panel (3 U).

ordering instructions

RS 232 programmable micro-ohmmeter	
Basic instrument 10 A	OM 21-1
Basic instrument 10 A + battery and charger	OM 21-2
Basic instrument 10 A + IEEE 488-2	OM 21-3
Basic instrument 10 A + IEEE 488-2 + battery	OM 21-4

Accessories

Kelvin lead set	AN 5806
Large Kelvin clip	AMT004
Kelvin micro-probe	AMT003
Clamping device	2381
Wire guide	2388
Carrying case	AN 6901
Brackets for panel mounting	AN 5883
Rack mounting	AN 5884
RS 232 cable (9-25 pin, female) (1)	AN 5874
RS 232 cable (9-9 pin, female) (1)	AN 5875
RS 232 cable (9-25 pin, male) (1)	AN 5876
IEEE 488 cable	AN 5836
PC 9/25 pin converter	AN 5894
Labview driver	OM2-LABV-DRIV
For OM21-1 and 21-3: power supply 3 V/10 A	AMT002

(1) The RS 232 connector is a 9 pin female

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industrial micro-ohmmeters
OM 22

The OM22 micro-ohmmeter is used for four-wire resistance measurement of very low values (with a resolution of 0.1 Ω) up to 20 kΩ, with an excellent accuracy

OM22 is pre-configured for each user, making its principal characteristic simplicity of operation. The user has only to select one of 6 programmes (using AOIP's factory pre-sets or those set up by the user according to his own specification) to find the desired configuration.

It can be powered from mains or from rechargeable batteries.

The instrument is calibrated electronically, with no internal adjustment needed.

- **Preconfigured**
- **One-button operation**
- **High resolution 0.1 µΩ**
- **Highly accurate 0.03%, 26 000 counts**
- **1000 measurement memory**
- **RS232 / IEEE-488 programmable**

Applications

OM22 is particularly suited to routine repetitive measurements, specifically in production testing. Some of its applications are listed below:

• Cable resistance and resistivity measurements
- High resolution,
- Compensation for sample temperature and thermal emfs,
- Display in Ω/km.

• Metallisation and ground continuity measurements
- GAM-EG13 standards,
- Pulsed or alternate current (10 A),
- Automatic compensation for thermal emfs.

• Contact resistance measurements (connectors, switches, relays)
- Standard NFC 93050, DIN/IEC,
- Maximum measurement voltage limited to 20 or 50 mV,
- Automatic compensation for thermal emfs.

• Inductive resistance measurement (motors, transformers, etc.)
- Total protection against over-voltages
- Direct current,
- Compensation for thermal emfs and for sample temperature,
- Automatic calculation of winding heating.

• Measurement of heat-sensitive devices (thermistors, temperature-sensitive components)
- Single-shot, pulsed current, very low power delivered.

general specifications

Programmes

OM22 is delivered with 6 pre-set programmes directly accessible by 6 push-buttons. These programmes are established according to user needs and are loaded into the instrument from a PC via RS232.
Each programme defines the range, current (type and value), number of measurements per cycle and timing, storage (or not) of values, temperature compensation if needed, calculations of heat-up in degrees, or calculation of line resistance in Ω/km, alarm values, maximum measurement voltage, analogue output.

The OM22 can be delivered programmed by AOIP to the user's specification. These programmes can also be loaded or modified by the user with a PC, and this task is facilitated by the programming software developed by AOIP.

Display
26 000 counts, 16-segment illuminated LCD, 11.5 mm high, alphanumeric characters for messages, measurement indication includes value and unit of measurement.
Incorrect connections or measurements going beyond range are indicated by an error message.

Four-wire measurement

Measurement time
< 1 second in continuous mode,
< 2 seconds in pulsed mode,
< 3 seconds in alternating pulsed mode.

Protection
• Electronic protection against break-off currents when measuring an inductive resistance,
• Possibility of limiting the voltage across the resistor terminals to 20 or 50 mV.

Environment
Nominal operating range: 0 to 50°C, 20 to 75% relative humidity.
Operating range limits: -10 to 55°C, 10 to 80% relative humidity.

Power supply
• 110/220 VAC ± 10%, 50/60 Hz,
• optional battery with built-in charger.

Presentation
Bench unit with optional rack mounting kit.
Dimensions: 225 x 88 x 310 mm.
Weight: 2 to 3 kg depending on options.

functions

All the functions and characteristics to be measured are set up by programme. For each application, the most appropriate parameters of measurement can be defined and then programmed, so that they are available for subsequent instant recall.

Range	Resolution	Measurement current	Voltage drops	Accuracy (1)
2 mΩ	0.1 µΩ	10 A	20 mV	0.05% + 0.3 µΩ
20 mΩ	1 µΩ	10 A	200 mV	0.05% + 2 µΩ
20 mΩ	1 µΩ	1 A	20 mV	0.05% + 3 µΩ
200 mΩ	10 µΩ	10 A	2 V	0.05% + 10 µΩ
200 mΩ	10 µΩ	1 A	200 mV	0.05% + 20 µΩ
200 mΩ	10 µΩ	100 mA	20 mV	0.03% + 30 µΩ
2 Ω	100 µΩ	1 A	2 V	0.05% + 100 µΩ
2 Ω	100 µΩ	100 mA	200 mV	0.03% + 200 µΩ
2 Ω	100 µΩ	10 mA	20 mV	0.03% + 300 µΩ
20 Ω	1 mΩ	100 mA	2 V	0.03% + 1 mΩ
20 Ω	1 mΩ	10 mA	200 mV	0.03% + 2 mΩ
20 Ω	1 mΩ	1 mA	20 mV	0.03% + 3 mΩ
200 Ω	10 mΩ	10 mA	2 V	0.03% + 10 mΩ
200 Ω	10 mΩ	1 mA	200 mV	0.03% + 20 mΩ
200 Ω	10 mΩ	100 µA	20 mV	0.03% + 30 mΩ
2 kΩ	100 mΩ	1 mA	2 V	0.03% + 100 mΩ
	100 mΩ	100 µA	200 mV	0.03% + 200 mΩ
20 kΩ	1 Ω	100 µA	2 V	0.03% + 1 Ω

(1) The accuracy is given as ±(% of the reading + counts) over 90 days at 23 ± 1°C.

Temperature coefficient
< 10% of the accuracy per degree Celsius.

Range
The instrument measures very low value resistances using a four-wire terminal method.
It has eight measurement ranges. For the same current, the range can be changed manually or automatically.
The user has a choice of three current values for each measurement range (except for extreme ranges).

Measurement current
• Amplitude selection (from 100 µA to 10 A,
• Waveform selection
- continuous,
- alternate pulses,
- positive pulses,
• With each type of current, measurements can be single-shot or repetitive (possibility to select the repetition rate),
• Current may also be supplied from an external source.

Manual or automatic range change
Manual or automatic measurement triggering, with measurement rate programmable from one measurement per second to one per hour.

Automatic compensation for thermal electromotive forces (emfs).

Automatic temperature compensation
Automatic temperature compensation of the element measured for temperatures between 0°C and 100°C. The instrument calculates the resistance value at 20°C.
Element temperature is:
• either programmed,
• or is measured by a platinum resistance probe (Pt100).
Metal type, or its temperature coefficient, is indicated on the OM22.

Relative measurements
The instrument can display:
• either L = M-R,
• or L = (M-R)/R (i.e. direct readout in %)
(L = reading display, M = value measured, R = stored reference value).

Memory
Up to 1 000 measurements can be stored, along with their mean, minimum or maximum, and can be read back on the read-

out or through digital or analog interfaces. Two programmable thresholds with output on two relays (1 A/220 VAC).

Floating analog output of 0 to 2.5 V (load ≥ 2.5 kΩ, 10 mV resolution).
The origin and extent of the measurements can be programmed to get a "zoom" effect.

The measurement values stored in the memory can be extracted and output in the form of analogue voltages.

Calculations
OM22 can calculate automatically the heat-up of a motor or transformer. Similarly it can calculate the resistance per km of single core or multi-core cables.

RS 232 C and IEEE 488-2 interfaces
The standard RS 232C and optional IEEE 488-2 interfaces make it possible, by computer, to:
- program the instrument completely,
- analyze the measurements (curve plot, printout, etc.)
- calibrate the instrument.

software

The PC software allows programming of the OM21 or 22 from a compatible PC. It is menu-driven, with the operator completely guided by a question and answer system.
A second function of the software is to manipulate the stored readings; transfer into the PC's memory or onto a disk in a file which can be used for spreadsheets; presentation of the readings in the form of tables or graphs.

Labview driver
This driver, delivered, on request, free of charge with IEEE version, allows to connect OM with Labview, to command the microhmmeters (OM 21 or 22 with IEEE) from a PC and to process the data.

accessories

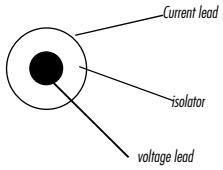
Kelvin lead set - AN 5806
A pair of measurement leads, each with a KELVIN clip, 1.20 m of wire and two plugs. The KELVIN clip can be used for four-wire measurement because there is a perfect galvanic isolation between the current input and the voltage connector.
Gold-plated contacts.
Maximum opening: 1.2 cm.
Maximum current: 10 A.

Carrying case - AN 6901
A soft carrying case designed for storage and transport of all bench type instruments.
Dimensions: 31 x 26 x 14 mm.

Large Kelvin clip - AMT 004
One measurement lead with a large Kelvin clip.
Length of wire: 3 m.
Equipped of two 4 mm security banana plugs.
Maximum opening of clip: 3 cm.
Maximum current: 10 A.

Kelvin test probe - AMT 003
One measurement lead with a dual probe (concentric).
Length of rod: 85 mm.
Diameter of rod: 8 mm.
Length of wire: 3 m.
Equipped of two 4 mm security banana plugs.
Maximum current: 10 A.

Probe body section



Rack mounting kit AN 5884
This kit allows rack mounting. It includes 2 brackets (AN5883) and a 19" rack panel (3U).

ordering instructions

RS 232 programmable micro-ohmmeter

Basic instrument 10 A	OM 22-1
Basic instrument 10 A + battery and charger	OM 22-2
Basic instrument 10 A + IEEE 488-2	OM 22-3
Basic instrument 10 A + IEEE 488-2 + battery	OM 22-4

Accessories

Kelvin lead set	AN 5806
Large Kelvin clip	AMT004
Kelvin micro probe	AMT003
Carrying case	AN 6901
Brackets for panel mounting	AN 5883
Accessory for rack mounting	AN 5884
RS 232 connector cable (9-25 pin, female) (1)	AN 5874
RS 232 connector cable(9-9 pin, female) (1)	AN 5875
RS 232 connector cable (9-25 pin male) (1)	AN 5876
PC 9/25 pin converter	AN 5894
IEEE 488 connector cable	AN 5836
Labview driver	OM2-LABV-DRIV
Clamping device	2381
For OM22-1 and 22-3: 3 V/10 A power supply	AMT002

(1) The RS232 connector for the OM 22 is a 9 pin female.

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Specifications subject to modification without prior notice

high precision thermometer
PHP 601

- **Resolution 0.001°C**
- **Accuracy 0.005°C**
- **Self-contained**
- **RTDs and thermocouples**
- **Dual inputs**
- **RS 232 or IEEE 488 interfaces**

Main applications include:
- Temperature measurements using RTDs and/or thermocouples
- Absolute or differential measurements over two channels.
- Differential thermal analysis.
- Checking the temperature stability of furnaces or baths.
- Monitoring (alarm) and temperature recording.

functions

The PHP 601 is a high accuracy, dual input thermometer suitable for use with RTDs (e.g.: Pt 100) and thermocouples. The PHP 601 is capable of storing sensor characteristics and coefficients and can scan up to 12 sensors using the model SHP 101 Scanner.
Its main applications include the calibration of temperature sensors. By using our CAL'EXPERT software to drive the PHP 601 thermometer, scanner and a thermal device such as temperature bath, dry block calibrator or oven, a complete calibration procedure can be performed, reports generated and certificates printed for individual sensors.

Resistance measurement (1)

		Accuracy (2)	
All ranges	Stability 24 hours	90 days	1 year
25 to 3 200 Ω	0.0005%Cal	0.0015% + 0.0005%	0.0030% + 0.0005%

(1) 4 wire configuration, all currents. For the 3 wire configuration, add 1mΩ.
(2) Accuracy is expressed in ± (% reading + % range) at 23°C ± 1°C.

DC voltage measurement

				Accuracy (1)	
Range	Measurement range	Resolution	Stability 24 hours	90 days	1 year
100 mV	- 50 to + 117.5 mV	0.2 µV	0.001% + 0.4 µV	0.004% + 0.6 µV	0.008% + 0.8 µV

(1) Accuracy is expressed in ± (% reading + nV) at 23°C ± 1°C.

Temperature coefficient ≤ 10% of accuracy/°C over 90 days.

Temperature measurement

Direct reading in mV or °C, °F or K.
- From 1 to 4 calibration points may be entered for all types of sensors.
- Digital filter.
- Programming using either the RS 232 link (standard) or the IEEE 488 link (option).
- Direct control of the SHP 101 scanner.
- Storage of up to 5000 measurements together with date.
- Measurements triggered by internal or external event.
- 2 alarm outputs relays.

RTD measurement

Measurement of all types of sensors as described below:
- Standardized sensors according to IEC Publication 751/1995,
α = 3851, Pt 100, 200, 500 and 1000.
JISC 1604/1989, α = 3912, JPt 100.
EIT 90, α = 3926, Pt 100.
DIN 43760, α = 618, Ni 100.
MIL-T 24388C, α = 672, Ni 120.
MINCO 16/9, α = 427, Cu 10.

- Callendar and Van Dusen equations defined by coefficients (Ro, A, B, C) or by 4 couples of points (resistance/temperature).

- EIT 90 equations defined by R at 0.01°C and the deviation function coefficients or by resistance values at fixed points.

- Polynomial equations defined per point (25 points max.).

For sensors not complying to the International Temperature Scale (ITS 90) correction of the deviation ITS 90-IPTS 68, 1993 is applied.

Choice of 6 measuring currents (0.125 up to 4 mA), 3 current waves (direct, pulse and alternate) together with $I/\sqrt{2}$ function to define self-heating measurement.
3 or 4 wire configuration.

Standard sensors	Measurement range	Range	Resolution	Stability 24 hours	Accuracy 90 days (1)	Accuracy 1 year (1)
Pt 100 Ω at 0°C α = 3851	- 210 to + 45°C	100 Ω	0.001°C	0.002°C	0.002% + 0.005°C	0.004% + 0.009°C
	- 210 to + 365°C	200 Ω	0.002°C	0.004°C	0.002% + 0.006°C	0.004% + 0.010°C
	- 210 to + 1 100°C	400 Ω	0.005°C	0.010°C	0.002% + 0.010°C	0.004% + 0.015°C
JPt 100 Ω at 0°C α = 3916	- 200 to + 44°C	100 Ω	0.001°C	0.002°C	0.002% + 0.005°C	0.004% + 0.009°C
	- 200 to + 358°C	200 Ω	0.002°C	0.004°C	0.002% + 0.006°C	0.004% + 0.010°C
	- 200 to + 510°C	400 Ω	0.005°C	0.010°C	0.002% + 0.010°C	0.004% + 0.015°C
Pt 100 Ω at 0°C α = 3926	- 210 to + 45°C	100 Ω	0.001°C	0.002°C	0.002% + 0.005°C	0.004% + 0.009°C
	- 210 to + 365°C	200 Ω	0.002°C	0.004°C	0.002% + 0.006°C	0.004% + 0.010°C
	- 210 to + 1 100°C	400 Ω	0.005°C	0.010°C	0.002% + 0.010°C	0.004% + 0.015°C
Pt 200 Ω at 0°C α = 3851	- 210 to + 45°C	200 Ω	0.001°C	0.002°C	0.002% + 0.005°C	0.004% + 0.009°C
	- 210 to + 365°C	400 Ω	0.002°C	0.004°C	0.002% + 0.006°C	0.004% + 0.010°C
	- 210 to + 1 100°C	800 Ω	0.005°C	0.010°C	0.002% + 0.010°C	0.004% + 0.015°C
Pt 500 Ω at 0°C α = 3851	- 210 to + 233°C	800 Ω	0.001°C	0.002°C	0.002% + 0.005°C	0.004% + 0.008°C
	- 210 to + 800°C	1 600 Ω	0.002°C	0.004°C	0.002% + 0.006°C	0.004% + 0.010°C
	- 210 to + 1 200°C	3 200 Ω	0.005°C	0.010°C	0.002% + 0.010°C	0.004% + 0.015°C
Pt 1000 Ω at 0°C α = 3851	- 210 to + 230°C	1 600 Ω	0.001°C	0.002°C	0.002% + 0.005°C	0.004% + 0.008°C
	- 210 to + 800°C	3 200 Ω	0.002°C	0.004°C	0.002% + 0.006°C	0.004% + 0.010°C
Ni 100 Ω at 0°C α = 618	- 60 to + 30°C	100 Ω	0.001°C	0.002°C	0.004°C	0.007°C
	- 60 to + 180°C	200 Ω	0.001°C	0.002°C	0.005°C	0.009°C
Ni 120 Ω at 0°C α = 672	- 40 to + 136°C	200 Ω	0.001°C	0.002°C	0.005°C	0.008°C
	- 40 to + 205°C	400 Ω	0.002°C	0.004°C	0.006°C	0.010°C
Cu 10 Ω at 25°C α = 427	- 200 to + 260°C	25 Ω	0.002°C	0.004°C	0.002% + 0.007°C	0.004% + 0.010°C

(1) Accuracy is given in ± (% reading + n°C) or ± (n°C) at 23°C ± 1°C.

Temperature measurement with thermocouples

Types of sensors:
- Standardized according to IEC Publication 580-1/1995 (thermocouples K, T, J, E, R, S, B and N).
Thermocouples U and L according to DIN 43710.
Thermocouple C according to Hoskins curve.
Thermocouple Platinel (Pl) according to Engelhard curve.
- Special thermocouple Molybdenum/Nickel Molybdenum (Mo).
- Polynomial equations defined per point (25 points max.).

True differential measurements.
Programmable internal or external reference junction compensation.
For sensors not complying to the International Temperature Scale (ITS 90) correction of the deviation ITS 90-IPTS 68, 1993 is applied.

Thermocouple	Measurement range	Resolution	Stability 24 hours	Accuracy (1) 90 days	Accuracy (1) 1 year
K	- 250 to - 220°C - 220 to - 100°C - 100 to + 1 350°C	0,05°C 0,02°C 0,01°C	0,2°C 0,03°C 0,0015 % + 0,01°C	0,25°C 0,06°C 0,005 % + 0,015°C	0,5°C 0,1°C 0,01 % + 0,02°C
T	- 250 to - 220°C - 220 to - 90°C - 90 to + 400°C	0,05°C 0,02°C 0,01°C	0,1°C 0,03°C 0,015°C	0,15°C 0,06°C 0,025°C	0,3°C 0,1°C 0,04°C
J	- 210 to - 100°C - 100 to + 1 200°C	0,02°C 0,01°C	0,03°C 0,001 %+ 0,01°C	0,05°C 0,004 % + 0,015°C	0,1°C 0,04°C
E	- 250 to - 180°C - 180 to - 100°C - 100 to + 980°C	0,05°C 0,02°C 0,01°C	0,1°C 0,02°C 0,001 %+ 0,01°C	0,15°C 0,04°C 0,004 % + 0,01°C	0,3°C 0,06°C 0,008 % + 0,02°C
N	- 250 to - 175°C - 175 to - 100°C - 100 to + 1 300°C	0,05°C 0,02°C 0,01°C	0,2°C 0,04°C 0,02°C	0,25°C 0,06°C 0,004 % + 0,025°C	0,5°C 0,1°C 0,008 % + 0,03°C
S	- 50 to + 400°C + 400 to + 1 768°C	0,05°C 0,02°C	0,1°C 0,05°C	0,15°C 0,004 % + 0,06°C	0,2°C 0,01 % + 0,1°C
R	- 50 to + 400°C + 400 to + 1 768°C	0,05°C 0,02°C	0,1°C 0,05°C	0,15°C 0,004 % + 0,06°C	0,2°C 0,008 % + 0,08°C
B	+ 100 to + 400°C + 400 to + 1 820°C	0,2°C 0,05°C	0,4°C 0,1°C	0,6°C 0,15°C	1,0°C 0,2°C
U	- 200 to - 70°C - 70 to + 600°C	0,02°C 0,01°C	0,03°C 0,01°C	0,05°C 0,004 % + 0,015°C	0,08°C 0,008 % + 0,02°C
L	- 200 to - 70°C - 70 to + 900°C	0,02°C 0,01°C	0,02°C 0,01°C	0,04°C 0,004 % + 0,015°C	0,08°C 0,008 % + 0,02°C
C	- 20 to + 2 310°C	0,02°C	0,02 % + 0,03°C	0,008 % + 0,05°C	0,015 % + 0,07°C
Pl	- 100 to + 1 400°C	0,02°C	0,0015 % + 0,01°C	0,005 % + 0,02°C	0,01 % + 0,03°C
Mo	0 to + 1 375°C	0,05°C	0,05°C	0,05°C	0,10°C

(1) Accuracy is given for a reference junction at 0°C in ± (% reading + number of units) or in ± (number of units) at 23°C ± 1°C.
The uncertainty due to the internal reference junction is ± 0.15°C.
Temperature coefficient of the internal reference junction: ± 0.015°C/°C.

general specifications

Three languages available for the menus and on-line help (English, French and German).

LCD graphic display with backlighting.

Connection using 4-mm plugs and LEMO sockets.

Mains supply and optional battery pack.

Presentation
ABS bench-type unit with tilt bail/handle.
Dimensions: 225 x 88 x 310 mm.
Weight: 2 to 3 kg depending on options.

scanner SHP 101

(See separate leaflet).

This is a bench-type scanner dedicated to low level signals and intended to switch 12 (2 wire) inputs (thermocouples) or 6 (4 wire) inputs (RTDs) with the possibility to mix both types of inputs.
Switching the channels may be performed either automatically by the PHP, or manually through the keypad on the front panel.

Outstanding repeatability between channels: $\Delta t \leq 0.02°C$.
Easy sensor connection by use of screw terminal blocks.

calibration software LCL30

(See separate leaflet)

This software enables the user to define automatic calibration procedures.
It provides control of generated or simulated temperatures and will measure the difference between the standard thermometer and the sensor being calibrated

This software allows:
• to program the calibration procedure.
• to select a standard sensor from a list which will be used as reference; this list is updated by the user.
• to control the thermal reference source.
• to collect the measurements.
• to print and save calibration reports for all the sensors.
It also enables the user to document and recall the history of calibrated sensors.

accessories

• Standard sensor AN 5847 and "working" standard sensor AN 5848 are offered with various connections: plug, DIN socket or LEMO socket.
• LEMO-DIN adapter for connection to the probe equipped with DIN socket (PEM 40316).
• T 1200 sensor, standard thermocouple connectable by using plugs.
• Cable, 2-meter length (ACL 4603) with LEMO socket at one end and RTD free sensor connection at the other end.

ordering instructions

High accuracy thermometer	PHP 601-1
High accuracy thermometer with battery pack and charger	PHP 601-2
High accuracy thermometer with IEEE 488.2 interface	PHP 601-3
High accuracy thermometer with battery pack, charger and IEEE 488.2 interface	PHP 601-4

Accessories

Carrying case	AN 6901
Right-angle brackets for panel mounting	AN 5883
Rack mounting kit	AN 5884
RS 232 cable, 9-pin male/9-pin female	AN 5875
IEEE 488 cable, 2-meter	AN 5836
LEMO socket to be wired	ER 48379
Cable, 2-meter, LEMO/free	ACL 4603
Pt 100 standard sensor with plugs	AN 5847B
LEMO Pt 100 standard sensor	AN 5847C
Pt 100 reference sensor with plugs	AN 5848-20000A
LEMO Pt 100 reference sensor	AN 5848-30000A
LEMO Pt 100 reference sensor	AN 5848-30001A
Standard thermocouple	T 1200
LEMO-DIN adapter	PEM 40316
Automatic calibration software	LCL 30

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high precision thermometer
PHP 602

Main applications include:
- Temperature measurements using RTDs
- Absolute or differential measurements over two channels.
- Calibration of temperature sensors.
- Differential thermal analysis.
- Checking the temperature stability of furnaces or baths.
- Monitoring (alarm) and temperature recording.

- **Resolution 0.0001°C**
- **Accuracy 0.009°C**
- **RTDs**
- **Dual inputs**
- **RS 232 and IEEE 488 interfaces**

functions

The PHP 602 is a high accuracy, dual input thermometer suitable for use with RTDs.
If a large number of probes already exists in the data base, the user can at anytime, create new linearisation tables and the metrological parameters (correction versus standards, serial numbers, names, calibration dates ...) are stored in the memory.

Thanks to these functionalities, PHP 602 is perfectly designed for accurate probes calibration using comparison method and studies of temperature phenomena.

Resistance measurement (1)

All ranges	Stability 24 hours	Accuracy 90 days (2)	Accuracy 1 year (2)
25 to 3 200 Ω	0.0005%Cal	0.0030% + 0.0005%	0.0045% + 0.0005%

(1) 4 wire configuration, all currents. For the 3 wire configuration, add 1mΩ.
(2) Accuracy is expressed in ± (% reading + % range) at 23°C ± 1°C.

Temperature measurement
Direct reading in °C, °F or K.
- From 1 to 4 calibration points may be entered for all types of sensors.
- Digital filter.
- Programming using either the RS 232 link (standard) or the IEEE 488 link (option).
- Storage of up to 5000 measurements together with date.
- Measurements triggered by internal or external event.
- 2 alarm outputs relays.
- Choice of 6 measurement current from 0.125 to 4 mA.

Three current waves: direct, pulse and alternate, together with I/V2 function to define self-heating measurement.

3 or 4 wire configuration.

Measurement of all types of sensors as described below:
- Standardized sensors according to IEC Publication 751/1995,
α = 3851, Pt 100, 200, 500 and 1000.
JISC 1604/1989, α = 3916, JPt 100.
EIT 90, α = 3926, Pt 100.
DIN 43760, α = 618, Ni 100.
MIL-T 24388C, α = 672, Ni 120.
MINCO 16/9, α = 427, Cu 10.

- Callendar and Van Dusen equations defined by coefficients (Ro, A, B, C) or by 4 couples of points (resistance/temperature).

- EIT 90 equations defined by R at 0.01°C and the deviation function coefficients or by resistance values at fixed points.

- Polynomial equations defined per point (25 points max.).

Standard sensors	Measurement range	Range	Resolution	Stability 24 hours	Accuracy 90 days (1)	Accuracy 1 year (1)
Pt 100 Ω at 0°C α = 3851	- 210 to + 45°C - 210 to + 365°C - 210 to + 1 100°C	100 Ω 200 Ω 400 Ω	0.0001°C 0.0002°C 0.0005°C	0.002°C 0.004°C 0.010°C	0.003% + 0.009°C 0.003% + 0.010°C 0.003% + 0.012°C	0.004% + 0.013°C 0.004% + 0.014°C 0.004% + 0.016°C
JPt 100 Ω at 0°C α = 3916	- 200 to + 44°C - 200 to + 358°C - 200 to + 510°C	100 Ω 200 Ω 400 Ω	0.0001°C 0.0002°C 0.0005°C	0.002°C 0.004°C 0.010°C	0.003% + 0.009°C 0.003% + 0.010°C 0.003% + 0.012°C	0.004% + 0.013°C 0.004% + 0.014°C 0.004% + 0.016°C
Pt 100 Ω at 0°C α = 3926	- 210 to + 45°C - 210 to + 357°C - 210 to + 850°C	100 Ω 200 Ω 400 Ω	0.0001°C 0.0002°C 0.0005°C	0.002°C 0.004°C 0.010°C	0.003% + 0.009°C 0.003% + 0.010°C 0.003% + 0.012°C	0.004% + 0.013°C 0.004% + 0.014°C 0.004% + 0.016°C
Pt 200 Ω at 0°C α = 3851	- 210 to + 45°C - 210 to + 365°C - 210 to + 1 100°C	200 Ω 400 Ω 800 Ω	0.0001°C 0.0002°C 0.0005°C	0.002°C 0.004°C 0.010°C	0.003% + 0.009°C 0.003% + 0.010°C 0.003% + 0.012°C	0.004% + 0.013°C 0.004% + 0.014°C 0.004% + 0.016°C
Pt 500 Ω at 0°C α = 3851	- 210 to + 233°C - 210 to + 800°C - 210 to + 1 200°C	800 Ω 1 600 Ω 3 200 Ω	0.0001°C 0.0005°C 0.001°C	0.002°C 0.004°C 0.010°C	0.003% + 0.009°C 0.003% + 0.010°C 0.003% + 0.012°C	0.004% + 0.013°C 0.004% + 0.014°C 0.004% + 0.016°C
Pt 1000 Ω at 0°C α = 3851	- 210 to + 230°C - 210 to + 800°C	1 600 Ω 3 200 Ω	0.0002°C 0.0005°C	0.002°C 0.004°C	0.003% + 0.009°C 0.003% + 0.010°C	0.004% + 0.013°C 0.004% + 0.014°C
Ni 100 Ω at 0°C α = 618	- 60 to + 30°C - 60 to + 180°C	100 Ω 200 Ω	0.0001°C 0.0001°C	0.002°C 0.002°C	0.007°C 0.009°C	0.010°C 0.014°C
Ni 120 Ω at 0°C α = 672	- 40 to + 136°C - 40 to + 205°C	200 Ω 400 Ω	0.0001°C 0.0002°C	0.002°C 0.004°C	0.008°C 0.010°C	0.008°C 0.010°C
Cu 10 Ω at 25°C α = 427	- 200 to + 260°C	25 Ω	0.0002°C	0.004°C	0.003% + 0.010°C	0.0045% + 0.013°C

(1) Accuracy is given in ± (% reading + n°C) or ± (n°C) at 23°C ± 1°C.

general specifications

LCD graphic display with backlighting. Three languages available for the menus and on-line help (English, French and German).

Connection using 4-mm plugs and LEMO sockets.

Mains supply and optional battery pack.

Presentation
ABS bench-type unit with tilt bail/handle.
Dimensions: 225 x 88 x 310 mm.
Weight: 2 to 3 kg depending on options.

calibration software and accessories

The LCL30 software (see separate leaflet) enables the user to define automatic calibration procedures.
It provides control of generated or simulated temperatures and will measure the difference between the standard thermometer and the sensor being calibrated

This software allows:
- to print and save calibration reports for all the sensors.
- the user to document and recall the history of calibrated sensors with a PC.

• Standard sensor AN 5847 and "working" standard sensor AN 5848 are offered with various connections: plug, DIN socket or LEMO socket.
• LEMO-DIN adapter for connection to the probe equipped with DIN socket (PEM 40316).
• T 1200 sensor, standard thermocouple connectable by using plugs.
• Cable, 2-meter length (ACL 4603) with LEMO socket at one end and RTD free sensor connection at the other end.

ordering instructions

High accuracy thermometer	PHP 602-1
High accuracy thermometer + battery pack + charger	PHP 602-2
High accuracy thermometer with IEEE 488.2 interface	PHP 602-3
High accuracy thermometer with battery pack, charger and IEEE 488.2 interface	PHP 602-4

Accessories

Carrying case	AN 6901
Right-angle brackets for panel mounting	AN 5883
Rack mounting kit	AN 5884
RS 232 cable, 9-pin male/9-pin female	AN 5875
IEEE 488 cable, 2-meter	AN 5836
LEMO socket to be wired	ER 48379
Cable, 2-meter, LEMO/free	ACL 4603
Pt 25 reference sensor	AN 5681
Pt 100 standard sensor with plugs	AN 5847-2000
LEMO Pt 100 standard sensor	AN 5847-3000
Pt 100 reference sensor with plugs	AN 5848-2000
LEMO Pt 100 reference sensor	AN 5848-3000
LEMO Pt 100 reference sensor	AN 5848-3001
LEMO-DIN adapter	PEM 40316
Automatic calibration software	LCL 30

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Specifications are subject to modification without prior notice

high accuracy tester-calibrator
PJ 6301

PJ6301 is a high-accuracy instrument: ± 0.005% with 600,000 measuring counts on voltage and current ranges; 0.05°C for thermocouple and 0.005°C for RTD measurement resolution.

- **Simultaneous input and output**
- **RS232 / IEEE488 programmable**
- **Menu-driven design for easy use**

Description

The model PJ 6301 tester-calibrator is a high accuracy instrument for measuring and simulating process signals. Its new design incorporates outstanding performance with either easy manual set up or by computer operation for automatic test application.

Comprehensive, PJ 6301 measures and generates or simulates process signals such as DC voltages and currents, resistance, temperature signals from thermocouple or RTD sensors. Separated circuits allow simultaneous and independent measurement and sourcing.
Its graphical display is divided in two areas for simultaneous indication of measured and emitted values. Numerous other functions such as data processing, customised signal linearisation, recorder analogue output, transmitter function, ramp and step function, relative measurements... open a wide and incomparable application range.

User friendly, PJ 6301 is offered in a compact housing for on site as well as bench-top or panel mounted use. The graphical display concept leads to keyboard simplification. On-line help messages are available at any time when additional information on displayed options is required.

Fully programmable via its RS232 and IEEE488 interfaces, the PJ6301, with the rack mounting accessory, is ideal in test bench and automatic test equipment applications. In addition, the battery and memory storage capacity make the PJ 6301 very portable and most suitable for on-site use.

Applications

Due to its outstanding performance and quality the PJ6301 can achieve many and exacting requirements. Applications can be separated into three groups:
• Accurate measurement for calibration of signal generators such as sensors, voltage and current sources, resistance, and for process control instruments checking;
• Temperature simulation, voltage and current sourcing, resistance simulation for calibration of measuring equipment such as chart recorders, logical controllers, PLC analogue inputs...
• Test of signal conditioners or transmitters, using PJ 6301 simultaneous sensor simulation and output signal measurement capability.

PJ 6301 is naturally in its place in metrological departments, quality-control departments, research and development laboratories; it is also very suitable for maintenance and approval companies.
PJ 6301 is a major element at companies which have applied to ISO9000 certification. For this purpose, PJ 6301 is delivered with traceable test certificate.

PJ 6301 fields of application are extremely numerous, from energy (electrical, gas, oil,...), heavy industry (steel work, metallurgy, chemical, glass, cement,...), textile, paper, wood, rubber industries,... food industry, pharmaceutical industry, advanced technology industry (aerospace, military, transportation,...), scientific research...

functions

In measurement mode and for all functions ..
Maximum measurement capability: 125% of the range.

In simulation-sourcing mode and for all functions .....
Settling time < 25 ms to obtain specified accuracy.

Maximum admissible floating voltage compared with earth: 250 V AC or 350 V peak.

DC voltage

V-		Input			Output	
Resolution	Range	Accuracy (1)		Input impedance	Range	Accuracy (1)
		90 days	1 year			90 days / 1 year
0.1 µV	± 60 mV	0.005% + 4 µV	0.010% + 6 µV	> 1000 MΩ	-	-
1 µV	± 600 mV	0.005% + 4 µV	0.010% + 6 µV	> 1000 MΩ	- 100 to + 600 mV	0.007% + 4 µV / 0.015% + 6 µV
10 µV	± 6 V	0.005% + 20 µV	0.010% + 30 µV	> 1000 MΩ	- 1 to + 6 V	0.007% + 20 µV / 0.015% + 30 µV
100 µV	± 60 V	0.005% + 200 µV	0.010% + 300 µV	> 10 MΩ	- 10 to + 60 V	0.007% + 200 µV / 0.015% + 500 µV

(1) Accuracy is given in ±(% of reading + nV digits) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.

Measurement .....
Maximum admissible voltage: 100 V DC or AC peak.
Common mode maximum admissible voltage: 250 V AC or 350 V peak.
Common mode rejection ratio (60 mV range) > 150 dB.

Emission/calibration .....
Positive output maximum current: 60 mA (except 60 V range: 30 mA).
Negative output maximum current: - 5 mA.

Source resistance
< 0.5 mΩ with front panel terminals
< 2 mΩ with rear panel terminals.
Input protected against a temporary misconnection to - 18 V and + 100 V (DC or AC peak).

DC current

I-		Input			Output	
Resolution	Range	Accuracy (1)		Voltage drop	Range	Accuracy (1)
		90 days	1 year			90 days / 1 year
0.1 µA	± 60 mA	0.010% + 0.4 µA	0.020% + 0.6 µA	1.2 V	0 - 60 mA	0.010% + 0.5 µA / 0.020% + 0.8 µA

(1) Accuracy is given in ±(% of reading + nA) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.

Measurement .....
Electronic protection
When measuring current with a two-wire transmitter, the current loop can be supplied from an internal 24 V ± 10% source.

Emission/calibration .....
Maximum output voltage: 30 V.
External power supply:
When calibrating a 2 wire transmitter, the instrument can be powered by an external power supply ≤ 30 V DC.

Source resistance > 100 MΩ.
Outputs protected against a temporary misconnection to - 20 V and + 100 V.

Resistance

Measurement .....
Measurement with two-wire, three-wire or four-wire resistances.
Open circuit maximum voltage: 10 V.

Outputs protected against a temporary misconnection: 100 V DC or AC peak.

Ω			Input		Output	
Range	Resolution	Measurement current	Accuracy (1)		Accuracy (1) (2)	
			90 days	1 year	90 days	1 year
0 - 600 Ω	1 mΩ	1 mA	4 wire 0.005% + 4 mΩ 3 wire 0.005% + 20 mΩ	0.010% + 6 mΩ 0.010% + 20 mΩ	0.005% + 8 mΩ	0.010% + 10 mΩ
0 - 6 000 Ω	10 mΩ	0,1 mA	4 wire 0.005% + 40 mΩ 3 wire 0.005% + 70 mΩ	0.010% + 60 mΩ 0.010% + 80 mΩ	0.005% + 80 mΩ	0.010% + 100 mΩ

(1) In ±(% reading + nΩ) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.
(2) Accuracy is given for measurement current between 0.5 mA and 2.5 mA on 600 Ω range and between 0.05 mA and 0.25 mA on 6000 Ω range.
Admissible measurement current from 0.1 mA to 4 mA on 600 Ω range and from 0.01 mA to 0.4 mA on 6000 Ω range (lower accuracy)

Temperature with thermocouples

Temperature	Input				Output (2)		
Thermocouple	Range	Resolution	Accuracy (1) (3)		Range	Accuracy (3)	
			90 days	1 year		90 days	1 year
K	- 250 to - 200°C - 200 to - 120°C - 120 to 0°C 0 to + 1 372°C	0.2°C 0.1°C 0.05°C 0.05°C	1°C 0.3°C 0.2°C 0.010% + 0.1°C	1.5°C 0.5°C 0.3°C 0.015% + 0.2°C	- 240 to - 200°C - 200 to 0°C 0 to + 1 372°C	1°C 0.3°C 0.01% + 0.1°C	1.5°C 0.5°C 0.015% + 0.2°C
T	- 250 to - 200°C - 200 to - 0°C 0 to + 400°C	0.2°C 0.05°C 0.05°C	1°C 0.3°C 0.1°C	1.5°C 0.5°C 0.2°C	- 240 to - 200°C - 200 to 0°C 0 to + 400°C	1°C 0.3°C 0.1°C	1.5°C 0.5°C 0.2°C
J	- 210 to - 100°C - 100 to + 1 200°C	0.05°C 0.05°C	0.2°C 0.1°C	0.4°C 0.2°C	- 210 to - 100°C - 100 to + 1 200°C	0.3°C 0.01% + 0.1°C	0.5°C 0.015% + 0.2°C
E	- 250 to - 200°C - 200 to - 100°C - 100 to + 1 000°C	0. 1°C 0.05°C 0.05°C	0.5°C 0.2°C 0.1°C	1°C 0.3°C 0.2°C	- 240 to - 200°C - 200 to - 100°C - 100 to + 1 000°C	0.5°C 0.2°C 0.1°C	1°C 0.3°C 0.2°C
R	- 50 to + 120°C + 120 to + 450°C + 450 to + 1 768°C	0.5°C 0.2°C 0.1°C	1°C 0,5°C 0,5°C	2°C 1°C 1°C	- 50 to + 120°C + 120 to + 1 768°C	1°C 0.5°C	2°C 1°C
S	- 50 to + 120°C + 120 to + 450°C + 450 to + 1 768°C	0.5°C 0.2°C 0.1°C	1°C 0.5°C 0.5°C	1.5°C 1°C 1°C	- 50 to + 120°C + 120 to + 1 768°C	1°C 0.5°C	2°C 1°C
B	+ 400 to + 900°C + 900 to + 1 820°C	0.2°C 0.1°C	1°C 0.5°C	1.5°C 1°C	+ 400 to + 900°C + 900 to + 1 820°C	1°C 0.5°C	1.5°C 1°C
U	- 200 to 0°C 0 to + 600°C	0.05°C 0.05°C	0.3°C 0.2°C	0.5°C 0.3°C	- 200 to 0°C 0 to + 600°C	0.3°C 0.2°C	0.4°C 0.2°C
L	- 200 to - 100°C - 100 to + 900°C	0.05°C 0.05°C	0,2°C 0,1°C	0,3°C 0,2°C	- 200 to - 100°C - 100 to + 900°C	0.2°C 0.1°C	0.3°C 0.2°C
C	- 20 to + 900°C + 900 to + 2 310°C	0.1°C 0.1°C	0.5°C 0.03% + 0.1°C	1°C 0.05% + 0.2°C	- 20 to + 900°C + 900 to + 2 310°C	0.4°C 0.03% + 0.1°C	0.5°C 0.05%+ 0.2°C
N	- 240 to - 190°C - 190 to - 110°C - 110 to + 1 300°C	0.2°C 0.1°C 0.05°C	1°C 0.5°C 0.2°C	1.5°C 1°C 0.3°C	- 240 to - 100°C - 100 to + 1 300°C	1°C 0.2°C	1.5°C 0.4°C
Platinel	- 100 to + 1 400°C	0.05°C	0.2°C	0.4°C	- 100 to + 1 395°C	0.2°C	0.4°C
Mo	0 to + 1 375°C	0.05°C	0.1°C	0.2°C	0 to + 1 375°C	0.2°C	0.3°C

(1) Accuracy given with reference junction at 0°C. With internal reference junction compensation accuracy is decreased an additional 0.2°C .
(2) Calibration resolution (all ranges): 0.01°C.
(3) In ±(% reading + n°C) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.

Temperature with RTD

Temperature			Input		Output (2)		
RTD	Measurement range	Resolution	Accuracy (1) (3) 90 days	Accuracy (1) (3) 1 year	Range	Accuracy (3) 90 days	Accuracy (3) 1 year
Pt 100	- 220 to 0°C 0 to + 630°C + 630 to + 1200°C	0.01°C 0.005°C 0.01°C	0.02°C 0.01% + 0.02°C 0.1°C	0.04°C 0.015% + 0.04°C 0.2°C	- 220 to 0°C 0 to + 1200°C	0.04°C 0.01% + 0.04°C	0.06°C 0.015 % + 0.06°C
Pt 200	- 220 to 0°C 0 to + 630°C + 630 to + 798°C	0.01°C 0.005°C 0.01°C	0.02°C 0.01% + 0.02°C 0.7°C	0.04°C 0.015% + 0.04°C 0.15°C	- 220 to 0°C 0 to + 590°C	0.03°C 0.01% + 0.03°C	0.04°C 0.015% + 0.04°C
Pt 500	- 220 to 0°C 0 to + 1200°C	0.01°C 0.01°C	0.04°C 0.01% + 0.04°C	0.06°C 0.015% + 0.06°C	- 220 to 0°C 0 to + 1200°C	0.05°C 0.01% + 0.05°C	0.1°C 0.015% + 0.1°C
Pt 1000	- 220 to 0°C 0 to + 630°C + 630 to + 1200°C	0.01°C 0.005°C 0.01°C	0.03°C 0.01% + 0.03°C 0.15°C	0.05°C 0.015 % + 0.05°C 0.3°C	- 220 to 0°C 0 to + 1200°C	0.04°C 0.01% + 0.04°C	0.06°C 0.015% + 0.06°C
Ni 100	- 60 to + 180°C	0.05°C	0.1°C	0.15°C	- 60 to + 180°C	0.3°C	0.4°C

(1) Accuracy given with a four-wire sensor.
(2) Resolution (all ranges): 0.01°C
Accuracy is given for external current
- between 0.5 mA and 2.5 mA in Pt 100, Pt 200 and Ni 100 simulation
- of 1 mA in Pt 500 and Pt 1000 simulation
(3) Accuracy is given in ±(% of reading + n °C) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.

additional functions

Choice of temperature unit
In measurement or simulation mode temperature can be displayed in °C, °F or K.

Configuration memory
PJ6301 is able to store up to 5 user definable configuration programs, easily selectable on request from keyboard.

Input

Alarm thresholds
Two set points, or alarm limit S1 and S2, can be programmed with audible beep and relay output.

Peak and valley memory
Simultaneous display of current value, minimum and maximum value measured since unit initialisation, or since range switching from initialisation.

Relative measurements («Null» function)
Display of difference D (read value) between M (Measured value) and a value R. R is either memorised as a reference during measurement, or edited via keyboard:
D = M - R.

Linearisation by segments L = f(M)
Two possibilities are offered:
1- the relation between displayed and measured values is linear; in that case slope (a) and offset (b) are programmed so that displayed value L = aM + b.
2- the relation is not linear, but is known for a certain number of points. In that case up to 9 segments (each defined by a couple of points) can be programmed, to obtain the closest possible response curve. Couples are entered as $(X_0, Y_0),...(X_n, Y_n)$.
Displayed value L = f(M).

Digital filter
A programmable digital filter enables the PJ6301 to display a smoothed value taking into account previous measurements.

Trigger function
Acquisition on request can be replaced by triggered acquisition, one by one or with an acquisition procedure where number of measurements and time interval between measurements can be programmed.
Measurements of a burst are stored and can be processed off-line in the various ways described in the following paragraph.

Measurement memory
Up to 1000 measurements values can be stored in EEPROM in one burst, or up to 128 burst of one measurement. Bursts are tagged with an item number, and can be identified with a label. Data processing program allows to:
- display contents of a burst
- convert stored data into 4/20 mA or 0/10 V signals to be sent to a device fitted with analogue input
- download stored data onto a computer or printer via RS232 interface
Memory can be on request erased partially or totally.

Programmable recorder analogue output
An analogue output proportioned to any of the input ranges being measured is available on the rear terminals.
The output is 0-2.5 Vdc and is suitable for monitoring displayed values on a chart recorder.

Printer output
This digital output is available on RS232 interface to send displayed values onto a peripheral printer.

Output

Emission values memory
Up to 100 different emission-simulation values can be stored in memory, even on different ranges. These values can be entered by keyboard or via the RS232 link by a computer.
Each value can be sent one by one by keyboard, or using internal «synthesiser» function which allows automatic output according to operator's requirements.

Step function
Emitted value can vary by steps, whose amplitude, direction, and number of iterations are user programmable.

Ramp function
This function allows the emitted signal to vary between various programmable values, at programmable time intervals.
Ramps can be:
- simple (increasing or decreasing)
- cyclic.

Synthesiser function
This function allows to recall manually or automatically all or a part of memorised emission values. The generated signal varies according to memorised data, time interval between two consecutive values being programmable.

Scaling
This function allows to display a value A, and to obtain on terminals an output value S different from A but linked with relation S = f(A).
Two possibilities:
- A and S are related by a linear relation, with programmable slope (a) and offset (b). In that case the relation between displayed and emitted values is
S = aA + b.
- The relation between A and S is not linear. In that case the relation can be approached by segments. In the same way as for measurements, 9 sets of values can be programmed to linearise output signal from displayed value.

Transmitter function
The PJ6301's ability to measure and generate simultaneously is extremely useful in transmitter loop applications.
The measured signal can be linearised and converted to a 4-20 mA or 0-10 V signal available on the output terminals. The PJ6301 then reacts exactly as a programmable transmitter and interfaces sensor to process control or monitoring system.

Digital communications
RS 232 and IEEE 488-2 interfaces are designed for total control of instrument by external computer.

general specifications

Display
Graphical back-lit LCD display, with on-line menu and two separated areas for generation and measurement operation. 600000 counts + clear units + icons + messages.

Common mode voltage
Max. 250 V between earth and terminals.

Operating conditions
Reference temperature: 23 ± 1°C. Reference relative humidity (RH) 45 to 75%.
Nominal operating temperature and humidity: 0 to + 50°C, 20 to 75% RH.
Maximum operating temperature and humidity: - 10 to + 55°C, 10 to 80% RH.

Power supply
Mains 110 to 240 VAC, 50 to 400 Hz.
Optional battery with internal charger.

Presentation
Bench-top ABS plastic case with rack and panel mount adapters.
Dimensions: 225 x 88 x 310 mm
Weight: 2 to 3 kg according to hardware configuration.

Standards
For thermocouples type K, T, J, E, R, S, B: DIN-CEI 584-1 (NFC 42-321)
For thermocouple type L: DIN 43710
For RTD type Pt100: DIN-CEI 751 (NFC 42-330)
For RTD type Ni100: DIN 43760.

Traceability
AOIP owning in EVRY (France) a metrological laboratory accredited by French national bureau of Metrology (COFRAC) under number 2-1524 in Electricity and Magnetism and number 2-1525 in Temperature, PJ6301 is traceable to national and international standards. It is delivered with checking report available for ISO 9000. On request, it can be delivered with full calibration certificate.

sensors

Various sensors are available from our catalogue and can be delivered as options including traceable temperature probes and process sensors.

ordering instructions

Tester-calibrator	PJ 6301-3
Tester-calibrator + battery	PJ 6301-4

Accessories

Soft carrying case	AN 6901
RS 232 lead 9/25 female	AN 5874
RS 232 lead 9/9 male	AN 5875
RS 232 lead 9/25 male	AN 5876
IEEE 488 lead	AN 5836
Panel mounting kit	AN 5883
Rack mounting kit	AN 5884
Calibration certificate	On request
Processing software	On request
Sensors	On request

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pocket temperature and process calibrators

Measures and simulates thermocouples and RTD

Measures and generates milliamps/voltage

Memory, alarms, backlit display ...

Intrinsically safe versions

AOIP's pocket indicator-calibrator line are precision instruments that perform, easily and economically, all common equipment calibration in the field.
The different models in the range mean one fits exactly each user's needs.

• Thermometer models indicate temperature with thermocouples (field selection of 7 types) or RTD. Some models have additional functions such as: max, min, average measurements, ...

• Thermometer/indicators measure and simulate temperature with thermocouples and RTD. They have the some additional functions, Two models are intrinsically safe.

• Process signal calibrators generate and measure mA and mV.
One model is intrinsically safe.

These self-contained pocket-sized instruments are exceedingly robust: they will withstand common shocks and are unaffected by hostile environments. Special intrinsically safe versions are available for Ex-proof sites,

Key features
- Up to 7 types of thermocouple and RTD measured and simulated (KTJRSLN);
- Internal or external RJC (reference junction compensation);
- Choice of measurement units (°C or °F);
- 50 value memory;
- Maximum, minimum and mean value calculation;
- 2 programmable alarms;
- Analogue output drives strip or chart recorders;
- Backlit large character display.

various models

Thermometers

Version	Input sensor	Range	Additional functions
PN 6501	7 type Thermocouple	- 250 to + 1 760°C	Hold Max - Min - Average
PN 6511	RTD	- 200 to + 850°C	

Resolution: 0.1°C between - 100°C and + 300°C and 1°C outside these values.
1 year accuracy:
±(0.2% of reading + 0.2°C) between - 100°C and + 300°C, ±(0.2% + 2°C) outside these values.
For thermocouple devices accuracy is quoted for a reference junction at 0°C. Use of reference junction may add a max. error of 0.3°C.

Thermometers/Calibrators

	Version	Input sensor	In/Out range	Additional functions
Thermometer Calibrator	PJ 6521	7 type Thermocouple	- 250 to + 1 760°C	Backlit display 2 programmable alarms 50 measurement memory Hold Max - Min - Average Analogue output
	PJ 6522	RTD	- 200 to + 850°C	
Intrinsically safe	PJ 6521EX	7 type Thermocouple	- 250 to + 1 760°C	
	PJ 6522EX	RTD	- 200 to + 850°C	

Resolution: 0.1°C between - 100°C and + 300°C and 1°C outside these values.
1 year accuracy:
Output: ±(0.1% of reading + 0,2°C) between - 100°C and + 300°C, ±(0.1% + 2°C) outside these values.
Input: ±(0.2% of reading+ 0.2°C) between - 100°C and 300°C, ±(0.2%+ 2°C) outside these values.

Process signal calibrators

Version	Output	Input	Additional functions
Calibrator JN 6531	0 to 12Vdc 0 to 24 mAdc		Output in V, mA and % Output by steps of 25%
Calibrator/indicator JN 6532	0 to 12Vdc 0 to 24 mAdc	- 5 to 30 Vdc - 5 to 30 mAdc	Output in V, mA and % Output by steps of 25% Hold 50 measurement memory Backlit display
Calibrator/indicator intrinsically safe JN 6532EX	0 to 12Vdc 0 to 24 mAdc	- 5 to 30 Vdc - 5 to 30 mAdc	

Resolution: 0.01 V and 0.01 mA.
1 year accuracy:
- Voltage output:
0.1% of reading + 0.01 V
- Current output:
0.1% of reading + 0.02 mA
- Input: 0.2% of reading + 1 d.

general specifications

3 000 count measurement resolution.
Reading rate: 2 measures/second.
12.7 mm high, 7 segment liquid crystal display with optional backlighting.

Display indicates unit status:
- In (measurement) or out (simulation) mode;
- Thermocouple type with or without reference junction compensation;
- Measurement units (°C or °F);
- Storage status;
- Alarm status.

Power supply
9 V alkaline battery (type 6LR61 or 6LF22) giving > 100 hour useful life.
Optional rechargeable battery kit with external charger plug giving > 20 hour useful life.

Connections
Standard miniature polarised thermocouple plugs (2 pins) or RTD plugs (3 pins) or terminals on process calibrators.

Packaging
ABS antistatic moulded case sculpted for easy hand-held operation.
Isolated battery compartment with easily opened flap meets intrinsic safety requirements.
Watertight and splash proof to IP50 and 52 standards
Side groove takes detachable sensor probes.

Dimensions: 182 mm long, 75 mm wide, 43 mm thick.

Weight: 250 grams approx. according to battery and probe fitted.

additional functions

• Memory: up to 50 measurement values can be stored by pressing "MEM". Values are read out on the display with a sequence number.

• Reading "HOLD" function.

• Maximum, minimum and average measurements.

• Two setpoint alarms (up & low) can be programmed; alarm conditions generate an audible beep and up or down arrows on the display.

• Analogue output of the linearised value displayed as a volt signal (1 mV/°C) to drive chart recorders.

accessories

A wide range of sensors and probe attachments can be provided loose or in a custom foam-filled protective carrying case.

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The above characteristics are subject to modification

megohmmeter-ohmmeter
RL 2200

The RL2200 is particularly suited to maintenance, verification and reception of telephone lines, and more generally of all low voltage cables.
Its unique dual display offers both digital readings, for high accuracy measurements, and analogue readings to «feel» measurements tendency and monitor threshold limits.

The RL2200 measures loop resistance, insulation resistance, AC and DC voltages. Threshold limits can be set on resistance and insulation measurements.

France Télécom approved

- **Dual analogue/digital display**
- **Multi-purpose**
- **Quick cable loading feature**
- **Auto-discharge feature**
- **Rugged and designed for field use**

functions

Insulation resistance measurements

Ranges and measurement voltages:
- from 0.01 MΩ to 1 000 MΩ under 50 V
- from 0.1 MΩ to 10 000 MΩ under 500 V (500 V constant voltage for insulation > 5 MΩ).
- measuring current: < 1 mA.

Insulation threshold indication (beep) above adjustable limit.

Resistance range under 50 V

Analogue range	Digital range			Accuracy	
	Range	Measured resistance	Resolution	Analogue	Digital (1)
0.03 MΩ to 3 000 MΩ	0.00 MΩ to 99.50 MΩ	0.00 to 10.00 MΩ	0.01 MΩ	± 1 segment	5% + 0.01 MΩ
		10.00 to 30.00 MΩ	0.05 MΩ		
		30.00 to 50.00 MΩ	0.10 MΩ		
		50.00 to 99.50 MΩ	0.50 MΩ		
	100.0 MΩ to 1 000.0 MΩ	100.0 to 200.0 MΩ	1.0 MΩ		10%
		200.0 to 400.0 MΩ	5.0 MΩ		
		400.0 to 700.0 MΩ	10.0 MΩ		
		700.0 to 1 000.0 MΩ	20.0 MΩ		

(1) Accuracy is given 1 year in ±(% of reading + nΩ) at 23±1°C

Resistance range under 500 V

Analogue range	Digital range			Accuracy	
	Range	Measured resistance	Resolution	Analogue	Digital (1)
0.3MΩ to 30 000 MΩ	0.0 MΩ to 995.0 MΩ	0.0 to 100.0 MΩ	0.1 MΩ	± 1 segment	5% + 0.1 MΩ
		100.0 to 300.0 MΩ	0.5 MΩ		
		300.0 to 500.0 MΩ	1.0 MΩ		10%
		500.0 to 995.0 MΩ	5.0 MΩ		
	1000 MΩ to 10 000 MΩ	1 000 to 2 000 MΩ	10 MΩ		
		2 000 to 4 000 MΩ	50 MΩ		
		4 000 to 7 000 MΩ	100 MΩ		
		7 000 to 10 000 MΩ	200 MΩ		

(1) Over 1 year in ±(% of reading +nΩ) at 23±1°C

Resistance measurements

- Range : from 0 to 10 000 Ω
- Measuring current: < 1mA.

Continuity threshold indication (beep) below adjustable limit.

Analogue range	Digital range			Accuracy (1)	
	Range	Measured resistance	Resolution	Analogue	Digital
0.3 Ω to 30 000 Ω	0.0 Ω to 999.5 Ω	0.0 to 100.0 Ω	0.1 Ω	± 1 segment	0.5% + 0.2 Ω
		100.0 to 500.0 Ω	0.2 Ω		
		500.0 to 999.5 Ω	0.5 Ω		
	1 000 Ω to 10 000 Ω	1 000 to 2 000 Ω	1 Ω		
		2 000 to 3 000 Ω	2 Ω		
		3 000 to 5 000 Ω	5 Ω		
		5 000 to 10 000 Ω	10 Ω		

(1) At 23±1°C over one year and in ±(% of reading + nΩ) on digital display.

DC voltage measurements

3 digits digital display.
Range 0 to 100 V DC, resolution 0.1 V, accuracy ±(1%rdgs. + 0.5 V).
Range 100 to 500 V DC, resolution 1 V, accuracy ±(1%rdgs. + 1 V).
Input impedance: 200 KΩ.

AC voltage measurements

Range 0 to 100 V AC, resolution 0.1 V, accuracy ±(1%rdgs. + 0.5 V).
Range 100 to 400 V AC, resolution 1 V, accuracy ±(1%rdgs. + 1 V).
Input impedance: 200 KΩ.
Average value translated to RMS without DC component.
Band width: 40 to 400 Hz (higher frequencies can be measured with lower accuracy).

general specifications

Dual display
- analogue display: 67 segments bargraph on 5 decades logarithmic scale.
- digital display: 4 digits LCD.
Adjustment of ∞ value to adapt to peculiar measurement situation.

Safety
Using insulation measurement function under 50 V and 500 V, measuring voltage is applied on line only while measuring key is pressed. When the key is released, the cable is automatically unloaded within 1sec. Overload protection up to 380 V RMS on all ranges (90 V RMS on resistance ranges).

Quick load
Measurement settling time < 2 sec. for line capacitance < 1 µF.

Threshold limits
Set up of limits on resistance and insulation ranges with audible warning (beep).

Presentation
Plastic housing.
Dimensions : 195 x 100 x 45 mm.
Mass: 0.500kg.
Protection: IP54.
Connection: 2 safety 4mm plugs.

Power supply
4 x R6 or LR6 1.5 V type batteries.
Autonomy: 4500 measurements of 5 sec. each under 500 V with resistance ≥ 0.5 MΩ.
Auto switch-off function (after 30mn).

Environment
Operating range limits: -10 to +50°C, 20 to 80% relative humidity without condensation.
Storage and shipping range from -30°C to + 50°C.

Included as standard
- Carrying case for «hands free» use
- Measuring leads and «crocodile» type clamps.

ordering instructions

Analogue/digital Megohmmeter-ohmmeter RL 2200

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Specifications subject to modification without prior notice

direct voltage and current standard SN 8310

SN 8310 is a standard dc voltage and current source. It will supply voltages from 100 nV to 110 V and currents from 1 nA to 110 mA with an accuracy of better than 0,002% (20 ppm).

Remotely programmable using either RS 232C and IEEE 488 digital interface, the SN 8310 is easily integrated into a rack system, allowing it to be used in bench test sets.

- **High precision: 0.002%, 6 digits**
- **Programmable via RS232 and IEEE488**
- **Traceable to international metrology standards**
- **Mains and NiCd battery rechargeable**

functions

Applications

The exceptional precision, stability and extended range of the SN 8310 mean it can address a wide variety of applications. These can be grouped into 3 types:

- DC voltage and current standard for calibrating or testing voltmeters or ammeters (bench or panel mounted) up to 5 digits with 2000, 20 000, or 200 000 counts; also electronic systems, such as dividers, amplifiers, converters, oscillators and other components whether linear or not.
- Simulation of sensors such as µV, mV or mA sources to calibrate controllers, transmitters. recorders and other instruments used in process control.
- Ultra-stable, programmable, high precision power supply.

Output	Range	Span	Resolution	Accuracy (1)	
				90 days	1 year
DC Voltage	100 V	- 5 to + 110 V	100 µV	0.002% + 2	0.004% + 3
	10 V	- 1.10 to + 11.00 V	10 µV	0.002% + 2	0.004% + 3
	1 V	- 0.11 to + 1.10 V	1 µV	0.0025% + 4	0.005% + 6
	100 mV	- 11.00 to + 110 mV	100 nV	0.0035% + 20	0.007% + 20
DC Current	100 mA	- 11.00 to + 110 mA	100 nA	0.008% + 4	0.001% + 8
	10 mA	- 1.10 to + 11.00 mA	10 nA	0.008% + 4	0.001% + 8
	1 mA	- 0.11 to + 1.10 mA	1 nA	0.008% + 4	0.001% + 8

(1) ±(% of setting + counts) at 23 ±1°C

Range	Compliance with positive output	Compliance with negative output	Output impédance	Stability (1) 24 h DC-0.1 Hz	Noise 0.1-10 Hz	Noise 10 Hz-10 kHz
100 V	(2)	- 11 mA	< 0.5 mΩ	0.0001% + 1	50 µV	600 µV
10 V	110 mA	- 11 mA	< 0.5 mΩ	0.0001% + 1	5 µV	60 µV
1 V	110 mA	- 11 mA	< 0.5 mΩ	0.0001% + 2	5 µV	60 µV
100 mV	-	-	99 Ω	0.0001% + 5	500 nV	10 µV
100 mA	(2) (3)	- 5 V	> 10 MΩ	0.0003% + 3	500 nA	5 µA
10 mA	110 V (3)	- 10 V	> 10 MΩ	0.0003% + 3	50 nA	500 nA
1 mA	110 V (3)	- 10 V	> 10 MΩ	0.0003% + 3	5 nA	100 nA

1) ±(% of setting + counts) at 23 ±1°C
(2) Power delivered by instrument is limited to approximately 1.4 W
(3) Maximum output voltage can be limited to 25 V.

Temperature coefficient
< 10% of accuracy/°C.
Warm-up time: 30 seconds to obtain an output within 0.002% of final value,

5 minutes to obtain an output within 0.0002% of final value.

Linearity < 0.0003% of range.

Overshoot < 5%.
Response time < 3 seconds to be within specified accuracy + 1 second when changing range or inverting polarity.

special functions

• The unit stores 200 calibration values in memor y and will recall them:
- either via keyboard,
- or via the digital interface,
- or in automatic sequence with a programmable time interval between each value.

• It can generate programmable value increments , so that it steps (manually or automatically) through a particular range starting from a specified point.

• Digital communications
- standard RS 232C
- IEEE 488.

The instrument is designed for ease of use: conversational, illuminated alphanumeric liquid crystal display.
The user can generate a value either
- by direct entry using the SN 8310 keyboard,
- via the digital interface,
- increasing or decreasing each digit displayed in steps starting from the previous value (equivalent to a thumbwheel switch).

• Outputs on the front panel terminals are duplicated on the rear panel, this enables it to be used in rack-mounted applications.

Pre-set ranges straddle zero, change of polarity is also catered for.

general specifications

Display
Backlit LCD display (height 11.5 mm) up to 7 digits + units of measurement displayed. 6 digit resolution (1 100 000 counts).

Temperature operating range
0 to 45°C.

Common mode voltage
250 V max between earth and output terminals.

Power supply
- Mains 115 to 230 V ± 10%; 50 to 400 Hz
- NiCd rechargeable battery and charger (optional).

Supplied in a bench-style case with optional rack mounting kit.
Dimensions: 225 x 88 x 310 mm.
Weight: 2 to 3 kg depending on options.

traceability

Each SN 8310 is tested according to French standard NFX07-011 guidelines, with apparatus traceable (through AOIP metrology department) to the French COFRAC calibration chain (Electricity-Magnetism). An AOIP calibration and test report is delivered together with copies of the COFRAC calibration certificates.
These certificates are recognized by the following signatories of the EA (European Accreditation):
BMWA - Austria
BKO-OBE - Belgium
CAI - Czek Republic
DANAK - Denmark
DKD - Germany
NAB - Ireland
SIT - Italy
RVA - The Netherlands
NA - Norway
IPQ - Portugal
ENAC - Spain
SWEDAC - Sweden
SAS - Switzerland
UKAS - United Kingdom
NIST - USA
NATA - Australia
MRA - South Africa
IANZ - New Zealand.

ordering instructions

Calibrator with AC power supply	SN 8310-3
Calibrator with AC power supply + NiCd battery pack	SN 8310-4

Accessories

Carrying case	AN 6901
Panel mounting kit	AN 5883
Accessories for rack mounting	AN 5884
RS 232C connector cable (9 pin male-25 pin female)	AN 5874
RS 232C connector cable (9 pin male-9 pin male)	AN 5875
RS 232C connector cable (9 pin male-25 pin male)	AN 5876
IEEE 488 connector cable	AN 5836
User PC Software	LC 104

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