1 PERFORMANCE

A fundamental tool to monitor quality assurance test equipment as required by ISO 9000 and to mantain the traceability in accordance with National Standards.
The indicator-simulator **CL524** and **CL525** are high accuracy multifunction instruments, with 2 isolated and independent channels, designed to meet the needs of instrumentation engineers, both in laboratory and in field work.
Accurate, compact, rugged, easy to use; the ideal solution to measure and simulate:

Both **Channel 1 (In)** and **Channel 2 (Out)** have the following operative mode capability:

- **millivolts**
- **volts**
- **milliamperes (active and passive loop)**
- **ohms**
- **temperature with thermocouples**
- **temperature with resistance thermometers**
- **frequency**
- **pulse and counter**

Remote auxiliary inputs are available for :

- **Relative humidity and temperature**
  (the temperature sensor uses the same input of the remote cold junction sensor. The above inputs are non isolated from the "Out" channel)

CL520 series calibrators have been developed using the most advanced A/D conversion and a fast and powerful 32 bit microcontroller to provide high accuracy on extended ranges and a powerful operative flexibility. The firmware is stored in a flash memory to allow future upgrade directly from serial interface using a floppy disk in a Personal Computer

- All normalized IEC, DIN, JIS thermocouples
- Pt, Ni, Cu resistance thermometers, temperature measurement and active simulation with a proprietary circuit (patent n. 206327).
- mA, mV, V, Ω, frequency, pulse
- IPTS 68 and ITS 90 selection directly through keyboard
- Current INput/OUTput mode directly on active or passive loops
- Rechargeable Ni-Cd battery and line operations
- Bidirectional digital interface
- Portable, table top and panel mounting
- Report of Calibration

The **CL525** has an improved performance and accuracy, is equipped with a PCMCIA Memory Card and with a communication bus for an extension with pressure or optional modules.

1.2 Specifications

- **IN/OUT parameters:**
  Signal type mV, V, mA, Ω, K Ω, frequency, pulses
  thermocouples type J, K, T, R, S, B, N, C, E, U, L, F, G, D
  resistance thermometers Pt100 IEC, OIML, USLAB, US, SAMA, JIS Pt200, 500, 1000, 1000 OIML, Ni100, Ni120, Cu10, Cu100
- **Reference junction compensation:**
  internal automatic from -10 °C to +55 °C
  external adjustable from -50 °C to +100 °C
  remote with external Pt100 from -10°C to +100 °C
- **Rj compensation drift:** ±0.015°C/°C (from -10 °C to +55 °C)
- **Common mode rejection:** >140 dB at ac operation
- **Normal mode rejection:** >60 dB at 50 or 60 Hz
- **Temperature stability:**
  full scale: ± 8 ppm/°C
  zero: ± 0.2 µV /°C
- **Output impedance (emf output):** less than 0.5 ohm with a maximum current of 0.5 mA
- **Input impedance (mV, V and Tc ranges):** >10 M Ω
- **Input impedance (mA ranges):** <130 Ω at 1 mA
- **Source resistance effects:** ±1 µV error for 1000 ohms source resistance
- **RTD and Ω simulation excitation current:** from 0.1 to 2 mA
- **RTD and Ω measurement excitation current:** 0.4 mA
- **RTD terminals:** 2, 3 or 4 wires
- **RTD cable compensation:** up to 100 Ω (for each wire)
- **RTD cable compensation error (Pt100):** ±0.005°C/ Ω of total wire
- **Maximum load resistance:** 1000 Ω at 20 mA
- **Display:** graphic LCD 240 x 64 dots display with backlight device
- **Measurement sampling time:** 250 ms
- **Output noise (at 300 Hz):** <2 µVpp for ranges up to 200 mV f.s., <10 µVpp for ranges up to 2000 mV f.s. and <80 µVpp for ranges up to 20 V f.s.
- **Digital interface:** full bi-directional TTL (a RS232 adapter normal or insulated, is available as an option)
- **Channel 1-Channel 2 insulation:** 250 Vdc
- **Calculation functions:** hold, max, min, offset, average
- **Simulation mode:** in-line single digit setting, numerical entry, memory loaded value, autostep, autoramp, autoscan, autocycle
- **Selection °C/°F/K:** through the configuration procedure
- **Convert function:** displays the electrical equivalent of the engineering unit
- **Scale factor:** 5 setting with zero and span programmable within -399999 and +999999
- **Square root:** in combination with scale factor
- **Calibration:** self learning technique with automatic procedure
- **Logging mode:** >1500 input data items (optional memory card for memory extension)
- **In/Out data memory:** 20 data with manual or automatic recall
- **Power supply:** external charger and rechargeable Ni-Cd battery
- **Self contained operation:**
  6 h on Tc and mV input/output (backlight Off)
  3.5 h with 20 mA simulation (backlight Off)
- **Recharging time:** 5 h at 90% and 6 h at 99% with instrument switched off. The battery recharge is active only with the instrument switched off.
- **Battery charge indication:** bar graph on the LCD display
- **Line operation:** 100V - 115 V - 230V Vac through the external battery charger
- **Line transformer insulation:** 2500 Vac
- **Firmware release identification:** release code on the display
- **Operating environment temperature range:** from -10 °C to +55 °C
- **Storage temperature range:** from -30 °C to +60 °C
- **Case:** Injection molded ABS
- **Dimensions:** 264 x 96 x 172 mm (DIN size)
- **Weights:** net 4 Kg gross 5.5 Kg

1.3 Table of ranges and accuracy

IN-OUT RANGES

Sensor or parameter	Total range			Accuracy range			Resolution	CL525 Accuracy (% of reading)	CL524 Accuracy (% of reading)
Tc type J	-210	to	1200°C	-190	to	1200°C	0.1°C	±(0.01% +0.1°C)	± (0.02% +0.1 °C)
	-350	to	2200°F	-310	to	2192°F	0.1°F	±(0.01% +0.18F)	± (0.02% +0.18 °F)
Tc type K	-270	to	1370°C	-160	to	1260°C	0.1°C	±(0.01% +0.1°C)	± (0.02% +0.1 °C)
	454	to	2500°F	-256	to	2300°F	0.1°F	±(0.01% +0.18°F)	± (0.02% +0.18 °F)
Tc type T	-270	to	400°C	-130	to	400°C	0.01°C	±(0.01% +0.1°C)	± (0.02% +0.1 °C)
	-454	to	760°F	-238	to	752°F	0.1°F	±(0.01% +0.18°F)	± (0.02% +0.18 °F)
Tc type R	-50	to	1760°C	150	to	1760°C	0.1°C	±(0.01% +0.2°C)	± (0.02% +0.2 °C)
	-60	to	3200°F	302	to	3200°F	0.1°F	±(0.01% +0.36°F)	± (0.02% +0.36 °F)
Tc type S	-50	to	1760°C	170	to	1760°C	0.1°C	±(0.01% +0.2°C)	± (0.02% +0.2 °C)
	-60	to	3200°F	338	to	3200°F	0.1°F	±(0.01% +0.36°F)	± (0.02% +0.36 °F)
Tc type B	50	to	1820°C	920	to	1820°C	0.1°C	±(0.01% +0.3°C)	± (0.02% +0.3 °C)
	140	to	3310°F	1688	to	3308°F	0.1°F	±(0.01% +0.54°F)	± (0.02% +0.54 °F)
Tc type C	0	to	2300°C	0	to	2000°C	0.1°C	±(0.01% +0.2°C)	± (0.02% +0.2 °C)
	32	to	4180°F	32	to	3632°F	0.1°F	±(0.01% +0.36°F)	± (0.02% +0.36 °F)
Tc type G	0	to	2300°C	190	to	2300°C	0.1°C	±(0.01% +0.3°C)	± (0.02% +0.3 °C)
	32	to	4180°F	374	to	4172°F	0.1°F	±(0.01% +0.54°F)	± (0.02% +0.54 °F)
Tc type D	0	to	2300°C	0	to	2130°C	0.1°C	±(0.01% +0.3°C)	± (0.02% +0.3 °C)
	32	to	4180°F	32	to	3866°F	0.1°F	±(0.01% +0.54°F)	± (0.02% +0.54 °F)
Tc type U	-200	to	400°C	-160	to	400°C	0.1°C	±(0.01% +0.1°C)	± (0.02% +0.1 °C)
	-330	to	760°F	-256	to	752°F	0.1°F	±(0.01% +0.18°F)	± (0.02% +0.18 °F)
Tc type L	-200	to	760°C	-200	to	760°C	0.1°C	±(0.01% +0.1°C)	± (0.02% + 0.1 °C)
	-330	to	1400°F	-328	to	1400°F	0.1°F	±(0.01% +0.18°F)	± (0.02% +0.18 °F)
Tc type N	-270	to	1300°C	0	to	1300°C	0.1°C	±(0.01% +0.1°C)	± (0.02% +0.1 °C)
	-450	to	2380°F	32	to	2372°F	0.1°F	±(0.01% +0.18°F)	± (0.02% +0.18 °F)
Tc type E	-270	to	1000°C	-200	to	1000°C	0.1°C	±(0.01% +0.1°C)	± (0.02% +0.1 °C)
	-454	to	1840°F	-328	to	1832°F	0.1°F	±(0.01% +0.18°F)	± (0.02% +0.18 °F)
Tc type F	0	to	1400°C	0	to	1400°C	0.1°C	±(0.01% +0.1°C)	± (0.02% +0.1 °C)
	32	to	2560°F	32	to	2552°F	0.1°F	±(0.01% +0.18°F)	± (0.02% +0.18 °F)
Pt100 IEC	-200	to	850°C	-200	to	850°C	0.01°C	±(0.01% +0.05°C)	± (0.02% +0.05 °C)
OIML, a 3926	-330	to	1570°F	-328	to	1562 °F	0.1°F	±(0.01% +0.09°F)	± (0.02% +0.09 °F)
Pt100	-200	to	650°C	-200	to	650°C	0.01°C	±(0.01% +0.05°C)	± (0.02% +0.05 °C)
a 3902	-330	to	1210°F	-328	to	1210°F	0.1°F	±(0.01% +0.09°F)	± (0.02% +0.09 °F)
Pt100 JIS	-200	to	600°C	-200	to	600°C	0.01°C	±(0.01% +0.05°C)	± (0.02% +0.05 °C)
SAMA	-330	to	1120°F	-328	to	1112°F	0.1°F	±(0.01% +0.09°F)	± (0.02% +0.09 °F)
Pt 200	-200	to	850°C	-200	to	850°C	0.1°C	±(0.01% +0.15°C)	± (0.02% +0.15 °C)
	-330	to	1570°F	-328	to	1562°F	0.1°F	±(0.01% +0.27°F)	± (0.02% +0.27 °F)
Pt 500	-200	to	850°C	-200	to	530°C	0.1°C	±(0.01% +0.1°C)	± (0.02% +0.1 °C)
	-330	to	1570°F	-328	to	986°F	0.1°F	±(0.01% +0.18°F)	± (0.02% +0.18 °F)
Pt1000 IEC	-200	to	850°C	-200	to	850°C	0.01°C	±(0.01% +0.1°C)	± (0.02% +0.1 °C)
OIML	-330	to	1570°F	-328	to	1562°F	0.1°F	±(0.01% +0.18°F)	± (0.02 % +0.18 °F)
CU10	-70	to	150°C	-70	to	150°C	0.1°C	±(0.01% +0.4°C)	± (0.02% +0.4 °C)
	-100	to	310°F	-94	to	302°F	0.1°F	±(0.01% +0.72°F)	± (0.02% +0.72 °F)
CU100	-180	to	150°C	-180	to	150°C	0.1°C	±(0.01% +0.05°C)	± (0.02% +0.05 °C)
	-300	to	310°F	-292	to	302°F	0.1°F	±(0.01% +0.09°F)	± (0.02% +0.09 °F)
Ni100	-60	to	180°C	-60	to	180°C	0.1°C	±(0.01% +0.05°C)	± (0.02% +0.05 °C)
	-80	to	360°F	-76	to	356°F	0.1°F	±(0.01% +0.09°F)	± (0.02% +0.09 °F)
Ni120	0	to	150°C	0	to	150°C	0.1°C	±(0.01% +0.05°C)	± (0.02% +0.05 °C)
	32	to	310°F	32	to	302°F	0.1°F	±(0.01% +0.09°F)	± (0.02% +0.09 °F)
mV				-20	to	+200mV	1µV	±(0.01% +2µV)	± (0.02% +2 µV)
mV				-0.2	to	+2 V	10 µV	±(0.01% +10 µV	± (0.02% +10 µV)
V				-2	to	+20 V	0.1mV	±(0.01% +0.08mV)	± (0.02% +0.08 mV)
mA (In)				-5	to	+50mA	0.1µA	±(0.01% +0.4µA)	± (0.02% +0.4 µA)
mA (Out)				0	to	+50mA	0.1µA	±(0.01% +0.4µA)	± (0.02% +0.4 µA)
Ω IN				0	to	500Ω	1mΩ	±(0.01% +12mΩ)	± 0.02% +12 mΩ)
				0	to	5000 Ω	0.01Ω	±(0.01% +120mΩ)	± (0.02% +120 mΩ)
Ω OUT				0	to	500 Ω	1 mΩ	±(0.01% +20mΩ)	± (0.02% +20 mΩ)
				0	to	5000 Ω	0.01Ω	±(0.01% +200mΩ)	± (0.02% +200 mΩ)
Frequency				1	to	200 Hz	0.001 Hz	±(0.005% +0.001 Hz)	
				1	to	2000 Hz	0.01	±(0.005% +0.001 Hz)	
				1	to	20000 Hz	0.1 Hz	±(0.005% +0.001 Hz)	
Pulse counter				0	to	10^6 counts	1 count	infinite	
Pulse (Out)				0	to	6000 pulse/min	1 pulse/min	1 pulse / min	
				0	to	36000 pulse/h	1 pulse/h	1 pulse / min	

Note:

- The relative accuracy shown above are stated for 360 days and the operative conditions are from +18°C to +28°C
- Typical 90 day relative accuracy can be estimated by dividing the "% of reading" specifications by 1.6.
- Typical 2 year relative accuracy can be estimated by multiplying the "% of reading" specifications by 1.4.
- All input ranges: additional error ±1 digit.
- OMEGA traceability chart and uncertainty can be supplied on request.

IMPORTANT NOTES

REMEMBER THAT TO OBTAIN THE MAXIMUM PERFORMANCE IN TERM OF ACCURACY THE BACKLIGHT SHOULD BE SWITCHED OFF. IN FACT THE BACKLIGHT DEVICE IS A SOURCE OF INTERNAL HEATING THAT CAN CONTRIBUTE TO THE OVERALL ERROR OF THE INSTRUMENT. THE STATED RELATIVE ACCURACY IS DECLARED WITH THE BACKLIGHT DEVICE SWITCHED OFF.

2 GENERAL FEATURES

2.1 Innovative design

CL520 series calibrators use innovative electronics based an a powerful 32 bit microcontroller and sophisticated high stability, low level signal, thermal e.m.f. free analog circuit.
A Flash memory allows firmware updating through serial interface and modem.
CL525 Incorporates a real time clock, PCMCIA Memory Card and improved performances.

2.2 Flexibility

The operative set-up mode is simplified by a sequence of menu pages that only require <**Select**> and <**Enter**> instructions. A full set of operators notes are memory stored allowing a direct operator's assistance and instructions. Any relevant instruction may be recalled through the <**Help**> key. Separate terminals for Channel 1 and Channel 2 are installed on the front panel. The instrument accepts 2,3,4 wire resistance thermometers.

2.3 Keyboard - Display

A thermoformed metal-click polycarbonate membrane keyboard, with a working life of one million operations per key, seals the internal electronics from the surrounding environment.
Contact closure of the membrane keys is acknowledged as a coded signal directly by the microprocessor.
The setting of the simulation signal value uses the typical **OMEGA** in-line single digit setting mode or a direct numerical entry mode.
The high contrast LCD graphic display, equipped with a backlight device, allows easy reading even in poor light conditions.
The graphic display allows a simultaneous indication of the measured and simulated value (large digit), together with a comprehensive number of messages related to engineering units, type of sensor or signal, temperature scale, cold junction selection and battery level of charge.
A backlight auto power OFF mode is installed to save battery life.
A swap feature is also installed to change the position on the display of the IN and OUT parameters.

2.4 Digital interface

It is a full bi-directional TTL level digital interface for communication with computerized systems.
A RS232 adapter with galvanic insulation is available on request.

2.5 Firmware

The real time clock, Flash Memory and RAM handle logic functions, mathematical computation and data storage.
A removable Memory Card (PCMCIA) is installed on **CL525** only.

The firmware includes the following capabilities:
- multiple measurements and generation mode
- signal processing: filter, average, peak, alarms
- downloadable test procedure (CL520-CPS)
- data acquisition (CL520-LGM)
- switch test routine
- ramping and stepping for dynamic testing
- user definable linearization (CL520-SLS)
- user entry of probe specific calibration coefficients (CL520-SLS)

2.6 Scale factor - Square root

All non temperature ranges are fully programmable to read both measured and output values in term of engineering unit.
Four characters, adjustable in an alphanumeric way, are available on the display to show the symbol of the parameter (i.e. mbar, % RH, % CO, etc.) mA reading and output can be e.g. related to flow when using a ΔP transmitter across a calibrated flange.

2.7 Cold Junction compensation

Accurate and fast response automatic internal Rj compensation through a special low thermal capacity design of binding posts incorporating a thin film high accuracy Pt100.
The cold junction temperature is measured, acknowledged by the microprocessor, directly displayed for automatic Rj compensation.
In addiction to the automatic internal Rj compensation two alternative compensation modes can be selected: “external” with a programmable temperature value or “remote” automatic with an external resistance thermometer.

2.8 Calculated readings

To allow measurements of unstable input signals by a programmable averaging of a programmable number of conversions and min and max value identification.
A “hold” function is also present on the keyboard or external contact instructions.

2.9 Transmitter simulation and calibration

The instrument can be connected to system inputs to simulate a 4-20 mA transmitter.
It has an adequate power to drive 20 mA into a load of 1000 Ω in the source mode (50 mA su 350 Ω).
The operator can set and change temperature values while obtaining the equivalent mA output.
The mA mode may be connected directly either on passive or on active loops.

2.10 Frequency - Counts

The "Out" mode is designed to generate zero based pulses, with an adjustable amplitude, at a frequency up to 20 KHz.
A preset number of pulses may be programmed and transmitted to test or calibrate totalizers and counters.
The instrument can be configured to measure frequency and count pulse (totalizer mode).
Technical units in Hz, pulse/h and pulse/min.
The input threshold is adjustable from 0 to 20 V with 0.01 V resolution.

2.11 Programmable signal converter

The instrument can be used as a temporary signal convert replacement.
Any input signal (including the remote auxiliary inputs) can be converted into any of the available output signals while maintaining full galvanic isolation.

2.12 Resistance thermometer

Although resistance and temperature with resistance thermometer may be measured on a 2, 3 wire connection, the instrument is also designed for 4-wire measurements with a resolution as low as 0.01°C.

2.13 Remote temperature probe

A high accuracy probe is available on request for general purpose temperature measurement and/or remote cold junction compensation.

2.14 Graphic mode

To obtain a real time graph of the measured parameter.
The input data are memory stored and the actual values, relevant to the required time, can be digital displayed using the cursor key.

2.15 Simulation programs

Menu-driven set up to generate:

- a continuous or step ramp output where the total time, the starting point, the final point and the size of the steps are requested by the set-up procedure to run the program;
- a repetitive programmable cycle rises, soaks, falls;
- a manual requested increment through keyboard;

- an automatic sequence of up to 20 stored values (2 groups of 10 memories).

2.16 Power supply

External charger circuit and internal rechargeable battery.
The instrument can operate from mains line continuously without removing the battery.
When in normal operation from mains supply the battery is not recharged.
To recharge the battery the instrument must be switched off.

2.17 Report of Calibration

Each instrument is factory calibrated against Standards, that are periodically certified by an International recognized Laboratory to ensure traceability, and shipped with a Report of Calibration stating the nominal and actual values and the deviation errors. A special calibration report can be supplied on request.

2.18 CL520-CPS Software - Documents calibration data

Standard Agencies and Quality Auditors require the collections, organization and analysis of traceability documents.
A supporting software for DOS/Windows (CL520-CPS Calibration Procedure Manager) is available to transfer a selection of calibration routines from a PC to the internal memory of the instrument in order to simplify field calibrations selecting the appropriate tag number. Test and calibration data can be memory stored and downloaded to a PC to document the calibration activity. (“before" and “after” data).

2.19 CL520-LGM Software for data acquisition

Supporting software for DOS/Windows to download logged data from an internal memory to a PC. Data can be saved on disks, loaded from disks, viewed in a numeric or graphic mode and also printed in a numeric or graphic mode.

2.20 CL520-SLS Software for special linearizations

Supporting software for DOS/Windows to configure the instrument with, Tcx, RTDx special linearization. The program allows a highly accurate temperature measurement with a calibrated Pt100 loading the coefficients of the Calibration Report.

3 PHYSICAL DESCRIPTION

The **CL520** series calibrator consists of a rugged and compact case, a mother board with all base and IN/OUT circuits, a tactile polycarbonate membrane keyboard, a LCD display and a group of four Ni-Cd rechargeable batteries.
The internal surface of the case is metal coated through a special process to improve the characteristics of electrical noise shielding and thermal equalization of all internal circuits.
On the **CL520** series the battery container is located on the upper part of the case, and it is accessible through a cover with two fasteners.
The two sections of the case are joined together and fastened by five metal screws located on the bottom part of the case.
The optional leather case, with shoulder strap, assures better protection of the instrument against mechanical knocks or scratches.