High Accuracy Tester Calibrator
PJ 6301

Instruction Manual

NT 45983-100C
Edition dated March 29th, , 2006

Informations relatives à la basse tension

1. Respect des instructions fournies dans les documents d'accompagnement

L'appareil a été conçu pour fonctionner en toute sécurité si les instructions fournies dans les documents d'accompagnement sont respectées. Toute utilisation, hors celles définies, peut dégrader la sécurité de l'opérateur. Elle est donc, de ce fait, dangereuse et interdite.

2. Définition de la catégorie d'installation

Cette notion est appelée aussi catégorie de surtension. C'est la classification de l'installation suivant des limites normalisées pour les surtensions transitoires (norme CEI 664). Le niveau de ces limites dépend de la tension nominale du réseau par rapport à la terre, présent dans l'environnement fonctionnel de l'appareil.
La norme définit 4 niveaux de surtension croissante, de la CAT I à la CAT IV.

3. Tableau des symboles utilisés

Symbole/ *Symbol*	Désignation/*Designation*	Symbole/ *Symbol*	Désignation/*Designation*
~	Courant alternatif. *Alternating current.*	I	Mise en marche. *Power ON.*
⎓	Courant continu. *Direct current.*	O	Arrêt. *Power OFF.*
≂	Courant alternatif et continu. *Both direct and alternating current.*	⧈	Double isolation. *Double insulation.*
⏚	Borne de terre de mesure. *Measurement earth terminal.*	⚡	Risque de choc électrique. *Risk of electric shock.*
⏚	Borne de terre de sécurité. *Protective conductor terminal.*	⚠	Attention : voir les documents d'accompagnement. *Caution: refer to accompanying documents.*

4. Maintenance

L'appareil doit toujours être remonté conformément aux instructions présentes dans la notice. Tout montage incomplet ou mal fait peut nuire à la sécurité de l'opérateur.
L'autorité responsable doit s'assurer régulièrement que les éléments relatifs à la sécurité ne se sont pas altérés dans le temps et faire effectuer toutes les opérations préventives qui s'imposent.
Se reporter au chapitre correspondant.
Avant d'ouvrir l'appareil pour toute intervention, s'assurer impérativement que les fils de mesure sont déconnectés de l'appareil.
Tout réglage, entretien ou réparation de l'appareil ouvert doivent être évités autant que possible et, s'ils sont indispensables, être effectués **par un personnel qualifié, bien averti des risques que cela implique**.

5. Instructions avant la mise en service

Afin d'utiliser l'appareil avec toute la sécurité nécessaire, tout opérateur doit lire **attentivement** le chapitre qui, entre autre, traite de la sécurité avant toute prise en main.

6. Classe de sécurité

Se reporter à la déclaration de conformité, page 2.
L'altitude du lieu d'utilisation de l'appareil ne doit pas dépasser 2 500 m.
Nota 1 : Les prescriptions de sécurité concernant l'appareil sont rappelées dans la notice.
Nota 2 : Pour maintenir les performances de sécurité annoncées, les accessoires de mesurage doivent respecter la norme EN 61010-2-031 et avoir des caractéristiques de sécurité adaptées.

Low voltage information

1. Following instructions supplied with the accompanying documents

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

2. 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). Level of these limits depends on the nominal line voltage, regarding the earth, which is present in the unit environment.

The Publication has 4 levels of increasing overvoltage, from CAT I to CAT IV.

3. Table of the symbols used

4. Maintenance

The unit should be reassembled as explained in the instruction manual. Any incomplete or bad reassembling 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.
Refer to the corresponding chapter.
Before the casing is opened, make sure that the measuring leads 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.***

5. Instructions before switching on

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

6. Safety class

Refer to declaration of conformity, page 2.
The unit should not be used at altitude above 2,500 m.
Note 1*: Safety provisions for the unit are given in the instruction manual.*

Note 2*: In order to maintain performances of the announced safety provisions, the measuring accessories must meet the European Norm EN 61010-2-031 and have adapted safety characteristics.*

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AOIP
INSTRUMENTATION

CE

Déclaration de conformité
suivant le guide 22 ISO/CEI et la norme EN 45014

Declaration of conformity
according to ISO/IEC guide 22 and EN 45014

Nom du fabricant :
Manufacturer's name :

AOIP

Adresse du fabricant :
Manufacturer's address :

Z.I. de Saint-Guénault - Rue Maryse Bastié
BP 182 - 91006 EVRY CEDEX - FRANCE

Déclare que le produit
Declares, that the product

Désignation :
Designation :

Etalonneur numérique de précision
High accuracy calibrator

Référence :
Model number :

PJ 6301

Date :

06.05.97

a été fabriqué conformément aux spécifications techniques du produit et sous tous ses aspects, est conforme aux normes et réglementations en vigueur s'y rapportant et en particulier à la :

Sécurité

EN 61010-1 + amend. 1 (1995)
Catégorie de surtension : CAT III, 60 V.
Degré de pollution : 2

Compatibilité électromagnétique

CISPR 22 : EN 55022/1994, classe B
EN 50082-1/1992
- CEI 801-2/1991, niveau 3
- CEI 801-3/1984, niveau 2
- CEI 801-4/1988, niveau 2 (alim ≅)

Le produit nommé ci-dessus est conforme aux prescriptions de la directive européenne basse tension 73/23/CEE et à la directive CEM 89/336/CEE amendées par 93/68/CEE.

has been manufactured according to the technical specifications of the product and conforms in all respects to the relevant standards and regulations in force and especially to :

Safety

EN 61010-1 + amend. 1 (1995)
Overvoltage category: CAT III, 60 V.
Degree of pollution: 2

Electromagnetic compatibility

CISPR 22: EN 55022/1994, class B
EN 50082-1/1992
- *IEC 801-2/1991, level 3*
- *IEC 801-3/1984, level 2*
- *IEC 801-4/1988, level 2 (power ≅)*

The product herewith complies with the requirements of the low voltage directive 73/23/EEC and the EMC directive 89/336/EEC amended by 93/68/EEC.

R. SOUCEK
Directeur Assurance Qualité
Quality Assurance Manager

Unpacking Instructions

Remove the Packing List and verify that you have received all equipment, including the following (quantities in parentheses):

PJ6301 Series Calibrator (1)
Power Supply Cord (1)
Operator's Manual (1)

If you have any questions about the shipment, please call the **AOIP** Customer Service Department.

When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

Contents

Introduction

The **PJ6301** is a high accuracy digital calibrator which enables the user to:

- generate and measure voltages and DC currents,
- simulate and measure resistances, RTDs and thermocouples.

The unit is designed to check and calibrate equipment in telemetry loops such as sensors, transmitters, positioners, controllers, etc.

The main feature of the **PJ6301** is that the OUT and IN functions are electrically insulated and usable simultaneously. The unit, included in a telemetry loop, allows users to read the outputted quantity and the equivalent measured quantity at the same time.

Due to its outstanding performance and functions, such as alarms, measurement processing, storage and synthesizer, etc., possible rack mounting or bench-type operation, digital RS 232 output, optional IEEE 488 output, possible battery operation, the **PJ6301**) is suitable for metrological departments, quality-control departments and research and development laboratories.

It is also very simple to use because the graphic display leads to keyboard simplification. On-line help messages are available at any time when additional information on displayed options is required.

Models Available

Model No.	Description
PJ6301-1	Basic calibrator with RS-232 C.
PJ6301-2	**PJ6301**, with rechargeable battery/charger.
PJ6301-3	**PJ6301** with RS-232 C and IEEE-488.
PJ6301-4	**PJ6301** with rechargeable battery/charger.

1 - Description

Front panel:

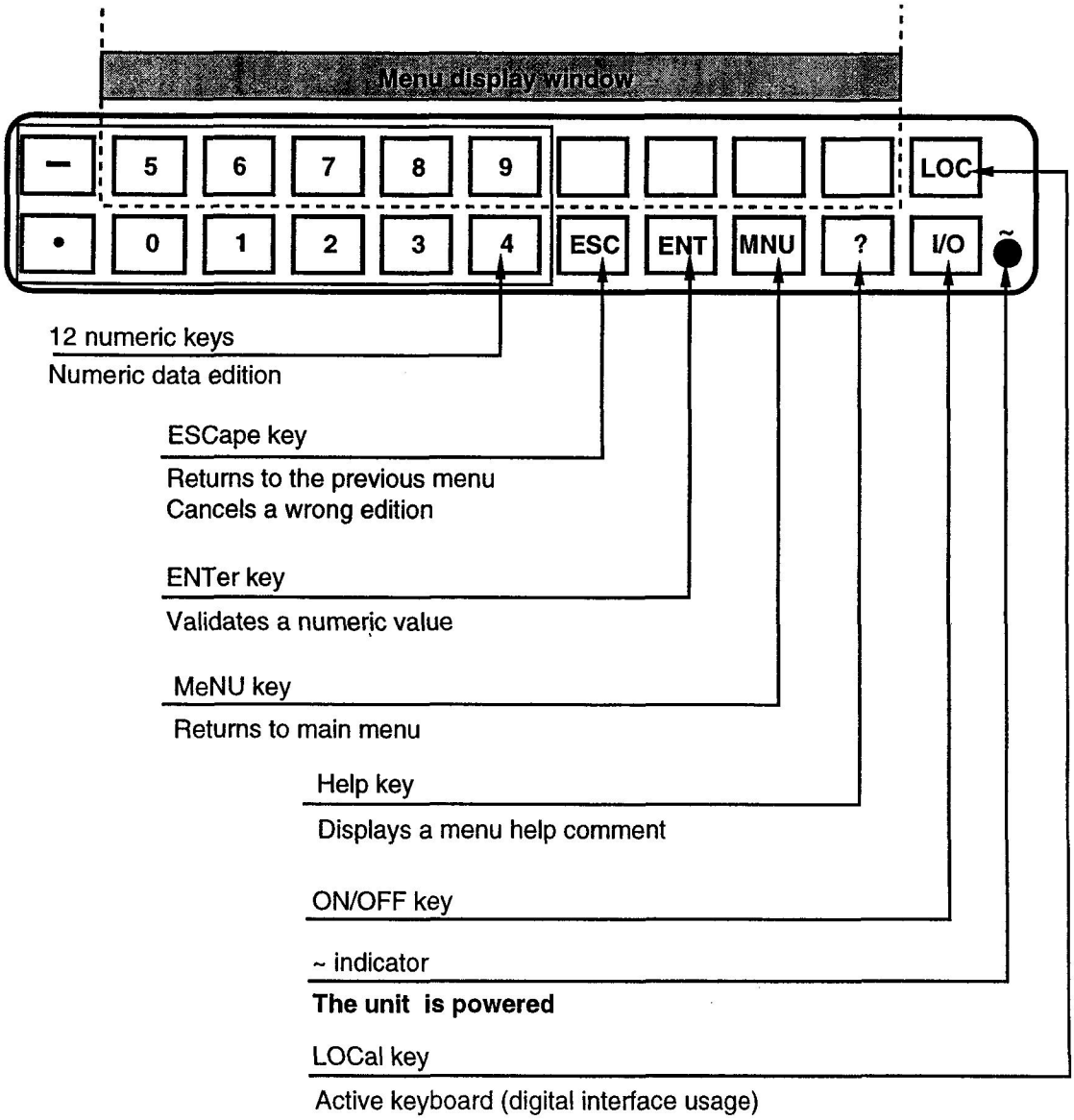
- A 22-key keyboard allowing the user to use the different functions and change the configuration parameters.
- Six terminals for connecting the measurement and emission to the external circuits.
- A display for reading the measured and emitted quantities, the configuration menus and the icons indicating the functions used.

Rear panel:

- Input connection: power, measurement and programmable trigger.
- Output connection: generated or simulated signal output, recorder output, alarm contacts, RS 232 and IEEE-488 digital outputs.

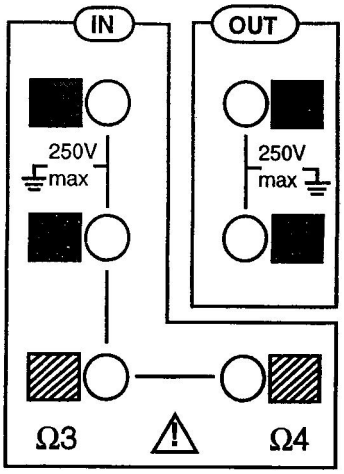
1.1 - Keyboard

9 keys located under the display enable the user to select one of the prompts appearing in the menu display window.



1.2 - Front terminal board

Equipped with six terminals made of copper for Ø 4 mm sockets.



2 OUTPUT terminals where the calibrator output signal is present (black terminal: low point).

4 INPUT terminals:
Red (+) and black (low point) terminals: Measurement input for voltage, current, and temperature by thermocouple.
Red and black terminals (and, if required Ω3 or Ω4) : Measurement input for resistance, and temperature by RTD.

The terminal board is equipped with an internal reference junction compensation (RJ).

1.3 - Rear terminal board

Assignment of the different connectors and terminals are shown clearly on the rear panel.

From left to right:

The 9-pin female plug for the RS 232 link (shielding connected to the safety ground).

2 terminals for the recorder to output the measured signal (analog output).

3 output terminals for alarm contacts with L1 for alarm 1 and L2 for alarm 2.

The optional 24-pin IEEE-488 connector.

2 terminals for the programmable trigger external command.
The ⏚ terminal for connection to a safety conductor when the unit is battery-operated (option).

The plug to connect the power cord.

Below these connectors, are:

4 **INPUT** terminals where:
Terminals + and - are assigned to voltage, current and temperature by thermocouple (internal reference junction compensation).
Terminals Ω3 and Ω4 are additional inputs for measuring resistance and temperature by RTD.

2 **OUTPUT terminals** to output the generated or simulated signal.

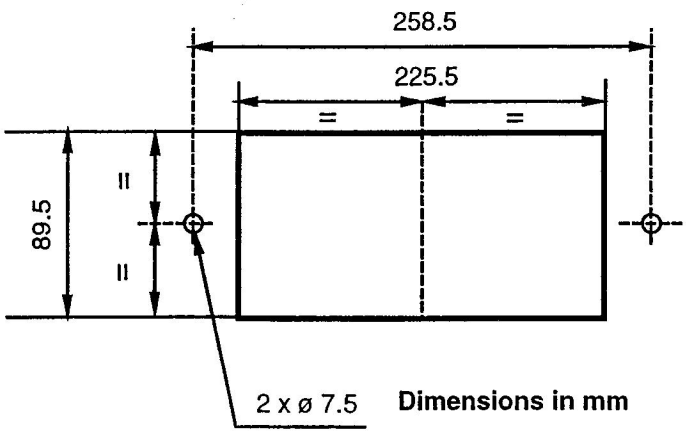
1.4 - Tilt stand position

To change position of the tilt stand:

- Press the two yellow knobs and turn the stand.
- Release the knobs and turn the stand up to its automatic interlocking position. The angle between each position is 30°.

1.5 - Panel or rack mounting

The panel or rack mounting is made by means of the right-angle brackets delivered with the **AN5883** kit. The accessory **AN5884** is used for the 3 U rack mounting and also includes the right-angle brackets above.



Dimensions in mm

- Make the panel cut-out according to the dimensions indicated above.
- Remove the stand by unscrewing the four fixing screws.
- Use the four holes to fix the two right-angle brackets by means of the 4 countersunk-head screws supplied.
- Insert the unit through the panel cut-out and secure it by using the two M6 screws.

1.6 - Optional accessories

AN5883	Right-angle brackets for panel mounting
AN5884	3 U panel and right-angle brackets for rack mounting
AN5836	IEEE-488 cable, 2 m long, for connection or extension
AN5875	RS232 cable, 2 m long, for connection to a microcomputer (PC XT, PC AT, or compatible equipped with à 9-pin male connector)
LCL301-0FA	Processing and configuration software from RS232 or IEE-488.2 interface

2 - Quick Set-up Guide

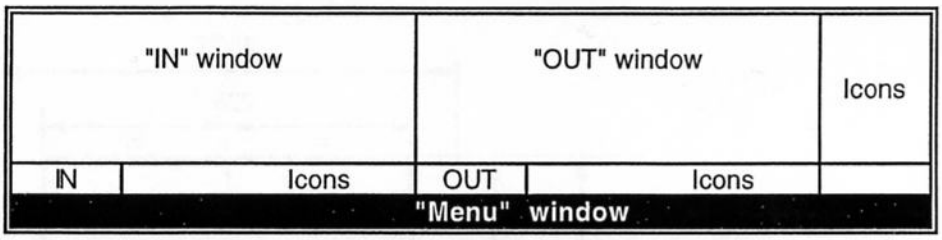
2.1 - Switching on

WARNING ! Before any connection, make sure that the voltage meets the one indicated at rear of the unit.

- Connect the **PJ6301** to the power supply.
  The indicator ~ comes on, indicating that the unit is powered.

- Press the [I/O] key.

After the initialization procedure, this screen appears, divided into three main windows.



1) In the "IN" window, read the measured quantity (value and unit).
2) In the "OUT" window, read the emitted value (value and unit).
3) In the "menu" window is the main menu in inverted video. This menu gives access to other menus which enable the user to configure the functions and the unit processing conditions.

MAIN MENU:

- Press the [?] to read the meaning of the mnemonics of this menu. The display is as follows:

```
Management and configuration of:
IN : Input
OUT : Output
CFG : General
STAT: Display current configuration
```

This help display shows that the main menu gives access to other functions of the unit : IN function, OUT function and general configuration.

- Pressing the [?] key a second time gives the following display:

```
                GENERAL USAGE
Return to main menu : MNU
Return to previous menu : ESC
Validate a numeric value : ENT
Display the instrument state : STAT
                                  (Cont'd)
                                  ↑    ↓
```

This is an operating short form. Pressing the key located under one of the two arrows enables the user to scroll through the following pages showing the prompts to be selected in the successive menus to access the mentioned functions.

- Press the [MNU] key to return to the main menu and initial display.

NOTES:

1 - At the bottom of each "IN" and "OUT" window is an area used to display icons. These simple pictures give information on which mode the measurement and/or emission operate (see appendix B).

2 - Upon switching on, the parameters used (function, range, and so on.) are those stored in permanent memory. Paragraph 2.4 explains how to display these parameters.

2.2 - General function keys

Four keys are used very often when using the unit.

ESC	ESCape	1 - In a menu, return to the previous menu. 2 - In the editor, cancel a wrong edition.
ENT	ENTer	In the editor, enter and store the data displayed.
MNU	MeNU	In any menu or in the editor, immediately return to the main menu.
?	Help	1 - Access help comments available on the menus. 2 - Pressing a second time gives access to the operating short form.

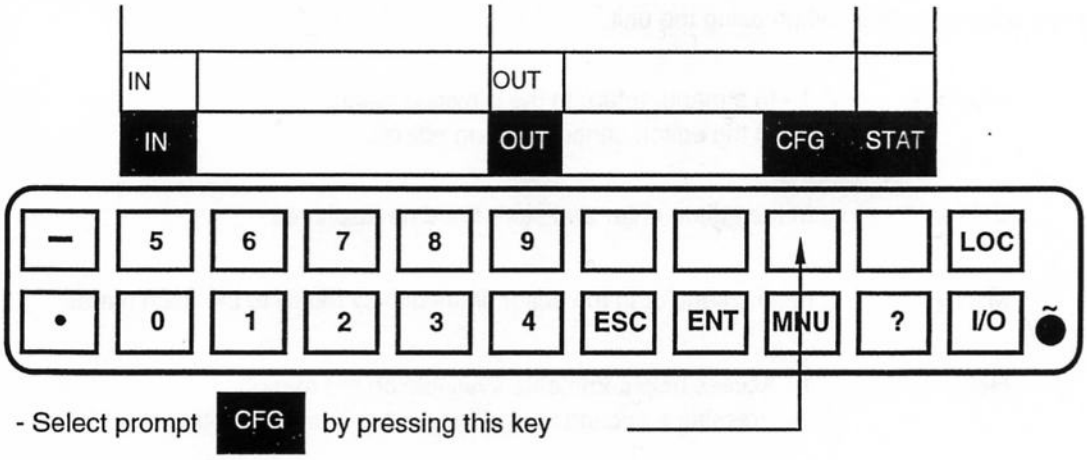
2.3 - How to use a menu

Using a menu involves selecting one of the prompts.

This choice is always performed by pressing the key located under the desired prompt. This applies for whatever menu is displayed.

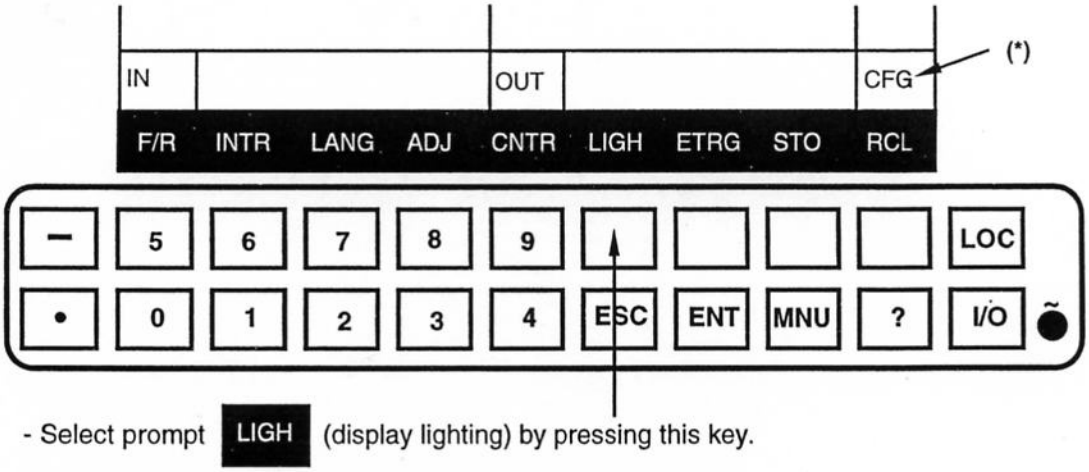
EXAMPLE : Lighting the display

The main menu is as follows:



- Select prompt **CFG** by pressing this key

A new menu appears:



- Select prompt **LIGH** (display lighting) by pressing this key.

The display is lighted.

NOTES:

1 (*) - Selecting a prompt from the main menu shows, at right and above the menu, a wording indicating in which function we are operating (for example, CFG : general **C**on**F**i**G**uration).

2 - Numeric keys (from 5 to 9) are only active when editing (sec. 2.5.2).

2.4 - Instrument state

Selecting the **STAT** prompt from the main menu displays operating information on measurement (IN), emission (OUT) and unit configuration (RS 232, software edition, and so on.).

2.4.1 - MEASUREMENT STATE (IN)

- Select **STAT** from the main menu.
- Select **IN**. Current measurement parameters are displayed (see example below).
- Then, return to the main menu by pressing **MNU**.

EXAMPLE : Programming display

Function :	V, run
Configuration :	Range AUTO
Processing :	Filter : no (2)
	Scaling : no
	Nul : no (000.000 e-3)
Alarms :	
L1 : no, T=1.00000, H=1.00000 e-3, M>Th	
L2 : no, T=1.00000, H=1.00000 e-3, M>Th	

Function used :	Voltmeter with continuous measurement cycle (run).
Configuration :	The voltmeter is set to autoranging.
Processing :	The filter is inactive. There is no scaling. There is no relative measurement (nul).
Alarms :	Alarms L1 and L2 are not validated. Values of thresholds are 1.00000 and hysteresis are 0.001. Alarm will occur if the measurement becomes higher than the threshold (M > Th).

The values between parentheses are stored but not usable for the moment (function not validated).

2.4.2 - EMISSION STATE (OUT)

- Select **STAT** from the main menu.
- Select **OUT**. Current emission-simulation parameters are displayed (see example below).
- Then, return to the main menu by pressing **MNU**.

EXAMPLE : Programming display

Function :	V, operate
Configuration :	Range 6 V
Processing :	Scaling : no

Function :	Voltage emission is activated (operate).
Configuration :	6 V max. can be generated.
Processing :	There is no scaling.

2.4.3 - GENERAL CONFIGURATION STATE

General configuration means all the parameters relating to the unit and its dialog possibilities. Configuration of IN and OUT functions are not concerned here.

- Select **STAT** from the main menu.
- Select **CFG**. General configuration parameters are displayed (see example below).
- Then, return to the main menu by pressing **MNU**.

EXAMPLE : Displaying the general configuration

Terminals :	Front	
Interface :	RS232, 19200 bauds, 8 bits,	
	1 stop-bit, no parity,	
	no protocol	
Software revision :		
logic : B.x	analog : Bx	ADC : A.x
Last adjustment date :	YY.WW	
Serial No =	XX	

Terminals :	The front terminals are used.
Interface:	The unit is programmed to be used with an RS 232 serial port. The transmission rate is 19,200 bauds. There is one "word" of 8 bits with one stop-bit, no parity and no protocol.
Software revision :	Indicates the software editions of the unit.
Last adjustment date :	Where YY is the Year and WW, the Week. Information useful for maintenance purpose.
Serial No :	Unit serial number.

WARNING : Upon receiving the unit, check that the software edition is the one indicated on page ii of this manual.

NOTE : State of the unit shown in the examples above is that of a **PJ6301** shipped from the factory when first switched on. Depending on options, state of the configuration may be different and any change on parameters will modify the displays given as examples.

2.5 - How to change parameters

"Wording" type parameters : Use a marker which is a small rectangle located at right of one of the prompts in a menu.

Example : V I ← marker

This marker indicates that the information is stored. Selecting another prompt in a menu moves the marker to this new prompt.

Digital parameters : Use an editor by validating the EDIT or PROG prompt in a menu.

2.5.1 - HOW TO USE THE MARKER

EXAMPLE : Measuring voltages over the 6 V range

From the main menu (phase 0).

Phase 0 | IN | | OUT | | CFG | STAT |

- Select IN. Unit switches to phase 1.

Phase 1 (IN) | FCT | CFG | | TRIG | | ALAR | | PROC | MEM |

- Select FCT.

Phase 2 (IN) | V I | | mA | | Ω | | Tc | | Rt |

The marker located near V indicates that the unit is operating as a voltmeter.

- Select V I to confirm the function. Another menu appears:

Phase 3 (IN) | AUTO I | 60mV | 0-6V | 6V | 60V | |

The voltmeter is set to autoranging.

- Select 6V to work over the 6 V range. The unit measures voltages over this range. Return to phase 1.

The ESC or MNU key returns to the main menu.

2.5.2 - HOW TO USE THE EDITOR

The editor is used to change a numeric value.

Access the editor by validating the EDIT or PROG prompt in a menu.

During an edition phase, are displayed:
- a numeric value in inverted video,
- in the "menu" window", the following indications:

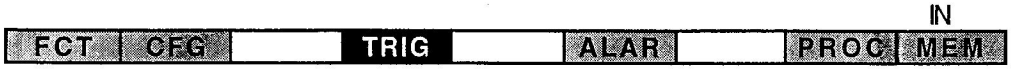
| numeric keys | < | > | >> | |

This is not a menu. This window indicates that the numeric keys are active and correspond to their assignment on the keyboard.

EXAMPLE : Changing parameters in triggered measurements

Phase 0 

- Select **IN** . Unit switches to phase 1.

Phase 1 

- Select **TRIG** . Triggered measurements (sec. 4.6).

Phase 2 

- Select **PROG** to program the measurement trigger parameters.

Two quantities are displayed in the "IN" window, both stored in permanent memory.
N is the number of measurements performed after trigger. It's a measurement burst.
T is the time interval between two consecutive measurements.

For example, we have:
N= 0 0 1 0 Burst of 10 measurements.
T= 1 . 0 s Interval of 1 second.

The N parameter is displayed in inverted video together with a cursor under the leftmost figure indicating that this number may be changed.

Phase 3 

< and > : Move the cursor.
>> : Selects the other parameter.

Changing a parameter (cursor at left)

- Press a numeric key and, if required, press [−] key for the sign (+ implied) and [•] for decimal numbers. Each time a key is pressed, the cursor moves one step to the right.
- Edit all the figures of the number.
- If any error occurs, press the [ESC] key. If the number is correct, press the [ENT] key to validate it.
- Return to the main menu by pressing [MNU].

NOTES:

1 - Only the figure pointed by the cursor can be changed. A number can be partially modified by moving the cursor and selecting **>** or **<** .

2 - Some parameters have the wording [EXP] at the extreme right of the "menu window". Choosing this wording displays the letter **e** after the number to be modified. It is then possible to enter the exponent value and, if desired, the sign (+ implied).
Example : The number 1.2 e-3 equals $1.2 \times 10^{-3} = 1.2 \times 0.001 = 0.0012$.

2.6 - How to generate a signal

The **PJ6301** can emit a voltage or a current but also simulate a thermocouple, an RTD or a resistance. In all cases, the generated or simulated signal is present on the "OUT" terminals of the unit.

EXAMPLE : Voltage emission

1.01853 V is to be emitted.

1) - Emission over the 6 V range

This range gives the best resolution.
From the main menu (phase 0):

Phase 0 

- Select **OUT**. Unit switches to phase 1.

Then, successively select the prompts with black rectangles ■ for each of the following phases.

Phase 1 

Phase 2 

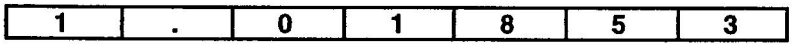
Phase 3 

Return to phase 1. Note that the procedure is similar to changing a range when measuring (sec. 2.5.1).

2) - Value edition and emission

Phase 1 

The editor is selected. Enter the value to be emitted using the keyboard.
- Press successively the following keys:



Press **ENT** to validate. The value is displayed in the "OUT" window. **The displayed voltage is present on the "OUT" terminals.**
We still remain in the editor and the setpoint value can be changed at any time.

In the example above, we can measure the voltage emitted by the unit. To measure the voltage:

- Set the voltmeter over the 6 V range as indicated in example in 2.5.1.
- Connect the red "IN" terminal to the red "OUT" terminal.
- Connect the black "IN" terminal to the black "OUT" terminal.
- Inside the "IN" and "OUT" windows, read the same values, except for measurement errors (see specifications in appendix A).

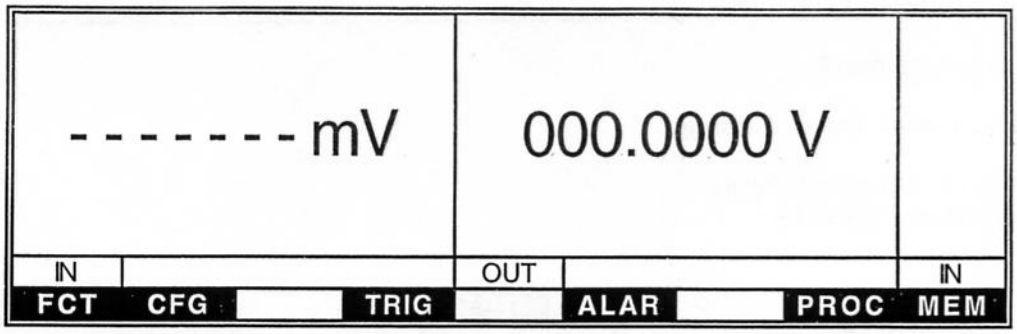
If the wires are crossed, read the same value in reverse polarity inside the specified tolerances.

This last operation shows that the measurement and emission functions are independent.

2.7 - Error messages

There is emission of an audible warning when editing a value out of limits, or pressing an inactive key.

- If a measurement is out of limits, the display is as follows:



- Any value preceded by an asterisk (*) indicates that it cannot be taken into account because it exceeds the instrument display capacity.
- If there is any operating incompatibility or impossibility, an error message appears instead of the menu for approximately 2 seconds.
  List of these messages and comments is available in appendix B.

2.8 - Typographic conventions

In examples above, the menus are represented as follows:

IN		OUT		CFG	STAT

represents the possible prompts.

indicates the selected prompt.

According to this typographic convention and if we refer to the example in sec. 2.5.1, the moving procedure in the successive menus can be represented as follows:

Main menu	IN				OUT			CFG	STAT
Access menu	FCT	CFG		TRIG		ALAR		PROC	MEM
Functions	V		mA		Ω		Tc		Rt
Ranges	AUTO	60mV	0.6V	6 V	60V				

Selecting **IN** from the main menu opens the access menu.

Selecting **FCT** from the access menu opens the function menu.

Selecting **V** from the function menu opens the range menu.

Selecting **6V** from the range menu sets the unit over the 6 V range.

3 - Measurement connections

This chapter describes how to connect and perform a measurement in the current function for which the unit is configured.

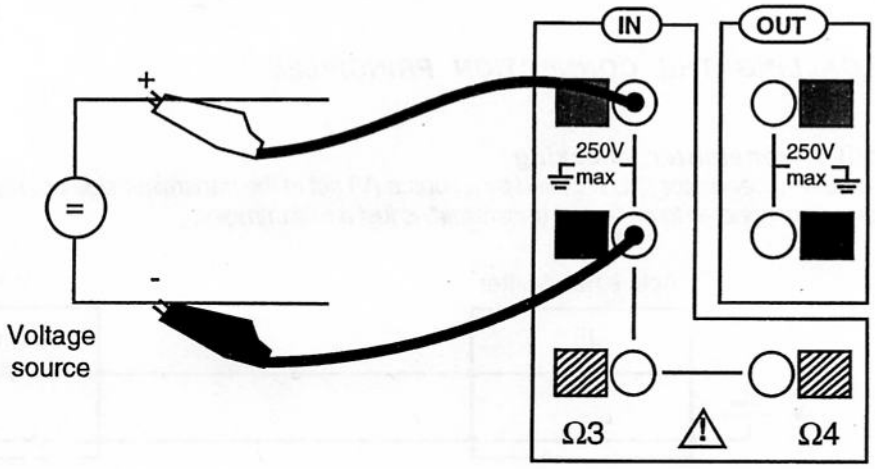
Before measuring, make sure that:

- the selected range is well-adapted to the quantity to be measured. For the voltmeter and ohmmeter measurement functions, it may be advisable to select the autoranging (see 4.3.1 and 4.3.3).

WARNING ! Before any connection, make sure that there is no dangerous voltage between the wires or measuring leads and between themselves and ground. The max. permissible voltage between the measurement terminals and ground is 250 V rms.

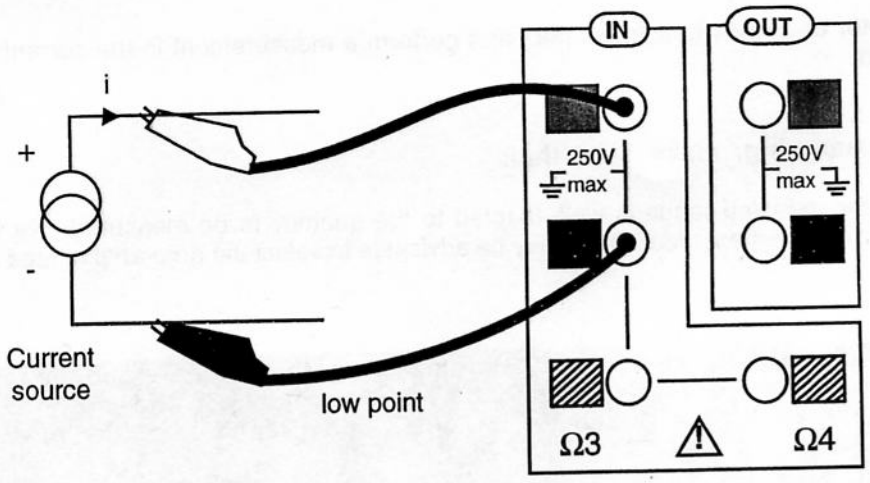
If operating with the internal battery, connect the ⏚ terminal, located at back of the unit, to a safety ground.

3.1 - DC voltmeter



The measurement "low point" is the black terminal (terminal -).

3.2 - DC milliammeter



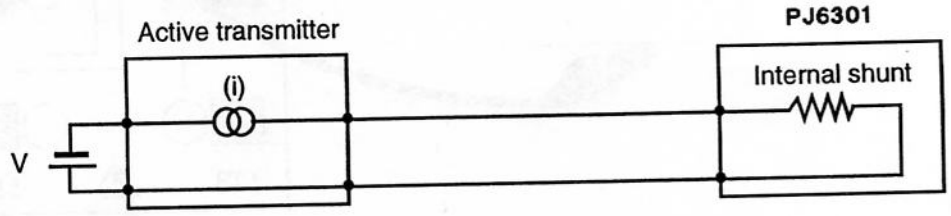
WARNING ! If the current loop must be opened to place the PJ6301, make sure that this may be done without any damage to the concerned installation.

If the PJ6301 is configured as a milliammeter connected to a "passive transmitter", 25 V are present on the measurement terminals, so avoid connection to an "active transmitter".

RECALLING THE CONNECTION PRINCIPLES

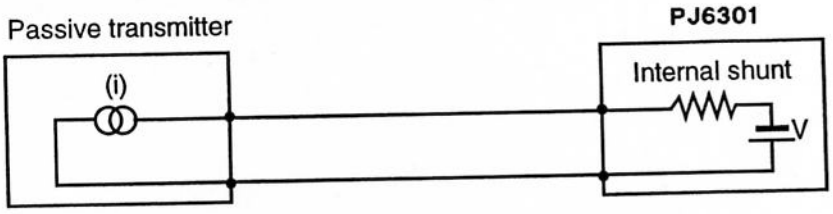
Active transmitter checking

The current generator (i) 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

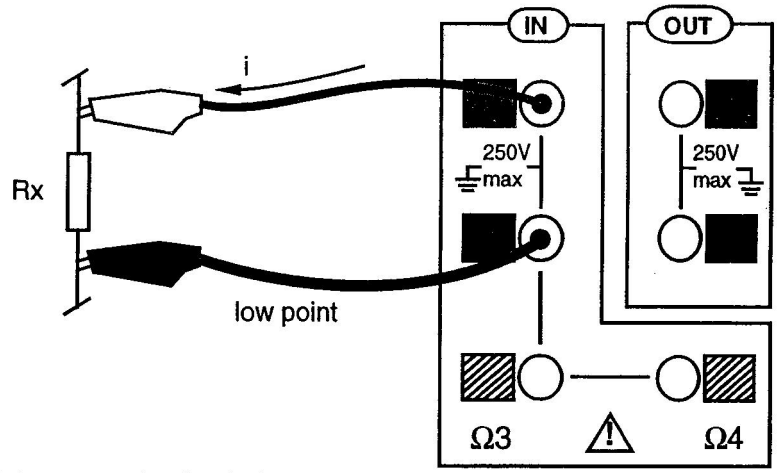
The **PJ6301** *always measures the loop current but also supplies the transmitter current source.*



3.3 - Ohmmeter

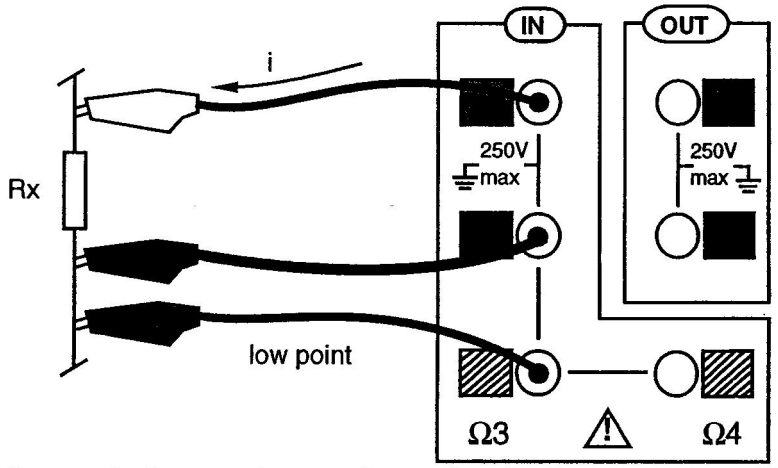
A current of known value flows in the unknown Rx resistor. One can deduce the Rx value by measuring the voltage at its terminals. Before making any connection and performing a correct measurement, make sure that there is no voltage at terminals of the resistor to be measured. Three types of connection are possible.

"2-wire" connection



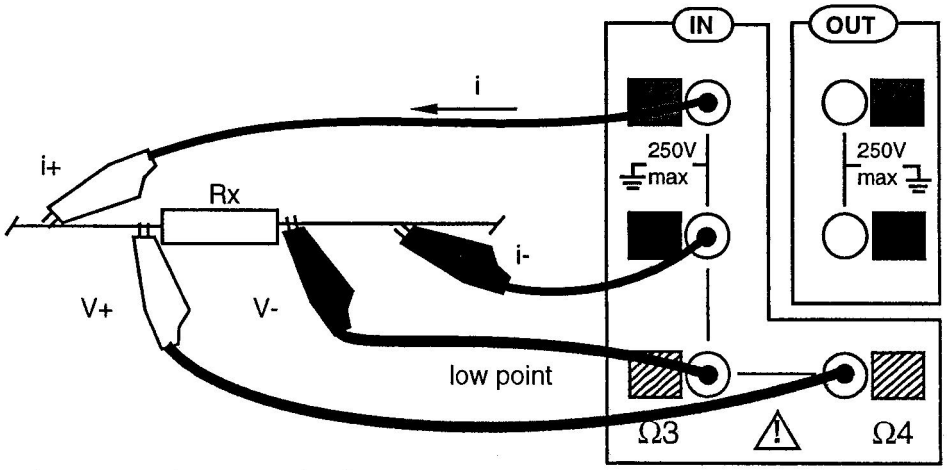
If the resistances of the measuring leads (plus the contact resistances) are low regarding the resistor to be measured, the "2-wire" connection may be suitable, but it is always advisable to make a "nul on the measurement" (see 4.5.2) to break free from a non-negligible error.

"3-wire" connection



This type of connection needs three conductors of same length, diameter and metallic nature (balanced line).

"4-wire" connection

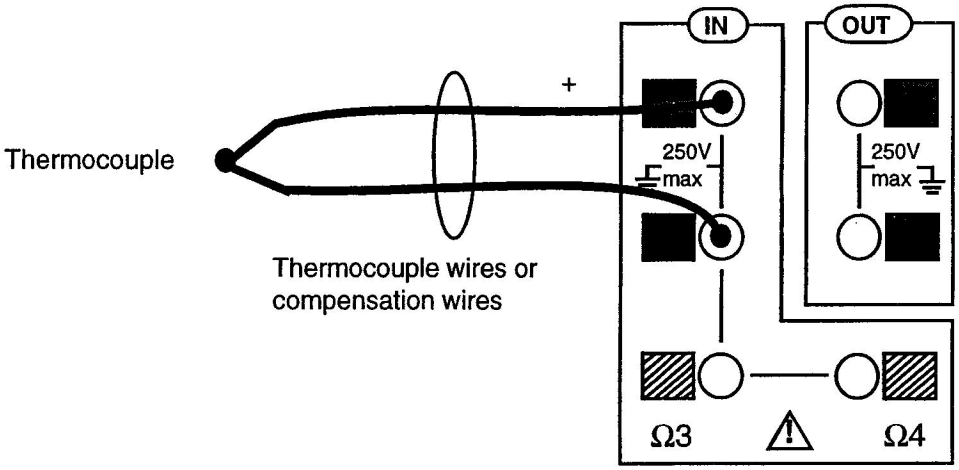


To take the voltage near the terminals of the resistor to be measured, this connection is the one which gives the minimum of error.

3.4 - Thermocouple thermometer

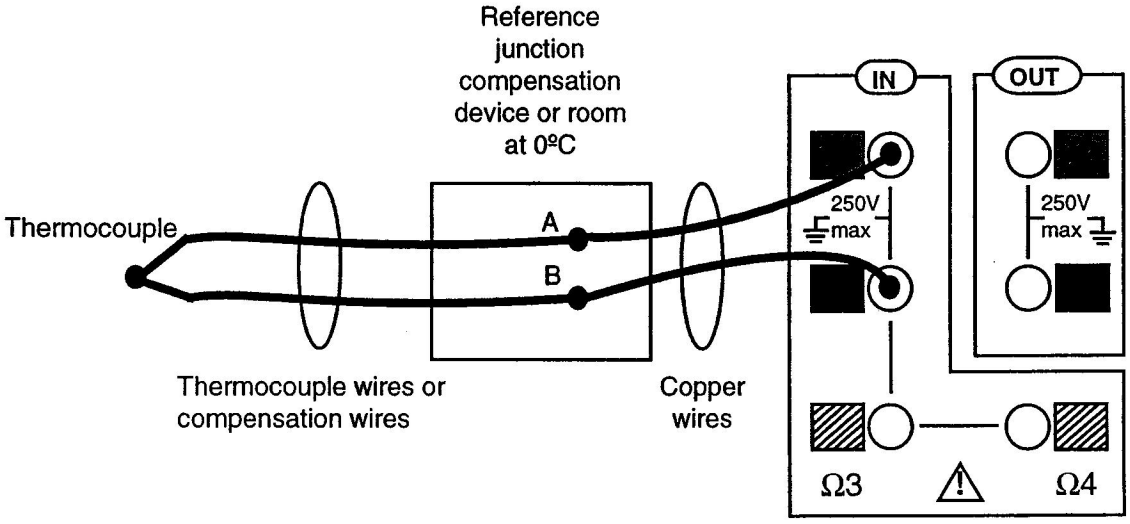
The unit measures the voltage delivered by the thermocouple, then converts the mV in °C according to the normalized tables. The temperature is displayed with the selected unit together with the unit conversion if necessary.
If the internal reference junction correction (RJ) is active or inactive, connections are quite different.

Internal reference junction active



The thermocouple wires or the compensation wires are connected directly to the unit terminals.

Internal reference junction inactive



Use an external reference junction compensation device or place the two terminals A and B in a 0°C room.

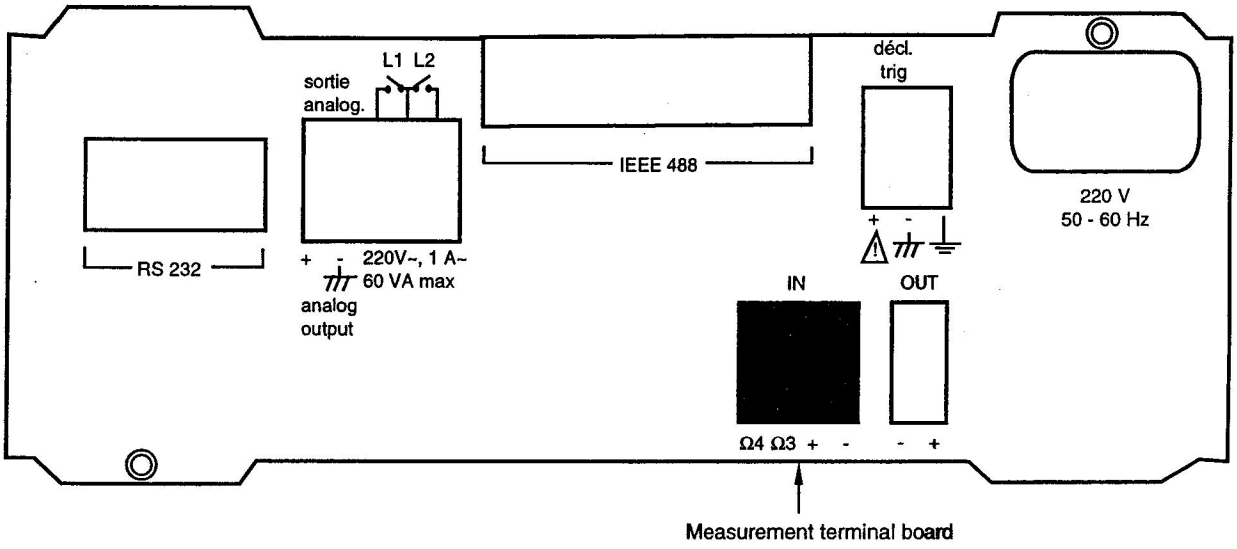
3.5 - RTD thermometer

This is a resistance measurement and the measurement principle is that of an ohmmeter. The specifications particular to each type of connecton are similar, except that values of the RTDs are generally very low (100 Ω at 0°C). We generally use the "3-wire" or "4-wire" connection (see 3.3).

Concerning the measurement current values, refer to specifications in appendix A.

3.6 - Using the rear terminal board

All the connections decribed above can be performed from the back of the unit on the "IN" terminal board.



To make the connections valid inside the unit, the rear terminal board should be confirmed using a specific program (see 7.1).

4 - Programming the measurement

Upon switching on, the unit is usable according to the configuration and parameters stored. State of this information is readable by selecting the prompts **STAT** , then **IN** from the main menu (sec. 2.4.1). The measurement program enables the user to change function, enter new parameters but also to use some operating mode (triggered measurements, display of max. and min. measurements, etc.) Access these features by the "access" menu.

4.1 - Access menu description

Selecting **IN** from the main menu opens the access menu.

Main menu
Access menu

IN				OUT			CFG	STAT	
FCT	CFG		TRIG		ALAR		PROC	MEM	

Selecting a measurement function (see 4.2)

FCT Enables the user to change the current function presently used. The parameters of this new function (range, for example) are those previously programmed by CFG from the access menu. However, we can also program new parameters in the current function with FCT.

Configuring the measurement functions (see 4.3)

CFG Enables the user to program in advance the parameters of all the measurement functions. However, on the current function, changing range for example is taken into account immediately. The programming procedures are similar with FCT and CFG.

Triggered measurements (see 4.6)

TRIG Used to output measurements at given programmed time or step by step. These measurements are stored to be processed later on.

Alarms (see 4.4)

ALAR Enables the user to program alarm values, threshold and hysteresis and to decide if the alarm occurs when the measurement is lower or higher than the programmed threshold.

Processing the measurement (see 4.5)

PROC Mathematical process on the measurement, such as:

- min. and max. values reached by the measurement since the initialization of this statistical computation,
- relative measurements computed regarding a measurement or a value entered on the keyboard,
- digital filter,
- special conversion scale,
- recorder output (max. deviation 2.5 V).
- printer output.

Mesurement memory (see 4.7)

MEM Enables the user to process the stored measurement bursts (measurement display, statistical computations, output to a printer or to the recorder output, etc.).

4.2 - Selecting a measurement function

WARNING ! Before changing function, it is advisable to remove all the connections from the terminals or the measurement terminal board. Make sure there is no dangerous voltage on the wires or on the measuring leads.

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
V		mA		Ω		Tc		Rt

- Select the desired measurement function (see specifications and ranges in appendix A).

V	Voltmeter for measuring DC voltages.
mA	Milliammeter for measuring DC currents.
Ω	Ohmmeter.
Tc	Thermocouple thermometer.
Rt	RTD thermometer.

After selection, the unit operates in this new function with the stored parameters. Another menu appears on the display.

This new menu, particular to the selected function, is used to:

1) **Display the parameters of the current function.** They are indicated by the marker.

2) **Change the parameters of the current function by selecting another prompt.** To make this selection, refer to the configuration procedures explained on the next pages.

Don't forget to use the help key !

?

4.3 - Configuring the measurement functions

Configuring the measurement functions stores into permanent memory a certain amount of parameters able to be changed (see table 1). The CFG prompt from the measurement menu opens on the configuration menus, **for all measurement functions, including the current function.**

IMPORTANT NOTE

FCT **modifies the current measurement function and associated parameters only.**

CFG **modifies parameters of all functions, including the current one.**

TABLE 1

Functions	Modifiable parameters
Voltmeter	Four ranges: 60 mV, 600 mV, 6 V, 60 V. Autoranging.
Milliammeter	Connection to an active or passive transmitter. (only one range: 60 mA).
Ohmmeter	Two ranges: 600 Ω, 6 kΩ. Autoranging. 2, 3 or 4-wire connection.
Thermocouple thermometer	Eleven thermocouple types: K, T, J, E, N, L, S, R, B, Pl, Mo. Internal or external reference junction correction. Thermocouple break detection. Three measurement units: °C, °F, Kelvin.
RTD thermometer	Four Platinum probe values: 100 Ω, 200 Ω, 500 Ω, 1 kΩ at 0°C. One 100 Ω at 0°C Nickel probe. 2, 3 or 4-wire connection. Three measurement units: °C, °F, Kelvin.

The following procedures are described according to the typographic conventions explained in 2.8.

4.3.1 - VOLTMETER CONFIGURATION PROCEDURE

Main menu
Access menu
Functions
Ranges

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
V		mA		Ω		Tc		Rt
AUTO	60mV	0.6V	6V	60V				

AUTO = Autoranging. Select this prompt or one of the other four ranges. After selection, the unit automatically returns to the access menu.

WARNING: Autoranging is inactive with triggered measurements (4.8).

4.3.2 - MILLIAMMETER CONFIGURATION PROCEDURE

Main menu
Access menu
Functions
Connection

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
V		mA		Ω		Tc		Rt
	TxP⊣⊢	TxA						

Select the type of transmitter connected to the **PJ6301** (3.2). **TxP⊣⊢** passive transmitter, **TxA** active transmitter. After selection, the unit automatically returns to the access menu.

NOTE: For usual current measurement, select the active transmitter.

4.3.3 - OHMMETER CONFIGURATION PROCEDURE

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
V		mA		Ω		Tc		Rt
AUTO	600Ω	6KΩ		2W	3W	4W		

Two options are available:

1) Ranges

AUTO	600Ω	6KΩ	

AUTO = Autoranging. Select this prompt or one of the other two ranges. After selection, the unit automatically returns to the access menu.

WARNING: Autoranging is inactive with triggered measurements (4.8).

2) Connection

	2W	3W	4W	

Select the type of connection according to the desired accuracy (see specifications in appendix A) and to the connection options.

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
V		mA		Ω		Tc		Rt
RJ		TYPE		TCX		UNIT		

There are several options in this menu:

1) Reference junction

RJ		TYPE		TCX		UNIT	
ON		OFF					

Internal reference junction active or inactive ("ON" or "OFF").

2) Thermocouple types

RJ		TYPE		TCX		UNIT		
K	T	J	E	N		L	S	>>

Pressing >> displays the other thermocouples.

<<	R	B		PI	Mo	

Pressing << (or ESC) returns to the beginning.
Select the desired thermocouple type.

3) Thermocouple break detection

RJ		TYPE		TCX		UNIT	
ON		OFF					

Thermocouple break detection active or inactive ("ON" or "OFF"). If you select ON, a thermocouple break will be displayed as a measurement out of limits.

4) Measurement unit

RJ		TYPE		TCX		UNIT	
°C		°F		K			

Select the desired measurement unit.

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
V		mA		Ω		Tc		Rt
P100	P200	P500	P1K	N100	2W	3W	4W	UNIT

There are several options in this menu:

1) RTD type

P100	P200	P500	P1K	N100	

Select the desired Platinum RTD: 100 Ω, 200 Ω, 500 Ω or 1 kΩ at 0°C.
Or, select the Nickel RTD: 100 Ω at 0°C.

2) Connection

	2W	3W	4W	

Select the connection according to the probe options (see 3.3).

3) Measurement unit

P100	P200	P500	P1K	N100	2W	3W	4W	UNIT
°C		°F		K				

Select the desired measurement unit.

4.4 - Alarms

There are two programmable alarms L1 and L2. A normally open contact available at rear of the unit is assigned to each alarm. Depending on programming, when the value read in "IN" window is either lower or higher than the threshold value, the alarm contact assigned to the threshold closes, thus allowing trigger of any external devices (220 V AC, 1 A AC, 60 VA max. permissible).

Parameters able to be changed by programming are as follows:
- threshold values,
- hysteresis value for each threshold (see below),
- alarm trigger when the measurement M is lower or higher than the programmed threshold Th (M < Th or M > Th),
- alarms 1 and/or 2 active or inactive,
- audible warning active or inactive when a threshold is exceeded.

WARNING: The alarm contacts L1 and L2 available at rear of the unit are not independent. They have a common point.

Alarm hysteresis operation

In any state changing device, an alarm system may lead to some fluctuations. The hysteresis is made to break free from these fluctuations.

The hysteresis shown above depends on the threshold direction (M > Th) or M < Th).
0 represents an inactive alarm. > indicates measurement increasing.
1 represents an active alarm. < indicates measurement decreasing.

ALARMS OPERATING PROCEDURE

Main menu
Access menu

Two options are available:

1) Threshold parameters

Select alarm L1 or L2 to be programmed.
The new menu opens on three options for the selected threshold:

Threshold direction

M>Th Alarm is activated when the measurement is higher than the threshold value.

M<Th Alarm is activated when the measurement is lower than the threshold value.

Threshold value and hysteresis

PROG In the editor read:

T : threshold value stored,
H : hysteresis value stored (positive number).
If required, enter the new values.
There is no programming limit, but it is advisable to stay inside the used range limits.

Threshold ON/OFF **ON** Threshold is active (see table 2 below).

OFF Threshold is inactive.

TABLE 2		AVAILABLE ICONS
Icon	Event	Comments
1 •))	Threshold 1 is exceeded.	L1 closes and there is an audible warning if the buzzer is active (see below).
2 •))	Threshold 2 is exceeded.	L2 closes and there is an audible warning if the buzzer is active (see below).

2) Buzzer

	L1		L2		BUZZ	
				ON		OFF

ON The buzzer sends audible signals (beep) if the measurement exceeds one of the two thresholds.

EXAMPLE : "on/off" regulation

A tachometric dynamo, supplying exactly 3 V for 3 ,000 RPM, is mounted on a shaft of a moving machine. By means of the alarm contacts L1 and L2, we wish to regulate the speed at 3 ,000 ± 5 RPM by measuring the dynamo voltage (3 V ± 5 mV). The hysteresis is set to 1 RMP (1 mV).

The machine is mounted so that
L1 closes -> the speed increases.
L2 closes -> the speed decreases.

The parameters are as follows:
L1 = 2.995 V; Hyst. = 1 mV ; M < Th
L2 = 3.005 V; Hyst. = 1 mV ; M > Th.

The diagram shows that the regulation range (L1 and L2 open) is situated between 2.996 and 3.005 V, or 3.004 V and 2.995 V depending on the measurement evolution direction.

Programming the unit is as follows:

Function	Select		Press					
Alarm program access	IN	ALAR						
Threshold 1 at 2.995 V	L1	PROG	2	.	9	9	5	ENT
Hysteresis at 1 mV	1	EXP	-	3	ENT			
Alarm if M < Th	M<Th	ON	ESC					
Threshold 2 at 3.005 V	L2	PROG	3	.	0	0	5	ENT
Hysteresis at 1 mV	1	EXP	-	3	ENT			
Alarm if M > Th	M>Th	ON	MNU					

4.5 - Processing the measurement

Processing the measurement is performing computations on the measurement in order to:

1) Display the result of these computations in the following operating modes:

Min. and max. measurements (4.5.1)	Simultaneously read three values: - the current measured value, - the lowest value measured during a measurement period initialized on the keyboard. - the highest value measured during this same period.
Relative measurements (NUL) (4.5.2)	Read L = M - R, where: M = measured value and R = reference value which is either a programmed value or a measurement. In the last case, from the moment we select the measurement reference, we have L = 0. A "nul" has been made on the measurement.
Scaling (4.5.3)	Read L = aM + b on 9 straight segments as a maximum, where: M = measured value, a and b constants issued from the programming; their values can be equal to or different for each of the 9 straight segments.
Digital filter	An "exponential smoothing" filter equivalent to a first order filter.

NOTES:
1 - All these processing options are compatible and may be used simultaneously (4.8).
2 - Changing function deactivates the processing mode(s) previously activated (except display of min. and max. measurements).

2) Convert the measurements into a signal directly usable by an external recorder.

3) Send the measurements to printer via the RS 232 link.

4.5.1 - MIN./MAX. DISPLAY OPERATING PROCEDURE

Main menu
Access menu
Processing

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
NUL	SCAL	FILT		↑:↓:			RCDR	PRNT
	ON		OFF			INIT		

Two options are available:

1) ON/OFF

	ON		OFF		INIT	

ON Displays the min. and max. measurements **performed since the last initialization.**

OFF Cancels min./max. display.

2) Initialization

	ON		OFF		INIT	

INIT Initializes min./max. scanning and displays these values.

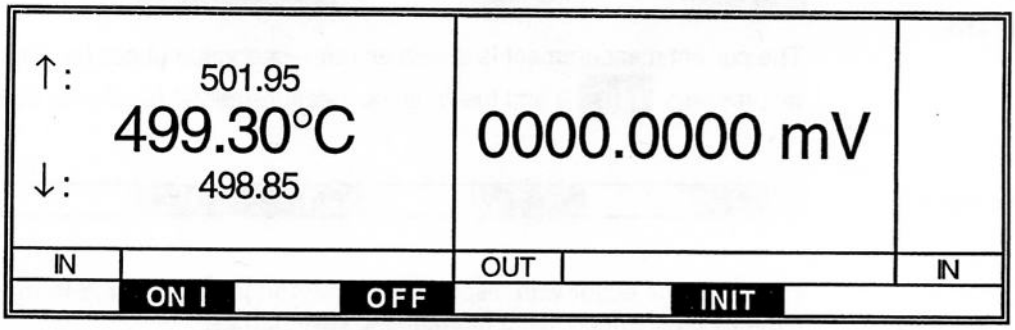
NOTES:
1 - Changing function initializes computations.
2 - An overrange on max. or min. value is indicated by a series of hyphens displayed instead of the value.
3 - A display capacity overload is indicated by an asterisk (*) in front of the max. or min. value.

EXAMPLE : Temperature measurement

For example, a **PJ6301** *measuring a temperature ranging about 500.00°C. We wish to know, during a space of time, the min. and max. temperatures reached by the oven under observation.*

From the main menu:

- Select **IN** then **PROC** then **↑:↓:** .
- Initialize the scanning and display of min./max values by pressing **INIT** . The display is as follows:



In the "IN" windows are displayed:
- the max. value on the first line (501.95°C),
- the current measurement on the second line (499.30°C),
- the min. value on the third line (498.85°C).

Min. and max. values displayed depend on the signals **since the last initialization.**

Main menu
Access menu
Processing

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
NUL	SCAL	FILT		↑:↓:			RCDR	PRNT
ON		OFF		TARE	EDIT			

Three options are available:

1) Nul on measurement

ON		OFF		TARE	EDIT	

The current measurement is stored as reference value (it can be displayed at any time by pressing EDIT) and the "relative measurements" function is activated.

2) Programmed reference

ON		OFF		TARE	EDIT	

We are in the editor with display of the reference value stored in memory. This value (N) may be changed using the numeric keys (2.5.2).

As soon as this value is validated by pressing ENT , it is stored into permanent memory. Whether the reference is acquired by making a "nul on the measurement" or by entering a value using the keyboard, **the stored information takes account of the measurement function on which the unit was placed when validating the reference** (see example next page).

3) ON/OFF

ON		OFF	

ON Relative measurements active (pressing TARE , automatically activates the relative measurements).

OFF Relative measurements inactive.

Note that this icon is present in the "IN" window when the measured value is not displayed. This is the case when the relative measurements are validated.

For example a **PJ6301** operating as a voltmeter over the 600 mV range. In procedure above and placed in the editor, if we dial [8] then [5] and validate by [ENT], **the quantity stored is 85.000 mV** (value + unit).

Pressing [ON] validates the function and displays the icon.

Now, if we switch to the 6 V range with a measurement of 2.04025 V, for example, we read 1.95525 V, i.e a difference of 0.08500 V or 85.00 mV.

This 85.000 mV reference stored into memory cannot be used in ohmmeter or thermometer as it is assigned to the voltmeter function.
Each of the five measurement functions have their own reference value with sign and unit stored into memory.

Don't forget to use the help key !

[?]

4.5.3 - SCALING

When there is no measurement processing, the displayed value (A) and the measured value (M) are equal. The A = f(M) conversion function is then an y = ax + b straight form where a = 1 and b = 0. In some applications, a different slope and/or an offset shift may be necessary. As this conversion function is a straight line, two points are sufficient to define it. When the conversion function is non linear (and continuous) an approached curve may be considered by defining consecutive straight segments. The CL8500 is able to set from 1 to 9 straight segments from 2 to 10 points whose coordinates are stored into permanent memory.

Conversion examples

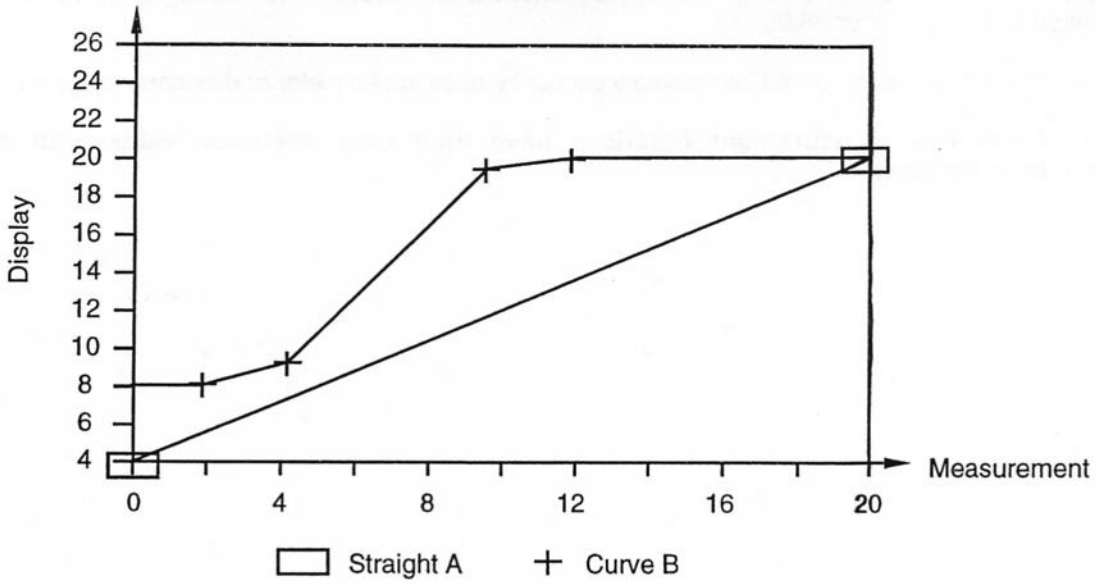


Diagram above shows two examples of conversion of a current measurement (x-coordinates) in a given display (y-coordinates).
Straight A: determined by the coordinates points (0;4) and (20;20).
Curve B : 6 points set 5 straight segments.
For measurement currents from 4.5 to 9.5 mA, the conversion slope is equal to 2. The display indicates twice the measurement.

SCALING **OPERATING PROCEDURE**

Main menu
Access menu
Processing

IN				OUT		CFG	STAT
FCT	CFG		TRIG		ALAR	PROC	MEM
NUL	SCAL	FILT		↑;↓;		RCDR	PRNT
ON		OFF			PROG		

Two options are available:

1) ON/OFF

ON		OFF	

ON Scaling is active with the stored parameters.

OFF Scaling is inactive.

Note that this icon is present in the "IN" window when the measured value is not displayed. This is the case when the scaling is entered.

2) Stored parameters

ON		OFF			PROG			
↑	↓	EDIP	ADDP	RES	UNIT		CLRP	CLRA

The display indicates the list of x- and y- coordinates of the stored points. Two points are needed as a minimum. This is the default programming as shown below (conversion straight, slope 1).

X0: 000.000e-3V	Y0: 0.00... ◄	
X1: 1.00000 V	Y1: 1.00...	

IN			OUT				IN
↑	↓	EDIP	ADDP	RES	UNIT	CLRP	CLRA

◄ is the line cursor which enables the user to select one line in the list.
X0 and Y0 are the coordinates of the first point.
X1 and Y1 are the coordinates of the second point.

The x-coordinate values are the measured values.
The y-coordinate values are the equivalent display. These values bear a unit selected from the menu under the coordinate list. By default, the unit name is indicated by three dots (. . .).

Several options are available:

Moving in the list

↑	↓	

↑ Moves the line cursor to the previous line.

↓ Moves the line cursor to the next line.

Resetting to zero

				CLRP	CLRA
	YES		NO		

CLRP then YES Clears the line marked by the line cursor from the memory.

CLRA then YES Clears all the point coordinates from the memory and returns to the default coordinates as displayed above.

Before editing new parameters, it is advisable to reset the memory to zero by selecting CLRA then YES in order to:

1 - Make room for the new points to be edited.
2 - Avoid contamination of the new list by the older. Note that **all the coordinates of the list are taken into account when scaling is active.**

Programming the parameters

	EDIP	ADDP	RES	

Three prompts call up the editor.

EDIP Edits coordinates of the line marked by the cursor. These values can then be modified.

ADDP Adds a new point. The place occupied in the list by this new point takes account of the value of the other x-coordinate points. **The unit sorts out the x-coordinate values by increasing order.**

RES Sets the resolution (5 decimals as a maximum) of the y-coordinate values.

Creating the display unit

↑	↓	EDIP	ADDP	RES	UNIT		CLRP	CLRA
A . . G	H . . N	O . . U	V . . Z	( ) _	0 . . 4	5 . . 9	<	>

The editor displays in inverted video the current display unit stored into memory.

Name : •••
cursor

IN			OUT			IN
A . . G	H . . N	O . . U	V . . Z	( ) _	0 . . 4	5 . . 5	<	>

A cursor located under the leftmost character indicates it can be modified.

Pressing [>] moves the cursor to the right.

Pressing [<] moves the cursor to the left.

To create a display unit, edit each character successively:

- Select the group including the desired character. For example, selecting **O . . U** opens the following prompts:

O	P	Q	R	S	T	U		CAPS

CAPS toggles between lower- and upper-case and vice-versa.

- Select the desired character. The cursor moves to the right.
- Edit the following character if desired.
- Then, validate by [ENT]. Return to the coordinate list.

NOTE: Prompt **( ) _** enables selection of some particular characters.

A . . G	H . . N	O . . U	V . . Z	( ) _	0 . . 4	5 . . 9	<	>
(	)		°	Ω	µ	%	.	/

Note that the interval [ ] is a blank character which enables the user to clear one or several characters from the displayed name.

EXAMPLE : Non linearity correction

A silo is equipped with a gauge and a current transmitter. The whole set is highly non linear. Measuring the filling level on a milliammeter linear from 0 to 20 mA and graduated from 0 to 100 % does not give usable indications.

Transmitter current (mA).	0.8	2	4	5.6	8	12	20
Measured filling level (%).	4	10	20	28	40	60	100
Real filling level (%).	0	25	50	62.5	75	87.5	100

To get a measurement nearest the actual, we replace the milliammeter by a **PJ6301** and perform a scaling on six straight segments. From the table above, enter the "transmitter current" in x-coordinates and the "real filling level" in y-coordinates to correct the non linearity of the system.

- From the main menu, successively select **IN** then **PROC** then **SCAL** then **PROG** .
- Select **CLRA** then **YES** to reset the memory to zero and avoid contamination of the new list.

Then, continue to enter the coordinates of the table by reprogramming first the points (X0, Y0) and (X1, Y1) of the default programming.

Function	Select	Press		
Enter the first x-coordinate (X0).	EDIP	.	8	ENT
Enter the y-coordinate (Y0).		0		ENT
Move the cursor to the second line.	↓			
Enter the second x-coordinate (X1).	EDIP	2		ENT
Enter the y-coordinate (Y1).		2	5	ENT
Enter the third x-coordinate (X2).	ADDP	4		ENT
Enter the y-coordinate (Y2).		5	0	ENT
Enter the following coordinates.	ADDP	... etc ...		
(same procedure as X2, Y2)				
Select two decimals.	RES	2		ENT
Select % as displayed unit.	UNIT ( ) _ %			ENT
Return to previous menu.				ESC
Set the scaling active.	ON			MNU

The measurement is performed with the programmed scaling. The linearity error is considerably corrected.

4.5.4 - DIGITAL FILTER

When there is no measurement processing, the displayed value A and the measured value M are equal.

If n is the index of the present values and n - 1 the index of the values at the instant of the previous measurement, setting the filter active by using the exponential smoothing technique changes the display according to the formula:

$$A_n = \frac{(2^N-1)\, A_{n-1} + M_n}{2^N}$$

where N is a whole number which characterizes the filter.

This filter is similar to an electronic filter (RC) whose time constant is $2^N \Delta t$ where Δt is the interval between two consecutive measurements (see appendix A).

DIGITAL FILTER	OPERATING PROCEDURE

Main menu
Access menu
Processing

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
NUL	SCAL	FILT		↑:↓:			RCDR	PRNT
	ON	INIT		OFF		PROG		

Three options are available:

1) Filtering coefficient

	ON	INIT		OFF		PROG	

The editor displays the stored coefficient **N**.
If required, enter the value with $1 \leq N \leq 8$.

2) ON/OFF

	ON	INIT		OFF	

ON Sets the filter active and initializes the computations.

OFF Sets the filter inactive.

3) Initialization

	ON	INIT		OFF	

INIT Initializes the computations and sets the filter active.
If the filter remains active, a new initialization may be performed at any time.

Note that this icon is present in the "IN" window when the measured value is not displayed. This is the case when the filter is entered.

EXAMPLE : Smoothing of a disturbed signal

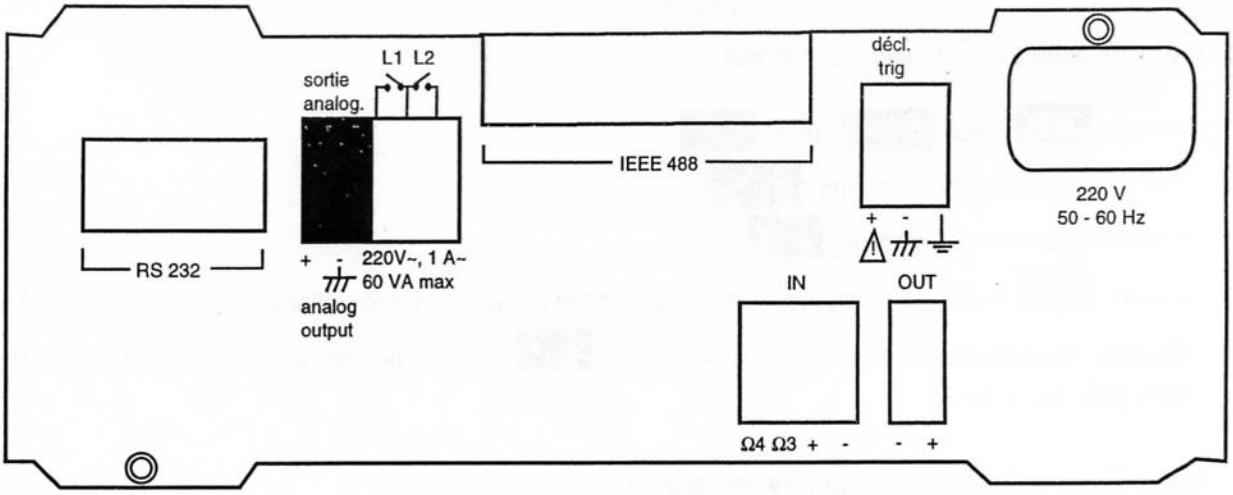
For example, a **PJ6301** *operating as a voltmeter over the 60 mV range. We measure a voltage ranging about 30 mV which shows a slight instability.*
Reading the min. and max. values taken over 5 minutes (see 4.5.1) shows ***a deviation of 17 points on display****, i.e 1.7 µV.*
We wish to read a measurement less fluctuating by using the digital filter with a coefficient of 4 for example.

From the main menu, proceed as follows:

- Select IN , then PROC , then FILT .
- Set the coefficient by selecting PROG .
- Start initialization by selecting INIT .
- Select ↑:↓: from the "processing" menu to read the measurement variations.
- Start initialization of min./max. display by selecting INIT and let the unit measure for 5 minutes, then note the min. and max. values.

One can see a deviation of **6 points on display**, i.e 0.6 µV.
If we compare this measurement to the previous one done without filter, we can see there is a smoothing of the observed signal.

Whatever measurement function is used, a signal from 0 to 2.5 V proportional to the **displayed value** can be outputted on the rear terminal board.
This voltage, available on "analog output" terminals, is used very often to observe evolution of the displayed value on an analog recorder. Note that the low point is the minus terminal (-).



RECORDER OUTPUT OPERATING PROCEDURE

The programming enables the user to set two display values, M1 and M2, corresponding to 0 and 2.5 V respectively on output.

Main menu
Access menu
Processing

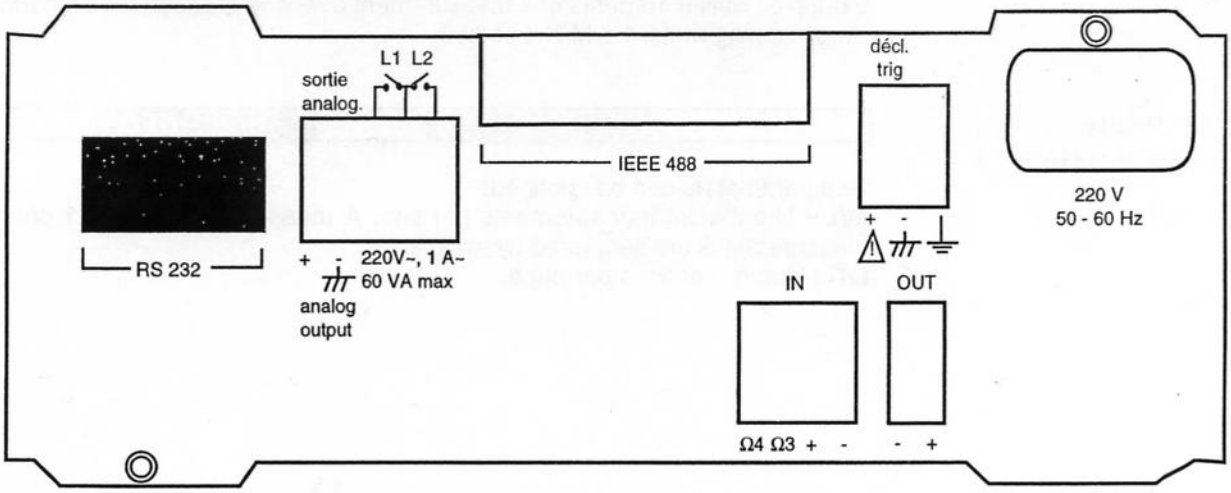
IN				OUT		CFG	STAT
FCT	CFG		TRIG		ALAR	PROC	MEM
NUL	SCAL	FILT		↑.↓.		RCDR	PRNT

After selection of **RCDR** from the "processing" menu, we are in the editor. Read the values M1 and M2 stored in permanent memory. They can be changed by means of the numeric keys and entered with the **ENT** key.
There is no programming limit, but **M1 should not be higher than or equal to M2**.

4.5.6 - PRINTER OUTPUT

The measurements can be printed on serial mode printer.
Connect the printer to the 9-pin female RS 232 connector located at rear of the unit. One of the cables available as an optional accessory can be used and connection is shown in table below.

REAR TERMINAL BOARD



RS 232 CONNECTION

PJ6301			Interface	
Pin no	Function		25-pin plug	9-pin plug
1	CD	----------->----------	8	1
2	RD	----------->----------	3	2
3	TD	----------<----------	2	3
4	DTR	----------<----------	20	4
5	Com.	----------	7	5
6	DSR	----------->----------	6	6
7	RTS	----------<----------	4	7
8	CTS	----------->----------	5	8
9	RI	----------->----------	22	9

Note: The pin 5 (common) is connected to ground by the power supply cord or by the ⏚ terminal on the rear terminal board (1.3).

PRINTER OPERATING PROCEDURE

Before using the printer, program the RS 232 link parameters according to sec. 7.2.1.
Parameters of the **PJ6301** and printer used should be compatible.

Main menu
Access menu
Processing

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
NUL	SCAL	FILT		↑:↓:			RCDR	PRNT
		ON	OFF		M/N	CFG		

Three options are available:

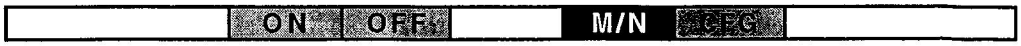
1) ON/OFF

	ON	OFF	

ON Starts printing.

OFF Stops printing.

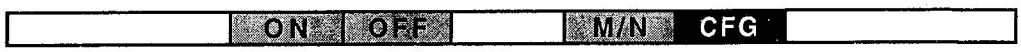
2) Printing frequency



The ratio M/N displayed is as follows:
M = Number of measurements performed.
N = Number of printed measurements always equal to 1 in the present case.

Example : M/N = 10 prints one measurement every 10 measurements performed.
Programming limits: $1 \leq M/N \leq 65\,000$.

3) Printer configuration



Two parameters can be changed:
M/L : Number of measurements per line. A measurement uses 11 characters and measurements are separated by two blanks.
L/P : Number of lines per page.

4.6 - Triggered measurements with storage

The unit operates in triggered measurement(s) when an event (pressing one key, closing of a contact external to the unit) triggers the measurement and the storage of one or several values.
Storage can be performed:
- **Step by step.** At each trigger command, a measurement is performed and stored in a list.
- **At programmed interval.** The continuous measurement cycle is stopped. The trigger command starts a series of measurements in which the number of stored measurements and the time interval between consecutive measurement are programmable.

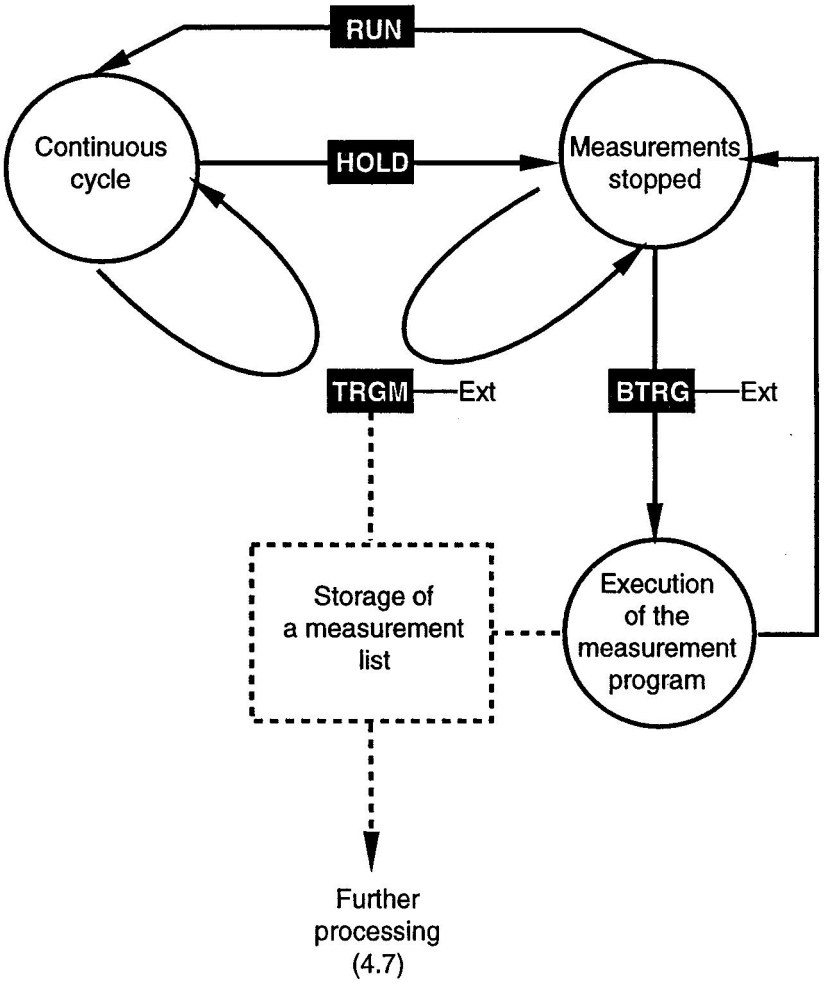
In both cases, the stored list is called a "measurement burst". A measurement burst may contain from one to 1,000 measurements.

4.6.1 - OPERATING PRINCIPLE

Four commands are available on the keyboard:

HOLD command stops the free rate (or continuous cycle).
RUN command restarts the continuous cycle.
TRGM command performs and stores a measurement step by step.
BTRG command triggers execution of a programmed burst.

An external trigger command (Ext) by contact closing is available on the rear panel.



Note : Execution of a programmed burst may be stopped by RUN.

Main menu
Access menu

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
RUN	HOLD		CLRM	TRGM		NAME	PROG	BTRG

Several options are available:

1) Trigger commands

RUN	HOLD		TRGM		BTRG

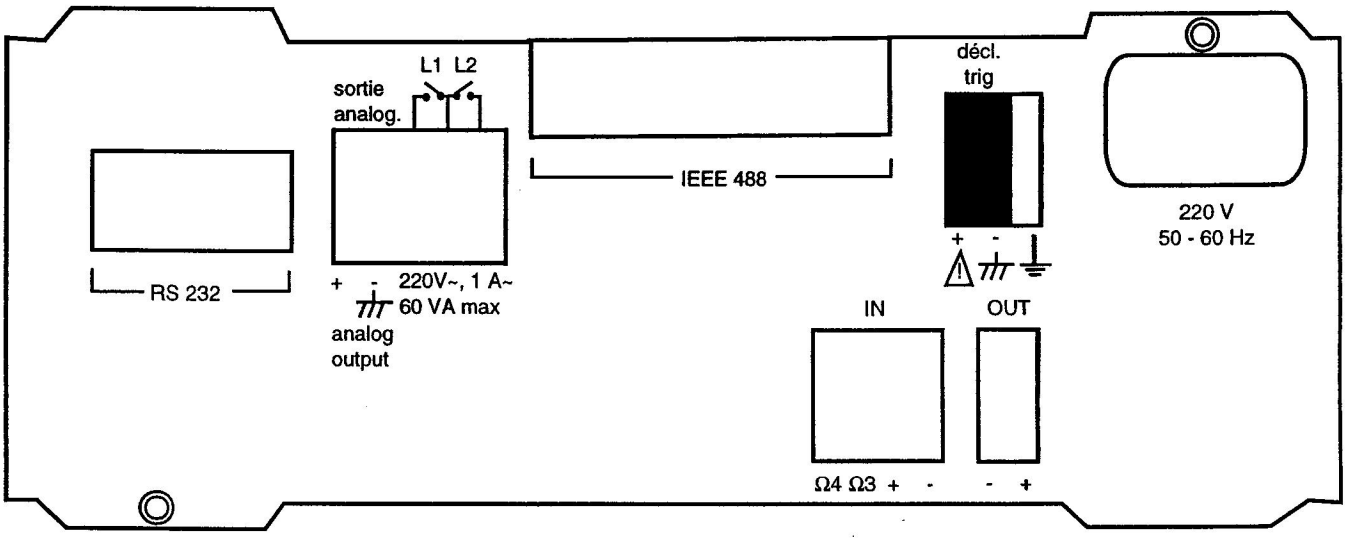
Actions of these commands are described in 4.6.1.

The number N in the 'IN" window indicates that:
After pressing **BTRG** , there are N measurements to be stored. This number N disappears at the end of the programmed cycle.
After pressing **TRGM** , N measurements have been stored.

NOTE: As soon as **TRGM** is pressed, a burst opens. To close it, switch to continuous cycle (RUN) or stop measurements (HOLD) or vice-versa. The number N then disappears from the "IN" window.

TABLE 3		AVAILABLE ICONS
Icon	Event	Comments
M	Pressing **RUN**	M is present at bottom of the "IN" window (icon area) **each time the unit performs a measurement** in normal rate or triggered measurements.
⧗	Pressing **HOLD**	The last measurement is maintained on the display.
⧗ and ⧗ alternate	Pressing **BTRG** or external trigger contact closed.	Icons present during storage of measurements of a programmed burst.

External trigger



The "trig" terminals should be connected to a normally open contact free from potential. With a semiconductor, follow the indicated polarities (5 V, 47 kΩ internal source). The minus terminal (-) is connected to the low point of the logic circuits.

WARNING: The external "step by step" or programmed trigger (TRGM or BTRG), results from a selection in one the unit configuration menus (7.3).

2) Clearing a measurement

RUN	HOLD		CLRM	TRGM		NAME	PROG	BTRG

CLRM Clears the last stored "step by step" measurement (TRGM). Several successive measurements can then be cleared.

3) Trigger parameters

RUN	HOLD		CLRM	TRGM		NAME	PROG	BTRG

In the editor, read in the "IN" window:
N = Number of measurements to be performed.
T = Interval between two consecutive measurements.

- Enter the new values to be stored in permanent memory.
Permissible values: $1 \leq N \leq 1{,}000$ and $0.3 \leq T \leq 6{,}500.0$ seconds.

4) Burst name

RUN	HOLD		CLRM	TRGM		NAME	PROG	BTRG
A ... G	H ... N	O ... U	V ... Z	( ) _	0 ... 4	5 ... 9	<	>

We are placed in the editor (4.5.3).
It is recommended to name the bursts as indicated below.

EXAMPLE : How to name a burst

A burst is to be named "**REM1**" (eight characters maximum).

Select								
0 ... U	then	CAPS	then	R
A ... G		then		E
H ... N		then		M
0 ... 4		then		1

The cursor moves to the right each time a character is selected.

Then, enter with **ENT**.

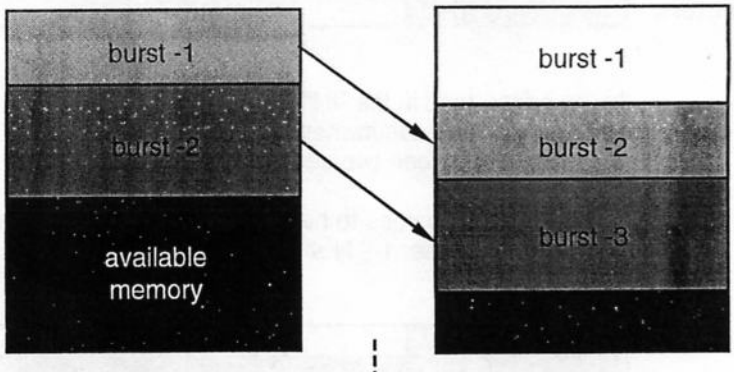
Don't forget to use the help key !

?

4.7 - Measurement memory

4.7.1 - OPERATING PRINCIPLE

The measurement memory or burst memory is a memory inside which the bursts edited in triggered mode (see 4.6 for storage) are piling up. It's a permanent memory which can contain from 1 to 128 bursts composed of 1,000 measurements and one measurement respectively. Each burst has an order number, the burst - 1 is the most recent.



Here, two bursts have been stored.
The older is the burst - 2 and the most recent is the burst - 1.

Another burst has been stored. It becomes the burst - 1 and the order numbers of the other bursts increase of one unit.

It is recommended to name each burst. When there is no more available memory, the oldest burst is erased by the others. If we wish to keep in memory a number (Ns) of bursts, we must satisfy to the following inequality:

$$Nm + (6 * Ns) \leq 1\ 024$$

where Nm is the total number of stored measurements.

4.7.2 - MEASUREMENT MEMORY OPERATING PROCEDURE

The processing program of measurement bursts enables the user to:

- display the contents of bursts,
- display statistical computations performed on a whole or partial burst,
- send, under analog form onto the recorder output, the whole set or part of the measurement bursts,
- print the whole set or part of the measurement bursts onto a serial printer connected to the unit.

Main menu
Access menu
Memory management

IN				OUT			CFG	STAT
FCT	CFG		TRIG		ALAR		PROC	MEM
CLRA	↑	↓	CLRB	NAME		OUT		DISP

This last menu appears on the display with, above, the header of the last burst stored as shown in example following.

Burst No -1 : OVENTEMP N = 30 T = 600 s Unit : °C MAX = 00769.95 MIN = 00695.05 AVG = 00730.31								
IN				OUT				IN
CLRA	↑		↓	CLRB	NAME		OUT	DISP

The first line is the order number of the burst together with its name.
The second line gives the number of measurement(s) stored, the time interval T between two measurements (only for the programmed bursts) and the measurement unit.
The third line displays the statistical data concerning the whole set of measurements stored in the burst.

With such a header, we can process the burst measurements by means of this management menu.
Four options are available:

1) Burst management

CLRA	↑	↓	CLRB	

Burst selection

↑ Selects a burst older than the one displayed.

↓ Selects a burst more recent than the one displayed.

Ressetting to zero

CLRA then YES Clears all the measurement bursts.

CLRB then YES Clears the selected burst. The order numbers (n) of the older bursts change to (n - 1).

2) Burst name

CLRA	↑	↓	CLRB	NAME		OUT		DISP
A ... G	H ... N	O ... U	V ... Z	( ) _	0 ... 4	5 ... 9	<	>

We are placed in the alphanumeric editor (4.5.3).

EXAMPLE : How to name a burst

A burst is to be named "**REM1**" (eight characters maximum).

Select

0 ... U	then	CAPS	then	R
A ... G		then		E
H ... N		then		M
0 ... 4		then		1

The cursor moves to the right each time a character is selected.

Then, enter with ENT.

3) Displaying contents of a burst

CLRA	↑	↓	CLRB	NAME		OUT		DISP

The display shows the first ten measurements of the selected burst together with a management menu of the measurements. The displayed measurements are called a "page".

EXAMPLE : Displaying a burst

Using the OVENTEMP display shown on the previous page:

B →	0: 00733.75 ◄		5: 00707.30					
	1: 00730.05		6: 00706.20					
	2: 00728.95		7: 00704.95					
	3: 00721.75		8: 00695.45					
	4: 00719.35	E ↓	9: 00695.05					
IN			OUT					IN
↑	↓	Pg ↑	Pg ↓	CLRM	SETB	SETE	STAT	>>

B → is the list beginning cursor.
E ↓ indicates that the list end cursor (E) is on another page.
◄ is the measurement cursor.
Note : Display of - - - - - - indicates a measurement out of limits. In that case, the same display will appear for the statistical data (MIN, MAX and AVG).

List of measurements to be selected is always between B and E.

Moving through the page

↑	↓	Pg ↑	Pg ↓	

Each page displays 10 measurements. To display the previous or next measurements, use the cursor.

↑	Moves the cursor to the previous line.
↓	Moves the cursor to the next line.
Pg ↑	Displays the previous page.
Pg ↓	Displays the next page.

Resetting to zero

↑	↓	Pg ↑	Pg ↓	CLRM	SETB	SETE	STAT	>>
			YES		NO			

Deletes the measurement marked by the cursor. The measurement is no longer stored in memory.
In the menu, another prompt enables the user to clear the measurements outside the list markers to create a short list.

Short list

	SETB	SETE	

SETB sets the list beginning (B) on the line marked by the measurement cursor.

SETE sets the list end (E) on the line marked by the measurement cursor.

We can select a short list including a group of measurements to be processed later on (see next page).

Statistics on a list

↑	↓	Pg ↑	Pg ↓	CLRM	SETB	SETE	STAT	>>

Indicates the max., min. and average values on measurements between by the two markers B and E.

EXAMPLE : Statistics over a burst

On the OVENTEMP burst (see examples) we desire statistical values between measurements 3 and 22.

1) Setting the list beginning and list end cursors to the lines 3 and 22 respectively creates a short list. Operate as follows:

Press	↓	to move the measurement cursor to line 3.
Press	SETB	to set the list beginning cursor to line 3.
Press	Pg ↓	to move to end of list.
Press	↓	to move the measurement cursor to line 22.
Press	SETE	to set the list end cursor to line 22.

A short measurement list from 3 to 22 has been created.

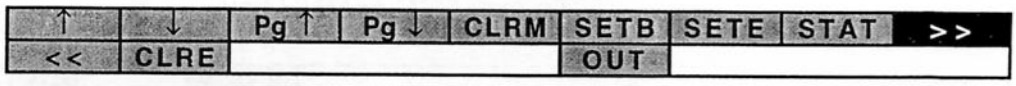
2) Then, start the statistical computations on the created list.

STAT displays:

```
Quantities computed between 3 and 22 :
MAX = 00767.95
MIN = 00695.05
AVG = 00719.66

To exit: ESC or MNU key
```

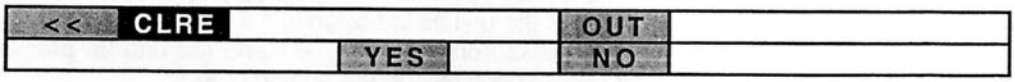
There is an extension to the menu by pressing **>>** .

Extension



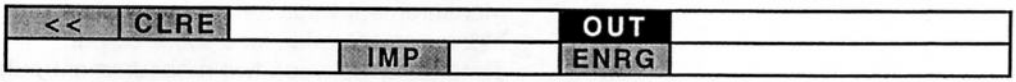
Pressing **<<** (or **ESC**), returns to the beginning of the display menu.

Clearing measurements



YES Clears all the lines outside the beginning and end cursors. The equivalent measurements are cleared from the memory.

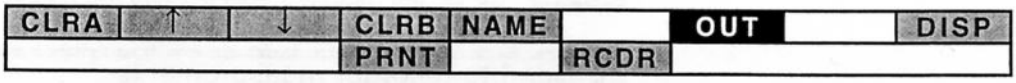
Modified burst output



OUT Ouputs the **modified or short burst**.

Procedure and interfaces used are the same for outputting the complete burst as shown below.

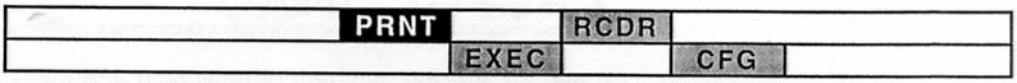
4) Burst output



OUT Sends the burst to:

- the RS 232 interface under "printer" format,
- the analog output for recorder.

Printer



The serial printer should be connected to the RS 232 connector at back of the unit as indicated in 4.5.6.

CFG Edits three configuration parameters:

M/L : Number of measurements per line.
L/P : Number of lines per page.
T/L : Time-delay between two lines with 1 ≤ T/L ≤ 6,500.0 s.

Each measurement uses 11 characters. The measurements are separated by three blanks. Printing ends by a page feed.

Printing example: M/L = 3

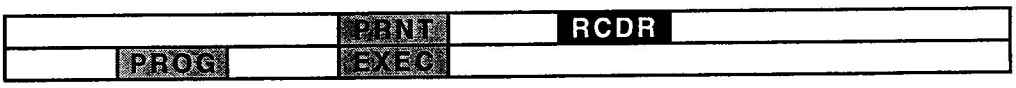
```
B_001 : OVENTEMP
N:2     T:600.0s    U:CEL (*)
MIN:      769.95    MAX:      695.05    AVG:      730.31
000:      733.75    001:      730,05    002:      728,95
003:      721,75    004:      719.35    005:      707.30
006:      706.20    007:      704.95    008:      695.45

(*) CEL : unit for °C.
```

EXEC Starts printing of the measurement burst.

Send to printer measurements
between Nos XX and YY

To exit: ESC or MNU key

Recorder



The analog recorder is connected to the "analog output" terminal board located at the back of the unit as indicated in 4.5.5.
Two measurement values M1 and M2 can be programmed corresponding to 0 and 2.5 V respectively on the analog output.
Two consecutive measurement outputs can be separated by a programmable time.

PROG Edits three parameters:

M1 : Measurement value for a 0 V output.
M2 : Measurement value for a 2.5 V output.
T : Time-delay between two measurement outputs.

There is no programming limit, except that **M1 should not be higher than or equal to M2.**
We must also have: 0.3 ≤ T ≤ 6,500.0 s.

EXEC Sends the measurement burst to the recorder output. Display is as follows:

Send to recorder measurements
between Nos XX and YY

To exit: ESC or MNU key

XX and YY are the numbers of beginning and end of list, complete or short, whose measurements are transmitted to the recorder.
This display remains on during the recording duration.

4.8 - Operating mode compatibility

When measuring, several operating modes can be used simultaneously (digital filter with scaling for example). The table below sums up all the possible cases and indicates comments if applicable.

TABLE 4	MEASUREMENT FUNCTION COMPATIBILITY					
→ ↓	Triggered measurements	Autoranging	Min./Max. display	Relative measurements	Scaling	Digital filter
Triggered measurements	✔	1	2	0	0	3
Autoranging	1	✔	0	0	0	0
Min./max. display	2	0	✔	0	4	0
Relative measurements	0	0	0	✔	0	0
Scaling	0	0	4	0	✔	5
Digital filter	3	0	0	0	5	✔

NOTE 0 Simultaneous usage of these operating modes does not call up any comments.

1 Activating the triggered measurements cancels the autoranging. The unit operates on the current range. The unit returns to autoranging as soon as the measurement switches to continuous cycle.

2 The maximum value is displayed instead of the number N which is the number of stored measurements or remaining to be stored.

3 We know that the time constant of the digital filter is $2^N \Delta t$ where Δt is the time interval between two measurements. With the triggered measurement mode active, this time is no more ranging a few hundred milliseconds as in free rate, but can reach a few seconds, indeed several minutes depending of the desired programming. One can see that the filter time constant may be then very important.

4 The scaling reinitializes the min. and max. measurements.

5 First the unit performs the filtering computations, then the scaling computations.

5 - Emission connections

Emission of an electrical signal or simulation of a physical quantity only needs two terminals, but the connections should be well-adapted to the function used.

Before emitting a signal or simulating a quantity, make sure that:

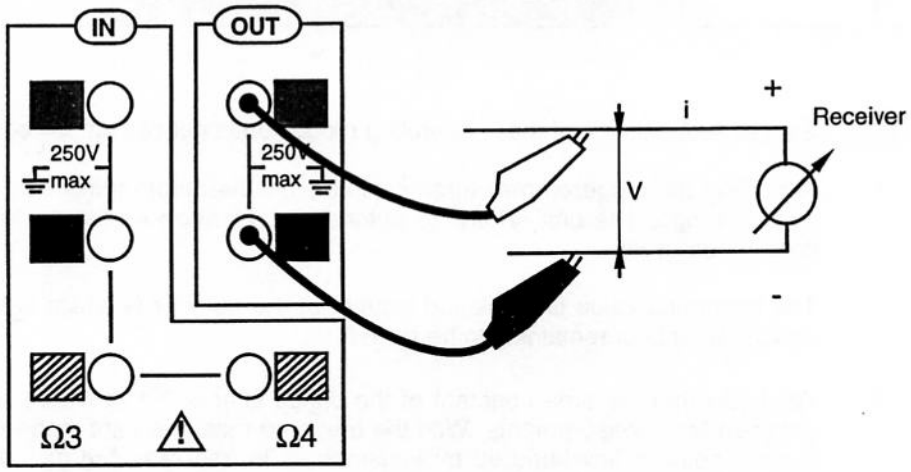
- depending on the function, range and different parameters selected, there is no risk for the external equipment. A simulation improperly performed in a regulation loop may lead to serious errors.

- Usage of external connection terminal boards does not add stray emf, especially when emitting low level signals (600 mV range for example).

WARNING ! Before any connection, make sure that there is no dangerous voltage between the two wires to be connected and between themselves and the earth. The max. permissible voltage between the emission terminals and the ground is 250 V rms.

If operating with the internal battery, connect the ⏚ terminal, located at back of the unit, to a safety ground.

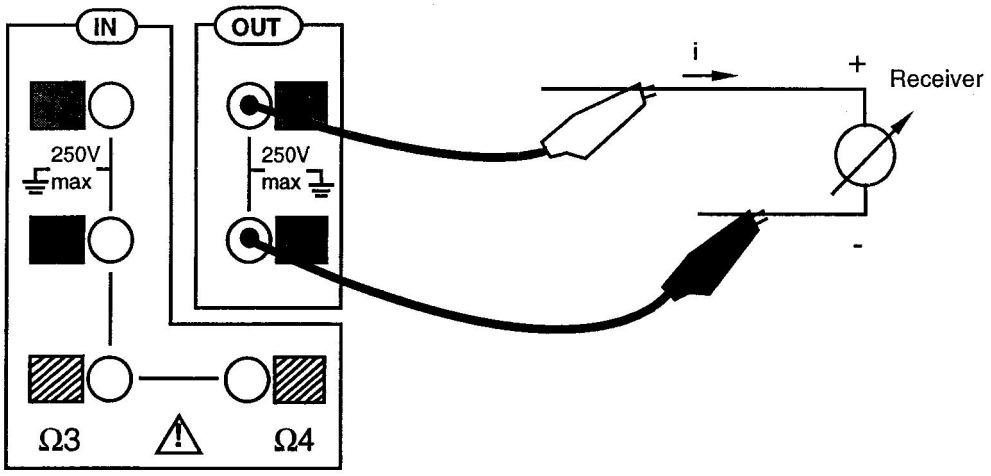
5.1 - Generating DC voltages



The generator "low point" is the the black terminal (terminal -).
To stay inside the specified tolerances (see appendix A), we need:
i ≤ 60 mA over the 0.6 V and 6 V ranges,
i ≤ 30 mA over the 60 V range.

5.2 - Generating DC currents

The unit current source includes its own supply. When the **PJ6301** emits current, it is similar to an "active transmitter" (see 3.2).



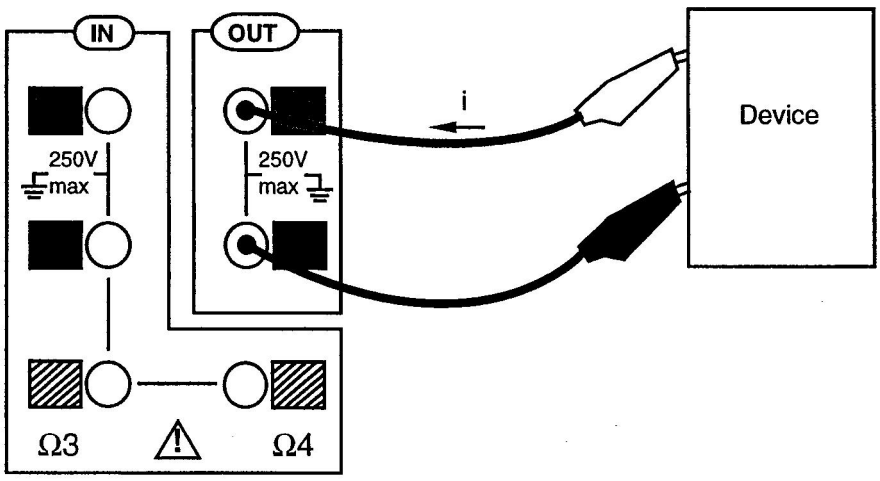
The **PJ6301** compliance is 30 V.

WARNING ! If the current loop must be opened to place the PJ6301 make sure that this handling may be done without any damage to the installation.

5.3 - Simulating resistances

When an external current (i) flows in the unit, any resistance value R programmed induces a potential difference V, such as V = Ri.
The connection direction doesn't matter but follow **0.5 In < i < 2.5 In** where In is the measurement rated current.

Reminder: In = 1 mA over the 600 Ω range; In = 0,1 mA over the 6 kΩ range.

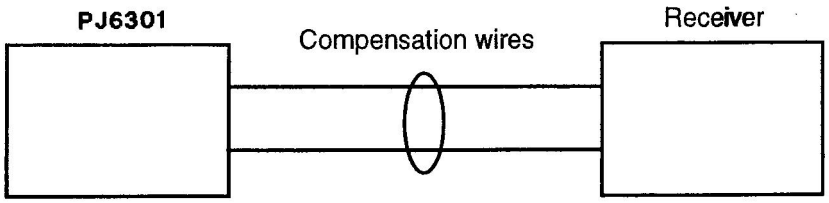


The figure above shows a 2-wire connection. However, the 2-, 3- or 4- wire connection can be used depending on the possibilities of the device used. (see 3.3).

5.4 - Simulating thermocouples

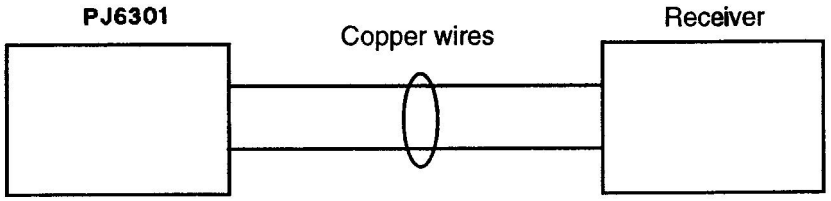
For a given thermocouple type, the temperature entered on the keyboard is converted into a voltage meeting the normalized tables. This voltage, available on the unit terminals, is corrected to take account of the reference junction temperature when the receiver is equipped with non-compensated terminals (see 3.4).

1) Receiver equipped with compensated terminals



The compensation cable goes to two compensated terminals, whether these terminals are those of the receiver or of an external device. The **PJ6301** is programmed in emission with reference junction and that means it "sees" a receiver equipped with reference junction compensation.

2) Receiver equipped with non-compensated terminals



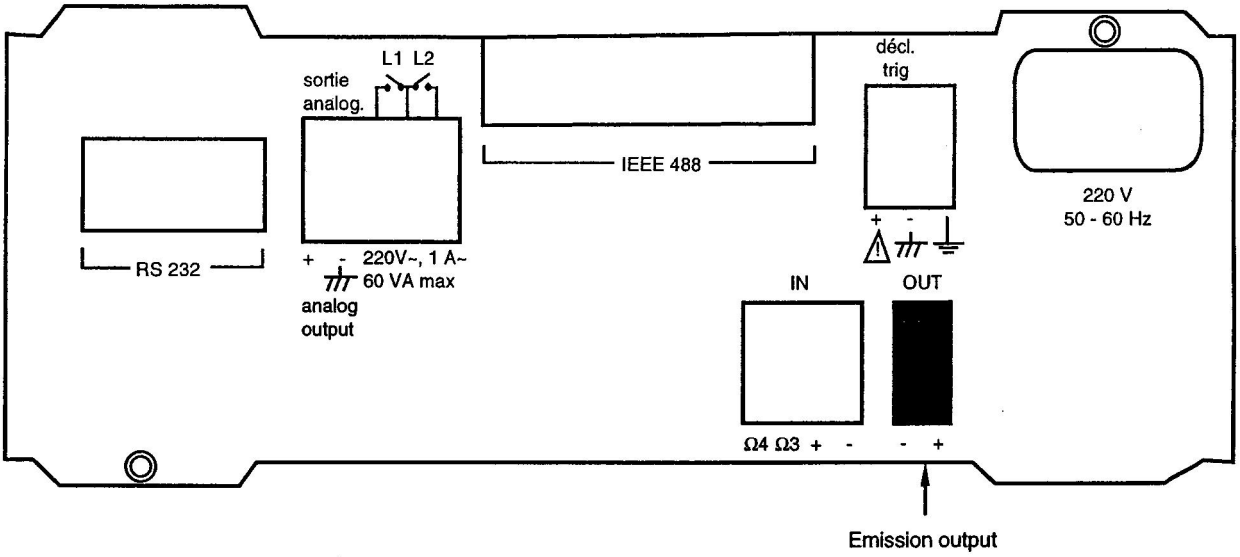
The link should be made with copper wires. The **PJ6301** is programmed in emission without internal reference junction. Each time it's possible, choose the connection which prevents errors due to the reference junction compensations.

5.5 - Simulating RTDs

Depending on the temperature value entered on the keyboard, the unit performs a conversion according to the normalized tables, then simulates, at its terminals, the equivalent resistance value.
Refer to 5.3.

5.6 - Using the rear terminal board

All the connections described above can be performed from the back of the unit on the "OUT" terminal board.



To make the connections valid inside the unit, the rear terminal board should be confirmed using a specific program (see 7.1).

6 - Programming the emission

The calibrator **PJ6301** emits or simulates a signal on its two "OUT" terminals in the same basic functions as in measurement (see specifications in appendix A).

Data stored are readable by selecting the prompts **STAT** then **OUT** from the main menu.The program enables the user to change functions, enter new parameters or use signal evolution modes (increments, ramps, synthetizer). An access menu allows programming of the whole set of parameters, usage of all the functions or simply enables to enter the signal value.

6.1 - Access menu description

Selecting **OUT** from the main menu opens the access menu.

Main menu
Access menu

Selecting an emission function (see 6.5)

FCT Enables the user to change the type of the emitted or simulated signal (voltage, temperature, resistance, etc.). The parameters of this new function are those previously programmed by **CFG** from the access menu. However, **we can also program new parameters in the current function with** **FCT**

Configuring the emission functions (see 6.6)

CFG Enables the user to program in advance the parameters of all the emission functions. However, on the current function, changing range for example is taken into account immediately. The programming procedures are similar with **FCT** and **CFG**.

Storing a value to be emitted (see 6.7)

STO Stores into memory up to 100 values entered on the keyboard, each of them bears a number.

Recalling a stored value (see 6.7)

RCL Recalls a stored value and emits or simulates the equivalent quantity.

Modifying a value to be emitted (see 6.2)

EDIT Access the editor for editing a new value of the quantity to be emitted inside the used range limits.

Incremental modification of the emitted value (see 6.3)

↓↑ Used to increment or decrement the emitted value.

STBY **Emission in standby mode (see 6.4)**

OPER **Emission in operational mode (see 6.4)**

Special function (see 6.8)

SPEC Access three automatic signal evolution functions whose parameters are programmable:

- Increment: the generated signal is stepping.
- Ramps: the generated signal increases or decreases in a linear way.
- Synthesizer: the signal moves according a cycle in which the stored values are successively recalled.

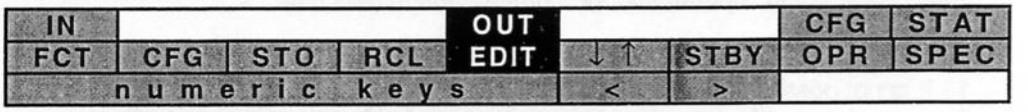
Two other special functions are available:
- Scaling: special conversion scale.
- Transmitter mode: the measurement is transcribed on the emission after signal normalization (4-20 mA or 0-10 V).

6.2 - Modifying a value to be emitted

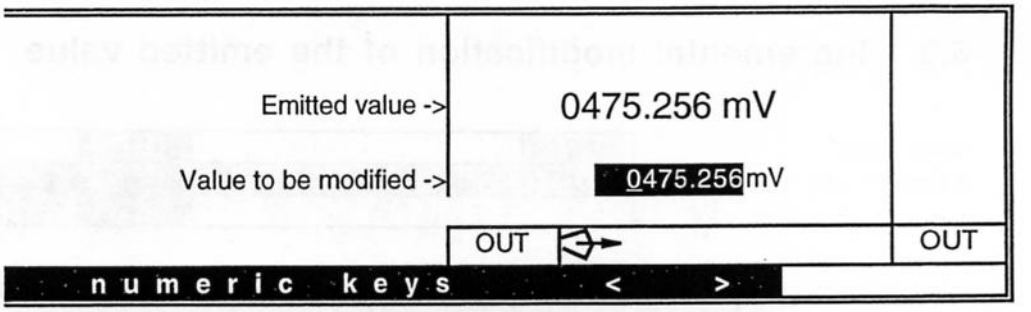
Upon switching on, the program gives a default value to the signal which is a null value (see 6.4). From the keyboard or an interface, the user may enter a new value or change the existing value.

HOW TO MODIFY A VALUE FROM THE KEYBOARD

Main menu
Access menu
Editor



In the editor, the "OUT" window is, for example, as follows:



Here, the unit emits 475.256 mV. This value also appears in inverted video in order to be changed. A cursor, placed under the leftmost figure, indicates that the value can be modified.

From this display, there are two possible options for changing the value:

1) Complete edition of a new value

Press	Results
[−] (if required) [•]	Minus sign (-) or decimal point.
[0] to [9]	Edition of the successive figures (the cursor moves one step to the right).
[ENT] or ..	Number validated or ...
..... [ESC]	.. new number edition.

After validation, the displayed quantity is present or not on the "OUT" terminals of the unit according to whether the emission is set to "operational" or "standby" mode (see 6.4).

NOTE: If the decimal number edited is higher than the display resolution (see appendix A) the unit performs a round computation.
Example : Over the 600 mV range, we edit 10.23789. After validation, only three decimals are displayed and we read 0010.238 mV.

2) Partial edition of a value

Move the cursor under the figure to be modified.

Select	Press	Results
<	or >	Moves the cursor under the figure to be modified.
−	0 to 9	Changes the figure marked by the cursor (minus sign at left).
ENT	or.....	The number is validated or ...
.....	ESC	.... not (wrong edition).

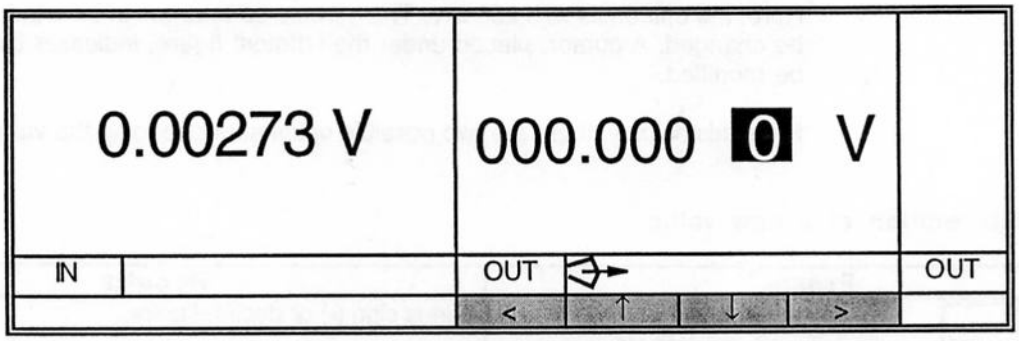
After validation, the displayed quantity is present on the "OUT" terminals of the unit according to whether the emission is set to "operational" or "standby" mode (see 6.4).

NOTES:
1 - It is not possible to change the decimal point.
2 - Any refusal activates the audible warning. The old value is maintained.

6.3 - Incremental modification of the emitted value

Main menu
Access menu

↓↑ Access the incremental editor and, for example, the display below:



The emitted value appears in the "OUT" window. The figure in inverted video can be changed.

< and > select the figure to be modified.

↑ Increments the selected figure (with carry).

↓ Decrements the selected figure (with carry).

The emitted value can then move step by step.
Any limit overload displays an error message.

6.4 - Standby or operational mode emission

When necessary, the emission can be switched to standby or operational mode.

Main menu
Access menu

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC

STBY Switches the emission to **ST**and**BY** mode. This is equivalent **to sending a null value in the current function.**

OPR Switches the emission to **OPeR**ational mode. The displayed value is present on the "OUT" terminals of the unit.

TABLE 5		AVAILABLE ICONS
Icon	Event	Comments
STBY 	Pressing **STBY** Pressing **OPR**	For safety reasons regarding the equipment connected to the **PJ6301**, it's better to switch to "**ST**and**BY**" mode before changing the value to be emitted. When you are sure of the value, switch to "**OPeR**ational" mode.

NOTE: Changing the emission parameters (range, type of thermocouple, reference junction) resets the emitted quantity or the quantity to be emitted to zero. This is equivalent to a power-up.

6.5 - Selecting an emission function

WARNING ! Before changing emission function make sure that the existing connections are compatible with the new function.
Make sure that there is no dangerous voltage on the wires or leads connected to the "OUT" terminals.

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
V		mA		Ω		Tc		Rt

Select the desired emission function (see specifications and ranges in appendix A).

V	Emitting DC voltages.
mA	Emitting DC currents.
Ω	Simulating resistances.
Tc	Simulating thermocouples.
Rt	Simulating RTDs.

After selection, the unit operates in this new function with the stored parameters. Another menu comes on the display. This new menu, particular to the selected function, is used to:

1) Display the parameters of the current function. They are indicated by the marker (see 2.5).

2) Change the parameters of the current function by selecting another prompt. To make this selection, refer to the configuration procedures explained on next pages.

6.6 - Configuring the emission functions

Configuring the emission functions stores into permanent memory a certain amount of parameters able to be changed (see table 6). The CFG prompt from the main menu opens the configuration menus, **for all the measurement functions, including the current function.**

IMPORTANT NOTE

FCT : modifies the current emission function and associated parameters only.

CFG : modifies parameters of all functions, including the current one.

TABLE 6	
Functions	**Modifiable parameters**
Voltage generator	Three ranges: 600 mV, 6 V, 60 V.
Resistance simulator	Two ranges: 600 Ω, 6 kΩ.
Thermocouple simulator	Eleven thermocouple types: K, T, J, E, N, L, S, R, B, Pl, Mo. Compensated terminals (RJ) or not. Three available measurement units: °C, °F, Kelvin.
RTD simulator	Four Platinum probe values: 100 Ω, 200 Ω, 500 Ω, 1 kΩ. One 100 Ω at 0°C Nickel probe. Three available measurement units: °C, °F, Kelvin.

NOTE: There is only one emission current range (60 mA) and no choice to be performed. When emitting current, the **PJ6301** is always an "active transmitter" (see 5.2).

6.6.1 - VOLTAGE GENERATION CONFIGURATION PROCEDURE

Main menu
Access menu
Functions
Range

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
V				Ω		Tc		Rt
		0.6V	6 V	60V				

Select one of the three ranges.

6.6.2 - RESISTANCE SIMULATION CONFIGURATION PROCEDURE

Main menu
Access menu
Functions
Range

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
V				Ω		Tc		Rt
	600Ω	6KΩ						

Select one of the two ranges.

6.6.3 - THERMOCOUPLE SIMULATION

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
V				Ω		Tc		Rt
RJ		TYPE				UNIT		

There are several options available in this menu:

1) Reference junction

RJ		TYPE			UNIT	
ON		OFF				

Select **ON** or **OFF** whether the **PJ6301** "sees" a receiver whose terminals are compensated or not in temperature (see 5.4).

2) Thermocouple type

RJ		TYPE			UNIT			
K	T	J	E	N		L	S	>>

Pressing **>>** displays the other thermocouples.

<<	R	B		PI	Mo	

Pressing **<<** (or **ESC**) returns to the beginning.
Select the desired thermocouple.

3) Simulation unit

Jr		TYPE			UNIT	
°C		°F		K		

Select the desired unit.

6.6.4 - RTD SIMULATION

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
V				Ω		Tc		Rt
P100	P200	P500	P1K			N100		UNIT

Two options are available:

1) Probe type

P100	P200	P500	P1K		N100	

Select the desired Platinum probe to be simulated.
Or, select the 100 Ω at 0°C Nickel probe.

2) Simulation unit

P100	P200	P500	P1K		N100		UNIT
°C		°F		K			

Select the desired unit.

6.7 - Storing a value to be emitted

In emission-simulation, the **PJ6301** has 100 memories (from 00 to 99) in which a value, entered on the keyboard, can be stored whatever the function and range used. This storage enables the user to successively recall the memories either manually or according to the synthesizer program. In that case, the signal evolution is automatic.

6.7.1 - HOW TO STORE A VALUE

Main menu
Access menu

IN				OUT			CFG	STAT
FCT	CFG	**STO**	RCL	EDIT	↓ ↑	STBY	OPR	SPEC

In the "OUT" window:
Val = XXXXX where X is the value currently stored and
No = 0 No, the memory number.

- Enter the value to be stored, then validate with **ENT**, or simply validate the edited value if suitable.
- Enter the memory number (from 00 to 99). After validation, storage is effective and the new value takes the place of the old value, then the display indicates the parameters of the next memory.
- Enter the next value **Val**, then number **No** if desired.
- Proceed as above for the successive values if desired.
- Exit from the editor by **ESC** or **MNU**.

6.7.2 - HOW TO RECALL MEMORIES

Main menu
Access menu

IN				OUT			CFG	STAT
FCT	CFG	STO	**RCL**	EDIT	↓ ↑	STBY	OPR	SPEC

The unit asks for the memory number **No** to be recalled.
- Enter this number (from 00 to 99), then validate. Two alternatives may occur:

1) The value is out of the range limits: the unit refuses to recall the memory and displays an error message.
2) The value is inside the range limits: it is displayed in the "OUT" window together with the unit corresponding to the function and range used. The value is present on the "OUT" terminals of the unit according to whether the emission is set to "operational" or "standby" mode.

Note that recalling successively the memories by increasing or decreasing order is performed by means of the synthesizer program (see 6.8.3).

EXAMPLE : Setpoint value emission

4.0000 mA and 20.0000 mA to be emitted.

Function	Select				Press		
1) Storing into memories							
Store value 4 in memory 1	OUT	STO	4	ENT	1	ENT	
Store value 20 in memory 2			20	ENT	2	ENT	MNU
2) Recalling memories							
Place the **PJ6301** in current generator mode	OUT	FCT	mA				
Emit 4 mA (recalling memory 1)		RCL			1	ENT	
Emit 20 mA (recalling memory 2)		RCL			2	ENT	

These two values can then be emitted by recalling the memory numbers.

NOTE: The memories store numeric values but not physical quantities.
In example above, the value 20 stored in memory 2 gives 20 Ω if the memory is recalled in resistance simulation, or 20°C if recalled in temperature simulation, or 20 **mA** if recalled over the 60 mV range.

PROG Enables the user to program the evolution parameters:

I = Increment value without programming limit.
N = Number of increment(s) with $1 \leq N \leq 65,000$.
T = Step duration with $0.5 \leq T \leq 6,500$ seconds.
These parameters are stored into permanent memory.

2) Cycle execution

Starts an increasing increment cycle. (*)

Starts a decreasing increment cycle. (*)

STOP Stops cycle execution.

HOLD Holds cycle execution.

REST Restarts cycle execution.

Note that this icon is present in the "OUT" window when a cycle is in progress.

(*) External trigger
Executing a series of increments may be done by closing of an external contact connected to the "trig" terminals located at back of the unit (see 4.6.2).

WARNING: This option results from a choice made in one of the unit configuration menus (see 7.3).

EXAMPLE : Incrementing from 4 to 20 mA

One wishes to check current loop receivers. Instead of the transmitter, place a **PJ6301** *supplying a current from 4 to 20 mA per eight increments of 2 mA.*

Set the unit to current emission and proceed as follows from the main menu:

Function	Select	Press
Enter in the program, then in the editor.	OUT SPEC INCR EDIT	
Edit the initial value of 4 mA.	4	ENT
Exit from the editor and return to the previous menu.	ESC	
Edit the cycle parameters.	PROG	
Edit the increment value (2 mA).	2	ENT
Edit the number of increments (8).	8	ENT
Edit the step duration (see note).	X	ENT
Execute increasing increments.	⌐	) or by external
Execute decreasing increments.	¬	) trigger
If required: Stop cycle.	STOP	
Hold cycle.	HOLD	
Restart cycle execution.	REST	

NOTE: The **PJ6301** may be used simultaneously to make measurements on the loop. One can then operate in triggered measurements (see 4.6) and program the same time in triggered measurements and in increment execution. This time is long enough to be able to start increment cycle after the triggered measurement cycle. The value measured at each step will then be stored.

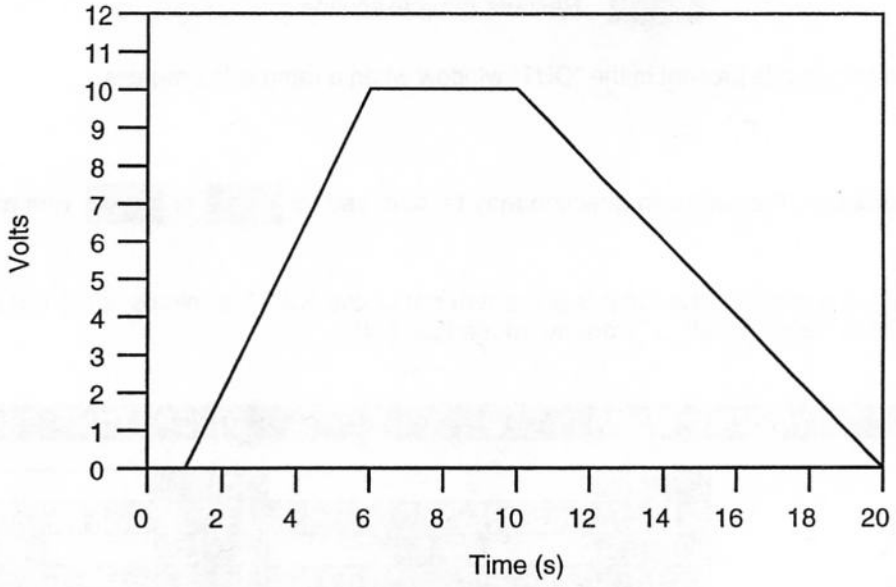
6.8.2 - RAMP GENERATION

Generating a ramp is supplying, on the output terminals, a signal which changes linearly with time. The unit may generate two types of ramps:

1) A simple increasing or decreasing ramp

We program
- Δ : which is the difference between the initial and final value (amplitude).
- ΔT : which is the ramp duration.

2) A cyclical increasing then decreasing ramp is shown below.



We program
- **Δ** ramp amplitude (here 10 V).
- **N** number of cycles.
- **T 0** initial value home time (here 1 s).
- **T0 -> 1** rise time (here 5 s).
- **T 1** final value home time (here 4 s).
- **T1 -> 0** fall time (here 10 s).

SIMPLE RAMPE **OPERATING PROCEDURE**

Main menu
Access menu
Functions
Ramps

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
INCR		RAMP		SYNT		SCAL		TRX
PROG	⌐	⌐	STOP	HOLD	REST	EDIT	⌐	PROG

EDIT Access the editor (see 6.2) to edit the ramp initial value. Press **ENT** to validate, then press **ESC** to return to the menu. By default, this value is the one emitted or to be emitted.

PROG (at left of the menu) is made to enter the parameters of the simple ramp Δ and ΔT (see above).
Δ should be between the used range limits and $0.1 \leq \Delta T \leq 100{,}000$ seconds.

Starts execution of an ascending ramp.

Starts execution of a descending ramp.

STOP Stops ramp execution.

HOLD Holds ramp execution.

REST Restarts ramp execution.

Note that this icon is present in the "OUT" window when a ramp is in progress.

NOTES:

1 - During execution, the evolution direction may be reversed by or with no need to hold the ramp execution.

2 - When starting execution, the ramp is present or not on the "OUT" terminals of the unit according to whether the emission is set to "operational" or "standby" mode (see 6.4).

CYCLICAL RAMP OPERATING PROCEDURE

Main menu
Access menu
Functions
Access menu

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
INCR		RAMP		SYNT		SCAL		TRX
PROG			STOP	HOLD	REST	EDIT		PROG

EDIT Access the editor (see 6.2) to enter the ramp initial value. Press **ENT** to validate, then press **ESC** to return to the menu.

PROG (at right of the menu) is made to edit the six parameters of the cyclical ramp such as indicated above.
Δ should be inside the used range limits.
1 ≤ N ≤ 65,000.
0,1 ≤ Time ≤ 100,000 second(s), for the four time parameters.

Starts execution of a cycle including one or several ramps.

STOP Stops cycle execution.

HOLD Holds cycle execution.

REST Restarts cycle execution.

Note that this icon is present in the "OUT" window when a ramp is in progress.

EXAMPLE : Time base

To analyze evolution of very low phenomena we use an X, Y recorder. We need a time base supplying sawteeth with period adjustable from 10 to 100 seconds and amplitude equal to 2.5 V.

Aim	Select			Press
Enter in the ramp menu.	OUT	SPEC	RAMP	
Set the initial level to 0 V.	EDIT	0	ENT	ESC
Program the cyclical ramp parameters.	PROG	at right of the menu		
Set the sawtooth amplitude to 2.5 V	2	.	5	ENT
Set the number of cycles to 10	1	0		ENT
Enter the initial value home time (minimum 100 ms)	.	1		ENT
Enter the sawtooth rime time (in seconds)	from 10 to 100 ...			ENT
Enter the final value home time (minimum 100 ms)	.	1		ENT
Enter the fall time (minimum 100 ms)	.	1		ENT
Start the sawtooth.				

Don't forget to use the help key !

?

The synthesizer enables the user to recall the contents of successive emission memories (see 6.5). This recall can be performed either manually, memory per memory, or automatically by starting one or several memory processing cycles.
One can then generate a signal whose evolution depends on the values stored into memory.

SYNTHESIZER OPERATING PROCEDURE

Main menu
Access menu
Functions

IN			OUT				CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
INCR		RAMP		SYNT		SCAL		TRX
M ↑	M ↓		CYCL	STOP	HOLD	REST		PROG

Three options are available:

1) Editing parameters

M ↑	M ↓		CYCL	STOP	HOLD	REST		PROG

M1 = First memory cycle number.
M2 = Last memory cycle number.
T = Time between two successive scannings with $0.5 \leq T \leq 6\,500$ seconds.
N = Number of cycles with $1 \leq N \leq 65\,000$.
All these parameters are stored into permanent memory.

2) Executing a manual cycle

M ↑	M ↓	

M ↑ Recalls the next memory in the programmed cycle.

M ↓ Recalls the previous memory. In both cases, scanning is made by rotational selection.

3) Executing an automatic cycle

	CYCL	STOP	HOLD	REST	

CYCL Starts cycle(s) for recalling memories in increasing order (*).

STOP Stops cycle execution.

HOLD Holds cycle execution.

REST Restarts cycle execution.

Note that this icon in present in the "OUT" window when a cycle is in progress.

(*) External trigger

A step by step or cyclical recall may be done by closing an external contact connected to the "trig" terminals located at back of the unit (see 4.6.2).

WARNING: This option results from a choice made in one of the unit configuration menus (see 7.3).

EXAMPLE : Rise in temperature

One wishes to simulate rise in temperature of an RTD placed on a component of an internal combustion engine. Under certain conditions, this temperature changes from 100°C to 250°C in less than 6 minutes.

We have a table composed of 18 temperature values taken in triggered measurements every 20 seconds and we wish to work from this table.

TEMPERATURE EVOLUTION TABLE									
TIME (seconds)	20	40	60	80	100	120	140	160	180
TEMPERATURE (°C)	143.8	172.5	192.8	209.3	221.0	228.2	233.4	237.3	240.1
TIME (seconds)	200	220	240	260	280	300	320	340	360
TEMPERATURE (°C)	241.9	243.5	245.6	246.8	247.9	249.0	249.8	250.0	250.0

1) Enter the values into memory

The temperature values of the table above are entered into memory from 0 to 18 (see 6.7), the initial value 100 (for 100°C) is placed into memory 0.

2) Select the function and type of probe to be simulated

- Set the unit in RTD simulation (see 6.6.4) and select the type of probe to be simulated.

3) Edit the synthesizer parameters

From the main menu:

- Select **OUT** then **SPEC** then **SYNT**.

- Select **PROG**, then enter and validate by pressing **ENT**.

  0 for M1 (first memory).

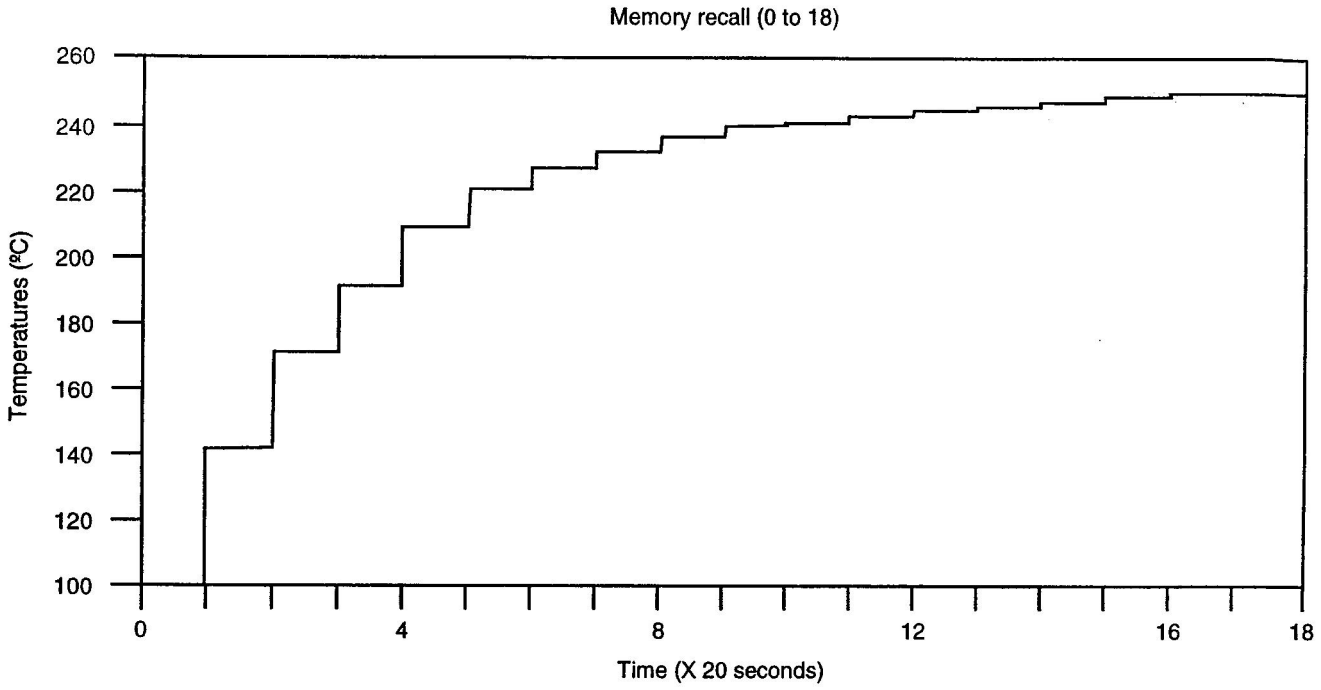
  18 for M2 (last memory).

  20 for T (time between each recall).

  1 for N (number of cycles).

4) Executing cycle

- Select **CYCL** . The cycle runs with display of the recalled values together with the memory address. The table temperature measurements are simulated according to the curve below:



A better definition can be obtained by using a greater number of stored values in a greater number of memories.

6.8.4 - SCALING

Without scaling, the value read in emission (A) and the value present on the output terminals are equal. The E = f (A) conversion function is then an y = ax straight form where slope (a) is equal to 1. In some applications, a different slope and/or an offset shift may be necessary. As this conversion function is a straight line, two points are sufficient to define it. When the conversion function is non linear (and continuous) an approached curve may be considered by defining consecutive straight segments. The CL8500 is able to set from 1 to 9 straight segments from 2 to 10 points whose coordinates are stored into permanent memory.

Scaling in emission is similar to measurement scaling (see 4.5.3).

SCALING OPERATING PROCEDURE

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
INCR		RAMP		SYNT		SCAL		TRX
ON		OFF			PROG			

Two options are available:

1) ON/OFF

ON		OFF	

ON Scaling is active with the stored parameters.

OFF Scaling is inactive.

WARNING: With the scaling active, execution of ramps and usage of the transmitter mode are not possible.

Note that this icon is present in the "OUT" window when the emitted value is not displayed. This is the case when the scaling is validated.

2) Stored parameters

ON		OFF			PROG			
↑	↓	EDIP	ADDP	RES	UNIT		CLRP	CLRA

The display indicates the list of x- and y- coordinates of the stored points. This list is composed of two lines as a minimum (one line per point).
◄ is the line cursor which enables the user to select one line in the list.
X0 and Y0 are the coordinates of the first point.
X1 and Y1 are the coordinates of the second point and so on if the list is composed of more than two points.
The x-coordinates values are the values displayed in emission.
The y-coordinates are the equivalent emitted values.
The displayed values may have a unit selected from the menu present under the coordinate list.

Several options are available:

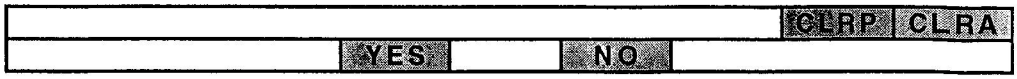
Moving in the list

↑	↓	

↑ Moves the line cursor to the previous line.

↓ Moves the line cursor to the next line.

Resetting to zero



CLRP then **YES** Clears from the memory the coordinates of the point marked by the cursor line.

CLRA then **YES** Clears all the coordinates from the memory and returns to the default coordinates (slope conversion 1).

Before editing new parameters, it is advisable to reset the memory to zero by selecting **CLRA** then **YES** in order to:
1 - Make room for the new points to be edited.
2 - Avoid contamination of the new list by the older. Note that **all the coordinates of the list are taken into account when scaling is active.**

Programming the parameters

EDIP Edits coordinates of the point marked by the line cursor. These values can then be modified.

Note: In voltage emission and resistance simulation, we edit "volts" and "ohms" (instead of millivolts and kilo-ohms).
Example : We wish to output 400 mV for 10.00 bars displayed.
- Set the unit to voltage emission, 600 mV range (see 6.4.1).
- Edit X = 10.00 (RES = 2) and Y = 400 e-3 (instead of 400) .
Note that the unit emits the same electrical quantities, simulates the same physical quantities as operating without scaling. Range should be chosen to avoid any emission overrange.

ADDP Adds a new point. The place occupied in the list by this new point takes account of the value of the other x-coordinate points. **The unit sorts out the x-coordinate values by increasing order.**

RES Sets the resolution (5 decimals as a maximum) of the displayed values (X).

WARNING: If the requested resolution is too high, the edited values are displayed with an asterisk indicating that the display capacity is exceeded (see 2.7). These values cannot be taken into account.

A prompt of the menu calls up the alphanumeric editor which is similar to the numeric editor.

Unit name

The alphanumeric editor displays, in inverted video, the name of the current unit present in permanent memory.

To edit a name, edit each character successively:
- Select the group including the desired character.
- Select **CAPS** to switch to lower- or upper-case or vice-versa.
- Select the desired character. The cursor moves to the right.
- Edit the following character if desired (3 characters maximum).
- **<** and **>** move the cursor either to the left or to the right.
- Then, validate by pressing **ENT**.

6.8.5 - ACTIVE TRANSMITTER MODE

The transmitter mode enables the user to use the **PJ6301** in telemetry loops with the unit accuracy. Depending on the display present in measurement, a signal from 0 to 10 V or from 4 to 20 mA is present on the "OUT" terminals of the unit. The measurement may be processed, such as scaling for example.

Programming the transmitter mode consists in editing two points:
M1 is the **displayed value** in measurement to output 4 mA or 0 V on the "OUT" terminals.
M2 is the **displayed value** in measurement to output 20 mA or 10 V on the "OUT" terminals.

TRANSMITTER OPERATING PROCEDURE

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
FCT	CFG	STO	RCL	EDIT	↓ ↑	STBY	OPR	SPEC
INCR		RAMP		SYNT		SCAL		TRX
	ON	OFF			PROG	4 - 20	0 -10	

Three options are available:

1) Output quantity

				4 - 20	0 -10

4 - 20 For a 4 to 20 mA output signal.

0 - 10 For a 0 to 10 V output signal.

2) Editing parameters

	ON	OFF		PROG	4 - 20	0 -10	
numeric keys				<	>	>>	EXP

The "OUT" window indicates two stored values M1 and M2 where:
M1 : is the measurement value corresponding to 4 mA or 0 V emission.
M2 : is the measurement value corresponding to 20 mA or 10 V emission.
There is no programming limit but M1 should not be higher than or equal to M2.

3) ON/OFF

	ON	OFF	

ON Transmitter mode is active.

TRX Note that this icon is present when the function is validated.

The value of the emitted or simulated signal is displayed in the "OUT" window . This signal is present or not on the "OUT" terminals according to whether the emission is set to "operational" or "standby" mode (see 6.4).

OFF Transmitter mode is inactive.

NOTE: Using the editor or setting another emission-simulation function active, deactivates the transmitter.

7 - General configuration

This chapter deals with configuration of all the parameters which concern the unit and its interfaces (RS 232, IEEE-488). Configuring the measurement and emission functions are explained in the previous sections (see 4.3 and 6.6).

REMINDER: *To read the unit configuration state:*

- Select **STAT** *then* **CFG** *from the main menu.*

- Return to the main menu by pressing **MNU**.

If a modification is required, select **CFG** from the main menu. Switch to the access menu.

F/R	Selects either the front or rear terminal board	see 7.1.
INTR	Specifies the interface together with its parameters	see 7.2.
LANG	Language of the displayed messages	see 7.4.
ADJ	**WARNING: This prompt should be used for maintenance purposes only.**	
CNTR	Display contrast	see 7.5.
LIGH	Display lighting	see 7.6.
ETRG	External trigger assignment	see 7.3.
STO	Storing the current general configuration	see 7.7.
RCL	Recalling the stored configuration	see 7.7.

7.1 - Selecting the front or rear terminal board

- **In measurement**: the front and rear terminals are connected. There is no switching except that of the temperature device for the reference junction (see 3.4).
- **In emission**: the front and rear terminals are connected. But the unit switches a signal regulation device on the output terminals.

WARNING: Never connect the front terminals when the rear terminal board is selected or vice-versa.

Main menu
Access menu

IN				OUT			CFG	STAT
F/R	INTR	LANG	ADJ	CNTR	LIGH	ETRG	STO	RCL
		FRNT		REAR				

Select **FRNT** or **REAR** depending on the terminal board to be used. After this selection, the unit automatically returns to the access menu.

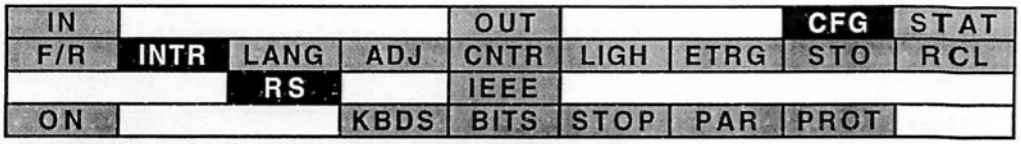
TABLE 6	AVAILABLE ICONS
Icon	Event
	Pressing **FRNT** from the F/R access menu.
REAR	Pressing **REAR** from the F/R access menu.

7.2 - Specifying the interface

The aim is to select the parameters of the RS 232 interface (transmission rate, parity, etc.) If the optional IEEE-488 board is present, select one of the two interfaces.

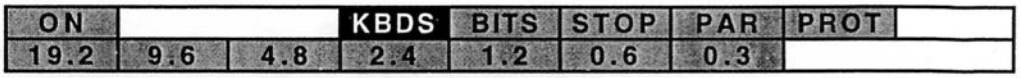
7.2.1 - RS 232 SERIAL LINK PARAMETERS

Main menu
Access menu
Interface selection
RS menu



Several options are available:

1) Transmission rate



- Select the desired transmission rate (expressed in **K**ilo**B**au**DS**) compatible with the equipment connected to the RS 232 link.

2) Number of bits

- Select the desired number of bits: 7 or 8.

3) Number of stop bits

- Select the desired number of stop bits: 1 or 2.

4) Parity check

- Select the desired prompt (even parity, odd parity or no parity). If you do not know this parameter, select **IGNP** (**IGN**ore **P**arity).

5) Protocol

- Select the desired prompt. XON/XOFF or Data Terminal Ready or no protocol.

6) Setting ON

Validates the RS 232 serial link and returns to the main menu.

7.2.2 - OPTIONAL IEEE-488 BUS PARAMETERS

Only one parameter is to be programmed which is the address of the **PJ6301** on the bus.

Main menu
Access menu
Interface selection

IN				OUT			CFG	STAT
F/R	INTR	LANG	ADJ	CNTR	LIGH	ETRG	STO	RCL
		RS		IEEE				
ON		ADDR						

ADDR Access the editor to edit the unit address (from 0 to 30).

ON Validates the IEEE-488 interface. When there is no interface board connected, the units displays an error message.

7.3 - External trigger assignment

In measurement and emission/simulation, some cyclical functions are triggered from the keyboard. This trigger may also be performed by closing of an external contact connected to the "trig" terminals located at back of the unit (see 4.6.2).

The functions concerned are:
- Triggered measurements (see 4.6).
- Increment generation (see 6.8.1).
- Ramp generation (see 6.8.2).
- Synthesizer signal generation (see 6.8.3).

For each function, an external trigger may be selected from the menu as indicated below:

Main menu
Access menu
Functions

IN				OUT			CFG	STAT
F/R	INTR	LANG	ADJ	CNTR	LIGH	ETRG	STO	RCL
TRGM	BTRG	M ↑	M ↓	CYCL	⌐¯	¯⌐	⌐	¯

Triggered measurements:

TRGM A measurement is stored each time the external trigger contact closes.

BTRG A measurement burst is stored when the external trigger contact closes.

Synthetizer:

M ↑ The emission memories (see 6.7) are called one by one, by increasing order, each time a trigger command occurs

M ↓ The emission memories (see 6.7) are called one by one, by decreasing order, each time a trigger command occurs.

CYCL The emission memory recall cycles start each time a trigger command occurs.

Increments:

⌐¯ An increasing increment cycle starts each time an external trigger command occurs.

¯⌐ A decreasing increment cycle starts each time an external trigger command occurs.

Ramps:

⌐ Execution of an ascending ramp starts each time an external trigger command occurs.

¯ Execution of a descending ramp starts each time an external trigger command occurs.

7.4 - Language of the displayed messages

Information and messages displayed are available in French (FRA), English (ENGL) and German (DEUT).

Main menu
Access menu
Languages

IN				OUT			CFG	STAT
F/R	INTR	LANG	ADJ	CNTR	LIGH	ETRG	STO	RCL
	FRA		ENGL		DEUT			

- Select the desired language.

7.5 - Display contrast

Depending on the lighting conditions, it may be necessary to change the display contrast.

Main menu
Access menu

IN				OUT			CFG	STAT
F/R	INTR	LANG	ADJ	CNTR	LIGH	ETRG	STO	RCL
	-		+		>I<			

Select **−** or **+** to get less or more display contrast.

Select **>I<** to return to the default contrast.

After selection, press **ESC** to return to the access menu.

7.6 - Display lighting

Main menu
Access menu

IN				OUT			CFG	STAT
F/R	INTR	LANG	ADJ	CNTR	LIGH	ETRG	STO	RCL

Toggles ON or OFF the display lighting.

7.7 - Configuration memory

Upon switching on, five memories, from 1 to 5, store the unit default configuration (see 2.4). Different configurations can then be stored in these memories and recalled at any time.

7.7.1 - STORAGE

Main menu
Access menu

IN				OUT			CFG	STAT
F/R	INTR	LANG	ADJ	CNTR	LIGH	ETRG	STO	RCL
	1	2	3	4	5			
			YES		NO			

By confirming one of the numbers, the current unit configuration is stored into memory.

7.7.2 - RECALLING A CONFIGURATION

Main menu
Access menu

IN				OUT			CFG	STAT
F/R	INTR	LANG	ADJ	CNTR	LIGH	ETRG	STO	RCL
	1	2	3	4	5			
			YES		NO			

By confirming one of the numbers, the recalled configuration replaced the current one.

Note: All the parameters (range, alarm threshold, number of increments) which characterize a configuration stored under an order number are valid again when recalling this order number.
However, parameters not stored into permanent memory are not taken into account. They are:

- Setting ON mathematical process on the measurement (except min./max. display and printer).
- Interruption of a continuous cycle (switching to HOLD position).
- Emitted value (except function and range which are stored).
- Scaling in emission and transmitter mode validated.

Moreover, the stored measurement bursts, not dependent from the configuration, are not linked to a saved configuration.

EXAMPLE : Using different types of sensors

In a thermic processing works we have several types of temperature sensors such as K and J and several 100 Ω at 0°C Platinum RTDs. One wishes to perform periodic checks on these sensors and print the temperatures measured by the thermocouples.

Three configurations should be entered then stored:

	Select				Press				
Configuration 1									
Select K thermocouple	IN	FCT	Tc	TYPE	K				
Set RJ ON				RJ	ON				
Couple break detection				TCX	ON				MNU
Enter parameters	IN	PROC	PRNT	M/N	XX	ENT			
Printer (see 4.5.6)				CFG	XX	ENT	XX	ENT	MNU
Save configuration 1	CFG	STO	1						MNU
Configuration 2									
	Same as configuration 1, but select type J thermocouple, then ...								
Save configuration 2	CFG	STO	2						MNU
Configuration 3									
Select Pt 100	IN	FCT	Rt	P100					
3-wire connection				3W					
Save configuration 3	CFG	STO	3						MNU

Note:

XX Numeric keys depending on the parameter values.

The measurements are expressed in °C which is the default unit.

Then, recall the desired configuration:

CFG RCL 1 to perform measurements on thermocouple K, then MNU or

CFG RCL 2 to perform measurement on thermocouple J, then MNU and

IN PROC PRNT ON to print the measurements, then MNU.

Configuration 3 will be called as follows:

CFG RCL 3 to perform measurements over Pt 100 RTD.

This example shows that operating the **PJ6301** becomes easier by using the configuration memories.

8 - Operation with IEEE-488 and RS 232 interfaces - remote commands

8.1 - Introduction

The **PJ6301** can be remote controlled by an IEEE-488 controller, a computer or a terminal, either via the asynchronous serial interface included as standard equipment on all instruments (RS 232), or by an optional IEEE-488 bus if installed.

For convenience, any unit or system capable of handling this remote control function will be referred to in this document as a controller.

The **PJ6301**'s IEEE-488 interface has been implemented with the following functions:

AH1, SH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2

The remote control mode and parameters must be set from the instrument's keyboard (see 7.2).

Most remote commands and parameters are the same for both modes, with the exception of the following differences:
- the IEEE-488 mode will only work when the **PJ6301** is operating on AC power.
- in RS 232 mode:
  . remote control is possible during battery-powered operation,
  . the REM, LLO and LOC commands replace the corresponding messages of the IEEE-488 mode,
  . there is no service request facility (SRQ),
  . the IEEE-488 handshake is replaced by a protocol.

8.2 - Syntax

The **PJ6301** 's remote control commands meet the IEEE-488.2 standard.

8.2.1 - COMMAND MESSAGES

The controller talks to the **PJ6301** by means of **command messages**. These messages can contain several elementary commands separated by <;> (hexadecimal code 3B or decimal code 59).

The message command must end with a **terminator**, as follows:

- either the character **<LF>** (hexadecimal code 0A or decimal code 10),
- or the message **<EOI>** on an IEEE-488 bus (line EOI active during the last character),
- or **<LF + EOI>**

In RS 232 mode, the terminator must always be an **<LF>**.

Characters in a message command can be either Upper or Lower Case.

Command message structure:

COMMAND1;COMMAND2;...;COMMANDn<EOI> or <LF> or <LF + EOI>

An elementary command which will be referred to as a **command**, is composed of a **header** followed by one or more **arguments** defining the command.

The header must be separated from arguments by at least one **space** < > (hexadecimal code 20 or decimal code 32) and arguments must be separated by <,> (hexadecimal code 2C or decimal code 44).

Extra spaces before or after the header or arguments are ignored.

Command headers conforming to IEEE-488.2 standard all start with a <*> character.

Command structure:

HEADER ARGUMENT1,ARGUMENT2,...,ARGUMENTn

The **PJ6301** recognizes three types of argument: **decimals, mnemonics** and **blocks of definite length.**

Decimals:

Decimal arguments are used to specify a whole or fractional numerical value. They are composed of a mantissa and an optional exponent and may optionally be followed by a **suffix** if necessary.

The mantissa is a whole or fractional number (the whole and fractional parts are separated by <.>), with or without a sign, including a maximum of 255 characters (non-significant head zeros <0> excluded).

The exponent is a signed or unsigned whole number, up to four figures long, between - 3 200 and + 3 200.

Mantissa and exponent are separated by the character <**e**> or <**E**>. Spaces before or after the <e> or <E> are ignored.

The suffix associates a unit (or a multiple or a submultiple) to the numerical value.

The **PJ6301** recognizes the following suffixes:

- voltages: UV (µV), MV (mV), V,
- currents: UA (µA), MA (mA), A,
- resistances: UOHM (µΩ), MOHM (mΩ), OHM, KOHM (kΩ),
- temperatures: CEL (°C), FAR (°F), K (Kelvin).
- times: MS (ms), S.

By default, the voltages are expressed in volts, the currents in milliamperes, the resistances in ohms and the times in seconds.

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:

- function mnemonics [FCT]:
  "V" "MA" "OHM" "TC" "RT".

- range mnemonics [RAN]:
  "V60" "V6" "MV600" "MV60" "V_AUTO",
  "MA60",
  "OHM6000" "OHM600" "OHM_AUTO",
  "TC",
  "RT".

- sensor type mnemonics [TYPE]:
  "TYP_K" "TYP_T", "TYP_J" "TYP_E" "TYP_N" "TYP_L" "TYP_S" "TYP_R" "TYP_B"
  "TYP_PL" "TYP_MO",
  "TYP_PT100" "TYP_PT200" "TYP_PT500" "TYP_PT1000" "TYP_NI100".

- temperature unit mnemonics [TEMP_UNIT]:
  "CEL" "FAR" "K".

- connection mnemonics [CONNECTION]:
  "WIRE4" "WIRE3" "WIRE2" : 4-wire connection (WIRE4), 3-wire connection (WIRE3) or 2-wire connection (WIRE2) of the resistance or the resistive probe in measurement.
  "TXA" "TXP" : active transmitter (TXA) or passive transmitter (TXP) when measuring current.
  "TCX_ON" "TCX_OFF" : thermocouple break detection active (TCX_ON) or inactive (TCX_OFF).

- reference junction mnemonics (JR):
  "JR_ON" "JR_OFF" : internal reference junction compensation active (JR_ON) or inactive (JR_OFF).

The minimum and maximum number of arguments and the type of each one are specific to 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 [ ].

Eight-bit byte blocks of definite length :

These arguments are used to specify binary data which are not numerical, nor mnemonics. They are as follows : #NX..X0..0 where :
N: non-zero numerical character (1 to 9).
X..X: N numerical characters representing, in decimal notation, the number of eight-bit bytes in the argument (not including #NX..X).
0..0: X..X eight-bit bytes representing the data to be acquired.

In case these eight-bit bytes are characters, in addition to the alphanumerical characters, the unit will recognize the following ones (according to ASCII code page 437):
" " ; "%" ; "." ; "(" ; ")" and "/".
"°" (code 248) ; "µ" (code 230) : "Ω" (code 234).

8.2.2 - RESPONSE MESSAGES

Certain commands imply a response from the **PJ6301**. The headers of these commands end with <?> and are referred to as **queries.**

When a command message contains queries, the **PJ6301** 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 + EOI>.

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

The IEEE-488.2 standard defines eleven types of response elements ; the **PJ6301** 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).
- Character strings starting and finishing with <">.
- Eight-bit byte arbitrary blocks of definite length.
- Arbitrary block of 7 bit ASCII characters (except <LF>) always at the end of the message.

8.2.3 - DETECTING REMOTE CONTROL ERRORS

The IEEE-488.2 standard defines four types of error according to their cause and report in the Event Status Register ESR.

Command error:
Illegal command code (unknown header, illegal argument code, type or number of arguments different to those defined by the command). The command and all the following message commands are not executed. The CDE bit of ESR is set to 1.

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. The EXE bit of ESR is set to1.

Instrument error:
The command cannot be executed for reasons to do with the current state of the instrument. All following message commands are executed. The DDE bit of ESR is set to 1.

Querry error:
See exception procedures, 8.2.7.

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

8.2.4 - INSTRUMENT REGISTERS, SERVICE REQUEST

The unit contains several registers able to generate a service request through the report and enable actions:

One condition register:
ISR (Instrument Status Register).

Two event registers:
ESR (standard Event Status Register) .
ISCR (Instrument Status Change Register).

One status register:
STB (STatus Byte) which stores the status word of the IEEE-488 interface each time a change occurs.

Three enable registers:
ESE (standard Event Status Enable).
SRE (Service Request Enable).
ISCE (Instrument Status Change Enable register).

One configuration register:
PCR (Programmed Configuration Register).

Definition of register bits

ISR, ISCR, ISCE registers:

b12							b8			b4					b0
REM	ACCU	ETRIG		SPEC	SAT	OOVL	OUT			MEM	L2	L1	IOVL	EXTR	MEAS
⎍	⌐	⌐		⎍	⌐	⌐	⌐			⎍	⎍	⎍	⌐	⌐	⌐

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.

When an ISCR bit is set to 1, if the corresponding ISCE bit is at 1, the ISB bit of STB register (STatus Byte) goes to 1.

MEAS:
Indicates that a new measurement is present since the last acquisition. This bit is reset to 0 by reading the measurement.

EXTR:
Indicates that a new extremum is present (minimum or maximum) since the last acquisition. This bit is reset to 0 by reading the extrema.

IOVL:
Overload : signals that the available measurement is out of limits.

L1:
Alarm 1 is in alarm state.

L2:
Alarm 2 is in alarm state.

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 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.

ETRIG:
Goes to 1 when an external trigger is detected but cannot be executed according to the unit current state. Reset to 0 by reading ISR.

ACCU:
Indicates the battery must be recharged.

REM:
"REMote" state, only the LOC key of the keyboard is active.

PCR register:

b12							b8				b4				b0
LOCK	REAR				SPEC	OSCAL	STBY	MINMAX	L2	L1	FILT	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.

FILT:
Measurement filtering is validated.

L1:
Alarm 1 is set to "supervision" mode.

L2:
Alarm 2 is set to "supervision" mode.

MINMAX:
Indicates that the unit displays the minimum and maximum measurements.

STBY:
The emission-simulation part is set to standby mode (0 on output).

OSCAL:
Emission-simulation setpoint scaling according to the programmed law.

SPEC:
Indicates that an automatic evolution function of the emission-simulation setpoint is selected (it can be running, held or ended).

REAR:
Indicates that the rear terminal board is selected.

LOCK:
"Remote" state locked, only the controller can reset the unit to "local" mode (valid keyboard).

ESR, ESE registers:

b7							b0
PON		CDE	EXE	DDE	QYE		OPC

When an ESR bit is set to 1, if the corresponding ESE bit is at 1, the ESB bit of STB goes to 1.

PON:
Set to 1 at each power on cycle of the instrument or each time the IEEE-488 interface mode changes (i.e: each time the interface becomes active).

CDE:
Command error: unknown header or incorrect arguments.
The following message commands are not executed.

EXE:
Execution error: usually arguments out of limits. The following message commands are executed.

DDE:
Instrument dependent error: usually arguments out of limits or inconsistent with the current state of the instrument. The following message commands are executed.

QYE:
Query error: error acquiring a response message.

OPC:
Operation complete: set to 1 after the command *OPC as soon as all pending commands are complete.

STB, SRE, status word registers:

b7							b0
	MSS RQS	ESB	MAV	EAV	ISB		

When one of the status word bits (other than RQS) goes to 1 and the corresponding SRE bit is set to 1, the RQS bit in the status word and the MSS bit in STB are set to 1 and the SRQ bus line becomes active.

When the controller receives the IEEE-488 interface status word by initiating a serial poll, the interface unasserts the SRQ line and the RQS bit goes to 0, whereas the MSS bit in STB only goes to 0 when the service request has disappeared.

ESB:
Event Status Register report.

MAV:
Message available: at least one eight-bit byte available in the output buffer.

EAV:
Error message available: at least one error message available in the fault queue.

ISB:
Instrument Status Change Register report.

8.2.5 - INPUT BUFFER

IEEE-488 mode:

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).

Each eight-bit byte of the input buffer is linked to an attribute which stores the state of the EOI line of the IEEE-488 bus and memorizes the GET message as specific eight-bit byte.

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

Once it is full, the unit inhibits the handshake by pulling down the NRFD (Not Ready For Data) line which is freed as soon as an eight-bit byte has been decoded, authorizing the controller to send a new eight-bit byte.

The input buffer is cleared during each power on cycle and each time a DCL (Device Clear) or SDC (Selected Device Clear) message are received on the IEEE-488.

RS 232 mode:

The input buffer works in the same way, except for the following details:

- When in XON/XOFF protocol, if the input buffer contains more than 96 eight-bit bytes (75 %), the unit sends a Control/S (XOFF, hexadecimal 13 or decimal 19).

  When the input buffer only contains 32 eight-bit bytes (25 %), it sends a Control Q (XON, hexadecimal 11 or decimal 17).

  When in DTR/CTS protocol, the CTS line of the serial interface is forced high or low as in XON/XOFF protocol (XON = +; XOFF = -).

  If the controller ignores the protocol and the input buffer capacity is exceeded, the unit stores no further characters and sends an error code.

- Control/D (hexadecimal 04 or decimal 4) and Control/T (hexadecimal 14 or decimal 20) have the same function as DCL and SDC messages on the IEEE-488 bus.

8.2.6 - OUTPUT BUFFER

IEEE-488 mode:

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.

As soon as the unit is set to talk mode by the controller, the contents of the output buffer are sent over the IEEE-488 bus, then once the whole of the response message has been received by the controller, the response terminator <LF + EOI> is sent over the bus.

RS 232 mode:

The output buffer works in the same way, except for the following details:

- In either protocol mode, the DTR line must be forced high before the serial interface can send characters.

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

- In XON/XOFF protocol, the interface stops transmitting as soon as a Control/S (XOFF) has been received, and restarts transmitting as soon as a Control/Q (XON) has been received.

8.2.7 - EXCEPTION PROCEDURES

If the controller does not follow IEEE-488.2 standard, exception procedures avoid total system hang ups.

INTERRUPTED:
The controller must read the response message before it attempts to send another command message. Otherwise, the QYE bit of ESR is set to 1, the output buffer is cleared and an INTERRUPTED error message is placed in the fault queue.

UNTERMINATED:
The controller must send a command message containing queries before it attempts to read a response message. Otherwise, the QYE bit of ESR is set to 1, the output buffer is cleared and an UNTERMINATED error message is placed in the fault queue.

DEADLOCKED:
A command message containing queries should not create a situation where the unit output buffer is full and there are still additional characters to be stored before the end of the message can be read. In this case, the QYE bit of ESR is set to 1, the output buffer is cleared, a DEADLOCKED error message is placed in the fault queue and the rest of the command message is executed.

TRUNCATED RESPONSE:
When the response to a query should be placed as an arbitrary block of characters at the end of a message, it should not be followed by another query in the same command message. Otherwise, the QYE bit of ESR is set to 1, a TRUNCATED RESPONSE error message is placed in the fault queue and the responses to following queries are cleared from the response message.

8.2.8 - SEQUENTIAL AND OVERLAPPED COMMANDS, COMMANDS IGNORED IN LOCAL

Commands executed immediately as they are encountered are called sequential commands.
Commands that begin execution, but are completed some time later are called overlapped commands.
Most unit commands are sequential.
All commands which change the unit output or the values stored in protected memory are ignored if the unit is in **local** mode. The DDE bit of ESR is set to 1 and a LOCAL error message is placed in the fault queue.

8.3 - Unit remote commands

8.3.1 - COMMANDS DEFINED BY IEEE-488.2 STANDARD

***CLS** (sequential command)
Clears the ESR and ISCR.
Argument: none.

***ESE VAL** (sequential command)
Programs the Event Status Enable register.
Argument: VAL = decimal number between 0 and 255.

***ESE?** (sequential command)
Returns the value from the Event Status Enable register.
Argument: none.
Response: decimal whole number between 0 and 255.

***ESR?** (sequential command)
Returns the value from the Event Status Register and clears it.
Argument: none.
Response: decimal whole number between 0 and 255.

***SRE VAL** (sequential command)
Programs the Service Request Enable register.
Argument: VAL = decimal number between 0 and 255 (The bit 6 of SRE cannot be changed).

***SRE?** (sequential command)
Returns the values from the Service Request Enable register.
Argument: none.
Response: decimal whole number between 0 and 255.

***STB?** (sequential command)
Returns the value from the STatus Byte register. Does not reset to 0 the MSS bit and asserts the SRQ line of the IEEE-488 bus.
Argument: none.
Response: decimal whole number between 0 and 255.

***IDN?** (sequential command)
Returns the instrument identification.
Argument: aucun.
Response: arbitrary block of characters with four fields separated by <,>.

1 OMEGA	
2 CL8500	
3 Sssssss	Serial number
4 A.aa_L.ll_C.cc	A.aa: Analog board software edition. L.ll: Logic board software edition. C.cc: ADC board software edition.

***OPC** (sequential command)
Sets the OPC bit of ESR register to 1 when all pending operations are complete.
Argument: none.

***OPC?** (sequential command)
Returns a 1 when all pending operations are complete.
Argument: none.
Response: decimal whole number "1".

***WAI** (sequential command)
Forces the unit to wait untill all pending operations are complete.
Argument: none.

***TRG** (sequential command)
Acts like the "external trigger" input (same as the GET bus message).
Argument: none.

***RST** (sequential command)
Forces all pending commands to complete in the shortest possible time. If automatic evolution functions of the emission-simulation setpoint are running, they are interrupted.
Resets the unit to its power on state.
The command does not affect any other state of the unit.
Argument: none.

***TST?** (sequential command)
Checks the integrity of the link between the analog and logic boards of the unit and controls the validity of the adjustment coefficients.
Argument: none.
Response: decimal whole number "0".

***PSC FLAG** (sequential command)
Checks the automatic resetting to zero of the ESE and SRE registers at switching on.
Argument: decimal number between - 32767 and 32767.
If FLag = 0: ESE and SRE keep the value they have before the previous switching off of the unit, thus enabling a service request at switching on.
If not, ESE and SRE are reset to 0 at switching on and there is no service request capacility before programming of ESE and SRE.
Example : *PSC 0;*ESE 128;*SRE 32 enables a service request each time the unit is switched on.

***PSC?** (sequential command)
Returns the status of the automatic reset flag of ESE and SRE.
Argument: none.
Response: decimal whole number 0 = no resetting to zero.
1 = resetting to zero.

8.3.2 - COMMANDS AFFFECTING THE RS 232 MODE

REM (sequential command)
Sets the instrument to remote control status; acts in the same way as the REN message of IEEE-488 bus.
Argument: none.

LOC (sequential command)
Resets the unit to local status; acts in the same way as the GTL message of IEEE-488 bus.
Argument: none.

LLO (sequential command)
Inhibits a return to local mode using the LOC key; acts in the same way as the LLO message of IEEE-488 bus.
Argument: none.

8.3.3 - COMMANDS AFFECTING THE UNIT SPECIFIC REGISTERS

ISCE VAL (sequential command)
Programs the Instrument Status Change Enable register.
Argument: VAL = decimal number between 0 and 65,535.

ISCE? (sequential command)
Returns the value from the ISCE register.
Argument: none.
Response: decimal whole number between 0 and 65,535.

ISR? (sequential command)
Returns but does not clear the value from the Instrument Status Register.
Argument: none.
Response: decimal whole number between 0 and 65,535.

ISCR? (sequential command)
Returns and clears the value from the Instrument Status Change Register.
Argument: none.
Response: decimal whole number between 0 and 65,535.

8.3.4 - COMMANDS AFFECTING MEASUREMENTS

8.3.4.1 - Commands affecting the measurement configuration

RANGE_IN RAN [,CONNECTION [,TYPE [,TEMP_UNIT [,JR]]]]
Selects the specified measurement range.
(sequential command ignored in local)

RAN: Range mnemonic.
[CONNECTION]: Measurement connection mnemonic.
[TYPE]: Sensor type mnemonic.
[TEMP_UNIT]: Temperature unit mnemonic.
[JR] : Reference junction mnemonic.
Example : RANGE_IN RT, WIRE4, TYP_PT100, CEL

CFG_IN? [FCT]
Returns information on measurement configuration.
(sequential command)

Response:
- if argument [FCT] does not exist: current range mmnemonic.
- if argument [FCT] exists, returns the measurement specifications of the FCT function:

[FCT] = V
Selected range mnemonic (V60, V6, MV600, MV60, V_AUTO).

[FCT] = MA
MA60 range mnemonic.
Selected measurement connection mnemonic (TXA, TXP).

[FCT] = OHM
Configured range mnemonic (OHM6000, OHM600, OHM_AUTO).
Selected measurement connection mnemonic (WIRE4, WIRE3, WIRE2).

[FCT] = TC
TC range mnemonic.
Selected connection mnemonic (TCX_ON, TCX_OFF).
Selected sensor type mnemonic (TYP_K, .., TYP_MO).
Selected unit mnemonic (CEL, FAR, K).
Reference junction mnemonic (JR_ON, JR_OFF).

[FCT] = RT
RT range mnemonic.
Selected connection mnemonic (WIRE4, WIRE3, WIRE2).
Selected sensor type mnemonic (TYP_PT100, .., TYP_NI100).
Selected unit mnemonic (CEL, FAR, K).

Examples:

Command: CFG_IN?	Response: RT.
Command: CFG_IN? RT	Response: RT,WIRE4,TYP_PT100,CEL.
Command: CFG_IN? TC	Response: TC,TCX_ON,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.
(sequential command)

Response: Measurement value (decimal number).
Mnemonic (V, MA, OHM, CEL, FAR, K, SCAL if scaling is validated).

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

Example: 0.599876,V
100.0000,SCAL

MEAS ACTION
Acts on the measurement sequence.
(sequential command ignored in local)

ACTION :	Mnemonic of the action to be performed.
ACTION = HOLD	The measurement are stopped (HOLD mode).
ACTION = RUN	Free rate measurements (RUN mode).
ACTION = TRIGM	Triggers and stores one isolated measurement.
ACTION = CLRM	Clears the last stored and isolated measurement.
ACTION = BTRIG	Triggers a programmed measurement cycle and stores under measurement burst form. **Note** : It is necessary to be in HOLD mode with no measurement burst under storage.

8.3.4.2 - Commands affecting the measurement supervision

MIN_MAX ACTION
Acts on detection of measurement extrema.
(sequential command ignored in local)

ACTION :	Mnemonic of the action to be performed.
ACTION = ON	Reads the extrema on the unit display.
ACTION = OFF	Stops reading.
ACTION = INIT	Initializes minimum and maximum.

MIN_MAX?
Returns minimum and maximum values from the measurement since the last initialization. The EXTR bit of ISR is deactivated upon receiving this command.
(sequential command)

Response:
Measurement minimum value (decimal number).
Measurement maximum value (decimal number).
Mnemonic (V, MA, OHM, CEL, FAR, K, SCAL if scaling is validated).

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

STO_ALARM NO, TH_VAL[SUF] [,HYST[SUF] [,DIRECTION [,BUZZER]]]
Programs one of the two alarms.
(sequential command ignored in local)

NO:	Alarm number (decimal number 1 or 2).
TH_VAL:	Alarm threshold value (decimal number).
[HYST]:	Alarm hysteresis value (decimal number).
[DIRECTION]:	Mnemonic indicating the alarm direction (M_HI, alarm when the measurement is higher than the programmed threshold and M_LO, alarm when the measurement is lower than the programmed threshold).
[BUZZER]:	Mnemonic activating or deactivating the audible signal associated to an alarm condition (ON or OFF)

Example: STO_ALARM 1, 100MV, 500UV, M_HI, OFF

ALARM NO, ACTION
Activates or deactivates one of the two alarms.
(sequential command ignored in local)

NO:	Alarm number (decimal number 1 or 2).
ACTION:	Mnemonic ON or OFF.

ALARM? NO
Returns the programmed parameters from the specified alarm.
(sequential command)

NO:	Alarm number (decimal number 1 or 2).

Response:
Threshold value (decimal number).
Hysteresis value (decimal number).
Trigger condition (mnemonic M_HI or M_LO).
Audible signal associated or not to the alarm state (mnemonic ON or OFF).

Example: 100.000E-3,500.000E-6,M_HI,OFF

STO_NUL REF_VAL[SUF] [,FCT]
Associates a reference value (NUL) to the current function (if FCT argument does not exist) or to the specified FCT function.
(sequential command ignored in local).

REF_VAL: Reference value (decimal number).
[FCT]: Function mnemonic (V, MA, OHM, TC, RT) or SCAL mnemonic.
If FCT = SCAL, the specified reference value will be associated to usage of the measurement scaling.

NUL ACTION
Acts on execution of relative measurements.
(sequential command ignored in local)

ACTION : Mnemonic of the action to be performed.
ACTION = ON Validates the relative computation (subtracting the reference value from the rough measurement).
ACTION = OFF Inhibits the relative computation.
ACTION = TARE Stores the last measurement as the reference value and validates the relative computation.

NUL? [FCT]
Returns the reference value (NUL) from the current function (if FCT argument does not exist) or from the specified FCT function.
(sequential command)

[FCT]: Function mnemonic (V, MA, OHM, TC, RT) or SCAL mnemonic.
If FCT = SCAL, the returned reference value will be associated to usage of the measurement scaling.

Response:
Reference value (decimal number).
Function mnemonic (V, MA, OHM, TC, RT) or SCAL mnemonic.

Example:
Command: NUL? Response: 1.00000E-3,V
Command: NUL? TC Response: 100.000E+0,TC

STO_ISCAL X0[SUF], Y0, X1[SUF], Y1, RES
Clears all the scaling specifications to replace them by those in arguments, the unit is reinitialized ("...").
(sequential command ignored in local)

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 5).

Example: STO_ISCAL 4MA, 0, 20MA, 100, 2

ADDP_ISCAL X[SUF], Y
Adds an additional point to the current scaling specification (10 points as a maximum).
(sequential command ingored in local)

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
Stores the scaling unit in the permanent memory.
(sequential command ignored in local)

MESSAGE: Eight-bit byte block of definite length (see 8.2.1).

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

Example: STO_ISCALUNI # 202 µV.

ISCAL ACTION
Activates or inhibits the measurement scaling function.
(sequential command ignored in local)

ACTION :	Mnemonic of the action to the performed.
ACTION = ON	Activates the scaling.
ACTION = OFF	Inhibits the scaling.

ISCAL?
Returns the measurement scaling specifications.
(sequential command)

Response: Eight-bit byte block of definite length.

Example:

#40085<CR><LF>	(reponse length)
0: 4.00000E+0, 000.000E+0<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>	(resolution)

ISCALUNI?
Returns the scaling unit.
(sequential command)

Response : Eight-bit byte block of definite length (see 8.2.1).
Example : # 12 µA.

STO_FILT ORDER
Specifies the digital filter coefficient.
(sequential command ignored in local)

ORDER: Filter coefficient (decimal number between 1 and 8).

FILT ACTION
Validates or inhibits the measurement digital filter.
(sequential command ignored in local)

ACTION :	Mnemonic of the action to be performed.
ACTION = ON	Initializes and sets the filter ON.
ACTION = OFF	Sets the filter OFF.
ACTION = INIT	Initializes the filter on the next measurement.

FILT?
Returns the digital filter coefficient.
(sequential command)

Response: Filter coefficient (decimal number).

STO_RCDR VAL_0[SUF], VAL_2_5[SUF]
Specifies the recorder output characteristics.
(sequential command ignored in local)

VAL_0 : Measurement value corresponding to 0 V on the recorder output (decimal number).
VAL_2_5 : Measurement value corresponding to 2.5 V on the recorder output (decimal number).

Example: STO_RCDR 100 CEL, 250 CEL

RCDR?
Returns the programmed specifications from the recorder output.
(sequential command)

Response:
Decimal number indicating the measurement value corresponding to 0 V on the recorder output.
Decimal number indicating the measurement value corresponding to 2.5 V on the recorder output.

8.3.4.4 - Commands affecting the measurement memories

STO_MEASPROG NB, INTERVAL[SUF] [, NAME]
Stores the specifications of the triggered measurement program into the unit permanent memory.
(sequential command ignored in local)

NB: Number of measurements to be performed (decimal number between 1 and 1,000).
INTERVAL: Time between two consecutive measurements (decimal number between 0.3 and 6,500 s).
[NAME] : Burst name for a further processing.
(Only the first eight characters are taken into account).

Example: STO_MEASPROG 100, 10 S, TEMP0

MEASPROG?
Returns the specifications from the triggered measurement program.
(sequential command)

Response:
Number of measurements to be performed (decimal number).
Time between two consecutive measurements (decimal number).
Time unit (mnemonic).
Measurement burst name. (Characters "°", "Ω" and "µ" are replaced respectively by "D", "R" and "U". Characters "(", ")", "blank", "%", "." and "/" are replaced by "_".

STO_MEASNAME MESSAGE
Stores in permanent memory the measurement burst name for a further processing.
(sequential command ignored in local)

MESSAGE: Eight-bit byte block of definite length (see 8.2.1).

Note: Only the first eight characters are taken into account. Contrary to SOT_MEASPROG command, all characters readable by the unit are accepted and do not undergo any modifications.

Example: STO_MEASNAME # 207 Meas1

MEASNAME?
Returns the measurement burst name.
(sequential command)

Response: Eight-bit byte block of definite length (see 8.2.1).
Example: # 17 Meas1

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

OUT_MEMORY?
Returns a summary of the contents of all the measurement bursts in memory.
(sequential command ignored in local)

Response: Eight-bit byte block or indefinite length.

Example (2 bursts stored):

#0<CR><LF>	(indefinite length)
BURST:002<CR><LF>	(number of stored bursts)
B-001:Burst Name<CR><LF>	(burst number and name)
N:3,T:1.0,s,U:mA<CR><LF>	(number, time between measurements and unit)
B-002:...<CR><LF>	(summary of the previous burst)
N:100,T:0.5,s,U:OHM<CR><LF>	
<LF>	

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

MEMORY? [N1 [, N2]]
Returns a summary of the contents of the specified measurement bursts.
(sequential command ignored in local)

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 block of indefinite length.

Examples:

Command: MEMORY? -1, -2
Response:

#0<CR><LF>	
B-001:Burst Name<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>	

Command: MEMORY? -1, -5
Response:

#0<CR><LF>	
BURST:002<CR><LF>	(error, only two bursts stored)
<LF>	

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

OUT_BURST?
Returns the contents of all the stored bursts.
(sequential command ignored in local)

Response: Eight-bit byte block of indefinite length.

Example:

#0<CR><LF>	(indefinite length)
BURST:002<CR><LF>	(number of stored bursts)
B-001:Burst Name<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>	(first measurement)
001:23.45<CR><LF>	(second 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]]
Returns the contents from the specified measurement bursts.
(sequential command ignored in local)

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: BURST? -3
Response:

#0<CR><LF>	
B-003:LaboTemp<CR><LF>	(burst number and name)
N:5,T:60.0,s,U:CEL<CR><LF>	(number, time between measurements and unit)
000:23.55<CR><LF>	(first measurement)
001:23.45<CR><LF>	(second measurement)
002:23.10<CR><LF>	(...)
003:22.50<CR><LF>	(...)
004:22.25<CR><LF>	(...)
<LF>	

Command: BURST? -1, -5
Response:

#0<CR><LF>	
BURST:002<CR><LF>	(error, only two bursts stored).
<LF>	

CLR_BURST [N1]
Clears the specified measurement burst.
(sequential command ignored in local)

[N1] : Burst to be cleared (decimal number), if the argument does not exist the last stored burst will be cleared.

8.3.5 - COMMANDS AFFECTING THE EMISSION-SIMULATION

8.3.5.1 - Commands affecting the emission-simulation configuration

RANGE_OUT RAN [,TYPE [,TEMP_UNIT [,JR]]]
Selects the specified emission-simulation range.
(sequential command ignored in local)

RAN:	Range mnemonic.
[TYPE] :	Sensor type mnemonic.
[TEMP_UNIT] :	Temperature unit mnemonic.
[JR] :	Reference junction mnemonic.

Example: RANGE_OUT TC, TYP_K, CEL, JR_OFF

CFG_OUT? [FCT]
Returns information on emission-simulation configuration.
(sequential command)

Response:
- if argument [FCT] does not exist: current range mnemonic.
- if argument [FCT] exists, returns the simulation specifications of the FCT function:

[FCT] = V
Selected range mnemonic (V60, V6, MV600).

[FCT] = MA
MA60 range mnemonic.

[FCT] = OHM
Configured range mnemonic (OHM6000, OHM600).

[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).

[FCT] = RT
RT range mnemonic.
Selected sensor type mnemonic (TYP_PT100, .., TYP_NI100).
Selected unit mnemonic (CEL, FAR, K).

Examples:
Command: CFG_OUT? Response: RT
Command: CFG_OUT? RT Response: RT,TYP_PT100,CEL

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

OUT?
Returns the emission-simulation setpoint value together with the unit. The OUT bit of ISR is deactivated upon receiving this command.
(sequential command)

Response:
Output setpoint value (decimal number).
Mnemonic (V, MA, OHM, CEL, FAR, K, SCAL if scaling is validated).

Example:
0.599876,V
100.0000,SCAL

STBY
Emission setpoint value in standby, the unit output is set to 0.
(sequential command ignored in local)

OPER
The unit output takes the requested setpoint value.
(sequential command ignored in local)

8.3.5.2 - Commands affecting the emission-simulation setpoint value memories

STORE NO [, VAL[SUF]]
Stores an emission-simulation setpoint value into the specified memory.
(sequential command ignored in local)

NO:	Number of the setpoint memory (decimal number between 0 and 99).
[VAL]:	If VAL argument does not exist, the current simulation value is stored into memory. If VAL argument exists (decimal numter), this value is stored.

RECALL NO
Gives the value contained in the specified memory to the output setpoint.
(sequential command ignored in local)

NO :	Number of the setpoint memory (decimal number between 0 and 99).

The stored value should be inside the current range limits.

MEM? NO1 [, NO2]
Returns the setpoint values stored into the specified memories.
(sequential command)

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: MEM? 10, 12
Response:

#40049<CR><LF>	(response length)
10: 4.00000E+0<CR><LF>	(memory 10)
11:-1.00000E-3<CR><LF>	(memory 11)
12:-100.000E-6<CR>	(memory 12)

STO_SYNTHE NO1, NO2, INTERVAL[SUF], NB
Stores into permanent memory new synthesizer execution specifications (successive series of several setpoint memory contents)
(sequential command ignored in local)

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 cyles to be executed (decimal number between 1 and 65,000).

SYNTHE ACTION
Acts on the synthesizer program execution.
(overlapped command ignored in local)

ACTION:	Mnemonic of the action to be performed.
ACTION = RUN	Triggers the synthesizer program.
ACTION = UP	Recalls the next memory contents in the programmed cycle.
ACTION = DOWN	Recalls the previous memory contents in the programmed cycle.
ACTION = HOLD	Holds the synthesizer execution.
ACTION = REST	Restarts the synthesizer execution.

SYNTHE?
Returns the synthesizer program specifications.
(sequential command)

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).

8.3.5.3 - Commands affecting incrementing the emission-simulation setpoint

INCR VAL_INCR[SUF]
Increments the emission-simulation setpoint value to the specified value.
(sequential command ignored in local)

VAL_INCR : Increment value (decimal number).

After incrementation, the setpoint value should be inside the current range limits.

STO_INCRP VAL_INCR[SUF], NB, INTERVAL[SUF]
Stores into permanent memory new execution specifications of the automatic incrementation.
(sequential command ignored in local)

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 and 6,500 s).

INCRP ACTION
Acts on the execution of the automatic incrementation program of the output setpoint.
(overlapped command ignored in local)

ACTION:	Mnemonic of the action to be performed.
ACTION = UP	Starts execution of the automatic incrementation program with the stored increment value (VAL_INCR).
ACTION = DOWN	Starts execution of the automatic incrementation program with an increment value opposed to the one stored (-VAL_INCR).
ACTION = HOLD	Holds execution of the automatic incrementation.
ACTION = REST	Restarts execution of the automatic incrementation.

INCRP?
Returns the specifications from the automatic incrementation program.
(sequential command)

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

8.3.5.4 - Commands affecting the simple ramp

STO_RAMPS VAL_RAMP[SUF], INTERVAL[SUF]
Stores into permanent memory new execution specifications of the simple ramp.
(sequential command ignored in local)

VAL_RAMP:	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 ACTION
Acts on the simple ramp execution.
(overlapped command ignored in local)

ACTION:	Mnemonic of the action to be performed.
ACTION = UP	Starts execution of the simple ramp with the stored deviation (VAL_RAMP).
ACTION = DOWN	Starts execution of the simple ramp with the opposed stored deviation (-VAL_RAMP).
ACTION = HOLD	Holds execution of the simple ramp.
ACTION = REST	Restarts execution of the simple ramp.

RAMPS?
Returns the simple ramp stored specifications.
(sequential command)

Response:
Difference between final and initial values (decimal number).
Ramp duration (decimal number).
Time unit (mnemonic).

8.3.5.5 - Commands affecting the cyclical ramp

STO_RAMPC VAL_RAMP[SUF], NB, T0[SUF], T_UP[SUF], T1[SUF], T_DOWN[SUF]
Stores into permanent memory new execution specifications of the cyclical ramp.
(sequential command ignored in local)

VAL_RAMP:	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 ACTION
Acts on the cyclical ramp execution.
(overlapped command ignored in local)

ACTION:	Mnemonic of the action to be performed.
ACTION = RUN	Starts execution of the cyclical ramp with the stored specifications.
ACTION = HOLD	Holds execution of the cyclical ramp.
ACTION = REST	Restarts execution of the cyclical ramp.

RAMPC?
Returns the cyclical ramp stored specifications.
(sequential command)

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).

8.3.5.6 - Commands affecting the output setpoint scaling

STO_OSCAL X0, Y0[SUF], X1, Y1[SUF], RES
Clears all the scaling specifications to replace them by those in arguments, the unit is reinitialized ("...").
(sequential command ignored in local)

X0:	Decimal number indicating the setpoint value of the first scaling point.
Y0:	Decimal number indicating the value to be emitted of the first scaling point.
X1:	Decimal number indicating the setpoint value of the second point.
Y1:	Decimal number indicating the value to be emitted of the second scaling point.
RES:	Selected display resolution (decimal number between 0 and 5).

Example: STO_OSCAL 4, 0MA, 20, 100MA, 2

ADDP_OSCAL X, Y[SUF]
Adds an additional point to the current scaling specification (10 points as a maximum).
(sequential command ignored in local)

X:	Decimal number indicating the value to be emitted of the new point.
Y:	Decimal number indicating the setpoint value of the new point.

Example: ADDP_OSCAL 12, 60MA

STO_OSCALUNI MESSAGE
Stores the scaling unit in the permanent memory.
(sequential command ignored in local)

MESSAGE: Eight-bit byte block of definite length (see§ 8.2.1).

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

Example: STO_OSCALUNI # 202 µV

OSCAL ACTION
Activates or inhibits the emission-simulation scaling function.
(sequential command ignored in local)

ACTION:	Mnemonic of the action to be performed.
ACTION = ON	Activates the scaling.
ACTION = OFF	Inhibits the scaling.

OSCAL?
Returns the specifications from the emission-simulation scaling.
(sequential command)

Response: Eight-bit byte block of definite length.

Example:

#40085<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>	(resolution)

OSCALUNI?
Returns the scaling unit.
(sequential command)

Response: Eight-bit byte block of definite length (see 8.2.1).

Example: # 12 µA

8.3.5.7 - Commands affecting the transmitter function

STO_TRX TYPE, VAL1[SUF], VAL2[SUF]
Stores into permanent memory new specifications of the transmitter function.
(overlapped command ignored in local)

TYPE:	Mnemonic indicating the type of signal to be generated (MA4_20 or V0_10).
VAL1:	Measurement value (decimal number) corresponding to 4 mA (if TYPE = MA4_20) or to 0 V (if TYPE = V0_10).
VAL2:	Measurement value (decimal number) corresponding to 20 mA (if TYPE = MA4_20) or to 10 V (if TYPE = V0_10).

Example: STO_TRX MA4_20, 0 CEL, 1000 CEL

Programs 4 mA in emission for a 0°C measurement and 20 mA in emission for a 1,000°C measurement.

TRX ACTION
Activates or inhibits the transmitter function.
(sequential command ignored in local)

ACTION:	Mnemonic of the action to be performed.
ACTION = ON	Activates the transmitter function.
ACTION = OFF	Inhibits the transmitter function.

TRX?
Returns the stored specifications from the transmitter function.
(sequential command)

Response:
Mnemonic indicating the type of signal to be generated (MA4_20 or V0_10).
Measurement value (decimal number) corresponding to 4 mA (if TYPE = MA4_20) or to 0 V (if TYPE = V0_10).
Measurement value (decimal number) corresponding to 20 mA (if TYPE = MA4_20) or to 10 V (if TYPE = V0_10).

8.3.5.8 - Miscellaneous command

SPEC_OUT?
Returns information on the automatic evolution function of the output setpoint.
(sequential command)

Response:

Mnemonics indicating the automatic evolution function:
INCR "Incrementation" function requested.
RAMP: "Ramp" function requested.
SYNT: "Synthesizer" function requested.
TRX: "Transmitter" function requested.
NONE: No automatic evolution function requested.

Mnemonics indicating how is the requested function:
RUN: Function is running.
STOP: Function is ended.
HOLD: Function is held.

8.3.6 - COMMANDS AFFECTING THE UNIT GENERAL USAGE

TERMINALS FRONT_REAR
Selects the input-output terminal board.
(sequential command ignored in local)

FRONT_REAR : Mnemonic specifying usage of the front terminal board (FRONT) or rear terminal board (REAR).

PCR?
Returns the value from the Programmed Configuration Register.
(sequential command)

Response: Register value (decimal number).

STO_CFG NO
Saves the current configuration in the specified configuration.
(sequential command ignored in local)

NO Configuration number (decimal number).

STO_ETRG USAGE
Programs assignment of the "external trigger" input from the *TRG standardized command and bus GET message.
(sequential command ignored in local)

USAGE =	Input assignment mnemonic.
USAGE = TRIGM	Triggers and stores an isolated measurement.
USAGE = BTRIG	Triggers a programmed measurement cycle and stores under measurement burst form. **Note** : It is necessary to be in HOLD mode with no measurement burst under storage.
USAGE = SYNT_CYCLE	Starts cyclical execution of the synthesizer program.
USAGE = SYNT_UP	Recalls contents of the next memory in the synthesizer programmed cycle.
USAGE = SYNT_DOWN	Recalls contents of the previous memory in the synthesizer programmed cycle.
USAGE = SYNT_CYCLE	Starts cyclical execution of the synthesizer progam.
USAGE = INCRP_UP	Starts execution of the automatic incrementation program with the stored increment value (VAL_INCR).
USAGE = INCRP_DOWN	Starts execution of the automatic incrementation program with an increment value opposed to the one stored (-VAL_INCR).
USAGE = RAMPS_UP	Starts execution of the simple ramp with the stored deviation (VAL_RAMP).
USAGE = RAMPS_DOWN	Start execution of the simple ramp with the opposed stored deviation (-VAL_RAMP).

ETRG?
Returns assignment of the "external trigger" input from the *TRG normalized command and from the bus GET message.

Response : Input assignment mnemonic.

STO_IMPR M/N[,M/L[,L/P]]
Stores the new parameters in permanent memory for the printer output.
(sequential command ignored in local)

M/N: Number of measurements between two printings (decimal number).
M/L: Number of measurements printed per line (decimal number).
L/P: Number of lines printed per page (decimal number).

IMPR?
Returns the parameters of the printer output.
(sequential command)

Response:
Number of measurements between two printings (decimal number).
Number of measurements printed per line (decimal number).
Number of lines printed per page (decimal number).

8.3.7 - COMMANDS AFFECTING 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.
The EAV bit of STB is set to 1 as long as there is, at least, an error message in the queue.

ERR_NO?
Returns the most recent error code and deletes it from the queue. If there are no more errors in the queue, the EAV bit of STB is set to 0.

ERR? [NO]
Returns information on errors. If the [NO] argument does not exist, the most recent error is cleared from the queue. If the queue is empty, the EAV bit of STB is set to 0.

[NO]: Error code.

Response:
- if argument [NO] is omitted, returns the number of the most recent error followed with the meaning.
- if argument [NO] exists, returns the error meaning corresponding to [NO] code.

Examples:
Command: ERR? Response: 10, UNKNOWN MNEMONIC
Command ERR?5 Response: UNKNOWN HEADER

CL_ERR
Clears all the error messages from the queue and sets the EAV bit of STB to 0.

8.4 - 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 an additional point to the measurement scaling.	8.3.4.3
ADDP_OSCAL { }	Adds an additional point to the emission-simulation scaling.	8.3.5.6
ALARM { }	Activates or deactivates one of the alarms.	8.3.4.2
ALARM? { }	Returns the programmed parameters from the specified alarm.	8.3.4.2

B

BURST? { }	Returns the contents from the specified measurement burst(s).	8.3.4.4

C

CFG_IN? { }	Returns configuration from the specified measurement function.	8.3.4.1
CFG_OUT? { }	Returns configuration from the specified emission function.	8.3.5.1
CL_ERR	Clears all the error messages from the queue.	8.3.7
CLR_BURST { }	Clears the specified measurement burst.	8.3.4.4
CLR_MEMORY	Clears all the stored measurement bursts.	8.3.4.4
*CLS	Clears the ESR and ISCR.	8.3.1

E

ERR?	Returns information on errors.	8.3.7
ERR_NO?	Returns the most recent error code.	8.3.7
*ESE?	Returns the value from the ESE register.	8.3.1
*ESR?	Returns the value from ESR register and clears it.	8.3.1
*ESE { }	Programs the ESE register.	8.3.1
ETRG?	Returns assignment of the external trigger input	8.3.6

F

FILT { }	Validates or inhibits the measurement digital filter.	8.3.4.3
FILT?	Returns the digital filter coefficient.	8.3.4.3

I

*IDN?	Returns the instrument identification.	8.3.1
ISCR?	Returns and clears the value from the ISCR.	8.3.3
ISCAL { }	Activates or inhibits the measurement scaling function.	8.3.4.3
ISCAL?	Returns the measurement scaling specifications.	8.3.4.3
ISCALUNI?	Returns the scaling unit.	8.3.4.3
ISCE?	Returns the value from the ISCE register.	8.3.3
ISCE { }	Programs the Instrument Status Change Enable register.	8.3.3
ISR?	Returns but does not clear the value from the ISR.	8.3.3
IMPR?	Returns parameters from the printer output.	8.3.6
INCR { }	Increments the emission-simulation setpoint value to the specified value.	8.3.5.3
INCRP { }	Acts on the execution of the automatic incrementation program.	8.3.5.3
INCRP?	Returns the specifications from the automatic incrementation program.	8.3.5.3

L

LOC	Resets the unit to local status.	8.3.2
LLO	Inhibits a return to local mode using the LOC key.	8.3.2

M

MEAS { }	Acts on the measurement sequence (triggered measurements).	8.3.4.1
MEAS?	Returns the last measurement value available together with the unit.	8.3.4.1
MEASNAME?	Returns the measurement burst name.	8.3.4.4
MEASPROG?	Returns the specifications from the triggered measurement program.	8.3.4.4
MEM? { }	Returns the setpoint values stored into the specified memories.	8.3.5.2
MEMORY? { }	Returns a summary of the contents of the specified measurement bursts.	8.3.4.4
MIN_MAX { }	Acts on detection of measurement extrema.	8.3.4.2
MIN_MAX?	Returns minimum and maximum values from the measurement.	8.3.4.2

N

NUL { }	Acts on execution of relative measurements.	8.3.4.3
NUL? { }	Returns the reference value from the current function.	8.3.4.3

O

*OPC	Sets the OPC bit of ESR to 1 when all pending operations are complete.	8.3.1
*OPC?	Returns a 1 when all pending operations are complete.	8.3.1
OPER	The unit output takes the requested setpoint value.	8.3.5.1
OSCAL { }	Activates or inhibits the emission-simulation scaling function.	8.3.5.6
OSCAL?	Returns the specifications from the emission-simulation scaling.	8.3.5.6
OSCALUNI?	Return the scaling unit.	8.3.5.6
OUT { }	Specifies an emission-simulation setpoint value.	8.3.5.1
OUT?	Returns the emission-simulation setpoint value together with the unit.	8.3.5.1
OUT_BURST?	Returns the contents of all the stored bursts.	8.3.4.4
OUT_MEMORY?	Returns a summary of the contents of all the mesurement bursts in memory.	8.3.4.4

P

PCR?	Returns the value from the Programmed Configuration Register.	8.3.6
*PSC { }	Checks the automatic resetting to zero of the ESE and SRE registers at switching on.	8.3.1
*PSC?	Returns the status of the automatic reset flag of ESE and SRE.	8.3.1

R

RAMPC { }	Acts on the cyclical ramp execution.	8.3.5.5
RAMPC?	Returns the cyclical ramp stored specifications.	8.3.5.5
RAMPS { }	Acts on the simple ramp execution.	8.3.5.4
RAMPS?	Returns the simple ramp stored specifications.	8.3.5.4
RANGE_IN { }	Selects the specified measurement range and parameters.	8.3.4.1
RANGE_OUT { }	Selects the specified emission-simulation range and parameters.	8.3.5.1
RCDR?	Returns the programmed specifications from the recorder output.	8.3.4.3
RECALL { }	Gives the value contained in the specified memory to the output setpoint.	8.3.5.2
REM	Sets the instrument to remote control status.	8.3.2
*RST	Resets the unit to its power on state.	8.3.1

S

SPEC_OUT?	Returns information on the automatic evolution function of the output setpoint.	8.3.5.8
*SRE?	Returns the values from the Service Request Enable register.	8.3.1
*SRE VAL	Programs the Service Request Enable register.	8.3.1
*STB?	Returns the value from the STatus Byte register.	8.3.1
STBY	Emission setpoint value in standby.	8.3.5.1
STO_ALARM { }	Programs one of the two alarms.	8.3.4.2
STO_CFG { }	Saves the current configuration in the specified configuration.	8.3.6
STO_ETRG { }	Programs assignment of the external trigger input.	8.3.6
STO_FILT { }	Specifies the digital filter coefficient.	8.3.4.3
STO_IMPR { }	Stores the new parameters in permanent memory for the printer output.	8.3.6
STO_INCRP { }	Stores new increment parameter execution.	8.3.5.3
STO_ISCAL { }	Clears all the scaling specifications to replace them by those in arguments.	8.3.4.3
STO_ISCALUNI { }	Stores the scaling unit in permanent memory.	8.3.4.3
STO_MEASNAME { }	Stores the measurement burst name in permanent memory.	8.3.4.4
STO_MEASPROG { }	Stores the specifications of the triggered measurement program.	8.3.4.4
STO_NUL { }	Associates a reference value to the current function.	8.3.4.3
STO_OSCAL { }	Clears all the scaling specifications to replace them by those in arguments.	8.3.5.6
STO_OSCALUNI { }	Stores the scaling unit in permanent memory.	8.3.5.6
STO_RAMPC { }	Stores into pemanent memory new execution specifications of the cyclical ramp.	8.3.5.5
STO_RAMPS { }	Stores into pemanent memory new execution specifications of the simple ramp.	8.3.5.4
STO_RCDR { }	Specifies the recorder output characteristics.	8.3.4.3
STO_SYNTHE { }	Stores into permanent memory new synthesizer execution specifications.	8.3.5.2
STO_TRX { }	Stores into permanent memory new specifications of the transmitter function.	8.3.5.7
STORE { }	Stores an emission-simulation setpoint value into the specified memory.	8.3.5.2
SYNTHE { }	Acts on the synthesizer program execution.	8.3.5.2
SYNTHE?	Returns the synthesizer program specifications.	8.3.5.2

T

TERMINALS { }	Selects the input-output terminal baord.	8.3.6
*TRG	Acts like the external trigger input.	8.3.1
TRX { }	Activates or inhibits the transmitter function.	8.3.5.7
TRX?	Returns the stored specifications from the transmitter function.	8.3.5.7
*TST?	Checks the link between boards and controls the validity of the adjustment coefficients.	8.3.1

W

*WAI	Forces the unit to wait untill all pending operations are complete.	8.3.1

9 - Maintenance

This chapter deals with simple maintenance operations (changing fuses, for example). All the maintenance operations are described in the maintenance manual (contact **AOIP**).

WARNING ! When a maintenance procedure requires opening the instrument cover, remove all the connections from the external circuits as well as the power cord.

9.1 - Opening/closing the upper cover

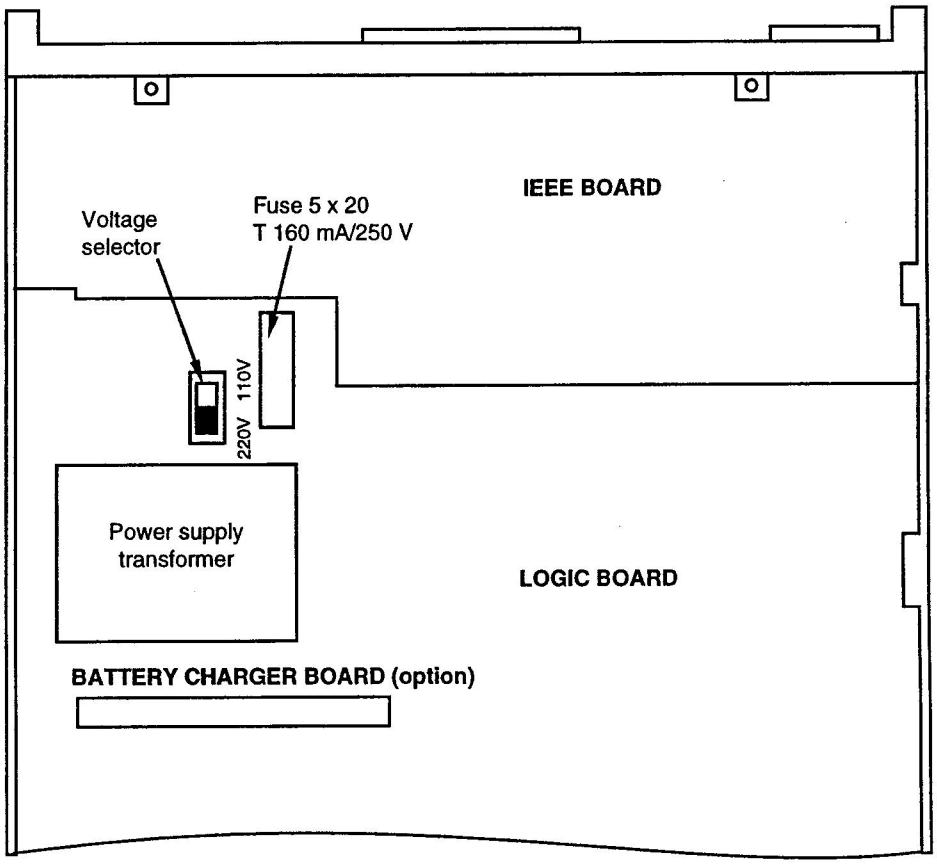
The cover needs to be opened for:
- changing the power supply,
- replacing the power fuse.

Apart from these operations, the unit should not be opened.

To open the upper cover:

- **Switch the unit OFF.**
- **Remove the power cord and disconnect the unit from any electrical connection.**
- Loosen the four cover screws (two short screws at back and two long screws on sides).
- Lift the cover and pull it towards the back.

The board appears as follows:



To close the upper cover:

- Replace the upper cover.
- Insert the four screws into the cover (short screws at back, long screws on sides).

9.4 - Battery (option)

This chapter concerns the instruments equipped with lead battery. This battery does not require maintenance and checking charge state is all that is required.

9.4.1 - USUAL OPERATION

1) Battery discharge
During battery operation the icon below advises the user to recharge the battery.

In that state, the remaining life is approximately 30 or 90 minutes depending on usage. After that time, the unit switches off and it cannot be switched on again. **Recharge the battery.**

2) Recharging the battery
- Connect the unit to the power supply. The "~" indicator indicates that the battery is charging.
- Leave the battery recharging for 12 to 14 hours, **unit switched off** (blank display). The unit may remain in that state for a long period with no damage for the battery.

9.4.2 - STORAGE

WARNING ! To preserve battery life, never store the unit with discharged battery.

If the unit is to be stored for a few days with a discharged battery, note that the unit may lose a part of its operating autonomy.
If the unit is to be stored for a few weeks with a discharged battery, note that the unit cannot be used longer.

If the unit is to be stored for a long period, note that the self discharging current of a lead battery changes with the temperature.
Before storage, a complete recharge is necessary. Refer to table below:

TABLE 7	RECHARGING THE UNIT		
Storage temperature	- 15°C to 25°C	25°C to 40°C	40°C to 50°C
Complete recharge	Every year	Every 6 months	Every 2 months

For a storage temperature ranging about 25°C, it is advisable to recharge the unit for 12 h every 6 months.
At 50°C, the storage temperature limit, the unit may remain charged permanently (blank display).

9.5 - Checking of performances

The user may require periodic checking of the performance in order to keep track of the quality.

This operation implies, as follows:

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

- Known accuracy for the instruments used for checking and, for the unit below or equal to:
  ± 0.0010 % for the voltage standard,
  ± 0.0025 % for the current and resistance standards and by taking the environmental factors into account.

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

1) Adjust the unit according to the procedure described in the maintenance manual.

2) Return the unit to **AOIP** for inspection.

APPENDIX A

Specifications

1 - Applicable standards

1.1 - Safety class

In accordance with European Norm EN 61010-1.
Class 1.
Isolating voltage: 250 V max.
Note: The safety provisions for the unit are given in page 2.

1.2 - Ambient conditions

In accordance with IEC Publication 359 (national standards NF C 42-600, DIN 43745) : operating category I.
Reference range: 23 °C ± 1°C, relative humidity: 45 % to 75 %.
Normal operating range: 0°C to + 45°C, relative humidity: 20 % to 80 % non-condensing.
Operating range limits: 0°C to + 50°C, relative humidity: 10 % to 80 % non-condensing.
Storage and transport range: - 30°C to + 55°C (- 15°C to + 50°C with charged battery).
The unit can be used at altitudes below or equal to 2,200 m and under barometric pressure between 700 and 1 060 hPa (between 525 and 800 mmHg).

1.3 - Mechanical conditions

Protection according to IEC Publication 529 (harmonized standard HD 365 S3, national standard NF C 20-010) : IP 40.
Vibrations and shock according to European Norm EN 61010-1.

1.4 - Measurements at reference conditions

In accordance with IEC Publication 359 and IEC Publication 443 (national standard NF C 42-620).

1.5 - 100 Ω at 0°C RTDs

In accordance with IEC Publication 751, harmonized standard HD 459 (national standards NF C 42-330 and DIN IEC 751).
Ni 100 Nickel RTD: according to standard DIN 43760.
The ohmic values for Pt 200, Pt 500, Pt 1 000 are multiples of those for Pt 100 at the same temperature and in the specified measuring spans.
International Temperature Scale according to ITS 90.

1.6 - Thermocouples

Couples K, T, J, E, N, S, R et B: according to IEC Publication 584-1, harmonized standard HD 446-1 (national standards NF C 42-321, DIN IEC 584-1).
Couple L : according to standard DIN 43710.
Platinel couple (Pl): according to Engelhard curve.
Molybdenum/Nickel Molybdenum couple (Mo) : not standardized.
International Temperature Scale according to ITS 90.

1.7 - IEEE-488 bus

In accordance with IEC Pubication 625-1 and 625-2 (harmonized standards HD 414-1 and HD 414-2, national standards NF C 42-910 and NF C 42-911, DIN IEC 625-1 and DIN IEC 625-2) and American standard IEEE-488.2.

1.8 - RS 232 transmission

In accordance with ANSI EIA-232-D-1986 standard.

2 - General specifications

- Bench-type instrument with carrying handle and power supply cord; one model with rechargeable battery pack.

- Usable in rack mounting with accessories.

- Liquid crystal display, 240 x 64 pixels.

- Languages available: French, English, German.

- 22-key keyboard for processing and programming.

- Audible warning (beep) of any incorrect operation when programming or processing.

- Output terminals on front also duplicated at rear of the unit for rack usage.

- Power supply:
  230 V ± 10 %, 50-400 Hz.
  115 V ± 10 %, 50-400 Hz by internal switching.
  Consumption: : 20 VA max.

- Dimensions: 225 mm x 88 mm x 310 mm (overall width: 275 mm with handle); 8.86" x 3.46" x 12.20".

- Weight: 2 kg (3 kg max. with battery and optional IEEE-488); 4.4 lb (6.6 lb max.).

3 - Particular specifications

3.1 - Accuracy

Stated accuracies are expressed in ± (n % rdg + C) with rdg = reading and C = constant. They applied to instruments placed in the reference conditions defined elsewhere after warming up for 30 minutes.
Operation for 5 minutes warrants signals at **0.001 %** of the value given by an heat-stabilized instrument.

3.2 - Measurement functions

Specifications common to all functions:
Temperature coefficient: < 10 % of accuracy /°C.
Measurement max. capacity: 125 % of range.

3.2.1 - DC VOLTAGE MEASUREMENTS

Range	Resolution	Accuracy (23°C ± 1°C)	
		over 90 days	over 1 year
± 60 mV	0.1 µV	0.005 % + 4 µV	0.010 % + 6 µV
± 600 mV	1 µV	0.005 % + 4 µV	0.010 % + 6 µV
± 6 V	10 µV	0.005 % + 20 µV	0.010 % + 30 µV
± 60 V	100 µV	0.005 % + 200 µV	0.010 % + 300 µV

Input resistance:
- over 60 mV, 600 mV, 6 V ranges: > 1 000 MΩ, input current: < 200 pA.
- over 60 V range: 10 MΩ.
Max. permissible voltage on all ranges: 100 V or AC peak.
Normal mode rejection (60 mV range): > 80 dB.
Common mode rejection (60 mV range): > 150 dB.
Max. permissible common mode voltage: 250 V AC or 350 V peak (see safety provisions).

3.2.2 - DC CURRENT MEASUREMENTS

Range	Resolution	Accuracy (23°C ± 1°C)	
		over 90 days	over 1 year
± 60 mA	0.1 µA	0.010 % + 0.4 µA	0.020 % + 0.6 µA

Max. voltage drop: 1.2 V.
PTC electronic protection, max. applicable voltage: 100 V DC or AC peak.
Normal mode rejection: 80 dB.

Note : An internal source of 24 V ± 10 % limited to 25 mA can be connected when measuring current on a transmitter supplied by the current loop.

3.2.3 - RESISTANCE MEASUREMENTS

Range	Resolution	Measure-ment current	Connection	Accuracy (23°C ± 1°C)	
				over 90 days	over 1 year
0-600 Ω	1 mΩ	1 mA	4 wires	0.005 % + 4 mΩ	0.010 % + 6 mΩ
			3 wires	0.005 % + 20 mΩ	0.010 % + 20 mΩ
			2 wires	0.005 % + 50 mΩ	0.010 % + 50 mΩ
0-6 000 Ω	10 mΩ	0.1 mA	4 wires	0.005 % + 40 mΩ	0.010 % + 60 mΩ
			3 wires	0.005 % + 70 mΩ	0.010 % + 80 mΩ
			2 wires	0.005 % + 100 mΩ	0.010 % + 100 mΩ

Connection of the resistor to be measured:
- 4 wires: permissible line resistance over wires Ω3 or Ω4: < 10 kΩ per wire; over wires + or -: < 350 Ω per wire.
- 3 wires: add error due to resistance unbalance of connection wires; permissible line resistance: < 50 Ω.
- 2 wires: add error due to resistances of connection wires (+ and -). Measurement line resistance and unit internal residual can be taken into account (< 20 mΩ).

Max. voltage in open circuit: 10 V.
Max. applicable voltage: 100 V DC or AC peak.

3.2.4 - TEMPERATURE MEASUREMENTS BY THERMOCOUPLES

Sensor	Measurement range (°C)	Resolution (°C)	Accuracy (23°C ± 1°C)	
			over 90 days	over 1 year
K	from - 250 to - 200	0.2	+ 1.0°C	+ 1.5°C
	from - 200 to - 120	0.1	+ 0.3°C	+ 0.5°C
	from - 120 to 0	0.05	+ 0.2°C	+ 0.3°C
	from 0 to + 1 372	0.05	0.01 % + 0.1°C	0.015 % + 0.2°C
T	from - 250 to - 200	0.2	+ 1.0°C	+ 1.5°C
	from - 200 to 0	0.05	+ 0.3°C	+ 0.5°C
	from 0 to + 400	0.05	+ 0.1°C	+ 0.2°C
J	from - 210 to - 100	0.05	+ 0.2°C	+ 0.4°C
	from - 100 to + 1 200	0.05	+ 0.1°C	+ 0.2°C
E	from - 250 to - 200	0.1	+ 0.5°C	+ 1.0°C
	from - 200 to - 100	0.05	+ 0.2°C	+ 0.3°C
	from - 100 to + 980	0.05	+ 0.1°C	+ 0.2°C
R	from - 50 to + 120	0.5	+ 1.0°C	+ 2.0°C
	from + 120 to + 450	0.2	+ 0.5°C	+ 1.0°C
	from + 450 to + 1 768	0.1	+ 0.5°C	+ 1.0°C
S	from - 50 to + 120	0.5	+ 1.0°C	+ 1.5°C
	from + 120 to + 450	0.2	+ 0.5°C	+ 1.0°C
	from + 450 to + 1 768	0.1	+ 0.5°C	+ 1.0°C
B	from + 400 to + 900	0.2	+ 1.0°C	+ 1.5°C
	from + 900 to + 1 820	0.1	+ 0.5°C	+ 1.0°C
L	from - 200 to - 100	0.05	+ 0.2°C	+ 0.3°C
	from - 100 to + 900	0.05	+ 0.1°C	+ 0.2°C
N	from - 240 to - 190	0.2	+ 1.0°C	+ 1.5°C
	from - 190 to - 110	0.1	+ 0.5°C	+ 1.0°C
	from - 110 to + 1 300	0.05	+ 0.2°C	+ 0.3°C
PI	from - 100 to + 1 400	0.05	+ 0.2°C	+ 0.4°C
Mo	from 0 to + 1 375	0.05	+ 0.1°C	+ 0.2°C

The accuracy is guaranteed for a reference junction at 0°C.
Accuracy when using the internal reference junction:
- front terminal board: ≤ 0.2°C.
- rear terminal board: ≤ 0.4°C.
Normal mode rejection for 10 mV, 50/60 Hz : < 0.1°C over R and S thermocouples; < 0.03°C over the other thermocouples.
Common mode rejection for 10 V, 50/60 Hz : < 0.03°C over R and S thermocouples; < 0.01°C over the other thermocouples.

3.2.5 - TEMPERATURE MEASUREMENTS BY RTDs

Sensor	Measurement range (°C)	Resolution (°C)	Accuracy (23°C ± 1°C) over 90 days	Accuracy (23°C ± 1°C) over 1 year
Pt 100	from - 220 to 0 from 0 to + 630 from + 630 to + 1 200	0.01 0.005 0.01	+ 0.02°C 0.01 % + 0.02°C + 0.1°C	+ 0.04°C 0.015 % + 0.04°C + 0.2°C
Pt 200	from - 220 to 0 from 0 to + 630 from + 630 to + 798	0.01 0.005 0.01	+ 0.02°C 0.01 % + 0.02°C + 0.07°C	+ 0.04°C 0.015 % + 0.04°C + 0.15°C
Pt 500	from - 220 to + 0 from 0 to + 1 200	0.01 0.01	+ 0.04°C 0.01 % + 0.04°C	+ 0.06°C 0.015 % + 0.06°C
Pt 1 000	from - 220 to 0 from 0 to + 630 from + 630 to + 1 200	0.01 0.005 0.01	+ 0.03°C 0.01 % + 0.03°C + 0.15°C	+ 0.05°C 0.015 % + 0.05°C + 0.3°C
Ni 100	from - 60 to + 180	0.05	+ 0.1°C	+ 0.15°C

The accuracy above is given for a temperature sensor connected in a 4-wire balanced circuit.
Measurement currents: 1 mA for Pt 100, Pt 200, Ni 100 and 0.1 mA for Pt 500 and Pt 1 000.

Additional error due to the measurement configuration:

	Pt 100	Pt 200	Pt 500	Pt 1 000	Ni 100
3 wires	0.05°C	0.03°C	0.03°C	0.02°C	0.05°C
2 wires	0.20°C	0.10°C	0.04°C	0.02°C	0.10°C

3.2.6 - ADDITIONAL SPECIFICATIONS

3.2.6.1 - Measurement repeatability

Emission function ⇓ / Measurement function ⇒	V mA	Tc (RJ ON)	Tc (RJ OFF)	Ω Rt		
				4 wires	3 wires	2 wires
Tc (RJ ON)	300 ms	300 ms	300 ms	500 ms	700 ms	500 ms
Others	400 ms	300 ms	400 ms	400 ms	600 ms	400 ms

3.2.6.2 - Analog output

From 0 to 2.55 V on load > 2.5 kΩ.
Resolution: 10 mV (256 counts).
Accuracy: ± 10 mV.
Response time: that of the measurement.

3.2.6.3 - Alarms

Each alarm activates a normally open contact: 1 A AC, 220 V AC, 60 VA max. These contacts have a common point.

3.3 - Emission-simulation function

Specifications common to all functions:
Temperature coefficient: < 10 % of accuracy/°C.
Settling time: < 25 ms to get the specified accuracy.
Max. permissible floating voltage: 250 V AC or 350 V peak regarding ground.

3.3.1 - DC VOLTAGE EMISSION

3.3.1.1 - Accuracy

Range	Emission range	Resolution	Accuracy (23°C ± 1°C) over 90 days	Accuracy (23°C ± 1°C) over 1 year
600 mV	from - 100 mV to + 600 mV	1 µV	0.007 % + 4 µV	0.015 % + 6 µV
6 V	from - 1 V to + 6 V	10 µV	0.007 % + 20 µV	0.015 % + 30 µV
60 V	from - 10 V to + 60 V	100 µV	0.007 % + 200 µV	0.015 % + 300 µV

These accuracies are defined for output currents lower than those given below.

3.3.1.2 - Noise

Range	Noise 0.1 Hz to 10 Hz	Noise 10 Hz to 10 kHz
600 mV	2 µV peak to peak	30 µV rms
6 V	5 µV peak to peak	50 µV rms
60 V	50 µV peak to peak	300 µV rms

3.3.1.3 - Other output specifications

Range	Output current positive output	Output current negative output	Internal resistance FRONT terminals	Internal resistance REAR terminals
600 mV	60 mA	- 5 mA	< 0.5 mΩ	< 2 mΩ
6 V	60 mA	- 5 mA	< 0.5 mΩ	< 2 mΩ
60 V	30 mA	- 5 mA	< 0.5 mΩ	< 2 mΩ

Max. permissible capacity at load terminals: 10 µF.
Protection against overloads and short-circuits by internal electronic limitation in current, voltage and power.
Max. permissible overvoltage on the output terminals: from - 18 V to + 100 V (DC or AC peak).
Common mode rejection: > 140 dB.

3.3.2 - DC CURRENT EMISSION

Range	Emission range	Resolution	Accuracy (23°C ± 1°C) over 90 days	Accuracy (23°C ± 1°C) over 1 year
60 mA	from 0 to 60 mA	0.1 µA	0.010 % + 0.5 µA	0.020 % + 0.8 µA

Max. output voltage: 30 V.
Possible external supply: ≤ 30 V.
Noise:
from 0.1 to 10 Hz: 500 nA.
from 10 Hz to 10 kHz: 3.3 µA.
Source resistance: > 100 MΩ.
Protection against external voltage: between - 20 V and + 100 V.

3.3.3 - RESISTANCE SIMULATION

Range	Emission range	Resolution	Accuracy (23°C ± 1°C) over 90 days	Accuracy (23°C ± 1°C) over 1 year
600 Ω	from 0 to 600 Ω	1 mΩ	0.005 % + 8 mΩ	0.010 % + 10 mΩ
6 000 Ω	from 0 to 6 000 Ω	10 mΩ	0.005 % + 80 mΩ	0.010 % + 100 mΩ

Accuracies above are for a measurement current I such as 0.5 I_N < I I I < 2.5 I_N. Reference range with I_N (rated measurement current): 1 mA over the 600 Ω range and 0.1 mA over the 6 000 Ω range.
Permissible measurement current: 0.1 I_N to 4 I_N. For measurement currents between the permissible range, but not between the reference range, the accuracy is twice the reference accuracy.
Max. permissible current or voltage:
- 600 Ω range: 100 mA or 60 V DC or peak.
- 6 000 Ω range: 10 mA or 60 V DC or peak.

3.3.4 - THERMOCOUPLE SIMULATION

Sensor	Simulation range (°C)	Resolution (°C)	Accuracy (23°C ± 1°C) over 90 days	Accuracy (23°C ± 1°C) over 1 year
K	from - 240 to - 200	0.01	+ 1.0°C	+ 1.5°C
	from - 200 to 0	0.01	+ 0.3°C	+ 0.5°C
	from 0 to + 1 372	0.01	0.01 % + 0.1°C	0.015 % + 0.2°C
T	from - 240 to - 200	0.01	+ 1.0°C	+ 1.5°C
	from - 200 to 0	0.01	+ 0.3°C	+ 0.5°C
	from 0 to + 400	0.01	+ 0.1°C	+ 0.2°C
J	from - 210 to - 100	0.01	+ 0.3°C	+ 0.5°C
	from - 100 to + 1 200	0.01	0.01 % + 0.1°C	0.015 % + 0.2°C
E	from - 240 to - 200	0.01	+ 0.5°C	+ 1.0°C
	from - 200 to - 100	0.01	+ 0.2°C	+ 0.3°C
	from - 100 to + 1 000	0.01	+ 0.1°C	+ 0.2°C
R	from - 50 to + 120	0.01	+ 1.0°C	+ 2.0°C
	from + 120 to + 1 768	0.01	+ 0.5°C	+ 1.0°C
S	from - 50 to + 120	0.01	+ 1.0°C	+ 2.0°C
	from + 120 to + 1 768	0.01	+ 0.5°C	+ 1.0°C
B	from 0 to + 400	0.01	-	-
	from + 400 to + 900	0.01	+ 1.0°C	+ 1.5°C
	from + 900 to + 1 820	0.01	+ 0.5°C	+ 1.0°C
L	from - 200 to - 100	0.01	+ 0.2°C	+ 0.3°C
	from - 100 to + 900	0.01	+ 0.1°C	+ 0.2°C
N	from - 240 to - 100	0.01	+ 1.0°C	+ 1.5°C
	from - 100 to + 1 300	0.01	+ 0.2°C	+ 0.4°C
PI	from - 100 to + 1 395	0.01	+ 0.2°C	+ 0.4°C
Mo	from 0 to + 1 375	0.01	+ 0.2°C	+ 0.3°C

The accuracy is guaranteed for a reference junction at 0°C.
Accuracy when using the internal reference junction:
- front terminal board: ≤ 0.2°C,
- rear terminal board: ≤ 0.4°C.

The other specifications are similar to those given in DC voltage emission over the 600 mV range.

3.3.5 - RTD SIMULATION

Sensor	Simulation range (°C)	Resolution (°C)	Accuracy (23°C ± 1°C) over 90 days	Accuracy (23°C ± 1°C) over 1 year
Pt 100	from - 220 to 0 from 0 to + 1 200	0.01 0.01	+ 0.04°C 0.01 % + 0.04°C	+ 0.06°C 0.015 % + 0.06°C
Pt 200	from - 220 to 0 from 0 to + 590	0.01 0.01	+ 0.03°C 0.01 % + 0.03°C	+ 0.04°C 0.015 % + 0.04°C
Pt 500	from - 220 to 0 from 0 to + 1 200	0.01 0.01	+ 0.05°C 0.01 % + 0.05°C	+ 0.1°C 0.015 % + 0.1°C
Pt 1 000	from - 220 to 0 from 0 to + 1 200	0.01 0.01	+ 0.04°C 0.01 % + 0.04°C	+ 0.06°C 0.015 % + 0.06°C
Ni 100	from - 60 to + 180	0.01	+ 0.3°C	+ 0.4°C

Accuracies above are for an external current I such as 0.5 I_N < I I I < 2.5 I_N where I_N is the 1 mA rated current in Pt 100, Pt 200 and Ni 100 simulation and 0.1 mA in Pt 500 and Pt 1 000 simulation.
The other specifications are similar to those given in resistance simulation.

3.4 - Other specifications

3.4.1 - RS 232 LINK

The **PJ6301** has an RS 232 output via a 9-pin SUB-D female connector.
A key returns the unit to local mode.

Link specifications:
- Transmission rate: 300, 600, 1 200, 2 400, 4 800, 9 600, 19 200 bauds.
- Character format: 7 or 8 bits with 1 or 2 stop bits.
- Parity: even, odd, ignore or no parity.
- Protocol: XON/XOFF, DTR/CTS or no protocol.

These parameters are programmed from the unit keyboard and stored into permanent memory.

3.4.2 - IEEE-488.2 LINK (OPTION)

Connection to the bus is performed via a standardized 24-pin plug.
Address of the unit is entered using the keyboard and kept into permanent memory (31 available addresses).
A key returns the unit to local mode.
Both IEEE and RS 232 circuits are set to the same potential together with the trigger command.

Functions available:

AH1 SH1 T6 L4 SR1 RL1 PP0 DC1 DT0 C0 E2

3.4.3 - BATTERY PACK SUPPLY (OPTION)

12 V lead battery pack.
Battery life: 2 h to 3 h 30 mn depending on the processing mode and charge value.
Power supply automatic disconnection.
Recharge time (unit switched off): 12 to 14 h.

APPENDIX B

Error messages
Icon meaning

List of the error messages

This list, with comments, deals with error messages appearing at the bottom of the display. Also indicated are the paragraphs or chapters of the instruction manual where the function concerned may be found.

Impossible in Auto mode 4.3.1

Displaying min. and max. values is not possible with autoranging mode selected.

Scaling in progress 4.5.3 and 6.8.4

Changing the scaling specifications is not possible when that mode is validated.

Trigger not possible in Run mode 4.6

When the unit operates in continuous cycle, it is not possible to store measurements in a programmed burst. First, stop the continuous cycle (HOLD).

Measurement cycle in progress 4.6

When the continuous cycle stops (HOLD) "step by step" storage cannot be performed at the same time as a programmed burst and vice-versa. Switch to RUN mode.

Interface command in progress 4.6

The keyboard cannot be used to act on the bursts while an interface command affecting the bursts is in progress.

External trig not possible 4.7

When calling the measurement memories, it is not possible to store, at the same time, new measurements by an external trigger.

Empty measurement burst 4.7

When displaying measurements from a burst, measurements of this burst have been cleared or the burst is not yet triggered.

No burst present 4.7

There is no measurement burst stored into memory. The unit reads "No burst present".

Err: Begin. cursor after end cursor 4.7

When displaying list of stored measurements, the list end cursor (E) has been placed by mistake before the list beginning cursor (B).

Err: M1 higher than or equal to M2 4.5.5 and 4.7

When using the analog recorder, the measurement value for a null output (M1) should not be higher than or equal to the value for a 2.5 V output (M2).

X-value already assigned 4.5.3 and 6.8.4

When entering x-coordinate points of a scaling, it is impossible to give the same x-value to two different points.

Number of points between 2 and 10 4.5.3 and 6.8.4

From two points as a minimum up to 10 points as a maximum should be programmed in a scaling.

Value out of limits 6.2, 6.3 and 6.8

The value to be emitted cannot be emitted (for example: current range out of limits). The old value remains valid.

Execution not possible, out of limits 6.8.2

When starting a ramp, the amplitude (Δ) of the programmed ramp is higher than the emission range used.

Edition not possible, ramp in progress 6.8.2

It is not possible to edit the initial value of a ramp when that one is in progress.

Ramp + scaling not possible 6.8.2 and 6.8.4

Starting execution of ramp is not possible while an emission-simulation scaling is validated.

Incompatible scaling 6.8.4

The scaling is incompatible with the unit output specifications.

TRX function + scaling not possible 6.8.4 and 6.8.5

It is not possible to use the transmitter mode while an emission-simulation scaling is validated.

Communication error with analog board

An abnormal error has occured during communication between the two boards of the instrument.

Err: no IEEE option or line 7.2

The IEEE-488 bus cannot be used if the board is not installed or if the unit is battery-operated.

Not possible in IEEE mode 7.2

The printer should be used only with the RS 232 serial link.

Wrong access code 7

The access code to the adjustment program is wrong.

Adjustment out of limits 7

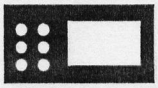
The unit has computed too high an adjustment correction.

WARNING ! Any handling in the adjustment program may considerably affect the unit performances.

Refer to maintenance manual.

Icon table

FUNCTION	ICON	MEANING
Measurement	**Icon in "IN" window**	
Free measurements or triggered measurements	**M**	This icon blinks each time a new measurement is performed.
	⧗	Measurements are stopped ("HOLD" mode).
	⧗ and ⧗ alternate	Triggered measurement cycle in progress.
Alarm thresholds	1 •))	Limit 1 in alarm.
	2 •))	Limit 2 in alarm.
Measurement processing		Computations performed from the rough measurement (Example: relative measurements, or scaling, or ... digital filter validated (ON)).
Emission	**Icon in "OUT" window**	
Signal emission		Emission is operational.
	STBY	Emission is held.
Output amplifier saturated	 blinking	Load too low in voltage mode. Load too high in current mode.
Increment execution		The cycle is in progress.
Ramp execution		The cycle is in progress.
Synthesizer		The cycle is in progress.
Transmitter	**TRX**	Transmitter ON.
Emission processing		Scaling ON.

General configuration		
Front terminal board or rear terminal board		The front terminal board is used.
	REAR	The rear terminal board is used.
Maintenance		
Battery		The battery must be recharged.

APPENDIX C

Operating programs - Short form

Measurement operation (IN)

PROMPTS OF THE SUCCESSIVE MENUS ☛						PARAMETERS TO BE CHOSEN WHEN:
Main menu	Access menu	Function menu	Range menu			CHANGING FUNCTION OR CONFIGURING FUNCTIONS
IN	FCT or CFG	V	AUTO 60mV 0.6V 6V 60V			Autoranging and voltmeter range.
		mA	TxP⊥/⊤ TxA			The **PJ6301** supplies a voltage source to the transmitter (Passive transmitter). The transmitter self-outputs the current (Active transmitter).
		Ω	AUTO 600Ω 6kΩ			Autoranging and ohmmeter range.
			2W 3W 4W			2-wire connection or 3-wire connection or 4-wire connection.
		Tc	RJ	ON OFF		Reference junction correction ON or OFF.
			TYPE	K T J E N L S >>	<< R B PI Mo	Types of thermocouples.
			TCX	ON OFF		Thermocouple break detection ON or OFF.
			UNIT	°C °F K		Temperature measurement unit.
		Rt	P100 P200 P500 P1K N100			Types of RTDs.
			2W 3W 4W			2-wire connection or 3-wire connection or 4-wire connection.
			UNIT	°C °F K		Temperature measurement unit.

The menus continue on next table.

☛ **Changing from one menu to another is made by selecting a prompt.**

Main menu	Access menu	Function menu				PARAMETERS TO BE CHOSEN IN:
						TRIGGERED MEASUREMENTS AND MEASUREMENT STORAGE
IN	↓					
	TRIG	RUN				Free rate (continuous measurements).
		HOLD				Holds the free rate.
		CLRM				Clears a measurement stored.
		TRGM				Stores the next measurement.
		NAME	A ... G H ... N etc ..	A B C D E F G CAPS		Name of the burst. (8 characters max.). - First, select the group including the desired character. - Select this character. - Proceed as above for the other characters. - Then, validate.
		PROG	Editor			**N** = Number of measurements in the burst. **T** = Time between two measurements.
		BTRG				Triggers a programmed burst and store the measurements
						ALARM THRESHOLDS
	ALAR	L1	ON OFF			Alarm 1 is active or inactive.
			PROG	Editor		**T** : Value of threshold 1. **H** : Hysteresis value for alarm 1.
			M > Th M < Th			Alarm if the measurement M is > or < than threshold Th.
		L2	ON OFF			Alarm 2 is active or inactive.
			PROG	Editor		**T** : Value of threshold 2. **H** : Hysteresis value for alarm 2.
			M > Th M < Th			Alarm if the measurement M is > or < than threshold Th.
		BUZZ	ON OFF			Buzzer is active or inactive.
↓	↓					

The menus continue on next table.

Main menu	Access menu	Function menu				PARAMETERS TO BE CHOSEN WHEN:
						PROCESSING THE MEASUREMENT
IN	↓					
	:					**Relative measurements**
	PROC	**NUL**	**ON**			Relative measurements are active or inactive.
			OFF			
			TARE			"Nul" on the measurement (automatic tare).
			EDIT	Editor		**N** = reference value.
						Scaling
		SCAL	**ON**			Scaling is active or inactive.
			OFF			
			:			
			PROG	↑ ↓		In the coordinate list, the cursor is set to the previous point or to the next point.
				EDIP	Editor	Changes coordinates of the point marked by the cursor.
				ADDP	Editor	Adds a new point to the coordinates.
				RES	Editor	Displayed value resolution.
				UNIT	**A ... G**	Unit to be displayed.
				:	:	*For using the editor,*
				:	etc ...	*see previous page.*
				CLRP	**YES**	Clears the coordinates of the
				:	**NO**	point marked by the cursor.
				CLRA	**YES**	Clears all the list for
				:	**NO**	returning to the default list.
						Digital filter
		FILT	**ON**			Sets the digital filter active and initializes the computations.
			:			
			INIT			Initializes the computations.
			OFF			Sets the digital filter inactive.
			PROG	Editor		**N** = Filtering coefficient (§ 4.5.4).
						Min/max display
		↑ : ↓ :	**ON**			Min/max display active or inactive.
			OFF			
			INIT			Initializes the computations.
						Recorder output
		RCDR	Editor			**M1** : Measurement for 0 V on output. **M2** : Measurement for 2.5 V on output.
						Printer output
		PRNT	**ON**			Printer is active or inactive.
			OFF			
			M/N	Editor		Number of measurements between two printings.
			CFG	Editor		**M/L** : Number of measurements per line. **L/P** : Number of lines per page.
↓	↓					

Main menu	Access menu	Function menu				PARAMETERS TO BE CHOSEN WHEN:
						USING THE MEASUREMENT MEMORY
IN	↓					
	MEM	CLRA	YES NO			Clears all the burst memory.
		↑↓				Searching for an older or more recent burst.
		CLRB	YES NO			Clears the displayed burst.
		NAME	A ... G	A B C D E F G		Name of the burst. (8 characters max). - First, select the group including the desired character. - Select this character. - Proceed as above for the other characters. - Then, validate.
			H ... N			
			etc ..	CAPS		
		OUT	PRNT	EXEC		Sends measurements to printer.
				CFG	Editor	**M/L** : Number of measurements per line. **L/P** : Number of lines per page. **T/L** : Time-delay between two printed lines.
			RCDR	PROG	Editor	**M1** : Value displayed for 0 V on the analog output. **M2** : Value displayed for 2.5 V on the analog output. **T** : Time-delay between two consecutive measurements.
				EXEC		Sends measurements to recorder.
		DISP	↑↓			Scrolls through the burst measurements, line per line or page per page.
			Pg ↑ Pg ↓			
			CLRM	YES NO		Clears the measurement marked by the cursor.
			SETB SETE			To get a short list, sets the cursor to beginning of the list (B) .... sets the cursor to end of the list (E).
			STAT			Statistics on the list (short or complete).
			>>	<<		
				CLRE	YES NO	Clears the measurements outside the short list.
				OUT	PRNT : RCDR	Outputs the displayed list (short or complete) to a printer or to a recorder. Same procedure as below.
OUT						

Emission-simulation operation (OUT)

PROMPTS OF THE SUCCESSIVE MENUS ☛						PARAMETERS TO BE CHOSEN WHEN:
Main menu	Access menu	Function menu	Range menu			CHANGING FUNCTION OR CONFIGURING FUNCTIONS
IN : OUT	FCT or CFG	V : mA : Ω : Tc : Rt	0.6V 6 V 60V 600Ω 6kΩ RJ : TYPE : UNIT P100 P200 P500 P1K N100 UNIT	 ON OFF K T J E N L S >> °C °F K °C °F K	 << R B Pl Mo	Range of the voltage generator. Current emission function (no configuration, only one range 0-60 mA. Prompt not available in function configuration). Resistance simulation ranges. Internal reference junction ON or OFF (5.4). Types of simulated thermocouples. Simulated temperature unit. Types of simulated RTDs. Simulated temperature unit.

The menus continue on next table.

☛ **Changing from one menu to another is made by selecting a prompt.**

Main menu	Access menu		PARAMETERS TO BE CHOSEN WHEN:
			STORING A VALUE
OUT	STO	Editor	**Val** : Value to be stored. **No** : Memory number.
			RECALLING A STORED VALUE
	RCL	Editor	**No** : Number of the memory recalled.
			EDITING A VALUE TO BE EMITTED
	EDIT	numeric keys	Numeric keys, minus sign (-) and decimal point. The cursor automatically moves to the right to edit the next figure. Then, validate with **ENT**.
		< >	Moves the cursor to the left or to the right.
			CHANGING A VALUE
		< >	Moves the cursor to the left or to the right.
		↑ ↓	Increments or decrements the figure marked by the cursor (with carry).
			STANDBY/OPERATE
	STBY		Emission in standby.
	OPR		Operational emission.

The menus continue on next table.

Main menu	Access menu	Function menu				PARAMETERS TO BE CHOSEN WITH: SPECIAL FUNCTIONS
						Increment generation
OUT	SPEC	INCR	⌐¬			Generates positive increments (increasing signal) or negative increments (decreasing signal).
			STOP			Stops execution of increments.
			HOLD			Holds execution of increments.
			REST			Restarts execution of increments.
			EDIT	Editor		Edits the initial value.
			PROG	Editor		**I** = Value of the increment. **N** = Number of increments. **T** = Time between two increments.
						Ramp generation
		RAMP	PROG	Editor		Δ : Simple ramp amplitude. **Δt** : Simple ramp duration.
			⟋ ⟍			Starts an ascending or descending ramp.
			STOP			Stops execution of simple or cyclical ramp.
			HOLD			Holds execution of simple or cyclical ramp.
			REST			Restarts execution of simple or cyclical ramp.
			EDIT	Editor		Edits the initial value.
			⟋⟍			Starts a cyclical ramp.
			PROG	Editor		Δ : Cyclical ramp amplitude. **N** : Number of cycles. **T0** : Initial value home time. **T0 -> 1** : Rise time. **T1** : Final value home time. **T1 -> 0** : Fall time.
						Synthesizer
		SYNT	M ↑ M ↓			Manual recall of the emission memories by increasing order of numbers or by decreasing order of numbers.
			CYCL			Automatic recall of memories by increasing order of numbers according to the programmed cycle parameters.
			STOP			Stops execution of cycle.
			HOLD			Holds execution of cycle.
			REST			Restarts execution of cycle.
			PROG			**M1** = First memory cycle number. **M2** = Last memory cycle number. **T** = Time between two consecutive memory recalls. **N** = Number of cycles

The menus continue on next table.

Main menu	Access menu	Function menu				SPECIAL FUNCTIONS (Cont'd)
						Scaling
↓ : OUT	↓ : SPEC	↓ : SCAL	ON OFF PROG			Scaling is active or inactive.
				↑↓		Moves the cursor to the previous line or to the next line.
				EDIP	Editor	Edits the coordinates of the point marked by the curso
				ADDP	Editor	Adds coordinates of a new point.
				RES	Editor	Defines resolution of the value displayed.
				UNIT	A ... G : : : : : H N etc ...	Unit to be displayed (3 characters max). - First, select the group including the desired character. - Select this character. - Proceed as above for the other characters. - Then, validate.
				CLRP	YES NO	Clears the point marked by the cursor or keeps it into memory.
				CLRA	YES NO	Clears all the points or keeps them into memory.
						Transmitter mode
		TRX	ON OFF PROG			Transmitter mode active or inactive.
				Editor		**M1** : Value in "IN" window to output 4 mA or 0 V. **M2** : Value in "IN" window to output 20 mA or 10 V.
			4-20 0-10			4-20 mA output or 0-10 V output.
↓ : CFG						

The menu continues on the "General configuration" table.

General configuration

Main menu	Access menu				PARAMETERS TO BE CHOSEN WHEN:
↓					**CONFIGURING THE UNIT**
OUT					
CFG					**Front/rear terminals**
	F/R	FRNT REAR			The front terminals or the rear terminals of the unit are used.
	INTR				**Interfaces**
		RS	ON		The RS 232 serial link is active.
			KBDS	19.2 9.6 4.8 2.4 1.2 0.6 0.3	Transmission rate in KiloBauDs.
			BITS	7 8	Number of bits.
			STOP	1 2	Number of stop bits.
			PAR	EVEN ODD NOP IGNP	Even parity or odd parity or no parity or ignore parity.
			PROT	XON DTR NOPR	XON/XOFF protocol or DTR protocol or no protocol.
		IEEE	ON		The IEEE-488 interface is active.
			ADDR	Editor	Address of the unit on the bus.
					Message language
	LANG	FRA ENGL DEUT			Display is in French or in English or in German.
					Instrument adjustment
	ADJ				***Program reserved for maintenance purposes.***
					Display contrast
	CNTR	- + >I<			Less contrast or more contrast or default contrast.
					Display lighting
	LIGH				Display lighting ON or OFF.
↓	↓				

Main menu	Access menu				PARAMETERS TO BE CHOSEN WHEN:
					CONFIGURING THE UNIT (Cont'd)
CFG					**External triggers**
	ETRG	TRGM BTRG			**Measurement storage:** Triggers measurements either manually or automatically according to the programmed cycle.
		M↑ M↓ CYCL			**Synthesizer function:** Emission memories are recalled by increasing order of number or decreasing order of number according to the programmed cycle.
					**Increment generation:** Execution of an increasing increment cycle or a decreasing increment cycle.
					**Ramp generation:** Execution of an ascending ramp or a descending ramp.
					Configuration memory
	STO	1 2 3 4 5	YES : NO		Storage of the current general configuration in one of the five memories.
	RCL	1 2 3 4 5	YES : NO		Recalling one of the five configurations stored.
STAT	IN OUT CFG				Displays the measurement (IN) parameters or the emission-simulation (OUT) parameters or the general configuration.

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