

ONE CALIBRATOR ONLY



The MEMOCAL 2000 is a lightweight versatile, portable, hand-held calibrator developed to solve two different and coexisting customer needs: field calibration (maintenance) and laboratory calibration (maintenance, quality control, process simulation, training, etc...).

- The field calibration requires small dimensions, no additional accessories, long battery life, ergonomics, friendly interface, low temperature drift, high noise immunity and simple programming capabilities.

The laboratory calibration requires: digital interface to data loggers or supervision and control systems, large range of I/O capabilities, high accuracy and stability over time.

MAIN FEATURES:

- Double linearization standards for thermocouples and RTD.
- Accuracy: 0.015% (*) .
- Temperature drift 0.1 $\mu\text{V}/^\circ\text{C}$.
- Operates with standard AA type alkaline batteries or rechargeable batteries (Ni-Cd or Ni-Mh).
- Advanced battery power management for circuit stand-by mode or when voltage step-up is not required.
- 24 hours (average) battery life operation (**).
- Built-in bi-directional RS-232 interface for remote programming and data recording by personal computer (***) .
- Calibrator cradle, recharger and RS-232C / RS-485 converter in a companion desk-top module.
- Like the forerunner, the Memocal 81, it is encased in a genuine leather protective case.
- Autoranging during measurement and generation.
- Simulates and measures T/C signals (15 T/C type) and RTD signals (Pt 100 and Ni 100).
- Generates and measures mA, mV, V and OHM signals.
- Square root extraction and quadratic signal generation.
- Programmable scaling for mA, mV and V measurement and generation.
- Built-in 24 V DC power supply for 2-wires transmitter excitation and measurement.
- Programmable external cold junction compensation value.
- Peak and valley data hold.
- Direct connection for all input types (no special connectors are required for TC inputs).
- Up to 50 program steps to create one or more programs.
- Ramp, soak and step function capabilities.
- 2 dry contact logic inputs for program advance/wait.
- 2 rows by 16 characters alphanumeric LCD display.
- Timed back lighted display.
- Ergonomic front panel with:
 - numerical multi function tactile keyboard
 - menu driven display with parameters-naming capability.

(*) Reference accuracy (see table)
(**) With Ni-MH batteries
(***) For software requirement contact ERO Electronic.



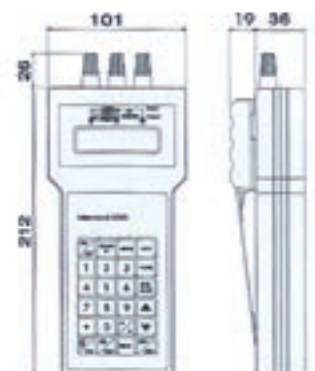
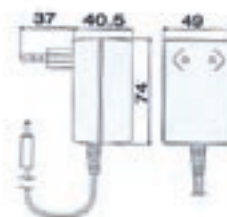
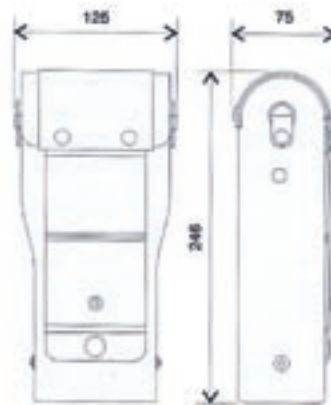
MEMOCAL 2000

GENERAL SPECIFICATIONS

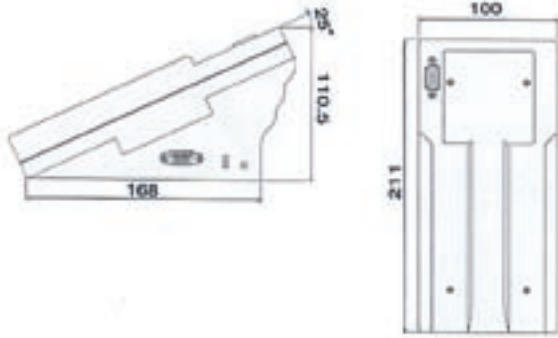
Case: ABS, colour similar to RAL 6038.
Self extinguishing degree: V-0 according to UL.
Input protection: all measured and generated range are protected against fault connection to signals up to 30 V AC/DC.
Terminals: 3 external screw FEMALE plugs Ø 4 mm.
Weight: 600 g max. (1,4 lb).
Power supply:
4 batteries AA size:
- Alkaline 1,5 V or
- Ni-Cd 1,2 V or
- Ni-MH 1,2 V.
- Switching type AC adapter (100 to 240 V AC).

Battery life: 24 hours (average) with Ni-MH batteries.
Recharging time: 12 hours.
Insulation resistance: > 100 MΩ according to IEC 348.
Isolation voltage: 1500 V r.m.s. according to IEC 348.
Common mode rejection ratio: 120 dB @ 50/60 Hz.
Normal mode rejection ratio: 60 dB @ 50/60 Hz.
Electromagnetic compatibility: This instrument is marked **CE**. Therefore, it is conforming to council directive 89/336/EEC (reference harmonized standard EN-50081-2 and EN-50082-2).

A/D conversion: dual slope integration.
Sampling time: 500 ms.
Display update time: 500 ms.
Temperature drift: 0.0028%/°C or 28 ppm/°C.
Operating temperature: from 0 to +40 °C.
Storage temperature: from -10 to +60 °C.
Humidity: from 20% to 85% RH non condensing.



► FOR FIELD AND LABORATORY USE:



*Desk-top stand
with RS-232 / RS-485 converter
(isolated) and battery quik recharge
capability.*



Leather bag

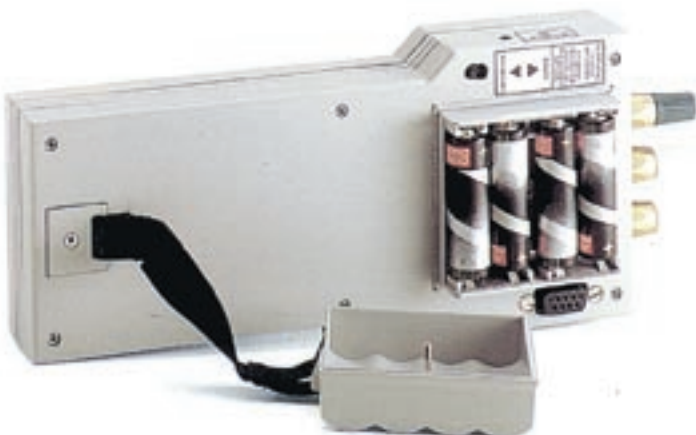
This accessory has been designed to assure a mechanical protection to the instrument but also to simplify the operativity in non comfortable conditions.

For this reason, in addition to the standard use, it performs 3 additional functions:

- 1) waistband support with snap clutch,*
- 2) long-strap bag with "hand free operation" capability,*
- 3) desk-top stand.*

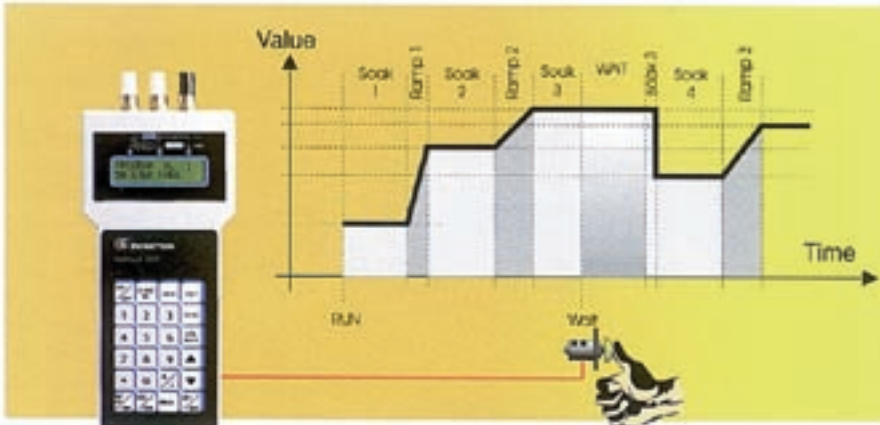


Standard equipment

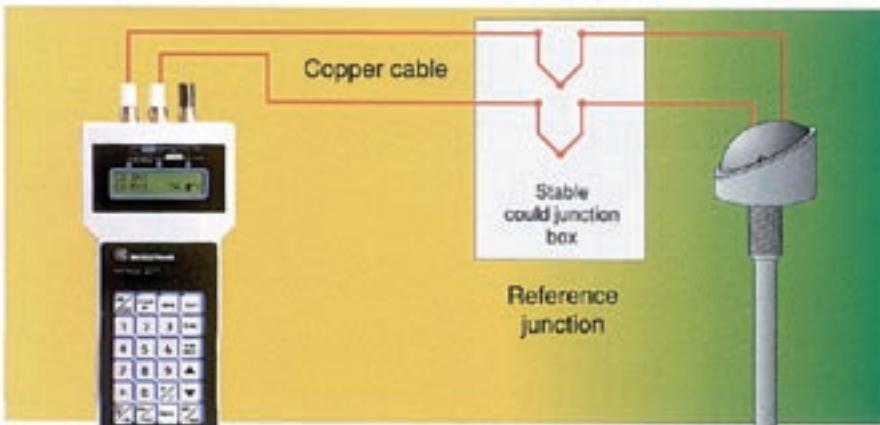


The MEMOCAL 2000 is shipped with AC adapter (100 to 240 V AC) and 4 Ni-Ca rechargeable batteries.

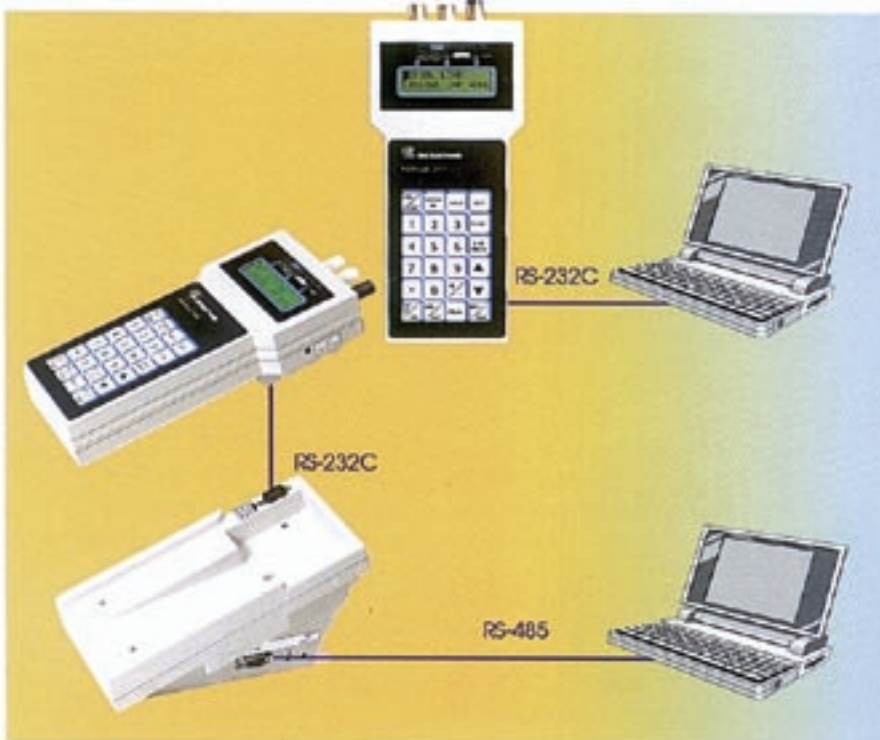
FRIENDLY, ACCURATE AND COMPACT



- Up to 50 steps program or smaller programs in 50 steps.
- Ramp or step and soak function capabilities.
- 2 dry contact logic inputs for program advance/wait.



- Programmable external cold junction compensation value.



2 SERIAL INTERFACES
Built-in RS-232 or external RS-485.

ALKALINE	RECHARGEABLE	RECHARGEABLE	<h3>3 TYPES OF BATTERY SOLUTIONS (AA size)</h3>
ALKALINE	RECHARGEABLE	RECHARGEABLE	
ALKALINE	RECHARGEABLE	RECHARGEABLE	
ALKALINE	RECHARGEABLE	RECHARGEABLE	
MON-RECHARGEABLE (common off-the-shelf)	RECHARGEABLE (standard type)	RECHARGEABLE (higher capacity)	

MEMOCAL 2000

MEASURING INPUTS

mA and V inputs

Ranges: see table below.
 Resolution: see table below.
 Reference accuracy: see table below.
 Range selection: automatic or manual.
 Input impedance: 10 Ω for mA input
 > 10 M Ω for mV inputs
 > 500 k Ω for 20 V input.
 Square root extraction: programmable.
 Read-out: keyboard programmable from -20000 to 20000.
 Decimal point: programmable in any position.

STANDARD RANGES TABLE

Range	Resol.	Ref. Accur. (\pm)
-20 mV to 20 mV	1 μ V	0.015%
-200 mV to 200 mV	10 μ V	0.015%
-2 V to 2 V	100 μ V	0.015%
-20 V to 20 V	1 mV	0.020%
-20 mA to 20 mA	1 μ A	0.015%
-130 mA to 130 mA	10 μ A	0.020%

TX MEASUREMENT

The TX measurement is a mA measurement with a 24 V power supply generated by the instrument and is used to calibrate 2, 3 or 4-wire transmitters.
 Power supply: 24 V DC (maximum current 24 mA).
 Resolution: 1 μ A.
 Reference accuracy: 0.015%.
 Input impedance: 10 Ω for mA input.
 Input range: 0 to 20 mA.
 Square root extraction: programmable.
 Read-out: keyboard programmable from -20000 to 20000.
 Decimal point: programmable in any position.
 Burn out: the instrument shows the "OPEN" message when a burn out condition is detected.

RTD input

RTD type:
 - Pt 100 3-wire connection.
 - Ni 100 3-wire connection.
 Calibration: programmable according to IPTS-68 or ITS-90.
 Line resistance: up to 20 Ω /wire with no measurable error.
 Engineering unit: $^{\circ}$ C or $^{\circ}$ F keyboard programmable.
 Measuring current: 100 μ A.
 Burn out: detection of the sensor open circuit and one or more wires open circuit.

STANDARD RANGE TABLE FOR RTD Pt 100

Range (Pt 100)	Resol.	Ref. Accur. (\pm)
-200 $^{\circ}$ C to 850 $^{\circ}$ C	0.1 $^{\circ}$ C	0.028%
-328 $^{\circ}$ F to 512 $^{\circ}$ F	0.1 $^{\circ}$ F	0.012%
513 $^{\circ}$ F to 1562 $^{\circ}$ F	< 0.2 $^{\circ}$ F	0.029%

STANDARD RANGE TABLE FOR RTD Ni 100

Range (Ni 100)	Resol.	Ref. Accur. (\pm)
-60 $^{\circ}$ C to 350 $^{\circ}$ C	0.1 $^{\circ}$ C	0.029%
-76 $^{\circ}$ F to 662 $^{\circ}$ F	0.1 $^{\circ}$ F	0.029%

Ω input

STANDARD RANGE TABLE

Range	Resolution	Ref. Accuracy (\pm)
0 to 800 Ω	0.1 Ω	0.025%

Thermocouples

Type: B, E, J, K, L, N, Ni/Ni-18% Mo, PLII, R, S, T, U, W, W3 and W5 keyboard programmable.
 Engineering unit: $^{\circ}$ C or $^{\circ}$ F keyboard programmable.
 Burn out: detection of the open input circuit (wires or sensor) with "OPEN" indication.
 Cold junction: automatic compensation.
 Cold junction compensation error: ± 0.3 $^{\circ}$ C ± 0.005 $^{\circ}$ C/ $^{\circ}$ C.
 External cold junction compensation: programmable value from -20 to 80 $^{\circ}$ C.
 Input impedance: > 10 M Ω .
 Calibration: programmable according to IPTS-68 or ITS-90.



New "International Temperature Scale" (ITS-90)
 In September '89, the "International Committee of Weights and Measures" defined the new "International Temperature Scale" (ITS-90) that replaces the "International Practical Temperature Scale" (IPTS-68). Compared to the previous scale, the new one is more extensive, more reproducible and more accurate.
 The various reference organisations are developing tables relative to thermocouples and RTD according to the new standard.
 Therefore, at the present time, there are no actual references for ITS-90 but only INFORMATIVE NOTES issued by the various organisations which, in a preliminary phase, includes the tables relative to some thermocouples and RTD.
 Thanks to these informative notes, it was possible to implement the linearization of almost all the most common thermocouples and RTD.



STANDARD RANGES TABLE

TC type	RANGE in °C	Resolution	Ref. Accuracy (±)
J	-200°C to 1200°C	0,1 °C	0,021%
K	-200°C to 967°C 968°C to 1370°C	0,1 °C < 0,2 °C	0,018% 0,032%
T	-200°C to 0°C 1°C to 400°C	0,1 °C 0,1 °C	0,045% 0,023%
E	-200°C to 1000°C	0,1 °C	0,019%
R	-50°C to 0°C 1°C to 350°C 351°C to 1684°C 1685°C to 1760°C	< 0,3 °C < 0,2 °C 0,1 °C < 0,2 °C	0,08% 0,048% 0,024% 0,037%
S	-50°C to 0°C 1°C to 600°C 601°C to 1760°C	< 0,3 °C < 0,2 °C 0,1 °C	0,06% 0,048% 0,024%
B	50°C to 100°C 101°C to 200°C 201°C to 600°C 601°C to 1150°C 1151°C to 1820°C	< 3 °C < 1 °C < 0,5 °C 0,2 °C 0,1 °C	0,7% 0,23% 0,11% 0,039% 0,023%
U	-200°C to 600°C	0,1 °C	0,027%
L	-200°C to 900°C	0,1 °C	0,026%
N	0°C to 1410°C	< 0,2 °C	0,034%
Ni/Ni 18%Mo	0°C to 1300°C	0,1 °C	0,024%
PLII	-100°C to 961°C 962°C to 1400°C	0,1 °C < 0,2 °C	0,014% 0,039%
W (G)	0°C to 50°C 51°C to 100°C 101°C to 250°C 251°C to 1530°C 1531°C to 2300°C	< 1 °C < 0,3 °C < 0,2 °C 0,1 °C < 0,2 °C	0,126% 0,048% 0,035% 0,019% 0,03%
W3 (D)	0°C to 100°C 101°C to 1090°C 1091°C to 2310°C	0,1 °C 0,1 °C 0,3 °C	0,019% 0,014% 0,042%
W5	0°C to 1096°C 1097°C to 2250°C 2251°C to 2315°C	0,1 °C 0,2 °C < 0,3 °C	0,014% 0,037% 0,042%

TC type	RANGE in °F	Resolution	Ref. Accuracy (±)
J	-328°F to 2192°F	0,1 °F	0,021%
K	-328°F to 32°F 33°F to 1772°F 1773°F to 2264°F 2265°F to 2498°F	< 0,2 °F 0,1 °F 0,1 °F < 0,3 °F	0,018% 0,014% 0,023% 0,032%
T	-328°F to 32°F 33°F to 752°F	< 0,2 °F 0,1 °F	0,045% 0,023%
E	-328°F to 1832°F	0,1 °F	0,019%
R	-58°F to 32°F 33°F to 350°F 351°F to 500°F 501°F to 3062°F 3063°F to 3214°F	< 0,5 °F < 0,4 °F < 0,3 °F < 0,2 °F < 0,3 °F	0,08% 0,048% 0,036% 0,025% 0,037%
S	-58°F to 32°F 33°F to 140°F 141°F to 470°F 471°F to 3214°F	< 0,5 °F < 0,4 °F < 0,3 °F < 0,2 °F	0,06% 0,048% 0,036% 0,024%
B	122°F to 212°F 213°F to 320°F 321°F to 600°F 601°F to 1250°F 1251°F to 1770°F 1771°F to 3276°F	< 4 °F < 2 °F < 1 °F < 0,5 °F < 0,3 °F < 0,2 °F	0,75% 0,25% 0,12% 0,063% 0,041% 0,025%
U	-328°F to 1112°F	0,1 °F	0,027%
L	-328°F to 1299°F 1300°F to 1652°F	0,1 °F < 0,2 °F	0,016% 0,026%
N	32°F to 1083°F 1084°F to 2006°F 2007°F to 2570°F	< 0,2 °F 0,1 °F < 0,2 °F	0,014% 0,028% 0,031%
Ni/Ni 18%Mo	32°F to 1529°F 1530°F to 2372°F	0,1 °F < 0,2 °F	0,016% 0,024%
PLII	-148°F to 924°F 925°F to 1761°F 1762°F to 2552°F	0,1 °F < 0,2 °F < 0,3 °F	0,013% 0,015% 0,039%
W (G)	32°F to 392°F 393°F to 1292°F 1293°F to 2309°F 2310°F to 2786°F 2787°F to 3276°F	< 1,2 °F < 0,2 °F 0,1 °F 0,2 °F < 0,3 °F	0,16% 0,045% 0,023% 0,025% 0,038%
W3 (D)	32°F to 572°F 573°F to 1832°F 1833°F to 1994°F 1995°F to 3276°F	< 0,2 °F 0,1 °F < 0,2 °F < 0,3 °F	0,024% 0,017% 0,019% 0,053%
W5	32°F to 572°F 573°F to 1958°F 1959°F to 3276°F	< 0,2 °F < 0,3 °F < 0,4 °F	0,018% 0,048% 0,054%

MEMOCAL 2000

GENERATIONS

mA and V generation

Ranges: see table below.
 Resolution: see table below.
 Accuracy: see table below.
 Output impedance:
 50 Ω for mV output
 0.5 Ω for the other V outputs.
 Maximum load for mA output:
 500 Ω .
 Range selection:
 automatic or manual.
 Quadratic signal generation:
 programmable.
 Read-out: keyboard programmable
 from -4000 to 20000.
 Decimal point: programmable in
 any position.

STANDARD RANGE TABLE

RANGES	Resol.	Ref. Accur. (\pm)
-4 mV to 20 mV	1 μ V	0.015%
-40 mV to 200 mV	10 μ V	0.015%
-400 mV to 2000 mV	100 μ V	0.015%
-4 V to 20 V	1 mV	0.020%
0 mA to 21 mA	1 μ A	0.015%

RTD simulation

RTD type:
 - Pt 100 3 wire connection.
 - Ni 100 3 wire connection
 Calibration: programmable
 according to IPTS-68 or ITS-90.
 Engineering unit:
 $^{\circ}$ C or $^{\circ}$ F keyboard programmable

STANDARD RANGE TABLE FOR RTD Pt 100

Ranges (Pt 100)	Resol.	Ref. Accur. (\pm)
-200 $^{\circ}$ C to 850 $^{\circ}$ C	0.1 $^{\circ}$ C	0.029%
-328 $^{\circ}$ F to 512 $^{\circ}$ F	0.1 $^{\circ}$ F	0.022%
513 $^{\circ}$ F to 1562 $^{\circ}$ F	< 0.2 $^{\circ}$ F	0.025%

STANDARD RANGE TABLE FOR RTD Ni 100

Ranges (Ni 100)	Resol.	Ref. Accur. (\pm)
-60 $^{\circ}$ C to 350 $^{\circ}$ C	0.1 $^{\circ}$ C	0.036%
-76 $^{\circ}$ F to 680 $^{\circ}$ F	0.1 $^{\circ}$ F	0.036%

Ω simulation

STANDARD RANGE TABLE

Range	Resolution	Ref. Accuracy (\pm)
15 to 500	0.1 Ω	0.031%

Thermocouples

Type: B, E, J, K, L, N, Ni/Ni-18%Mo, PLII, R, S, T, U, W, W3 and W5
 keyboard programmable.
 Engineering unit:
 $^{\circ}$ C and $^{\circ}$ F keyboard programmable.
 Output impedance: 50 Ω .
 Calibration: see table.
 Standard ranges: for ranges,
 accuracies and resolutions see
 thermocouples standard ranges
 table.

SPECIAL FEATURES

Backlight: LED backlighting with
 manual ON and automatic
 (30 seconds) shut OFF.
 Self diagnostic:
 at instrument start up.
 Peak detection: minimum and
 maximum Peak Picker.

SEQUENTIAL FUNCTION ROUTINE

This instrument is provided of 50
 steps which can be utilized to make
 up one or more programs.
 Each program can encompass a free
 number of soak and ramp
 simulations, measurements and
 stand by steps.

Low battery test

A test is provided at 3 different
 levels:

- 1) Level 1: the instrument is fully
 operative.
- 2) Level 2: the instrument shows the
 message "BATTERY LOW" on the
 upper display while the lower
 display shows the measured or
 generated value.
 The instrument is still fully
 operative.
- 3) Level 3: the instrument turns OFF
 automatically and utilizes the
 remaining power for memory
 back up only.

SERIAL INTERFACE (optional)

Types:

- Built-in: RS-232C.
- External: RS-232 to RS 485
 optoisolated converter installed
 in the desk-top stand.

Protocol type: MODBUS, JBUS.

Baud rate: keyboard programmable
 from 600 to 19200 BAUD.

Byte format: 8 bit.

Parity: even, odd or none
 programmable.

Stop bit: one.

Address: from 1 to 255.

Output voltage levels:
 according to EIA standard.

LOGIC INPUTS

The MEMOCAL 2000 is equipped
 with 2 logic inputs.

They are mutually exclusive with
 serial interface.

These 2 logic inputs have the
 following functions:

- 1) Logic input 1: sequences to the
 next program step.
- 2) Logic input 2: it allows to start
 or to suspend the program
 execution (RUN/WAIT).