Sefram

INSTRUMENTS & SYSTEMES

TWO - CHANNEL RECORDER

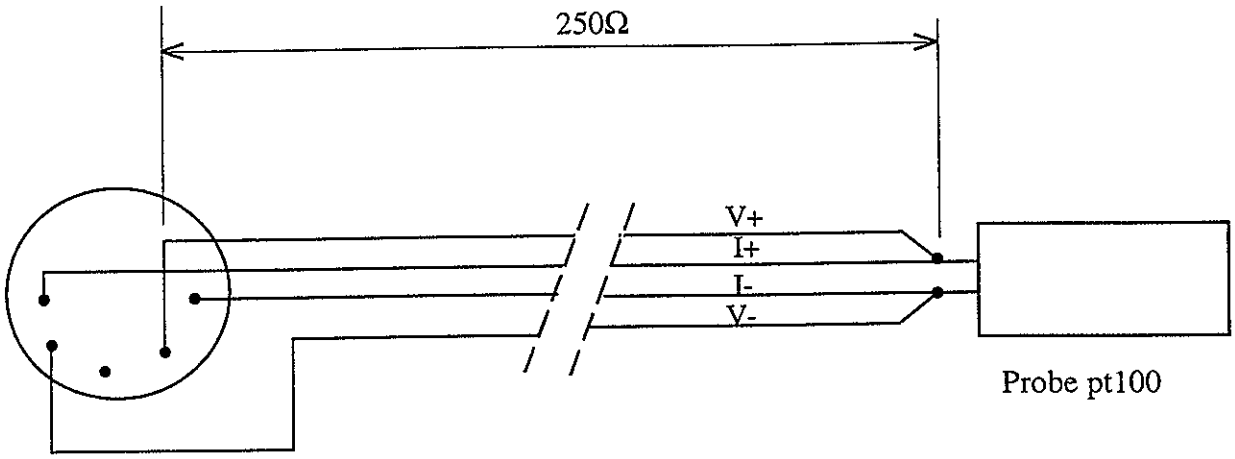
8210

USER MANUAL

Issue : December 1994

M8210001A/00

This instrument is equiped of PT100 long distance measurement option , réf : 982102000 . It's able to give accuracy of temperature measurement with wire resistor cable of 250Ω / wire impedance.



Mâle DIN plug
solder side wiew

from vers.2.4 for 8210

from vers.1.6 for 8211

UTILIZATION ADVICE FOR 8210 PENS

For optimal utilization of the 8800 pen recorder, it is important to choose the pen most adapted to your recording conditions.
The following remarks and the chart will help you obtain a good quality tracing.

The ball-point felt pen : code 883500051 to 883500058

This felt pen consists of a ball-point. It is of very general utilization and possesses the following characteristics :

- fine writing
- quick and slow writing (>20mm/h)
- length of writing : 1500 at 0.2m/s
- good life span : evaporation is minimal for the ink only evacuates when the ball turns.

The left pen : code 883500043 to 883500050 (EX455/1 to EX455/8)

- thicker writing than the ball-point felt pen therefore giving a good contrast
- quick and slow writing (>20mm/h)
- length of writing : 1500m at 0.2 m/s
- cap the pen after usage to avoid evaporation

The slow recording felt : code 883500500 to 883500507

- recommended for recording rates inferior to 50 mm/h
- weak ink deposit : tracing hardly visible when rate exceeds 100mm/s

Note : in the case where paper feeding (1mm to 20mm/h) due to very slow recordings use filters that give a fine tracing and avoid leaving ink blotches that could deteriorate paper

At slow rates it is recommended to use paper in rolls to avoid the problem of ink flowing into the folds of folded paper.

Utilization chart corresponding to the paper feeding

Rate	1 mm/h	2 mm/h	5 mm/h	10 mm/h	20 mm/h	50 mm/h	1 mm/mn	2 mm/mn	5 mm/mn	10 to 50 mm/mn mm/s
Ball-point felt						X	X	X	X	X
Felt						X	X	X	X	X
Slow felt	X	X	X	X	X					
Mini filter	0.02hz	0.02hz	0.07hz	0.25hz	0.5hz	1hz	indif.	indif.	indif.	indif.
Paper	rolls	rolls	rolls	rolls	rolls	indif.	indif.	indif.	indif.	indif.

indif. : indifferent

GENERAL USE PRINCIPLES FOR THE 8210
TWO-CHANNEL RECORDER

for an easier information research on the 8210, the manual is composed of various chapters. The contents of each chapter are given in the table of contents.

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PRELIMINARY

1 - PRELIMINARY

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1 - PRELIMINARY

1.1 GENERALITES

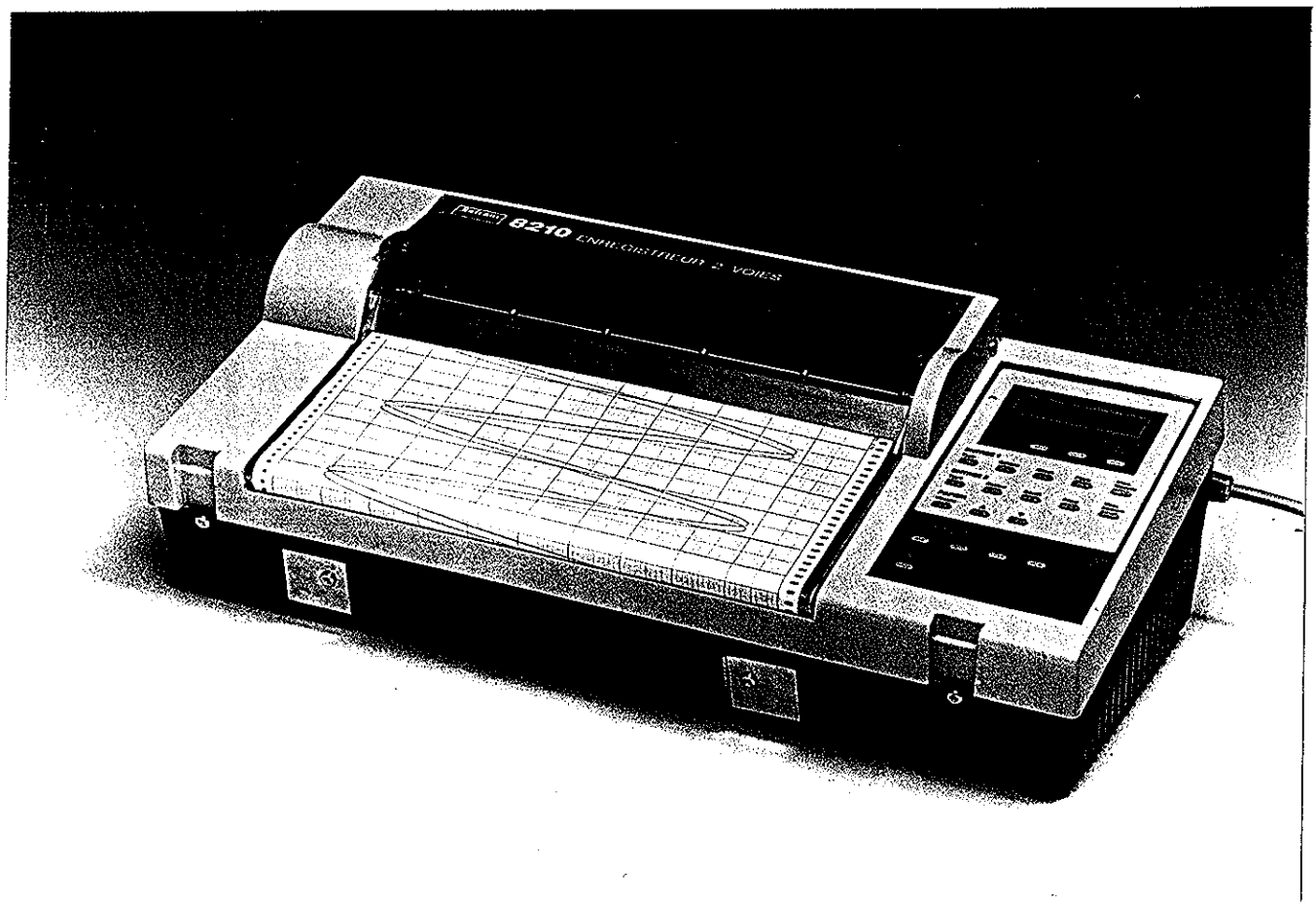
The 8210 is a programmable graphic recorder for simultaneously measuring and recording voltages or temperatures on two channels.

The 8210 has two function modes : continuous and digital. Measurements made with the 8210 require prior programming of the operating parameters.

The dialog between the operator and the recorder is made possible by the display of a menu on the front panel display.

The 8210 is fully computer-programmable via a calculator (RS 232 link).
When pen displacement is controlled by instructions given by the calculator, the 8210 is operating in digital mode.

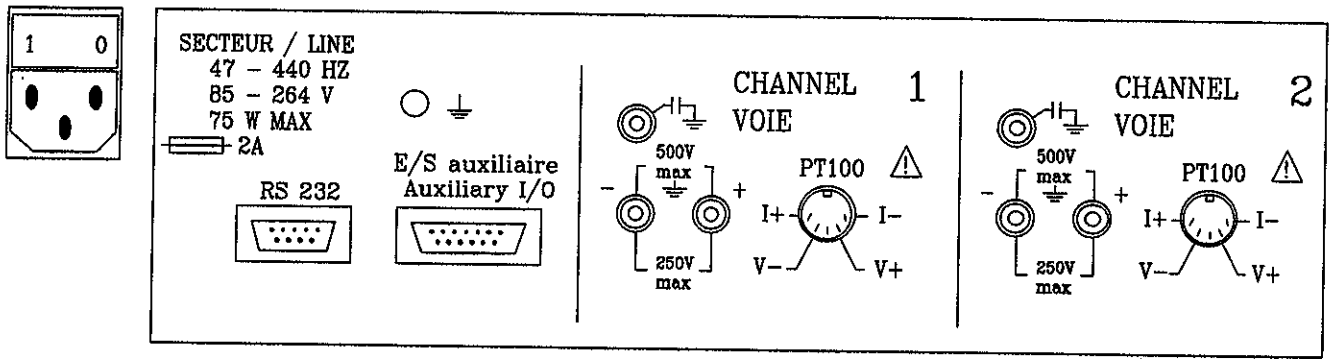
1.2 DESCRIPTION



1.2.1 Back side

The back side comprises:

- 2 input ports. Each comprises :
  - . 1 red terminal : "+" input
  - . 1 black terminal : "-" input
  - . 1 white terminal :Guard (capacity between terminal and mainframe)
  - . 1 DIN plug : PT 100
- an earth plug
- an RS 232 9-pin connector
- an 15-pin auxiliary command connector
- a mains supply plug
- an on-off switch.



1.2.2 Front side

On the front side of the recorder there are:

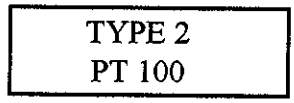
- a chart paper-drive subsystem (the paper has an effective width of 250 mm)
- a recording-pen subsystem for the writing
- a panel to facilitate operating parameters programming. It is a compound of various keys and a built-in LCD screen
- a pen protective cap
- a carrying handle.

NB: In the chart paper-drive subsystem, a self winding-unwinder alternative can be incorporated.

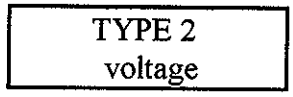
1.3 DISPLAY

The parameters permitting the recorder configuration are displayed on the screen by depressing one of the three series of keys : Input, paper and RS 232.

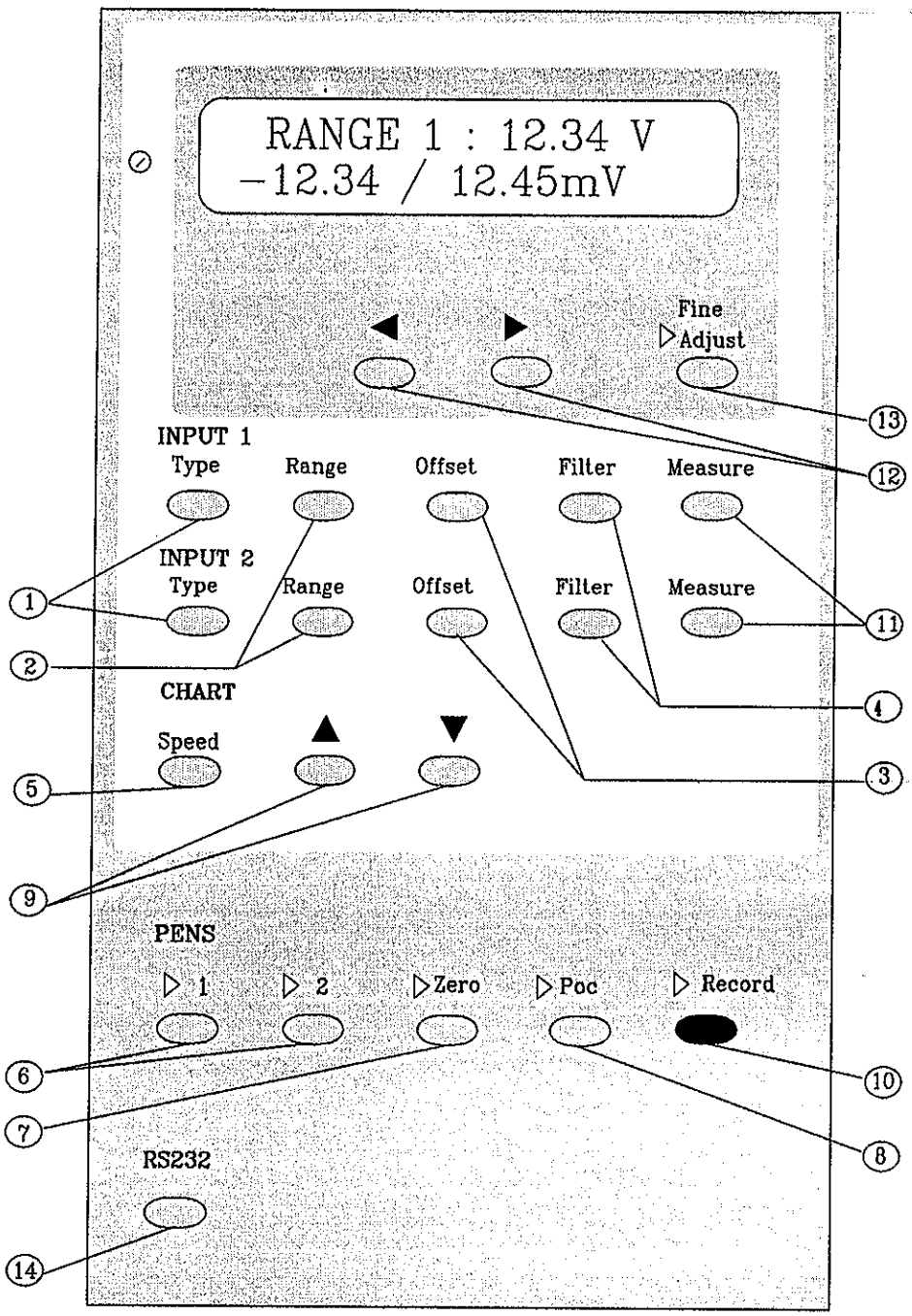
Example : Input 1 - PT 100 measurement mode



Example : Input 2 - VOLTAGE measurement mode



1.4 FRONT SIDE KEYS



1.4.1 Input-programming keys

Type keys (1) INPUT1 OR INPUT2

This key allows access to the adjustment and vizualisation of the type of input selected. The parameter may be :

. either a voltage,

. or a temperature (PT 100, thermocouple).

Range keys (2) INPUT1 or INPUT2

This key allows access to the adjustment and vizualisation of the range; that is, the range of the measurement corresponding to a 250 mm paper width.

Offset key (3) INPUT1 or INPUT2

This key allows access to the choice and visualisation of the recording range centre value.

Filter keys (4) INPUT1 or INPUT2

This key allows access to the choice and visualization of cut-off frequencies.

1.4.2 Paper-programming key

Speed key (5)

This key allows visualization and access to the choice of different paper feeding speeds or inhibition of the paper roller (See chapter 9).

NB. : For the choice of the different input or paper parameters see chapter 3.

1.4.3 Instant-action keys

Pressing these keys does not bring a menu up on the display. Some keys have indicator lights which, when lit up, confirm that the action has been validated.

Pen keys (6)

Action on a pen key controls the associated lmechanical channel auto control. Each pen is associated to an input (pen 1 - input 1 ; pen 2 - input 2) and may be separately stopped. A stopped pen is put back on the left-hand side of the table and the clutch of the corresponding motor is released.

Zero key (7)

This key allows simulation of the presence of short-circuit (0v in voltage or 0°C in temperature) on all the inputs and the positionning of the pens as a function of the measurement range (range and offset). This zero is not necessarily centered on the paper.

Synchro key (8)

This key allows an electrical compensation, for the 3 mm mechanical space between channels. The time axis is the same for all channels.

Paper keys (9)

These keys allow the paper to be fed in both directions - forward and backward. Keep on the pression on the key to validate the action.

Plot key (10)

Pressing this key allows all the pens to come into contact with the paper and thus to record.

Measure keys (11)

This key allows visualization of the measure on the display screen.

1.4.4 Increase/decrease keys (12)

These keys allow, by successive pushes, to modify the working parameters.

1.4.5 Fine adjust key (13)

This key associated to an indicator light, allows to choice the fine adjustment of the range and the offset.

1.4.6 RS 232 key (14)

This key allows the choice of the RS 232 parameters (speed, format, parity, protocol) depending of the used controller.

1.5 ADJUSTING POTENTIOMETER

It allows the adjustment of the display contrast.

OPERATION

2

2 - OPERATION

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2 - OPERATION

2.1 CHOICE AND CHANGING OF PENS

Three types of pens may be used :

ball-point pen	: red and blue
fibre tip pen	: red and blue
slow recording pen	: red and blue (available in option)

The quality of the plots depends on type of pen used. It is important to choose the pen best suited to the operator's purpose.

UTILIZATION ADVICE FOR 8210 PENS

The ball-point pen : code 883500051 and 883500052

This felt pen consists of a ball-point. It is of very general utilization and possesses the following characteristics :

- fine writing
- quick and slow writing (>20 mm/h)
- length of writing : 1500 m at 0.2 m/s
- good life span : evaporation is minimal for the ink only evacuates when the ball turns.

The fibre tip pen : code 883500043 and 883500044

- thicker writing than the ball-point felt pen therefore giving a good contrast
- quick and slow writing (>20 mm/h)
- length of writing : 1500 m at 0.2 m/s
- cap the pen after usage to avoid evaporation.

The slow recording felt : code 8835000500 and 8835000501

- recommended for recording rates below to 50 mm/h
- weak ink deposit : tracing hardly visible when paper-feed exceeds 100 m/s.

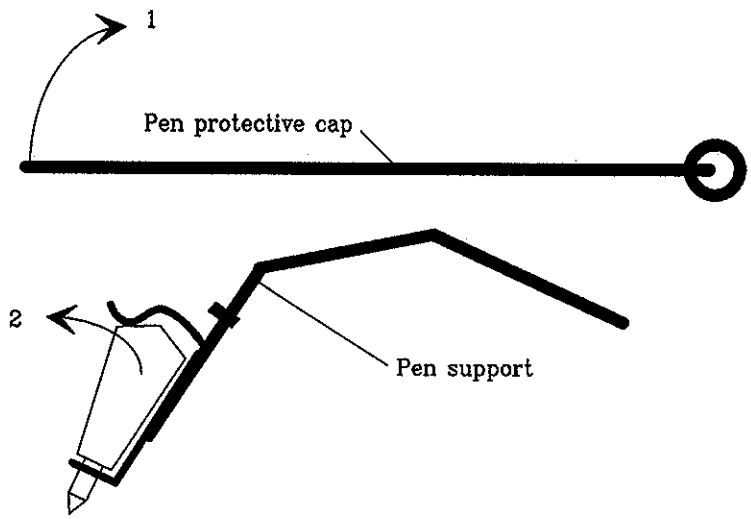
Note : At slow rates it is recommended to use paper in rolls to avoid the problem of ink flowing into folds of folded paper. Very slow paper feeding (1 mm to 20 mm/h) correspond to recordings of very slow events. In these cases use filters to get a fine tracing and avoid ink blotches that could deteriorate paper.

UTILIZATION CHART CORRESPONDING TO THE PAPER FEEDING

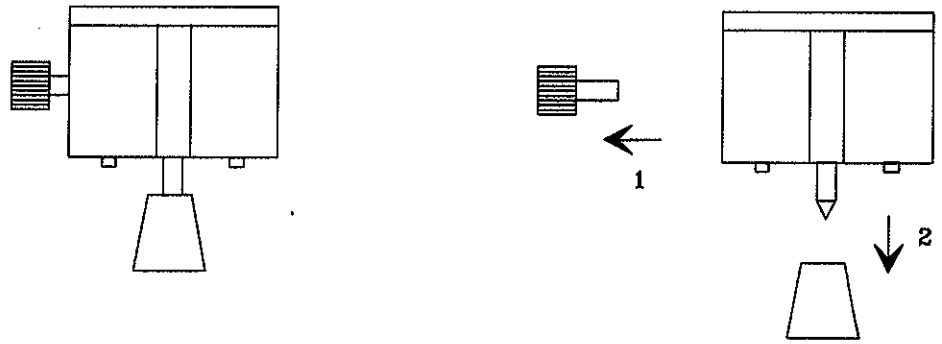
SPEED	10 mm/h	20 mm/h	50 mm/h	1 mm/mn	2 mm/mn	5 mm/mn	10 to 50 mm/mn mm/s
Ball-point felt			X	X	X	X	X
fibre tip		X	X	X	X	X	
slow felt	X	X					
min filter	0.25 hz	0.5 hz	0.5 hz	1 hz	ind.	ind.	ind.

To change a pen use the following procedure:

- cut the power off of the pen to be changed (pen 1 or 2 key)
- move manually the adequate channel to the table center
- rock the pen protective cap towards the back side of the instrument
- disengage the pen from its support by rocking the upper part towards yourself.



Pen replacement



- before use, first take off the cork (1) and then the cap (2)
- set up the new pen by positionning the two pins on the lower part of the pen in the receiving holes
- gently push the pen into position.

N.B. : Do not forget to put the cork and the cap back after use.

2.2 CHART PAPER LOADING

For loading a paper used with a self-winding unwinder refer to chapter 8. This chapter only concerns the basic instrument.

This handling is better carried out power off, so that the clutch of the motor is released.

Operations to effectuate :

- Lift the covering cap of the feeding table

- Introduce the paper axis into the roll.

- Position this assembly into the location provided to this purpose (round holes to the left, oblong holes to the right). Handlings will be easier if you position the paper into the location situated on the side of the carrying handle.

- Correctly introduce the paper under the pins of the toothed weels. In the same time check that the paper is well placed and advance the paper by running manually the toothed weel.

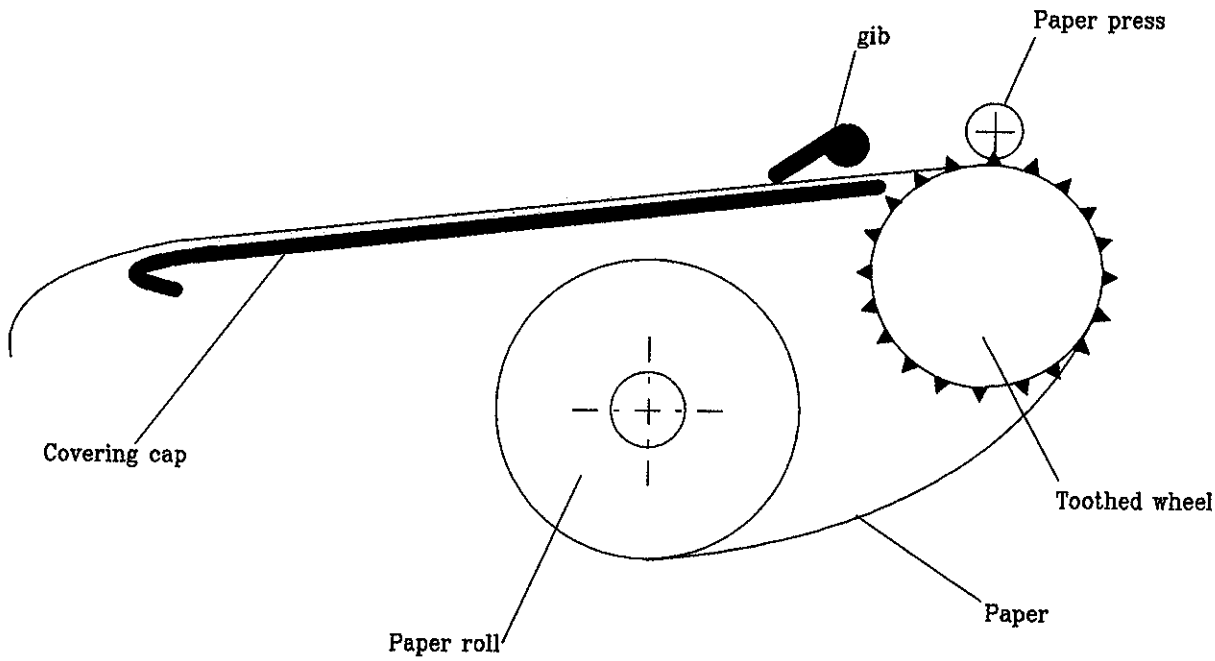
- Check that the paper is correctly placed. If it is not re-make the handling.

- Make the paper go under the paper press and under the gib.

- Close the covering cap.

Note: In case using a second hand paper roll, it is better to re-cut it so that the first roud hole (on the left of the paper) and the first oblong hole (on the right of the paper) are well lined up. The paper will then correctly swings around the toothed weels.

SCHEMATIC VIEW ON THE PAPER PASSAGE



ALTERNATE METHOD TO LOAD THE PAPER

This method is printed under thecovering cap.

The paper is delivered with the extremity cut in point, so it's easier to load it.

- Introduce the paper under the pins of the toothed wheels, and recuperate it by the point above the cap.

- Get out the paper by thepoint by aligning the thick line with the marks of the rule.

2.3 POWER SUPPLY

The 8210 recorder is mains-operated on :

85 V AC - 264 V AC
47 Hz - 440 Hz

The 8210 may be powered from a 12V DC / 220 V AC. For more information contact the SEFRAM INSTRUMENTS ET SYSTEMES After-Sales Service.

2.3.1 Switching on

- Connect the recorder to the mains supply using the mains cable; set the start-up switch in position 1.
- When the recorder is switched on, the LCD screen displays an introductory message showing :
  . The device type
  . the sofware version.

SEFRAM 8210 Version 1.0

N.B. : All the pens move towards the left end of the mainframe to find their reference position and then, if not in use, assume their rest position otherwise their measurement position.

IT IS ESSENTIAL THAT YOU DO NOT IMPEDE THE PENS DISPLACEMENT WHEN THEY ARE SEEKING THEIR REFERENCE POSITIONS.

2.3.2 Fuse

The protective fuse for the power supply is NOT accessible to the user.
In case of trouble, contact the SEFRAM After-Sales Service.

2.4 CONFIGURATION ON SWITCHING ON

On switching on, the recorder is in the configuration it has before being switched off. The first time it is switched on, the recorder is in a configuration that was determined by the Manufacturer.

N.B.: If the configuration is not retrieved on switching on contact the S.A.V. SEFRAM INSTRUMENTS ET SYSTEMES After-Sales Service.

The operator can return at any time to this initial configuration by keeping pressed down the RS 232 key while switching on the device.

This configuration is as follow :

- **Inputs** - **Type** : Voltage
  - **Range** : 100 V
  - **Centre** : 0 mV
  - **Filter** : nóne
- **Speed** : 1 mm/s
- **Zero,Synchro,Trace** not validated

2.5 CONNEXION OF THE MEASUREMENT CIRCUITS

2.5.1 Voltage measurement

The voltage is measured between the red and black input terminals. Two possible connections are proposed :

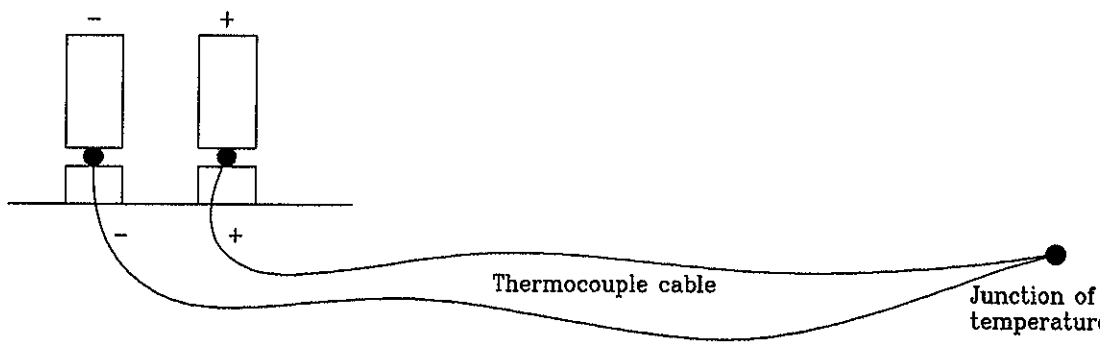
- by wires fitted with «banana» plugs

- by wires bared at their ends; in this case, unscrew the terminals slightly and thread the wires through the small transverse holes, then screw the terminals to ensure a good contact.

2.5.2 Temperature measurement by thermocouple

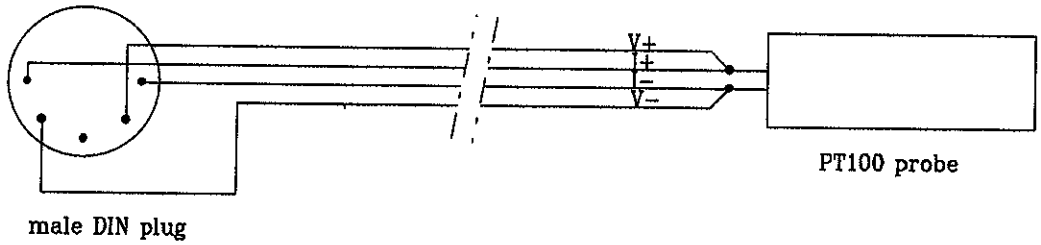
The voltage produced by the thermocouple should be measured between the red and black input terminals.

To ensure a good measurement, connect the bare ends of the wires of the thermocouple cable directly to the terminals and screw them firmly down, making sure that the polarity is correct.



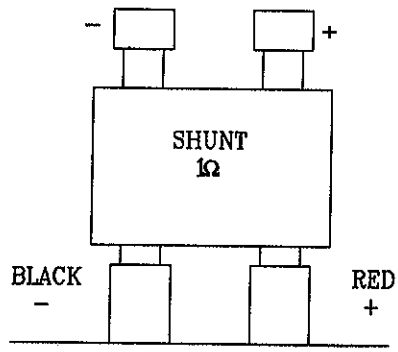
2.5.3 Temperature measurement by PT 100 probe

Each input is fitted with a DIN plug specially reserved for a PT 100 probe.
The probe should be connected to the 8210 by a four-wire cable :



2.5.4 Current measurement

Current measurements are possible. Prior to making a measurement, the operator should connect a 1 Ohm shunt between the + and - input terminals.



Connect the measurement wires to the shunt terminals.

The results display in volts are corresponding to ampere, and these display in mV are corresponding to mA.

2.5.5 Frame wiring

When making low level measurements, problems due to induced interference caused by electronic fields or common-mode voltages assume an importance that is directly proportional to the level of sensitivity chosen. It should be borne in mind that external connections must be made according to not always easily defined rules.

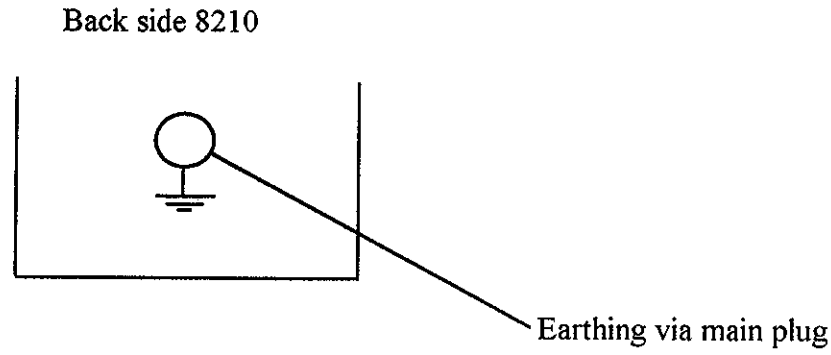
Some of the causes of these difficulties are :

- uncertainty about the exact origin of the perturbing voltages and their associated impedances,
- uncertainty about unwanted capacitors of the wiring circuits,
- inaccebility of the common-mode entry point of the circuit voltage carrying the signal to be recorded,
- non-conformity of some instruments with the current norms,
- sometimes even ignorance of the source of impedances of the signals to be recorded.

When making low-level measurements with an instrument with floating inputs and high impedance, it is necessary, in the event of abnormal functioning (vibrations, background noise, hum. etc ...), to undertake a critical evaluation of the external connections before incriminating the instrument itself.

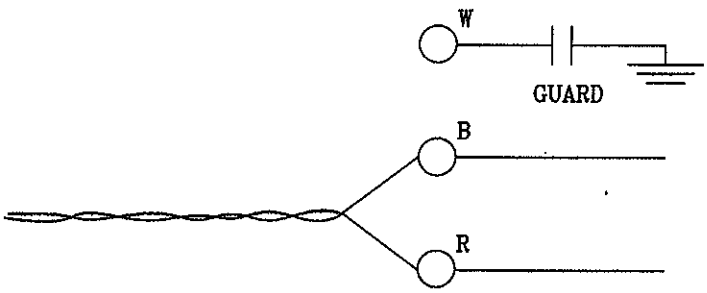
THE FOLLOWING GUIDELINES SHOULD BE GENERALLY RESPECTED

1° - All instrument mainframe should be connected to earth. The recorder's mainframe is earthed through the electrical supply cable (assuming that the earth is in fact connected to the mains plug). However, if other instruments in the circuit do not have an earthing facility, their frames must be connected to that of the 8210 via the earth socket.

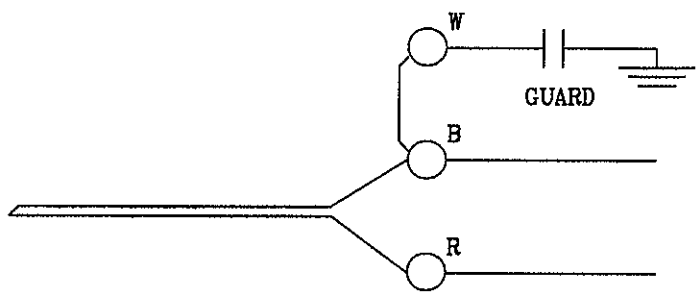


2° - If the source of the signal has a low internal impedance, stranded wires, should be used; and if this impedance is high, shielded wires should be used.

3° - To minimise the common-mode effect, one of the plugs (black or red) may be connected to the white (guard) terminal; this, however, sacrifies the differential channel input.

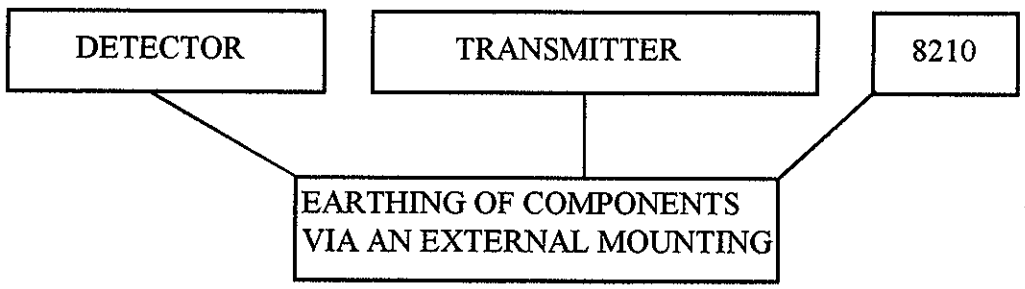


FOR LOW INTERNAL IMPEDANCE SOURCE : STRANDED WIRES



FOR A HIGH INTERNAL IMPEDANCE SOURCE : CONNECT THE BLACK TERMINAL TO THE WHITE TERMINAL (shielding connected to the wite terminal)

4°- If it is wished to earth by external wiring the frames of a group of measuring instruments via terminals, and to avoid a short-circuit, make sure that there is no low voltage impedance between the terminals. A full knowledge of all the measuring system components is generally sufficent; however, in case of doubt, apply a small load (i.e. 1 kOhm) between the circuit terminals and check for any voltage.



2.6 ROUTINE MAINTENANCE

The user should only clean the outside of the recorder.
All other maintenance operations require a qualified serviceman.

CAUTION
Disconnect the recorder from the power supply before undertaking any maintenance.

- Do not allow water to get inside the recorder, so as to avoid any risk of electrical discharge.
- Clean the recorder from time to time in accordance with the following guidelines :
- Use soapy water for the front and back plates; avoid all products containing petroleum, trichoethylene, benzene or alcohol, which will damage the front plate printing.
- Wipe with a hair free clothe.

3

PROGRAMMING THE INPUT CHANNELS

3 - PROGRAMMING THE INPUT CHANNELS

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3 - PROGRAMMING THE INPUT CHANNELS

3.1 PROGRAMMING THE PARAMETERS

3.1.1 Choice of the measurement type

1° - Using the input keys (1), select the preferred channel for the measurement.
2° - Select, by means of the increase/decrease keys (12), the type that corresponds to the the measurement to be made. This type may be :

- Voltage
- PT 100
- Therm J)
  K)
  T)
  S)
  B) Compensated or not
  E)
  N)
  W5)

Example: Voltage mode on input 1

TYPE 1
voltage

N.B. :

- For the thermocouple type :

With compensation of the cold junction, the measurements are automatically corrected with respect to the signal on the input terminals. The temperature indicated by the 8210 thus represents the definitive temperature of the hot junction (measurement junction). Without compensation it becomes possible to connect to the inputs a probe that has already been compensated, or to measure temperature variations.

- For the PT 100 type :

It is imperious to disconnect the "+" and "-" terminals (red and black) of the corresponding input in order to get a correct temperature measure.

3.1.2 Choice of the measurement range

1°- Select the range parameter by pressing the range key (2) for the input channel (1 or 2) selected.

2° - Select the appropriate signal amplitude range by pressing the increase/decrease keys (12)

The range may be :

FOR VOLTAGE MODE :

1mV	500 mV
2 mV	1V
5 mV	2 V
10 mV	5 V
20 mV	10 V
50 mV	20 V
100 mV	50 V
200 mV	100 V

FOR PT 100 MODE : (°C)
20°
50°
100°
200°
500°
1000°

FOR J THERMOCOUPLE MODE : (°C)
20°
50°
100°
200°
500°
1000° 2000°

FOR K THERMOCOUPLE MODE : (°C)
20°
50°
100°
200°
500°
1000°

FOR T THERMOCOUPLE MODE : (°C)
20°
50°
100°
200°
500°

3 - PROGRAMMING THE INPUT CHANNELS

FOR S THERMOCOUPLE MODE : (°C)
50°
100°
200°
500°
1000°
2000°

FOR B THERMOCOUPLE MODE: (°C)
200°
500°
1000°
2000°

FOR E THERMOCOUPLE MODE: (°C)
20°
50°
100°
200°
500°
1000°

FOR N THERMOCOUPLE MODE: (°C)
20°
50°
100°
200°
500
1000°

FOR W5 THERMOCOUPLE MODE: (°C)
50°
100°
200°
500°
1000°
2000°

N.B.:The values displayed under the range represents the left and right limits of the paper.

Example

RANGE.1 :1.000 V -500.0/500.0mV

Channel 1 : voltage mode
range : 1V
measurement range : - 500 to + 500mV

N.B. : The range can be adjusted more finely by selecting the fine adjust key (13) and pressing the increase/decrease keys (12).

3.1.3 Choice of the offset

1° - Select thre offset parameter by depressing the offset key (3) of the selected input (1 or 2). The 8210 displays on the first line the center value of the measurement range and on the second the values of the upper and lower limits of the measurement range.
2° - Press the increase/decrase keys (12) to select the offset value so as to set your measurement within the measurement range. This offset may be plus or minus two times the range in the domain.

Example:

OFFS. 1 : 50 V 0.000 / 100 V

Channel 1 : voltage mode
offset : 50 V
measurement range : 0 to + 100 V

N.B. : The offset can be adjusted more finely by selecting the fine adjust key (13) and pressing the increase/decrease keys (12).

3.1.4 Filters setting

- Select the filter parameter by depressing the filter key (4) of the selected input. Choose the filter by means of the increase/decrease keys (12). The filter may be : 1Hz, 0.5 Hz, 0.25 Hz, 0.07 Hz, 0.02Hz.

N.B. : In some cases, filters may be used to eliminate noise..

3.2 MEASUREMENT RANGE OPTIMIZATION

Search for the center value on the paper :

1- Press the input keys (1) to select the preferred channel for the measurement. Select, with the increase/decrease keys (12), the type that corresponds to the measurement to be made.

2- Press the offset key (3) of the selected input.

3- Press the fine adjust key (13).

4-Switch on the pen associated to the input.

5- Adjust, by means of the increase/decrease keys (12), the center value so that the signal covers approximatively the full paper width (250 mm).

Search for the range

1- Press the range key (2) of the selected input (1 or 2).

2- Press the fine adjust key (13).

3- Adjust the range value by means of the increase/decrease keys (12) so that the signal covers approximatively the full paper width (250 mm).

3.3 EXAMPLE OF PROGRAMMING

Recording a N voltage of unknown amplitude.

1- Switch on the recorder.

2- Connect the signal between the red and black terminals.

3- Press the type key (1) of input 1.

4- Select the voltage type by means of the increase/decrease keys (12).

5- Press the range key (2) and select the maximum range (100 V) by means of the increase/ decrease keys (12).

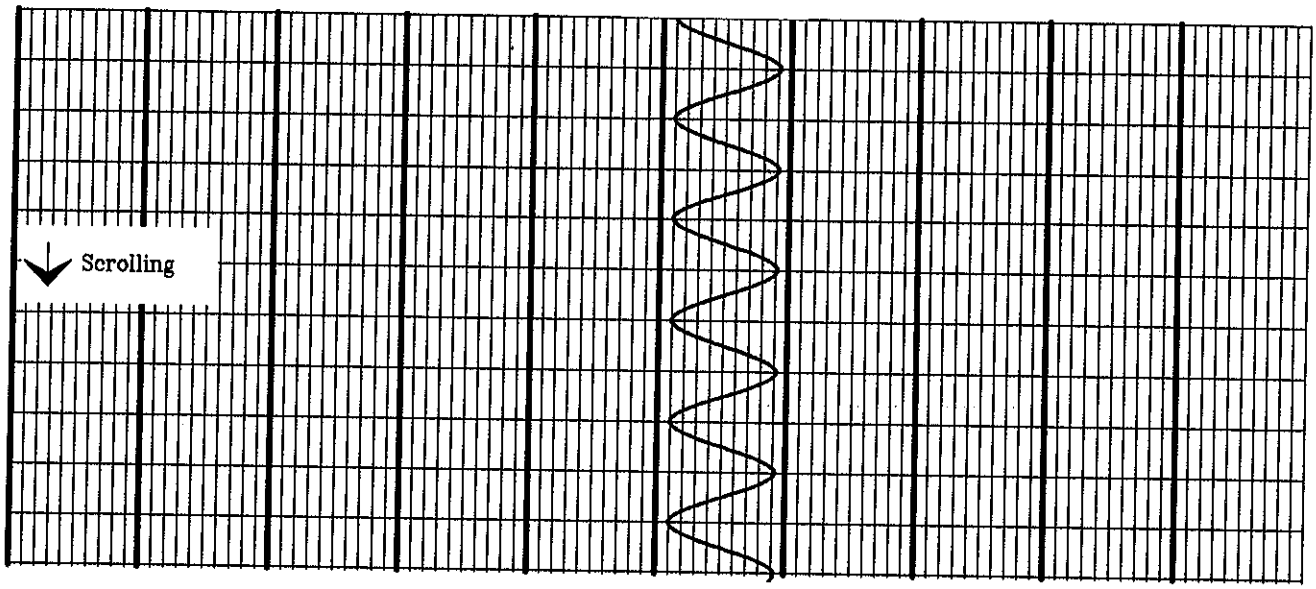
6- Select the mechanical channel no. 1 by pressing the pen1 key (6).

7- Press the offset key (3) and with the increase/decrease keys (12) center the signal on the paper.

8- Press the filter key (4) and select the none position.

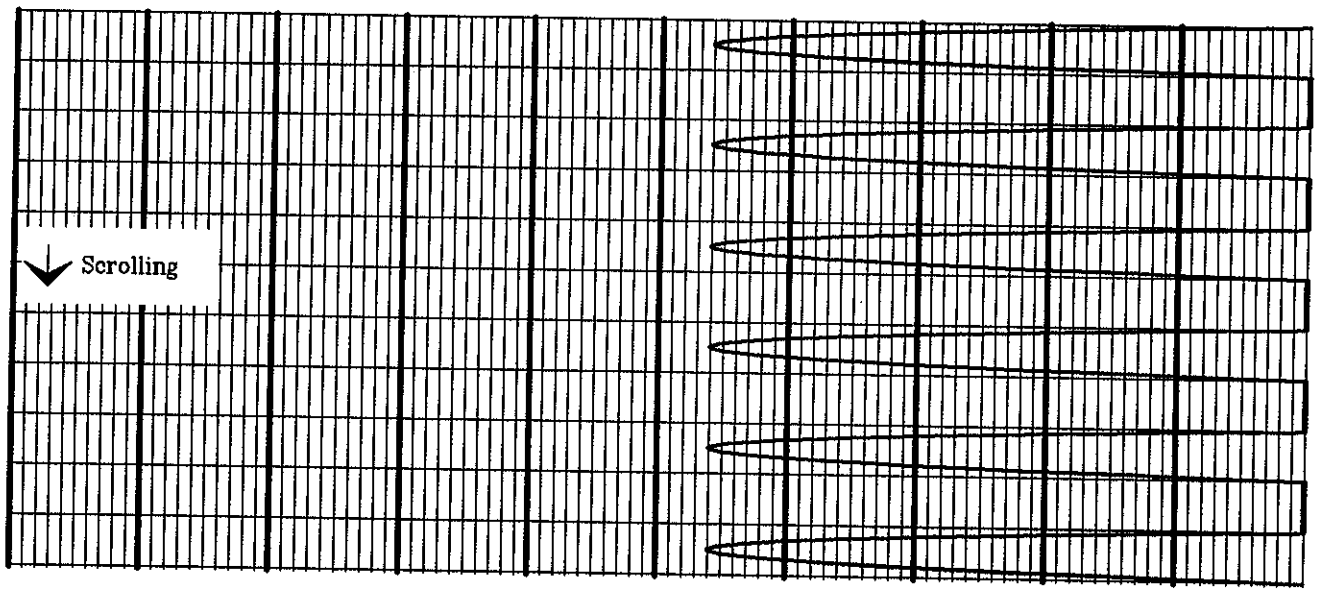
9- Adjust the paper-feed speed by means of the increase/decrease keys (12).

10- Press the plot key (10).



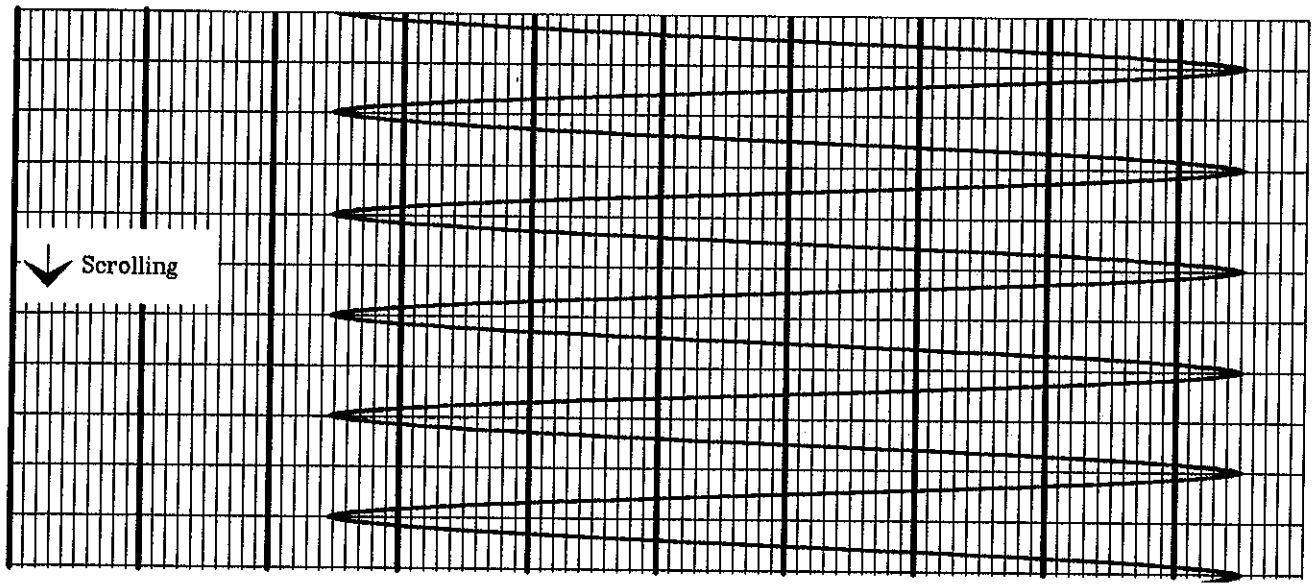
The paper has 100 divisions across it; the sensitivity of the measurement for a range of 100V is 1 V per division. The signal measured occupies eight divisions on the paper, hence the amplitude of the signal is 8 volts.

11 Select the 10 V range.



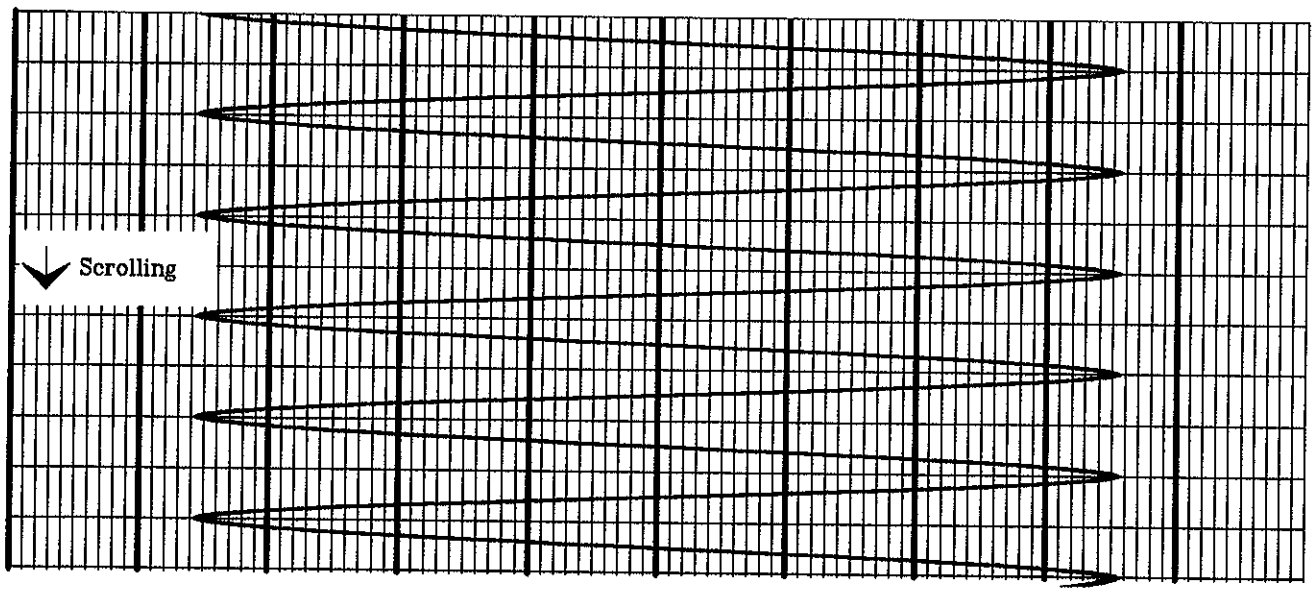
The recorded signal is cut at the right-hand (maximum) edge of the paper. The plot is thus improperly centered relatively to the center of the paper.

12 - Press the offset key (3) and by means of the increase/decrease keys (12) centre at best the signal on the paper.



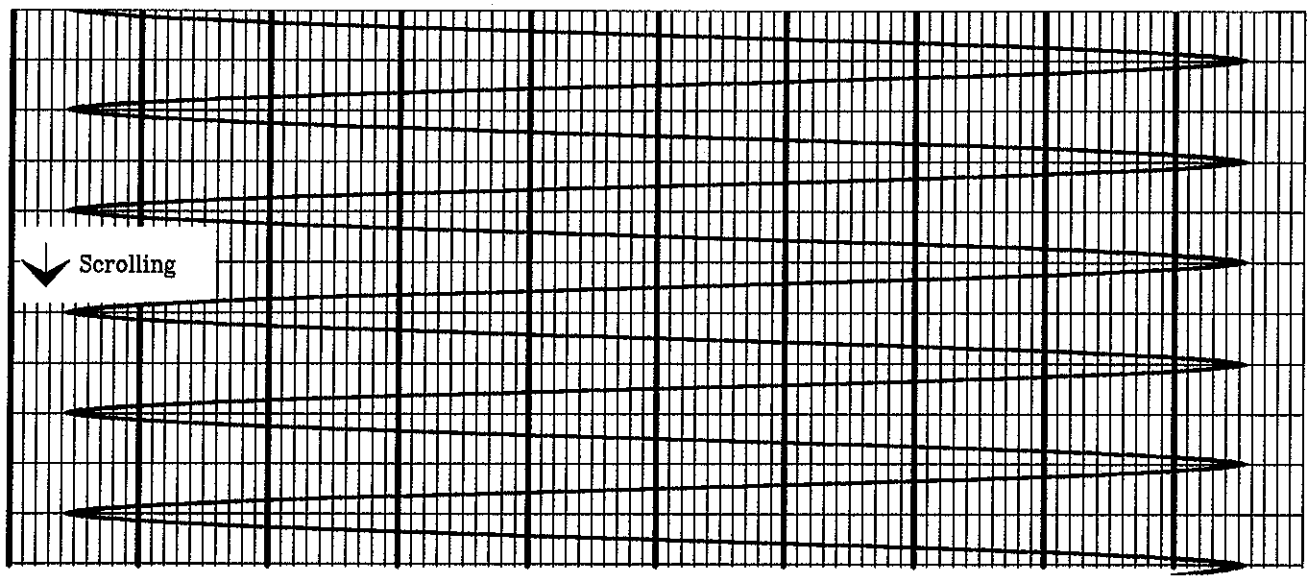
The plot is within the paper limits, althought it could be better centered.

13 - Press the fine adjust key (13) and adjust the position of the centre by means of the increase/decrease keys (12).



The operator may ensure that the signal plot occupies the full width of the paper.

14. Press the range key (2) and then the fine adjust key (13). By means of the increase/ decrease keys (12) select the appropriate range so that the plot occupies the full paper width.



4

PROGRAMMING THE PLOT

4 -PROGRAMMING THE PLOT

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4 -PROGRAMMING THE PLOT

4.1 PAPER SPEED

The choice of paper speed depends on the measurement to be made.

The 8210 recorder offers a wide choice of paper speed :

In internal mode operation : f(t) mode : paper speed is programmed between 10 mm/h (minimum) and 50 mm/second (maximum).

In external mode operation : step-by-step mode : paper speed is defined by the frequency of pulses received by the two-channel recorder via the auxiliary command connector and is expressed in number of millimetres per step.

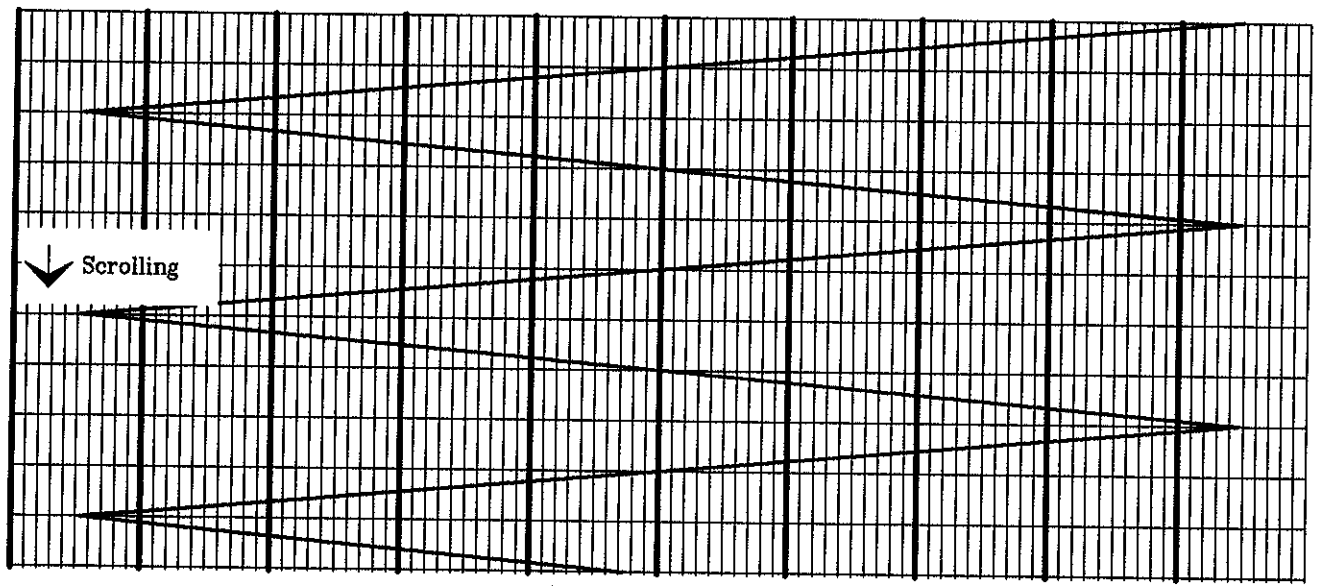
4.1.1 Programming the speed

1 - Press the speed key (5).

2 - Press the pen key(s) (6) to select the channel(s) forseen for the measurement.

3 - Press the plot key (10) to plot the measurement.

4 - Adjust the paper speed by means of the incresase/decrease keys (12).



4.1.2 Programming in the step-by-step mode

The paper speed may be programmed with the back side socket (auxiliary I/O connector).(Refer to chapter 5).

4.2 PLOT SYNCHRONIZATION

4.2.1 Plot without channels synchronization

The channels produce plots in real time across the width of the paper. The pens move simultaneously about parallel lines 3 mm apart. Consequenently, the plots show a spacing of 3 mm in the direction of the axis o the paper feed (time axis).

4.2.2 Plots with channels synchronization

With this function, plots can be exploited immediately, since each channel has the same origin in time. The principle consists of storing into memory at a given moment the pen 1 position and to return this position with a delay (as a function of paper speed), to compensate for the mechanical separation between channels.

4.2.3 Implementing the channels synchronization

1° - Press the synchronization key (8). The related indicator light lights up stating the validation.

2° - Press the plot key (10) to start the signal recording.

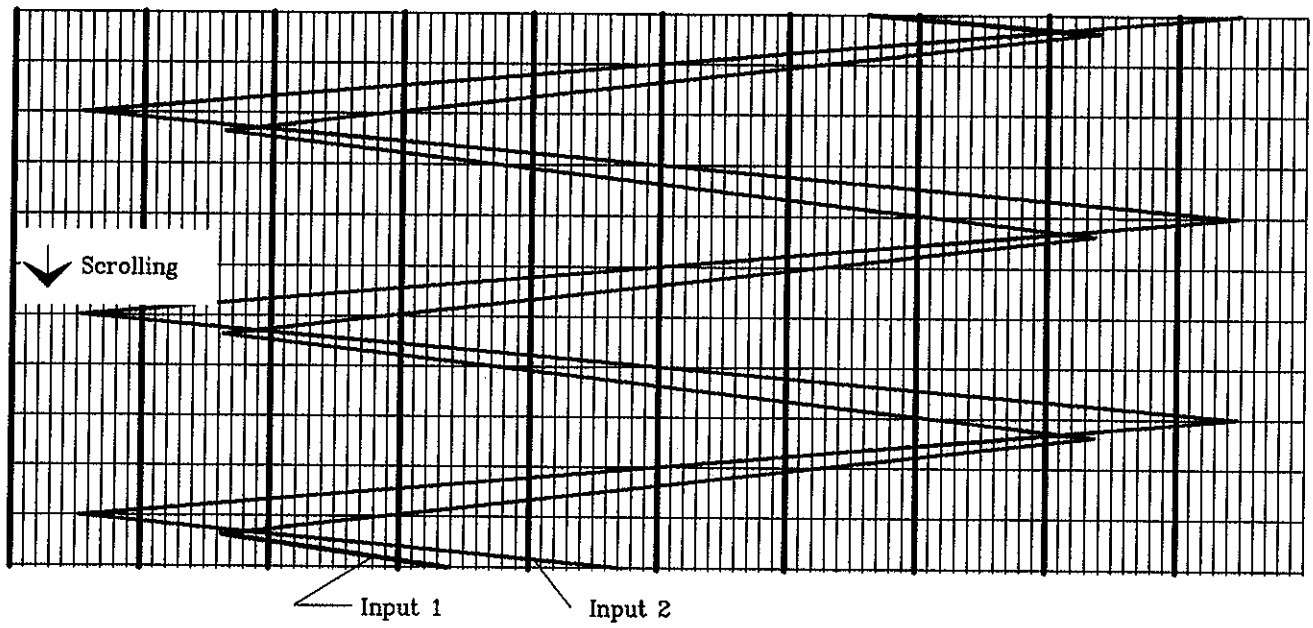
N.B.: At the beginning of the plot, the pen1 will be synchronized on pen 2 after a 3 mm displacement of the paper (for example after 18 mn if the speed is 10mm/h) .

Limitation of the synchronization possiblities
The channels synchronization has be made to retrace all possible phenomen except the extremum function modes cases described below

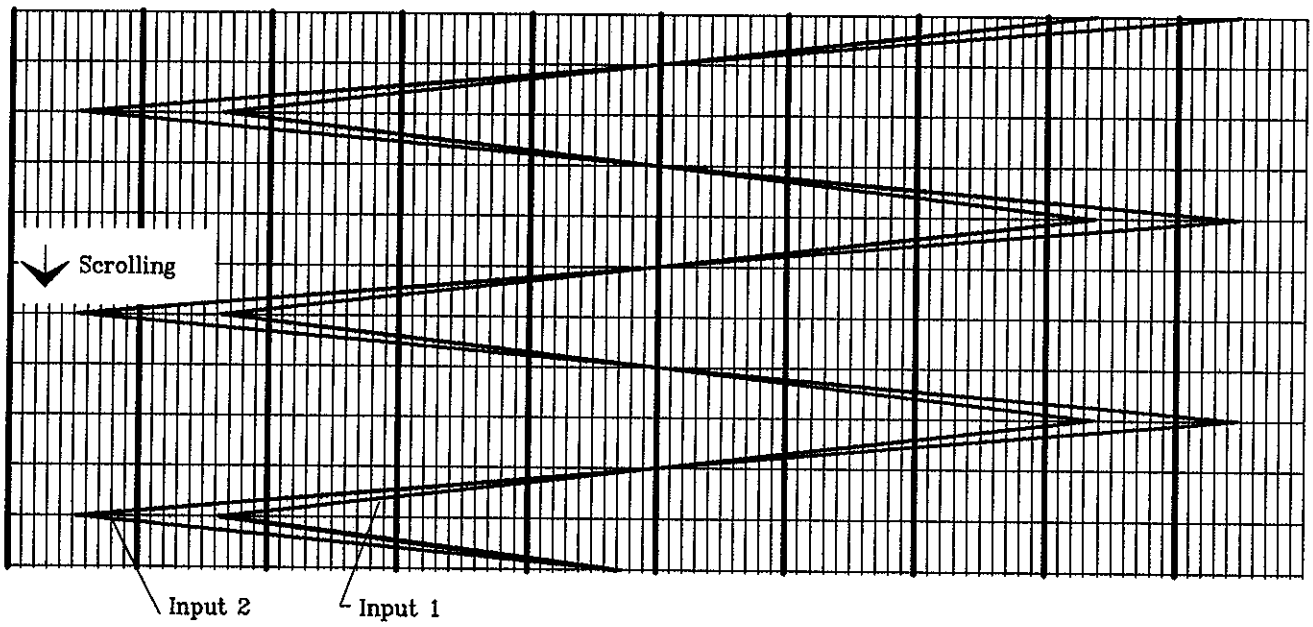
The management resolution of the synchronization is limited to a sampling frequency of 16 ms and 10 dots memorized for a displacement of 1mm of the paper :

- At 50 mm/s the compensation will then be of $\pm$ 0,4 mm and even lower for lower paper speed
- When using the 8210 to record at very slow speed, if the signal varies a lot all the dots will not be memorized (10 dots/mm). The drift of the represented curv on the paper is reduced, comparatively to the real amplitude of the electrical signal applied on the corresponding input (input 1).

EXAMPLE: Plot without synchronization



EXAMPLE: Plot with synchronization



5

AUXILIARY COMMANDS

5 -AUXILIARY COMMANDS

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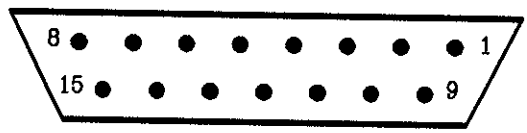
5 -AUXILIARY COMMANDS

5.1 AUXILIARY COMMANDS CONNECTOR



Back view

PINS	SIGNALS NAMES
1	Mainframe (earth)
2	Step-by-step pulses
3	Channel 1 marker
4	Channel 2 marker
5	Unused
6	Plot triggering
7	Step-by-step validation
8	Earth
9 to 15	Unused

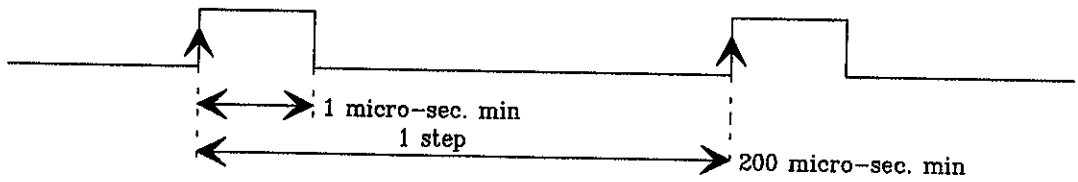
5.2 STEP-BY-STEP PAPER-FEED MODE

Configuration of the auxiliary commands connector

The pins number 2 - 7 and 8 of the auxiliary commands connector are the ones relevant to the step-by-step mode.

- Connect pin 7 to pin 8 : changing to the step-by-step mode
- Input the command pulses to pin 2 (earth on pin 8).

Characteristics of the command signal



The recorder takes into account the command pulses of the step-by-step mode by detecting the signal negative edge. To validate the negative edge effectively, the pulse must be held at a low level for at least one µs. The maximum frequency of the command signal depends on the speed selected, knowing that the fastest paper feed speed is limited to 50 mm/s.
Example : 5 KHz for a speed of 0.01 mm/step.

PROGRAMMING THE STEP-BY-STEP MODE

The 8210 two-channel recorder detects a possible low level on the step-by-step validation input (pin 7 of the auxiliary command connector). If the level is low, the 8210 changes to the step-by-step mode. This mode has the highest priority.

- Press the paper speed key (5).

- Select the paper-feed resolution by means of the increase/decrease keys (12). The paper-feed speed resolution goes from 0.01 mm/step to 1 mm/step.

Example:

PAPER SCALE 0.1mm / step

The paper speed corresponds to the paper displacement for 1 pulse sent on the step-by-step pulse input on the auxiliary connector.

5.3 PAPER COMMAND

A low signal on input 6 of the connector causes the pen to plot and the paper to start feeding in conformity with the speed programmed on the front pannel.

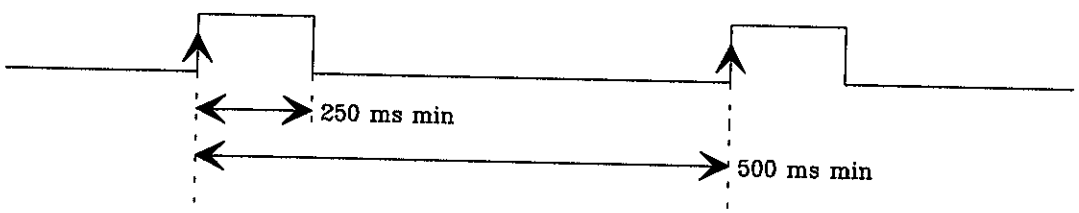
5.4 USE OF THE MARKER FUNCTION

This function traces a horizontal mark of 6-10 mm.
The plot of these references traces is triggered by an external signal.
For each mechanical channel of the 8210 recorder there is an associated marker input on the auxiliary commands connector.

Configuration of the auxiliary commands connector

Pins 3 and 4 are associated respectively with markers inputs 1 and 2.

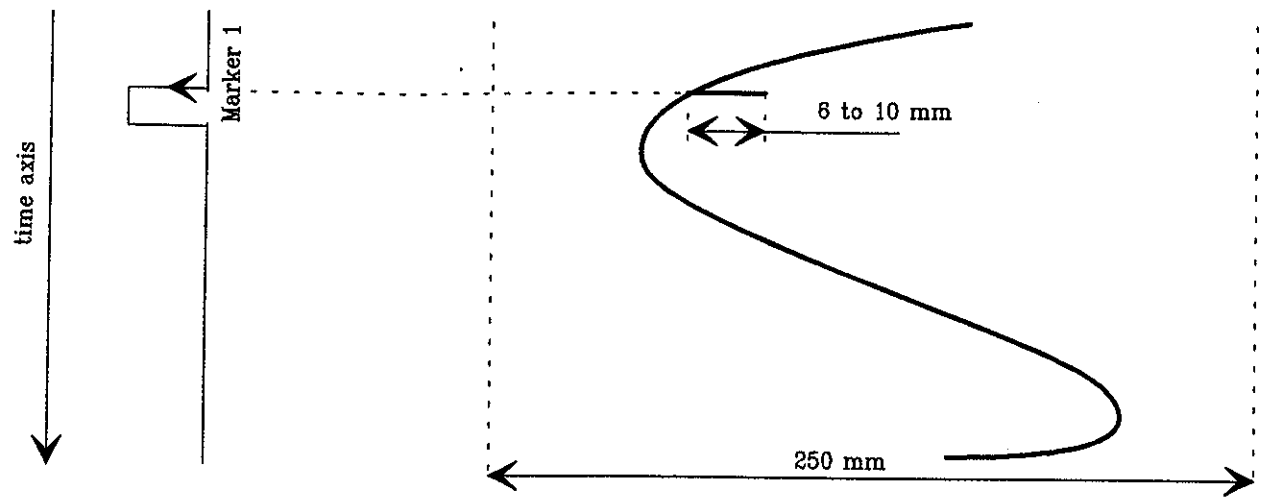
Characteristics of the command signal



5 -AUXILIARY COMMANDS

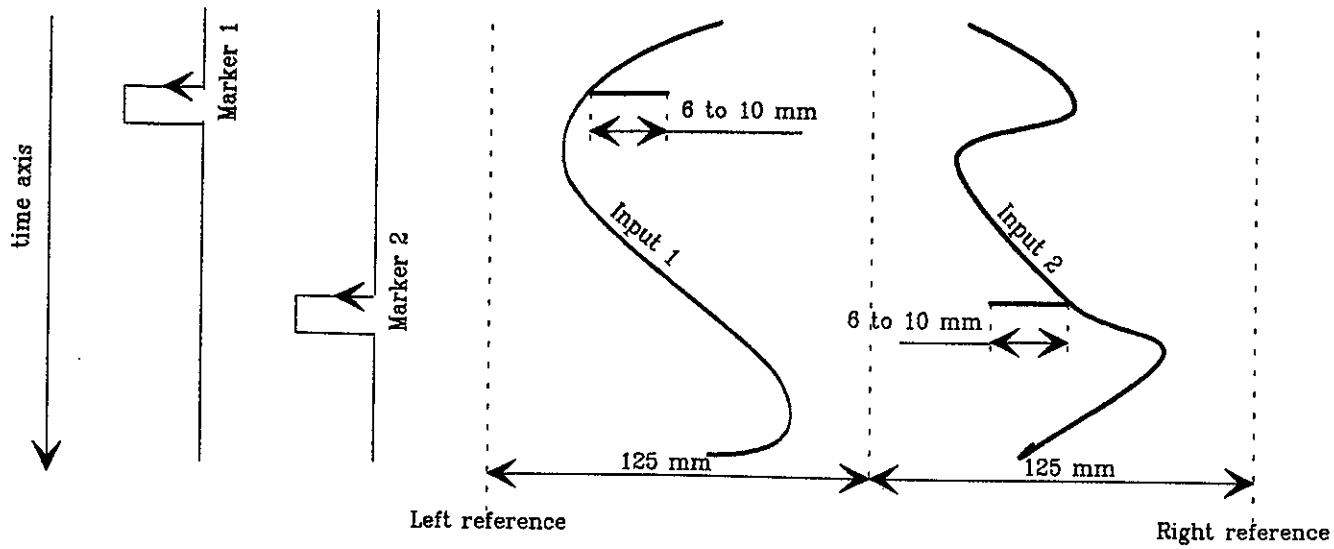
The recorder takes into account the marker pulses by detecting the negative edge on the connector's marker input signals.

Example of marks



- Signal recording : input 1.
- Marker signal : marker 1 (pin no. 3).

Special case of signals near the lateral limits of the recording paper



- Signal recording : input 1 and input 2.
- Marker signals : marker 1 (pin no. 3), marker 2 (pin no.4).

RS232 INTERFACE

6

6 - RS 232 INTERFACE

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6 - RS 232 INTERFACE

6.1 GENERALITES

Electrical standards

BINARY STATE	1	0
VOTAGE RANGE	+3V à + 25V	- 3V à - 25V
LEVEL NAME	SPACE	MARK
LINE STATE	high	low
FUNCTION	ON	OFF

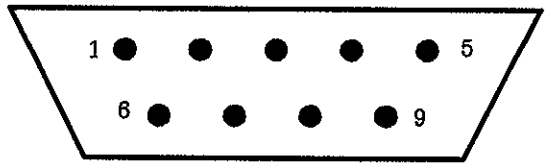
In the absence of data, the line is kept at the low level (0).

Connection type

The connection is of the full duplex (simultaneous bi-directional transmission) type.

Mechanical standards

9-pin connector of the Sub - D type. The 8210 is delivered in the DCE mode.



Back view

6.2 ASYNCHRONOUS TRANSMISSION

The various bits constituing the characters to be transmitted (ASCII code) are sent in serial form one after the other. Each character bloc sent is a compound of a start bit, the character bits, a parity bit and a stop bit.

The RS 232 standard specifies certain characteristics of the data line such as voltage level applied, and the start/stop protocol, but leaves the following characteristics flexible :

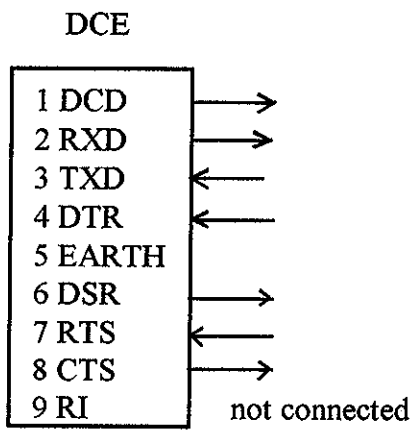
Transmission rate : It is expressed in bauds; it specifies th number of bits sent per second and, by extension, the number of characters sent per second. The proposed values are : 300, 600, 1200, 2400, 4800 and 9600 bauds.

6 - RS 232 INTERFACE

Character length : 7 or 8 bits

Parity : Even, odd or no parity
The 8210 proposes either 8 data bits with no parity or 7 data bits with an odd parity.

Connection lines



RS 232 signal definitions

TxD (transmitted data) : Data sent by the terminal via the transmitter modem.

RxD (received data) : Data coming from the receiver modem in response to signals from the transmitter modem.

RTS (request to send) : Indicates to a transmitter modem that the terminal is ready to send data.

CTS (clear to send): Indicates to a terminal that its modem is ready to transmit data.

DSR (data set ready): Indicates to a terminal that its modem is not in a test mode and that its power supply is ON.

DCD (data carrier detect) : Indicates to a terminal that its modem is receiving a signal from the transmitter modem.

DTR (data terminal ready) : Indicates to a modem that its terminal is ready to receive data.

6.3 CHARACTERISTICS OF THE 8210 INTERFACE

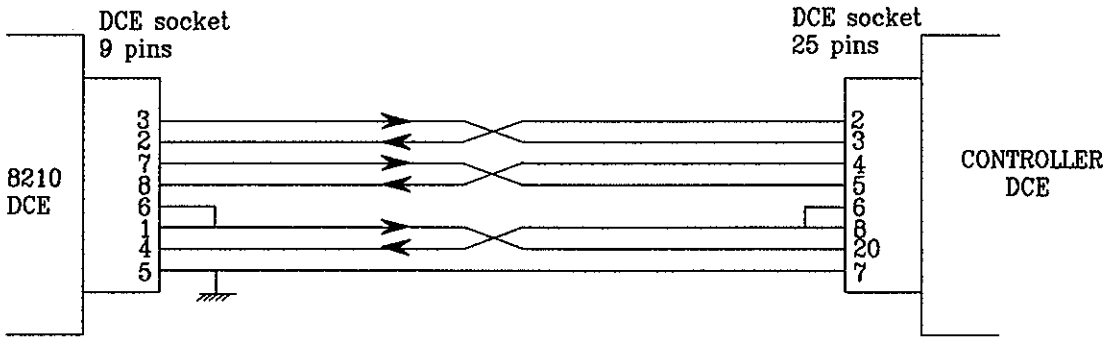
- Transmission mode : asynchronous.
- Connection : full duplex type.
- Output : DCE
- Transmission rate in bauds : choice from the menu
- Character composition :
  - . 1start bit
  - . 8 data bits without parity
    or 7 data bits with an even parity.
  - . 1stop bit

6.4 PRINCIPLE OF OPERATION

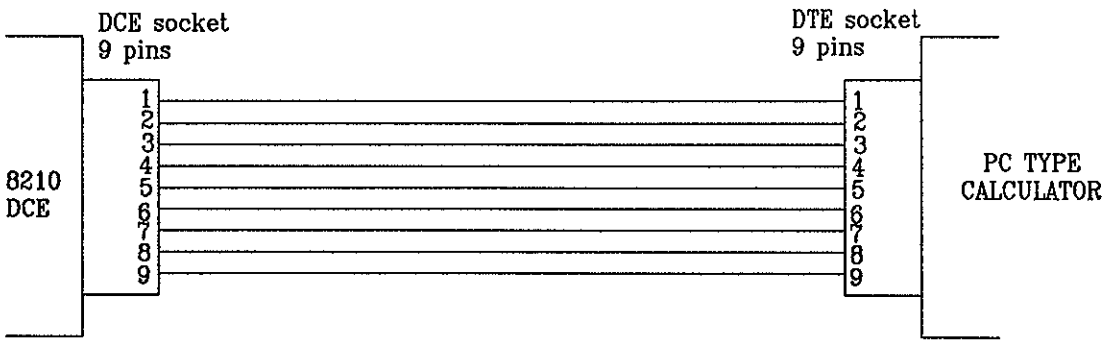
When switched on, the 8210 puts the RTS, DTR and DCD lines in the high state (>3 V), showing that it is ready to transmit data on TxD.

N.B.: When a universal controller is used in DCE mode, a croosed cable should imperatively be used.

Crossed cable linking the 8210 to a 25-pin DCE socket



Cable linking the 8210 to a PC type calculator



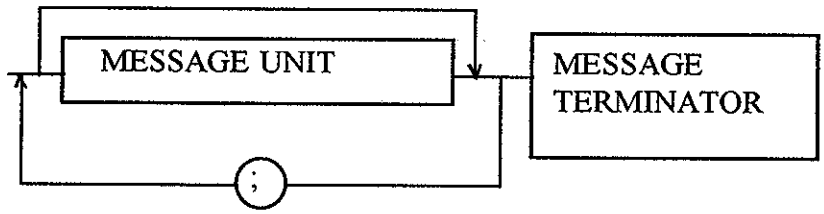
6.5 PROGRAMMING LANGUAGE

6.5.1 Reception messages format

N.B. : In all the following examples, the space character is represented by a blank space.

The exchanges between a controller and the 8210 take the form of messages consisting of a sequence of ASCII characters (and possibly of binary octet) ending with a terminator.

The syntax of a message is as follow :



Message unit : If the message includes several message units, these are separated by a semi-colon ":" and may be preceded an/or followed by one or several "filling" characters in ASCII code (0 to 9 and 11 to 32, in decimal value).

The message terminator is any of the following terminators :

CR	:	Carriage Return (ASCII code - (decimal))
LF	:	Line Feed (ASCII code -10 (decimal))

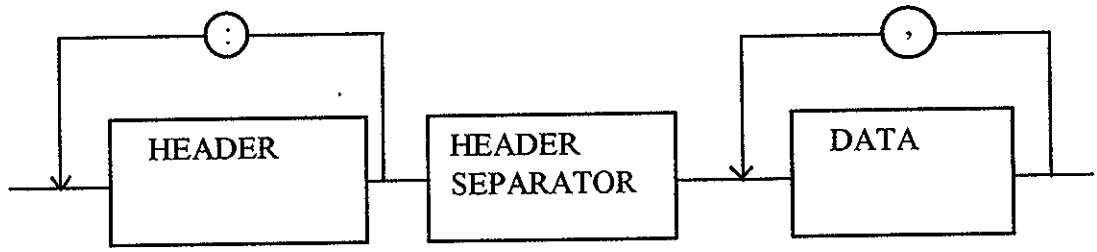
The message terminator could be preceded by one or several "filling" characters in ASCII code (0 to 9 and 11 to 32, in decimal value).

Example of messages consisting of 3 message units

MESSAGE 1; MESSAGE 2 ; MESSAGE 3 'CR'

CHANNEL 1; :ZERO WITH 'LF'

Syntax of a message unit :



A message unit (for example : PAP:SPEED 1, MM_S) has several fields :

Header : For command messages (for example : PAP:SPEED 1, MM_S) or for polling messages (for example : PAP:SPEED ?).

A string comprises 1 to 12 alphanumeric characters or the character "_" (coded in ACII by 95 in decimal).

The recommended string length is of 4 characters.

A header string must start with an alphabetic character. It could also be preceded by a colon ":" (composite header) or end with a question mark "?" (polling mesage)..

CAUTION : A POLLING MESSAGE MUST ALWAYS BE FOLLOWED BY A TERMINATOR

In a composite header, the ASCII character strings are separated by colons ':' (for example :PAP:SPEED).

Header separator : One or more ASCII characters (0 to 9 and 11 to 32, in decimal values).

One or more data : (e.g. : PAP:SPEED 1,MM_S), alphanumeric, numeric or consisting of any character or binary octets.

Data separator : A comma "," possibly followed and/or preceded by one or more "filling" characters in ASCII code (0 to 9 and 11 to 32, in decimal values)

Data
There are several types of data :

- Alphanumeric data:

A word of 1 to 12 characters that may be alphabetic (upper case or lower case), numerical, or the character "_" (95d) ASCII-coded. The word must begin with an alphabetic character. For example, for a non-numerical character : voltage.

-Decimal numerical data :

They consist of a mantissa and possibly an exponent and are represented by a sequence of characters in ASCII code beginning with a digit or a sign (+ or -). They are of the type NR1 (integer), NR2 (decimal), NR3 (with an exponent) or a combination of these three types. The mantissa comprises a maximum of 255 characters and the exponent has a value between -128 and +127. If the received value has a greater resolution than expected, it is rounded off before beeing used. A decimal numerical value could be associated with a unit.

-Text :

This is a string of any ASCII-coded character framed by quotation marks. For example : "8210 recorder"

6.5.2 Emission messages format

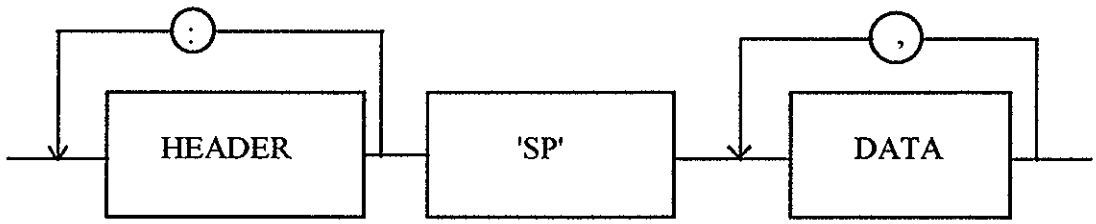
The exchanges between the 8210 and a controller take the form of messages consisting of a string of ASCII characters (and possibly binary octets) ending with a *message terminator*.
The format of the emitted messages is identical to that of the received messages. Nevertheless, its structure is more rigid. The syntax of a transmitted message is as follows :

Message unit : If the message consits of more than one message unit, these are separated by semi-colons ';'.

Message terminator : It is always CR, LF? CR/LF, EOT. It is chosen on the front side.

CHANNEL 2 CR/LF

Messages units



A message unit (e.g. : PAP:POS REC) comprises several fields :

- A header : (e.g. :PAS:POS) consiting of one (simple header) or several (composite header) strings of 1 to 12 alphabetic characters (capitals only) or numerical ones or the character "_" (95d).
A header string starts with an alphabetic character.

In a composite header, the character strings are separated by colons ':' (e.g. : PAP:POS).

-A header separator : character space only.

-One or more data: (e.g. : 1,MM_S) alphanumeric, numeric or consisting of any kinds of characters or binary octets.

-A data separator : A comma ','.

Data
There are several types of data :

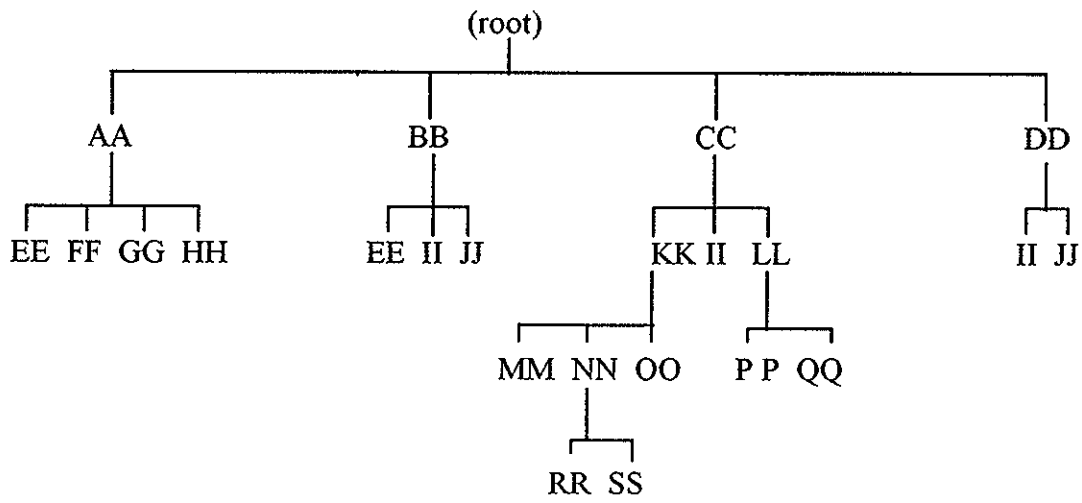
- Alphanumeric data : Words of 1 to 12 characters that may be alphabetic (capitals only), numeric, or the character "_" (95d) in ASCII code. (e.g. "voltage").

- Decimal numerical data : Represented by a set of ASCII-coded characters beginning with a number or a sign (+ or -) and being one of the three types NR1 (integer), NR2 (decimal), NR3 (with an exponent) . For example, for a numerical parameter : 25.02.

- Any ASCII character string ending with the message terminator.

6.5.3 Messages units treeing

The 8210 messages units have a tree-like structure and the routing through the tree follows specific rules.



COMMENTS :

- The set AA / EE FF GG HH constitues a tree.
- The set "EE FF GG HH" is a sub-tree of "AA".
- "AA" is a node
- "EE" "FF" "GG" "HH" are sub-nodes.

The examples below show the various applications of the message-writing rules.

1 AA:EE 5;:BB:EE 7 'CR'

The character ':' at the beginning of the second message unit is a return to the tree root.

application 8210 : MOD:CONT;:PAPER :MOD FT; SPEED 10,MM_S 'CR'

2 AA:EE 5 'CR' BB:EE 7 'CR'

The terminator of the first message unit is a return to the root. The ':' before BB:EE 7 is therefore of no use to signal a return to the root..

application 8210 : PAPER :MOD FT 'CR' PAPER:SPEED 10,MM.S 'CR'

Errors examples

1 AA:EE 7 ; BB:EE 7 "CR"

The node "BB" is not a sub-node of "AA". The correct message is :
AA:EE 7;:BB:EE 7 "CR"

2 CC:KK:MM 3; LL:PP 7 " CR"

The node "LL" is not a sub-node of "KK". The correct message is :
CC:KK:MM 3;:CC:LL:PP 7 "CR"

6.5.4 Event status register : STATUS

The status word is associated to a 16 bits register which enables to check the instrument state.
This register may contain 16 bits.
N.B.: Bits 8 to 16 are unused

	0/1	0/1	X	X	0/1	0/1	0/1	0/1
bits	7	6	5	4	3	2	1	0

X: unused bit. By default its value is 0 as for bits 8 to 16.

Reading the state of this data structure.
The reading of the structure state is made by the command : STATUS ?.
The reading of the content of a register induces its clearing.

bit 0 : Plot start
This bit indicates the effective start of the plot.

bit 1 : Plot end
This bit indicates the end of plot.

bit 2 : Feeding end
This bit indicates that the paper feeding controlled by a PAP:MOV P1 or PAP:POS REC order is finished.

bit3 : Writing end
This bit indicates the writing end.

bit 6 : Motor defect
This bit indicates a functioning problem on the 8210.

bit 7 : Overheated motor
This bit indicates a functioning or using problem on the 8210.

6.5.5 Instructions

All instructions start with an asterisk "*".

*IDN? INSTRUMENT IDENTIFICATION REQUEST
Instrument response : SEFRAM 8210 (instrument type) - V1.0 (software version)

*RST RESET INSTRUMENT TO ZERO
Action : Initialization of the 8210 in a fixed configuration .
TYPE 1 and 2 : voltage mode
RANGE 100 V
WITHOUT OFFSET
WITHOUT FILTER
PEN 1 and 2 activated

*REM CHANGE TO RS 232 PROGRAMMING

*LOC Return to local mode.

When the 8210 is in the programming mode, the LCD screen displays :

-DISTANT MODE-

After a return to local mode, the screen displays :

-LOCAL MODE-

6.6 PROGRAMMING DICTIONARY

6.6.1 Channels programming parameters

Reminder : In headers and parameters names, small letters are optional.

HEADER	PARAMETERS	EXAMPLES
CHAnnel P1	Allows definition of a input to be modified by the following command P1 = Input choice (1 or 2)	CHAN 2
CHAnnel ?	Returns number and value of selected input	
PARCHannel	P1,P2,P3,P4 Allows modification of all input parameters by the CHANNEL command. P1= Input type P2= Range value P3= Offset value P4= Filter value	PARCH TEN,0.01, 0.02,FIL05 TYPE voltage RANGE 10 mV OFFSET 20mV FILTER of 0.5Hz
PARCHannel ?	Returns all parameters of the chosen input.	
TYPe P1	Allows modification of type of input defined by the CHANNEL command P1= Input type TENsion, PT100, TJN, TKN,TTN, TSN,TBN,THEN, TNN, TW5N, TJCmp, TKCmp, TTCmp, TSCmp, TBCmp, TECmp, TNCmp, TW5Cmp.	TYPE TENS Set the TYPE for the chosen input to voltage
TYPe ?	Returns the input TYPE..	

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HEADER	PARAMETERS	EXAMPLES
CALdec	P1, P2 Allows modification of input range and centre defined by the CHANNEL command. P1 = range in ISO units in V or °C P2 = Centre in ISO units in V or °C	CALDEC 0.001,0 RANGE 1mV CENTER 0mV
CALdec ?	Returns RANGE and CENTER of the chosen input.	
FILter	P1 Allows modification of FILTER or input defined by the CHANNEL command. P1 = Filter type WOUT, FIL1, FIL05, FIL025, FIL007 FIL002.(WOUT= without)	FIL FIL05 chosen input FILTER : 0.5 HZ
FILter ?	Returns the FILTER of chosen input.	

6.6.2 Paper-feed programming parameters

HEADER	PARAMETERS	EXAMPLES
PAPer:MODe	P1 Allows choice of paper-feed mode P1 = Paper-feed type FT DIGital (the paper is then set entirely by the command PAPER:MOVE)	PAP:MOD FT The 8210 is in mode f(t)
PAPer : MODE ?	Returns the type of feed.	
PAPer:SPEed	P1,P2 Allows choice of paper speed in f(t) mode (without auxiliary command). P1 = Speed value 1,2,5,10,20,50 P2 = units MM_S (mm/second) MM_M (mm/minute) MM_H (mm/hour) for 10, 20, 50 values	PAP:SPE 20,MM_S Paper speed : 20 mm/s
PAPer:SPEed ?	Returns the paper speed.	
PAPer:STEp	P1 Allows choice of paper scale in step-by-step mode under auxiliary command. P1 = Number of step/mm 1,2,5,10,20,50,100	PAP:STE 10 Scale: 10 steps per mm
PAPer:STEp ?	Returns paper-step scale under auxiliary command.	

HEADER	PARAMETERS	EXAMPLES
PAPer:POSiton P1	Allows memorization of paper position and return to it. P1 = MEM memorization RECall return	PAP:POS REC Return to memorized paper position
PAPer:MOVe P1	Allows paper displacement independently of mode used. P1 = Displacement by 1/10 mm steps -300 000 to + 300 000	PAP:MOV - 1450 145 mm reverse direction of paper
PAPer:ROLler P1	Allows validation of paper up feature P1= ON or OFF	PAP:ROL ON

6.6.3 General parameters

HEADER	PARAMETERS	EXAMPLES
MODe	P1 Allows definition of mode of use of the 8210. P1 = Function mode : CONTi: Channels correspond to inputs DIGital : The channels correspond to positions assigned by calculator. N.B. The digital mode can only be requested by a calculator, in local mode instrument sets to continuous mode.	MODE CONT Continuous recording mode.
MODe ?	Returns the command state.	
STATUS ?	Allows reading of the register state bits	Response : STATUS 1 end of plot

HEADER	PARAMETERS	EXAMPLE
ZERo	P1 Allows all inputs to be reset to zero P1 = Reset to zero WOUT, WITH	ZER WITH The ZERO function is validated
ZERo ?	Returns the command state.	
SYNchro	P1 Allows choice of channel synchronization. P1 = Synchronized plot WOUT, WITH	SYN WITH Plot synchronization
SYNchro ?	Returns the synchronization state.	
PEN	P1 , P2 Allows pen validation P1 = pen number P2 = pen state ON or OFF	PEN 1, ON Validates pen 1
PEN ?	Returns state of each pen.	

6.6.4 Starting the plot

HEADER	PARAMETERS	EXAMPLES
MEAsure	P1 Starting or stopping a plot. P1 = ON or OFF	MEA ON Plot start-up (same effect as plot key)
MEAsure ?	Returns the plot state.	

6.6.5 Reading the measured values

HEADER	PARAMETERS	EXAMPLES
RECord:UNIt	P1 Selection of measurement unit of signals requested via RECord:MEA P1= Measure unit ISO unit for each channel MM Units in tenths of a millimetre.	REC:UNI ISO Returns volt, or degrees depending on type.
RECord:UNIt ?	Returns the chosen unit.	
RECord:CHAnnel	P1,P2 Allows definition of channels returned via the command REC:MEA? P1 = Choice of channel 1 ON, OFF P2= Same for channel 2	REC:CHA ON,OFF Returns the input 1 values.
RECord:CHAnnel ?	Returns the command state.	
RECord:MEAsure ?	Returns values of previously chosen inputs; the unit is chosen by REC:UNIT.	

NB : Inputs may also be read via the command CHAN? and the positioning of the pen via the command POS (one then has the relation to the inputs only if the recorder is in the CONT mode and the channels validated).

6.6.6 Writing parameter

HEADER	PARAMETER	EXAMPLES
WRIte	P1,"M1" Writing of a particular message within quotation marks. P1 Pen number. M1 message	WRI 1,"8210"

6.6.7 Pen position command/reading

HEADER	PARAMETERS	EXAMPLES
POSition	P1,P2 Allows direct positioning of pen in a given position when in DIGIT MODE. P1 = Pen 1 position in tenths of a millimetre (0 to 2500). P2 = Pen 2 position.	POS 0,0 Positioning the two channels on the left-hand side.
POSition ?	Gives the channels position in tenths of a millimetre, from 0 to 2500; no account is taken of synchronization of operative pens, regardless of mode.	

6.7 SUPPLEMENTARY FUNCTIONS

SUPPLEMENTARY FUNCTIONS LINKED TO THE PROGRAMMING BY THE INTERFACE.

When the 8210 is programmed by the RS 232, it offers some supplementary functions :

Digital mode (or numeric mode)

In this mode the controller guides the displacement, thus allowing, for example, the drawing of a curv computed by the controller.

Programming

- Choice of digital mode via command :
  MODe DIGital (see § 6.6.3)
- Pen position command :
  POSition P1,P2 (see §6.6.7)

Pens take up position Pi (expressed in tenths of a millimetre) and remain there till a new POS command or a mode change occurs.

Pen position reading

Each time the polling message POSition? (see §6.6.7) is sent, the 8210 returns the pens positions in tenths of a millimetre. This allows the signal reproduced by the pens to be followed or stored in the memory.

Memorization of a paper position and return to it

- Memorization of paper position via command :
  PAPer:POSition MEM (see § 6.6.2)
  (e.g., before sending a plot command).

- Return to the memorized position via the command :
  PAPer:POSition RECall (see § 6.6.2)
  (e.g. return to the beginning of the plot).

Paper feed in digital mode

In this mode, the controller guides paper feed (f(t) mode is inhibited).

Programming

- Choice of paper-feed digital mode via command :
  PAPer:MODe DIGital (see § 6.6.2)

- Paper-feed command :
  PAPer:MOVe P1 (see § 6.6.2)
  The paper is advanced by the distance P1 (expressed in tenths of a millimetre, ±30 m maximum).
  It remains in this position until a new command PAPer : MOVe is received. The controller can thus control paper-feed.

N.B. : The command PAPer:MOVe may also be used in the f(t) mode.

Writing a message on the paper

Selection of the pen and of the message via the command :
WRIte P1,P2 (see §6.6.6)
The P1 pen writes the M1 message on the paper.

Request for the 8210 status.

The user may be informed of some specific events by reading the status register.
Refer to § 6.5.4 and §6.6.3.

6.8 PROGRAMMING EXAMPLES

The following programs illustrate some possibilities of the remote control of the 8210 with a PC compatible micro-computer via the RS 232 interface (refer to connection § 6.4)
These examples are writing in GW-BASIC and are compatible with QBasic.

EXAMPLE 1: Measure reading on the inputs

Action :
- configuration of the 8210,
- starting the plot,
- display every second of the measures of the both inputs on the PC screen,
- stop by pressing a key on the PC keyboard.
-

Configuration of the 8210 in the RS 232 mode :
- SPEED : 9600 bauds,
- DATA - PARITY : 8 bits - without,
- TERMINATOR : CR,
- PROTOCOL : rts/cts.

Program :

```
10 OPEN «COM1: 9600,N,8,1» FOR RANDOM AS #1
20 " Open the COM 1 port and configuration

30 PRINT #1, «*REM;*RST»
40 " Programmation of the 8210 in remote control mode and full initialization (refer to §2.4)

50 " Programming loop on the 1V range, centre 0V and switch ON of the pens on the two inputs
60 FOR N.ENTREE = 1 TO 2
70   N.ENTREE$ = STR$(N.ENTREE)
80   PRINT #1, «CHAN « + N.ENTREE$ + «;CAL 1,0;PEN « + N.ENTREE$ + «,ON»
90 NEXT N.ENTREE

100 PRINT #1, «PAP:MOD FT;:PAP:SPE 1,MM_S;:MEA ON»
110 " Programming the paper-feed in the f(t) mode, the speed
120 " at 1mm/s and starting the plot
130 "Do not forget the character «:» before PAP:SPE and MEA ON to send back
140 "to the top of the tree (refer to §7.1.3)
150 " The command message may be sent under different forms :
160 "  «PAP:MOD FT;SPE 1,MM_S;:MEA ON»
170 "  (The SPE node is a sub-node of the PAP node, therefore there is no use to call
180 " again the PAP header; refer to §7.1.3)
190 "  «PAPER:MODE FT;:PAPER:SPEED 1,MM_S;:MEASURE ON»
200 "  (full writing for a better lisibility of the program)

210 PRINT #1, «REC:CHA ON,ON;UNIT ISO»
220 " Selection of the two imputs in order to read the measures in ISO units

230 CLS   " clearing the screen
240 ARRET = 0
250 PRINT «MESURES OF THE 8210 :»

260 " Jump to the sub-program of 8210 measures reading every second
270 ON TIMER(1) GOSUB 1000
```

```
280 TIMER ON
290 IF ARRET <> 1 THEN GOTO 290

300 PRINT #1, «MEA OFF;*LOC» " Command the plot stop and return to the local mode
310 END


1000 " Sub-program of 8210 measures reading
1010 PRINT #1, «REC:MEA ?» " Asking for the measures reading
1020 LINE INPUT #1, MESURE$ " Measures reading
1030 LOCATE 3, 12, 0 " Position the cursor on the screen
1040 PRINT «ENTREE «; MID$(MESURE$, 17, 11) " Display the input 1 measure
1050 LOCATE 3, 36, 0: PRINT «ENTREE «; MID$(MESURE$, 29, 11) " Display the input 2 measure
1060 IF INKEY$ <> «» THEN TIMER OFF: ARRET = 1 " Stop when a key is depressed
1070 RETURN
```

EXAMPLE 2 : Using the status word of the 8210

CAUTION : this example concerns a 8210 fitted with a roller option.

Action :
- Configuration of the 8210,
-Starting the plot for 50s,
-Rewind the paper up to the beginning of the plot

Configuration of the 8210 in the RS232 mode :
- SPEED : 9600 bauds,
- DATA - PARITY : 7 bits - even,
- TERMINATOR : CR,
- PROTOCOL : rts/cts.

Program :

```
10  OPEN «COM1: 9600,E,7,1» FOR RANDOM AS #1
20  " Open the COM1 port and configuration

30  PRINT #1, «*REM;*RST»
40  " Programmation of the 8210 in remotely command mode and full  initialisation (see 2.4)

50  " Programming loop on the 1V range, centre 0V and start the pens off the two inputs
60  FOR N.ENTREE = 1 TO 2
70    N.ENTREE$ = STR$(N.ENTREE)
80    PRINT #1, «CHAN « + N.ENTREE$ + «;CAL 1,0;PEN « + N.ENTREE$ + «,ON»
90  NEXT N.ENTREE

100  PRINT #1, «PAP:MOD FT;:PAP:SPE 20,MM_S»
110  " Programming the paper-feed in the f(t) mode, the speed to 10mm/s

130 CLS  " clear the screen
140 PRINT «STATE OF 8210 :»
150 GOSUB 2000: ETAT=0 " Reading the 8210 status register in order to re-initialize it
160 ON TIMER(50) GOSUB 1000 "Jump to the sub-program which stops the ploting after 50s
170 PRINT #1, «PAP:POS MEM;:MEA ON»: TIMER ON
180 " Command the storage of the paper position and start the plot; validation of the interruption by the timer
190 LOCATE 3, 18, 0: PRINT «TRACE IN PROGRESS»

200 " Loop - awaiting the end of the plot
210 WHILE (ETAT AND 2) <> 2
220   GOSUB 2000    " Reading the 8210 status
230 WEND

240 PRINT #1, «PAP:POS REC»
250 " Paper command rewind up to the stored position (start of plot)

260 LOCATE 3, 18, 0: PRINT «REWINDING IN PROGRESS»
```

```
270 " Loop - awaiting the end of the rewind
280 WHILE (ETAT AND 4) <> 4
290   GOSUB 2000   " Reading the 8210 status
300 WEND

310 LOCATE 3, 18, 0: PRINT «END OF OPERATIONS»
320 PRINT #1, «*LOC»  " Command the return to the local mode
330 END


1000 " Sub-program which commands the 8210 plot stop
1010 TIMER OFF
1020 PRINT #1, «MEA OFF»  " Command which stops the plot
1030 RETURN


2000 " Sub-program which reads the 8210 status register, result in STATUS
2010 PRINT #1, «STATUS  ?»
2020 LINE INPUT #1, ETAT$
2030 ETAT = VAL(MID$(ETAT$, 9, 5))
2040  RETURN
```

ADJUSTMENTS TROUBLESHOOTING

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7 -ADJUSTMENTS -TROUBLESHOOTING

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7.1 ORIGIN - ELONGATION ADJUSTMENTS

Adjustments are made at the factory. However, when new paper is installed, it is possible that the chart has a little offset with respect to the pen trace.

The following procedure allows the operator to re-align the channels concerned.

CAUTION : These adjustments must be made in the order - origin then elongation.

1° Press simultaneously the fine adjust and the type keys of the selected input. The message **ORIGIN CHANNEL 1** (or 2) is displayed on the screen.
The considered pen moves automatically to the left-hand measuring limit of the paper.

2° Press the plot key (10). Conform the pen-tip with the solid line of the paper left-hand side limit by means of the increase/decrease keys (12).

3° Press one more time the type key of the selected input (1 or 2). The message **ELONGATION CHANNEL 1** (or 2) is displayed on the screen.
The considered pen moves automatically to the right-hand measuring limit of the paper. Conform the pen-tip with the solid line of the paper right-hand side limit by means of the increase/decrease keys (12).

4° Press the type key of the selected input. The message **EEPROM STORAGE CONFIRM** is displayed on the screen.

5 ° Press one more time the type key of the selected input. The message EEPROM **STORAGE UNDER WAY** is displayed. When the storage is finished, the measurement type, of the selected input, is displayed on the screen.

7.2 AUTOTEST

The autotest allows a quick test of the 8210 to be made.

7.2.1 Starting the autotest

1°- Disconnect the inputs.
2° - Switch OFF the instrument (ON/OFF switch).
3° - Press the fine adjust key (13). Keep the fine adjustment key depressed and restart the instrument. Release the fine adjust key when the message **AUTOTEST 8210** is displayed on the screen.

7.2.2 Autotest result

The message **AUTOTEST 8210 OK** or **Err n** is displayed on the second line of the screen.

OK	The 8210 is working
ERR1	The battery is discharged
ERR 2	The EEPROM is defective
ERR 3	Incorrect EEPROM checksum
ERR 4	Input 1 is defective
ERR 5	Input 1 is not calibrated
ERR 6	Input 2 is defective
ERR 7	Input 2 is not calibrated

In this case contact the SEFRAM INSTRUMENTS ET SYSTEMES After-Sales Service.

NB. : The autotest changes the configuration to the following one:
type : voltage
Range 100 V, no offset
Zero function inhibited.

7.3 INCIDENTS CAUSING AN ERROR MESSAGE

Displayed messages	Explanations/actions
MOTOR DEFECT	Check that the pen can move freely. Switch the 8210 OFF/ON; check that all the pens can assume their reference position on the left-hand side. If the problem persists contact the SEFRAM After-Sales Service.
OVERHEATED MOTOR	The signal on the input is too fast. Decrease its frequency. There is too much noise added to the signal. Select a filter. If the problem persists contact the SEFRAM After-Sales Service.

7.4 INCIDENTS IN THE REMOTE CONTROL MODE

SIf the 8210 has received a message (sent by the controller) which contains an error, an error message is displayed on the LCD screen..

DISTANT MODE ERR : n

n	
1	UNKNOWN COMMAND
2	AWAITING A SEPARATOR
3	AWAITING A MESSAGE END TERMINATOR
4	NUMBER FORMAT ERROR
5	OUT OF RANGE NUMBER
6	AWAITING A COMMA
7	RESERVED WORD ERROR

7.5 TROUBLESHOOTING

Operating incident	Explanations/actions
The pens do not respond to the input but remain immobile	Check that the zero key has not been activated. (associated indicator light is lit)
The pen 2 respond to the input signal but the pen 1 remains immobile.	Synchronization has been activated (indicator light lit) and the immobile pen is awaiting synchro command (see§4.2.3)
The configuration of the 8210 is lost every time the 8210 is switched off.	Back-up battery discharged.
The input measurement is false.	Check that the recommendations on connecting earths given in §2.5 have been followed. Check that the input has not been configurated with too strong a filter relatively to the signal being measured (see §7.2)
Noise or incorrect measure in the PT 100 mode.	Check that the red and black terminals (+ and -) are disconnected.

Operating incidents	Explanations/actions
No display on the screen	Try to adjust the contrast on the display screen. If the problem persists the 8210 is defective.
No functioning at all.	Major defect ...

In the event a problem persists, contact the SEFRAM INSTRUMENTS ET SYSTEMES After-Sales Service (tél. 77 59 01 01) Fax(77 57-23-23).

Try to describe precisely the configuration and the conditions under which the 8210 is being operated that cause the defective operation.

If it is necessary to send the recorder back to the factory, enclose recordings that illustrate the problem. In effect the 8210 offers numerous possibilities for use and this information will help us to be even more effective.

SELF-WINDING UNWINDER OPTION

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8 -SELF-WINDING UNWINDER OPTION

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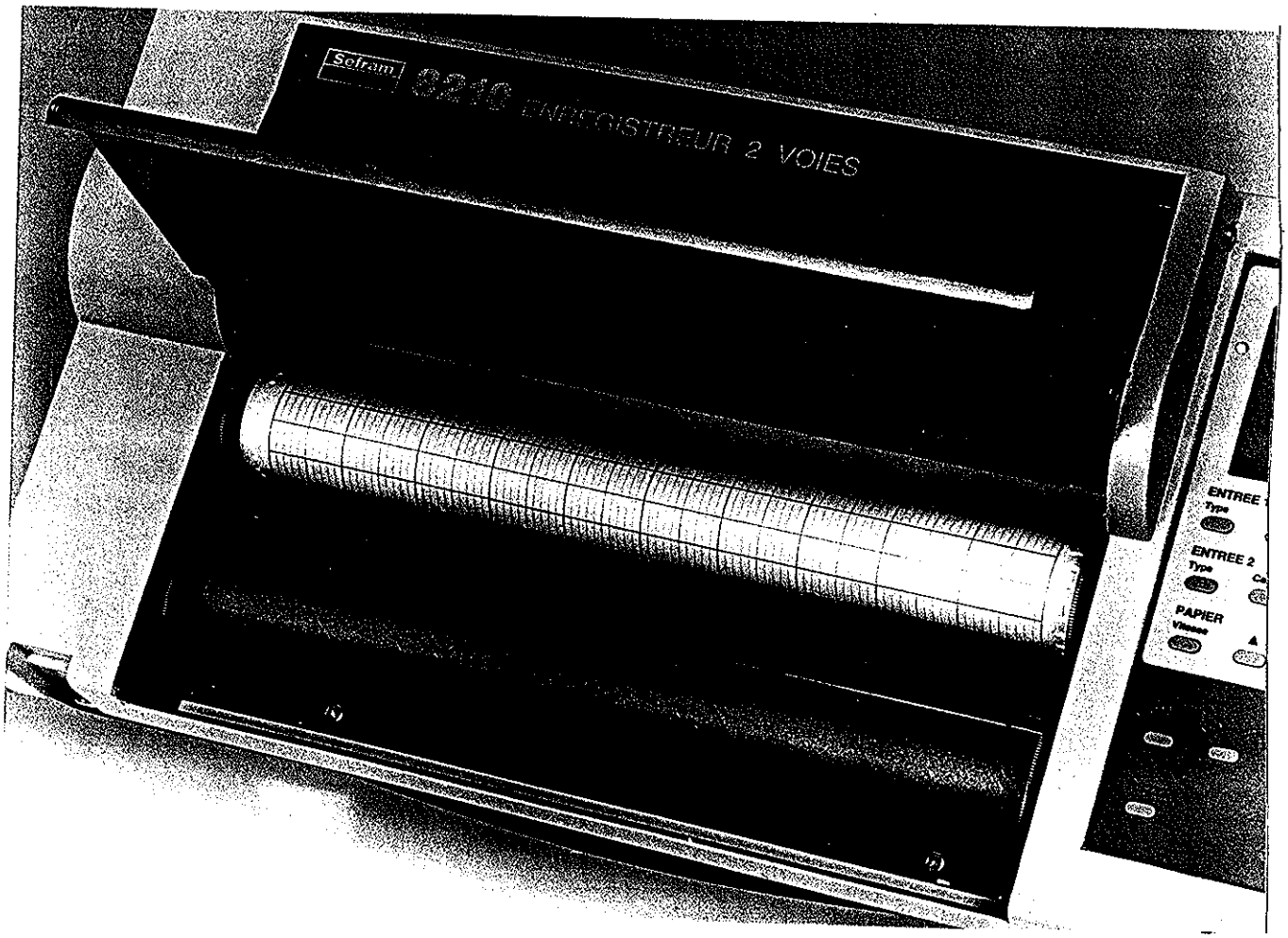
8 -SELF-WINDING UNWINDER OPTION



8 -SELF-WINDING UNWINDER OPTION

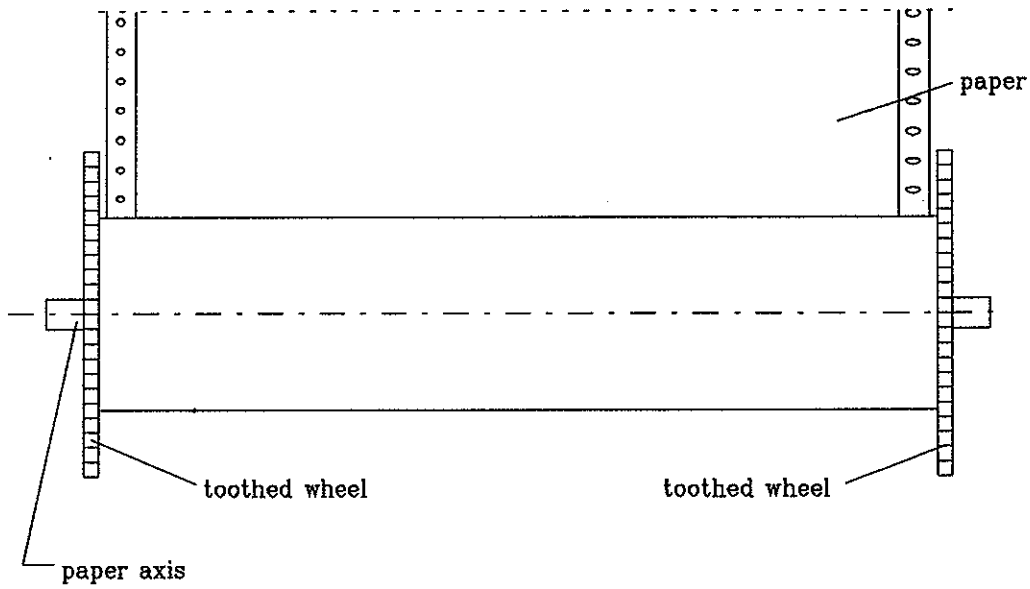
The 8210 may be fitted with the unwinding option. This option may be installed later but in this case the instrument must be send back to the factory for its installation.

8.1 INSTALLING THE PAPER

- Lift the covering cap of the feeding table

- Position the paper roll (oblong holes to the right) between the 2 toothed wheels.

- Introduce the paper axis (see sketch belows)



- Position this assembly into the location provided to this purpose (handle side) to facilitate paper handlings.

- Correctly introduce the paper under the pins of the 2 toothed wheels.

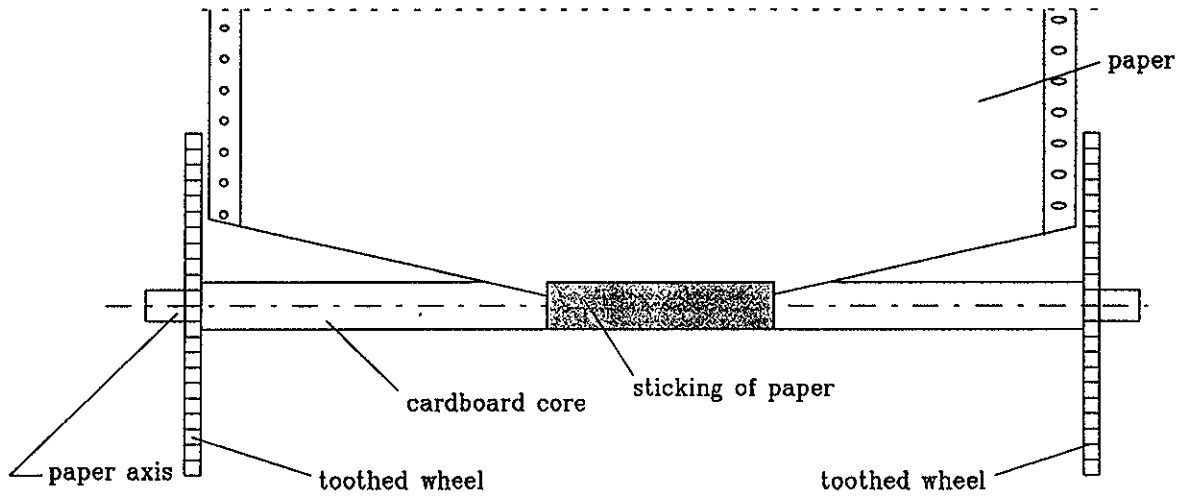
- Make the paper go under the paper press and under the gib.

- Replace the assembly (paper roll, toothed wheels and axis in the high location (roll side).

- Position the cardboard paper core between the two other toothed wheels.

- Introduce the axis.

8 -SELF-WINDING UNWINDER OPTION

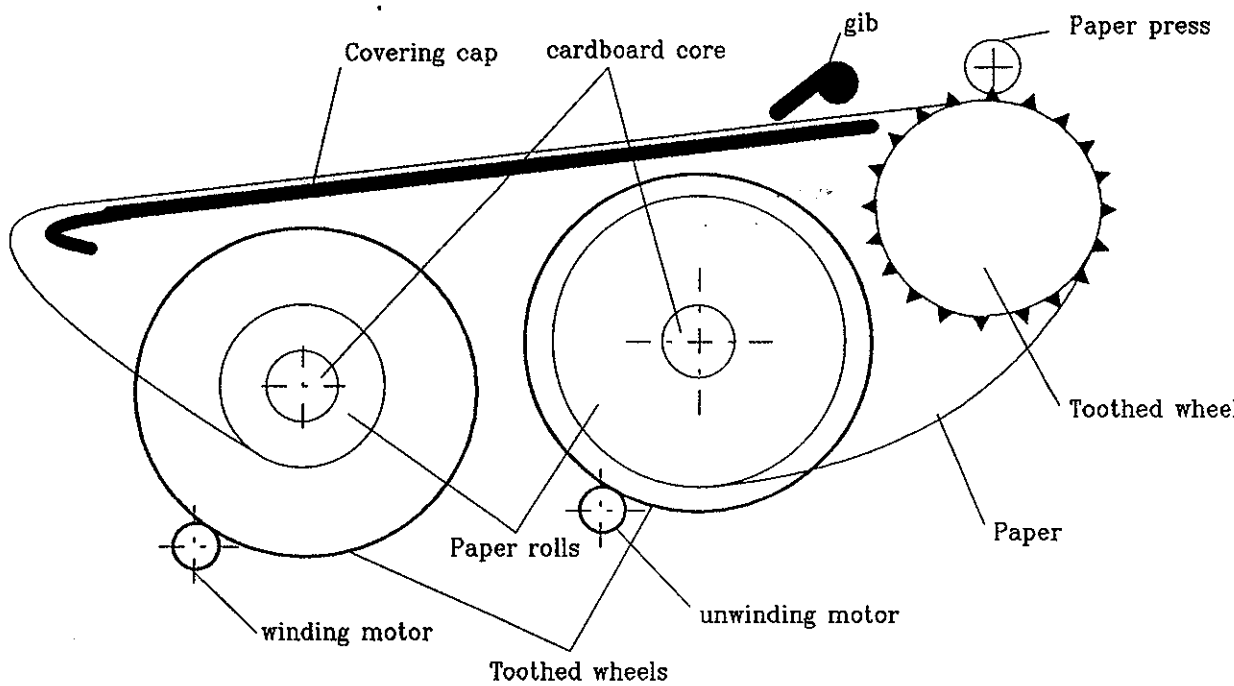


- Place this assembly into the free location (handle side)

- Make the paper go under the table covering cap and rubber it on the cardboard core (trying to center correctly the paper).

- Roll the paper by hand.

- Close the covering cap of the feeding-table.



Note: In case using a second hand paper roll, it is better to re-cut it so that the first round hole (on the left of the paper) and the first oblong hole (on the right of the paper) are well lined up. The paper will then correctly swings around the toothed weels.

ALTERNATE METHOD TO LOAD THE PAPER

This method is printed under the covering cap.

The paper is delivred with the extremity cut in point, so it's easier to load it.

- Introduce the paper under the pins of the toothed wheels, and recuperate it by the point of the paper above the cap.

- Get out the paper by the point by aligning thethick line with the marks of the rule.

8.2 FUNCTIONING

- Press 2 times the speed key (5)
The following message is displayed on the screen :

ROLLER on

- By means of the increase/decrease key (12) choose the ON option.

- In this case, the paper will wind automatically roud the cardboard core, immediately after a pression has been made on the plot key.

-The motor of the cardboard core may be inhibited when the roller is not used. To this intention, by means of the increase/decrease keys (12), choose the stop option to inhibit the roller.

TECHNICAL SPECIFICATIONS

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9 - TECHNICAL SPECIFICATIONS

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9 - TECHNICAL SPECIFICATIONS

9 - TECHNICAL SPECIFICATIONS

9.1 RECORDING POSSIBILITIES

9.1.1 Recording voltages

Maximum range : 100V.

Minimum range : 1mV (0,5 mV with fine adjustment)

Progression : steps of 1-2-5, fine adjustment allows intermediate values.

Offsets (displacements) : Fine adjustment of the centre and in jumps of 1/2 the range value.

N.B. : One displacement = 1/2 paper width (125 mm)
= 1/2 range (250 mm)

9.1.2 Recording temperatures

SENSORS	DOMAIN OF APPLICATION	RANGES
PT100 Probe	-200°C/+ 850° C	20 to 1000°C
Couple J	-210°C/+ 1200°C	20 to 2000°C
Couple K	-250°C/+ 1370°C	20 to 2000°C
Couple T	-200°C/+ 400°C	20 to 500°C
Couple S	-50°C/+1760°C	50 to 2000°C
Couple B	+200°C/+1820°C	200 to 2000°C
Couple E	-250°C/+1000°C	20 to 1000°C
Couple N	-250°C/+1300°C	20 to 1000°C
Couple W5	0°C/+2320°C	50 to 2000°C

Range : by steps of 1-2-5, fine adjustment allows intermediate values.
Choice of sensor type via keyboard.
The displacements of the origin are possible within the limits +/- 4 displacements within the sensor measurement limits (a displacement = 1/2 the paper width).

9.2 INTERFACE

One interface is available on the 8210 : the RS 232.

9.2.1 Interface possibilities

- Programming the operating parameters.
- Reading the operating parameters.
- Ploting the values sent by the calculator.
- Forward, backward paper-feed; return to a memorized position.

9.2.2 Interface RS 232C DCE mode

- Word : 8 bits without parity or 7 bits with an even perity.
- Output rate : 300 to 9600 bauds.
- Selecion : 1 STOP bit.
- Terminator : CR - LF - CR/LF - EOT
- Protocol : with no protocol or rts/cts.

9.3 AUXILIARY COMMANDS

- TTL level protected up to +/- 24 V.
- Remotely controlled functions :
  - . 2 event markers, one per channel.
  - . Step-by-step paper-feed validation.
  - . Step-by-step pulse input.
  - . Ploting mode command.

9.4 METROLOGICAL CHARACTERISTICS

These characteristics are given in the reference conditions (nominal temperature : 20 °C to 25 °C).

9.4.1 Voltage recording

-Measurement resolution : 12 bits. Precision : +/- 10 µV, +/- 0.25 % of the maximum measurable value taking into account cumulative offsets for the adopted range, the values being taken on the graph paper.

OFFSET temperature drift : 100 ppm/°C ± 1µV/°C

9.4.2 Temperature recording

Pt100 and Thermocouple Accuracy :

The measurement accuracies are given in appendix (chapter 10)

Cold junction compensation

Couple J, K, T, S, N, E, W5 : $\pm$ 1.0°C

9.5 MECHANICAL CHARACTERISTICS

These characteristics are valid for specified levels.

9.5.1 Insensitivity threshold / Dead band

It is less than 0.3 mm; that is, 0.12% of full scale.
Overstep : < 1 mm.

9.5.2 Pen response

Maximum speed : Approximatively 1.5 m/s.
Maximum acceleration : About 6 g.
Response time : From 10 % to 90 % of full scale, about 150 ms.

9.5.3 Frequency response

AMPLITUDE PP	-10 % (min)	-3 dB (min)	-3dB (typical)
16.6 cm	2.8 Hz	4 Hz	4.5 Hz
10cm	2.8 Hz	5 Hz	6 Hz
2.5 cm	3 Hz	5 Hz	6 Hz

N.B. : When a channel moves too fast, the 8210 switches automatically a filter on the corresponding input to preserve the mechanics. The time before this limitation is realized, varies from a few seconds to several minutes, and depends on signal frequency, signal amplitude, and channel's mechanical characteristics.

9.5.4 Paper feed

Dynamic characteristics, formard feed :

- Minimum speed : 10 mm/h
- Maximum speed : 50 mm/s
- Fast feed forwards or backwards : 100mm/s

Precision of the feed speed : 0.01%

9.5.5 External clock command

- Minimum pulse width : 1µs.
- Active edge : increasing.
- Resolution : by steps of 0.01mm to 1 mm.
- Maximum frequency : 5 KHz and within the maximum speed of the paper-feed (50mm/s)

9.5.6 Mechanical behaviour (shipping conditions)

Tested along each axis.

- Impact : 15 g ; 11 ms ; 6 impacts on each axis.
- Shaking : 15 g ; 6 ms ; 1000 on each axis, rate : one per second.
- Sinusoidal vibrations :
  - . From 5 to 9 Hz : 3 mm peak to peak,
  - . From 9 to 200 Hz : 1 g maxi
  - . Logarithmic scanning : 1 octave / mn, 6 logarithm cycles on each axis.

9.5.7 Bulkiness, weight

- Height : 150 mm
- Width : 450 mm
- Depth : 220 mm
- Weigth : 5 kgs

9.6 ANALOG INPUTS STAGES

9.6.1 Impedance

- Range < or equal to 2 V : input impedance > 25 MΩ
- Range > 2 V : input impedance = 2 MΩ ± 10 %

9.6.2 Maximum allowable voltages

- Between a measurement channel and the mainframe : +/- 500 V.
- Between two measurement channels : 500 V
- Between the + and - terminals of an input : +/-250 V

9.6.3 Insulation

- Between the mainframe and the measurement channel : 1000 MΩ under 500 V DC.

9.6.4 Interference signals

Tests in conformity with IEC 484.

- Serial mode :

Rejection rate for all the ranges at 50 HZ: >50 dB

- Common mode :

. DC voltages

Ra = 0Ω and Rb = Rmax or Ra = Rmax and Rb = 0Ω.
Rejection rate in common mode > 140 dB for all the ranges.

. AC 50 Hz voltages

Ra	Rb	RANGE < or equal to 2V	CALIBRE > 2V
0	10	90 dB	70 dB
10	0	90 dB	70 dB
0	Rmax	90 dB	70 dB
Rmax	0	90 dB	70 dB

Ra and Rb are expressed in Ω

Maximum resistance of the measurement circuit :

R max. = 1000 Ω

9.7 ENVIRONMENTAL CONDITIONS

9.7.1 Climatic conditions

- Operating temperature : 0°C to 40 °C.
- Maximum relative humidity : 80 % without condensation.
- Storage temperature : -20 °C to 70°C.

9.7.2 Mains

- 85 V to 264 V without commutation.
- 47 to 440 Hz
- Consumption : 75 W.
- Internal fuse 2A.

9.7.3 Insulation class (referring to ECI 348)

Class 1 material.
Security : in conformity with the ECI 348 and 1010-1

9.7.4 Electromagnetic compatibility

Interferences immunity to electromagnetic interferences	Satisfactory or better than IEC 801	- Electrostatic discharge IEC 801-2 level 3 (NFC 46-021) - Susceptibility to electrical fields IEC 801-3 level 2 (NFC 46-022) - Susceptibility to rapid conducted interferences IEC 801-4 level 2 (NFC 46-23)
Perturbations due to recorder	Satisfactory or better than EN 55022 and VDE 871 class B	- Conducted and radiated perturbations

9.8 SPARE PARTS DELIVERED WITH THE INSTRUMENT

1 user manual	: ref. : M821000UF
1 red fibre-tip pen	: ref. : 883500043
1 blue fibre-tip pen	: ref. : 883500044
1 red ball-point pen	: ref. : 883500051
1 blue ball-point pen	: ref. : 883500052
1 roll of paper, 30 m, millimetre grid	: ref. : 837500021
or roll of paper, 30m ,standardized	: ref. : 837500016
2 DIN plugs	: ref. : 214426056
1 Mains cable	: ref. : 241510301
1 SUB-D mâle 15 pins	: ref : 214200150
1 Cover connector	: ref : 214299013

9.9 SPARE PARTS SUPPLIED ON REQUEST

Green fibre-tip pen	ref. : 883500045
Black fibre-tip pen	ref. : 883500046
Violet fibre-tip pen	ref. : 883500047
Brown fibre-tip pen	ref. : 883500048
Turquoise fibre-tip pen	ref. : 883500049
Orange fibre-tip pen	ref. : 883500050
Green ball-point pen	ref. : 883500053
Black ball-point pen	ref. : 883500054
Violet ball-point pens	ref. : 883500055
Brown ball-point pen	ref. : 883500056
Turquoise ball-point pen	ref. : 883500057
Orange ball-point pen	ref. : 883500058
Red slow recording pen	ref. : 883500500
Blue slow recording pen	ref. : 883500501

Roll of paper, 30 m, standardized	ref. : 837500016
Roll of paper, 30m, millimetre grid	ref. : 837500021
1 Ohm 0.1% shunt (plug-in type)	ref. : 899620026
RS232 cord PC sub D	
9 and 25 contacts	ref.: 982101000

<u>OPTIONS</u> :

Self-winding / unwinder	ref. : 782100010
Protective covering cap	ref. : 782100040
Rack-mounting kit	ref. : 782100030

APPENDIX

10

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SUMMARY **page**

10 - APPENDIX

10.1 INPUT RANGE INFORMATION

10.1.1 Voltage type input

RANGE	SENSIBILITY	MINI measure	MAX measure
1 mV	40 µV/cm	-2.5 mV	+ 2.5 mV
2 mV	80 µV/cm	-5 mV	+5 mV
5 mV	200 µV/cm	-12.5 mV	+12.5 mV
10 mV	400 µV/cm	-25 mV	+25 mV
20 mV	800 µV/cm	-50 mV	+50 mV
50 mV	2 mV/cm	-125 mV	+125 mV
100 mV	4 mV/cm	-250 mV	+250 mV
200 mV	8 mV/cm	-500 mV	+500 mV
500 mV	20 mV/cm	-1.25 V	+1.25 V
1 V	40 mV/cm	-2.5 V	+2.5 V
2 V	80 mV/cm	-5 V	+5 V
5 V	200 mV/cm	-12.5 V	+12.5 V
10 V	400 mV/cm	-25 V	+25 V
20 V	800 mV/cm	-50 V	+50 V
50 V	2 V/cm	-125 V	+125 V
100 V	4 V/cm	-250 V	+250 V

10.1.2 PT100 type input

RANGE	SENSIBILITY	MINI measure	MAX measure
20 °C	0.8 °C/cm	-50 °C	+50 °C
50 °C	2 °C/cm	-125 °C	+125 °C
100 °C	4 °C/cm	-200 °C	+250 °C
200 °C	8 °C/cm	-200 °C	+500 °C
500 °C	20 °C/cm	-200 °C	+850 °C
1000 °C	40 °C/cm	-200 °C	+850 °C

10.1.3 J type thermocouple input

CALIBRE	SENSIBILITE	MINI mesurable	MAX mesurable
20 °C	0.8 °C/cm	-50 °C	+50 °C
50 °C	2 °C/cm	-125 °C	+125 °C
100 °C	4 °C/cm	-210 °C	+250 °C
200 °C	8 °C/cm	-210 °C	+500 °C
500 °C	20 °C/cm	-210 °C	+1200 °C
1000 °C	40 °C/cm	-210° C	+1200 °C
2000 °C	80 °C/cm	-210 °C	+1200 °C

10.1.4 K type thermocouple input

RANGE	SENSIBILITY	MINI measure	MAX measure
20 °C	0.8 °C/cm	-50 °C	+50 °C
50 °C	2 °C/cm	-125 °C	+125 °C
100 °C	4 °C/cm	-250°C	+250 °C
200 °C	8 °C/cm	-250°C	+500 °C
500 °C	20 °C/cm	-250°C	+1250 °C
1000 °C	40 °C/cm	-250°C	+1370 °C
2000 °C	80 °C/cm	-250°C	+1370 °C

10.1.5 T type thermocouple input

RANGE	SENSIBILITY	MINI measure	MAX measure
20 °C	0.8 °C/cm	-50 °C	+50 °C
50 °C	2 °C/cm	-125 °C	+125 °C
100 °C	4 °C/cm	-200 °C	+250 °C
200 °C	8 °C/cm	-200 °C	+400 °C
500 °C	20 °C/cm	-200 °C	+400 °C

10.1.6 S type thermocouple input

RANGE	SENSIBILITY	MINI measure	MAX measure
50 °C	2 °C/cm	-50 °C	+125 °C
100 °C	4 °C/cm	-50 °C	+250 °C
200 °C	8 °C/cm	-50 °C	+500 °C
500 °C	20 °C/cm	-50 °C	+1250 °C
1000 °C	40 °C/cm	-50 °C	+1760 °C
2000 °C	80 °C/cm	-50 °C	+1760 °C

10.1.7 B type thermocouple input

RANGE	SENSIBILITY	MINI measure	MAX maesure
200 °C	8 °C/cm	+200 °C	+500 °C
500 °C	20 °C/cm	+200 °C	+1250 °C
1000 °C	40 °C/cm	+200 °C	+1820 °C
2000 °C	80 °C/cm	+200 °C	+1820 °C

10.1.8 E type thermocouple input

RANGE	SENSIBILITY	MINI measure	MAX measure
20 °C	0.8 °C/cm	-50 °C	+50 °C
50 °C	2 °C/cm	-125 °C	+125 °C
100 °C	4 °C/cm	-250 °C	+250 °C
200 °C	8 °C/cm	-250 °C	+500 °C
500 °C	20 °C/cm	-250 °C	+1000 °C
1000 °C	40 °C/cm	-250 °C	+1000 °C

10.1.9 N type thermocouple input

RANGE	SENSIBILITY	MINI measure	MAX measure
20 °C	0.8 °C/cm	-50 °C	+50 °C
50 °C	2 °C/cm	-125 °C	+125 °C
100 °C	4 °C/cm	-250 °C	+250 °C
200 °C	8 °C/cm	-250 °C	+500 °C
500 °C	20 °C/cm	-250 °C	+1250 °C
1000 °C	40 °C/cm	-250 °C	+1300 °C

10.1.10 W5 type thermocouple input

RANGE	SENSIBILITY	MINI measure	MAX measure
50 °C	2 °C/cm	0 °C	+125 °C
100 °C	4 °C/cm	0 °C	+250 °C
200 °C	8 °C/cm	0 °C	+500 °C
500 °C	20 °C/cm	0 °C	+1250 °C
1000 °C	40 °C/cm	0 °C	+2320 °C

10.2 MEASUREMENT ACCURACY WITH THERMOCOUPLE

Note : Measurement inaccuracies given below are the maximum values. Typical values are 2 to 3 times lower.

The measurement accuracy in temperature is the addition of several possible inaccuracy sources :

Pl : linearization accuracy
Ps : cold junction accuracy
Pm : equivalent voltage measurement accuracy
Pd : offset measurement accuracy

Therefore the total accuracy Pt is : $Pt = Pl + Ps + Pm + Pd$

for the 8210 :

Pl = $\pm$ 0.25 °C for all the thermocouples
Ps = $\pm$ 1 °C for all the thermocouples
Pd = $\pm$ 0.25% of the offset
Pm = explained below

Measurement accuracy : Pm

The measurement accuracy Pm depends on the voltage range used by the instrument. The measurement error in degrees will be the voltage error divided by the slope in Volt/°C of the thermocouple. For each thermocouple an indicative value of the slope at a given temperature is given. This slope is significant of the thermocouple and permits to deduce the error in temperature. If someone want to refine further he must read the slope in the thermocouples tables (due to the fact that they are fonction of the temperature).

For all the voltage ranges the accuracy is $\pm$ 0.25% $\pm$ 10µV.

10.2.1 J Thermocouple

Slope at 0°C = 50μV/°C

Temperature Range	Voltage Range (mV)	Max Error in Voltage(μV)	Max Error in °C
20	2	15	0.3
50	5	22.5	0.45
100	10	35	0.7
200	20	60	1.2
500	50	135	2.7
1000	100	260	5.2
2000	100	260	5.2

10.2.2 K Thermocouple

Slope at 0°C = 40μV/°C

Temperature Range	Voltage Range (mV)	Max Error in Voltage(μV)	Max Error in °C
20	2	15	0.37
50	5	22.5	0.56
100	10	35	0.88
200	10	35	0.88
500	50	135	3.4
1000	50	135	3.4
2000	100	260	6.5

10.2.3 T Thermocouple

Slope at 0°C = 40µV/°C

Temperature Range	Voltage Range (mV)	Max Error in Voltage(µV)	Max Error in °C
20	2	15	0.37
50	5	22.5	0.56
100	10	35	0.88
200	20	60	1.5
500	50	135	3.4

10.2.4 S Thermocouple

Slope at 500°C = 10µV/°C

Temperature Range	Voltage Range (mV)	Max Error in Voltage(µV)	Max Error in °C
50	1	12.5	1.25
100	2	15	1.5
200	5	22.5	2.25
500	10	35	3.5
1000	20	60	6
2000	20	60	6

10.2.5 B Thermocouple

Slope at 1000°C = 9µV/°C

Temperature Range	Voltage Range (mV)	Max Error in Voltage(µV)	Max Error in °C
200	5	22.5	2.5
500	10	35	3.9
1000	20	60	6.7
2000	20	60	6.7

10.2.6 E Thermocouple

Slope at 0°C = 60μV/°C

Temperature Range	Voltage Range (mV)	Max Error in Voltage(μV)	Max Error in °C
20	5	22.5	0.38
50	5	22.5	0.38
100	10	35	0.58
200	20	60	1
500	50	135	2.3
1000	100	260	4.3
2000	100	260	4.3

10.2.7 N Thermocouple

Slope at 0°C = 26μV/°C

Temperature Range	Voltage Range (mV)	Max Error in Voltage(μV)	Max Error in °C
20	1	12.5	0.48
50	2	15	0.58
100	5	22.5	0.87
200	10	35	1.4
500	20	60	2.3
1000	50	135	5.2
2000	100	260	10

10.2.8 W5 Thermocouple

Slope at 1000°C = 18µV/°C

Temperature Range	Voltage Range (mV)	Max Error Voltage(µV)	Max Error in °C
50	1	12.5	0.7
100	2	15	0.83
200	5	22.5	1.25
500	10	35	2
1000	20	60	3.3
2000	50	135	7.5

10.3 MEASUREMENT ACCURACY WITH Pt 100

Note : Measurement inaccuracies given below are the maximum values. Typical values are 2 to 3 times lower.

The measurement accuracy in Pt 100 is the addition of several possible inaccuracy sources :

Pl : linearization accuracy
Pz : zero accuracy
Pm : equivalent voltage measurement accuracy
Pd : offset measurement accuracy

Therefore the total accuracy Pt is : Pt = Pl + Pz + Pm + Pd

for the 8210 :

Pl = ± 0.25 °C
Pz = ± 0.25 °C
Pd = ± 0.25% of the offset
Pm = explained below

Measurement accuracy : Pm

The measurement accuracy Pm depends on the voltage range used by the instrument. The measurement error in degrees will be the voltage error divided by the slope in Volt/°C of the thermocouple.
For all the voltage ranges the accuracy is ± 0.25% ± 10µV.

Slope versus temperature:
Slope is dependant of option présence

Temperature (°C)	-200	-100	0	200	400	600	800
Slope standard (µV/°C)	402	371	352	323	295	269	245
Slope and option (µV/°C)	397	372	359	337	316	295	273

Measurement accuracy at 0°C :

Temperature Range	Voltage Range (mV)	Max Error in Voltage(µV)	Max Error in °C standard	Max Error in °C and option
20	10	35	0.099	0.097
50	20	60	0.17	0.17
100	50	135	0.38	0.38
200	100	260	0.74	0.72
500	200	510	1.4	1.4
1000	500	1260	3.6	3.5

10.4 EXAMPLE OF ACCURACY CALCULATION

10.4.1 Thermocouple

Measurement performed on 50°C range and 25°C centre with a J thermocouple, without cold junction compensation.

Pt = Pl + Ps + Pm + Pd

Pl = ± 0.25 °C (linearization accuracy)
Ps = ± 0°C (no cold junction compensation)
Pd = ± 0.06°C (± 0.25% of the middle range temperature)
Pm= ± 0.45°C (read in the table, for a 50°C range)

Therefore the maximum total accuracy is :

Pt = 0.25 + 0.06 + 0.45 = ± 0.76°C

10.4.2 Pt 100

240°C measurement performed on 500°C range and 0°C centre with Pt 100 without PT100 long distance measurement.

Pt = Pl + Pz + Pm + Pd

Pl = ± 0.25 °C (linearization accuracy)
Pz = ± 0.25°C (zero accuracy)
Slope at 240°C ≈ 323 + (295 - 323) x 40 / 200 ≈ 317 µV/°C
Pm = 510 / 317 ≈ ± 1.6°C
Pd = 0°C (no offset)

Therefore the maximum total accuracy is :

Pt = 0.25 + 0.25 + 1.6 ≈ ± 2.1°C

GLOSSARY

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11 - GLOSSARY

CLASS OF PRECISION - CLASS INDEX

This is one of the essential concepts in the IEC recommendation; it tends to reduce the need to enumerate the specifications. To this end, it introduces the notion of CLASS OF PRECISION,this being determined by the CLASS INDEX C. The standardized values of the class index are : C = 0,1 ; 0,25 ; 0,5 and 1.

According to the IEC, the assignment of an instrument to a class of precision implies the following specifications :

- The intrinsic error (under reference conditions) does not exceed +/- C% (the Manufacturer may also specify the intrinsic limit in absolute value (for example, +/- 5 µV) for the first ranges).

- The variations (in the measured value), when one of the influencing factors varies in the nominal use range, do not exceed C% for the position for magnetic induction originating from an external source for the interference voltages.

. 0,5 C% for power supply
. From 0.3% depending on the class index for the ambient temperature (0.15% for the 0.25 class).

- Moreover, the dead band should not exceed :

. C% under reference conditions

. 1,5C% for the maximum resistance of the external measuring circuit.

. 2C% for interference voltages.

- Finally, overstep should not exceed 2C% (4C% for the limits of the power supply).

It can be seen, that it is thus possible, by reference to its class of precision, to summarize a good number of the recorder's specifications.

RANGE

A value that corresponds to the paper width of 250 mm.

For the 8210, the range corresponds to the difference between the maximum value (right-hand limit of the paper) and the minimum value measurable (left-hand limit of the paper).

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MEASUREMENT DOMAIN

Space between one edge of the paper and the other.

OVERSTEP

The measured value may vary suddently by about 2/3 of the measurement interval; overstep is the difference between the extreme recorded value and that registered after the stabilisation of the plotter.

It should not exceed twice the class index (four times the limit of the power supply in the domain of utilization).
(Example : for an instrument in class 0.25%, and a measurement interval of 25 cm, the maximum overstep is 1.25 mm).

INFLUENCING VARIABLES

They correspond to the environment notion.
They are the magnitudes, other than that of the measurement, the variation(s) of which are liable to modify the value given by the instrument instead of the true value of the magniture measured. The environmental factors generally taken into account are :

- the ambient temperature
- the position of the instrument (flat, inclined, vertical ...)
- the magnitude induction from an external source (direct, alternating),
- interference voltages (direct, alternating, serial mode, common mode),
- the instrument's power supply (voltage, frequency),
- the resistance of the external measurement circuit.

SERIAL MODE INTERFERENCE

The specifications should indicate the effect of te serial mode factor (or the CMRR rejection rate) for the mains frequency (50 Hz) and for twice this frequency.

Several values could be given if the recorder contains one or more commutable filters.

COMMON-MODE INTERFERENCE

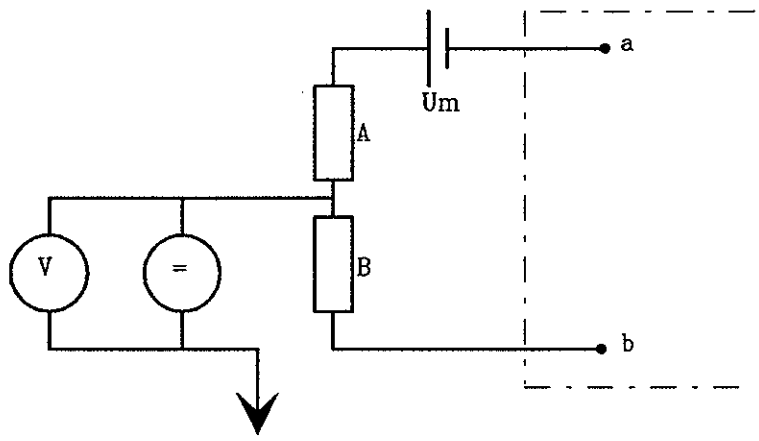
The measurement set-up is shown in the figure below. To simplify, the measured voltage Um

can be zero. The values of the influencing factors are shown for four combinations of resistances A and B :

	1rst test	2nd test	3rd test	4rth test
A :	10 ohms	0	Ra	0
B :	0	10 ohms	0	Rb

Ra and Rb are equal one to the maximum value of the external resistance of the input circuit indicated by the Manufacturer, the other to any value indicated by the Manufacturer.
The Manufacturer must specify the lower of the values of the environmental factor obtained by the first two and the last two tests, respectively.

There can be as many series of values as there are commutable filter positions in the recorder. Indeed, the values are specified according to whether the interference voltage is direct or alternating at the mains frequency.
For all tests, the possible increase in the dead band limit should not exceed twice the class index. Many user guides indicate the CMRR rejection rate for Ra = 1000 Ohms (3rd test) and sometimes for Rb = 1000 Ohms (4rth test).



V = Interference voltage between the measurement circuit and earth

Um = Measured voltage

11 - GLOSSARY

DEAD BAND

A limit within which the measured magnitude may be varied without provoking plotter displacement. It is connated to the resolution notion.

FREQUENCY RESPONSE

Apply a sinusoidal voltage produced by a low frequency generator to the recorder at a frequency close to 0.1 Hz and adjust range and voltage to obtain a graphic trace with an initial amplitude of A0.
Progressively increase the frequency F. Graphic trace amplitude A is initially virtually equal to A0, and then decrements faster and faster.
This procedure establishes the frequency response for the recorder. The attenuation, expressed as a pourcentage, is :

100 (A0-A)/Ao. The value is often expressed in decibels i.e. : - 20 x log A/Ao.

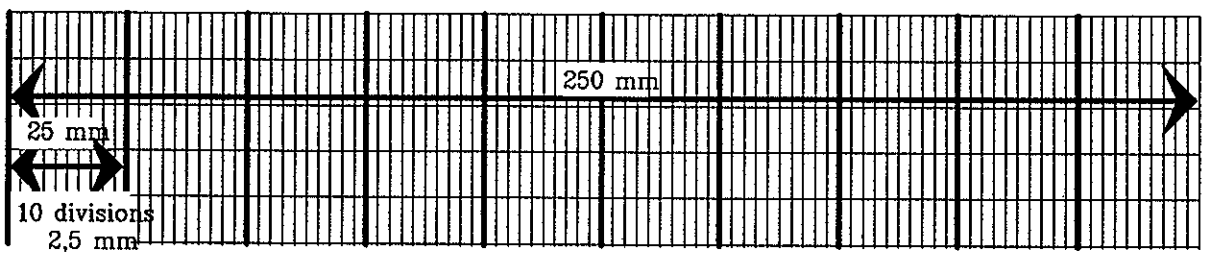
The term "bandwidth" is often used to designate the frequency range lying betwee 0 Hz and frequency Fm if, within this range, attenuation does not exceed a specific limit.
If the procedure is repeated with an initial amplitude A0, set at 2.5 cm peak-to-peak value, a new bandwidth is obtained.
It is obvious that any value falling within a bandwidth is only meaningful if the following data is supplied :

- the initial amplitude of the graphic plot

- the maximum limits accepted within the bandwidth.

SENSITIVITY

Example : Value of the measurement per cm of paper.



For 1 cm, sensibility = $\frac{\text{range x 4}}{100}$ = measure unit/cm

For 2,5 mm = $\frac{\text{range}}{100}$

DIGITAL MODE

The mechanical channels are no longer controlled by the input signals but by instructions sent directly by the calculator.

DIRECT MODE (CONTINUOUS MODE)

In continuous mode, the 8210 records, in real time, low frequency analog signals generated by temperatures and inscribes them directly onto the recording paper via the mechanical channels.

The transcription is done by the displacement of a pen carrier.

The carrier displacement is limited to a few Herz (5Hz). If the signal to record is translated into too rapid a movement, the mechanical parts cannot follow, in which case a new mode must be adopted : this is the transient mode.

MARKER

Possibility to write references (marks) on the paper during plotting.

CE

DECLARATION OF CONFORMITY

DECLARATION DE CONFORMITE

ELECTRO-MAGNETIC COMPATIBILITY and SAFETY

COMPATIBILITE ELECTRO-MAGNETIQUE ET SECURITE

N° 96 5201

According to testing performed by : SEFRAM INSTRUMENTS & SYSTEMES
Suite aux essais réalisés par 32, rue E. MARTEL - BP 55
42009 ST ETIENNE CEDEX 2

We declare, under own responsability, that the below mentionned product is in compliance with :
Nous déclarons, sous notre seule responsabilité, que le produit défini ci-dessous est conforme à

the EUROPEAN DIRECTIVE CEM 89/336/CEE
Emission Standard EN 50081-1
Immunity standard EN 50082-1
la DIRECTIVE EUROPEENNE CEM 89/336/CEE
en Emission selon EN 50081-1
en Immunité selon EN 50082-1

&

the EUROPEAN Low Voltage DIRECTIVE 73/23/EEC
Safety requirements for electrical equipement for measurement, control and laboratory use
NF EN 61010-1
la DIRECTIVE EUROPEENNE Basse Tension CEE 73-23
Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire
NF EN 61010-1

PRODUCT NAME : Two channel recorder
DESIGNATION Enregistreur 2 voies

MODEL NUMBER : 8210
NUMERO DE SERIE

Sécurité :

Isolation : Classe 1
Degré de pollution :2
Catégorie d'install. de l'alimen. CAT II (264Vmax)

Insulation : Class 1
Degree of pollution : 2
Power supply CAT II (264V max)

ST ETIENNE LE :24 Dec 1996

Name / Position : T. TAGLIARINO Quality Manager
Nom Fonction / Responsable Qualité

This declaration has been established in conformity with the article 10 of the 89/336/EEC european directive dated May 3, 1989 and in application of the EN 45014 european standard dated 1989.
Cette declaration est établie conformément à l'article 10 de la directive européenne 89/336/CEE du 3 Mai 1989 et en application de la norme européenne EN 45014 de 1989.

C965201.PM4