User's Guide

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CL526
Multifunction Indicator-Simulator

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WARNING: These products are not designed for use in, and should not be used for, patient connected applications.

INTRODUCTORY NOTE

This publication contains operating instructions, as well as a description of the principles of operation, of ***CL526*** *multifunction portable calibrator.*
This information covers all models of the instrument, including the basic equipment and its options and accessories.
This manual is a complete "USER GUIDE", providing step-by-step instructions to operate the instrument in each of its designed functions.

OMEGA *has used the best care and efforts in preparing this book and believes the information in this publication are accurate. The* ***OMEGA*** *products are subjected to continuous improvement, in order to pursue the technological leadership; these improvements could require changes to the information of this book.*
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CL526 *multifunction portable calibrator uses sophisticated analogic and digital technologies. Any maintenance operation must be carried out by qualified personnel* ***ONLY****. We recommend to contact our technicians for any support requirements.*
The instrument is supplied by a Ni-MH rechargeable battery pack or by 100, 115, 230V ±10% 50/60Hz line supply using the special power supply module provided with the ***CL526*** *when the rechargeable battery is ordered.*

CL526 *is fully tested in conformity with the directive n°89/336/CEE Electromagnetic Compatibility.* ***OMEGA*** *shall not be liable in any event, technical and publishing error or omissions, for any incidental and consequential damages, in connection with, or arising out of the use of this book.*

TABLE OF CONTENTS

4

1   GENERAL PERFORMANCE

A complete system for testing, measuring and calibrating built in a single, compact portable instrument. The portable calibrator **CL526** is a multifunction instrument designed to meet, in a modern and practical way, the needs of instrumentation engineers, both in laboratory and field work.
Accurate, compact, rugged, easy to use; the ideal solution for measuring and simulating:

- **millivolts**
- **volts**
- **milliamperes (active and passive loop)**
- **ohms**
- **thermocouples**
- **resistance thermometers**

The **CL526** has been developed using the most advanced microprocessor technology to provide high accuracy on extended ranges and a powerful operating flexibility.
The modular firmware includes the algorithms of thermocouples and resistance thermometers in accordance with IEC, DIN standards. IPTS68 and ITS90 linearization are memory stored and can be selected through the keyboard.
The simulation-measurement of resistance and temperature with resistance thermometer uses a special proprietary active circuit.
An unique internal automatic Rj compensation system allows the CL526 to provide accurate input and output readings over wide operating conditions, with a temperature range from -5°C to +50°C. Further, external compensation is available with temperature adjustable from -50°C to +100°C.
The selection of operating functions is made on a polycarbonate thermoformed membrane keyboard which assures up to one million operations per key.
Two thick film membrane "slidewires" are used to set the simulated signal value.
Measured and simulated values are indicated on a high quality LCD dot matrix display which provides good contrast even in poor light conditions.
A menu-driven procedure allows for the generation of up to 60 memory stored values, or, for continuous or step ramp values.
The instrument carries out mathematical functions for averaging unstable input signals and, in combination with scale factor, square root calculation.
The case, made in shock-resistant ABS, is ergonomically designed for easy practical use.
The instrument is powered by four Ni-MH rechargeable batteries; an external battery charger is supplied as a standard accessory.

1.1 Specifications

- **IN/OUT parameters:**
  - mV, V, mA, Ω
  - Tc type J, K, T, R, S, B, N, C, E, F, U, L, G, D
  - Rtd type Pt100, Ni100 and Ni120

- **Reference junction compensation:**
  - automatic internal with Pt100 sensor from -5°C to +50°C;
  - external with manual setting from -50°C to +100°C

- **Rj compensation drift:**
  ± 0.015°C/°C

- **Rj compensation error:**
  ±0.15°C

- **In/Out ranges:**
  see following tables

- **Resolution:**
  see following tables

- **Limits of error:**
  see following tables

- **Common mode rejection:**
  > 130 dB at 50/60 Hz

- **Normal mode rejection:**
  > 60 dB at 50/60 Hz

- **Temperature stability:**
  span   ± 0.005% of the reading/°C
  zero   ± 0.2 µV /°C

- **Output impedance (emf output and Tc):**
  < 0.5 Ω with maximum current of 0.5 mA

- **Input impedance:**
  > 10 MΩ (> 1MΩ on 10 V range)

- **Source resistance effect:**
  1 µV error for 1000 Ω source resistance

- **Rtd and Ω simulation excitation current:**
  from 0.2 to 5 mA

- **Rtd and Ω measurement excitation current:**
  0.25 mA

- **Rtd cable compensation:**
  up to 100 Ω (each wire)

- **Shunt resistance (mA ranges):**
  38 Ω

- **Maximum resistance load:**
  1000 Ω (20mA)

- **Maximum input over voltage dc:**
  50 V (mV, V, Tc)   5 V (Rtd)

- **Display:**
  high contrast dot matrix LCD (7x5 dots per character -16 characters)

- **Engineering unit indications:**
  up to 4 characters shown directly on the display

- **Scale factor:**
  zero and span programmable within -10000 and +10000

- **Square root:**
  in combination with scale factor (display limits 0 and +2500)

7

- **Calibration:**
  semi-automatic procedure

- **Power supply:**
  n. 4 Ni-MH batteries 1.25 V 1.2 A/h

- **Battery life:**
  4 hours with 20 mA simulation mode
  12 hours on measuring mode

- **Recharge time:**
  10 hours with instrument switched -Off- (at 90%)

- **Battery voltage:**
  value indicated on the display

- **Program release identification:**
  release code on the display

- **Operating environment temperature range:**
  from -5°C to +50°C

- **Storage temperature range:**
  from -30°C to +60°C

- **Case:**
  ABS with internal metal coating

- **Dimensions:**
  120x60x230 mm

- **Weights:**
  net 1 Kg
  gross with packing 2.5 Kg

1.2.1 Table of ranges and accuracy

Sensor or parameter	Total range	High accuracy range	Resolution	Limit of error
Tc type J	-210 to +1200°C *-346 to +2192°F*	-190 to +1200°C *-310 to +2192°F*	0.1°C *0.1°F*	± (0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Tc type K	-270 to +1370°C *-454 to +2498°F*	-150 to 1300°C *-220 to 2372°F*	0.1°C *0.1°F*	± (0.02% of rdg +0.1°C) *±(0.02% of rdg +0.18°F)*
Tc type T	-270 to +400°C *-454 to +752°F*	-150 to 400°C *-202 to 752°F*	0.1°C *0.1°F*	± (0.02% of rdg +0.1°C) *±0.02% of rdg +0.18°F)*
Tc type R	0 to +1760°C *32 to 3200°F*	500 to 1700°C *932 to 3092°F*	0.1°C *0.1°F*	± (0.02% of rdg +0.3°C) *± (0.02% of rdg +0.154°F)*
Tc type S	0 to +1760°C *32 to +3200°F*	600 to 1760°C *1112 to 3200°F*	0.1°C *0.1°F*	± (0.02% of rdg +0.3°C) *± (0.02% of rdg +0.154°F)*
Tc type B	200 to +1820°C *392 to +3308°F*	1000 to 1820°C *1832 to 3308°F*	0.1°C *0.1°F*	±(0.02% of rdg +0.4°C) *± (0.02% of rdg +0.172°F)*
Tc type C	0 to +2300°C *32 to +4172°F*	1150 to 2300°C *2102 to 4172°F*	0.1°C *0.1°F*	± (0.02% of rdg +0.4°C) *± (0.02% of rdg +0.172°F)*
Tc type G	0 to +2300°C *32 to +4172°F*	300 to 2000°C *572 to 3632°F*	0.1°C *1°F*	± (0.02% of rdg +0.4°C) *± (0.02% of rdg +0.172°F)*
Tc type D	0 to +2300°C *32 to +4172°F*	300 to 2000°C *572 to 3632°F*	0.1°C *0.1°F*	± (0.02% of rdg +0.4°C) *± (0.02% of rdg +0..72°F)*
Tc type U	-200 to +400°C *-328 to +752°F*	-150 to +400°C *-238 to +752°F*	0.1°C *0.1°F*	±(0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Tc type L	-200 to +760°C *-328 to +1400°F*	-200 to 760°C *-328 to 1400°F*	0.1°C *0.1°F*	± (0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Tc type N	0 to 1300°C *+32 to 2372°C*	0 to 1300°C *32 to 2372*	0.1°C *0.1°F*	±(0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Tc type E	-270 to +1000°C *-454 to +1832°F*	-200 to +1000°C *-328 to +1832°F*	0.1°C *0.1°F*	±(0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Tc type F	0 to 1400°C *32 to 2552°F*	0 to 1400°C *32 to 2552°F*	0.1°C *0.1°F*	±(0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Pt 100 (IEC)	-200 to +850°C *-328 to +1562°F*	-200 to +850°C *-328 to +1562°F*	0.1°C *0.1°F*	±(0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Pt100 (JIS)	-200 to +600°C *-328 to +1562°F*	-200 to +600°C *-328 to +1562°F*	0.1°C *0.1°F*	±(0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Pt100 (US)	-200 to +850°C *-328 to +1562°F*	-200 to +850°C *-328 to +1562°F*	0.1°C *0.1°F*	±(0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Ni100	-60 to +180°C	-60 to +180°C *-76 to +356°F*	0.1°C *0.1°F*	±(0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
Ni120	0 to +150°C *32 to +302°F*	0 to +150°C *32 to +302°F*	0.1°C *0.1°F*	±(0.02% of rdg +0.1°C) *± (0.02% of rdg +0.18°F)*
mV	-18.000 to +22.000	-10.000 to +22.000	1 µV	± (0.01% of rdg +3µV)
mV	-10.00 to +100.00	-10.000 to +21.000 +21.00 to +53.00 +53.00 to +100.00	10 µV 10 µV 10 µV	± (0.01% of rdg +3µV) ± (0.01% of rdg +3µV) ± (0.01% of rdg +6µV)
mV	0.0 to +1000.0	0.0 to +1000.0	100 µV	± (0.01% of rdg +40µV)
V	0.000 to +10.000	0.000 to +10.000	1 mV	± (0.02% of rdg +0.4mV)
mA	0.000 to +21.000	0.000 to +21.000	1 µA	± (0.02% of rdg +0.5 µA)
Ω (IN)	0.0 to 400.0 Ω	0.0 to 400.0 Ω	10 mΩ	± (0.02% of rdg +38mΩ)
Ω (OUT)	0.0 to 400.0 Ω	0.0 to 400.0 Ω	10 mΩ	± (0.03% of rdg +78mΩ)

Note:
- Accuracy shown are based on tests at 23°C ±5°C for 360 days
- All Input ranges: additional error ± 1 digit
- Traceability chart to WECC or SIT available on request

2 GENERAL FEATURES

2.1 Input and output flexibility

Advanced flexibility of performance has been achieved using microprocessor technology. Each instrument, through a menu-driven procedure, allows measurement or simulation of mV, V, mA, Ω, or any normalized IEC, DIN and JIS thermoelectric sensor J, K, T, R, S, B, C, U, L, N, E, F, G, D, Pt100, Ni100 and Ni120.
The microprocessor performs automatic polynomial linearization and cold junction compensation to assure high accuracy. °C or °F selection can be made through a reconfiguration set-up.

2.2 Self calibration

The hardware-firmware design allows an automatic calibration of the instrument. A precision source (from 0 to 10V), a 0°C reference system, a standard resistor of 400Ω (±0.02% accuracy) and an ohmmeter are necessary. The calibration procedure is protected by a security code.

2.3 Keyboard

A thermoformed metal-click tactile polycarbonate membrane keyboard, with a working life of one million operations per key, seals the internal electronics from the surrounding environment.
Contact closure of membrane keys is acknowledged, as a coded signal, directly by the microprocessor. Two membrane slidewires (patent pending) allow operator setting of the simulation value.

2.4 Display

The high contrast alphanumeric LCD display with dot matrix (7x5 dots per character-16 characters) allows easy readings, even in poor light conditions, and simultaneously indicates the active function (measured or simulated), engineering unit and type of sensor or signal.

2.5 Digital interface

A digital interface with TTL logic levels is available as standard for communication with external units.
A serial data port provides communication capability at a logic level of 0-5V (four wires: Tx, Rx, GND, Vcc).
A seven-pole cable, with mini DIN connector is supplied as a standard accessory, and a TTL to RS 232 adaptor is available as an option.

2.6 Scale factor function

Easy menu-driven set-up to read or simulate electrical signal value in terms of engineering units. Four programmable alphanumeric characters are available on the display to show the symbol of the parameter (i.e. mbar, %RH, %CO, etc.). The display will indicate the scaled input/output value.

2.7 Square root function

Can be programmed during the set-up procedure (e.g. linear ranges only) to obtain direct readings of flow from a dP transmitter signal. The display limits are 0 and +2500.

2.8 Average measurements

For the measurement of unstable input signals by a progressive averaging of a programmable number of conversions.

2.9 Simulation programs

Menu-driven set-up to generate:

10

- a continuous or step ramp output where the total time, the start point, the end point and the size of the step are requested by the set-up procedure to run the program;
- a manual repeat increment through keyboard;
- an automatic sequence of up to 60 stored values (20 groups of 3 memories).

2.10   Case

The case is designed for easy hand held operation and transportation.
The body is injection moulded, shock-resistant ABS with internal metal coating .
A leather carrying case with shoulder strap is supplied with the instrument as a standard accessory.

3   PHYSICAL DESCRIPTION

The **CL526** portable calibrator consists of a rugged and compact case, a mother board with all base functions, a daughter board for the auxiliary functions, a tactile membrane keyboard, an LCD display and a group of four nickel-cadmium rechargeable batteries.
The internal surface of the case is metal coated to improve the characteristics of electrical noise shielding and thermal equalization of all internal circuits.
The battery container is located on the lower part of the case, and is accessible through a cover fastened by a metal screw.
The two halves of the case are joined together by four metal screws located on the back side.
The leather case, with shoulder strap, assures better protection of the instrument against mechanical knocks or scratches.

4 FUNCTIONAL DESCRIPTION

The **CL526** portable calibrator block diagram is shown below.
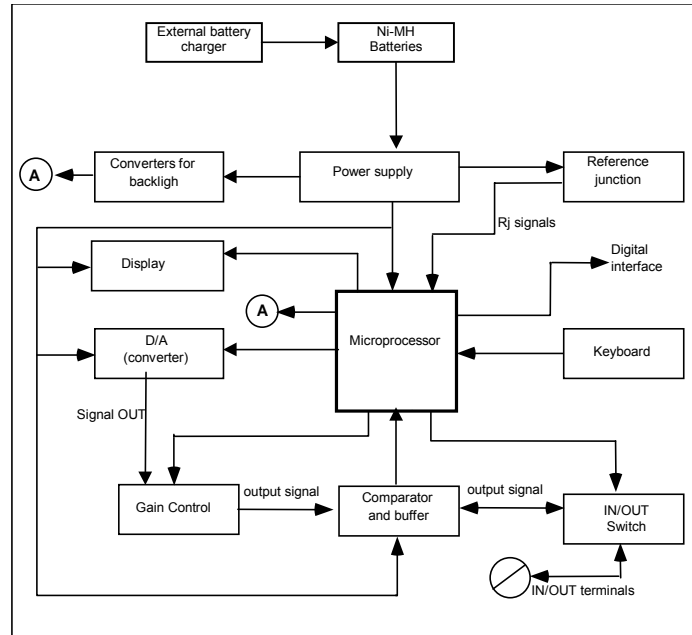
- **power supply**
- **microprocessor (central unit + memory)**
- **input circuit**
- **cold junction compensator (Rj)**
- **LCD display**
- **operative keyboard**
- **digital to analog converter**

4.1 Power supply

The instrument is powered, if not otherwise specified with the order, by four internal batteries that can be recharged through an external charger module supplied as a standard accessory.
The internal batteries are Ni-MH rechargeable AA type with a nominal voltage of 1.25 V. The jumper "J1" (mounted on the mother board), when soldered into the "B" position, allows the instrument to be powered by the four internal rechargeable batteries or, if needed, directly from the power line. The voltage of the four batteries in series (approximately 5V) is connected to the input of a hybrid circuit.
Pressing the <**ON**> key will provide the two levels of voltage for the circuitry of the instrument:

       + 5 V for logic and analog circuits
       - 5 V for analog circuits

The second section, on the power supply circuit, is configured as a voltage multiplier generating for the final output stage, a voltage of 24V dc. The above voltage levels are required to work with an external resistance of 1000Ω maximum when in current simulation mode (20 mA - 20 V). During operative modes, other than current simulation a diode de-energizes the hybrid circuit reducing the overall power consumption.
Recommendations and instructions to convert the instrument for a power supply with normal alkaline batteries are described in par. 8.3.

4.2 Keyboard

The front panel is a tactile polycarbonate membrane keyboard, and has a working life of one million operations per key.
The contact closure of the membrane keyboard is acknowledged as a coded signal by the microprocessor that recognizes the operators instructions.
Keys are interconnected on a 4x3 matrix; the microprocessor identifies directly the active key.
The values of the **<▲>** and **<▼>** keys (membrane slidewires) are acknowledged through the converters built in the microprocessor chip.

ON	Power ON switch
OFF	Power OFF switch
IPTS68-ITS90	Temperature Scale selection
Rj	Reference junction internal-external selection
<▲> <▼>	Membrane slidewires to set the simulation value (to scroll the menu of input tables and library of engineering characters).
STORE	Memory load
<←> <→>	Parameter selection or decimal point position
START	Low limit setting of the simulation cycle
END	High limit setting of the simulation cycle
STEP	Step value setting of the simulation cycle
MODE	Simulation cycle mode selection
SOAK	Soak time setting of the simulation cycle
TIME	Total time setting of the simulation cycle
0, 1, 2	In/Out memories
°C/°F	Technical unit selection
SELECT	Parameter selection procedure
AVERAGE	Average measurements
IN/OUT	In/Out mode selection
CONVERT	Technical unit to equivalent electrical signal
AUTORAMP	Ramp program start
PROGRAM X	Scale factor program
BATTERY	Battery voltage indication
ENTER	Memory load key
SHIFT	Key secondary function
LAMP	Display backlight switch (special - only on request)

4.3   Input circuit

The input circuit is based on an output buffer wired as an error amplifier. The input signal drives the negative channel (-) of the integrated circuit.

14

The microprocessor recognizes if the D/A converter is generating a voltage signal higher or lower than the input signal and gives correcting instructions to keep the input amplifier output on the nearest value to zero. In the above conditions the microprocessor acknowledges the value of the input signal as equivalent to the setting of the digital to analog converter.
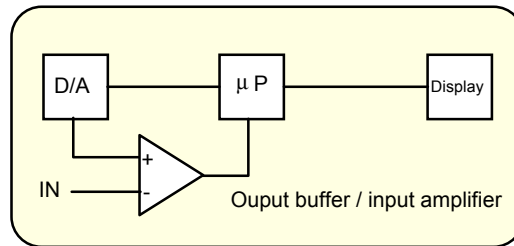
4.4 Microprocessor

The microprocessor handles all the logic functions of the instrument, performs the linearization for non linear transducers, compensates for the reference junction temperature, drives the digital display and acknowledges all operator instructions.
The heart of the circuit is a single-chip microcomputer that utilizes HCMOS technology to provide the low power characteristics and high noise immunity of CMOS plus the high speed operation of HMOS.
The microcomputer provides highly sophisticated, on- chip peripheral functions including: 256 bytes of static RAM, an 8 channel analog to digital (A/D) converter (used to read the Rj value, the setting of the input comparator, the battery package voltage and the value of the two membrane slidewires), a serial communication interface (SCI) subsystem, and a serial peripheral interface (SPI) subsystem.
The microprocessor works with an 8-bit communication bus to the EPROM and EEPROM memories and is interfaced with a decoder, a latch of address and an inverter-driver.

4.5 Firmware

The operating system firmware handles all logic instructions to the internal peripheral circuits and performs the computation of the linearization equations.
The application system firmware is resident on the non-volatile memory (EEPROM) of the microprocessor chip. It is used to store the installation parameters (autocalibration data, programs data, etc.)

4.6 Digital display

The digital display, mounted on an auxiliary board, uses high contrast LCD technology (STN liquid). Character generation is made by a secondary dedicated microprocessor driven by two integrated circuits with signal input from the bus of the main microprocessor.
The 16 characters are displayed with a 7x5 dot matrix. On request, **CL526** can be equipped with a backlight device for easy readings in poor light conditions.

4.7 Digital to analog converter

A 14-bit digital to analog device, driven directly by the microprocessor converts the digital value of the selected parameter into an analog current output.
The current signal is converted into a voltage signal across a resistance strip network.
Two low thermal emf relays select one of the four available output points as a function of the selected range. The ranges are:

-18	to	+22 mV	Tc type R, S, B, T and the negative portion of all Tc's
-0.2	to	+54 mV	all other thermocouples
-0.2	to	+100,1 mV	100 mV range and Rtd
-2	to	+1001 mV	1000 mV range and 0-20 mA range
-0.02	to	+10.010 V	10 V range

The above signal, through an output buffer, is sent to an integrated circuit that will generate the voltage or current requested by the operator keyboard settings.

15
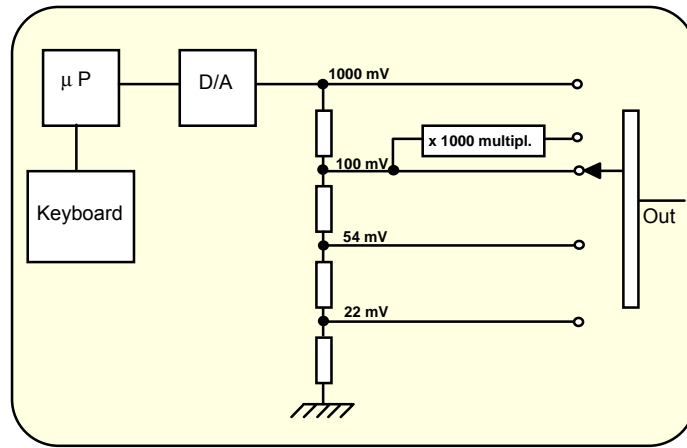
4.8   Battery charger. Operation from line source

ATTENTION: ONLY FOR USE WITH NI-MH BATTERIES.

The auxiliary module, supplied as a standard accessory, allows operation from 110-120 Vac or 220-240 Vac 50/60 Hz. The calibrator, if needed, can be operated directly from a line source through the charger. The plastic case of the battery charger incorporates the line voltage plug and a cable with connector for interconnection to the instrument. The charger circuit is designed with an insulating transformer and a voltage stabilizer circuit.
The step-down transformer reduces the power line (110-120 Vac or 220-240 Vac nominal) to a value of 10 Vac. The above voltage is full wave rectified, filtered and stabilized. The output voltage of 6,6 V is the ideal value to recharge the internal Ni-MH batteries.

4.9   Digital interface

The digital interface circuit is essentially based on the serial communication interface subsystem (SCI) on the chip of the microprocessor at 0 to +5V level.
An adaptor to convert TTL to RS 232 voltage levels can be obtained on request.

4.10   Resistance and Rtd measurements

The resistance thermometer (Rtd) is connected to terminals A-B-C in a 3-wire configuration (see figure on the next page).
Two constant current generators are provided by the auxiliary module for supplying the Rtd.
The first half of "IC1" generates the negative current I_A= - 0.25 mA that flows from terminal B to terminal A through the Rtd and line resistances RLA and RLB. I_A is kept constant by the microprocessor that controls the zero voltage level.

The second half of "IC 1", with the associated resistors, generates the positive current I_C that flows from terminal C to terminal B through line resistances RLC and RLB. Current I_C is kept exactly = 2 x I_A, so the resultant current I_B = I_C - I_A flows through RLB. The input measured signal across terminals A and B is the algebraic sum of drop voltages across Rtd and line resistances RLA and RLB. As drop voltages across RLA and RLB are exactly the same (providing that line resistances RLA and RLB are equals), but with opposite poles, the resultant voltage across terminals A and B is proportional to Rtd resistance variation, with no influence of line resistance.
The measured signal is then handled by the microprocessor that linearizes it and displays the corresponding value in engineering units.

16
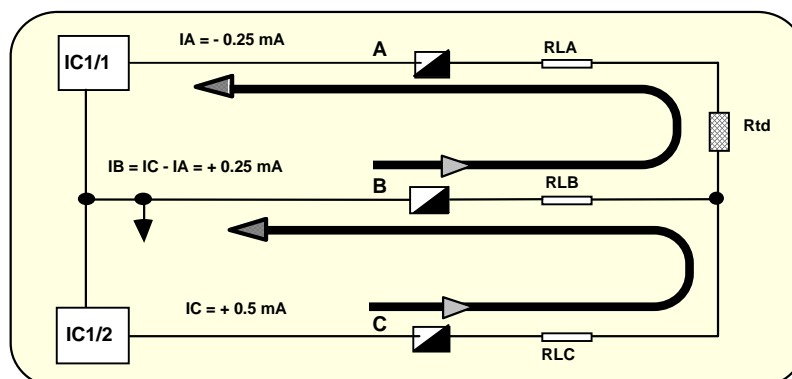
4.11   Resistance and Rtd simulation

CL526 portable calibrator is equipped with an electronic circuit for the active simulation of platinum and nickel resistance thermometers and resistances.
It is based on the assumption that the instrument to be calibrated will supply the excitation current to the sensor; this current must be between 0.2 and 5 mA (typical working values).
A lower value will generate an insufficient precision level and a higher current won't permit the simulation of high resistance values (maximum voltage drop on the simulated resistance is 2 V).
The excitation current must be applied to the pertinent terminals as indicated in par. 7.1 (simulation).
That current, flowing through resistance " Ra" (precision ± 0.01%) will generate a voltage drop that will be amplified and sent to the D/A converter. The output amplifier will simulate the variation of the output resistance as a function of the value set by the operator through the keyboard.
The connection between "+" and "-" terminals must be left open.
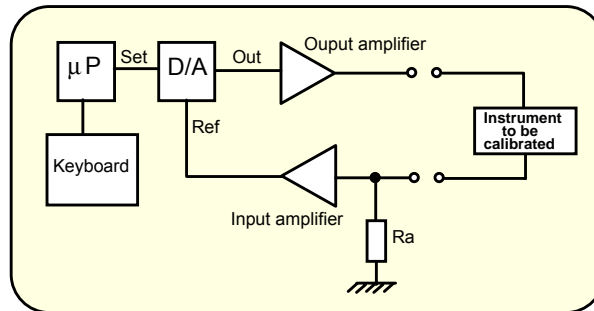
4.12   Thermocouples input-output circuit

A thermocouple, a temperature sensor, in its most common form consists of two wires of different composition, joined together at one end. The two wires are joined together at two points which have different temperatures.
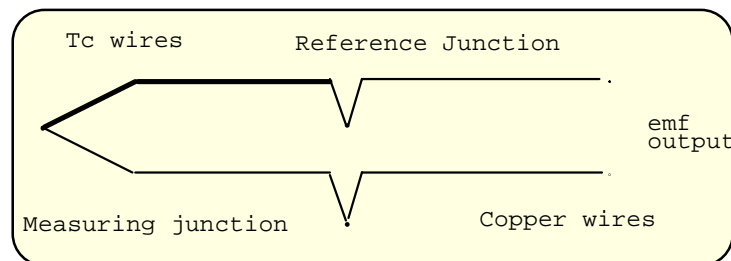
The reference junction is also often, but less preferably, called the "cold" junction.
The   temperature   of   the reference junction can be held   constant or its variation electrically compensated in the associated measuring instrumentation.
The second junction is the measuring junction (or "hot" junction).
A thermocouple is a practical tool for temperature sensing because it generates a measurable electrical signal.
The signal is proportional to the temperature difference between the measuring and reference junctions and is defined, by means of tables, based on the International Practical Temperature Scales (IPTS68 or ITS90).
The portable calibrator **CL526** has the reference junction located in the negative (black) terminal post. To improve overall accuracy the terminals are designed with a very low thermal capacity.
Inside the body of the negative terminal is placed a thin film Pt100 resistance thermometer that dynamically measures, with high accuracy, the temperature of the reference junction.
The microprocessor uses the above signal (Pt100) to adjust the input signal to compensate for the Rj temperature.
Reference junction compensation can be internal or external, depending upon the application requirements.

17

5   UNPACKING

Remove the instrument from its packing case and remove any shipping ties, clamps, or packing materials.
Carefully follow any instructions given on any attached tags.
Inspect the instrument for scratches, dents, damage to case corner etc. which may have occurred during shipment.
If any mechanical damage is noted, report the damage to the shipping carrier and then notify OMEGA directly or its nearest agent, and retain the damaged packaging for inspection.
A label, inside the battery container, indicates the serial number of the instrument.
Refer to this number for any inquiry for service, spare parts supply or application and technical support requirements.
OMEGA will keep a data base with all information regarding your instrument.

6   PRE-OPERATIONAL CHECK

The **CL526** portable calibrator is powered by four Ni-MH rechargeable batteries.
The external battery charger, supplied as standard, may be ordered for either 110/120 Vac or 220/240 Vac power source. To modify the charger's power voltage follow the instructions in par. 8.2.
Before using the instrument carefully verify the nominal voltage value of the charger; in case of modification do not forget to correct the pertinent label.
The instrument should be used in environments where the temperature does not exceed the specified limits (from -5°C to +50°C) and where the relative humidity is lower than 95%.


```
Out 1248.3°C ▯Tc
```
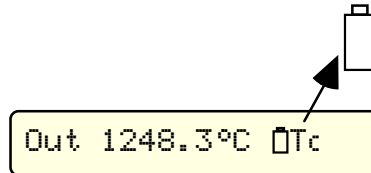
In case of "low" battery condition (voltage lower than 4.6 V) the display will show the appropriate symbol. An empty symbol means that the battery package has enough energy for about 30 minutes operation. A black symbol means that batteries charge is below the minimum acceptable level: operation of the instrument is no longer possible. In this condition the instrument batteries must be recharged.

WARNING

THE INSTRUMENT IS SUPPLIED WITH NI-MH RECHARGEABLE BATTERIES.
DO NOT USE NORMAL ALKALINE BATTERIES.
ALKALINE BATTERIES, WHEN CONNECTED TO A DC VOLTAGE SUPPLY UNDERTAKE AN OVERHEATING PROCESS WITH A RISK OF EXPLOSION.

19

7   ELECTRICAL CONNECTIONS

Appropriate extension wires should be used between the thermocouple (or instrument under calibration) and the **CL526** unless the thermocouple leads permit direct connection.
Make sure that both thermocouple and compensating cable are connected with the correct polarity.
If in doubt, the polarity of the compensating leads can be checked by connecting a length of lead to the indicator, shorting the free ends of the wires together and noting that the indicator reading increases when the wires connection is heated.
Color codes of compensating cables change in different countries. Check the appropriate table.
For Rtd connection use a cable of adequate gauge to lower the overall input resistance.
The use of a cable with a good resistance balance between conductors is also necessary.

Table A
Colour code & polarity for extension wires

Thermocouple			Wires	Colour code
E	Chromel	(+)	Chromel	Purple
	Constantan	(−)	Constantan	Red
J	Iron	(+)	Iron	White
	Constantan	(−)	Constantan	Red
K	Chromel	(+)	Chromel	Yellow
	Alumel	(−)	Alumel	Red
R	Pt 13% Rh	(+)	Copper	Black
	Platinum	(−)	Alloy 11	Red
S	Pt 10% Rh	(+)	Copper	Black
	Platinum	(−)	Alloy 11	Red
T	Copper	(+)	Copper	Blue
	Constantan	(−)	Constantan	Red
B	Pt 6% Rh	(+)	Copper	
	Pt 30% Rh	(−)	Copper	
N	Nicrosil	(+)	Nicrosil	Orange
	Nisil	(−)	Nisil	Red

7.1   Wiring practice

Although the **CL526** portable calibrator is designed to be insensitive to transients or noise, the following recommendations should be followed to reduce ac pick up in the signal leads and to ensure good performance.
The input leads should not be run near ac line wiring, transformers and heating elements.
Input/output leads should, if possible, be twisted and shielded with the shield grounded at the end of the cable.
When shielded cables are used the shield must be connected to the positive terminal.
Above figure shows some examples of input/output wiring and connections.

Examples of input /output wiring and connections

MEASURE CH1   SIMULATION CH1

Thermocouples, mV   Thermocouples, mV
mA Active loop   mA Active loop

```
+        -        +PS          +        -        +PS
                  +IN                            +IN
-                 -IN          -                 -IN
                  RTD                            RTD
```

mA Passive Loop   mA Passive Loop

```
+        -        +PS          +        -        +PS
                  +IN                            +IN
-                 -IN          -                 -IN
                  RTD                            RTD
```

Rtd (2 wire)   Rtd (2 wire)

```
                  +PS                            +PS
         -        +IN                   -        +IN
                  -IN                            -IN
                  RTD                            RTD
```

Rtd (3 wire)   Rtd (3 wire)

```
                  +PS                            +PS
         -        +IN                   -        +IN
                  -IN                            -IN
                  RTD                            RTD
```

Rtd (4 wire)   Rtd (4 wire)

NOT CONNECTED

```
                  +PS                            +PS
         -        +IN                   -        +IN
                  -IN                            -IN
                  RTD                            RTD
```
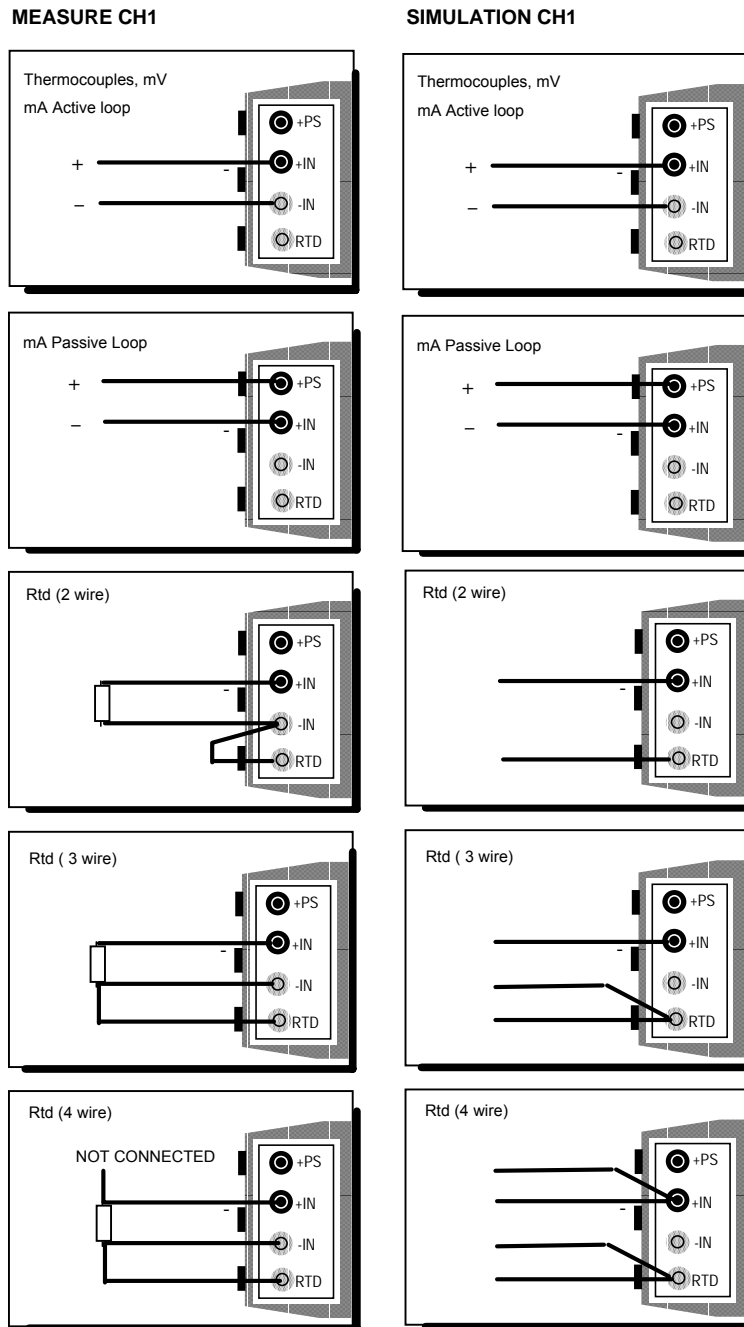
7.2   Thermocouple wires

When making measurements where additional wires have to be connected to the thermocouple leads, care must be exercised in selecting these wire types, not only where they are claimed to be of the same composition as the thermocouple involved, but, also, of their "quality".
Performance results where high precision is required and in circumstances where some types of thermocouple wire leads are added to the original installation should be reviewed carefully for the impact of the choice of the additional wire leads.
The quality of thermocouple wire is established by the limit of error to be expected with its use.
There are three recognizable levels of quality:
- Special or Premium grade
- Standard grade
- Extension wire grade

The error limits determining the grade quality differ from thermocouple type to thermocouple type, reflecting the degree of difficulty in maintaining the precise levels of purity of the metal used.

21

The table below summarizes the error limits for Premium and Standard grades, while Extension grade wire is characterized by limits of error exceeding those in the table.
Errors up to ±4°C may be experienced when using Extension grade thermocouple wire for J and K thermocouples.

Limit of Error of thermocouple wires

The range indicated is the temperature limit for the indicated errors Cold junction at 0 °C

Tc	Class 1	Class 2	Class 3
type T	0.5°C (-40 to +125°C)	1°C (-40 to 133°C)	1°C (-67 to 40°C)
	0.004 . T (T >125°C)	0.0075 . T (T >133 °C)	0.015. T (T <-67°C)
T range	-40 to +350°C	-40 to +350°C	-200 to 40°C
type E	1.5°C (-40 to 375°C)	2.5°C (-40 to 333 °C)	2.5°C (-167 to +40°C)
	0.004.T (T >375°C)	0.0075.T (T >333°C)	0.015.T (T <-167°C)
T range	-40 to 800°C	-40 to 900°C	-200°C to 40°C
type J	1.5°C (-40 to 375°C)	2.5°C (-40 to 333 °C)	2.5°C (-167 to +40°C)
	0.004.T (T >375°C)	0.0075.T (T >333°C)	0.015.T (T <-167°C)
T range	-40 to 750°C	-40 to 750°C	-----
type K e N	1.5°C (-40 to 375°C)	2.5°C (-40 to 333 °C)	2.5°C (-167 to +40°C)
	0.004.T (T >375°C)	0.0075.T (T >333°C)	0.015.T (T <-167°C)
T range	-40 to 1000°C	-40 to 1200°C	-200°C to 40°C
type R e S	1°C (0 to 1100°C)	1.5°C (-40 to 600 °C)	4°C (600 to +800°C)
	1 + 0.003 (T-100)	0.0075.T (T >600°C)	0.005.T (T>800°C)
	(T >1100°C)		
T range	0 to 1600°C	0 to 1600°C	----
type B	1°C (0 to 1100°C)	1.5°C (-40 to 600 °C)	4°C (600 to +800°C)
	1 + 0.003 (T-100)	0.0075.T (T >600°C)	0.005.T (T>800°C)
	(T >1100°C)		
T range	-----	600 to 1700°C	600 to 1700°C

8   POWER SUPPLY

8.1   Rechargeable batteries

The **CL526** portable calibrator is powered by four built-in rechargeable batteries. The instrument is shipped with an average level of charge. After unpacking, a full charge of the batteries is recommended; connect the instrument to the charger module ("OFF" condition) for a period of 10 hours minimum.
The Ni-MH rechargeable batteries do not suffer when used in cyclic operations.
Cyclic operation is understood as a method of operation by which the battery is continually charged and discharged.
Note that a battery, at its lower limit of discharge, risks a non uniform cell polarization: this condition makes it difficult to recharge with the charger supplied.
Avoid leaving the instrument, with batteries totally or partially discharged, for a long time without recharging.
To charge the batteries use only the original supplied charging module. The module incorporates protection and current limiting devices not normally found in other commercial chargers.
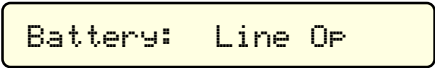
- When the **CL526** is connected to the battery charger module, by pressing keys <**SHIFT**> + <**BATTERY**> the following indication will be displayed:

> Battery: Line Op

If a numeric value appears, it indicates that the charger is probably faulty.
Replace the battery charger module; if the indication persists, contact **OMEGA** -Technical Assistance Dept.

WARNING:

AVOID USING ALKALINE BATTERIES ON AN INSTRUMENT SET FOR NI-MH RECHARGEABLE BATTERIES.
THIS IS EXTREMELY DANGEROUS AS IT COULD CAUSE THE ALKALINE BATTERIES TO EXPLODE.

8.2   Battery Charger

The external battery charger is configured, before shipment, for a supply voltage of 110-120 Vac or 220- 240 Vac, upon order specification. The nominal voltage value is indicated on the front label of the charger. Check for the correct input voltage before connect it to the line.

8.3   How to maximize the battery life

Disconnect the ac mains supply when the battery is charged. Use the battery until it is completely discharged.
Leaving the ac mains supply plugged in will decrease the life of the battery.
Keeping the battery terminal clean will help maximize the operating time. Periodically wipe the positive and negative terminals with a dry cloth.
Removing and replacing the batteries will ensure electrical contact. This should be done when using a battery that has not been used for a long time.
Note that the operating time decreases at low temperatures.
A Ni-MH battery can be recharged about 500 times when used with the recommended instructions.
When replacing the Ni-MH batteries with a new set always replace simultaneously the four pieces.

9 OPERATION & APPLICATIONS
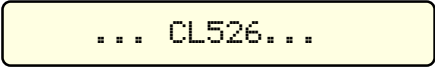
9.1 Power ON

ATTENTION: ALL VALUES IN THE FOLLOWING FIGURES ARE ONLY LISTED AS AN EXAMPLE.

During set-up and load memory remember that the instructions of the manual related to key operation have the following meaning:

<A> + <B>   Press the **<A>** key and keeping the pressure on the key, press then the **<B>** key.
<A> , <B>   Press in sequence, first the **<A>** key and then the **<B>** key.

- To power the instrument press the <**ON**> key; the indication :

```
   ... CL526...
```

will appear for a few seconds.
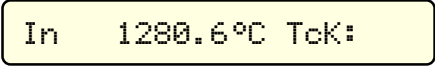
- The instrument runs an autodiagnostic routine for the self-checking of critical circuits and components.

- A positive check will be shown with the indication

```
Test OK Ver 7.001
```

for about one second.

- The number on the right side of the display indicates the version of the memory installed on the instrument.

- The instrument is ready for measurement (IN mode) with the previously selected operating mode, as indicated below:
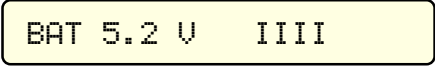
```
In   1280.6°C TcK:
```

Any faulty conditions that may be indicated are described in par. 8.9.
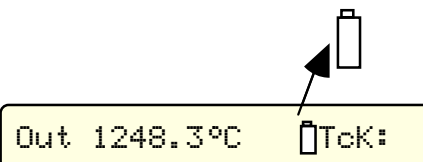
9.2 Battery voltage indication

- To recall the battery voltage on the display press the **<SHIFT> + <BATTERY>** keys. The indication will be as follows:

```
BAT 5.2 V   IIII
```

- The horizontal bar indicates the level of charge of the battery (each bar is equivalent to 25% of the full capacity)

- The "low" limit of the battery voltage, for the correct operation of the instrument, is +4.6V.

- Press any key to reset the operative mode.

- During normal operating modes (measure or simulation), "low battery" condition will be shown as follows:

```
Out 1248.3°C  TcK:
```

The battery symbol indicates that the battery has enough energy for about 30 minutes operation.
A black symbol means that battery charge is below minimum: batteries must be recharged.

9.3 Operating mode set up

To select the required operating mode follow the procedures indicated below.

24

9.3.1   IN - OUT mode selection

- Press the **<ON>** key to power the instrument.

- After diagnostic routine, the calibrator will be forced into the "IN" function with the active parameter previously selected (i.e. with the indication of a measured value of +1032 °C with thermocouple type "K").

```
In  1032.2°C  TcK:
```

- Open input terminals will cause a fluctuation of the reading up to "Underflow " or "Overflow" conditions.

- To select the simulation mode press the <**IN-OUT**> key (the indication will be for example, relative to a simulated value of 0 °C for a thermocouple type "K").

```
Out    0.0°C  TcK:
```

- The output value can be programmed using the two membrane slidewires (<▲> and <▼> keys).

- Keep the key pressed to cause a continuous variation of the simulated value; the speed of variation will change by moving the pressure to the extremity of the keys.

- By touching a point, near the two central zones, the value will increase or decrease by one single digit.

- Press simultaneously <▲> and <▼> cursor slidewires to set the simulated value to zero.

9.3.2   Parameter or sensor selection

To select the electrical parameter or the sensor required by the application, in any measuring or simulation mode, follow the procedure indicated below.

- Switch the instrument -ON-

- Press the <**SELECT**> key : the display will show one of the following menu pages:

```
Tc  J K T U L N E
```

```
Tc  R S B C F G D
```

```
Pt100   IEC JIS US
```

```
ni100  ni120  Ohm
```

```
mV V mA  Xscaling
```

- Press <▲> or <▼> cursor slidewire to select the appropriate page.

- Select the required parameter or sensor, by moving left or right the flashing cursor with keys <◄> or <►> (eg. to activate the thermocouple type T choose the page and cursor position as indicated below).

```
Tc  J K T U L N̄ E
```

- Press the <**ENTER**> key to memory load the selection; the instrument will return to the previous operative mode with the new selected electrical signal or sensor.

- By pressing the <**SELECT**> key, instead of <**ENTER**>, the instrument will not acknowledge any variation and return to the previous parameter or sensor.

25

9.3.3   Tecnical unit

- To change the technical unit from °C to °F (or viceversa) follow the procedure indicated below:
  Instrument operative in -Out- mode as follows:

```
Out        0.0°C TcK:
```

- Switch the instrument -OFF-

- Keep pressed the <**SELECT**> key and switch the instrument <**ON**> obtaining the following reading:

```
In         10.0°F TcK:
```

- Use the same procedure to return in °C switching the instrument -Off-

- Press the <**SELECT**> + <**ON**> key to read:

```
In        -12.0°C TcK:
```

9.3.4   Decimal point position

The decimal point position, to increase or decrease the resolution upon the application, is made by pressing keys <◄> or
<►>.
The instrument will automatically convert values in °C or °F from decimal to integer (and viceversa) when they are in the
range limits stated in par. 1.2.1.
On mV or V mode one of the following decimal point positions can be obtained:

          0.000   V
          0.0   mV
          0.00   mV
          0.000   mV

Decimal conversion is not possible for the mA mode (always with three decimal points).

9.3.5   International Temperature Scale

The memory of the instrument stores both linearisations of the old International Practical Temperature Scale of 1968
(IPTS68) and the new International Temperature Scale of 1990 (ITS90).
The active linearisation is indicated on the right side of the display as follows:
       ❏   IPTS 68
       ■   IPTS 90

- The change from one scale to the other is possible directly from the keyboard:

- Press <**SHIFT**> + <**ITS**> keys

9.3.6   Rj mode

The instrument can operate with an internal automatic cold junction (Rj) compensation or a remote programmable from -
50 to 100°C.
The active Rj compensation mode is indicated on the right side of the display as follows:
       ❏   internal automatic
       ■   external programmable

- To change the reference junction (Rj) compensation mode, press <**SHIFT**> + <**Rj**> keys.

9.3.7   Convert function

The "convert" function allows readings of the electrical signal equivalent to the technical unit indication. Can be used in
both -IN- or -OUT- mode for thermocouples, resistance thermometers and x scaling.

26

- To "convert" the type of indication, with the instrument operative in any of the above indicated modes, press **<SHIFT> + <CONVERT>** keys obtaining for example the following indications:

```
Out   100.0 °C TcK
```

- Press <**SHIFT**> + <**CONVERT**> keys to obtain the equivalent mV indication:

```
Cvt   3.185
```

```
In    100.0 °C Pt
```

- Press <**SHIFT**> + <**CONVERT**> keys to obtain:

```
Cvt   138.0
```

- To return in technical unit indication press the **<ENTER>** key.

9.3.8   Average readings

The use of the "Average" function is advised with unstable input signals.
The average represents a progressive integration of the input signal.

- To enable the "Average" mode press keys **<SHIFT> + <AVERAGE>**: the display will show:

```
Avg   128.6°C TcK :
```

- To disable the " Average " function press again **<SHIFT> + <AVERAGE>** keys.

9.3.9   IN-OUT data memories

The availability of 60 slots of memory represents an important feature both either in simulation and/or in measurement modes.
In the measurement mode it can be useful to store a number of input values pertinent to special test conditions.
In the simulation mode, the permanent availability of 60 calibration values can be useful, eg. during the calibration of the scale of different recorders.

9.3.9.1   Data memory configuration

- To store each memory slot press keys:

    <SHIFT> + <0>

    <SHIFT> + <1>

    <SHIFT> + <2>
The following data is stored:
  - operative mode
  - measured or simulated value:
  - decimal point position (eg. 0.1°C or 1°C)
  - °C or °F technical unit
  - internal or external Rj mode
  - type of sensor or selected parameters: (eg thermocouple type)
  - International Temperature Scale (IPTS68 or ITS90)
  - 60 memory slots are available.

Memory slots are split in 20 groups each of three memories for a total of 60 memories.
Each group is identified by a letter:

   group **A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T.**

27

To select the required group follow the procedure indicated below:

- Press the **<SELECT>** key to obtain one of the menu pages

- Press the **<0>** key to obtain the following indication:

```
Sel STO  Group: A
```

- Press the <▲> or <▼> key to select the required group number

- Press the **<0>** key to confirm the selection and to return to the previously selected operative mode.

9.3.9.2   Data memory manual recall

To recall data memory values, select first the appropriate or required group number and press then the **<0>, <1>,** or **<2>** key.

9.3.9.3   Data memory automatic scanning

The 60 stored items of data can be assigned, besides the group number, to a pre-programmed sequence.
The programmed sequence (a number of calibration points, or a number of data items to be supervised), includes a linear sequence of memory starting from a "start" point and ending with a "end" point".
Memory for seven different pre-programmed sequences are available and the procedure is indicated below.
The numerical value and the parameter indicated below are an operative example eg. to memory load 5 calibration points of a scale of a potentiometric recorder (temperature with a thermocouple type K).

1 =   -50°C
2 =   0°C
3 =   +100°C
4 =   +200°C
5 =   +500°C

As described in par. 8.6.9.1 memory store the calibration data as follows:

```
point 1 =    memory 0 - group A
point 2 =    memory 1 - group A
point 3 =    memory 2 - group A
point 4 =    memory 0 - group B
point 5 =    memory 1 - group B
```

The simulation program set-up procedure is now required.

- Press the **<SELECT>** key to obtain one of the menu pages

- Press the **<1>** key to obtain the following indication:

```
SEL Program  # 1
```

- Press the **<▲>** and **<▼>** keys to enter the program number required (1 to 7)

- Press the **<1>** key to confirm the selection of the program number and to return to the indication of one of the menu pages

- Press the **<2>** key to obtain the following indication:

```
Prog #1   from A1
```

- Press the **<▲>** and **<▼>** keys to select the "start" group/memory (eg. A1)

- Press the **<2>** key to confirm the "start" point obtaining the following indication:

```
Prog #1    to A2
```

- Press **<s>** and **<t>** keys to select the "end" group/memory (eg. A2)

28

- Press the **<2>** key to confirm the selection and to return to the menu page

- Press the **<AUTORAMP>** key to obtain one of the following indications:

```
Sel : Program
```

- Select with <▲> and <▼> keys the required "Sel:program" page

- Press the **<AUTORAMP>** key to confirm the selection and to return to the menu page

- Press the **<SELECT>** key to memory load the program and to return to the operative mode

9.3.9.4   Manual step advance

To run the program with manual step advance, press the **<AUTORAMP>** key obtaining the following indication (as per example indicated at par. 8.6.9.3)

```
.A0    -50  TcK :
```

The symbol on the left of the display has the following meaning:
  O   =   output
  I   =   input

- Press the **<AUTORAMP>** key to advance one step of the program. After the "end" point (n.5 in the example - B1) the manual sequence will start again from the point 1.

- To go back to the previous step press **<ENTER> + <AUTORAMP>** keys

- Press the <▲> or <▼> or **<SELECT>** or <◄> or <►> key to exit the program

9.3.10   Automatic simulation cycle

The instrument can be programmed for simulating two types of pre-programmed continuous or step ramp output.
By programming the incremental steps to its minimum value (0.1 or 1 degree resolution) the step ramp can be assimilated to a continuous ramp.
Select first the technical unit (°C or °F), the type of thermocouple and then follow the procedure indicated below.
The procedure will consider a simulation in mV.

9.3.10.1   Simulation cycle selection

Two different automatic simulations identified as "Autoramp1" and "Autoramp 2" can be memory stored.
To select the required program press the **<SELECT>** key to obtain one of the menu pages.

- Press the **<AUTORAMP>** key to obtain one of the following indications:

```
Sel : Autoramp 1
```

```
Sel : Autoramp 2
```

- Press the <▲> and <▼> key to select the required Autoramp program

- Press the **<AUTORAMP>** key to confirm the selection and to return to the menu page indication

- Press the **<SELECT>** key to return to the operative mode

The automatic ramp cycle has the following behaviour

29
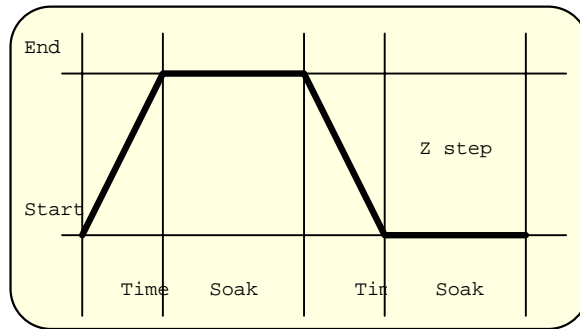
- To memory load the cycle parameters, follow the procedure indicated below

- Select the required tecnical unit or electrical parameters

- Select the required decimal point position

- Press **<SHIFT> + <TIME>** keys to enter the cycle set-up procedure obtaining the following indication

```
Time    0h   0m 50s
```

related to the "time" in hours, minutes and seconds. The maximum setting is limited to 5 hours 33 minutes   20   seconds (20.000 seconds)

- Press the **<START>** key to obtain the following indication:

```
Start        0.0mV
```

- Press the <▲> and <▼> cursors to set the "Start" level of the cycle

- Press <**ENTER**>+<**START**> keys to memory store the new value

- Press the **<END>** key to obtain the following indication:

```
End        100.0mV
```

- Press <▲> and <▼> cursors to set the "end" level of the cycle

- Press <**ENTER**>+<**END**> keys to memory store the new value

- Press the **<STEP>** key to obtain the following indication:

```
Step         1.0mV
```

- Press <▲> and <▼> cursors to set the size of each individual step. To have a continuous ramp set the minimum possible value (e.g. = 0.1)

- Press <**ENTER**>+<**STEP**> keys to memory store the new value

- Press the **<TIME>** key to obtain the following indication:

```
Time    0h   0m 50s
```

- Press <▲> and <▼> cursors to set the required ramp time - max. 5h-33m-20s (20000 seconds)

- Press <**ENTER**>+<**TIME**> keys to memory store the new value

- A setting of 0h-0m-00s allows a manual step advance each time the <**AUTORAMP**> key is pressed.

- Press the **<SOAK>** key to read the following indication:

```
Soak    0h   0m 50s
```

- Press <▲> and <▼> cursors to set the waiting time (or soak time). If the setting is 0h-0m-0s the waiting or soak time is excluded

30

- Press <**ENTER**>+<**SOAK**> keys to memory store the new value

- Press the **<MODE>** key to obtain one of the following indications:

```
Mode 1      ^ ramp
```
single cycle program

```
Mode 1      ^ ramp
```
repeated cycling program

```
Mode 1      1 ramp
```
single cycle program

```
Mode +      1 ramp
```
repeated rise ramp program.

- Press the <▲> or <▼> key to select the required program type.

- Press <**ENTER**> + <**MODE**> keys to memory store the new selection.

- Press the <◄> or <►> key to exit the set-up procedure.

9.3.10.2 Simulation cycle

- Press the <**SELECT**> key to obtain one of the menu pages.

- Press the <**AUTORAMP**> key to obtain one of the two following indications:

```
Sel : Autoramp 1
```

```
Sel : Autoramp 2
```

- Press <▲> or <▼> key to select the required program.

- Press the <**AUTORAMP**> to memory store the selection and to return to the menu page.

- Press the <**SELECT**> key to return to the normal operative mode.

- To run the automatic simulation cycle press the <**AUTORAMP**> key

- The display indicates the actual cycle position as shown below:

```
Prg        18.0mV
```

- On the repeated cycling to stop the program press <**SHIFT**> + <**AUTORAMP**> keys.

9.3.11   Rj compensation mode check

The internal/external reference junction compensation is only enabled for temperature measurement or simulation with thermocouples.

- During both simulation or measuring mode to check the type of reference junction mode previously installed press the <**SELECT**> key to enter the type of sensor or parameter selection menu page.

- Press the <**IN/OUT**> key to obtain the following indication:

```
RJ :    22.8°C int
```

The above reading indicates that the instrument is preset with an internal automatic reference junction compensation. The temperature indication is the value measured by the precision thin film resistance thermometer placed inside the In/Out terminal. If, instead of the code "int" the indication

```
RJ :       0.0°C ext
```

is displayed, it means that an external reference junction compensation has been selected for a temperature of 0.0°C (programmable from -50°C to +100°C).
The reference junction compensation mode can be reprogrammed as indicated in par. 8.5.6. The external reference junction compensation value can be programmed as indicated in par. 8.5.13.2.

9.3.12   Scale factor program

The "scale factor" mode is a method to read or to simulate electrical signals values in terms of engineering units.
The example explains the procedure of installing the "scale factor" function for the calibration of a potentiometric recorder with a scale from 0.0 mbar to 400.0 mbar corresponding to the required electrical linear input signal.

- Press <**SHIFT**> + <**PROGRAM X**> keys to enter the "Scale Factor" set-up procedure. The display will indicate the low end of the scale eg. in mbar.

```
LO:        0.0 Prog
```

- Press one of the <◄> or <►> keys if a decimal point shift is required.

- Press the <▲> or <▼> keys to adjust to the required value.

- Press the <**ENTER**> key to load in the memory the value and to advance the program one step: the display will indicate the full scale value of the technical unit (eg. mbar).

```
HI:      400.0 Prog
```

- Press the <**▲**> or <**▼**> keys to adjust the full scale value.

- Press the <**ENTER**> key to load in the memory the value: the display will indicate one of the menu pages as follows:

```
Type : 0-1000   mV
```

```
Type :  0-100   mV
```

```
Type :   0-10    V
```

```
Type :    1-5    V
```

```
Type :   0-400
```

```
Type :   4-20   mA
```

```
Type :   0-20   mA
```

- Select, through <**▲**> or <**▼**> keys, the required page and

- press the <**ENTER**> key to memory load the needed parameter. The display will indicate one of the two following pages:

```
Mode :     Linear
```

```
Mode :     Square
```

32

- Press the **<▲>** or **<▼>** key to select the required page.
- Press the **<ENTER>** key to memory load the selection.
- The program will advance to the next step with the indication :

```
WORD:              !
```

or from a previous set-up eg.

```
WORD:           mbar
```

This procedure allows the setting of four alphanumeric characters as a symbol of the measured or simulated parameter.

Library of characters

- By pressing keys **<◀>** or **<▶>** the needed character, identified by being underlined, will be activated.
- Press **<▲>** or **<▼>** keys to scroll the internal library of characters and symbols and select the pertinent one. (i.e. by a proper setting you can obtain words as indicated below)

```
WORD:           % RH
```

```
WORD:            psi
```

```
WORD:            hPa
```

If the application does not require a dedicated symbol, but the display of the electrical parameter (i.e. mV, mA, Ω), recall on the display the four blank spaces.

```
WORD:           _ _ _ _
```

- With a random display indication remember that the four blank spaces will be settable, through single digit setting, by pressing the **<▼>** key on its higher side, for a few seconds.
- Press the **<ENTER>** key to load in the memory the symbol.
- The "scale factor" mode will be activated as follows:
- Press the **<SELECT>** key to obtain one of the menu pages.
- Move the flashing cursor to the "X scaling" position

33

- Press the **<ENTER>** key to memory load the selection

- The display will indicate the scaled input/output value.

```
Out    105.8 mbar
```

9.3.13   Installation parameter procedure

- To enter this procedure press the **<ENTER>** + <**ON**> keys

- The display will indicate as shown below (the indicated numerical value is only an example).

```
CAL?   65388    N=0
```

- To exit from the procedure, in any of the following steps switch the instrument -Off-.

9.3.13.1   Firmware version code - Serial number

From the above step of the procedure it is possible to view the software version code .

- Press the **<IN/OUT>** key to obtain the following indication:

```
Ver2.000   #   65535
```
.

The reading on the display indicates that the instrument is equipped with a memory release code 2.000.
The above information is extremely useful to understand the update status of the instrument and to simplify information exchange with **OMEGA** engineers during repair or service operations.
The second number on the right side of the display is the Serial Number of the instrument.

- Press any key to exit the procedure with the following indication:

```
CAL?   65388    N=0
```

- Switch the instrument **-OFF-** to end the procedure.

9.3.13.2   External Rj compensation

To enter the External Rj compensation set-up start with the instrument switched -Off- and press <**ENTER**> + <**ON**> keys to obtain the following indication:

```
CAL?   65388    N=0
```

- Press the **<AUTORAMP>** key to obtain:

```
RJ :      0.0°C ext
```

- Set, with <▲> and <▼> keys, the temperature of the external Rj compensation (adjustable from -50°C to +100°C).

- Press the **<AUTORAMP>** key to memory load the new temperature value of reference junction compensation.

- To end this procedure switch the instrument **-Off-**

34
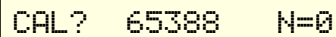
10   DIGITAL INTERFACE

The **CL526** portable calibrator is equipped with a digital interface. The interface circuit is essentially based on the serial communication interface subsystem (SCI) on the chip of the microprocessor. The output voltage levels are TTL at 0 to +5 V.
An optional adaptor to convert the voltage level from 0 to +5V to RS232 levels can be supplied on request. This adaptor is required to interface the CL526 with a Personal Computer.

10.1   Digital interface data program mode

- To enter the procedure, press the **<ENTER>** + **<ON>** keys. The display will indicate:

```
CAL?  65388    N=0
```

- To enter the program mode press the **<2>** key;

```
Baud Rate    19200
```

The numerical value of the "baud rate" can be one of the following : 19200, 9600, 4800, 2400, 1200, 600, 300
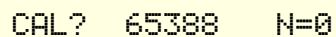
- Select, with the **<▲>** or **<▼>** key the "baud rate" used by the receiver unit and transmission lines.

- Press the **<2>** key to memory load the baud rate.

- The display will indicate:

```
ID-Name :        1
```

   The number represents the address code assigned to the instrument.

- Press the <▲> or <▼> key to select a number from 00 to 99.

- Press the **<2>** key to memory load the programmed value.

- The display will return to the original indication:

```
CAL?  65388    N=0
```

- To exit the procedure press the **<OFF>** key.

10.2   Digital output wiring practice

The wiring to the digital output signals is made through a mini DIN connector mounted on the lower end of the case.
The pertinent connections are indicated below.
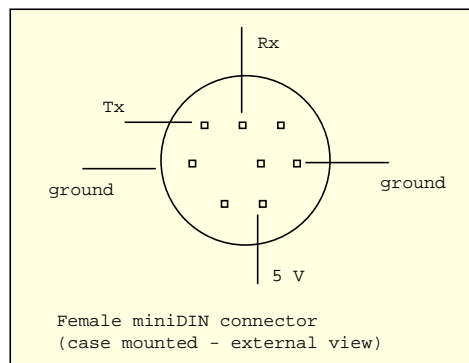
For easy interconnections a miniDIN connector with cable (cat. EE420123) con be supplied on request. The conductors color codes can change with different supplier; please check before using.

35

```
        6   5   4
        □   □   □

     □     □     □
     7     8     3

        □   □
        1   2
```

Front view
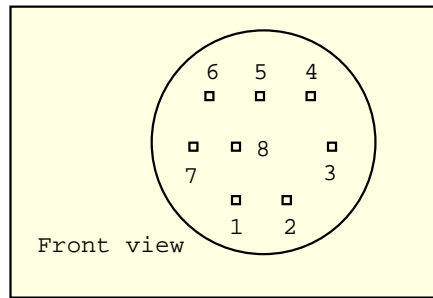
	LINDY	**CINCH**
pin 1 :	brown	black
pin 2 :	red	green
pin 3 :	green	blue
pin 4 :	gray	gray
pin 5 :	purple	yellow
pin 6 :	blue	white
pin 7 :	orange	red
pin 8 :	yellow	brown

10.3   TTL to RS 232 adapter

The cat. BB530001 TTL to RS232 adaptor consists of a cable to which are connected a male mini DIN connector (for the CL526) and a DB 25 connector, that contains the electrical circuitry (for the PC).
The basic circuit and connections are as follows:
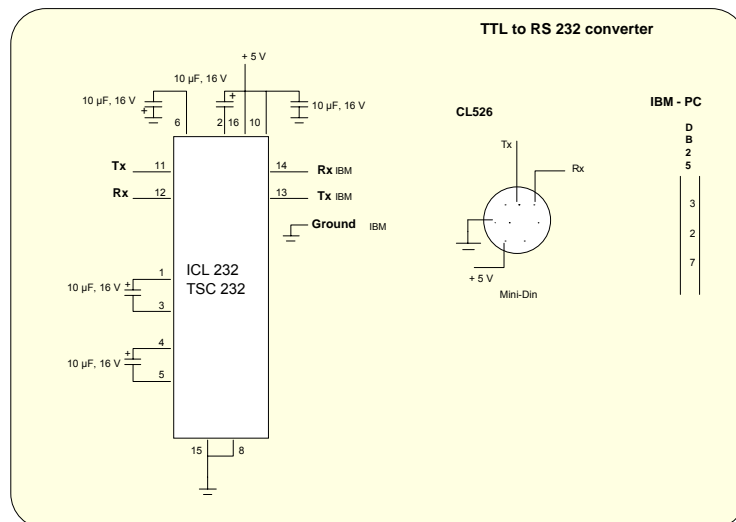
10.4   Communication protocol from CL526 to a PC

The exchange of information when a **CL526** is interconnected with a PC are as follows:

<u>COMPUTER REQUEST</u>

<u>Computer</u>		<u>CL526</u>	
Tx IDNAME	‾	Rx IDNAME	Proceed if name acknoledged
Rx IDNAME	÷	Tx IDNAME	If not, do not answer
Tx Instruction	‾	Rx Instruction	
Rx Instruction	÷	Tx Instruction	
Tx char	‾	Rx char	
Rx DATA 1	÷	Tx DATA 1	
Tx char	‾	Rx char	
Rx DATA 2	÷	Tx DATA 2	

36

Tx char		Rx char
Rx DATA 3	⇐	Tx DATA 3

Tx char		Rx char
Rx DATA 4	⇐	Tx DATA 4

Tx char		Rx char
Rx CHKSUM	⇐	Tx CHKSUM

IDNAME, Instruction, DATA 1, DATA 2, DATA 3, DATA 4 and CHKSUM are 8-bit values (1 byte)

Notes	Instruct	DATA 1	DATA 2	DATA 3	DATA 4
Actual value	24	display(actual)	lin(actual)	Val Hi(actual)	Val Lo(actual)
STO 0 Group A	164	x	x	Display (0)	Lin (0)
STO 0 Group A	165	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group A	165	x	x	Display (1)	Lin (1)
STO 1 Group A	166	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group A	166	x	x	Display (2)	Lin (2)
STO 2 Group A	167	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group B	168	x	x	Display (0)	Lin (0)
STO 0 Group B	169	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group B	169	x	x	Display (1)	Lin (1)
STO 1 Group B	170	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group B	170	x	x	Display (2)	Lin (2)
STO 2 Group B	171	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group C	172	x	x	Display (0)	Lin (0)
STO 0 Group C	173	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group C	173	x	x	Display(1)	Lin (1)
STO 1 Group C	174	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group C	174	x	x	Display (2)	Lin (2)
STO 2 Group C	175	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group D	176	x	x	Display (0)	Lin (0)
STO 0 Group D	177	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group D	177	x	x	Display (1)	Lin (1)
STO 1 Group D	178	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group D	178	x	x	Display (2)	Lin (2)
STO 2 Group D	179	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group E	180	x	x	Display (0)	Lin (0)
STO 0 Group E	181	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group E	181	x	x	Display (1)	Lin (1)
STO 1 Group E	182	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group E	182	x	x	Display (2)	Lin (2)
STO 2 Group E	183	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group F	184	x	x	Display (0)	Lin (0)
STO 0 Group F	185	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group F	185	x	x	Display (1)	Lin (1)
STO 1 Group F	186	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group F	186	x	x	Display (2)	Lin (2)
STO 2 Group F	187	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group G	188	x	x	Display (0)	Lin (0)
STO 0 Group G	189	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group G	189	x	x	Display (1)	Lin (1)
STO 1 Group G	190	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group G	190	x	x	Display (2)	Lin (2)
STO 2 Group G	191	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group H	192	x	x	Display (0)	Lin (0)
STO 0 Group H	193	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group H	193	x	x	Display (1)	Lin (1)
STO 1 Group H	194	Value Hi (1)	Value Lo (1)	x	x

STO 2 Group H	194	x	x	Display (2)	Lin (2)
STO 2 Group H	195	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group I	196	x	x	Display (0)	Lin (0)
STO 0 Group I	197	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group I	197	x	x	Display (1)	Lin (1)
STO 1 Group I	198	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group I	198	x	x	Display (2)	Lin (2)
STO 2 Group I	199	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group J	200	x	x	Display (0)	Lin (0)
STO 0 Group J	201	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group J	201	x	x	Display (1)	Lin (1)
STO 1 Group J	202	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group J	202	x	x	Display (2)	Lin (2)
STO 2 Group J	203	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group K	204	x	x	Display (0)	Lin (0)
STO 0 Group K	205	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group K	205	x	x	Display (1)	Lin (1)
STO 1 Group K	206	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group K	206	x	x	Display (2)	Lin (2)
STO 2 Group K	207	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group L	208	x	x	Display (0)	Lin (0)
STO 0 Group L	209	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group L	209	x	x	Display (1)	Lin (1)
STO 1 Group L	210	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group L	210	x	x	Display (2)	Lin (2)
STO 2 Group L	211	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group M	212	x	x	Display (0)	Lin (0)
STO 0 Group M	213	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group M	213	x	x	Display (1)	Lin (1)
STO 1 Group M	214	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group M	214	x	x	Display (2)	Lin (2)
STO 2 Group M	215	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group N	216	x	x	Display (0)	Lin (0)
STO 0 Group N	217	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group N	217	x	x	Display (1)	Lin (1)
STO 1 Group N	218	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group N	21£	x	x	Display (2)	Lin (2)
STO 2 Group N	219	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group O	220	x	x	Display (0)	Lin (0)
STO 0 Group O	221	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group O	221	x	x	Display (1)	Lin (1)
STO 1 Group O	222	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group O	222	x	x	Display (2)	Lin (2)
STO 2 Group O	223	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group P	224	x	x	Display (0)	Lin (0)
STO 0 Group P	225	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group P	225	x	x	Display (1)	Lin (1)
STO 1 Group P	226	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group P	226	x	x	Display (2)	Lin (2)
STO 2 Group P	227	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group Q	228	x	x	Display (0)	Lin (0)
STO 0 Group Q	229	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group Q	229	x	x	Display (1)	Lin (1)
STO 1 Group Q	230	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group Q	230	x	x	Display (2)	Lin (2)
STO 2 Group Q	231	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group R	232	x	x	Display (0)	Lin (0)
STO 0 Group R	233	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group R	233	x	x	Display (1)	Lin (1)
STO 1 Group R	234	Value Hi (1)	Value Lo (1)	x	x

38

Name	Addr	Col1	Col2	Col3	Col4
STO 2 Group R	234	x	x	Display (2)	Lin (2)
STO 2 Group R	235	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group S	236	x	x	Display (0)	Lin (0)
STO 0 Group S	237	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group S	237	x	x	Display (1)	Lin (1)
STO 1 Group S	238	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group S	238	x	x	Display (2)	Lin (2)
STO 2 Group S	239	Value Hi (2)	Value Lo (2)	x	x
STO 0 Group T	240	x	x	Display (0)	Lin (0)
STO 0 Group T	241	Value Hi (0)	Value Lo (0)	x	x
STO 1 Group T	241	x	x	Display(1)	Lin(1)
STO 1 Group T	242	Value Hi (1)	Value Lo (1)	x	x
STO 2 Group T	242	x	x	Display (2)	Lin (2)
STO 2 Group T	243	Value Hi (2)	Value Lo (2)	x	x
RAMP 1	128	x	x	Time Hi (1)	Time Lo (1)
RAMP 1	129	Start Hi (1)	Start Lo (1)	Stop Hi (1)	Stop Lo (1)
RAMP 1	130	Step Hi (1)	Step Lo (1)	Lin (1)	Display (1)
RAMP 1	131	Soak Hi (1)	Soak Lo (1)	x	Mode (1)
RAMP 2	132	x	x	Time Hi (2)	Time Lo (2)
RAMP 2	133	Start Hi (2)	Start Lo (2)	Stop Hi (2)	Stop Lo (2)
RAMP 2	134	Step Hi (2)	Step Lo (2)	Lin (2)	Display (2)
RAMP 2	135	Soak Hi (2)	Soak Lo (2)	x	Mode (2)
X SCALING	136	x	x	LOX Hi	LOX Lo
X SCALING	137	HiX Hi	HiX Lo	Decimal point	Type X
X SCALING	138	Mode X	CHAR 1	CHAR 2	CHAR 3
X SCALING	139	CHAR 4	x	x	x
VARIE	141	x	STO group	x	x
VARIE	248	x	x	Program	Ramp
VARIE	32	Vbat	x	x	x
PROGRAM	244	x	x	From (Prog 1)	to (Prog 1)
PROGRAM	245	From (Prog 2)	to (Prog 2)	From (Prog 3)	to (Prog 3)
PROGRAM	246	From (Prog 4)	to (Prog 4)	From (Prog 5)	to (Prog 5)
PROGRAM	247	From (Prog 6)	to (Prog 6)	From (Prog 7)	to (Prog 7)

display (name).AND.10hex=	0	= Rj int
	10hex	= Rj ext
display (name).AND.8 =	0	= ITS68
	8	= ITS90
display (name).AND.07hex =	0	= 1.9999
	1	= 19.999
	2	= 199.99
	3	= 1999.9
	4	= 19999
display (name.AND.40hex =	0	= °C
	40hex	= °F
display (name).AND.20hex =	0	= IN
	20hex	= OUT
lin (name)	0	= Tc J
	1	= Tc K
	2	= Tc T
	3	= Tc U
	4	= Tc L
	5	= Tc N
	6	= Tc E
	7	= Tc R
	8	= Tc S
	9	= Tc B
	10	= Tc C
	11	= Tc F
	12	= Tc G
	13	= Tc D
	14	= Pt100 (.385)
	15	= Pt100 (.3916 JIS)
	16	= Pt100 (.3910 OIML)
	17	= Ni100

39

	18	= Ni120
	19	= OHM
	20	= 22 mV
	21	= 100 mV
	22	= 1000 mV
	23	= 10 V
	24	= 20 mA
	25	= X scaling

Lin (name).AND.80hex =	0	= value OK
	80hex	= error

if line (name).AND.80hex = 80hex	0	= under
corresponding "Value Lo"	1	= over
	2	= error 7
	3	= error 2
	4	= error 6
	6	= error 0

if line (name).AND.80hex = 0
value (name) = 2nd complement (16 bit) Value Hi (name).256 + Value Lo (name)

Mode =	0	= one ramp dual slope
	1	= multi ramp dual slope
	2	= one step one slope
	3	= multi ramp one slope

Type X	0	= 0 - 100 mV
	1	= 0 - 1000 mV
	3	= 4 - 20 mA
	4	= 0 - 400 _
	5	= 1 - 5 V
	6	= 0 - 10 V

Mode X	0	= linear
	1	= square

STO Group selected	0	= A
	1	= B
	2	= C
	...	= ...
	n (max. 19)	= n (max. T)

Program	0	= Program 1
	1	= Program 2
	...	= ...
	n (max. 7)	= n (max. Program 7)

Ramp	0	= Autoramp 1
	1	= Autoramp 2
	2	= Program

From........To........	0	= STO 0 Group A
	1	= STO 1 Group A
	2	= STO 2 Group A
	3	= STO 0 Group B
	...	= ...
	n (max. 59)	= STO n Group n (max. STO 2 Group T)

Volt Vbat		= (Vbat x 2) / 51

CHKSUM (checksum) = DATA1 + DATA2 + DATA3 + DATA4).AND. FF

The above is useful to verify the integrity of transmitted and received data
The minimum time-out of the **CL526** is 5 seconds.

10.5 Computer request for CL526 settings

Computer		**CL526**	
Tx IDNAME	_	Rx IDNAME	Proceed if name acknoledged
Rx IDNAME	÷	Tx IDNAME	If not, do not answer
Tx Instruction	_	Rx Instruction	
Rx Instruction	÷	Tx Instruction	
Tx DATA 1	_	Rx DATA 1	
Rx char	÷	Tx char	
Tx DATA 2	_	Rx DATA 2	
Rx char	÷	Tx char	

40

Tx DATA 3   _   Rx DATA 3
Rx char   ÷   Tx char

Tx DATA 4   _   Rx DATA 4
Rx char   ÷   Tx char

Tx CHKSUM   _   Rx CHKSUM
Rx char   ÷   Tx char

The CL526 receives and verifies CHKSUM; when not valid, it does not accept the transmitted data

Each PC instruction for operative mode request must be followed by the CHECSUM recalculation Instruction 47 (with the pertinent A and B values) as per the table below

Notes	Instr	DATA 1	DATA 2	DATA 3	DATA 4	A	B
Set In	25	Lin (actual)	x	x	x	---------	
Set display	26	Display (actual)	x	x	x	---------	
Set value	27	Value Hi (Out)	Value Lo (Out)	x	x	---------	
Start ramp	28	x	x	x	x	---------	
Start ramp	33	x	x	x	x	---------	
TIME RAMP 1	127	0	2	Time Hi	Time Lo	0	0
START RAMP 1	127	0	4	Start Hi	Start Lo	0	0
STOP RAMP 1	127	0	6	Stop Hi	Stop Lo	0	0
STEP RAMP 1	127	0	8	Step Hi	Step Lo	0	0
Lin/Dis RAMP 1	127	0	10	Lin	Display	0	0
SOAK RAMP 1	127	0	12	Soak Hi	Soak Lo	0	0
MODE RAMP 1	127	0	14	0	Mode	0	0
TIME RAMP 2	127	0	18	Time Hi	Time Lo	0	16
START RAMP 2	127	0	20	Start Hi	Start Lo	0	16
STOP RAMP 2	127	0	22	Stop Hi	Stop Lo	0	16
STEP RAMP 2	127	0	24	Step Hi	Step Lo	0	16
Lin/Dis RAMP 2	127	0	26	Lin	Display	0	16
SOAK RAMP 2	127	0	28	Soak Hi	Soak Lo	0	16
MODE RAMP 2	127	0	30	0	Mode	0	16
LoX	127	0	34	LoX Hi	LoX Hi	0	32
HiX	127	0	36	HiX Lo	HiX Lo	0	32
DP/TYPE	127	0	38	DP	TYPE	0	32
MODE/Char 1	127	0	40	MODE	Char 1	0	32
Char 1/Char 2	127	0	41	Char 1	Char 2	0	32
Char 3/Char 4	127	0	43	Char 3	Char 4	0	32
Dis/Lin STO 0 #A	127	0	146	Display (0)	Lin	0	144
Value STO 0 #A	127	0	148	Value Hi (0)	Value Lo (0)	0	144
Dis/Lin STO1 #A	127	0	150	Dispaly (1)	Lin	0	144
Value STO 1 #A	127	0	152	Value Hi (1)	Value Lo (1)	0	144
Dis/Lin STO 2 #A	127	0	154	Display (2)	Lin	0	144
Value STO 2 #A	127	0	156	Value Hi (2)	Value Lo (2)	0	144
Dis/Lin STO 0 #B	127	0	162	Display (0)	Lin	0	160
Value STO 0 #B	127	0	164	Value Hi (0)	Value Lo (0)	0	160
Dis/Lin STO1 #B	127	0	166	Dispaly (1)	Lin	0	160
Value STO 1 #B	127	0	168	Value Hi (1)	Value Lo (1)	0	160
Dis/Lin STO 2 #B	127	0	170	Display (2)	Lin	0	160
Value STO 2 #B	127	0	172	Value Hi (2)	Value Lo (2)	0	160
Dis/Lin STO 0 #C	127	0	178	Display (0)	Lin	0	176
Value STO 0 #C	127	0	180	Value Hi (0)	Value Lo (0)	0	176
Dis/Lin STO 1 #C	127	0	182	Dispaly (1)	Lin	0	176
Value STO 1 #C	127	0	184	Value Hi (1)	Value Lo (1)	0	176
Dis/Lin STO 2 #C	127	0	186	Display (2)	Lin	0	176
Value STO 2 #C	127	0	188	Value Hi (2)	Value Lo (2)	0	176
Dis/Lin STO 0 #D	127	0	194	Display (0)	Lin	0	192
Value STO 0 #D	127	0	196	Value Hi (0)	Value Lo (0)	0	192
Dis/Lin STO 1 #D	127	0	198	Dispaly (1)	Lin	0	192
Value STO 1 #D	127	0	200	Value Hi (1)	Value Lo (1)	0	192

41

Dis/Lin	STO 2 #D	127	0	202	Display (2)	Lin	0	192
Value	STO 2 #D	127	0	204	Value Hi (2)	Value Lo (2)	0	192
Dis/Lin	STO 0 #E	127	0	210	Display (0)	Lin	0	208
Value	STO 0 #E	127	0	212	Value Hi (0)	Value Lo (0)	0	208
Dis/Lin	STO 1 #E	127	0	214	Dispaly (1)	Lin	0	208
Value	STO 1 #E	127	0	216	Value Hi (1)	Value Lo (1)	0	208
Dis/Lin	STO 2 #E	127	0	218	Display (2)	Lin	0	208
Value	STO 2 #E	127	0	220	Value Hi (2)	Value Lo (2)	0	208
Dis/Lin	STO 0 #F	127	0	226	Display (0)	Lin	0	224
Value	STO 0 #F	127	0	228	Value Hi (0)	Value Lo (0)	0	224
Dis/Lin	STO 1 #F	127	0	230	Dispaly (1)	Lin	0	224
Value	STO 1 #F	127	0	232	Value Hi (1)	Value Lo (1)	0	224
Dis/Lin	STO 2 #F	127	0	234	Display (2)	Lin	0	224
Value	STO 2 #F	127	0	236	Value Hi (2)	Value Lo (2)	0	224
Dis/Lin	STO 0 ##	127	0	242	Display (0)	Lin	0	240
Value	STO 0 ##	127	0	244	Value Hi (0)	Value Lo (0)	0	240
Dis/Lin	STO 1 ##	127	0	246	Dispaly (1)	Lin	0	240
Value	STO 1 ##	127	0	248	Value Hi (1)	Value Lo (1)	0	240
Dis/Lin	STO 2 ##	127	0	250	Display (2)	Lin	0	240
Value	STO 2 ##	127	0	252	Value Hi (2)	Value Lo (2)	0	240
Dis/Lin	STO 0 #H	127	1	2	Display (0)	Lin	1	0
Value	STO 0 #H	127	1	4	Value Hi (0)	Value Lo (0)	1	0
Dis/Lin	STO 1 #H	127	1	6	Dispaly (1)	Lin	1	0
Value	STO 1 #H	127	1	8	Value Hi (1)	Value Lo (1)	1	0
Dis/Lin	STO 2 #H	127	1	10	Display (2)	Lin	1	0
Value	STO 2 #H	127	1	12	Value Hi (2)	Value Lo (2)	1	0
Dis/Lin	STO 0 #I	127	1	18	Display (0)	Lin	1	16
Value	STO 0 #I	127	1	20	Value Hi (0)	Value Lo (0)	1	16
Dis/Lin	STO 1 #I	127	1	22	Dispaly (1)	Lin	1	16
Value	STO 1 #I	127	1	24	Value Hi (1)	Value Lo (1)	1	16
Dis/Lin	STO 2 #I	127	1	26	Display (2)	Lin	1	16
Value	STO 2 #I	127	1	28	Value Hi (2)	Value Lo (2)	1	16
Dis/Lin	STO 0 #J	127	1	34	Display (0)	Lin	1	32
Value	STO 0 #J	127	1	36	Value Hi (0)	Value Lo (0)	1	32
Dis/Lin	STO 1 #J	127	1	38	Dispaly (1)	Lin	1	32
Value	STO 1 #J	127	1	40	Value Hi (1)	Value Lo (1)	1	32
Dis/Lin	STO 2 #J	127	1	42	Display (2)	Lin	1	32
Value	STO 2 #J	127	1	44	Value Hi (2)	Value Lo (2)	1	32
Dis/Lin	STO 0 #K	127	1	50	Display (0)	Lin	1	48
Value	STO 0 #K	127	1	52	Value Hi (0)	Value Lo (0)	1	48
Dis/Lin	STO 1 #K	127	1	54	Dispaly (1)	Lin	1	48
Value	STO 1 #K	127	1	56	Value Hi (1)	Value Lo (1)	1	48
Dis/Lin	STO 2 #K	127	1	58	Display (2)	Lin	1	48
Value	STO 2 #K	127	1	60	Value Hi (2)	Value Lo (2)	1	48
Dis/Lin	STO 0 #L	127	1	66	Display (0)	Lin	1	64
Value	STO 0 #L	127	1	68	Value Hi (0)	Value Lo (0)	1	64
Dis/Lin	STO 1 #L	127	1	70	Dispaly (1)	Lin	1	64
Value	STO 1 #L	127	1	72	Value Hi (1)	Value Lo (1)	1	64
Dis/Lin	STO 2 #L	127	1	74	Display (2)	Lin	1	64
Value	STO 2 #L	127	1	76	Value Hi (2)	Value Lo (2)	1	64
Dis/Lin	STO 0 #M	127	1	82	Display (0)	Lin	1	80
Value	STO 0 #M	127	1	84	Value Hi (0)	Value Lo (0)	1	80
Dis/Lin	STO 1 #M	127	1	86	Dispaly (1)	Lin	1	80
Value	STO 1 #M	127	1	88	Value Hi (1)	Value Lo (1)	1	80
Dis/Lin	STO 2 #M	127	1	90	Display (2)	Lin	1	80
Value	STO 2 #M	127	1	92	Value Hi (2)	Value Lo (2)	1	80
Dis/Lin	STO 0 #N	127	1	98	Display (0)	Lin	1	96
Value	STO 0 #N	127	1	100	Value Hi (0)	Value Lo (0)	1	96
Dis/Lin	STO 1 #N	127	1	102	Dispaly (1)	Lin	1	96
Value	STO 1 #N	127	1	104	Value Hi (1)	Value Lo (1)	1	96

Dis/Lin STO 2 #N	127	1	106	Display (2)	Lin	1	96
Value STO 2 #N	127	1	108	Value Hi (2)	Value Lo (2)	1	96
Dis/Lin STO 0 #O	127	1	114	Display (0)	Lin	1	112
Value STO 0 #O	127	1	116	Value Hi (0)	Value Lo (0)	1	112
Dis/Lin STO 1 #O	127	1	118	Dispaly (1)	Lin	1	112
Value STO 1 #O	127	1	120	Value Hi (1)	Value Lo (1)	1	112
Dis/Lin STO 2 #O	127	1	122	Display (2)	Lin	1	112
Value STO 2 #O	127	1	124	Value Hi (2)	Value Lo (2)	1	112
Dis/Lin STO 0 #P	127	1	130	Display (0)	Lin	1	128
Value STO 0 #P	127	1	132	Value Hi (0)	Value Lo (0)	1	128
Dis/Lin STO 1 #P	127	1	134	Dispaly (1)	Lin	1	128
Value STO 1 #P	127	1	136	Value Hi (1)	Value Lo (1)	1	128
Dis/Lin STO 2 #P	127	1	138	Display (2)	Lin	1	128
Value STO 2 #P	127	1	140	Value Hi (2)	Value Lo (2)	1	128
Dis/Lin STO 0 #Q	127	1	146	Display (0)	Lin	1	144
Value STO 0 #Q	127	1	148	Value Hi (0)	Value Lo (0)	1	144
Dis/Lin STO 1 #Q	127	1	150	Dispaly (1)	Lin	1	144
Value STO 1 #Q	127	1	152	Value Hi (1)	Value Lo (1)	1	144
Dis/Lin STO 2 #Q	127	1	154	Display (2)	Lin	1	144
Value STO 2 #Q	127	1	156	Value Hi (2)	Value Lo (2)	1	144
Dis/Lin STO 0 #R	127	1	162	Display (0)	Lin	1	160
Value STO 0 #R	127	1	164	Value Hi (0)	Value Lo (0)	1	160
Dis/Lin STO 1 #R	127	1	166	Dispaly (1)	Lin	1	160
Value STO 1 #R	127	1	168	Value Hi (1)	Value Lo (1)	1	160
Dis/Lin STO 2 #R	127	1	170	Display (2)	Lin	1	160
Value STO 2 #R	127	1	172	Value Hi (2)	Value Lo (2)	1	160
Dis/Lin STO 0 #S	127	1	178	Display (0)	Lin	1	176
Value STO 0 #S	127	1	180	Value Hi (0)	Value Lo (0)	1	176
Dis/Lin STO 1 #S	127	1	182	Dispaly (1)	Lin	1	176
Value STO 1 #S	127	1	184	Value Hi (1)	Value Lo (1)	1	176
Dis/Lin STO 2 #S	127	1	186	Display (2)	Lin	1	176
Value STO 2 #S	127	1	188	Value Hi (2)	Value Lo (2)	1	176
Dis/Lin STO 0 #T	127	1	194	Display (0)	Lin	1	192
Value STO 0 #T	127	1	196	Value Hi (0)	Value Lo (0)	1	192
Dis/Lin STO 1 #T	127	1	198	Dispaly (1)	Lin	1	192
Value STO 1 #T	127	1	200	Value Hi (1)	Value Lo (1)	1	192
Dis/Lin STO 2 #T	127	1	202	Display (2)	Lin	1	192
Value STO 2 #T	127	1	204	Value Hi (2)	Value Lo (2)	1	192

Notes	Instr	DATA 1	DATA 2	DATA 3	DATA 4	A	B
CHKSUM recalc.	47	A	B	0	0	----------	
From/To PROG 1	127	1	210	From	To	1	208
From/To PROG 2	127	1	212	From	To	1	208
From/To PROG 3	127	1	214	From	To	1	208
From/To PROG 4	127	1	216	From	To	1	208
From/To PROG 5	127	1	218	From	To	1	208
From/To PROG 6	127	1	220	From	To	1	208
From/To PROG 7	127	1	222	From	To	1	208
PROGRAM	72	PROGRAM	0	0	0	----------	
RAMP	71	RAMP	0	0	0	----------	
SELECT GROUP	74	Group	0	0	0	----------	

The computer must split a 16 bit word into 2 words of 8 bit as follows

Value Hi (....)   Value Lo (....)
Higher 8 bit   Lower 8 bit

CHKSUM =   (DATA1 + DATA2 + DATA 3 + DATA 4) .AND.7F

10.6   Communication programs

In this paragraph are illustrated two examples of communication programs between the **CL526** and an IBM or IBM compatible PC.

Example A: (data transfer from CL526 to PC)
Set IDNAME=1 and BAUD RATE=9600 on **CL526** (see chapter 8.6). Connect CL526 through adapter BB530001 (TTL-RS232 converter), to personal computer communication port COM1.
Set CL526 in mA measurement (IN). Run the program and you will see on the computer screen the actual reading value (once).

Example B: (PC instructions to CL526)
Set IDNAME=1 and BAUD RATE=9600 on CL526 (see chapter 8.6). Connect **CL526** through adapter BB530001 (TTL-RS232 converter), to personal computer communication port COM1.
Set the CL526 for current OUT mode; run the program and CL526 will be set automatically to 20mA.

Example A:
```
1Ø CHAR = Ø
2Ø IDNAME = 1
3Ø INSTRUCTION = 24
35 OPEN "COM1: 96ØØ, N,8,1,CD,CS,DS,RS" FOR RANDOM AS # 1
4Ø PRINT #1, CHR$ (IDNAME);:REM TRANSMIT IDNAME TO CL526
5Ø WHILE LOC (1) = Ø: WEND: REM WAIT RECEIVING IDNAME FROM CL526
6Ø IDNAME = ASC (INPUT$ (1, 1)): REM READ RECEIVED IDNAME FROM CL526
7Ø PRINT #1, CHR$ (INSTRUCTION);
8Ø WHILE LOC (1) = Ø: WEND
9Ø INSTRUCTION = ASC (INPUT$ (1, 1))
1ØØ PRINT #1, CHR$ (CHAR);
11Ø WHILE LOC (1) = Ø: WEND
12Ø DATA 1 = ASC (INPUT$ (1, 1))
13Ø PRINT #1, CHR$ (CHAR);
14Ø WHILE LOC (1) = Ø: WEND
15Ø DATA 2 = ASC (INPUT$ (1, 1))
16Ø PRINT #1, CHR$ (CHAR);
17Ø WHILE LOC (1) = Ø: WEND
18Ø DATA 3 = ASC (INPUT$ (1, 1))
19Ø PRINT #1, CHR$ (CHAR);
2ØØ WHILE LOC (1) = Ø: WEND
21Ø DATA 4 = ASC (INPUT$ (1, 1))
22Ø PRINT #1, CHR$ (CHAR);
231Ø WHILE LOC (1) = Ø: WEND
24Ø CHKSUM = ASC (INPUT$ (1, 1))
25Ø IF CHKSUM <> ((DATA1 + DATA2 + DATA3 + DATA4) AND &HFF) THEN PRINT "Error": END
26Ø VALUE = DATA3 * 256 + DATA4
27Ø IF VALUE > 32767 THEN VALUE =VALUE - 65536: REM 2'S COMPLEMENT
28Ø PRINT "VALUE: " ; VALUE / 1ØØ
29Ø END
```

Example B:
```
1Ø CHAR = Ø
2Ø IDNAME = 1
3Ø INSTRUCTION = 27
4Ø VALUE = 2ØØØ
5Ø VALUE$ = HEX$ (VALUE)
55 WHILE LEN (VALUE$)<4: VALUE$ ="Ø"+VALUE$: WEND
6Ø IF LEN (VALUE$) > 4 THEN VALUE$ =RIGHT$ (VALUE$,4)
65 DATA1 = VAL ("&H" + LEFT$ (VALUE$, 2))
7Ø DATA2 = VAL ("&H" +RIGHT$ (VALUE$, 2))
75 DATA3 = Ø
8Ø DATA4 = Ø
9Ø CHKSUM = (DATA1 + DATA2 + DATA3 + DATA4) AND &H7F
1ØØ REM MEMORY RELEASE PREVIOUS 4.xx1 (Example 4.ØØØ, 4.2ØØ) MUST USE
11Ø REM NEXT LINE INSTEAD LINE 9Ø OR PROGRAM DOES'NT WORK
12Ø REM CHKSUM =(DATA1 + DATA2 + DATA3 + DATA4) AND &HFF
13Ø OPEN "COM1: 96ØØ,N,8,1,CD,CS,DS,RS" FOR RANDOM AS #1
14Ø PRINT #1, CHR$ (IDNAME)  ; : REM TRANSMIT IDNAME TO CL526
15Ø WHILE LOC (1) = Ø: WEND: REM WAIT RECEIVING IDNAME FROM CL526
```

44

```
16Ø IDNAME =  ASC (INPUT$ (1 , 1)): REM READ RECEIVED IDNAME FROM CL526
17Ø PRINT #1, CHR$ (INSTRUCTION) ;
18Ø WHILE LOC (1) = Ø : WEND
19Ø INSTRUCTION = ASC (INPUT$ (1 , 1))
2ØØ PRINT #1, CHR$ (DATA1) ;
21Ø WHILE LOC (1) = Ø : WEND
22Ø CHAR = ASC (INPUT$ (1 , 1))
23Ø PRINT #1, CHR$ (DATA2) ;
24Ø WHILE LOC (1) = Ø : WEND
25Ø CHAR = ASC (INPUT$ (1 , 1))
26Ø PRINT #1, CHR$ (DATA3) ;
27Ø WHILE LOC (1) = Ø : WEND
28Ø CHAR = ASC (INPUT$ (1 , 1))
29Ø PRINT #1, CHR$ (DATA4) ;
3ØØ WHILE LOC (1) = Ø : WEND
31Ø CHAR = ASC (INPUT$ (1 , 1))
32Ø PRINT #1, CHR$ (CHKSUM) ;
33Ø WHILE LOC (1) = Ø : WEND
34Ø CHAR = ASC (INPUT$ (1 , 1))
35Ø PRINT "Trasmitted."
39Ø END
```

11   MAINTENANCE

The **CL526** portable calibrator has been factory tested and calibrated before shipment.
The calibration should be verified and re-adjusted if the instrument is showing an error exceeding the declared specifications or when a critical active or passive component is replaced (either at component level or at board level).
OMEGA will supply, on request, a technical reference manual, with all instructions and recommendations for service and calibration. OMEGA engineers will give prompt support for any requests of assistance.

11.1   Safety recommendations

Primary elements (i.e. thermocouples, resistance thermometers, etc.) are normally linked to electrical potentials equal or near to the ground potential. However, in some applications, there may be present a common mode voltage to earth.
Check for voltage between input terminals and ground, as this voltage can be transmitted to other devices connected to the calibrator.

11.2   Faulty operating conditions

During start up, measuring and simulation modes, faulty conditions of the instrument will be announced, with coded messages as follows:

Error Checksum 1	Indicates a possible loss of data on "AUTORAMP" program or on the manual memories.
Error Checksum 2	Indicates a possible loss of data on "PROGRAM X".
Error Checksum 3	Indicates a possible loss of data on "AUTORAMP", "PROGRAM X" and/or on the manual memories.
Error Checksum 4	Indicates a possible loss of calibration data.
Error Checksum 5	Indicates a possible loss of calibration data, and/or "AUTORAMP" data and/or on the manual memories
Error Checksum 6	Indicates a possible loss of calibration data, and/or "PROGRAM X"data.
Error Checksum 7	Indicates a possible loss of calibration data, and/or "AUTORAMP" data, "Xscaling" and from the three manual memories
!!! ERROR 9 !!!	Indicates a data writing on the EEPROM memory not verified.

When the above error codes are indicated repeat the set-up of the application parameters and/or autoramp data and/or In-Out memories.

- UNDER -	Indicates "underflow" conditions
+ OVER +	Indicates "overflow" conditions
ERROR 2	Indicates an environment temperature (in correspondence with **<IN/OUT>** terminals) exceeding the stated limits
	Indicates that the load is exceeding the stated limits.
When in mA "OUT" function, the external load must not exceed 1000 Ω.

46

```
┌─────────────────────────────┐
│                             │
│         ERROR 6             │
│                             │
└─────────────────────────────┘
```
When in mV or Tc "OUT" function the current flow must not exceed 0.5 mA.

```
┌─────────────────────────────┐
│                             │
│         ERROR 7             │
│                             │
└─────────────────────────────┘
```
Indicates a possible error during scale factor computation.

The above indicated faulty conditions can be announced both during the autodiagnostic routine or in measure or simulation modes.
If the faulty condition is critical for the type of application, it is recommended to re-run the pertinent set up procedure.

11.3   Protection fuses

The **CL526** unit, is protected against overvoltage and overcurrent inputs, by thermal fuses. When they activate, you should disconnect the electrical connections from the unit and switch the instrument off for about 2 minutes. The thermal fuses will be automatically restored and you can resume your work.

11.4   Storage

If the instrument is left unused for a long time, it is recommended to remove the batteries.
Store the instrument in the original package, at a temperature from -30°C to +60°C, with R.H. less than 90%.
If the instrument has been unused for a month check the battery voltage, and charge the Ni-MH batteries for at least 12 hours.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WAR-RANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSEO OR IMPUED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABIUTY AND RTNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein ate exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence. Indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please has the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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