.1 YEAR WARRANTY

CE

User's Guide

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CALIBRATOR – TESTER
CL519

Specification indicated in the present instruction manual may be changed without prior notice.

Notes

1.OVERVIEW

Notes

1.1 General

The CL519 is perfectly suitable for calibration and maintenance. It allows the user to measure and simulate physical and electrical quantities on site as well as in a laboratory.
It realizes the following functions:

- Measurement of DC voltages, currents and resistances.
- Temperature measurements using either thermocouples or RTD probes.
- Measurement of quantities external to the unit.
- Generation of DC voltages and currents.
- Simulation of resistance, thermocouples and RTD probes.
- Simulation of quantities external to the unit.
- Transmitter calibration.

Measurement and emission can be performed simultaneously with dual display. Input and output circuits are galvanically insulated.

This calibrator has been designed for checking of instruments that can be found in regulation loops, such as sensors, converters, indicators, recorders, regulators, ...
Especially, conditioners or transmitters can be calibrated by generating, on the input, a signal in order to simulate a sensor and by measuring the conversion current or voltage. An internal software makes this operation easier. But, it also finds its place in other applications, such as monitoring of physical quantities under processing, transformation phenomena, thermal exchange either as experimentation or quality test.

The CL519 has many other additional functions which extend its application field:

- Relative measurements.
- Result display according to a linear conversion law or not.
- Triggered measurements with result memory.
- Generation of increments, simple or cyclical ramps.
- Emission value memory.
- Curve synthesis.

A series of improvements have simplified its operation:

- Direct access to any functions.
- Help messages.
- Multiple function keys which are defined step by step on display.
- Connection using 4-mm safety terminals.
- Protection against overloads.
- Supply by rechargeable batteries with a built-in quick charger.

It is conditioned in an ABS casing with elastomer enclosure.

The CL519 is equipped with an RS 232 C interface as standard and can be delivered with an optional Windows® software, thus allowing transfer and processing of the measurement results on a PC, pre-programming of operating configurations at PC level as well as preparing transmitter calibration certificates.
Windows® software is described in another instruction manual titled "CL519-SOFT".

Users

The CL519 finds its place in all departments performing checking, calibrations, measurements on site: maintenance, quality checking, adjusting, heat, electricity, energy, after-sales services. It concerns all the industrial fields which imply checking of physical quantities and specially temperatures. It also finds its place in metrology, research and development laboratories and in maintenance and technical checking companies.

2. MAIN FEATURES

Notes

2.1 Presentation

- Portable unit with removable Ni-MH battery pack, 1.6 Ah.
  Life: from 5 to 10 hours depending on the functions used.
- Graphic type LCD display, 128 x 64 pixels.
- Choice of the language for messages and programming of functions, ranges and parameters using 22-keypad keys.
- Display lighting available using one keypad key with automatic extinction after 5 minutes of idle period.
- Battery recharge: by means of the mains charger supplied with the unit or any supply delivering a DC voltage from 10 V to 14 V.
- Charger specifications: mains supply 230 V ± 10 %, 50/60 Hz or 115 V ± 10 %, 60 Hz.
- Charging time: 3 h max.
- Audible warning (beep) of any incorrect operation or, depending on programming, of certain measurement and emission/simulation functions.
- Automatic or manual ranging when measuring resistance or voltage.
- Permanent memory storage of 100 values to be emitted.
- Presentation: ABS casing with elastomer enclosure.
- Dimensions: 260 mm x 144 mm x 60 mm.
- Weight: 1.2 kg with enclosure and accessories.

2.2 Safety provisions

2.2.1 In accordance with safety standards

The unit is constructed and tested according to EN 61010-1 European Norm: safety rules for electronic measuring instruments.

This instruction manual contains information and advice that users must follow to be protected against electrical shocks and to ensure the reliability of the unit in order to maintain it in a satisfactory state with regard to safety.

The unit may occasionally be exposed to temperatures between - 10°C and + 55°C without its safety features being compromised.

2.2.2 Following instructions supplied with the accompanying documents

The unit is constructed to operate under safety conditions if the instructions supplied with the accompanying documents are followed. Any usage, except those described, may reduce the safety of the operator and then, becomes dangerous and prohibited.

2.2.3 Taking measurements

The test leads and measuring wires must be in good conditions and should be changed if there is any evidence of deterioration (insulation split burnt, etc. ...).

When the unit is connected to a circuit under test, some of its terminals may be hazardous; therefore the hands should be kept away from any used or unused terminals. This precaution also applies to terminals of the battery charger and to the RS 232 C link which are directly or indirectly connected to the terminals of the unit. Any intervention on these circuits should be performed with the unit disconnected from any other external circuit.

Never exceed the safety limit values indicated in chapter 11.

When the quantity to be measured is unknown, be sure that the measuring range used is the highest possible or select the autoranging mode.

Before changing functions, disconnect the measuring wires from the external circuit. When measuring currents and/or voltages, even low, remember that circuits may show dangerous voltage regarding the ground.

Never perform resistance measurements on a live circuit.

2.2.4 Faults and abnormal constraints

Should there be any indication that the protection of the unit has been compromised, it should be switched off and steps taken to prevent it being used inadvertently.
The protection may have been compromised in the following cases, for example:

- The unit is obviously damaged.
- The unit is no longer capable of taking accurate measurements.
- The unit has been stored under unfavorable conditions.
- The unit has been subject to severe stresses during transport.

2.2.5 Definitions

2.2.5.1 Definition of the installation category

This is also called overvoltage category.
It's the installation classification according to standardized limits for transient overvoltages (IEC Publication 664).

2.2.5.2 Table of the symbols used

Symbol	Description
	Warning: see the accompanying document.

2.2.6 Maintenance

Refer to chapter 10.

The unit should be reassembled as explained in the instruction manual. Any incomplete or bad reassembly may be dangerous for the safety of the operator.

The responsible body must check at regular time interval that all the components ensuring safety are not subject to wear and undertake all the necessary steps for preventive operations.

Before the casing is opened, make sure that all the wires have been disconnected from the unit.

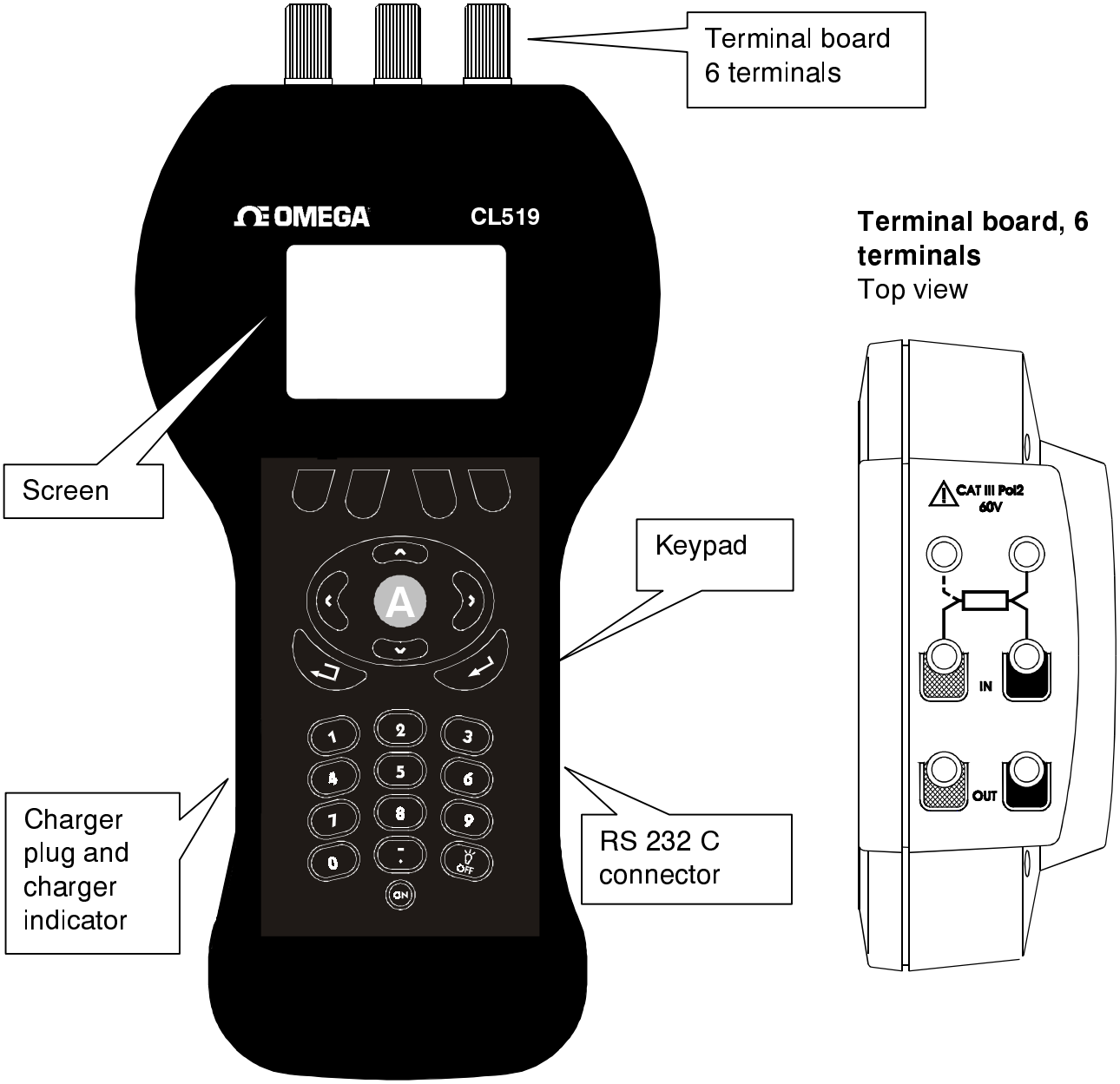
The unit should not be opened up for adjustment, maintenance or repair when live unless this is absolutely essential, in which case this work should be carried out **only by qualified personnel advised of the risk entailed**.

Notes

3. DESCRIPTION

Notes

3.1 The unit



3.2 Terminal board

- Four terminals for "measurement" (IN) function; these terminals are reserved to the 3-wire or 4-wire connection when measuring resistance and temperature using RTD and when measuring current with a passive transmitter. Refer to chapter 6.
- Two terminals for "emission/simulation" (OUT) function. Refer to chapter 7.

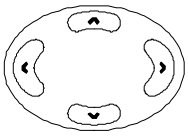
3.3 Screen

The screen is composed of:

- One window for displaying and programming parameters of the "measurement" (IN) function. Refer to chapter 6.
- One window for displaying and programming parameters of the "emission/simulation" (OUT) function. Refer to chapter 7.
- One bar showing the different menus available by pressing the keys located under the screen. Refer to chapter 4.

3.4 Keypad

The keypad is composed of:

- 4 empty keys used to select the different menus appearing on the screen . Refer to chapter 4.
- The navigator: 
- : Validation key.
- : Canceling key (Escape).
- A Direct access to transmitter calibration menu.
- 11 keys used to program parameters. Refer to chapter 4.
- 

: Key used to light the screen on or off and to switch the unit off.
- 

: Key used to switch the unit on.

3.5 Accessories

3.5.1 Delivered with the unit

- An elastomer enclosure.
- A charger for charging the battery pack and the unit supply.
- A carrying case, part number: ER 40932.
- An instruction manual.

3.5.2 Optional accessories

- A digital pressure sensor with RS 232/485, part number CL519-ACL333.
- A processing software CL519-SOFT with its own instruction manual.
- RS 232 C cords, part numbers: AN 5874, AN 5875, AN 5876.
- A replacement battery pack, part number: AN 6010. Refer to chapter 10 to replace it.
- An automobile cigarette lighter adapter cord, part number ATL 306.

Notes

4.RAPID SET-UP GUIDE

Notes

4.1 Instructions before use

4.1.1 Unpacking

The CL519 is mechanically and electrically checked before dispatch. Every precaution has been taken to ensure that it reaches the operator undamaged.
Nevertheless, it is advisable to carry out a quick check for any damages that may have occurred in transit. If any such damage is found, it should be reported to the shipper.

4.1.2 Return

If the unit is to be returned, the original packaging should be used and a note explaining as clearly as possible the reasons for returning it should be included.

4.2 Instruction before switching on

Before using the unit with all the necessary precautions, the operator must read **carefully** chapter 2 which deals with safety provisions.

4.3 Switching on

The unit is delivered with a mains adapter in order to charge the battery pack.

4.3.1 Battery operation

The unit is equipped with a Ni/MH battery as standard for an autonomous operation.

Five icons indicate the battery charge status:

1.  Battery with 100 % of charge.
2.  Battery with 75 % of charge.
3.  Battery with 50 % of charge.
4.  Battery with 25 % of charge.
5.  An audible warning (beep) is emitted and the battery symbol blinks indicating that approximately 10 minutes of operating time remains. The unit automatically stops operating. It is then necessary to recharge the battery before switching the unit on again. See chapter 10.

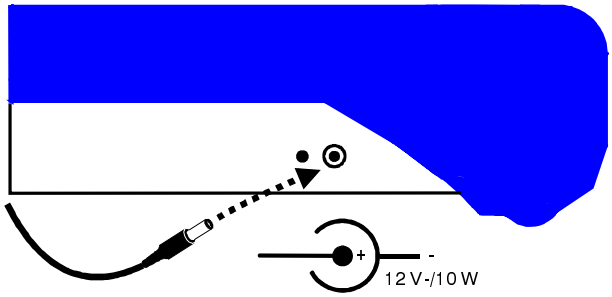
NOTE: When the unit stops, all data is stored in a permanent memory.

4.3.2 Mains operation

WARNING: Before any connection, make sure that the mains is compatible with the adapter.

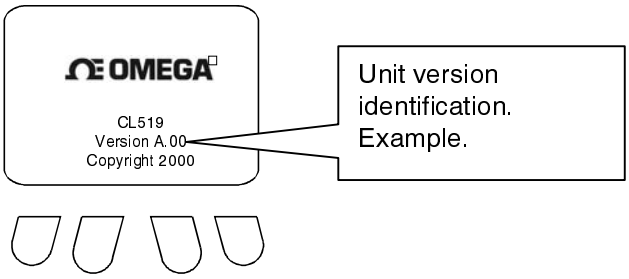
Connect the mains adapter DC output to the unit DC connection plug.
Connect the adapter to the mains.
The unit must not be used without battery. It can be used permanently on mains, via the adapter; the battery is then automatically recharged.

The charge indicator lights up for two seconds after the charger is connected and quickly blinks at the end of charge. Charging time: 3 h maximum.



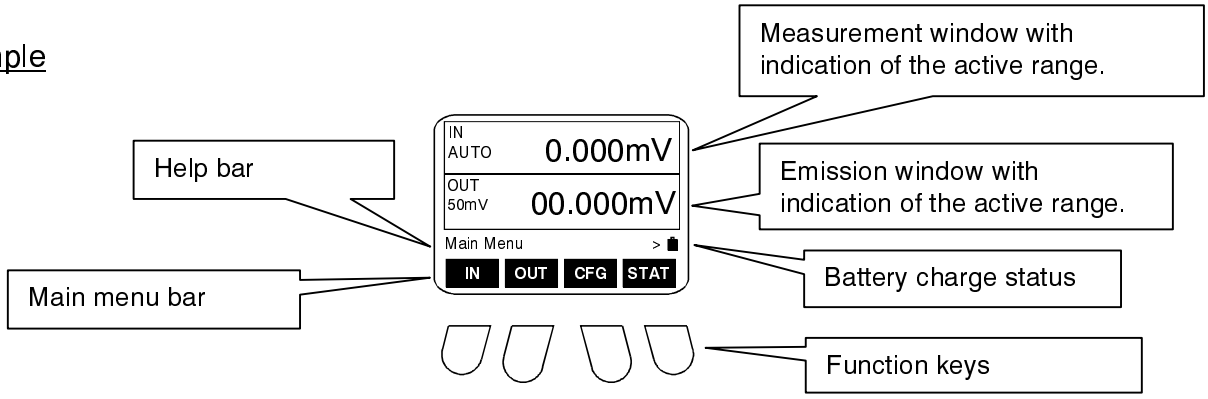
4.3.3 Getting started

Make sure that the unit is disconnected from any external circuit.
Press ON key for more than two seconds.
After an initialization procedure, the screen is as follows:



Then, it displays and validates the information of the working screen and is ready for use.

Example

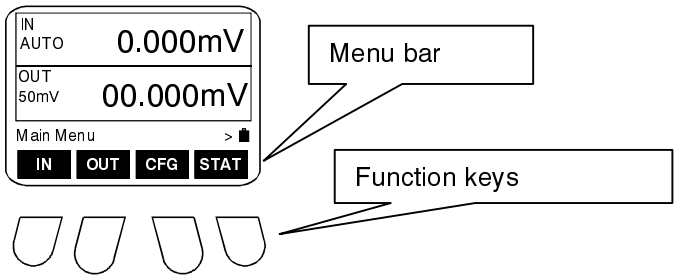


At switching on:
- the unit switches to the last operating configuration,
- it cancels processing or scaling functions,
- it resets the emission level to zero.

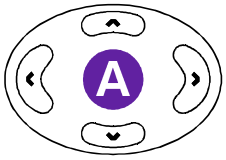
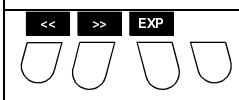
To switch the unit off, press  key up to emission of a beep (2 seconds approx.).

4.3.4 Function keys

The different processing and programming functions of the unit are available using menus. Selecting the different prompts is done by pressing the function keys located under the screen.



Menu navigation requires use of the following keypad keys:

	ESC key • **Returns** to previous menu **without validation** of the parameter. • **Cancels** the current programming. • **Returns** to main menu by pressing the key more than 2 seconds.
	ENT key: • **Validation** and storage of the displayed value.
	Navigator: • Access to **next** › or **previous** ‹ prompts in a same menu. • **Incrementation** ^ or **decrementation** ˇ in the edition windows. • Ⓐ Direct access to transmitter calibration menu.
	• Short keypress: Switches the screen **backlit** on or off. • Long keypress: Switches the unit off.
	• Using the function keys, moves to the **next** (>>) or **previous** fields (<<) in the edition windows.

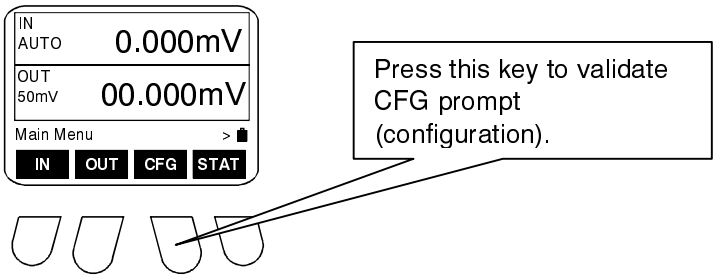
4.4 Using the menus

4.4.1 Validating a prompt

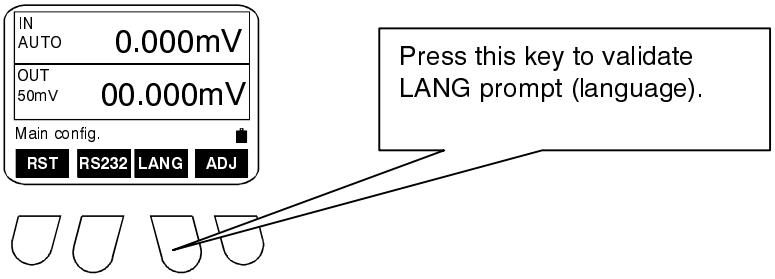
Configuration and programming of the unit are made easier using successive menus.
The menus are located at the bottom of the screen.
To validate a prompt in a menu, press the function key located under this prompt.
If required, a new menu appears, validate again one of these prompts.
And so on until complete programming.
When a menu includes more than four prompts to be validated, symbol > is displayed above the menu bar and tells the user that there are additional prompts available by pressing the › key from the navigator. In the same way, the symbol < is displayed for returning to the beginning of prompts using the ‹ key from the navigator.

Example: Language configuration

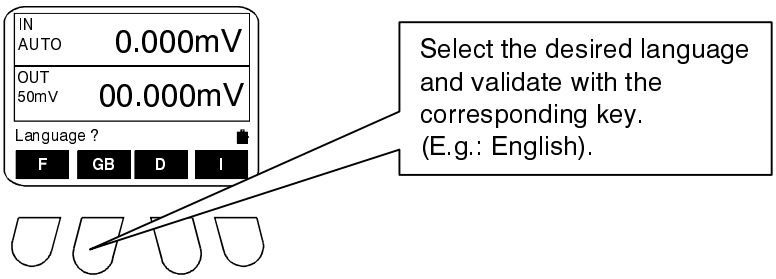
- From the main menu:



- From the configuration menu:



- From the language menu:



(F = French, GB = English, D = German, I = Italian, S = Sweden, E = Spanish, CZ = Czech, NL = Dutch, PL = Poland).

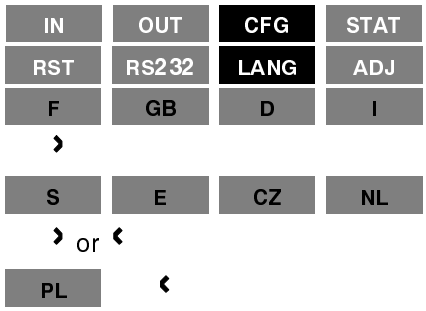
- Return to main menu.

4.4.2 Typographic conventions

In order to help the operator, the different programming procedures are written in a simplified manner.
The menus are represented as they appear on the display by respecting the programming order.
By convention, in the examples following:

- prompt shown as **CFG** should be **validated**,
- prompts shown as **STAT** should be **ignored**,
- prompts shown as **GB** indicate the **different prompts** to be chosen and validated by the operator depending on his/her application.

Example: Language configuration



1. Selecting CFG prompt.
2. Selecting LANG prompt.
3. Prompt to be chosen by the operator.

Return to main menu.

Parameters to be modified in the edition mode are described as follows:

Example: RJ = **XXX.XX**°C.

XXX.XX is the maximum format of the permissible numerical value.

4.4.3 The marker

When programming the unit and for some menus, a marker represented as ♦ and located at right of a prompt tells the operator the active range or function of the unit.
Validating another prompt moves the marker to the new active function.

Example: programming DC voltage over 5 V range

IN	OUT	CFG	STAT
FCT	TRIG	SPE	
V♦	mA	Ω	TEMP

Symbol ♦ indicates that the active function is the voltage measurement.

AUTO♦	50mV	0.5V	5V

The active range is AUTO,
pressing 5V activates the 5 V range and moves the marker to this prompt.

4.4.4 Modifying the parameters

During a programming procedure for entering a number, the unit switches to the editing mode and displays the parameter to be modified in video inverted.

Modification can be performed according two ways:

- Select the digit to be modified using the ‹ and › keys from the navigator, then correct using the keypad, or sometimes, select ←↓↑→ prompt.
- Directly enter the new value using the keypad.

NOTE: To enter a value in exponential notation, activate EXP function from the menu.

Example: Enter 2.5 x 10^{-3} value

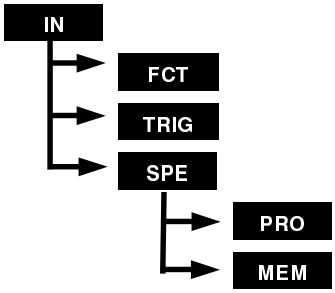
- using the keypad, enter: 2 . 5
- then validate: EXP
- then enter: - 3

In case several variables are necessary, changing to the next (or previous) parameter is done by validating the >> (<<) prompt using the function key.
When all the parameters are correctly entered, validate by pressing the ↵ key.
In case of error, press ↵ to exit without modification.

4.5 Menu flowchart

For the operators trained to programming procedures using successive menus, the simplified representation below will give direct access to the different functions of the unit.

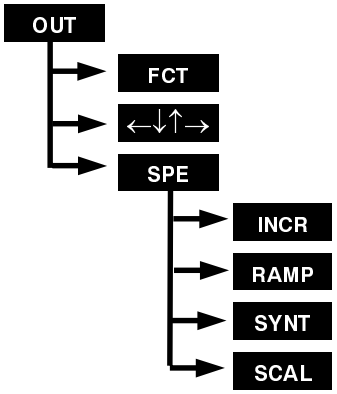
4.5.1 Measurement menu



Chapter 6

- Selects the quantity to be measured.
- Programs the trigger modes.
- Measurement processing.
- Measurement memory.

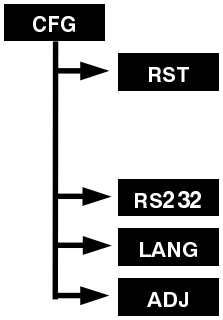
4.5.2 Emission menu



Chapter 7

- Selects the quantity to be emitted.
- Manual editing of values.
- Increment mode.
- Ramp mode.
- Synthesizer mode.
- Scale/linearization corrections.

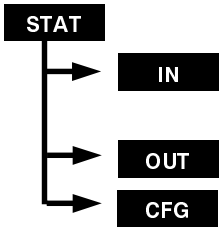
4.5.3 Configuration menu



Chapter 5

- Clears all the data from the memory and resets the unit to its "works" configuration.
- Configures the RS 232 C link.
- Selects message language.
- Reserved to maintenance purposes.

4.5.4 Status menu

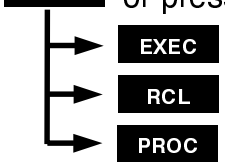


- Displays the measurement configuration.
- Displays the emission configuration.
- Displays the main configuration.

Chapter 5

4.5.5 Transmitter calibration menu

CALTX or pressing A key from the keypad.



- Execution of calibration procedure.
- Recalls calibration report memory.
- Prepares calibration procedure.

Chapter 8

5. MAIN CONFIGURATION

Notes

This chapter deals with the main configuration of all the parameters which concern the unit itself and its RS 232 C interface.

5.1 Status

For displaying status of the unit from the main menu:

IN OUT CFG **STAT**	1. Selection of STAT prompt.
IN OUT CFG	2. Selection of IN prompt and display of the current configuration of the measurement function.
IN **OUT** CFG	3. Selection of OUT prompt and display of the current configuration of the emission function.
IN OUT **CFG**	4. Selection of CFG prompt and display of the unit main configuration.
↵ Return to main menu.	

5.2 Resetting to zero (RST)

From the main menu:

IN OUT **CFG** STAT	1. Selection of CFG prompt.
RST RS232 LANG ADJ	2. Selection of RST prompt.
YES NO	3. Confirmation to be chosen by the operator: If YES, all the data and configurations stored in the permanent memory are reset to "works" values, i.e.: - burst memory is empty, - calibration reports are no longer stored, - possible processing procedures are no longer stored, - measurement: return to VDC range, autoranging, - emission: return to VDC range, 50 mV, If NO, return to the main configuration menu with all the data and configurations already stored in the permanent memory.
↵ Return to main menu.	

5.3 RS 232 C

From the main menu:

IN OUT **CFG** STAT	1. Selection of CFG prompt.
RST **RS232** LANG ADJ	2. Selection of RS 232 prompt.
ON OFF KBDS PROT	3. Enabling (ON) or disabling (OFF) the RS 232 C link.
ON OFF **KBDS** PROT 19.2 9.6 4.8 2.4	4. Selection of transmission rate. Rate in Kbauds to be selected from those prompted.
ON OFF KBDS **PROT** NONE DTR	5. Selection of RS 232 communication protocol. Prompt to be chosen by the operator: NONE: no protocol. DTR: CTS/DTR protocol.
↵ Return to main menu.	

NOTES:

- Length of word is 8 bits.
- Number of stop bits is 1.
- There is no parity checking.

5.4 Language

From the main menu:

IN OUT **CFG** STAT	1. Selection of CFG prompt.
RST RS232 **LANG** ADJ	2. Selection of the language for the menus and help.
F GB D I › S E CZ NL	Select the desired language.
› or ‹ PL ‹	
↵ Return to main menu.	

5.5 Adjustment

From the main menu:

IN OUT CFG STAT	1. Selection of CFG prompt.
RST RS232 LANG ADJ	2. Selection of the unit adjustment. **Adjustment is strictly reserved to maintenance purposes.** All the details concerning this adjustment are given in a maintenance manual.
↵ Exit from adjustment and return to main menu.	

Notes

6. MEASUREMENT FUNCTIONS

Notes

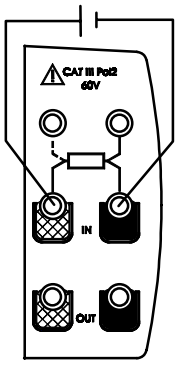
WARNING
The unit measurement input is galvanically insulated from the emission and RS 232 link. Moreover, this input is protected against connection errors and accepts, over all ranges, 60 V as common mode voltage regarding the ground.

6.1 Measuring DC voltage

From the main menu:

IN OUT CFG STAT FCT TRIG SPE V mA Ω TEMP	1. Select the DC voltage measurement function.
AUTO 50mV 0.5V 5V › 50V ‹	2. Select the range adapted to the measurement.

Connection



Ranges	Auto	50 mV	0.5 V	5 V	50 V
Impedance	----	> 1 000 MΩ	> 1 000 MΩ	10 MΩ	10 MΩ
Protection	**60 VDC or AC**				

6.2 Measuring current

From the main menu:

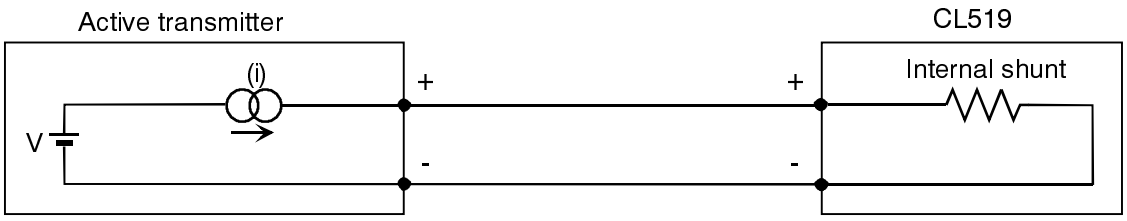
IN OUT CFG STAT FCT TRIG SPE V mA Ω TEMP	1. Select the current measurement function.
ATX PTX⏚	2. Type of transmitter connected to the unit: ATX: Active transmitter. PTX⏚: Passive transmitter.

Single range	50 mA
Voltage drop	< 1.2 V
Protection	**60 VDC or AC**

RECALLING THE CONNECTION PRINCIPLES

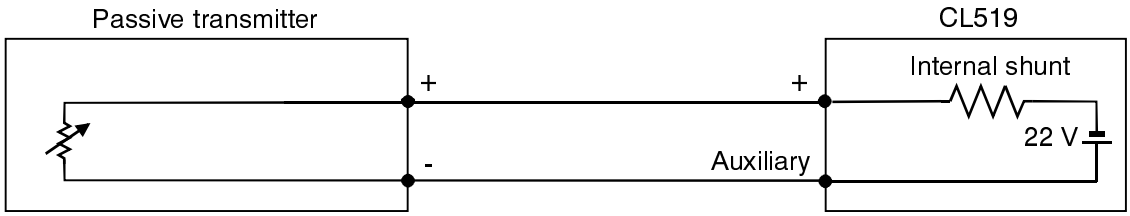
Active transmitter checking

The current generator (i) of the transmitter is supplied by a source (V) set to the transmitter side or inside the telemetry loop. The unit, connected to an "active transmitter", is just a milliammeter.



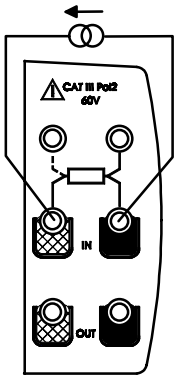
Passive transmitter checking

The CL519 always measures the loop current but also supplies the transmitter current source.



6.2.1 Measuring conventional current

Connection



From the main menu:

IN	OUT	CFG	STAT	1. Select the current measurement function.
FCT	TRIG	SPE		
V	mA	Ω	TEMP	
	ATX	PTX⊣⊢		2. Select ATX prompt: active transmitter.

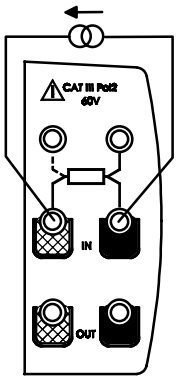
6.2.2 Measuring current with connection to a transmitter

NOTE: If the current loop must be opened to place the unit, make sure that this handling may be done without any damage for the concerned installation.

Active transmitter

From the main menu:

Connection

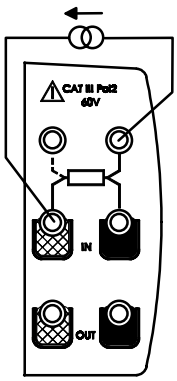


IN	OUT	CFG	STAT	1. Select the current measurement function.
FCT	TRIG	SPE		
V	mA	Ω	TEMP	
	ATX	PTX⊣⊢		2. Select the ATX transmitter type.

Passive transmitter

From the main menu:

Connection



IN	OUT	CFG	STAT	1. Select the current measurement function.
FCT	TRIG	SPE		
V	mA	Ω	TEMP	
	ATX	PTX⊣⊢		2. Select the PTX⊣⊢ transmitter type.

6.3 Measuring resistance

From the main menu:

IN	OUT	CFG	STAT	1. Select the resistance measurement function.
FCT	TRIG	SPE		
V	mA	Ω	TEMP	
AUTO	500Ω	5kΩ	MODE	2. Select the 2, 3 or 4-wire mode.
w2	w3	w4		
AUTO	500Ω	5kΩ	MODE	3. Select the desired range.

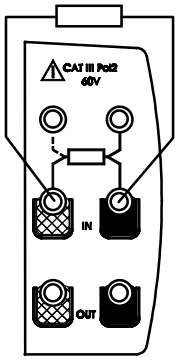
NOTE: With the 2-wire mode, the measurement will include the resistance of the measuring leads.

Ranges	Auto	500 Ω	5 kΩ
Measurement current	----	1 mA	0.1 mA
Protection	**60 VDC or AC**		

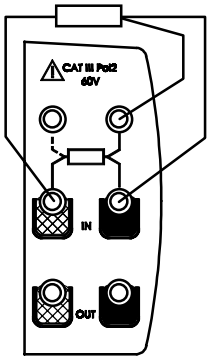
NOTE: To perform a correct resistance measurement with the 3-wire mode, it is necessary to use 3 conductors having:

- the same length,
- the same diameter,
- the same metallic nature.

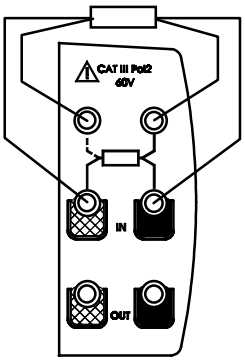
2-wire connection



3-wire connection



4-wire connection



6.4 Measuring temperature with a thermocouple

From the main menu:

IN OUT CFG STAT FCT TRIG SPE V mA Ω TEMP	1. Select the temperature measurement function.
TC Rt UNIT °C °F K	2. If required, select the temperature unit.
TC Rt UNIT CJC TYPE K T J E › N U L S › or ‹ R B C PL › or ‹ MO ‹	3. Select the Tc prompt, then the desired thermocouple.

Available thermocouples	**K, T, J, E, N, U, L, S, R, B, C, PL, Mo**

6.4.1 Cold junction compensation

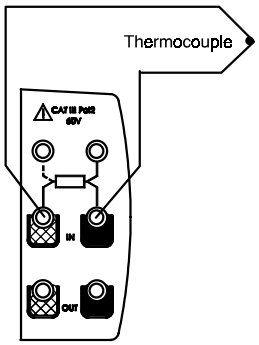
6.4.1.1 Internal reference junction

The thermocouple is directly connected (or by means of compensation cable) to the terminals of the unit. The correction is performed by the unit which permanently measures the temperature at terminals (room temperature).

CJC TYPE ON OFF PROG	Activate the internal reference junction.

WARNING: After an important heat shock, we suggest you to leave the unit to settle in temperature before to use the internal reference junction (CJC) in order to get the max. accuracy.

Direct connection

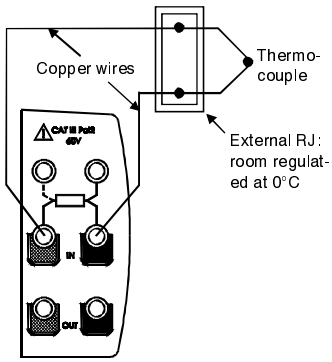


6.4.1.2 External reference junction at 0°C

In that case, the temperature measurement is not compensated by the unit internal reference.
The junction between the thermocouple and the emf conductor cable is realized at 0°C room temperature.

CJC TYPE ON OFF PROG	Deactivate the internal reference junction.

Connection with external RJ at 0°C

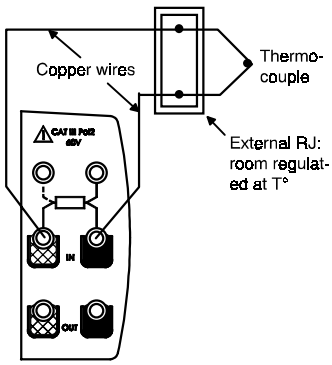


6.4.1.3 External reference junction different from 0°C

When the junction between the thermocouple and the emf conductor cable is made at regulated room temperature different from 0°C, it is necessary to compensate this value by program.

CJC TYPE ON OFF PROG RJ: XXX.XX °C	1. Enter the temperature value of the reference junction using the keypad.
↵	2. Validate.

Connection with external RJ regulated at T°



6.5 Measuring temperature with an RTD

From the main menu:

IN OUT CFG STAT FCT TRIG SPE V mA Ω TEMP	1. Select the temperature measurement function.
TC Rt UNIT °C °F K	2. If required, select the temperature unit.
TC **Rt** UNIT	3. Select the RTD function.
Pt Ni Cu MODE w2 w3 w4	4. Select the 2, 3 or 4-wire mode.
Pt Ni Cu MODE	5. Select type of the RTD used.
Pt Ni Cu MODE P50 P100 P200 P500 › P1K 3916 3926 ‹	6. Select the Pt prompt, then the desired RTD, or
Pt **Ni** Cu MODE N100 N120 N1K	7. Select the Ni prompt, then the desired RTD, or
Pt Ni **Cu** MODE CU10 CU50	8. Select the Cu prompt, then the desired RTD.

Available Pt RTDs	Pt 50	Pt 100 (3851)	Pt 200	Pt 500	Pt 1000
Protection	**60 VDC or AC**				
Available Pt RTDs (Cont'd)	Pt 100 (3916)	Pt 100 (3926)			
Protection	**60 VDC or AC**				

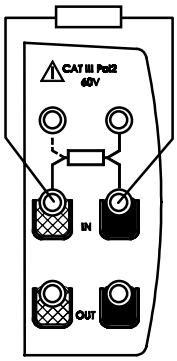
Available Ni RTDs	Ni 100	Ni 120	Ni 1000
Protection	**60 VDC or AC**		

Available Cu RTDs	Cu 10	Cu 50
Protection	**60 VDC or AC**	

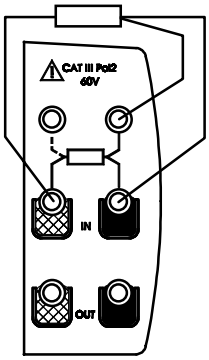
NOTE: To avoid any error when measuring in 3-wire mode, we suggest you:

- perform measurements using conductors of same length, same diameter and same metallic nature (a difference of 40 mΩ between 2 wires leads to an error of approximately 0.1°C),
- take care of connections to avoid stray emf.

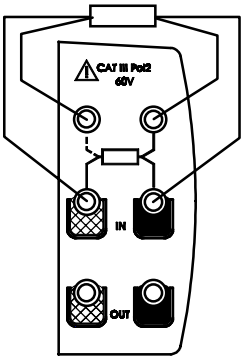
2-wire connection



3-wire connection



4-wire connection



6.6 Measuring with an external module

From the main menu:

IN OUT CFG STAT FCT TRIG SPE	
V mA Ω TEMP › HM28 PRES ‹	1. Select measurement function with an external module CL519-ACL333.

6.6.1 Connection

Connect the external module and the unit using a cord connected to the RS 232 C connector and check that the RS 232 C communication is active (ON) (see paragraph. 5.3).
Check that the communication parameters are similar for the CL519 and the external module.
For more details, refer to the instruction manual of the external module.
The unit and the module, connected as indicated above, communicate and each measurement performed by the module is displayed by the unit in the IN window.

6.7 Relative measurements

The relative measurement function enables the user:
- to program a reference value different from the unit one's (NUL function),
- to cancel by measurement or program a constant or stray value (TARE function).

When the relative measurement function is validated, symbol  appears on the screen in the IN window.
The unit has a reference value in memory per function (V, mA, ohm, TC, RT) and also a reference value associated to the scaling function.

6.7.1 Programming a new reference value

By program, the **Ref** value (positive or negative) is subtracted from the measurements:

[READING] = [MEASUREMENT] – Ref

From the main menu:

IN OUT CFG STAT FCT TRIG SPE PRO MEM NUL SCAL	1. Select the relative measurement mode.
ON OFF TARE PROG Ref : X.XXXXe+XX	2. Program the reference value.
↵	3. Validate.

Validate either **ON** or **OFF** to activate or exit from this mode.

6.7.2 Measuring a new reference value

TARE function measures the quantity present at the unit terminals and then subtracts it from all the measurements:

[READING] = [MEASUREMENT] - TARE

From the main menu:

IN OUT CFG STAT FCT TRIG SPE PRO MEM NUL SCAL	1. Select the relative measurement mode.
ON OFF TARE PROG	2. The reference value is measured and taken into account.

TARE function is activated since the prompt is validated.

To exit from this operating mode, perform the procedure again and select **OFF**.

6.8 Scale correction

Scale correction function performs the conversion between the measured electrical quantities and the converted physical quantities.
Programming 2 points defines a scale correction straight enabling a direct reading of physical quantities:

$$[\ \textbf{READING}\ ] = [\ \textbf{K} \times \textbf{MEASUREMENT}\ ] + \Delta$$

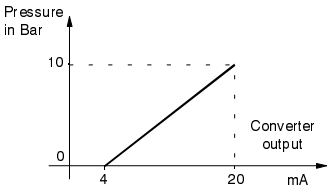
Symbol is displayed on the screen in the IN window when the scale correction is activated.
In case of display capacity overrange when programming a too high multiplier coefficient, symbol ✳ is also displayed on the screen.

From the main menu:

IN OUT CFG STAT FCT TRIG SPE PRO MEM NUL SCAL	1. Select the scale correction function.
ON OFF PROG › CLRP CLRA RES UNIT ‹	2. If required, clear all the current corrections.
ADDP ↓ ↑ EDITP X0 : 0.0000e+00 >> Y0 : 0.0000e+00	3. Enter the new coordinates: X0, Y0.
↵	4. Validate.
ADDP ↓ ↑ EDITP X1 : 1.0000e+00 >> Y1 : 1.0000e+00	5. Enter the new coordinates: X1, Y1.
↵	6. Validate.
› CLRP CLRA RES UNIT Res : 2	7. Select the display resolution. (max. **Res** = 4).
↵	8. Validate.
CLRP CLRA RES UNIT Unit : ...	9. Select the measurement unit using the ^, v, ‹ and ›, from the navigator. Available characters: from 0 to 9, from A to Z and from a to z, as well as various symbols and all characters usable with the selected language.
↵	10. Validate.
↵ ON OFF PROG	11. Activate or deactivate the scale correction.

Example

A converter returns, on a 4-20 mA scale, a signal proportional to a pressure which varies from 0 to 10 bar, i.e.:



Hence:
for X0 = 4 mA, Y0 = 0 Bar and for X1= 20 mA, Y1= 10 Bar.
After programming coordinates of these two points, the unit computes the displayed value according to the measured value.
E.g.: Measuring 12 mA will display 5 Bar on the screen.

NOTES:

- Programming function is not available if scale correction is activated.
- Whatever is the input order of the different points, we always have X0 < X1.

Summary of the scale correction programming functions:

PROMPTS	FUNCTIONS
ADDP	Adds a linearization point.
↓ ↑	Displays the previous or next point. The operator can also use the ^ and v keys from the navigator.
EDITP	Changes the coordinates of the displayed point.
CLRP	Clears the displayed point.
CLRA	Clears all the linearization points and returns to normal mode (y=x).
RES	Determines the display resolution.
UNIT	Defines the measurement unit.

6.9 Linearization

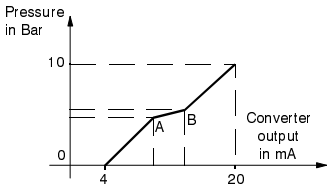
Linearization corrects in part the errors induced by non-linear sensors/converters systems. The SCAL function enables the user to define up to 9 straight segments; i.e. 10 points in order to approximate the non-linear response curve and to perform scale corrections according to each segment.
Programming a linearization is similar to scale correction, only the number of points to be defined is different.
When the linearization is activated, symbol is displayed on the screen in the IN window.
In case of display capacity overrange when programming a too high multiplier coefficient, symbol ✳ is also displayed on the screen.

From the main menu:

IN OUT CFG STAT FCT TRIG SPE PRO MEM NUL SCAL	1. Select the scale correction function.
ON OFF PROG › CLRP CLRA RES UNIT ‹	2. If required, clear all the current points.
ADDP ↓ ↑ EDITP X : 0.0000e+00 >> Y : 0.0000e+00	3. Change the X and Y coordinates of the first two linearization points. (X0, Y0 and X1, Y1).
↵	4. Validate.
ADDP ↓ ↑ EDITP X : 1.0000e+00 >> Y : 1.0000e+00	5. Add and enter the X and Y coordinates of the next linearization points.
↵	6. Validate each point.
› CLRP CLRA RES UNIT Res : 2	7. Select the display resolution. (max. **Res** = 4).
↵	8. Validate.
CLRP CLRA RES UNIT Unit : _ . . .	9. Select the measurement unit using the ^, v, ‹ and ›, from the navigator. Available characters: from 0 to 9, from A to Z and from a to z, as well as various symbols and all characters usable with the selected language.
↵	10. Validate.
↵ ON OFF PROG	11. Activate or deactivate the scale correction.

Example

A converter returns, on a non linear 4-20 mA scale, a signal proportional to a pressure which varies from 0 to 10 Bar, i.e.:



In addition to top and end scale points, it is necessary to define points A and B in order to compensate the sensor/converter system linearity error and perform a direct reading measurement.

NOTES:

- Linearization programming functions available are similar to the scale correction ones.
- Whatever is the input order of the different points, we always have X0 < X1 < X2 ... < X9.

6.10 Triggered and recorded measurements

The trigger mode enables the user:
- to acquire manual measurement bursts,
- to start acquisition of automatic measurement bursts,
- to program a trigger level of an automatic measurement burst,
- to hold measurement display.

Whatever is the trigger mode selected, the measurements are performed regarding the active range and function at the time of trigger.

6.10.1 Memorization principle

Each measurement burst is systematically stored and has an order number.
Each time a new record is performed:
- a burst with order number -1 is created,
- the existing bursts are shifted in the memory zone,
- the order number of existing bursts is decremented.

When the memory is full, the oldest bursts are erased and lost.
From 1 to 85 bursts composed from 1 000 measurements to one measurement can be kept in memory.
To keep in memory a burst number (**Ns**), we must satisfy to the inequality following:

$$Nm + (11 * Ns) \leq 1\,024$$

where **Nm** is the total number of recorded bursts.

6.10.2 Manual measurement burst

From the main menu:

IN OUT CFG STAT FCT TRIG SPE RUN HOLD BTRIG PROG ›	1. Select the triggered measurement function.
LTRIG MTRIG 🔔♦	2. Acquire a measurement.
‹ RUN HOLD BTRIG PROG	3. Exit from the manual acquisition mode.

Each time MTRIG is validated, the displayed measurement is stored in the burst and this up to validation of RUN to exit from this mode.

When the trigger mode is activated, symbols ⧗ and ⧖ are alternately displayed on the screen in the IN window.

Prompt 🔔♦ enables the user to activate or not an audible warning (beep) each time a record is performed, the marker indicates its status.

6.10.3 Automatic measurement burst

From the main menu:

IN OUT CFG STAT FCT TRIG SPE	1. Select the triggered measurement function.
RUN HOLD BTRIG PROG N = XXXX >> T = XXXX.X s ↵	2. Program the burst: - enter the number of samples, - enter the time interval between each sample.
RUN HOLD BTRIG PROG	3. Start execution of burst.

Programming limits

$1 \leq N \leq 1\,000$.
$0.5\text{ s} \leq T \leq 6{,}500\text{ s}$.
If T < 0.8 s (Ω and RTD ranges), it automatically adjusts to 0.8 s.

Each time BTRIG is validated, a new measurement burst is stored.
It is possible, at any time, to stop execution of an automatic measurement burst by validating RUN prompt.
When the trigger mode is activated, symbols ⧗ and ⧖ are alternately displayed on the screen in the IN window.
Prompt 🔔♦ enables the user to activate or not an audible warning (beep) each time a record is performed, the marker indicates its status.

6.10.4 Level trigger

From the main menu:

IN OUT CFG STAT FCT TRIG SPE RUN HOLD BTRIG PROG › LTRIG MTRIG 🔔♦	1. Program the burst as described above and select the level trigger function (or level L).
⎍ ⎍ PROG Level : X.XXXXe+XX ↵	2. Program the trigger level. - enter the level value.
⎍ ⎍ PROG	3. An automatic measurement burst is triggered after detection of a level either on ascending or descending edge depending on choice.

Overrun of a level always triggers an automatic measurement burst such as programmed.

It is possible, at any time, to exit from the trigger mode by validating RUN prompt.

Each measurement function has its own programmable level value.

Function active at the time of trigger determines the level value to be used.

6.10.5 Hold display

From the main menu:

IN OUT CFG STAT FCT TRIG SPE	1. Select the triggered measurement function.
RUN HOLD BTRIG PROG	2. Hold measurement display.

Return to normal display (continuous measurement cycle):

RUN HOLD BTRIG PROG	Run continuous measurement cycle.

6.11 Memory

The measurement bursts performed in trigger mode are saved in the permanent memory of the unit.
Saving data contained in memory is independent from the battery charge status. The batteries may be disconnected for maintenance purposes without altering the memory contents.
Function RST from the main configuration menu resets the memory content and clears all data.
The memory processing menu enables the user:

- to consult the measurement bursts,
- to display the minimum, maximum and average values of each measurement burst,
- to print the stored bursts,
- to clear the undesired bursts.

6.11.1 Consulting values of a measurement burst

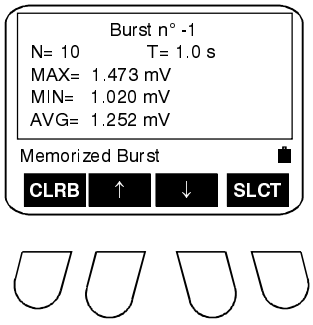
When selecting a burst, there are display of:

- the burst order number,
- the number of recorded values,
- the time interval between each value,
- the burst minimum, maximum and average values.

From the main menu:

IN OUT CFG STAT FCT TRIG SPE PRO MEM	1. Select the memory management function.
CLRB ↓ ↑ SLCT CLRB ↓ ↑ SLCT	2. Select the desired burst.
DISP OUT ↓ ↑	3. Display the burst values.

Example



6.11.2 Clearing a measurement burst

From the main menu:

IN OUT CFG STAT FCT TRIG SPE PRO MEM	1. Select the memory management function.
CLRB ↓ ↑ SLCT	2. Select the burst to be cleared.
CLRB ↓ ↑ SLCT YES NO	3. Clear the displayed burst.

When a measurement burst is cleared, its order number is assigned to the next burst. Consequently, the order number of all next bursts is decremented of one unit.

6.11.3 Printing a measurement burst

NOTE: Impossible if the external function is activated in measurement or emission.

A measurement burst may be directly printed on a serial printer:
- connect the printer cable to the RS 232 connector of the unit.
- make sure that parameters of the unit serial link and printer are compatible.

From the main menu:

IN OUT CFG STAT FCT TRIG SPE PRO MEM	1. Select the memory management function.
CLRB ↓ ↑ SLCT DISP OUT	2. Select the desired burst.
EXEC PROG M/L= XXXXX >> L/P= XXXXX >> T/L= XXXX.X S ↵	3. Program printing: - number of measurements per line, - number of lines per page, - time-delay between 2 lines.
DISP OUT EXEC PROG ↵	4. Start printing of the burst. To exit.

Programming limits

0.1 s ≤ **T/L** ≤ 6500 s

6.11.3.1 Printing format

When printing a measurement burst:
- each measurement has 11 characters,
- measurements are separated by 3 blanks,
- printing ends with a page feed.

6.11.3.2 RS 232 C connection

The serial link meets RS 232 C standards.
Connection to other equipment may be done using cords whose wiring is described below.

CL519 side	Signals		Printer side		
SUB D 9 Male	Function	Direction	SUB D 25 Female	SUB D 9 Female	SUB D 25 Male
1	CD	>	8	1	--
2	RD	>	3	2	3
3	TD	<	2	3	2
4	DTR	<	20	4	20
5	Com.		7	5	7
6	DSR	>	6	6	--
7	RTS	<	4	7	--
8	CTS	>	5	8	5
9	RI	>	22	9	--
OMEGA numbers	—	—	AN 5874	AN 5875	AN 5876

Wiring of the available RS 232 C link cords

Notes

7. EMISSION/SIMULATION FUNCTIONS

Notes

WARNING
The emission output of the unit is galvanically insulated from the measurement and RS 232 link. Moreover, this output is protected against connection errors and accepts, over all ranges, 60 V as maximum voltage regarding the ground.

7.1 Modifying the emission value

NOTE: Impossible when using the external emission function.
For safety reasons, and by default at switching on, the emission quantity is null (except when measuring temperatures with K unit where the value is 273 K).

7.1.1 Entering a new value

At any time and whatever is the active menu, the user may enter a new emission value (except in a programming mode).
Entering a new emission value is done directly by using the unit keypad.
It applies to the active function and bears the unit displayed. The quantity is present on the OUT terminals when pressing the ↵ key.

7.1.2 Incremental modification

From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE	1. Select the incremental function.
< ↓ ↑ >	2. Select and modify the desired digit.
↵	Return to previous menu.

In the OUT window, the selected digit is represented in video inverted.
< and > prompts (or the ‹ and › keys from the navigator) enable the user to select another digit.
Prompt ↑ (or the ^ key from the navigator) increments the selected digit of one unit (with carry).
Prompt ↓ (or the ˇ key from the navigator) decrements the selected digit of one unit (with carry).
The value displayed is active with no need of validation.
NOTE: With this menu, it is not possible to change emission function or range. Any overrange on the active function or range activates an audible warning (beep).

7.1.3 Checking the emitted electrical quantity

Symbol ⚠ blinks in the OUT window and there is emission au audible beep when:
- the load resistance is too low in voltage emission.
- the load resistance is too high in current emission.

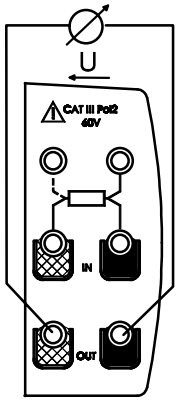
7.2 DC voltage emission

From the main menu:

IN	OUT	CFG	STAT	1. Select the DC voltage emission function.
FCT	←↓↑→	SPE		
V	mA	Ω	TEMP	
50mV	0.5V	5V	50V	2. Select the range adapted to the emission value.
3. Enter the value to be emitted using the keypad (see § 7.1.1 and 7.1.2).				

Ranges	50 mV	500 mV	5 V	50 V
Resolution	1 µV	10 µV	100 µV	1 mV
Source resistance	**< 0.1 Ω**			
Output current	**≤ 6 mA**			

Connection



7.3 DC current emission

The unit simulates a transmitter.

From the main menu:

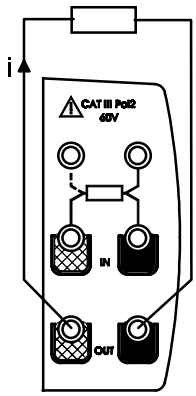
IN	OUT	CFG	STAT	1. Select the DC current emission function.
FCT	←↓↑→	SPE		
V	mA	Ω	TEMP	
PTX⏚	AT24	AT50		2. Select: PTX⏚: Passive transmitter. AT24: Active transmitter. AT50: Active transmitter.
3. Enter the value to be emitted using the keypad (see § 7.1.1 and 7.1.2).				

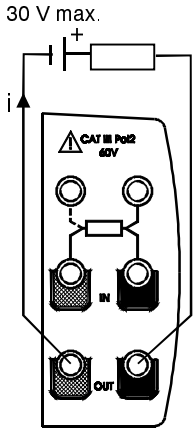
Ranges	TA24	TA50
Max. load resistance	900 Ω	1.8 kΩ

The DC current emission function enables the user to indifferently simulate active transmitters (AT24 or AT50) or passive transmitters (PTX⏚).
With active transmitters, the unit compliance is 26 V (AT24) or 50 V (AT50).
In case the current loop is powered (AT24 or AT50), the CL519 cannot simulate a current below 1 mA.

NOTE: If a current loop must be opened to place the CL519, make sure that this handling may be done without any damage for the concerned installation.

Connections





PTX connection

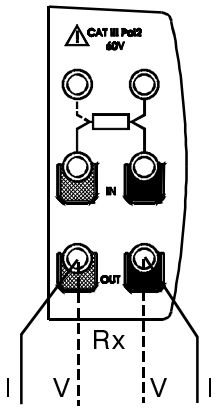
7.4 Resistance simulation

From the main menu:

IN / OUT / CFG / STAT FCT / ←↓↑→ / SPE V / mA / Ω / TEMP	1. Select the resistance simulation function.
500Ω / 5KΩ	2. Select the range adapted to the simulation value.
3. Enter the value to be simulated using the keypad (see § 7.1.1 and 7.1.2).	

Ranges	500 Ω	5 kΩ
Resolution	10 mΩ	100 mΩ
Rated current (**In**)	1 mA	0.1 mA
Settling time	≤ 5 ms	

Connection



Resistance simulation function can be used in **2-, 3- or 4-wire**.

Whatever is the mode used, it is compulsory to respect the measurement current limits (**measurement current < 5 In**).

The measurement current should be applied for at least **5 ms** to consider that the simulated resistance is stable.

NOTE: If using a scanning acquisition system, make sure that the current is present more than 5 ms to avoid any measurement errors due to response time of the resistance simulation function.

7.5 Thermocouple simulation

From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE V mA Ω TEMP	1. Select the thermocouple simulation function.
TC Rt UNIT °C °F K	2. If required, select the temperature unit.
TC Rt UNIT CJC TYPE K T J E › N U L S › or ‹ R B C PL › or ‹ MO ‹	3. Select the desired thermocouple to be simulated.
4. Enter the value to be simulated using the keypad (see § 7.1.1 and 7.1.2).	

Available thermocouples	**K, T, J, E, N, U, L, S, R, B, C, PL, Mo**

7.5.1 Cold junction compensation

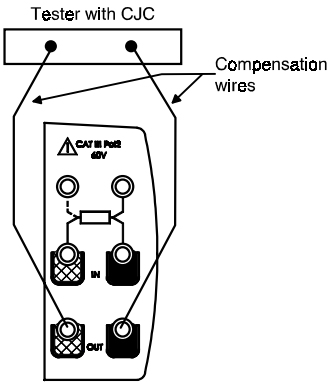
7.5.1.1 Internal reference junction

This type of connection is to be used when the receiver is equipped with an internal reference junction which should be activated.
From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE V mA Ω TEMP TC Rt UNIT CJC TYPE ON OFF RTD PROG	1. Activate the internal reference junction.

The function simulates a compensated thermocouple according to the room temperature.

Connection



WARNING: After an important heat shock, we suggest you allow the unit to settle in temperature before using the internal reference junction (CJC) in order to get the max. accuracy.

7.5.1.2 External reference junction at 0°C

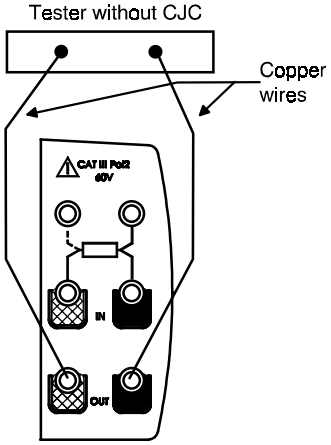
From the main menu:

IN	OUT	CFG	STAT
FCT	←↓↑→	SPE	
V	mA	Ω	TEMP
TC	Rt		UNIT
CJC		TYPE	
ON	OFF	RTD	PROG

1. Deactivate the internal reference junction.

In this case, the function simulates a non-compensated thermocouple with a reference junction at 0°C.

Connection



7.5.1.3 External reference junction different from 0°C

From the main menu:

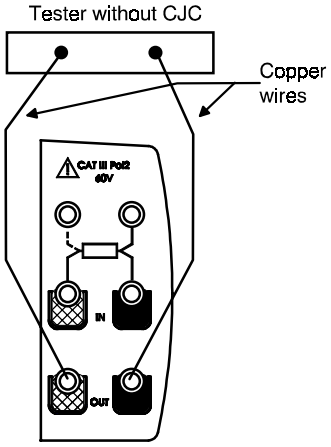
IN	OUT	CFG	STAT
FCT	←↓↑→	SPE	
V	mA	Ω	TEMP
TC	Rt		UNIT
CJC		TYPE	
ON	OFF	RTD	PROG

1. Select the reference junction programming function.

RJ : XXX.XX °C	2. Enter the new reference value.
↵	3. Validate.

The function simulates a non-compensated thermocouple with a reference junction different from 0°C.

Connection



7.5.1.4 Reference junction using the measurement input

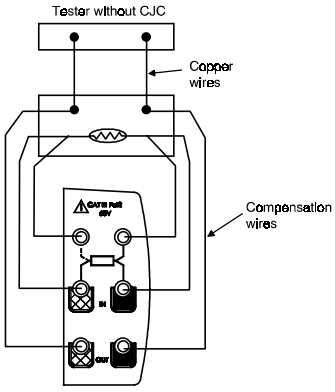
From the main menu:

IN	OUT	CFG	STAT
FCT	←↓↑→	SPE	
V	mA	Ω	TEMP
TC	Rt		UNIT
CJC		TYPE	
ON	OFF	RTD	PROG

1. Select the reference junction programming function using RTD.

Temperature of the reference junction can be measured by connecting a Pt 100 RTD on the measurement input.

Connection

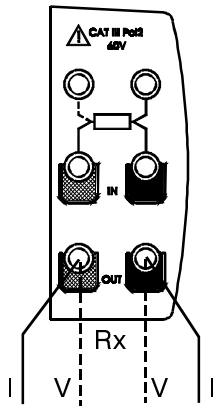


7.6 RTD simulation

From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE V mA Ω TEMP	1. Select the temperature simulation function.
TC Rt UNIT °C °F K	2. If required, select the temperature unit.
TC Rt UNIT	3. Select the RTD function.
Pt Ni Cu	4. Select type of the RTD used.
Pt Ni Cu P50 P100 P200 P500 › P1K 3916 3926 ‹	5. Select Pt prompt, then the desired RTD, or
Pt Ni Cu N100 N120 N1K	6. Select the Ni prompt, then the desired RTD, or
Pt Ni Cu CU10 CU50	7. Select the Cu prompt, then the desired RTD.
8. Enter the value to be simulated using the keypad (see § 7.1.1 and 7.1.2).	

Connection



Available Pt RTDs	Pt 50	Pt 100 (3851)	Pt 200	Pt 500	Pt 1000
Rated current (**In**)	1 mA			0.1 mA	

Available Pt RTDs (Cont'd)	Pt 100 (3916)	Pt 100 (3926)
Rated current (**In**)	1 mA	

Available Ni RTDs	Ni 100	Ni 120	Ni 1000
Rated current (**In**)	1 mA		0.1 mA

Available Cu RTDs	Cu 10	Cu 50
Rated current (**In**)	1 mA	

NOTE: If using a scanning acquisition system, make sure that the current is present more than 5 ms to avoid any measurement errors due to response time of the resistance probe simulation function.

The resistance probe simulation function can be used in **2-, 3-, or 4-wire** mode.

Whatever is the mode used, it is compulsory to respect the measurement current limits (**measurement current < 5 In**).

The measurement current should be applied for at least **5 ms** to consider that the simulated resistance probe is stable.

7.7 Simulation with an external module

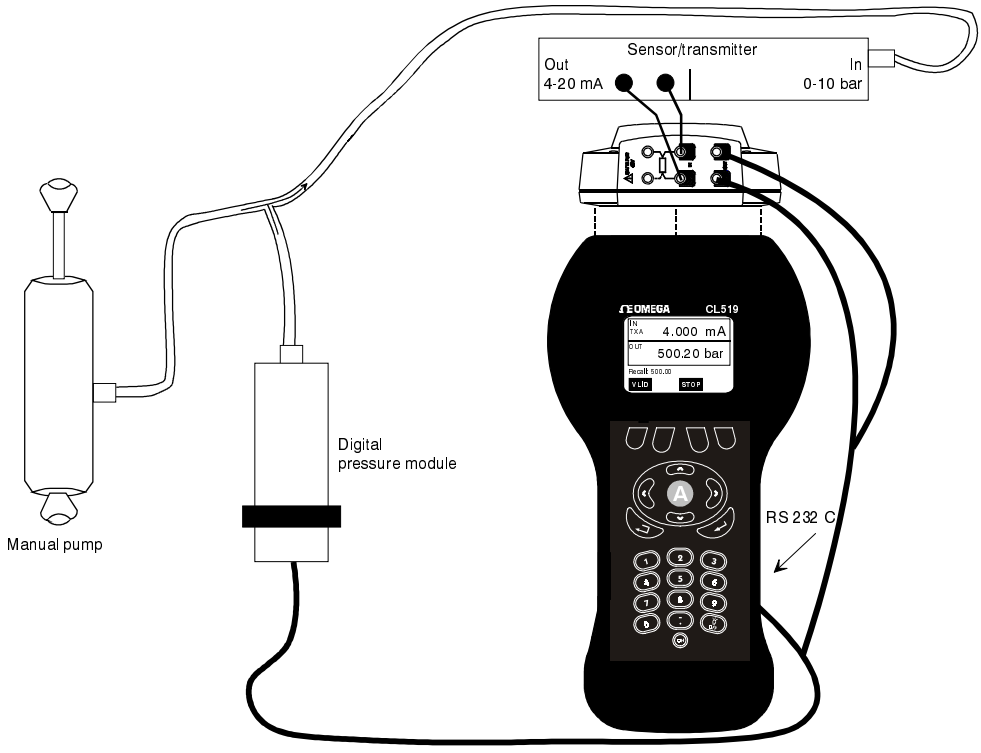
From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE V mA Ω TEMP › HM28 PRES ‹	1. Select simulation function with an external module CL519-ACL333.

7.7.1 Connection

Connect the external module and the unit using a cord connected to the RS 232 C connector and check that the RS 232 C communication is active (ON) (see paragraph. 5.3).
Check that the communication parameters are compatible for the CL519 and the external module.
For more details, refer to the instruction manual of the external module.
The unit and the module, connected as indicated above, communicate and each setpoint emitted by the module is displayed by the unit in the OUT window.
In these conditions, there is no setpoint emitted by the unit over its OUT +/- terminals and, consequently, any manual or automatic edition is impossible.

7.7.2 Example: Simulating pressure using an external module

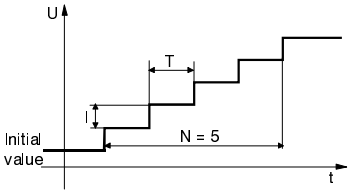


7.8 Increment generation

NOTE: Impossible when using the external emission function.

Increment generation function enables the user to program an incremental progression of the active emission function.

Signal progression is characterized as follows:
- increment amplitude (**I**),
- number of increments (**N**),
- step duration (**T**).



From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE INCR RAMP SYNT SCAL	1. Select the increment generation function.
PROG I = X.XXXXe+XX >> N = XXXXX >> T = XXXX.X s	2. Program the incremental progression, enter: • increment **amplitude**, • **number** of increments, • step **duration**.
↵	3. Validate.
⎍ ⎍ STOP H/R	4. Start an ascending or descending increment cycle.

Programming limits

Variation amplitude should not be higher that the active range limits.

$1 \leq \mathbf{N} \leq 65\,000$

$0.5\ s \leq \mathbf{T} \leq 6\,500\ s$

When an increment cycle starts, symbol ⎍ is displayed in the OUT window.

Incremental generation cycle starts at the initial value displayed up to the final value.

Prompt **STOP** stops progression at any time.

Prompt **H/R** holds or restarts the cycle again. When progression is held, symbol ⎍ blinks on the screen.

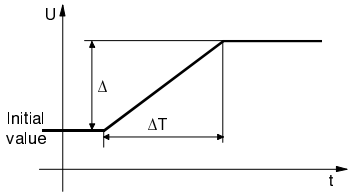
7.9 Ramp generation

NOTE: Impossible when using the external emission function.

Ramp generation function enables the user to program a linear variation of the active emission function.
This function supplies two types of variable signals on the output:
- an increasing or decreasing simple ramp,
- an increasing, then decreasing cyclical ramp.

7.9.1 Simple ramp

Simple ramp is characterized as follows:
- variation amplitude (Δ),
- variation duration (Δ**T**).



From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE INCR RAMP SYNT SCAL	1. Select the ramp generation function.
PROG ⌐‾ ‾⌙ H/R	2. Validate simple ramp programming function.
Δ = X.XXXXe+XX >> ΔT = XXXXXX.X s	3. Enter **amplitude** and ramp **duration**.
↵	4. Validate.
PROG ⌐‾ ‾⌙ H/R ›	5. Start execution of an ascending or descending ramp.
PROG ⌐‾⌙ STOP H/R	6. If required, stop progression.

Programming limits

Amplitude Δ of the variation should not be higher than the active range limits.
0.1 s ≤ Δ**T** ≤ 100 000 s

When execution of simple ramp starts, symbol ⁄ is displayed in the OUT window.

Ramp starts at the initial value displayed up to the final value.

Prompt **STOP** stops progression at any time.

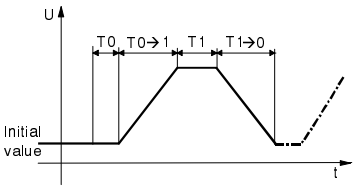
Prompt **H/R** stops or restarts the cycle again. When progression is held, symbol ⁄ blinks on the screen.

During execution, validation of ⌐‾ or ‾⌙ enables the user:
- to run again a complete execution of an ascending or descending simple ramp,
- to invert the variation direction of the active emission function.

7.9.2 Cyclical ramp

The cyclical ramp is characterized as follows:

- variation amplitude (Δ),
- number of cycles (**N**),
- initial value home time (**T0**),
- rise time (**T0→1**),
- final value home time (**T1**),
- fall time (**T1→0**).



From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE INCR RAMP SYNT SCAL	1. Select the ramp generation function.
PROG ⌐‾ ‾⌙ H/R › PROG ⌐‾⌙ STOP H/R	2. Validate cyclical ramp programming prompt.
Δ = X.XXXXe+XX >> N = XXXXX >> T0 = XXXXXX.X s ↵ T0→1= XXXXXX.X s >> T1 = XXXXXX.X s >> T1→0= XXXXXX.X s ↵	3. Enter parameters as follows: • ramp amplitude, • number of cycles, • initial value home time. Validate, then enter: • rise time, • final value home time, • fall time, Validate.
PROG ⌐‾⌙ STOP H/R	4. Start execution of cyclical ramps.

Programming limits

Amplitude Δ of variation should not be higher than the active range limits.
1 ≤ **N** ≤ 65 000.
0.1 s ≤ **T0** ≤ 100 000 s.
0.1 s ≤ **T0→1** ≤ 100 000 s.
0.1 s ≤ **T1** ≤ 100 000 s.
0.1 s ≤ **T1→0** ≤ 100 000 s.

When execution of cyclical ramps starts, symbol ⁄ is displayed in the OUT window.

Prompt **STOP** stops progression at any time.

Prompt **H/R** stops or restarts the cycle again. When progression is held, symbol ⁄ blinks on the screen.

7.10 Synthesizer

NOTE: Impossible when using the external emission function.

Synthesizer function enables the user:
- to store in permanent memory up to 100 emission values,
- to recall and emit manually or automatically the contents of these memories.

7.10.1 Entering values into memory

From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE INCR RAMP SYNT SCAL	1. Select the synthesizer function.
STO M↑ M↓ RCL	2. Select memory edition function.
No= XXX >> Val= X.XXXXe±XX ↵	3. Enter or modify the number and contents of all memories to be used. Validate each edition.
↵	4. Exit from edition mode.

In edition mode, the unit reads the number and the contents of a memory.

Editions or modifications are validated by pressing the ↵ key.

After validation, the edition of the next memory is prompted.

WARNING: Memories only keep the numerical values applicable to all emission functions. Recalling a memory containing value 10 will give:
- simulation of a resistance of 10 Ω if the active function is the resistance simulation,
- simulation of a temperature of 10°C if the active function is the temperature simulation,
- generation of a voltage of 10 V if the active function is the voltage emission, etc. ...

7.10.2 Manual cycle

From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE INCR RAMP SYNT SCAL	1. Select the synthesizer function.
STO M↑ M↓ RCL No = XXX ↵	2. Enter the memory number and recall its contents.

In case of overrange over the active range, there is emission of an audible warning and recall is refused.

Prompt M↑ gives access to the contents of the next memory.

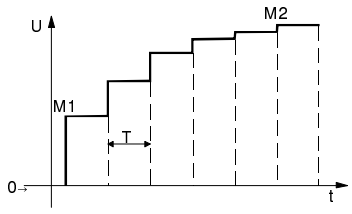
Prompt M↓ gives access to the contents of the previous memory.

7.10.3 Automatic cycle

Automatic recall of values contained in memory is characterized as follows:
- the number of the first memory (**M1**),
- the number of the last memory (**M2**),
- the number of scanning cycles (**N**),
- the time interval between two scanning (**T**).

From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE INCR RAMP SYNT SCAL	1. Select the synthesizer function.
STO M↑ M↓ RCL › RUN H/R STOP PROG	2. Select the programming mode.
M1 = XXX	3. Enter M1.
>>	
M2 = XXX	Enter M2.
>>	
N = XXXXX	Enter N.
>>	
T = XXXX.X	Enter T.
↵	Validate data.
RUN H/R STOP PROG	4. Start memory automatic recall.



Programming limits

$1 \leq N \leq 65\,000$

$0.5\ s \leq T \leq 6\,500\ s$

When automatic scanning of memories starts, symbol ⎍ is displayed in the OUT window.

Prompt STOP stops scanning at any time.

Prompt H/R holds or restarts the cycle again. When scanning is held, symbol ⎍ blinks on the screen.

7.11 Scale correction

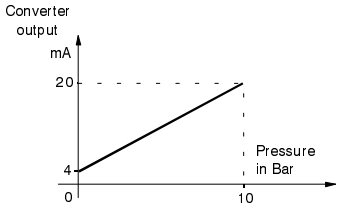
Scale correction function performs the conversion between the displayed physical quantities and the simulated electrical quantities.
Programming 2 points defines a scale correction straight enabling a direct reading of physical quantities: [**DISPLAY**] = [**K** × **EMISSION**] + Δ
Symbol is displayed on the screen in the OUT window when the scale correction is activated. In case of display capacity overrange over the active range when programming a too high multiplier coefficient, symbol ✳ is also displayed.

From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE INCR RAMP SYNT SCAL	1. Select the scale correction function.
ON OFF PROG ADDP ↓ ↑ EDITP › CLRP CLRA RES UNIT ‹	2. If required, clear all the current corrections.
ADDP ↓ ↑ EDITP X0 : 0.0000e+00 >> Y0 : 0.0000e+00	3. Enter the new coordinates: X0, Y0.
↵	4. Validate.
ADDP ↓ ↑ EDITP X1 : 1.0000e+00 >> Y1 : 1.0000e+00	5. Enter the new coordinates: X 1, Y1.
↵	6. Validate.
› CLRP CLRA RES UNIT Res = 2	7. Select the display resolution (max. **Res** = 4).
↵	8. Validate.
CLRP CLRA RES UNIT Unit : _ . . .	9. Select the measurement unit using the ⌃, ⌄, ‹ and ›, from the navigator. Available characters: from 0 to 9, from A to Z and from a to z, as well as various symbols and all characters usable with the selected language.
↵	10. Validate.
↵ ON OFF PROG	11. Activate or deactivate the scale correction.

Example

Simulation of a converter, returning on a 4-20 mA scale, a signal proportional to a pressure which varies from 0 to 10 Bar, i.e.:



Hence:
for X0 = 0 bar, Y0 = 4 mA
and for X1= 10 bar,
Y1= 20 mA.
After programming coordinates of these two points, the unit computes the simulated value according to the displayed value.
E.g.: Reading 5 Bar on the screen will emit 12 mA.

NOTES:

- Programming function is not available if scale correction is activated.
- Whatever is the input order of the different points, we always have X0 < X1.
- When the active function in emission is the external function, a scale correction becomes useless because the unit does not directly output through its terminals.

Summary of the scale correction programming functions:

PROMPTS	FUNCTIONS
ADDP	Adds a linearization point.
↓ ↑	Displays the previous or next point. The operator can also use the ^ and v keys from the navigator.
EDITP	Changes the coordinates of the displayed point.
CLRP	Clears the displayed point.
CLRA	Clears all the linearization points and returns to normal mode (y=x).
RES	Determines the display resolution.
UNIT	Defines the measurement unit.

7.12 Linearization

Linearization corrects in part the errors induced by non-linear sensors/converters systems.
The SCAL function enables the user to define up to 9 straight segments, i.e. 10 points in order to approximate the non-linear response curve and to perform scale corrections according to each segment.
Programming a linearization is similar to scale correction, only the number of points to be defined is different.

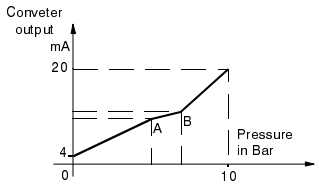
When the linearization is activated, symbol is displayed on the screen in the OUT window. In case of display capacity overrange over the active range when programming a too high multiplier coefficient, symbol ✱ is also displayed.

From the main menu:

IN OUT CFG STAT FCT ←↓↑→ SPE INCR RAMP SYNT SCAL	1. Select the scale correction function.
ON OFF PROG ADDP ↓ ↑ EDITP › CLRP CLRA RES UNIT ‹	2. If required, clear all the current corrections.
ADDP ↓ ↑ EDITP X : 0.0000e+00 >> Y : 0.0000e+00	3. Change X and Y coordinates of the first 2 linearization points (X0, Y0 and X1, Y1).
↵	4. Validate.
ADDP ↓ ↑ EDITP X : 1.0000e+00 >> Y : 1.0000e+00	5. Add and enter the X and Y coordinates of the next linearization points.
↵	6. Validate each point.
› CLRP CLRA RES UNIT Res = 2	7. Select the display resolution (max. **Res** = 4).
↵	8. Validate.
CLRP CLRA RES UNIT Unit : ...	9. Select the measurement unit using the ^, v, ‹ and ›, from the navigator. Available characters: from 0 to 9, from A to Z and from a to z, as well as various symbols and all characters usable with the selected language.
↵	10. Validate.
↵ ON OFF PROG	11. Activate or deactivate the scale correction.

Example

Simulation of a converter returning, on a non linear 4-20 mA scale, a signal proportional to a pressure which varies from 0 to 10 Bar, i.e.:



In addition to top and end scale points, it is necessary to define points A and B in order to compensate the sensor/converter system linearity error and perform a direct simulation of the displayed value.

NOTES:

- Linearization programming functions available are similar to the scale correction ones.
- Whatever is the input order of the different points, we always have X0 < X1 < X2 ... < X9.
- When the active function in emission is the external function, a scale correction becomes useless because the unit does not directly output through its terminals.

Notes

8. TRANSMITTER CALIBRATION

Notes

8.1 Overview

The CL519 enables the user to calibrate active or passive transmitters (see paragraph 6.2). The unit is able to certify by a test if a transmitter meets its given electrical characteristics and to evaluate deviations regarding the theoretical values.

For that, the CL519 simulates a sensor (V, mA, Ω, temperatures or other physical quantities with scaling function) and, at the same time, measures the process quantity (4-20 mA or 0-10 V) coming from the transmitter. This function is also used to calibrate indicators as the CL519 enables the user to enter manually the measurement values.

All parameters needed for execution of the test should be programmed in a procedure using the keypad or via the RS 232 C interface (see chapter 12).

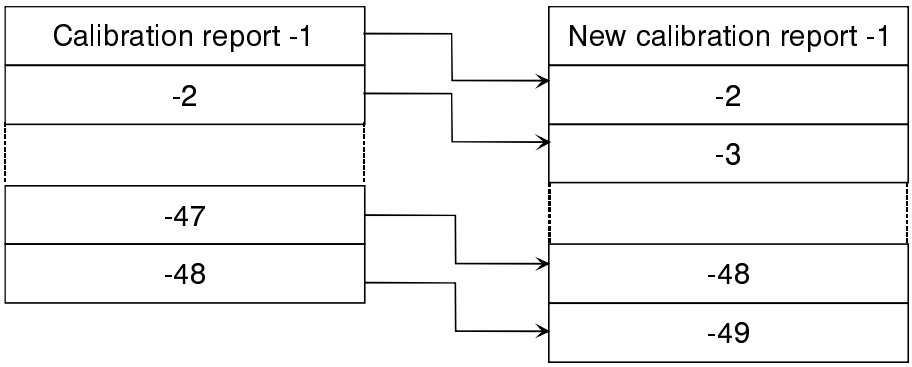
The CL519 can memorize up to 12 procedures from which 50 calibration reports (or PV) can be performed.

When resetting the unit to zero or at the first switching on, all the procedures are initialized as follows:

- all numbers are reset to zero,
- all character strings are empty,
- there is no setpoint stored,
- CL519 input configuration: 50 V range,
- CL519 output configuration: 0-10 V,
- Up/down function deactivated,
- automatic execution mode in measurement and emission.

8.2 Memorization principle

Each calibration report performed is placed in memory and bears an order number.
Each time a new record occurs, a calibration report number -1 is created.
The existing calibration reports are shifted in the memory zone as shown on diagram below and their order number is decremented.



Up to 50 calibration reports can be kept in memory.
If the memory is full, confirm clearing of the oldest calibration report (no -50) before performing calibration.

8.3 Accessing the transmitter calibration function

From the main menu:

IN	OUT	CFG	STAT	1. Select the transmitter calibration function.
›				
CALTX				

8.4 Accessing the indicator calibration function

"Indicator" means any unit able to measure any quantity but with no simulation function available.
The CL519 enables the user to calibrate such units by entering manually, during test execution, the measurements performed by the indicator.
The difference, between calibration of indicators and calibration of transmitters, is in the programming of some parameters, such as:

- INCF (see paragraph 8.6.2).
- Measurement execution mode (see paragraph 8.6.3.3).

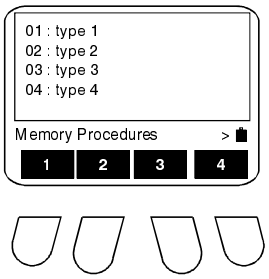
It's the execution mode of measurements which determines calibration of an indicator (measurements will be performed manually in this case).
For programming a procedure, test execution and reading memory, refer to chapters which deal with transmitter calibration.

8.5 Accessing programming of a calibration procedure

From the main menu:

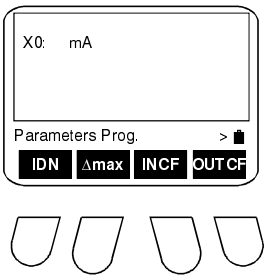
IN OUT CFG STAT › CALTX	1. Select the transmitter calibration function.
EXEC RCL PROC	2. Access to programming.
1 2 3 4 › 5 6 7 8 › or ‹ 9 10 11 12	3. Select the procedure to be modified.

3. Select the procedure



The display indicates the numbers of four procedures and their "type" parameters.

Example



From this moment, there is no setpoint programmed.

It will then be possible to program by modifying the desired parameters in the different menus offered (see paragraph 8.6).

8.6 Procedure definition parameters

8.6.1 CL519 output configuration

IDN	ΔMAX	INCF	OUTCF	1. Select the desired function and range.
V	mA	Ω	TEMP	
›				
	HM28	PRES	‹	

Selecting functions and ranges is performed in the same way as the CL519 emission/simulation function (see chapter 7).

NOTE: Each time the function is changed, the prompted configuration is the one defined using menus OUT, FCT. In particular, for temperature transmitters (TC or RT) the unit stored is the one selected using menus OUT, FCT, TEMP, UNIT. To change it, refer to paragraphs 7.5 and 7.6.

8.6.2 CL519 input configuration

NOTE: Impossible if the measurements are performed manually.

Depending on the calibrated transmitter, the CL519 will measure a 0-10 V or 4-20 mA signal. Selection is done using menu INCF.

IDN	ΔMAX	INCF	OUTCF	1. Select the desired range: 0-10 V or 4-20 mA.
	0-10	4-20		
	0-10	4-20♦		2. Selecting 4-20 mA implies to select the transmitter type ATX or PTX$\frac{1}{T}$.
	ATX	PTX$\frac{1}{T}$		

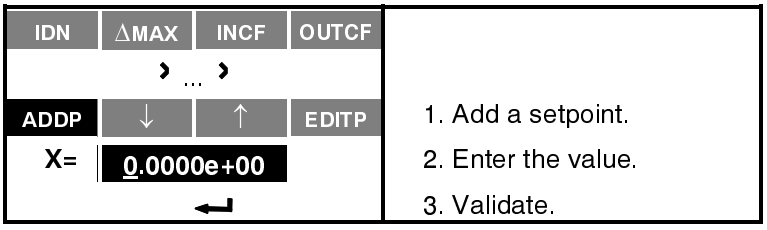
NOTES:

- For a transmitter and at the time of calibration, the CL519 will switch to measurement over the 50 V range if 0-10 V is selected, or over 50 mA range if 4-20 mA is selected.
- For an indicator as the measurements are performed manually, the CL519 will force INCF = OUTCF and programming OUTCF will determine the measurement range.

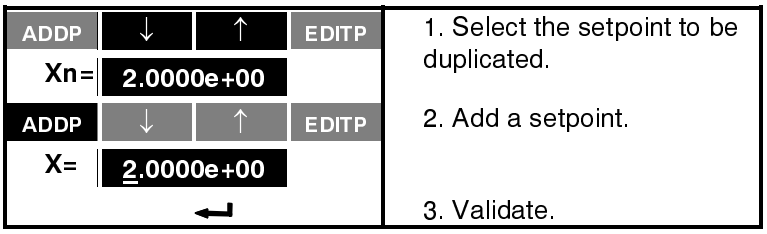
8.6.3 Simulation setpoints

Test setpoints are the emission values which will be sent to the transmitter during calibration. A setpoint may be added, modified or cleared.

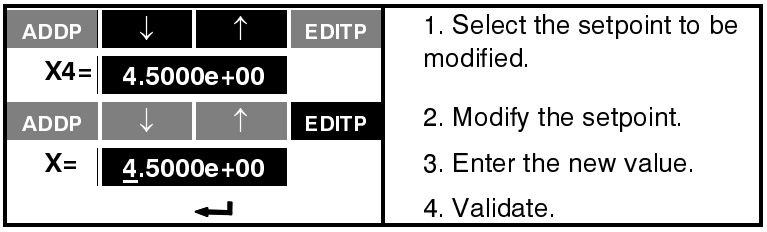
Adding a setpoint:



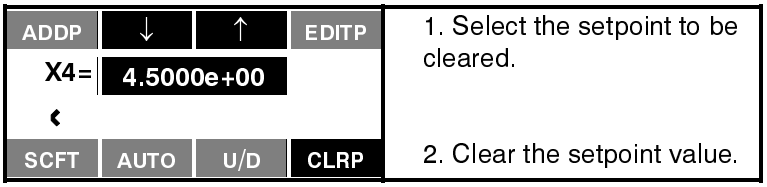
Adding a setpoint similar to Xn setpoint:



Modifying a setpoint:



Clearing a setpoint:



Up to 10 test setpoints can be programmed. At least, one setpoint is necessary for execution.

NOTE: When entering the first setpoint and if a scale correction or a linearization is activated in emission it will be stored just as it is (number of points together with value, unit and resolution) in the procedure. So if a scale correction or a linearization must be added or removed, first clear all the procedure setpoints, program or switch the SCAL function OFF from the CL519 emission and program again the procedure setpoints.

Example

SCFT AUTO U/D CLRP	1. Clear the setpoints one by one. 2. Return to main menu.
IN OUT CFG STAT FCT ←↓↑→ SPE INCR RAMP SYNT SCAL	3. Program a scale correction or a linearization and set this function in use (see § 7.10 and 7.11).
CALTX EXEC RCL PROC 1 2 3 4 IDN ΔMAX INCF OUTCF › ... › ADDP ↓ ↑ EDITP	4. Return to transmitter calibration menu and complete programming of the desired procedure. 5. Program the test setpoints.

NOTE: When a setpoint is programmed, it is accepted only if it meets the emission range of the procedure. So do take care when changing the emission range (see § 8.6.1) after the setpoints are programmed because setpoints could not be compatible with the new range.

That is why it is advisable to program the emission range first.

When starting calibration, the setpoints will be sent by the CL519 to the transmitter according to the execution mode, and to the Up/Down function if validated. If a value cannot be emitted, there is emission of an audible warning (beep) indicating that the computation will be wrong.

8.6.3.1 Automatic execution mode for emission setpoints

In this case, the CL519 sends the setpoints one by one in the order they are programmed.

SCFT	AUTO	U/D	CLRP	Activate the emission mode.
IN	OUT			

8.6.3.2 Manual execution mode for emission setpoints

In this case, the CL519 prompts the setpoints one by one and waits, each time, for a manual validation (see § 8.7.2).

SCFT	AUTO	U/D	CLRP	Deactivate the emission mode.
IN	OUT♦			

This function may be useful to pressure purposes.

8.6.3.3 Automatic execution mode for measurements

In this case and for each test points, the CL519 will read the measurement value over its terminals, then will stored it in the calibration report.

SCFT	AUTO	U/D	CLRP	Activate the automatic measurement mode.
IN	OUT			

8.6.3.4 Manual execution mode for measurements

In this case, the CL519 does not measure the quantity over its terminals, but waits, after each setpoint is sent, for a manual entry of the measurement (see paragraph 8.7.2).

SCFT	AUTO	U/D	CLRP	Deactivate the automatic measurement mode.
IN♦	OUT			

NOTE: When both execution modes for setpoints and measurements are automatic, the calibration runs automatically and the CL519 tests all the points, one by one in the order they are programmed and at the rate of one every 5 seconds.

8.6.3.5 Up/Down function

This function enables the user, during the test, to emit n setpoints from X0 to Xn-1, then from Xn-2 to X0. So, if 10 setpoints have been programmed, 19 test points will be performed.

SCFT	AUTO	U/D	CLRP	Activate the Up/Down function or
FCTR	AUTO	U/D♦	CLRP	Deactivate the Up/Down function.

This function may be useful to measure sensor hysteresis.
NOTE: The emission manual execution mode and the Up/Down function are not compatible.

8.6.4 Transmitter specifications

The transmitter is made to convert a physical quantity into a 0-10 V or 4-20 mA electrical quantity. Each transmitter has its own specifications that define a linear conversion law between these two quantities.
For that, the transmitter assigns to the output signal extreme values (0 and 10 V or 4 and 20 mA) a couple of input values.
These two couples should be supplied to the CL519 in order to compute the conversion coefficients: A * electrical quantity + B = physical quantity.
These specifications are also called transmitter scale factor.

Programming example

0 bar on transmitter input = 4 mA on transmitter output.
5 bar on transmitter input = 20 mA on transmitter output.

SCFT	AUTO	U/D	CLRP	
	C1= 0.0000e+00			1. Program the scale factor:
	C1= 0.0000e+00			C1 = 0.
>>	M1= 0.0000e+00		mA	Enter M1 = 4.
>>	C2= 0.0000e+00			Enter C2 = 5.
>>	M2= 0.0000e+00			Enter M2 = 20.
↵				2. Validate.

NOTES:
- This parameter is compulsory for procedure execution, if not, the CL519 can not to determine if the value measured meets the simulated value.
- It is impossible to program this parameter for an indicator.

8.6.5 Tolerance on the permissible error

The max. permissible tolerance will permit to set the calibration report conclusion in order to determine if the test performed is valid. For that, an error, not to be exceeded, should be supplied. This error is determined by a term "A" relative to the transmitter input value and by an absolute term "B" expressed in input unit. It is under the form A% + B.

So, if the CL519 simulates 3 bar and that the tolerance is 0.04 % + 0.002, the test point will be valid if the difference between the setpoint emitted by the CL519 and its measurement (reduced to physical unit by the scale factor) does not exceed 0.04 % * 3 + 0.002 bar in absolute value.

A calibration report is found to conform if all the test points are valid.

IDN	ΔMAX	INCF	OUTCF	
				1. Program the permissible error:
	0.0000e+00 %			Enter the relative term.
>>	+ 0.0000e+00			Enter the absolute term.
↵				2. Validate.

Programming limits

Values ≥ 0.

This parameter must be programmed before starting the procedure; otherwise, the CL519 will not be able to confirm on the calibration validity.

8.6.6 Procedure identification parameters

This menu concerns programming of the transmitter "type" together with its "manufacturer".

IDN ΔMAX INCF OUTCF	1. Program the procedure identification:
Type: XXXXXXXX	Enter the transmitter type using the alphanumeric keys, from the keyboard. Available characters: from 0 to 9, from A to Z and from a to z, as well as various symbols and all characters usable with the selected language.
>> Man.: XXXXXXXX	Enter the transmitter manufacturer using the alphanumeric keys, from the keyboard . Available characters: from 0 to 9, from A to Z and from a to z, as well as various symbols and all characters usable with the selected language.
↵	2. Validate.

The Type and Manufacturer are 8-character strings max.

To edit alphanumeric data, use the keypad keys (1 ABC, 2 DEF, 3 GHI, 4 JKL, 5 MNO, 6 PQR, 7 STU, 8 VWX, 9 YZ, -.()) as well as the navigator keys (‹ ›) and ↵.

To insert a space, press the 0 key.

Quick successive pressing on a same key gives access to the other characters of the key.

The cursor switches automatically to the next character, one second after the last pressing on the key.

To modify data during edition:

- Either press on an alphanumeric key: data are completely cleared and replaced by the selected character.
- Or press the › key from the navigator: the cursor moves one character to the right without clearing data.

The cursor position is shown as an underlining bar.

As soon as the operator enters the data, the following function keys appear at bottom of the screen:

- A → a key = Changing from capital letter to small letter or opposite.
- DEL key = Clears the character located above the cursor.

After edition is finished:

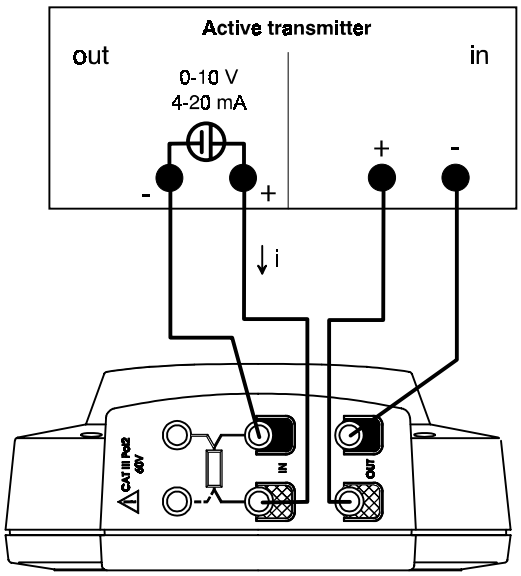
- Either validate the data by pressing the ↵ key (Enter key),or exit without validation by pressing the ↵ key (Escape key).

8.7 Test progress

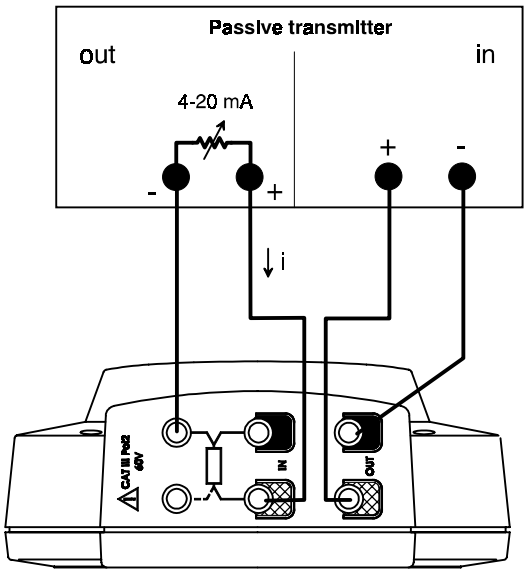
NOTE: If a current loop must be opened to connect the unit, make sure that this handling may be done without any damage for the concerned installation.

8.7.1 Connection

8.7.1.1 Active transmitter



8.7.1.2 Passive transmitter



NOTES:

- When calibrating indicators, only the OUT +/- terminals are connected to the indicator, the measurement terminals are free.
- When calibrating transmitters with an external module, only the measurement terminals are connected to the transmitter, the OUT +/- terminals are free.

8.7.1.3 Pressure transmitter

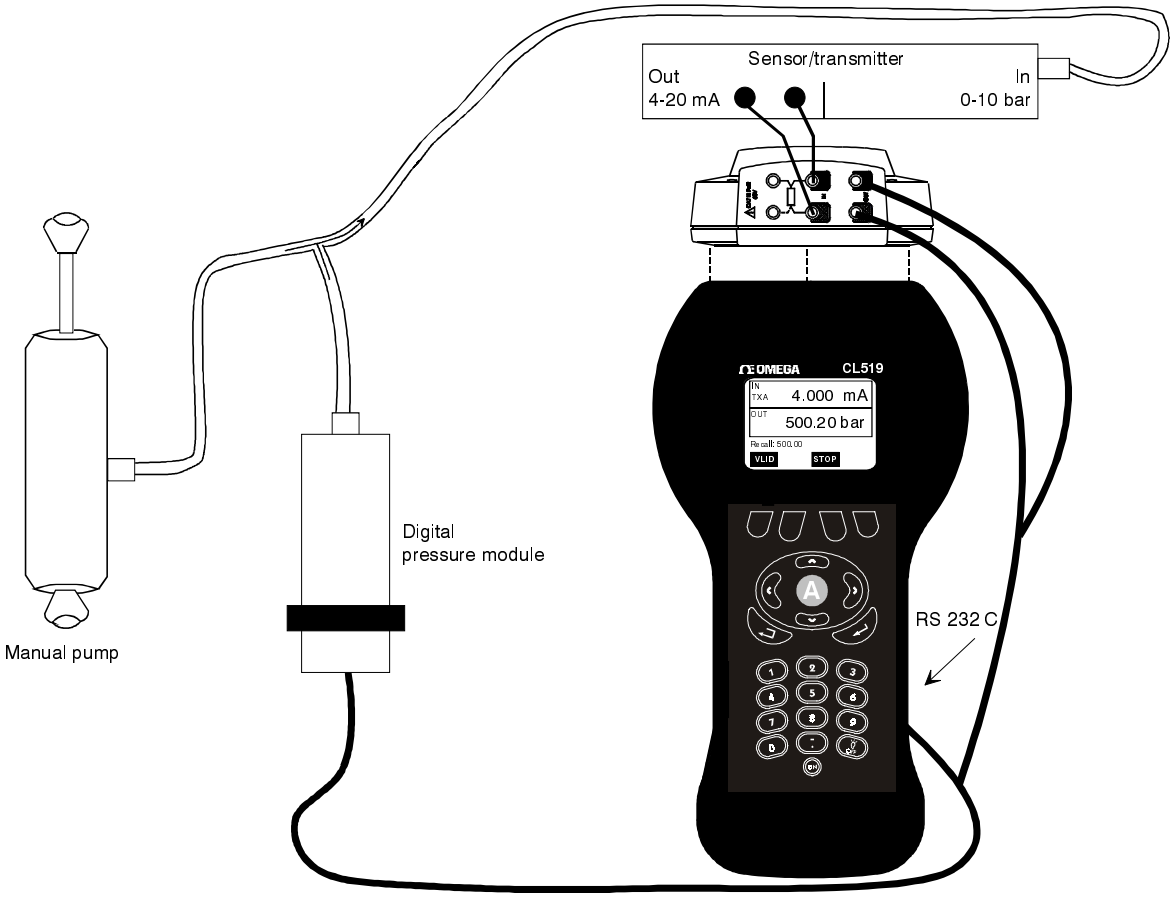
In this case, the CL519 cannot generate such a physical quantity.

It is advisable to use an external pressure module CL519-ACL333.

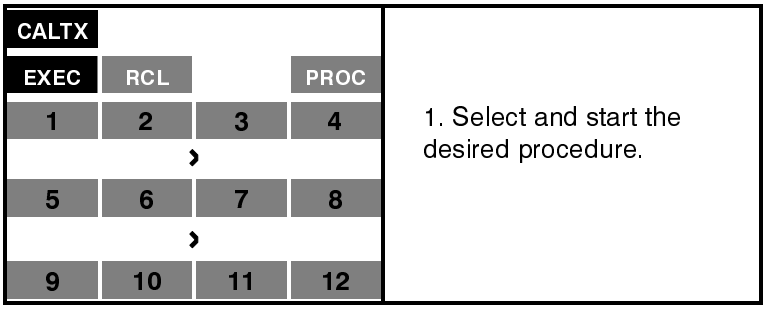
During the test, the CL519 prompts the pressure setpoints, one by one.

Using a generator (pump, gas cylinder, ...), the user will have to adjust the pressure indicated in the OUT window close to the programmed setpoint.

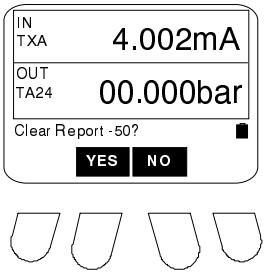
Example: 0-10 bar/4-20 mA transmitter



8.7.2 Execution

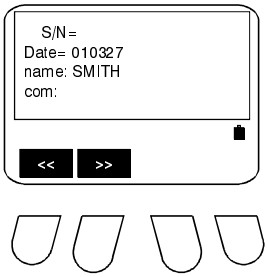


In case there are 50 calibration reports already stored, the CL519 asks for clearing no -50. If the answer is YES the calibration report no -50 is cleared as soon as the procedure starts. If the answer is NO, the CL519 returns to the previous menu bar, thus enabling the operator to clear the desired calibration report.



Pressing the procedure number opens a programming window:

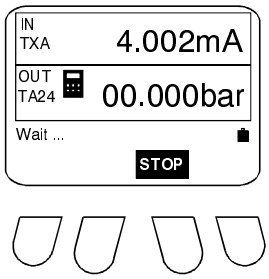
- S/N is the transmitter Serial Number (10-character string max.). This parameter is compulsory and should be filled; the other parameters are optional.
- For Date and Name, the CL519 reads, the default last two parameters stored since the last execution of the procedure. The date is a 6-figure whole format; it is advisable to fill it under YYMMDD form (Year, Month, Day).
- Name and comments are 8- and 12-character strings max. respectively.



If a scaling or a linearization is activated in measurement, it is deactivated.
For both measurement and emission functions, the ranges are those determined by the programming performed (see paragraphs 8.6.1 and 8.6.2).
Then, the test will be carried out according to its execution mode.

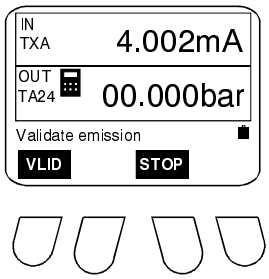
Automatic mode in emission and measurement

The CL519 emits, according to the programming order, all the test setpoints at the rate of one setpoint every 5 seconds. In the same time, it performs measurement supplied by the transmitter.
Test evolution can be checked easily on the screen which displays permanently the couples: simulated setpoint/corresponding measurement.
The test stops automatically when all the setpoints are sent.



Manual mode in emission

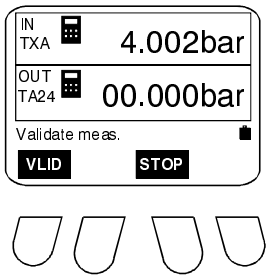
In this case, the CL519 prompts the test setpoints one by one and waits for validation using VLID key to take account of the measurement realized.
The operator may validate the setpoint or change it by editing a new value using the digital keys.
In both cases, the emission setpoint will be stored when pressing the VLID key.



Manual mode in measurement

In this case, the operator must edit the measurement using the keypad and press VLID to validate it.

NOTE: Any edition using the keypad must be ended by pressing the ↵ key (see paragraph 7.1.1).
Whatever is the execution mode, it is possible, at any time, to stop the test by pressing STOP key. This will be a definitive stop. When the test will run again, it will start at the beginning.



NOTES:
- The execution being complete, the calibration report is stored into memory and further modifications are not possible.
- The CL519 returns to the main menu if the report memory is full.

8.8 Reading and processing the calibration report memory

8.8.1 Displaying a calibration report

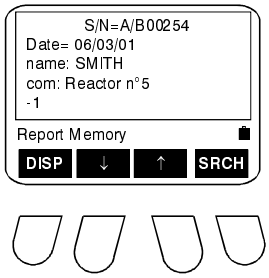
Each stored calibration report may, at any time, be recalled for displaying the results, printing or clearing.

Selecting the calibration report is done by scrolling the memory using the arrow keys or by searching the serial number pressing the SRCH key.

Displaying the results:

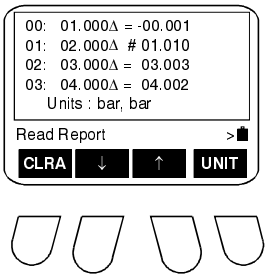
CALTX EXEC RCL PROC	
DISP ↓ ↑ SRCH	1. Select the report.
DISP ↓ ↑ SRCH	2. Display the results.

1. Select the report



The order number of the report appears at bottom left of the screen

2. Display the results



Symbol # appears when the result is incorrect, i.e.: when the computed deviation is higher than the authorized deviation. In this example, the transmitter will be considered as discrepant. By default, setpoints and deviations are displayed in physical unit emitted by the CL519. Nevertheless, the deviation can be displayed in electrical unit measured by the CL519.

CLRA ↓ ↑ UNIT	1. Press UNIT.
CAL TX	2. Select TX for displaying with transmitter unit (V or mA) or select CAL for displaying with calibrator unit (V, mA, Ω, °C, bar ...).

8.8.2 Clearing calibration reports

Clearing a report:

CALTX EXEC RCL PROC	
DISP ↓ ↑ SRCH	1. Select the report.
DISP ↓ ↑ SRCH CLRA ↓ ↑ UNIT ›	2. Display the results.
CLRRP OUT YES NO	3. Clear the report.

Clearing all the reports:

CALTX EXEC RCL PROC	
DISP ↓ ↑ SRCH	1. Select the report (optional) and display the results.
DISP ↓ ↑ SRCH CLRA ↓ ↑ UNIT YES NO	2. Clear all the reports.

8.8.3 Printing a calibration report

NOTE: Impossible if the external function is activated in measurement or in emission.

CALTX EXEC RCL PROC	
DISP ↓ ↑ SRCH	1. Select the report.
DISP ↓ ↑ SRCH	2. Display the results.
CLRA ↓ ↑ UNIT › CLRRP OUT	3. Print the report.

During print-out, we find the transmitter heading recalling all the programming parameters, the calibrator heading showing its name, serial number and a table indicating the results as well as calibration report conclusion (conform – PASS – or not conform – FAIL –).
The table contains the setpoints emitted by the CL519, the measurements performed, the deviations expressed in both electrical and physical units and the max. permissible deviation in physical unit.

8.8.4 CL519-SOFT processing software

Refer to the separate instruction manual.

9.MEASURING AND CALIBRATING PRESSURE

Notes

9.1 Connection between CL519 and pressure module CL519-ACL333

The calibrator-tester CL519, connected to a pressure module CL519-ACL333 ensures, on site or in laboratory, in addition to its numerous basic functions, the measurement of pressures as well as calibration of pressure sensors-transmitters used in process.

The pressures may be relative, or absolute. Ranges are between 100 mbar and 1000 bar depending on the module selected.

9.2 CL519 + CL519-ACL333 operating principle

The module performs the measurement, while the calibrator CL519 processes, displays and stores it for a further processing.

Both units CL519 and CL519-ACL333 communicate via the RS 232 C link. The CL519 is previously programmed to be used with an external module in three different ways:

- Measurement.
- Simulation.
- Test of transmitters.

The module CL519-ACL333 is connected to the CL519 using the RS cord.

When "measuring with an external module", the result is displayed in the CL519 IN window and any other simultaneous measurement cannot be performed.

When "simulating with an external module", the value emitted by the pressure generator and measured by the module CL519-ACL333 (emitted setpoint) is displayed in the CL519 OUT window and any other measurement, displayed in the IN window, can be performed simultaneously. Therefore, it will be possible to measure or display the output current or voltage of a transmitter under test which is the main application of both CL519-CL519-ACL333 connected together.

9.3 Operation

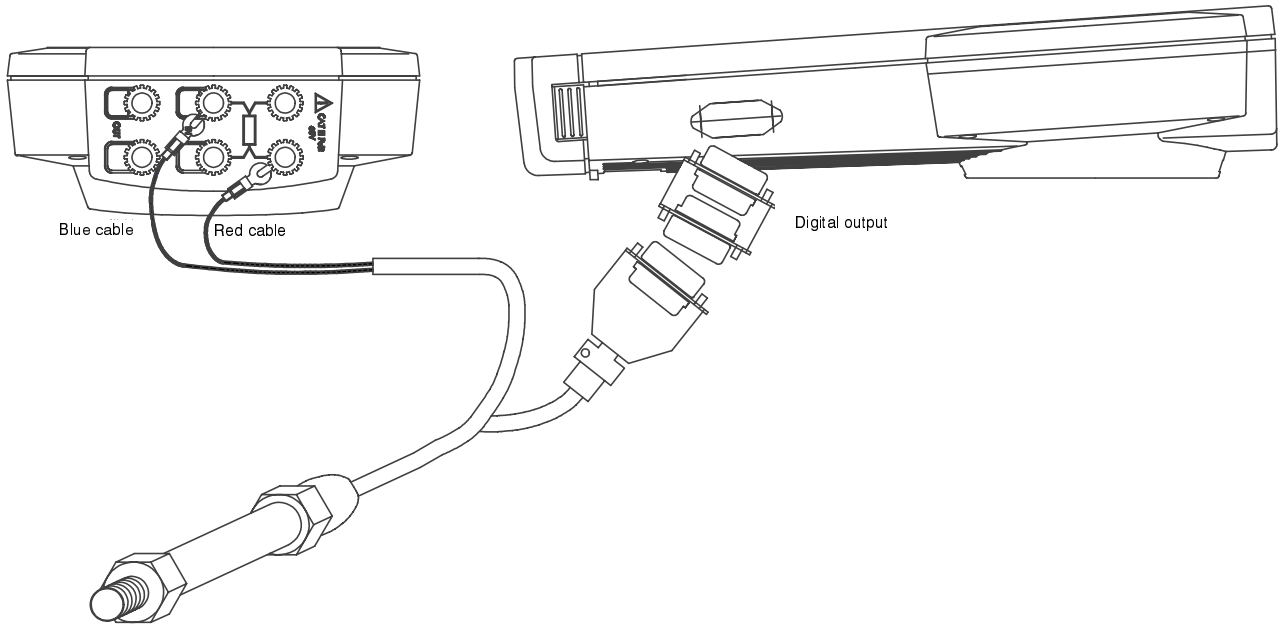
This paragraph deals with the CL519-CL519-ACL333 particular operating conditions.

9.3.1 Measuring pressure

Select measurement function with an external module:

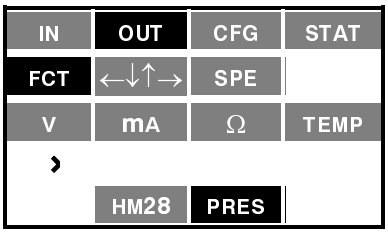
IN	OUT	CFG	STAT
FCT	TRIG	SPE	
V	mA	Ω	TEMP
›			
	HM28	PRES	

Connections:

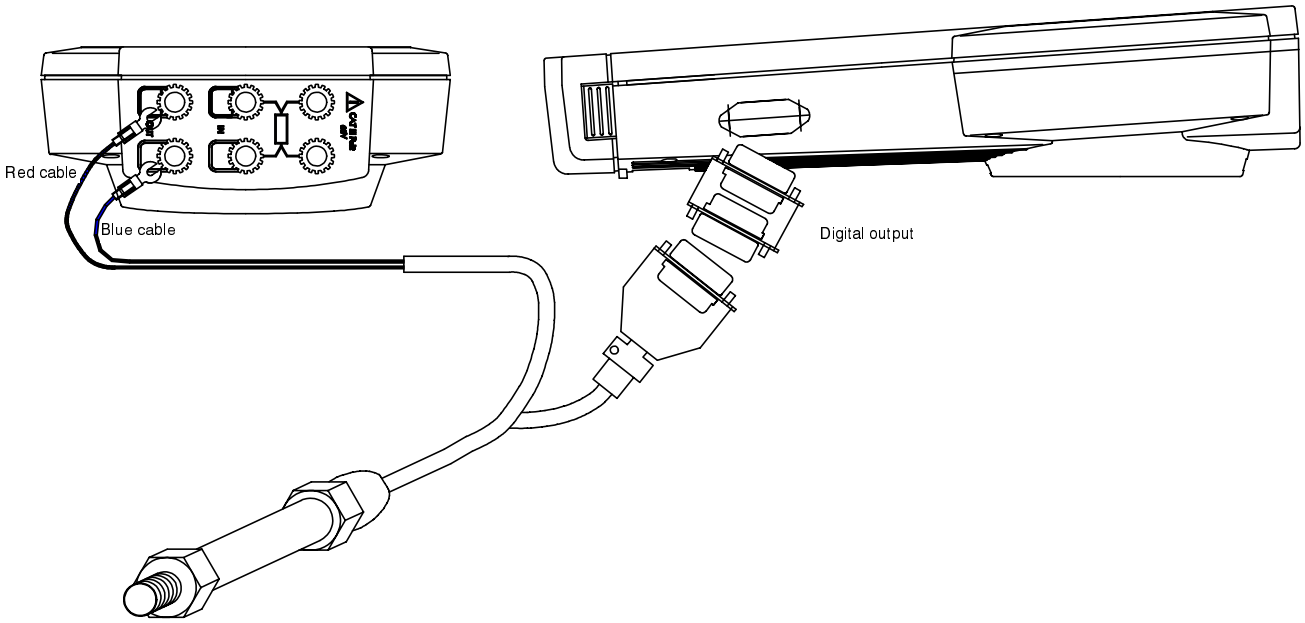


9.3.2 Calibrating pressure

Select simulation functions with an external module:



Connections:



Each setpoint emitted is displayed in the OUT window. In reality, there is no setpoint emitted on the OUT terminals of the CL519, the unit only displays (and if required stores) the setpoint value emitted by the pressure generator and measured by the module CL519-ACL333.
The link being performed and the units switched on, we can see that, as long as the communication is not established, the CL519 displays "- - - - -" either in the IN or OUT window (depending on the external function selected) and the module CL519-ACL333 reads the measured pressure.

To return the module to local mode and to control it using the keypad, program a function other than the external function on the CL519.

9.4 Calibrating sensors–transmitters

A pressure generator (pump, gas cylinder, ...) applies simultaneously a certain pressure (setpoint) to the sensor-transmitter and to the module CL519-ACL333 which is used as a reference measuring instrument. The module sends the result to the CL519 which displays the value (simulation function with external module) and the user can then adjust the pressure to a value close to the desired setpoint. The sensor-transmitter, for its own, measures the pressure and transforms it into a normalized voltage or current value; this value is sent to the CL519 (IN terminals) which measures it and displays it in the IN window.

9.4.1 Test procedures

Transmitter test procedures can be prepared as described in chapter 8, but the setpoint values programmed are given as a guide, the real corresponding setpoints being set externally.

During execution of the test, the CL519 prompts the setpoints and for each of them, the user realizes an approximate value measured by the module and displayed by the CL519 (OUT window). When the value is correct, pressing the VLID key takes it into account and stores it. At the same time, the current or voltage value coming from the transmitter and measured, and if required processed by the CL519, is stored into memory.

All further processing procedures, such as result presentation, edition of reports, described in chapter Transmitter calibration can be elaborated. It will then be possible to realize calibration reports, using either a printer, or a PC by means of the optional processing software which can be delivered with the CL519.

See chapter 8 giving an example for the connection and the test of transmitters.

10. MAINTENANCE

Notes

In view of the necessary precautions and the risks involved, any maintenance operations, apart from those relating to battery charging and replacement, should be left to **qualified personnel**. All maintenance operations are described in another manual called "maintenance manual", see paragraph 3.5.2.

10.1 Battery pack

10.1.1 Charge

When symbol  blinks on the display, the battery should be recharged as soon as possible.

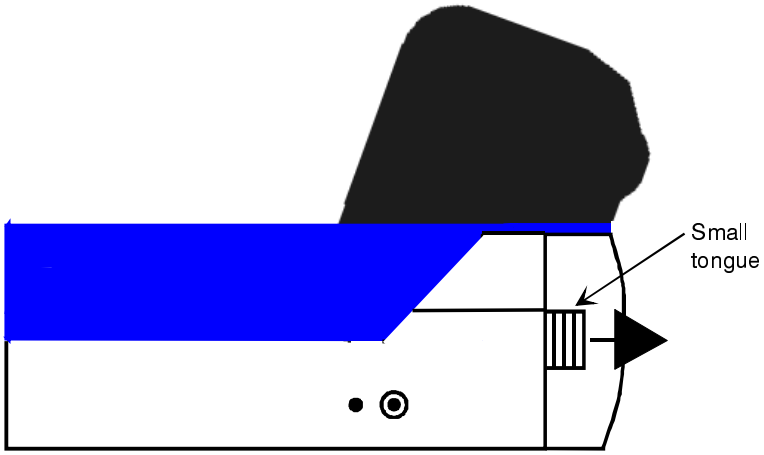
- Plug the charger jack in the connector available on the side of the unit, see paragraph 4.3.2.
- Connect the charger to the mains, making sure that the mains voltage is compatible.
- Recharging the battery takes 3 h approximately.
- Disconnect the charger when the charge indicator quickly blinks

10.1.2 Storage

The CL519, even switched off, keeps in SRAM memory all the data previously programmed.

Note: The calibration coefficients of the unit are always kept in memory regardless of the battery discharge status (EEPROM memory).

10.1.3 Replacement



- Remove the elastomer enclosure from the bottom part.
- Remove the battery pack by pressing on the lateral small tongues.
- Replace with a new battery (OMEGA part number: AN 6010).
- Replace the enclosure.
- Charge the battery fully.

10.2 Checking of performances

The operator may require cyclic checking of the performances in order to keep track of the quality.

This operation implies as follows:

- Room temperature: 23°C ± 1°C.
- Relative humidity: 45 % to 75 %.

- Known accuracy for the instruments used for checking below or equal to ± 0.008 %.

The unit should only be adjusted if one or more characteristics are really outside the tolerances specified in chapter 11. The user may:

- Adjust the unit according to the procedure described in the maintenance document. This implies equipment with performances equal to the one used for verification above.

Notes

Notes

11. APPENDIX

Notes

11.1 Applicable standards

11.1.1 Safety class

In accordance with European Norm EN 61010-1.
Category III, pollution 2.
Rated voltage: 60 V.
The unit should not be used at altitudes above 2 500 m.
Note 1: Safety provisions for the unit are given in chapter 2.
Note 2: In order to maintain performances of the announced safety provisions, the measuring accessories must meet European Norm EN 61010-2-031 and have adapted safety characteristics.

11.1.2 EMC conformity

Performances of the unit meet the EN 61326 (1997)/A1 (1998) norm:
- Emission of radiated disturbances: class B.
- Immunity with charger: appendix B.

11.1.3 Ambient conditions

In accordance with IEC Publication 359: operating category I.
Reference range: 23°C ± 5°C, relative humidity: 45 % to 75 %.
Normal operating range: 0°C to + 50°C, relative humidity: 20 % to 80 % non-condensing.
Operating range limits: - 10°C to + 55°C, relative humidity: 10 % to 80 % (70 % at 55°C).
Storage and transport range: - 30°C to + 60°C.

11.1.4 Mechanical conditions

Protection according to IEC Publication 529: IP 30.
Vibrations according to IEC Publication 68-2-6.
Shocks in accordance with European Norm EN 61010-1.

11.1.5 Measurements at reference conditions

According to IEC Publication 485.

11.1.6 100 Ω at 0°C RTDs

Pt 50 Ω, 100 Ω, 200 Ω, 500 Ω, 1 000 Ω (α = 3851) in accordance with IEC Publication 751/1995.
JPt 100 Ω (α = 3916) in accordance with JIS C 1604/1989 Publication.
ITS90 Pt 100 Ω sensors (α = 3926).
Ni 100 Ω, 1000 Ω (α = 618) in accordance with DIN 43760 Publication.
Ni 120 Ω (α = 672) in accordance with MIL-T-24388C Publication.
Cu 10 Ω (α = 427) in accordance with MINCO 16/9 Publication.
Cu 50 Ω (α = 428).

- International Temperature Scale ITS 90.
- For linearizations non-conforming to this scale, the correction ITS 90 – IPTS 68/1993 is applied.

11.1.7 Thermocouples

K, T, J, E, N, S, R and B according to IEC Publication 584-1/1995.
U and L thermocouples according to DIN 43710 standard.
C thermocouple according to Hoskins curve.
Platinel (Pl) thermocouple according to Engelhard curve.
Molybdenum/Nickel Molybdenum (Mo) thermocouple, not standardized.

- International Temperature Scale ITS 90.
- For linearizations non-conforming to this scale, the correction ITS 90 – IPTS 68/1993 is applied.

11.1.8 RS 232 C communication

In accordance with ANSI EIA-232-D-1986 standard.
Max. rated voltage: 60 VDC or AC.

11.2 Specifications

11.2.1 General

Stated accuracies apply from + 18°C to + 28°C, except other indications, and are expressed in ± (n % rdg + C) with rdg = reading and C = Constant expressed as a practical unit.

They apply to a unit situated in the reference conditions defined elsewhere after warming up for 15 minutes.

11.2.2 "Measurement" function

Measurement rate: 0.5 s per measurement (0.8 s for resistance and resistive sensor measurements).
Max. common mode rated voltage: 60 VDC or AC.

11.2.2.1 DC voltage

Range	Measurement range	Resolution	Accuracy (23°C ± 5°C)	
			90 days	1 year
50 mV	- 60 mV, + 60 mV	1 µV	0.02% + 5 µV	0.04 % + 7 µV
0.5 V	- 0.6 V, + 0.6 V	10 µV	0.02 % + 30 µV	0.04 % + 50 µV
5 V	- 6 V, + 6 V	0.1 mV	0.02 % + 0.3 mV	0.04 % + 0.5 mV
50 V	- 60 V, + 60 V	1 mV	0.02 % + 3 mV	0.04 % + 5 mV

Input impedance:
- > 1 000 MΩ (50 mV and 0.5 V ranges).
- 10 MΩ (5 V and 50 V ranges).

Input current: 20 pA typical, 100 pA maximum (50 mV and 0.5 V ranges).
Temperature coefficient: < 40 ppm/°C.
Normal mode rejection (50 mV range): > 70 dB at 50 Hz.
Common mode rejection (50 mV range):
- > 120 dB for DC voltage.
- > 120 dB from 45 to 66 Hz.

11.2.2.2 DC current

Range	Measurement range	Reso-lution	Accuracy (23°C ± 5°C) 90 days	1 year	Voltage drop
50 mA	- 60 mA, + 60 mA	1 µA	0.02 % + 3 µA	0.04 % + 5 µA	< 1.2 V

Normal mode rejection: > 70 dB at 50 Hz.
Temperature coefficient: < 40 ppm/°C.
With passive transmitter, the loop is supplied with 22 V.

11.2.2.3 Resistance

Measurement with 4-wire, 3-balanced wire or 2-wire.

Range	Measurement range	Reso-lution	Accuracy (4 wires) (23°C ± 5°C) 90 days	1 year	Measure-ment current
500 Ω	0 to 600.00 Ω	10 mΩ	0.02 % + 30 mΩ	0.04 % + 50 mΩ	1 mA
5 kΩ	0 to 6.0000 kΩ	0.1 Ω	0.02 % + 0.3 Ω	0.04 % + 0.5 Ω	0.1 mA

Open circuit voltage across terminals: < 2.5 V.
Temperature coefficient: 25 ppm/°C.
Permissible line resistance: ≤ 10 Ω per wire.
With the 2-wire connection, the measurement includes the line resistances.
With the 3-wire connection, add the line resistances.

11.2.2.4 Temperature with thermocouples

Sensor	Measurement range	Temperature spans	Resolution	Accuracy (23°C ± 5°C) 90 days	Accuracy (23°C ± 5°C) 1 year
K Ni-Cr/Ni-Al	- 250°C + 1 372°C	- 250°C ≤ T < - 200°C - 200°C ≤ T < - 120°C - 120°C ≤ T < - 50°C - 50°C ≤ T < + 1 372°C	0.2°C 0.1°C 0.1°C 0.1°C	1.3°C 0.4°C 0.2°C 0.03 % + 0.1°C	2.2°C 0.7°C 0.3°C 0.05 % + 0.2°C
T Cu/Cu-Ni	- 250°C + 400°C	- 250°C ≤ T < - 200°C - 200°C ≤ T < - 100°C -100°C ≤ T < + 400°C	0.2°C 0.1°C 0.1°C	1.0°C 0.4°C 0.2°C	1.7°C 0.6°C 0.3°C
J Fe/Cu-Ni	- 210°C + 1 200°C	- 210°C ≤ T < - 150°C - 150°C ≤ T + 800°C + 800°C ≤ T < + 1 200°C	0.1°C 0.1°C 0.1°C	0.4°C 0.2°C 0.8°C	0.6°C 0.4°C 1.3°C
E Ni-Cr/Cu-Ni	- 250°C + 1 000°C	- 250°C ≤ T < - 180°C - 180°C ≤ T < + 700°C + 700°C ≤ T < + 1 000°C	0.1°C 0.1°C 0.1°C	0.7°C 0.2°C 0.6°C	1.2°C 0.4°C 1.0°C
N Ni-Cr-Si/Ni-Si	- 240°C + 1 300°C	- 240°C ≤ T < - 190°C - 190°C ≤ T < - 120°C - 120°C ≤ T < + 900°C + 900°C ≤ T < + 1 300°C	0.2°C 0.1°C 0.1°C 0.1°C	1.4°C 0.5°C 0.3°C 0.4°C	2.2°C 0.8°C 0.5°C 0.7°C
U Cu/Cu-Ni DIN	- 200°C + 600°C	- 200°C ≤ T < - 100°C - 100°C ≤ T < + 600°C	0.1°C 0.1°C	0.3°C 0.2°C	0.5°C 0.3°C
L Fe/Cu-Ni DIN	- 200°C + 900°C	- 200°C ≤ T < + 900°C	0.1°C	0.25°C	0.4°C
S Pt-10%Rh/Pt	- 50°C + 1 768°C	- 50° C ≤ T < + 150°C + 150°C ≤ T < + 550°C + 550°C ≤ T < + 1 768°C	0.5°C 0.2°C 0.1°C	1.2°C 0.7°C 0.8°C	1.8°C 1.0°C 1.3°C
R Pt-13%Rh/Pt	- 50°C + 1 768°C	- 50°C ≤ T < + 150°C + 150°C ≤ T < + 450°C + 450°C ≤ T < + 1 768°C	0.5°C 0.2°C 0.1°C	1.4°C 0.7°C 0.7°C	2.2°C 1.0°C 1.3°C
B Pt-30%Rh/Pt-6%Rh	+ 400°C + 1 820°C	+ 400°C ≤ T < + 900°C + 900°C ≤ T < + 1 820°C	0.2°C 0.1°C	1.3°C 0.7°C	1.8°C 1.2°C
C W-5%Rh/W-26%Rh	- 20°C + 2 320°C	- 20°C ≤ T < + 600°C + 600°C ≤ T < + 2 000°C + 2 000°C ≤ T < + 2 320°C	0.1°C 0.1°C 0.1°C	0.4°C 1.0°C 1.4°C	0.6°C 1.8°C 2.5°C
Platinel (Pl)	- 100°C + 1 400°C	- 100°C ≤ T < + 700°C + 700°C ≤ T < + 1 400°C	0.1°C 0.1°C	0.25°C 0.5°C	0.4°C 1.0°C
Molybdenum/ Nickel Molybdenum (Mo)	0°C + 1 375°C	0°C ≤ T < + 400°C + 400°C ≤ T < + 1 100°C + 1 100°C ≤ T < + 1 375°C	0.1°C 0.1°C 0.1°C	0.2°C 0.3°C 0.8°C	0.4°C 0.5°C 1.3°C

Accuracy is guaranteed for 0°C reference junction. When using the internal junction, except thermocouple B, add an uncertainty of 0.4°C for a measured temperature range from - 50°C up to the sensor full scale. The inherent temperature error of the sensor used and its operating conditions must also be taken into account.
Access to measurements in °F and K.
Direct keypad access to the sensor previously chosen by programming, with or without internal reference junction.
Normal mode rejection (10 mV, 50 Hz):

- Thermocouple K: < 0.1°C.
- Thermocouple S: < 0.4°C.

Common mode rejection (10 VDC or 50 Hz):
- Thermocouple K: < 0.3°C.
- Thermocouple S: < 1°C.

Temperature coefficient: < 10 % of accuracy/°C.
Except for thermocouple B, one of the following locations for the reference junction can be chosen by programming via the keypad:
- external at 0°C,
- internal (compensation of the temperature at the unit terminals),
- temperature programming.

11.2.2.5 Temperature with RTDs

Sensor	Measurement range	Resolution	Accuracy (23°C ± 5°C)	
			90 days	1 year
Pt 50 (α = 3851)	- 220°C + 1 200°C	0.01°C	0.03 % + 0.15°C	0.05 % + 0.3°C
Pt 100 (α = 3851)	- 220°C + 1 200°C	0.01°C	0.03 % + 0.1°C	0.06 % + 0.2°C
JPt 100 (α = 3916)	- 200°C + 510°C	0.01°C	0.03 % + 0.1°C	0.06 % + 0.2°C
Pt 100 (α = 3926)	- 210°C + 850°C	0.01°C	0.03 % + 0.1°C	0.06 % + 0.2°C
Pt 200 (α = 3851)	- 220°C + 600°C	0.01°C	0.03 % + 0.1°C	0.05 % + 0.2°C
Pt 500 (α = 3851)	- 220°C + 1 200°C	0.01°C	0.03 % + 0.15°C	0.05 % + 0.3°C
Pt 1 000 (α = 3851)	- 220°C + 1 200°C	0.01°C	0.03 % + 0.1°C	0.06 % + 0.2°C

Sensor	Measurement range	Resolution	Accuracy (23°C ± 5°C)	
			90 days	1 year
Ni 100 (α = 618)	- 60°C + 180°C	0.01°C	0.1°C	0.17°C
Ni 120 (α = 672)	- 40°C + 205°C	0.01°C	0.08°C	0.15°C
Ni 1 000 (α = 618)	- 60°C + 180°C	0.01°C	0.1°C	0.17°C

Sensor	Measurement range	Resolution	Accuracy (23°C ± 5°C)	
			90 days	1 year
Cu 10 (α = 427)	- 70°C + 150°C	0.1°C	0.9°C	1.5°C
Cu 50 (α = 428)	- 50°C + 150°C	0.01°C	0.2°C	0.4°C

The accuracy above is given for a temperature sensor connected in a 4-wire configuration. For a 3-wire configuration, an unbalance of 40 mΩ causes an additional error of 0.1°C, for the 100 Ω at 0°C sensors. The inherent temperature error of the sensor used and its operating conditions must also be taken into account.
Permissible line resistance: < 10 Ω per wire.
Measurement current:
- R0 ≤ 200 Ω: 1.0 mA.
- R0 ≥ 500 Ω: 0.1 mA.

Access to measurements in °F and K.
Direct keypad access to the sensor previously chosen by programming.
Temperature coefficient: < 10 % of accuracy/°C.

11.2.3 Additional "measurement" specifications

11.2.3.1 Manual or automatic ranging

For the mV, V and Ω functions, with autoranging mode, the unit switches to the higher range above 52 000 counts and to the lower range below 5 000 counts.

11.2.3.2 Relative measurement

The relative measurement function enables the user:
- to program a reference value different from the unit ones (NUL function),
- to cancel by measurement or program a stray or constant value (TARE function).

Refer to chapter 6.

11.2.3.3 Scale correction

The scale correction function performs conversions between the measured electrical quantities and the converted physical quantities.
Refer to chapter 6.

11.2.3.4 Linearization

Linearization corrects in part the errors induced by non-linear sensors/converters systems.
Refer to chapter 6.

11.2.3.5 Triggered and recorded measurements

The triggered measurement mode enables the user:
- to acquire manual measurement bursts,
- to start acquisition of automatic measurement bursts,
- to program a trigger level of an automatic measurement burst,
- to hold the measurement display.

Each burst is automatically stored and bears an order number.
Refer to chapter 6.

11.2.3.6 Memory

All the measurement bursts performed in triggered mode are saved into the unit permanent memory.
Refer to chapter 6.

11.2.4 "Emission/simulation" function

Max. common mode rated voltage: 60 VDC or AC.

11.2.4.1 DC voltage

Range	Simulation range	Resolution	Accuracy (LR = 100 kΩ, 23°C ± 5°C)	
			90 days	1 year
50 mV	- 10 mV to 50 mV	1 µV	0.025 % + 5 µV	0.04 % + 7 µV
0.5 V	- 100 mV to 500 mV	10 µV	0.025 % + 30 µV	0.04 % + 50 µV
5 V	- 1 V to 5 V	0.1 mV	0.025 % + 0.3 mV	0.04 % + 0.5 mV
50 V	- 1 V to 50 V	1 mV	0.025 % + 3 mV	0.04 % + 5 mV

When the load resistance is too low, the unit will display the symbol ⚠ and emit an audible warning (beep).
Emission current:

- 50 V range: - 5, + 24 mA.
- Other ranges: ± 5 mA.

Source resistance: < 0.1 Ω.
Settling time: ≤ 5 ms.
Temperature coefficient: < 25 ppm/°C.

11.2.4.2 DC current

Range ①	Simulation range	Load resistance or supply voltage	Accuracy (23°C ± 5°C)	
			90 days	1 year
PT (simulator)	1 – 24.000 mA	30 V max.	0.025 % + 3 µA	0.04 % + 5 µA
AT 24 (source)	0 – 24.000 mA	500 Ω max.	0.025 % + 3 µA	0.04 % + 5 µA
AT 50 (source)	0 – 24.000 mA	1.8 kΩ max.	0.025 % + 3 µA	0.04 % + 5 µA

① PT = Passive Transmitter. AT = Active Transmitter, compliance 24 V or 50 V.

Settling time: ≤ 5 ms.
When the loop is opened or the load resistance too high, the unit will display the symbol ⚠ and emit an audible warning (beep).
Temperature coefficient: < 25 ppm/°C.

11.2.4.3 Resistance

Range	Simulation range	Resolution	Accuracy (23°C ± 5°C)	
			90 days	1 year
500 Ω	0 to 500.00 Ω	10 mΩ	0.025 % + 30 mΩ	0.04 % + 50 mΩ
5 kΩ	0 to 5.0000 kΩ	0.1 Ω	0.025 % + 0.3 Ω	0.04 % + 0.5 Ω

Measurement current:

- 500 Ω range: I ≤ 5 mA.
- 5 kΩ range: I ≤ 0.5 mA.

Settling time: ≤ 5 ms.
Temperature coefficient: < 10 % of accuracy over 90 days/°C.

11.2.4.4 Thermocouples

Sensor	Simulation range	Temperature spans	Resolution	Accuracy (23°C ± 5°C) 90 days	Accuracy (23°C ± 5°C) 1 year
K Ni-Cr/Ni-Al	- 240°C + 1 372°C	- 240°C ≤ T < - 200°C - 200°C ≤ T < - 120°C - 120°C ≤ T < - 50°C - 50°C ≤ T < + 1 232°C + 1 232°C ≤ T < + 1 372°C	0.1°C 0.1°C 0.1°C 0.1°C 0.1°C	1.3°C 0.4°C 0.2°C 0.03 % + 0.1°C 1.3°C	2.2°C 0.7°C 0.3°C 0.05 % + 0.2°C 2.1°C
T Cu/Cu-Ni	- 240°C + 400°C	- 240°C ≤ T < - 200°C - 200°C ≤ T < - 100°C - 100°C ≤ T < + 400°C	0.1°C 0.1°C 0.1°C	1.0°C 0.4°C 0.2°C	1.7°C 0.6°C 0.3°C
J Fe/Cu-Ni	- 210°C + 1 200°C	- 210°C ≤ T < - 150°C - 150°C ≤ T + 870°C + 870°C ≤ T < + 1 200°C	0.1°C 0.1°C 0.1°C	0.4°C 0.3°C 0.8°C	0.6°C 0.4°C 1.3°C
E Ni-Cr/Cu-Ni	- 240°C + 1 000°C	- 240°C ≤ T < - 180°C - 180°C ≤ T < + 660°C + 660°C ≤ T < + 1 000°C	0.1°C 0.1°C 0.1°C	0.7°C 0.2°C 0.6°C	1.2°C 0.4°C 1.0°C
N Ni-Cr-Si/Ni-Si	- 240°C + 1 300°C	- 240°C ≤ T < - 190°C - 190°C ≤ T < - 120°C - 120°C ≤ T < + 900°C + 900°C ≤ T < + 1 300°C	0.1°C 0.1°C 0.1°C 0.1°C	1.4°C 0.5°C 0.3°C 0.4°C	2.2°C 0.8°C 0.5°C 0.7°C
U Cu/Cu-Ni DIN	- 200°C + 600°C	- 200°C ≤ T < - 100°C - 100°C ≤ T < + 600°C	0.1°C 0.1°C	0.3°C 0.2°C	0.5°C 0.3°C
L Fe/Cu-Ni DIN	- 200°C + 900°C	- 200°C ≤ T < + 855°C + 855°C ≤ T < 900°C	0.1°C 0.1°C	0.25°C 0.6°C	0.4°C 1.0°C
S Pt-10%Rh/Pt	- 50°C + 1 768°C	- 50° C ≤ T < + 150°C + 150°C ≤ T < + 550°C + 550°C ≤ T < + 1 768°C	0.1°C 0.1°C 0.1°C	1.2°C 0.7°C 0.8°C	1.8°C 1.0°C 1.3°C
R Pt-13%Rh/Pt	- 50°C + 1 768°C	- 50°C ≤ T < + 150°C + 150°C ≤ T < + 450°C + 450°C ≤ T < + 1 768°C	0.1°C 0.1°C 0.1°C	1.4°C 0.7°C 0.7°C	2.2°C 1.0°C 1.3°C
B Pt-30%Rh/Pt-6%Rh	0°C + 1 820°C	0°C ≤ T < + 900°C + 900°C ≤ T < + 1 820°C	0.1°C 0.1°C	1.3°C 0.7°C	1.8°C 1.2°C
C W-5%Rh/W-26%Rh	- 20°C + 2 320°C	- 20°C ≤ T < + 600°C + 600°C ≤ T < + 2 000°C + 2 000°C ≤ T < + 2 320°C	0.1°C 0.1°C 0.1°C	0.4°C 1.0°C 1.4°C	0.6°C 1.8°C 2.5°C
Platinel (Pl)	- 100°C + 1 395°C	- 100°C ≤ T < + 700°C + 700°C ≤ T < + 1 232°C + 1 232°C ≤ T + 1 395°C	0.1°C 0.1°C 0.1°C	0.25°C 0.5°C 1.5°C	0.4°C 0.8°C 2.4°C
Molybdenum/ Nickel Molybdenum (Mo)	0°C + 1 375°C	0°C ≤ T < + 400°C + 400°C ≤ T < + 1 000°C + 1 000°C ≤ T < + 1 375°C	0.1°C 0.1°C 0.1°C	0.25°C 0.4°C 0.8°C	0.5°C 0.7°C 1.3°C

The accuracy is guaranteed for a reference junction at 0°C and a load resistance ≥ 100 kΩ. When using the internal reference junction, except thermocouple B, add an uncertainty of 0.4°C for a simulated temperature range from - 50°C up to the sensor full scale.
Access to measurements in °F and K.
Source resistance: < 0.1 Ω.
Emission current: ± 5 mA.
Settling time: ≤ 5 ms.
Temperature coefficient: < 10 % of accuracy/°C.

11.2.4.5 RTDs

Sensor	Simulation range	Resolution	Accuracy (23°C ± 5°C)	
			90 days	1 year
Pt 50 (α = 3851)	- 220°C + 1 200°C	0.05°C	0.04 % + 0.15°C	0.05 % + 0.3°C
Pt 100 (α = 3851)	- 220°C + 1 200°C	0.02°C	0.04 % + 0.1°C	0.06 % + 0.2°C
JPt 100 (α = 3916)	- 200°C + 510°C	0.02°C	0.04 % + 0.1°C	0.06 % + 0.2°C
Pt 100 (α = 3926)	- 210°C + 850°C	0.02°C	0.04 % + 0.1°C	0.06 % + 0.2°C
Pt 200 (α = 3851)	- 220°C + 410°C	0.02°C	0.03 % + 0.1°C	0.05 % + 0.2°C
Pt 500 (α = 3851)	- 220°C + 1 200°C	0.05°C	0.04 % + 0.15°C	0.05 % + 0.3°C
Pt 1 000 (α = 3851)	- 220°C + 1 200°C	0.02°C	0.04 % + 0.1°C	0.06 % + 0.2°C

Sensor	Simulation range	Resolution	Accuracy (23°C ± 5°C)	
			90 days	1 year
Ni 100 (α = 618)	- 60°C + 180°C	0.02°C	0.1°C	0.17°C
Ni 120 (α = 672)	- 40°C + 205°C	0.02°C	0.08°C	0.15°C
Ni 1 000 (α = 618)	- 60°C + 180°C	0.02°C	0.1°C	0.17°C

Sensor	Simulation range	Resolution	Accuracy (23°C ± 5°C)	
			90 days	1 year
Cu 10 (α = 427)	- 70°C + 150°C	0.2°C	0.9°C	1.5°C
Cu 50 (α = 428)	- 50°C + 150°C	0.05°C	0.2°C	0.4°C

Measurement current:

- R0 ≤ 200 Ω: I ≤ 5 mA.
- R0 ≥ 500 Ω: I ≥ 0.5 mA.

Settling time: ≤ 5 ms.
Access to measurements in °F and K.
Temperature coefficient: < 10 % of accuracy/°C.

11.2.5 Additional "emission/simulation" specifications

11.2.5.1 Increment generation

The increment generation function enables the user to program an incremental progression of the current emission function.
Refer to chapter 7.

11.2.5.2 Ramp generation

The ramp generation function enables the user to program a linear variation of the current emission function.
Refer to chapter 7.

11.2.5.3 Synthesizer

The synthesizer function enables the user:
- to store up to 100 emission values into permanent memory,
- to recall or emit manually or automatically the contents of these memories.

Refer to chapter 7.

11.2.5.4 Scale correction

The scale correction function performs conversions between the displayed physical quantities and the simulated electrical quantities.
Refer to chapter 7.

Notes

12. RS 232 C INTERFACE

Notes

12.1 Connection

The serial link meets the RS 232 C standards.
Connection to the computer serial port is done using the cords whose wiring is given below.
Refer to warnings appearing above paragraphs 6.1 (measurement) and 7.1 (emission) concerning the precautions to take when using the RS 232 C link.

CL519 side	Signals		Computer side		
SUB D 9 Male	Function	Direction	SUB D 25 Female	SUB D 9 Female	SUB D 25 Male
1	CD	>	8	1	--
2	RD	>	3	2	3
3	TD	<	2	3	2
4	DTR	<	20	4	20
5	Com.		7	5	7
6	DSR	>	6	6	--
7	RTS	<	4	7	--
8	CTS	>	5	8	5
9	RI	>	22	9	--
OMEGA part numbers	—	—	AN 5874	AN 5875	AN 5876

Wiring of the available RS 232 C link cords

12.2 Configuration

From the main menu:

IN OUT **CFG** STAT	1. Selection of CFG prompt.
RST **RS232** LANG ADJ	2. Selection of RS 232 prompt.
ON OFF KBDS PROT	3. Enabling (ON) or disabling (OFF) the RS 232 C link. At switching on, the serial link is reset to the status (ON or OFF) it had before switching off. When resetting the unit (command CFG – RST – YES), the link is not in use (OFF) in order to limit consumption of the unit.
ON OFF **KBDS** PROT 19.2 9.6 4.8 2.4	4. Selection of transmission rate. Rate in Kbauds to be selected from those prompted.
ON OFF KBDS **PROT** NONE DTR	5. Selection of RS 232 communication protocol. Prompt to be chosen by the operator (if no imperative reason, select NONE protocol): NONE: no protocol. DTR: CTS/DTR protocol.
↵ Return to main menu.	

NOTES:

- Length of word is 8 bits.
- Number of stop bits is 1.
- There is no parity checking.

N.B: For a dialogue between the CL519 and the computer, do validate RS 232 on the CL519 side.

12.3 Remote command syntax

The unit remote commands meet the IEEE-488.2 standard.

12.3.1 Command messages

The controller talks to the unit by means of **message commands**.

12.3.1.1 Command message structure

A command message may contain several elementary commands separated by <;> (3B in hexadecimal or 59 in decimal).

A message command must end with a **terminator**, character <**LF**> (0A in hexadecimal or 10 in decimal).

Characters in a message command can be either in UPPER or lower case.

Example : COMMAND1;COMMAND2;...;COMMANDn <**LF**>

Command structure

An elementary command is composed of a **header** followed by one or more **arguments**.
Arguments are variable and define the commands.
Number of arguments as well as type of each one are specific for each command.
An optional argument can only be specified if its predecessor has been.
In the body of a command, arguments and optional suffixes are specified within brackets **[ ]**.
The header must be separated from arguments by at least one **space** (20 in hexadecimal or 32 in decimal).
Arguments must be separated by <,> (2C in hexadecimal or 44 in decimal).
Extra spaces before or after the header or arguments are ignored.

Example	HEADER	ARGUMENT1	, ARGUMENT2	, ARGUMENT3	, ARGUMENT4
	RANGE_OUT	**TC**	**, TYP_K**	**, CEL**	**, JR_OFF**

The unit recognizes three types of arguments:
- decimals,
- mnemonics,
- eight-bit byte blocks of definite length.

Decimals:
Decimal arguments are used to specify a numerical value.
Decimal arguments must meet the following format:

± X.XXXX E ±XXXX [SUF]

Suffix: unit multiple or submultiple associated to numerical value (optional).

Exponent: whole number between + 3200 and - 3200 (optional).

Exponential : character **e** or **E**, indifferently (optional).

Mantissa: whole or fractional number including a maximum of 255 characters (non-significant head zeros <0> excluded), the whole and fractional parts are separated by <.>.

Note: Spaces before or after the <**e**> or <**E**> characters are ignored.
The unit recognizes the following suffixes:

Units	Voltages			Currents			Resistances				Temperatures			Time	
Suffixes recognized	UV	MV	V	UA	MA	A	UOHM	MOHM	OHM	KOHM	CEL	FAR	K	MS	S
Multiples	µV	mV	V	µA	mA	A	µΩ	mΩ	Ω	kΩ	°C	°F	Kelvin	ms	s
Default units	V			mA			Ω				°C			s	

Mnemonics:
Mnemonic arguments are used to specify optional parameters complementing a command.
They are composed of a group of from one to twelve characters (alphanumeric or <_>) with a first alphabetic character.
The unit recognizes the following mnemonics:

Mnemonic type	Measurement mnemonics	Emission mnemonics
FCT	V, MA, OHM, TC, RT, EXTR (for some functions)	
RAN	V50, V5, MV500, MV50, V_AUTO	V50, V5, MV500, MV50
	MA50	MA24
	OHM5000, OHM500, OHM_AUTO	OHM5000, OHM500
	TC, RT	
	EXTR1, EXTR2	
TYPE	For RAN = TC TYP_K, TYP_T, TYP_J, TYP_E, TYP_N, TYP_U, TYP_L, TYP_S, TYP_R, TYP_B, TYP_C, TYP_PL, TYP_MO	
	For RAN = RT TYP_PT50, TYP_PT100, TYP_PT200, TYP_PT500, TYP_PT1000 TYP_A3916, TYP_A3926, TYP_NI100, TYP_NI120, TYP_NI1000 TYP_CU10, TYP_CU50	
		For RAN = MA24 TXP, TXA24, TXA50
TEMP_UNIT	CEL, FAR, K	
RJ	JR_ON, JR_OFF, JR_PROG	JR_ON, JR_OFF, JR_RTD JR_PROG,
CONNECTION	WIRE2, WIRE3, WIRE 4 For RAN = MA50 TXA, TXP	----------

Resistance or RTD measurement connection **[CONNECTION]**:
- 4 wires (WIRE4),
- 3 wires (WIRE3),
- 2 wires (WIRE2).

Reference junction specification **[JR]**:
- internal reference junction **activated** (JR_ON),
- internal reference junction **deactivated** (JR_OFF),
- reference junction **programmed** (JR_PROG),
- internal reference junction **measured** (JR_RTD).

Eight-bit byte blocks of definite length:
They allow to receive or send characters of any type (alphanumeric or not).
The eight-bit byte blocks of definite length have the following format:

 # NX..XY..Y

Eight-bit byte blocks representing the data to be acquired.

Numerical characters representing, in decimal, the number of eight-bit bytes in the Y..Y string.

Non-zero numerical character (1 to 9) representing, in decimal, the number of eight-bit bytes in the X..X string.

Eight-bit byte block identifier.

Examples	#	N	X..X	Y..Y
# 12µV	#	1	2	µV
# 202µV	#	2	02	µV
# 17Meas1	#	1	7	Meas1

The unit recognizes two types of characters:
- The alphanumeric characters: Upper, lower letters, figures and characters following:

SPACE	%	.	(	)	/

- The special characters following:

°	µ	Ω

12.3.2 Response messages

Certain commands imply a response from the unit. The headers of these commands end with <**?**> and are referred to as **queries**.

When a command message contains queries, the unit prepares a response message which normally should have been acknowledged by the controller before any command message is sent.

As a message command may contain several queries, the responses are placed in the response message according to the query order and are separated by <;>.

A response message ends with <LF>.

A response can contain several **response elements** separated by <,>.

The IEEE-488.2 standard defines eleven types of response elements. The unit supports the following ones:

- Mnemonic.
- Signed or unsigned decimal whole number (NR1).
- Decimal fractional number with **fixed decimal point** (NR2).
- Decimal fractional number with **floating decimal point** (NR3).
- Eight-bit byte arbitrary blocks of definite length.
- Arbitrary block of 7 bit ASCII characters (except <LF>), always at the end of the message.
- Eight-bit byte arbitrary blocks of indefinite length.

12.3.3 Detecting remote control errors

The IEEE-488.2 standard defines three types of error according to their cause.

Command error:
Illegal command code (unknown header, illegal argument code, type or number of arguments different to those defined by the command).

Execution error:
The command code is correct but cannot be executed as one or more arguments are out of the limits specified in the command or are mutually inconsistent. All following message commands are executed.

Instrument error:
The command cannot be executed for reasons to do with the current state of the unit. All following message commands are executed.

When an error occurs, an error message is stored in a fault queue which can contain up to 16 entries. Above 16, the first ones are discarded.

12.3.4 Instrument registers

One condition register:	ISR (Instrument Status Register)
One event register:	ISCR (Instrument Status Change Register).
One configuration register:	PCR (Programmed Configuration Register).

Definition of register bits

ISR, ISCR registers:

	b7	b6	b5	b4	b3	b2	b1	b0
ISR	ACCU	SPEC	SAT	OOVL	OUT	MEM	IOVL	MEAS
ISCR	⎍	⎍	⎍	⎍	⎍	⎍	⎍	⎍

ISCR bits are set to 1 when the corresponding ISR bit:
⎍ changes state (from 0 to 1 or from 1 to 0).
⎍ goes from 0 to 1.

	DESCRIPTION
MEAS	Indicates that a new measurement is present since the last acquisition. This bit is reset to 0 by reading the measurement.
IOVL	Overload : signals that the available measurement is out of the limits.
MEM	Measurement burst under storage. ⌐: opening; ¬: closing.
OUT	Indicates that a new simulation setpoint is requested by an internal function of setpoint automatic evolution. (During ramp execution, this bit remains inactive). This bit is reset to 0 by reading the emitted value.
OOVL	The requested emission setpoint is out of the limits.
SAT	Output amplifier saturated, the quantity present on the output terminals of the unit does not correspond to the setpoint value.
SPEC	Indicates that an automatic evolution function of the emission/simulation setpoint is running.
ACCU	Indicates that the battery must be recharged.

PCR register:

	b7	b6	b5	b4	b3	b2	b1	b0
PCR	REM	SPEC	OSCAL	ISCAL	NUL	HOLD	AUTO	-------

AUTO	Indicates that the unit is configured in measurement autoranging.
HOLD	Indicates that the measurement free rate (RUN mode) has stopped.
NUL	Relative measurements are validated.
ISCAL	Measurement scaling is validated according to the programmed law.
OSCAL	Emission/simulation setpoint scaling according to the programmed law.
SPEC	Indicates that an automatic evolution function of the emission/simulation setpoint is selected (or it can be running, held or ended).
REM	REMote status.

12.3.5 Input buffer

Each eight-bit byte received by the unit is stored in a memory zone called an **input buffer**. This holds up to 128 eight-bit bytes and operates as a **first in first out** fashion (FIFO).

The input buffer is transparent for the user, allowing the unit to receive data faster than it can decode them.

The input buffer is cleared during each power on cycle and each time a Control/D (04 in hexadecimal or 4 in decimal) or Control/T (14 in hexadecimal or 20 in decimal) character is received.

In DTR/CTS protocol, if the input buffer contains more than 96 eight-bit bytes (75 %), the unit inhibits transmission, then when the input buffer only contains 32 eight-bit bytes (25 %), the unit authorizes the transmission again.

If there is no transmission protocol programmed, the controller ignores the input buffer capacity and if it is exceeded, the unit stores no further characters which leads to loss of information.

12.3.6 Output buffer

Responses to queries are stored in a memory zone called an **output buffer** waiting until they are read by the controller. The output buffer holds up to 128 eight-bit bytes.

The interface only starts sending responses once the output buffer is full or a command message terminator has been decoded.

12.4 Unit remote commands

When defining commands, optional arguments and suffixes are specified within brackets [ ].
Any commands modifying the unit output or the values stored into permanent memory are ignored if the unit is set to **local** mode.

12.4.1 Commands affecting the unit general usage

***IDN?**	
Returns the unit identification.	
Response	Arbitrary block of characters with four fields separated by <,>.
	1 OMEGA 2 CL519 3 Sssssss Serial number. 4 A.aa A.aa : Software edition.

***RST**
• Forces all pending commands to complete in the shortest possible time. • Interrupts the possible emission/simulation automatic evolution functions. • Resets the unit to its power on state. • The command does not affect any other state of the unit.

REM
Sets the unit to remote control status.

LOC
Resets the unit to local status.

ISR?	
Returns the value from the Instrument Status Register.	
Response	Decimal whole number between 0 and 255.

ISCR?	
Returns and clears the value from the Instrument Status Change Register.	
Response	Decimal whole number between 0 and 255.

PCR?	
Returns the value from the Programmed Configuration Register.	
Response	Register value (decimal number).

12.4.2 Commands affecting the measurements

12.4.2.1 Commands affecting the measurement configuration

RANGE_IN RAN [,CONNECTION [,TYPE [,TEMP_UNIT [,JR [,VAL]]]]]		***(ignored in local)***
Selects the specified measurement range.		
RAN	Range mnemonic.	
[CONNECTION]	Measurement connection mnemonic.	
[TYPE]	Sensor type mnemonic.	
[TEMP_UNIT]	Temperature unit mnemonic.	
[JR]	Reference junction mnemonic.	
[VAL]	Reference junction value when JR = JR_PROG (decimal number).	
Example	RANGE_IN RT, WIRE3, TYP_PT100, CEL	

CFG_IN? [FCT]		
Returns information on measurement configuration.		
Response	[FCT] does not exist	Current range mnemonic.
	[FCT] exists	Returns the measurement specifications of the FCT function.
	[FCT] = V	Selected range mnemonic (V50, V5, MV500, MV50, V_AUTO).
	[FCT] = MA	MA50 range mnemonic. Selected measurement connection mnemonic (TXA, TXP).
	[FCT] = OHM	Configured range mnemonic (OHM5000, OHM500, OHM_AUTO). Selected measurement connection mnemonic (WIRE3, WIRE2).
	[FCT] = TC	TC range mnemonic. Selected connection mnemonic (WIRE2). Selected sensor type mnemonic (TYP_K, .., TYP_MO). Selected unit mnemonic (CEL, FAR, K). Reference junction mnemonic (JR_ON, JR_OFF, JR_PROG + Value).
	[FCT] = RT	RT range mnemonic. Selected connection mnemonic (WIRE3). Selected sensor type mnemonic (TYP_PT100, .., TYP_PT1000). Selected unit mnemonic (CEL, FAR, K).
	[FCT] = EXTR	EXTR function mnemonic (EXTR1 or EXTR2).
Examples	Command	Response
	CFG_IN?	RT
	CFG_IN?	EXTR
	CFG_IN? RT	RT,WIRE3,TYP_PT100,CEL
	CFG_IN? TC	TC,WIRE2,TYP_K,CEL,JR_ON

MEAS?	
Returns the last measurement value available together with the unit. The MEAS bit of ISR is deactivated upon receiving this command.	
Response	Measurement value (decimal number).
	Mnemonic (V, MA, OHM, CEL, FAR, K, EXTR, SCAL if scaling is validated).
Example	0.599876,V
	100.0000,SCAL

Note: In case of measurement capacity overload, the returned measurement value is fixed and equivalent to 10 000 000.

MEAS ***option***		***(ignored in local)***
Acts on the measurement sequence.		
option	HOLD	The measurements are stopped ("HOLD" mode).
	RUN	Free rate measurements ("RUN" mode).
	TRIGM	Triggers and stores one isolated measurement.
	BTRIG	Triggers a programmed measurement cycle and stores under measurement burst form.
	TRIGL [,LEV]	Starts a cycle on trigger level overrun. Overrun may occur on lower value (LEV=M_LO) or on higher value (LEV=M_HI).

Note: No measurement burst should be under storage.

STO_MEASTRIGL VAL[SUF]		***(ignored in local)***
Programs the measurement trigger level.		
VAL	Trigger level value (decimal number).	

MEASTRIGL?	
Returns the value of the measurement trigger level.	
Response	Level value (decimal number).
	Function mnemonic (V, MA, OHM, TC, RT, EXTR) or SCAL mnemonic.
Example	1.5000e+01,V
	1.5050e+00,SCAL

12.4.2.2 Commands affecting the measurement processing

STO_NUL REF_VAL[SUF] [,FCT]		***(ignored in local)***
Associates a reference value (NUL) to the current function (if FCT argument does not exist) or to the specified FCT function.		
REF_VAL	Reference value (decimal number).	
[FCT]	Function mnemonic (V, MA, OHM, TC, RT, EXTR) or SCAL mnemonic.	
	FCT = SCAL	The specified reference value will be associated to usage of the measurement scaling.

NUL *option*		***(ignored in local)***
Acts on execution of relative measurements.		
option	ON	Validates the relative computation (subtracting the reference value from the rough measurement).
	OFF	Inhibits the relative computation.
	TARE	Stores the last measurement in the reference value and validates the relative computation.

NUL? [FCT]		
Returns the reference value (NUL) from the specified FCT function.		
[FCT]	Function mnemonic (V, MA, OHM, TC, RT, EXTR) or SCAL mnemonic.	
	FCT does not exist	The returned reference value will be that associated to the usage.
	FCT = SCAL	The returned reference value will be that of the measurement scaling.
Response	Reference value (decimal number).	
	Function mnemonic (V, MA, OHM, TC, RT, EXTR) or SCAL mnemonic.	
Example	*Command*	*Response*
	NUL?	1.00000E-3,V
	NUL? TC	100.000E+0,TC

STO_ISCAL X0[SUF], Y0, X1[SUF], Y1, RES	***(ignored in local)***
Clears all the scaling specifications to replace them by those in arguments, the unit is reinitialized ("...").	
X0	Decimal number indicating the x-coordinate (rough measurement) of the first scaling point.
Y0	Decimal number indicating the y-coordinate (measurement after scaling) of the first point.
X1	Decimal number indicating the x-coordinate (rough measurement) of the second scaling point.
Y1	Decimal number indicating the y-coordinate (measurement after scaling) of the second point.
RES	Resolution selected after scaling (decimal number between 0 and 4).
Example	STO_ISCAL 4MA, 0, 20MA, 100, 2

ADDP_ISCAL X[SUF], Y	***(ignored in local)***
Adds an additional point to the current scaling specification (10 points as a maximum).	
X	Decimal number indicating the x-coordinate (rough measurement) of the new point.
Y	Decimal number indicating the y-coordinate (measurement after scaling) of the new point.
Example	ADDP_ISCAL 12MA, 60

STO_ISCALUNI *message*	***(ignored in local)***
Stores the scaling unit into the permanent memory.	
message	Eight-bit byte block of definite length.
Example	STO_ISCALUNI # 202 µV

Note: Only the first three characters are taken into account. Only characters readable by the unit should be entered.

ISCAL *option*		***(ignored in local)***
Activates or inhibits the measurement scaling function.		
option	ON	Activates the scaling.
	OFF	Inhibits the scaling.

ISCAL?		
Returns the measurement scaling specifications.		
Response	Eight-bit byte block of definite length.	
Example	#4089<CR><LF> 0: 4.00000E+0, 000.000E+0<CR><LF> 1: 12.0000E+0, 60.0000E+0<CR><LF> 2: 20.0000E+0, 100.000E+0<CR><LF> 2<CR><LF> OFF<CR>	(response length) (point 0) (point 1) (point 2) (resolution) (ON or OFF depending if it is in use or not).

ISCALUNI?	
Returns the scaling unit.	
Response	Eight-bit byte block of definite length.
Example	# 12 µA

12.4.2.3 Commands affecting the measurement memories

STO_MEASPROG NB, INTERVAL[SUF]	***(ignored in local)***
Stores the specifications of the triggered measurement program into the unit permanent memory.	
NB	Number of measurements to be performed (decimal number between 1 and 1 000).
INTERVAL	Time between two consecutive measurements (decimal number between 0.5 s and 6 500 s).
SUF	Suffix.
Example	STO_MEASPROG 100, 10 S

MEASPROG?
Returns the specifications from the triggered measurement program.
Response — Number of measurements to be performed (decimal number).
Time between two consecutive measurements (decimal number).
Time unit (mnemonic).

STO_MEASNAME ***message***	***(ignored in local)***
Stores in permanent memory the measurement burst name for a further processing.	
Message	Eight-bit byte block of definite length.
Example	STO_MEASNAME # 207 Meas1

Note: Only the first eight characters are taken into account.

MEASNAME?	***(ignored in local)***
Returns the measurement burst name.	
Response	Eight-bit byte block of definite length.
Example	# 17 Meas1

OUT_MEMORY?		
Returns a summary on the contents of all the measurement bursts in memory.		
Response	Eight-bit byte block of indefinite length.	
Example	2 bursts stored.	
	#0<CR><LF> BURST:002<CR><LF> B-001:Burstname<CR><LF> N:3,T:1.0,s,U:mA<CR><LF> B-002:...<CR><LF> N:100,T:0.5,s,U:OHM<CR><LF> <LF>	(indefinite length) (number of stored bursts) (burst number and name) (number, interval and unit) (summary of the previous burst)

Note: When isolated measurements have been stored in a measurement burst (MTRIG), time between two consecutive measurements has no meaning and the returned value is set to 10 000 000.

MEMORY? [N1 [, N2]]		*(ignored in local)*
Returns a summary on the contents of the specified measurement bursts.		
No argument	Summary of the last stored burst.	
[N1] alone	Summary of the N1 burst alone (decimal number).	
[N1] and [N2]	Summary of N1 to N2 bursts (N1 burst is the most recent).	
Response	Eight-bit byte of indefinite length.	
Examples	Command	Response
	MEMORY? -1, -2	#0<CR><LF> B-001:BurstName<CR><LF> (summary of burst -1) N:3,T:1.0,s,U:mA<CR><LF> B-002:...<CR><LF> (summary of burst -2) N:100,T:0.5,s,U:OHM<CR><LF> <LF>
	MEMORY? -1, -5	#0<CR><LF> BURST:002<CR><LF> (error, only 2 bursts stored) <LF>

CLR_MEMORY	*(ignored in local)*
Clears ALL the stored measurement bursts.	

Note: The following commands stop any measurement cycle in progress.

OUT_BURST?	***(ignored in local)***
Returns the contents from all the stored bursts.	
Response	Eight-bit byte block of indefinite length.
Example	# 0<CR><LF> BURST:002<CR><LF> (number of stored bursts) B-001:BurstName<CR><LF> (burst number and name) N:3,T:1.0,s,U:CEL<CR><LF> (number, time between measurements and unit) 000:23.55<CR><LF> (1st measurement) 001:23.45<CR><LF> (2nd measurement) 002:23.05<CR><LF> (...) B-002:...<CR><LF> (summary of the previous burst) N:2,T:2.5,s,U:OHM<CR><LF> 000:100.037<CR><LF> 001:100.126<CR><LF> <LF>

BURST? [N1 [, N2]]		***(ignored in local)***
Returns the contents from the specified measurement bursts.		
No argument	Contents of the last stored burst.	
[N1] alone	Contents of the N1 burst alone (decimal number).	
[N1] and [N2]	Contents of N1 to N2 bursts (N1 burst is the most recent).	
Response	Eight-bit byte block of indefinite length.	
Examples	*Command*	*Response*
	BURST? -3	#0<CR><LF> B-003:LaboTemp<CR><LF> (burst number and name) N:5,T:60.0,s,U:CEL<CR><LF> (number, interval and unit) 000:23.55<CR><LF> (1st measurement) 001:23.45<CR><LF> (2nd measurement) 002:23.10<CR><LF> (...) 003:22.50<CR><LF> (...) 004:22.25<CR><LF> (...) <LF>
	BURST? -1, -5	#0<CR><LF> BURST:002<CR><LF> (error, only 2 bursts stored) <LF>

CLR_BURST [N1]	***(ignored in local)***
Clears the specified measurement burst.	
[N1]	Burst to be cleared (decimal number), if the argument does not exist, the last stored burst will be cleared.

12.4.3 Commands affecting the emission-simulation

12.4.3.1 Commands affecting the emission-simulation configuration

RANGE_OUT RAN [,TYPE [,TEMP_UNIT [,JR [,VAL]]]]		***(ignored in local)***
Selects the specified emission/simulation range.		
RAN	Range mnemonic.	
[TYPE]	Sensor type mnemonic, or transmitter connection type (TXP, TXA24, TXA50).	
[TEMP_UNIT]	Temperature unit mnemonic.	
[JR]	Reference junction mnemonic.	
[VAL]	Reference junction value when JR = JR_PROG (decimal number).	
Example	RANGE_OUT TC, TYP_K, CEL, JR_OFF RANGE_OUT MA24, TXA24	

CFG_OUT? [FCT]		
Returns information on emission/simulation configuration.		
Response	[FCT] does not exist	Current range mnemonic.
	[FCT] = V	Selected range mnemonic (V50, V5, MV500, MV50).
	[FCT] = MA	MA24 range mnemonic. Connection type mnemonic TXP, TXA24, TXA50.
	[FCT] = OHM	Configured range mnemonic (OHM5000, OHM500).
	[FCT] = TC	TC range mnemonic. Mnemonic of the sensor type to be simulated (TYP_K, .., TYP_MO). Selected unit mnemonic (CEL, FAR, K). Reference junction mnemonic (JR_ON, JR_OFF, JR_PROG + Value).
	[FCT] = RT	RT range mnemonic. Selected sensor type mnemonic (TYP_PT100, .., TYP_PT1000). Selected unit mnemonic (CEL, FAR, K).
	[FCT] = EXTR	EXTR function mnemonic (EXTR1 or EXTR2).
Examples	*Command*	*Response*
	CFG_OUT?	RT
	CFG_OUT?	MA24, TXP
	CFG_OUT? RT	RT,TYP_PT100,CEL

OUT VAL[SUF]	***(ignored in local)***
Specifies an emission/simulation setpoint value. Stops any automatic evolution function.	

OUT?	
Returns the emission/simulation setpoint value together with the unit. The OUT bit of ISR is deactivated upon receiving this command.	
Response	Output setpoint value (decimal number).
	Mnemonic (V, MA, OHM, CEL, FAR, K, EXTR, SCAL if scaling is validated).
Example	0.599876,V
	100.0000,SCAL

SPEC_OUT?	
Returns information on automatic evolution functions of the output setpoint.	
Response	**Mnemonics indicating the automatic evolution function:**
INCR	"Incrementation" function requested.
RAMP	"Ramp" function requested.
SYNT	"Synthesizer" function requested.
NONE	No automatic evolution function requested.
	Mnemonics indicating how is the requested function:
RUN	Function is running.
HOLD	Function is held.

12.4.3.2 Commands affecting the emission-simulation setpoint values

STORE NO [, VAL[SUF]]	***(ignored in local)***
Stores an emission/simulation setpoint value into the specified memory.	
NO	Number of the setpoint memory (decimal number between 0 and 99).
VAL does not exist	The current simulation value is stored into memory.
VAL = decimal number	This value is stored.

RECALL NO	***(ignored in local)***
Gives the value contained in the specified memory to the output setpoint.	
NO	Number of the setpoint memory (decimal number between 0 and 99).

Note: The stored value must be inside the current range limits.

MEM? NO1 [, NO2]			
Returns the setpoint values stored into the specified memories.			
NO1	Decimal number indicating the memory number to be read if NO2 argument does not exist or the number of the first memory if NO2 argument exists.		
NO2	Decimal number indicating the number of the last memory to be read.		
Response	Eight-bit byte block of definite length.		
Example	Command	Response	
	MEM? 10, 12	#40049<CR><LF> 10: 4.00000E+0<CR><LF> 11:-1.00000E-3<CR><LF> 12:-100.000E-6<CR>	(response length) (memory 10) (memory 11) (memory 12)

CLR_ALLMEM	***(ignored in local)***
Clears all the emission/simulation memories (memory from 0 to 99).	

STO_SYNTHE NO1, NO2, INTERVAL[SUF], NB	***(ignored in local)***
Stores into permanent memory new synthesizer execution specifications.	
NO1	First memory to be scanned (decimal number between 0 and 99).
NO2	Last memory to be scanned (decimal number between 0 and 99).
INTERVAL	Time between two successive memory recalls (decimal number between 0.5 s and 6 500 s).
NB	Number of cycles to be executed (decimal number between 1 and 65 000).

SYNTHE *option*		***(ignored in local)***
Acts on the synthesizer program execution		
option		Mnemonic of the action to be performed.
	RUN	Triggers the synthesizer program.
	UP	Recalls the next memory contents in the programmed cycle.
	DOWN	Recalls the previous memory contents in the programmed cycle.
	HOLD	Holds the synthesizer execution.
	REST	Restarts the synthesizer execution.
	STOP	Stops the synthesizer execution.

SYNTHE?	
Returns the synthesizer program specifications.	
Response	First memory to be scanned (decimal number). Last memory to be scanned (decimal number). Time between two successive memory recalls (decimal number). Time unit (mnemonic). Number of cycles to be performed (decimal number).

12.4.3.3 Commands affecting the emission-simulation setpoint incrementation

INCR VAL_INCR[SUF]	***(ignored in local)***
Increments the emission/simulation setpoint value to the specified value.	
VAL_INCR	Increment value (decimal number).

Note: After incrementation, the setpoint value must be inside the current range limits.

STO_INCRP VAL_INCR[SUF], NB, INTERVAL[SUF]	***(ignored in local)***
Stores into permanent memory new execution specifications of the automatic incrementation.	
VAL_INCR	Increment value (decimal number).
NB	Number of successive increments (decimal number between 1 and 65 000).
INTERVAL	Time between two successive increments (decimal number between 0.5 s and 6 500 s).

INCRP *option*		***(ignored in local)***
Acts on the execution of the automatic incrementation program of the output setpoint.		
option	Mnemonic of the action to be performed.	
	UP	Starts execution of the automatic incrementation program with the stored increment value (VAL_INCR).
	DOWN	Starts execution of the automatic incrementation program with an increment value opposed to the one stored (-VAL_INCR).
	HOLD	Holds execution of the automatic incrementation.
	REST	Restarts execution of the automatic incrementation.
	STOP	Stops execution of the automatic incrementation.

INCRP?	
Returns the specifications from the automatic incrementation program.	
Response	Increment value (decimal number). Number of successive increments (decimal number). Time between two successive increments (decimal number). Time unit (mnemonic)
Example	100.000E-3,10,0.5,S

12.4.3.4 Commands affecting the simple ramp

STO_RAMPS RAMP_VAL[SUF], INTERVAL[SUF]		***(ignored in local)***
Stores into permanent memory new execution specifications of the simple ramp.		
RAMP_VAL	Difference between final and initial values (decimal number).	
INTERVAL	Ramp duration (decimal number between 0.1 s and 100 000 s).	
Example	STO_RAMPS 100MV, 60S	

RAMPS *option*		***(ignored in local)***
Acts on the simple ramp execution.		
option	Mnemonic of the action to be performed.	
	UP	Starts execution of the simple ramp with the stored deviation (RAMP_VAL).
	DOWN	Starts execution of the simple ramp with the opposed stored deviation (-RAMP_VAL).
	HOLD	Holds execution of the simple ramp.
	REST	Restarts execution of the simple ramp.
	STOP	Stops execution of the simple ramp.

RAMPS?	
Returns the simple ramp stored specifications.	
Response	Difference between final and initial values (decimal number). Ramp duration (decimal number). Time unit (mnemonic).

12.4.3.5 Commands affecting the cyclical ramp

STO_RAMPC RAMP_VAL[SUF], NB, T0[SUF], T_UP[SUF], T1[SUF], T_DOWN[SUF] ***(ignored in local)***	
Stores in permanent memory new execution specifications of the cyclical ramp.	
RAMP_VAL	Deviation on the output quantity (decimal number).
NB	Number of successive ramps (decimal number between 1 and 65 000).
T0	Initial value home time (decimal number).
T_UP	Time for changing from the initial value to the final value (decimal number).
T1	Final value home time (decimal number).
T_DOWN	Time for returning from the final value to the initial value (decimal number); times should be between 0.1 and 100 000 s.
Example	STO_RAMPC 100MV, 10, 500MS, 60S, 10S, 500MS

RAMPC *option* ***(ignored in local)***		
Acts on the cyclical ramp execution.		
option	Mnemonic of the action to be performed.	
	RUN	Starts execution of the cyclical ramp with the stored specifications.
	HOLD	Holds execution of the cyclical ramp.
	REST	Restarts execution of the cyclical ramp.
	STOP	Stops execution of the cyclical ramp.

RAMPC?	
Returns the cyclical ramp stored specifications.	
Response	Deviation on the output quantity (decimal number). Number of successive ramps (decimal number). Initial value home time (decimal number). Time unit (mnemonic). Time for changing from the initial value to the final value (decimal number). Time unit (mnemonic). Final value home time (decimal number). Time unit (mnemonic). Time for returning from the final value to the initial value (decimal number). Time unit (mnemonic).

12.4.3.6 Commands affecting the output setpoint scaling

STO_OSCAL X0, Y0[SUF], X1, Y1[SUF], RES		***(ignored in local)***
Clears all the scaling specifications to replace them by those in arguments, the unit is reinitialized ("...").		
X0	Decimal number indicating the setpoint value of the first scaling point.	
Y0	Decimal number indicating the value to be emitted for the first scaling point.	
X1	Decimal number indicating the setpoint value of the second point.	
Y1	Decimal number indicating the value to be emitted for the second point.	
RES	Selected display resolution (decimal number between 0 and 4).	
Example	STO_OSCAL 4, 0MA, 20, 100MA, 2	

ADDP_OSCAL X, Y[SUF]		***(ignored in local)***
Adds an additional point to the current scaling specification (10 points as a maximum).		
X	Decimal number indicating the value to be emitted for the new point.	
Y	Decimal number indicating the setpoint value of the new point.	
Example	ADDP_OSCAL 12, 20MA	

STO_OSCALUNI *message*		***(ignored in local)***
Stores the scaling unit into the permanent memory.		
message	Eight-bit byte block of definite length.	
Example	STO_OSCALUNI # 202 µV	

Note: Only the first three characters are taken into account. Only characters readable by the unit should be entered.

OSCAL *option*		***(ignored in local)***
Activates or inhibits the emission/simulation scaling function.		
option	Mnemonic of the action to be performed.	
	ON	Activates the scaling.
	OFF	Inhibits the scaling.

OSCAL?		
Returns the specifications from the emission/simulation scaling.		
Response	Eight-bit byte block of definite length.	
Example	#40088<CR><LF>	(response length)
	0: 4.00000E+0, 000.000E-3<CR><LF>	(point 0)
	1: 12.0000E+0, 60.0000E+0<CR><LF>	(point 1)
	2: 20.0000E+0, 100.000E+0<CR><LF>	(point 2)
	2<CR><LF>	(resolution)
	ON<CR>	(ON or OFF depending if it is in use or not.)

OSCALUNI?	
Returns the scaling unit.	
Response	Eight-bit byte block of definite length.
Example	# 12 µA.

12.4.4 Commands affecting the transmitter calibration

The RS commands enable the user to:
- read and clear the calibration reports stored in memory,
- read programming of procedures,
- modify programming of procedures.

Up to 10 setpoints as a maximum can be stored in each procedure.

12.4.4.1 Commands affecting the procedures

For all commands following:
N1 and N2: procedure numbers. Decimal number between 1 and 12.

PE? N1 [, N2]		***(ignored in local)***
Returns programming of the specified procedures.		
N1 alone	Summary of N1 procedure alone (decimal number between 1 and 12).	
N1 and [N2]	Summary of N1 to N2 procedures.	
Response	Eight-bit byte block of indefinite length.	
Example	#0<CR><LF>	(indefinite length)
	P01<CR><LF>	(procedure number 1)
	Type:<CR><LF>	(transmitter type)
	Man: <CR><LF>	(transmitter manufacturer)
	N:3,U:mA<CR><LF>	(number of test setpoints, units in transmitter input)
	Dir:UP_DOWN, Mode:AUTO<CR><LF>	(up/down function and execution mode)
	FCTR_L:0.00000e+00,4.00000e+00,mA<CR><LF>	(scale factor low point) ❶
	FCTR_H:4.00000e+01,2.00000e+01,mA<CR><LF>	(scale factor high point) ❶
	DELTA:0.04%,3U<CR><LF>	(max. permissible deviation)
	00:5<CR><LF>	(setpoint number 1)
	01:10<CR><LF>	(setpoint number 2)
	02:25<CR><LF>	(setpoint number 3)
	<LF>	

❶ Non significant for an indicator.

PECFG_IN? N1		
Returns CL519 measurement configuration for procedure number N1.		
Response	Depending on configuration "FCT" function:	
	FCT = 0-10V	Voltage range mnemonic (V50).
	FCT = 4-20MA	Current range mnemonic (MA50). Transmitter type mnemonic (TXA, TXP).
Example	V50 MA50,TXA	

Note: The indication returned is only significant for a transmitter calibration. For indicator calibration, the values are not measured by the unit, but edited by the operator.

PECFG_OUT? N1		
Returns CL519 emission configuration for the procedure number N1.		
Response	Depending on configuration "FCT" function:	
	FCT = V	Selected range mnemonic (V50, V5, MV500, MV50).
	FCT = MA	MA24 range mnemonic. Transmission type mnemonic TXP, TXA24, TXA50.
	FCT = OHM	Configured range mnemonic (OHM5000, OHM500).
	FCT = TC	Mnemonic of TC range. Mnemonic of sensor type to be simulated (TYP_K, .., TYP_MO). Mnemonic of selected unit (CEL, FAR, K). Mnemonic of reference junction (JR_ON, JR_OFF, JR_PROG + Value).
	FCT = RT	Mnemonic of RT range. Mnemonic of sensor type selected (TYP_PT100, .., TYP_PT1000). Mnemonic of selected unit (CEL, FAR, K).
	FCT = EXTR	EXTR function mnemonic (EXTR1 or EXTR2).
Example	MA24, TXA24 OHM5000 RT,TYP_PT100,CEL	

PESCALUNI? N1	
Returns the scaling unit from the procedure number N1.	
Response	Eight-bit byte block of definite length.
Example	# 12 µA.

PESCAL? N1	
Returns the scaling specifications from the procedure number N1.	
Response	If there is no scaling activated for the procedure: #40006<CR><LF> 0<CR><LF> <CR> otherwise: #4088<CR><LF> 0: 4.00000E+0, 000.000E-3<CR><LF> 1: 12.0000E+0, 60.0000E+0<CR><LF> 2: 20.0000E+0, 100.000E+0<CR><LF> 2<CR><LF> ON<CR>

12.4.4.2 Commands affecting the calibration reports

Note: Calibration report = PV

OUT_PVSUMMARY?	***(ignored in local)***
Returns a summary on contents of all calibration reports stored.	
Response	Eight-bit byte block of indefinite length.
Example	#0<CR><LF> (indefinite length) PV:02<CR><LF> (number of reports stored) P-01:001453<CR><LF> (report number -1 and report serial number) Commentaire<CR><LF> (calibration report comment) Date:950213<CR><LF> (report execution date: YYMMDD) P-02:001222<CR><LF> Commentaire<CR><LF> Date:<CR><LF> <LF>

PV? [N1 [, N2]]	***(ignored in local)***
Returns contents of all calibration reports specified.	
No argument	Summary of the last memorized calibration report.
[N1] alone	Summary of calibration report N1 alone (N1: report order number, decimal number < 0).
[N1] and [N2]	Summary of N1 to N2 reports (N1 is the most recent report).
Response	Eight-bit byte block of indefinite length.
Example	#0<CR><LF> (indefinite length) P-01:001453<CR><LF> (report number -1 and report serial number) Type:<CR><LF> (transmitter type) Man:<CR><LF> (transmitter manufacturer) Commentaire<CR><LF> (calibration report comment) Date:950213<CR><LF> (report execution date: YYMMDD) N:3,U:mA<CR><LF> (number of test setpoints, units in transmitter input) Dir:UP_DOWN, Mode:AUTO<CR><LF> (up/down function and execution mode) FCTR_L:0.00000e+00,4.00000e+00,mA<CR><LF> (scale factor low point) ❶ FCTR_H:4.00000e+01,2.00000e+01,mA<CR><LF> (scale factor high point) ❶ DELTA:0.04%,3U<CR><LF> (max. permissible tolerance) Name:SMITH <CR><LF> (operator's name) AdjustDate:9522<CR><LF> (date of the last adjustment of the standard during test: YYWW) 00:5,4.99<CR><LF> (couple setpoint/measurement number 1) 01:10,10.02<CR><LF> (couple setpoint/measurement number 2) 02:25,24.04<CR><LF> (couple setpoint/measurement number 3) <LF>

❶ Non significant for an indicator.

PVCFG_OUT? N1		
Returns CL519 emission configuration for the calibration of report number N1.		
Response	Depending on configuration "FCT" function:	
	FCT = V	Selected range mnemonic (V50, V5, MV500, MV50).
	FCT = MA	MA24 range mnemonic. Transmission type mnemonic TXP, TXA24, TXA50.
	FCT = OHM	Configured range mnemonic (OHM5000, OHM500).
	FCT = TC	Mnemonic of TC range. Mnemonic of sensor type to be simulated (TYP_K, .., TYP_MO). Mnemonic of selected unit (CEL, FAR, K). Mnemonic of reference junction (JR_ON, JR_OFF, JR_PROG + Value).
	FCT = RT	Mnemonic of RT range. Mnemonic of sensor type selected (TYP_PT100, .., TYP_PT1000). Mnemonic of selected unit (CEL, FAR, K).
	FCT = EXTR	EXTR function mnemonic (EXTR1 or EXTR2).
Example	MA24, TXA24 OHM5000 RT,TYP_PT100,CEL	

PV_EXTR2? N1	
Returns information on the external sensor used for the calibration of report number N1.	
Response	<Manufacturer name>, <Transmitter type >, <Serial number >
Example	KELLER, SERIES 30 : 0..100 Bar, 35154

OUT_PV?	***(ignored in local)***
Returns contents from all the memorized calibration reports.	
Response	Eight-bit byte block of indefinite length.
Example	#0<CR><LF> (indefinite length) PV:02<CR><LF> (number of memorized calibration reports) P-01:001453<CR><LF> (calibration report number -1 and calibration report serial number) Type:<CR><LF> (transmitter type) Man:<CE><LF> (transmitter manufacturer) Commentaire<CR><LF> (calibration report comment) Date:950213<CR><LF> (calibration report execution date: YYMMDD) N:3,U:mA<CR><LF> (number of test setpoints, units in transmitter input) Dir:UP_DOWN, Mode:AUTO<CR><LF> (Up/Down function and execution mode) FCTR_L:0.00000e+00,4.00000e+00,mA<CR><LF> (scale factor low point) ❶ FCTR_H:4.00000e+01,2.00000e+01,mA<CR><LF> (scale factor high point) ❶ DELTA:0.04%,3U<CR><LF> (max. permissible tolerance) Name:SMITH <CR><LF> (operator's name) AdjustDate:9505<CR><LF> (date of the last adjustment of the standard during test: YYWW) 00:5,4.99<CR><LF> (couple setpoint/measurement number 1) 01:10,10.02<CR><LF> (couple setpoint/measurement number 2) 02:25,24.04<CR><LF> (couple setpoint/measurement number 3) P-02:001222<CR><LF> (contents of calibration report -2) Type:<CR><LF> Man:<CR><LF> Commentaire<CR><LF> Date:950123<CR><LF> N:2,U:SCAL<CR><LF> Dir:UP_ONLY, Mode:AUTO<CR><LF> FCTR_L:0.00,4.00,mA<CR><LF> FCTR_H:40.00,20.00,mA<CR><LF> DELTA:0.04%,3U<CR><LF> Name:SMITH <CR><LF> AdjustDate:9505<CR><LF> 00:5,4.99<CR><LF> 01:25,24.04<CR><LF> <LF>

❶ Non significant for an indicator.

PVSCALUNI? [N1]	
Returns the scaling unit from the calibration report number N1.	
No argument	Unit of the last calibration report stored.
[N1]	Decimal number < 0.
Response	Eight-bit byte block of definite length.
Example	# 12 µA.

PVSCAL? [N1]	
Returns the scaling specifications from the calibration report number N1.	
No argument	Specifications of the last calibration report stored.
[N1]	Decimal number < 0.
Response	If there is no scaling activated for this calibration report: #40006<CR><LF> 0<CR><LF> <CR> otherwise: #40085<CR><LF> 0: 4.00000E+0, 000.000E-3<CR><LF> 1: 12.0000E+0, 60.0000E+0<CR><LF> 2: 20.0000E+0, 100.000E+0<CR><LF> 2<CR>

12.4.4.3 Commands affecting calibration report clearing

CLR_PV [N1]	*(ignored in local)*
No argument	Clears the last calibration report stored.
[N1]	Clears the calibration report number N1.

CLR_ALLPV	*(ignored in local)*
Clears ALL the calibration reports from the memory.	

12.4.4.4 Commands affecting the procedure programming

For all commands following:
N1: procedure number. Decimal number between 1 and 12.

STO_PE X0[SUF] ,N1	*(ignored in local)*
Programs the first setpoint of procedure number N1. All the other setpoints are cleared.	
X0	Decimal number indicating the first setpoint.
This command also stores in the procedure the following parameters (current parameters upon receiving the command): • CL519 measurement configuration: 50 V or 50 mA according to the current configuration; 50 mA if the CL519 is not set to V or mA function. For a calibration procedure of an indicator, the measurement configuration will be the same as the emission configuration. • CL519 emission configuration. • Scaling over CL519 emission if a scaling is activated.	

STO_PEEXTR1FCT X0[SUF] ,N1 *(ignored in local)* **STO_PEEXTR2FCT X0[SUF] ,N1** *(ignored in local)*	
Programs the first setpoint of procedure number N1 (all the other setpoints are cleared) and stores the external function (EXTR1 or EXTR2 depending on the command) in the output configuration of the procedure.	
X0	Decimal number indicating the first setpoint.
This command also stores in the procedure the following parameters (current parameters upon receiving the command): • CL519 measurement configuration: 50 V or 50 mA according to the current configuration; 50 mA if the CL519 is not set to V or mA function. For a calibration procedure of an indicator, the measurement configuration will be the same as the emission configuration.	

ADDP_PE X[SUF] ,N1 *(ignored in local)*	
Adds a setpoint to procedure number N1.	
X	Decimal number indicating the new setpoint.

STO_PEFCTR X0[SUF], Y0, X1[SUF], Y1 ,N1 *(ignored in local)*	
Programs the scale factor.	
X0	Decimal number indicating the low point of the value emitted.
Y0	Decimal number indicating the low point of the value measured.
X1	Decimal number indicating the high point of the value emitted.
Y1	Decimal number indicating the high point of the value measured.

STO_PEDELTA X, Y[SUF] ,N1 *(ignored in local)*	
Programs the max. permissible tolerance.	
X	Decimal number indicating the relative part of the error accepted.
Y	Decimal number indicating the absolute part of the error accepted.
Example	DELTA_PV 0.04, 3 for a 0.04 % + 3 U tolerance. (%: percent on the value read by the transmitter) (U: Unit in transmitter input).

STO_PEIDN Type, Manufacturer, N1 *(ignored in local)*	
Programs the type and manufacturer of the transmitter.	
Type	Eight-bit byte block of definite length (8 characters max.).
Manufacturer	Eight-bit byte block of definite length (8 characters max.).

STO_PEMODE MODE ,N1	*(ignored in local)*
Programs the mode.	
MODE=AUTO	Automatic mode in emission.
MODE=MANU	Manual mode in emission.
MODE=AUTOM	Automatic mode in measurement.
MODE=MANUM	Manual mode in measurement.

STO_PEDIR DIR ,N1	*(ignored in local)*
Programs the up/down function.	
DIR=UP_ONLY	Up only.
DIR=UP_DOWN	Up and down.

12.4.5 Commands affecting the errors

The errors detected during decoding or command execution are stored in an error message queue which can contain up to 16 errors. If a new error occurs while the queue is full, the oldest error is cleared from the queue.

ERR_NO?
Returns the most recent error code and deletes it from the queue.

ERR? [NO]		
Returns information on errors. If the [NO] argument does not exist, the most recent error is read then deleted from the queue.		
NO	Error code.	
Response	if [NO] is omitted, returns the most recent error code followed with the meaning, if [NO] exists, returns the error meaning corresponding [NO] code.	
Examples	*Command*	*Response*
	ERR?	10, UNKNOWN MNEMONIC
	ERR?5	UNKNOWN HEADER

CL_ERR
Clears all the message errors from the queue.

12.5 Programming examples

Example 1

```
'*****************************************************************
'       CL519-01.BAS display the current measurement and emission
'
'*****************************************************************


DECLARE FUNCTION RECEPTION$ ()
cc$ = "/-\|"

                                ' opening the serial port
                                ' 9600 bauds,no parity, 8 bits, 1
stop
OPEN "com1:9600,N,8,1,rs,cs,ds,cd,TB1,RB4000" FOR RANDOM AS #1
CLS

i = 1
DO
                                ' return the current measurement
PRINT #1, "meas?" + CHR$(10)
mesure$ = RECEPTION$

                                ' return the current emitted value
PRINT #1, "out?" + CHR$(10)
emission$ = RECEPTION$
                                'display
CLS
PRINT "Measurement: " + mesure$ + "      " + MID$(cc$, i, 1)
PRINT "Emission: " + emission$
PRINT ""
PRINT "Press any key to exit"

i = i + 1
IF (i > LEN(cc$)) THEN i = 1
                                ' time-delay
FOR t = 1 TO 1000
NEXT t

                                ' program stops while pressing any
key
LOOP WHILE (INKEY$ = "")
```

```
'*********************************************************
' receiving a string from the RS232 link
'*********************************************************
FUNCTION RECEPTION$
chaine$ = ""
octet$ = ""
DO
octet$ = INPUT$(1, 1)
chaine$ = chaine$ + octet$
LOOP WHILE (octet$ <> CHR$(10))

RECEPTION$ = chaine$
END FUNCTION
```

Example 2

```
'*****************************************************************
'       CL519-02.BAS program and execute a cyclical ramp with the
'       parameters following:
'                                50 mV range
'                                initial value 2mV
'                                excursion 47.3 mV
'                                initial duration: 4.5s
'                                rise time: 10.2s
'                                step duration: 5s
'                                fall time: 2s
'                                the cycle is repeated 3 times
'*****************************************************************


                                ' opening the serial port
                                ' 9600 bauds,no parity, 8 bits, 1
stop
OPEN "com1:9600,n,8,1,rs,cs,ds,cd,tb1,RB4000" FOR RANDOM AS #1

                                ' CL519 in REMOTE mode
PRINT #1, "REM" + CHR$(10)

                                ' programming 50 mV range
PRINT #1, "RANGE_OUT MV50" + CHR$(10)

                                ' emitting 2mV
PRINT #1, "OUT 2MV" + CHR$(10)

                                ' programming ramp
PRINT #1, "STO_RAMPC 47.3MV,3,4.5S,10.2S,5S,2S" + CHR$(10)

                                ' executing ramp
PRINT #1, "RAMPC RUN" + CHR$(10)



END
```

12.6 GLOSSARY OF THE REMOTE CONTROL COMMAND HEADERS

This list gives a summary of the remote control command headers. Headers with [ ] must be followed with one or several arguments. Refer to the mentioned paragraphs.

A		
ADDP_ISCAL [ ]	Adds a point to measurement scaling.	12.4.2.2
ADDP_OSCAL [ ]	Adds a point to emission/simulation scaling.	12.4.3.6
ADDP_PE [ ]	Adds a setpoint to procedure number N1.	12.4.4.4

B		
BURST? [ ]	Returns the contents from the specified burst(s).	12.4.2.3

C		
CFG_IN? [ ]	Returns configuration from the specified measurement function.	12.4.2.1
CFG_OUT? [ ]	Returns configuration from the specified emission function.	12.4.3.1
CL_ERR	Clears all the error messages from the queue.	12.4.5
CLR_ALLMEM	Clears all the emission/simulation memories.	12.4.3.2
CLR_ALLPV	Clears all the calibration reports from the memory.	12.4.4.3
CLR_BURST [ ]	Clears the specified measurement burst.	12.4.2.3
CLR_MEMORY	Clears all the memorized measurement bursts.	12.4.2.3
CLR_PV [ ]	Clears the calibration report number N1 from the memory.	12.4.4.3

E		
ERR?	Returns information on errors.	12.4.5
ERR_NO?	Returns the most recent error code.	12.4.5

I		
*IDN?	Returns the unit identification.	12.4.1
ISCR?	Returns and clears the value from the ISCR.	12.4.1
ISCAL [ ]	Activates or inhibits the measurement scaling function.	12.4.2.2
ISCAL?	Returns the measurement scaling specifications.	12.4.2.2
ISCALUNI?	Returns the scaling unit.	12.4.2.2
ISR?	Returns the value from the ISR.	12.4.1
INCR [ ]	Increments the emission setpoint to the specified value.	12.4.3.3
INCRP [ ]	Acts on the execution of the automatic incrementation program.	12.4.3.3
INCRP?	Returns specifications from the incrementation program.	12.4.3.3

L		
LOC	Resets the unit to local status.	12.4.1

M		
MEAS [ ]	Acts on the measurement sequence (triggered measurements).	12.4.2.1
MEAS?	Returns the last measurement value available together with the unit.	12.4.2.1
MEASNAME?	Returns the measurement burst name.	12.4.2.3
MEASPROG?	Returns the specifications from the triggered measurement program.	12.4.2.3
MEASTRIGL?	Returns the trigger level value of measurements.	12.4.2.1
MEM? [ ]	Returns the setpoint values stored into the memories.	12.4.3.2
MEMORY? [ ]	Returns a summary on contents of the specified measurement bursts.	12.4.2.3

N		
NUL [ ]	Acts on execution of relative measurements.	12.4.2.2
NUL? [ ]	Returns the reference value from the function.	12.4.2.2

O		
OSCAL [ ]	Activates or inhibits the emission/simulation scaling function.	12.4.3.6
OSCAL?	Returns the specifications from the emission/simulation scaling.	12.4.3.6
OSCALUNI?	Returns the scaling unit.	12.4.3.6
OUT [ ]	Specifies the emission/simulation setpoint value.	12.4.3.1
OUT?	Returns the emission/simulation setpoint value together with the unit.	12.4.3.1
OUT_BURST?	Returns the contents from all memorized bursts.	12.4.2.3
OUT_MEMORY?	Returns a summary from all memorized measurement bursts.	12.4.2.3
OUT_PV?	Returns the contents from all memorized calibration reports.	12.4.4.2
OUT_PVSUMMARY?	Returns a summary on contents of all memorized calibration reports.	12.4.4.2

P		
PCR?	Returns the value from the PCR.	12.4.1
PE? [ ]	Returns programming from specified procedures.	12.4.4.1
PECFG_IN? [ ]	Returns CL519 measurement configuration for procedure number N1.	12.4.4.1
PECFG_OUT? [ ]	Returns CL519 emission configuration for procedure number N1.	12.4.4.1
PESCAL? [ ]	Returns the scaling specifications from the specified procedure.	12.4.4.1
PESCALUNI? [ ]	Returns the scaling unit from the specified procedure.	12.4.4.1
PV? [ ]	Returns the contents from the specified calibration reports.	12.4.4.2
PVCFG_OUT? N1	Returns CL519 emission configuration for calibration report number N1.	12.4.4.2
PV_EXTR2? N1	Returns information on the external sensor used for calibration report number N1.	12.4.4.2
PVSCAL? [ ]	Returns the scaling specifications from the specified calibration report.	12.4.4.2
PVSCALUNI? [ ]	Returns the scaling unit from the specified calibration report.	12.4.4.2

R		
RAMPC [ ]	Acts on the cyclical ramp execution.	12.4.3.5
RAMPC?	Returns the cyclical ramp memorized specifications.	12.4.3.5
RAMPS [ ]	Acts on the simple ramp execution.	12.4.3.4
RAMPS?	Returns the simple ramp memorized specifications.	12.4.3.4
RANGE_IN [ ]	Selects the specified measurement range and parameters.	12.4.2.1
RANGE_OUT [ ]	Selects the specified emission range and parameters.	12.4.3.1
RECALL [ ]	Gives the value contained in the specified memory to the output setpoint	12.4.3.2
REM	Sets the unit to remote control status.	12.4.1
*RST	Resets the unit to its power on state.	12.4.1

S		
SPEC_OUT?	Returns information on evolution functions of the output signal.	12.4.3.1
STO_INCRP [ ]	Stores new increment execution parameters.	12.4.3.3
STO_ISCAL [ ]	Replaces the measurement scaling parameters.	12.4.2.2
STO_ISCALUNI [ ]	Stores the scaling unit into permanent memory.	12.4.2.2
STO_MEASNAME [ ]	Stores the measurement burst name into permanent memory.	12.4.2.3
STO_MEASPROG [ ]	Stores parameters of triggered measurement cycle.	12.4.2.3
STO_MEASTRIGL [ ]	Programs measurement trigger level.	12.4.2.1
STO_NUL [ ]	Associates a reference value to the measurement function.	12.4.2.2
STO_OSCAL [ ]	Replaces the emission scaling parameters.	12.4.3.6
STO_OSCALUNI [ ]	Stores the scaling unit into permanent memory.	12.4.3.6
STO_PE [ ]	Programs the first setpoint of procedure number N1.	12.4.4.4
STO_PEDELTA [ ]	Programs the max. permissible tolerance.	12.4.4.4
STO_PEDIR [ ]	Programs the Up/down function.	12.4.4.4
STO_PEEXTR1FCT [ ]	Programs the first setpoint of procedure number N1 and stores the external function EXTR1 in the procedure output configuration.	12.4.4.4
STO_PEEXTR2FCT [ ]	Programs the first setpoint of procedure number N1 and stores the external function EXTR2 in the procedure output configuration.	12.4.4.4
STO_PEFCTR [ ]	Programs the scale factor.	12.4.4.4
STO_PEIDN [ ]	Programs the type and manufacturer of the transmitter.	12.4.4.4
STO_PEMODE [ ]	Programs the mode.	12.4.4.4
STO_RAMPC [ ]	Stores new execution parameters for cyclical ramp.	12.4.3.5
STO_RAMPS [ ]	Stores new execution parameters for simple ramp.	12.4.3.4
STO_SYNTHE [ ]	Stores new execution parameters for synthesizer.	12.4.3.2
STORE [ ]	Stores an emission setpoint value into memory.	12.4.3.2
SYNTHE [ ]	Acts on the synthesizer program execution.	12.4.3.2
SYNTHE?	Returns the specifications from the synthesizer program.	12.4.3.2

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