FOGALE nanotech

User's guide

MSM
MultiSystMetrolog

Software for the control of leveling and alignment systems

CONTENTS

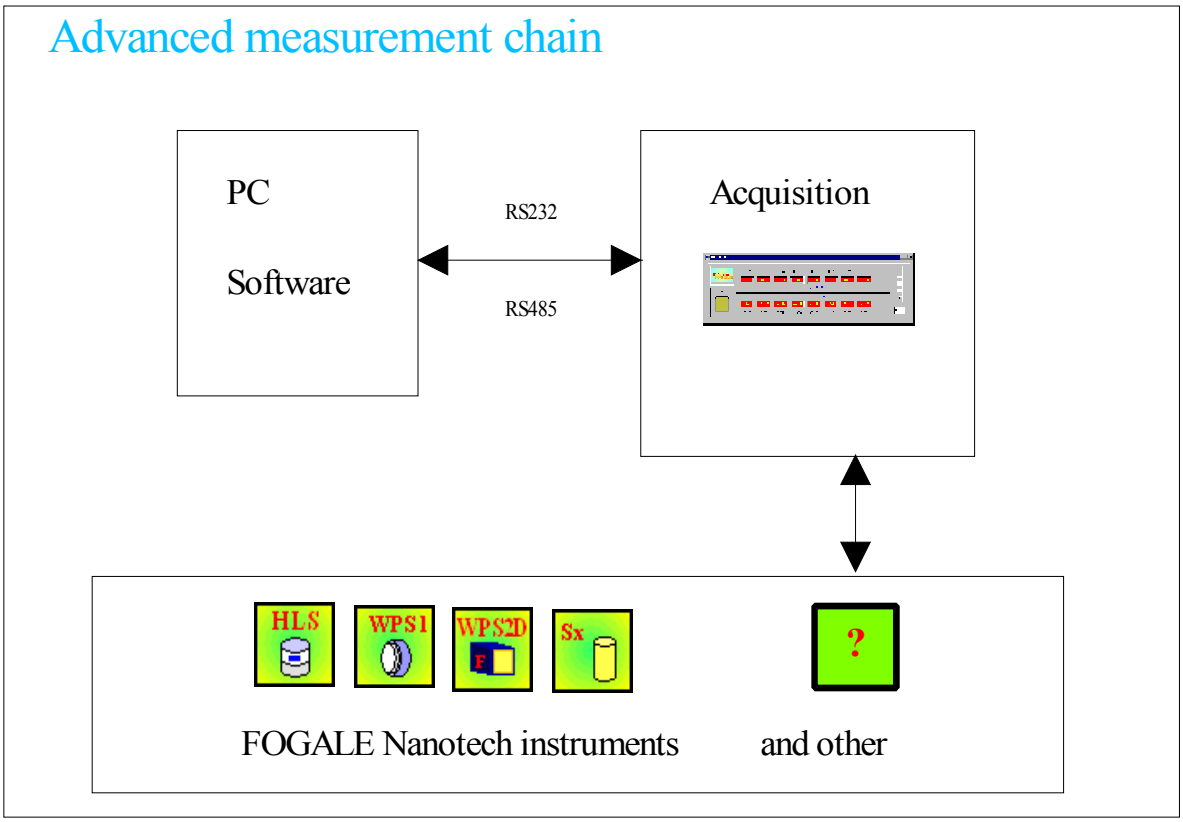
1. Presentation

The *MSM (MulitSystMetrolog)* software was developed so as to manage measurement systems allowing :

- machines positioning,
- structural control and survey.

Its principal functions are the following :

- Management and acquisition of measurement data from the RIA 8µP rack to which FOGALE Nanotech instruments or other are connected.
- Installation visualization
- Measurement data display
- Simultaneous specific data processes
- Measurement data saving
- Management of RIA 8µP racks network



The *MultiSystMetrolog* software was developed in C / C++ in Visual 5.0 and in the Windows NT4.0. environment. Its automatic Setup spares the user complex manipulations on the operating system.

2. Installation

The present section describes the installation procedure.

The *MSM* files are originally compressed and are automatically uncompressed during installation. The Setup program has to be runned before installing and running *MSM*.

2.1. Material features

2.1.1. Minimum required material

- Pentium 166
- 32 Mo
- Display adaptator, resolution SVGA 1024x768, 256 colors
- Hard disk unit, CD ROM player
- 200 Mo minimum disk free space

2.1.2. Advised configuration

- Microprocessor Pentium III 500 or better
- 256 Mo
- 400 Mo disk free space

2.1.3. Required environment

Windows NT 4.0 Pack 6a or advanced version
Windows 2000 Pro or advanced version

2.2. Installation of MultiSystMetrolog

Remark : before installation of a new version, please uninstall former version (Cf. &2.3).

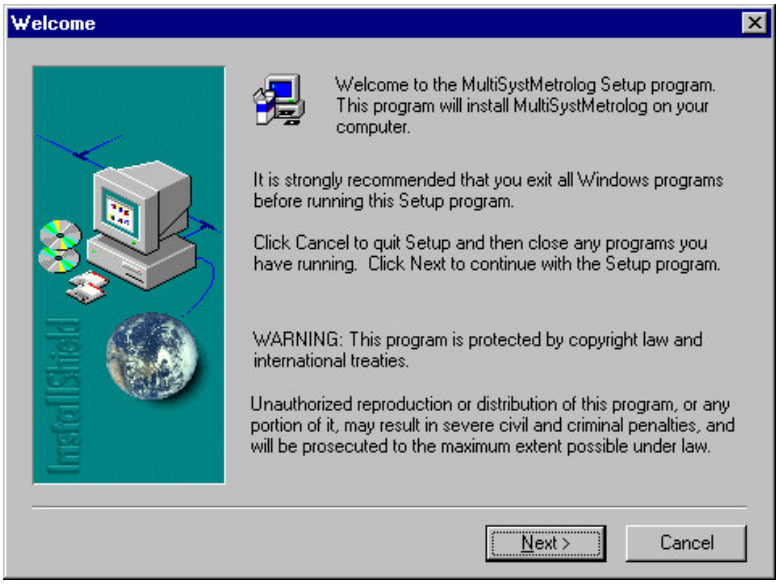
2.2.1. Lauching the Setup program

1. Open the « *Administrator* » session of Windows NT,
2. Insert CD in PC CD ROM player,
3. Launch the *setup.exe* program located on the CDROM in the following directory :

   Disk Images\Disk1

2.2.2. Welcome dialog

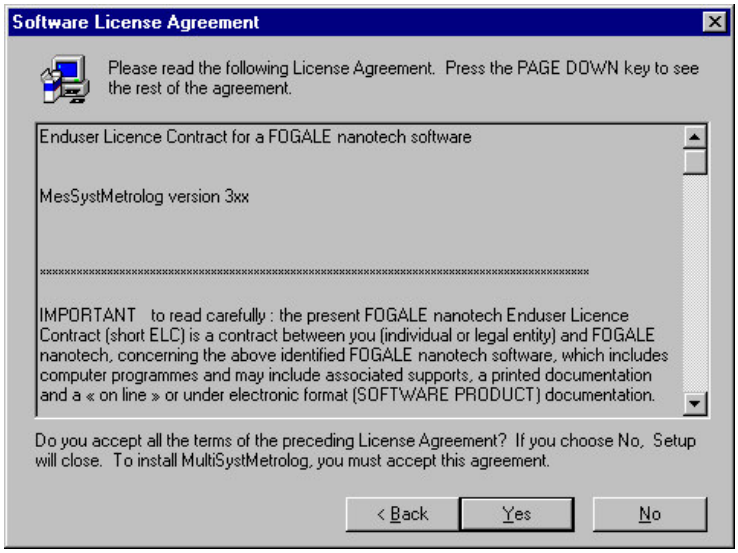
The welcome dialog recommends to quit all applications in Windows before running the Setup program.



Click on the *Next* button if no other application is running, otherwise quit the Setup program by clicking on *cancel* so as to quit all active files and applications.

2.2.3. Acceptation of the enduser licence contract

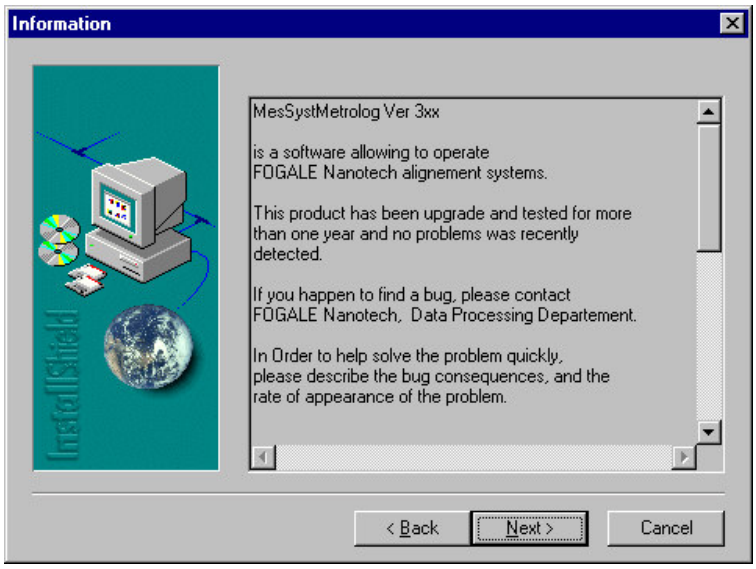
This dialog describes the licence contract for *MSM*. If you do not accept conditions (*No)*, the Setup stops.
Click on the *Back* button to come back to the former dialog.



Click on *Yes* to accept the licence contract conditions and go to the next dialog.

2.2.4. General information

This dialog gives general information about the software.
Click on *Cancel* to cancel the software Setup program.

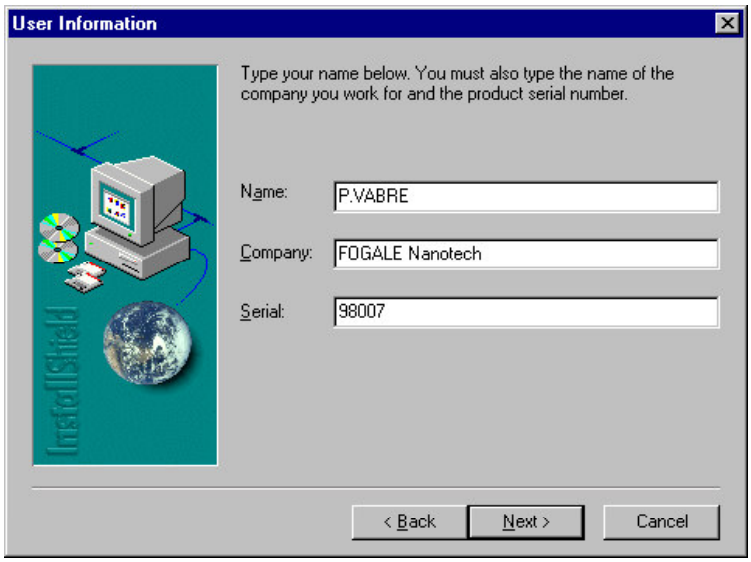


Click on *Next* to start Setup.

2.2.5. MultiSystMetrolog registration

Before going on with the *MSM* Setup, the user needs to enter the following information :

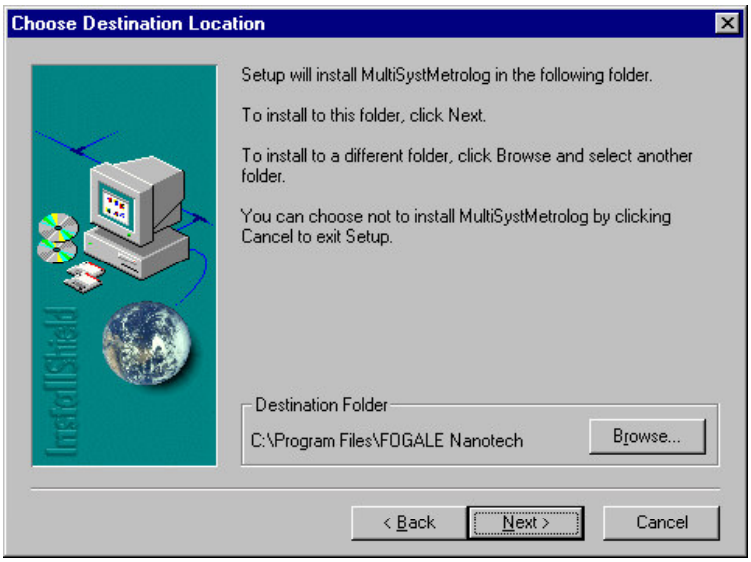
- Name: user's name
- Company: company name
- Serial: serial number to be found at the back of CD jacket.



Fill in the three blank spaces and click on *Next.*

2.2.6. Choosing the folder which contains the Setup files

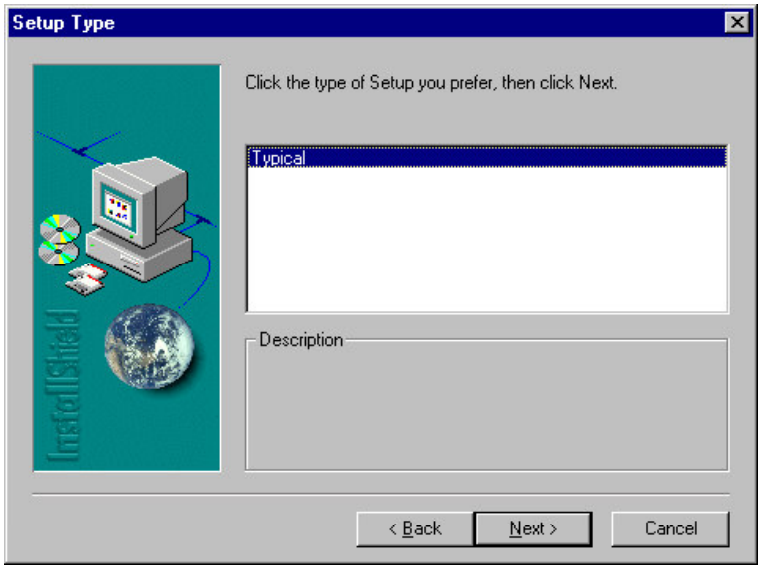
This dialog allows to valid the folder in which Setup files will be stored. The default folder is *Program Files\FOGALE Nanotech* (see below). The *Browse* button allows to select another folder but we strongly advise the user to keep the default selection.



Click on *Next* to valid the mentioned folder.

2.2.7. Validating the type of Setup

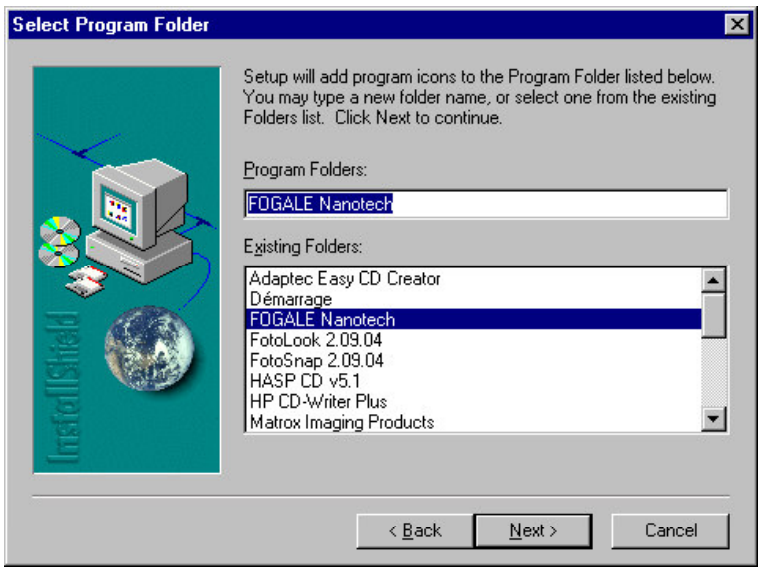
This dialog allows to validate the type of Setup :



Click on *Next* to valid the chosen Setup : Typical.

2.2.8. Accessing the software icon

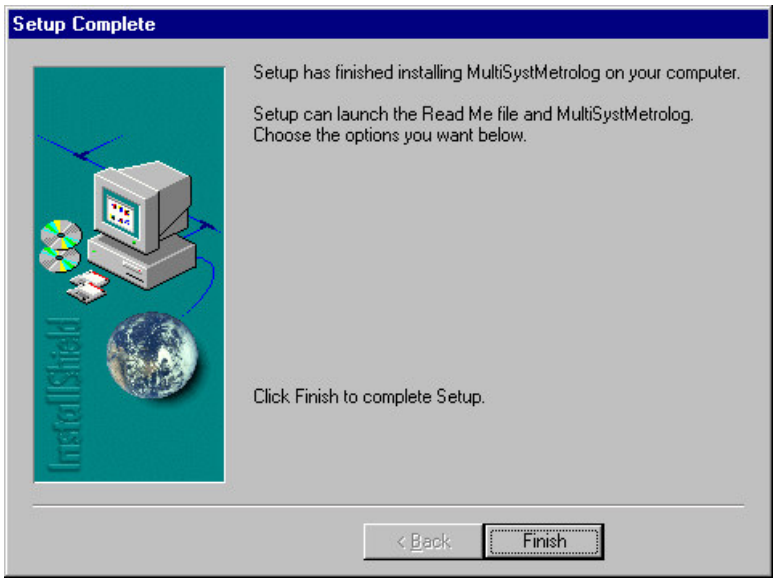
The icon of the software running is added in *program folders*.



Choose the desired folder and click on *Next.*

2.2.9. Completing the Setup

The dialog below confirms the success of the software Setup.



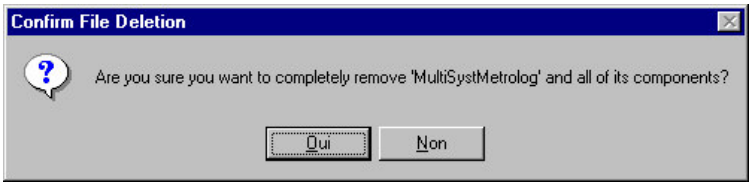
Click on *Finish* to complete the Setup.

2.3. Uninstallation

Use the uninstallation program of *MSM* to remove all the files associated to *MSM*.

2.3.1. Confirming the uninstallation

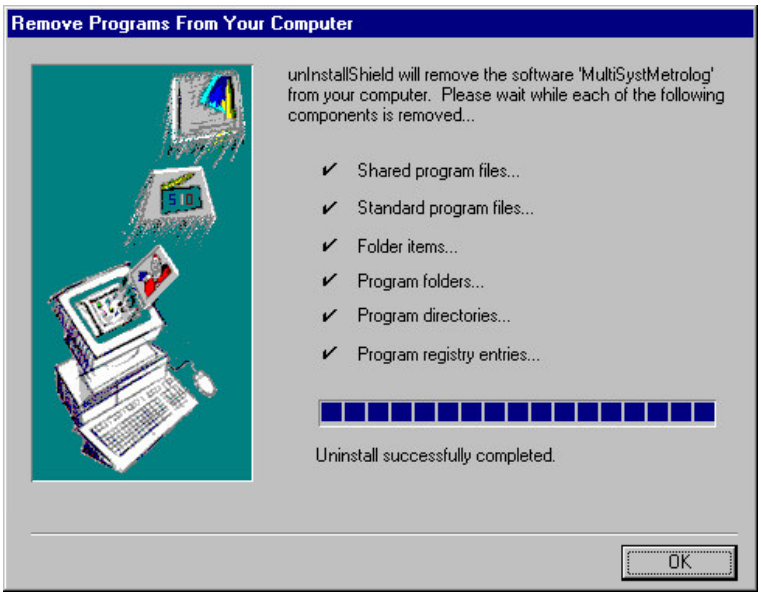
The dialog below asks the user to confirm the uninstallation of *MSM* and all its components. The *Non* button allows to cancel the uninstallation.



Click on *Yes* to confirm the uninstallation.

2.3.2. Completing the uninstallation

This dialog confirms that the program and all its components have been removed.



Click on *ok* to complete uninstallation.

Empty the NT Trash.

2.4. Installation of the electronic key driver

Install the electronic key on the parallel port (printer port).

Launch the *hdd32.exe* program located on the enclosed CDROM.

The installation menu is displayed. This installation is automatic and your ansver is yes for all the question. Then, restart the machine so that it takes the new driver and the different modifications of the registration keys into account.
The software Setup is completed and you can launch it by clicking on *MultiSystMetrolog* located in the *FOGALE Nanotech* sub-folder of the *Program Files* folder.

If one of the following messages appears "*driver is not correctly installed"* and/or "*key is not detected "*, please contact M. VABRE, Computer Department, FOGALE Nanotech.

2.5 Optimization of the MSM operation in Win NT 4.0

This particular configuration allows, by giving the maximum running priority to our program, to get regular acquisitions and records. The user has to open *task manager*. Select *Processes*. Activate the *MultiSystMetrolog* program and, by clicking on the right button of the mouse, select the *set priorities* menu and choose the *Real time* sub-menu. A dialog box warns the user about a possible risk of system dysfunction due to this modification : valid if the system administrator gives the authorization.

2.6 Specific configuration :

In the case the number of instruments is superior to the number of channels of the acquisition system (unsufficient racks number), we can make particular configurations allowing to take one instrumentation or another into account. They are activated by a *.bat* file that allows to make files copies and launch *MSM*.

These *.bat* files are located in the directory *c:\program files\fogale nanotech*.

Example of file name : copie_config11.bat
copie_config12.bat
copie_config13.bat

3. Description of the MultiSystMetrolog modules

The *MSM* software consists in two modules :

- the basic module MSM –32 bits- for Windows NT 4.0,
- the adaptation module (to the customer's project).

3.1. The basic module : MSM –32 bits- for Windows NT 4.0

It is composed of two parts :

- A visualization and command function, allowing :

  - to display the measurement data,
  - to display the alarms control screen,
  - to manage actuators manually or automatically,
  - to display the instruments control screen (visualization of the racks state).

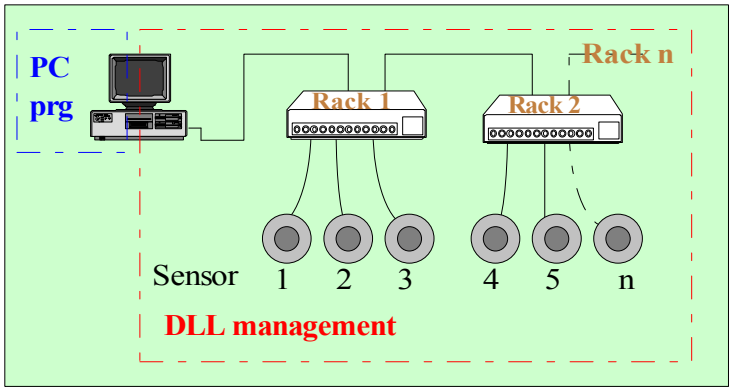
  This part of the software is described in section 4 of the present documentation.

- A dynamic link library (DLL)

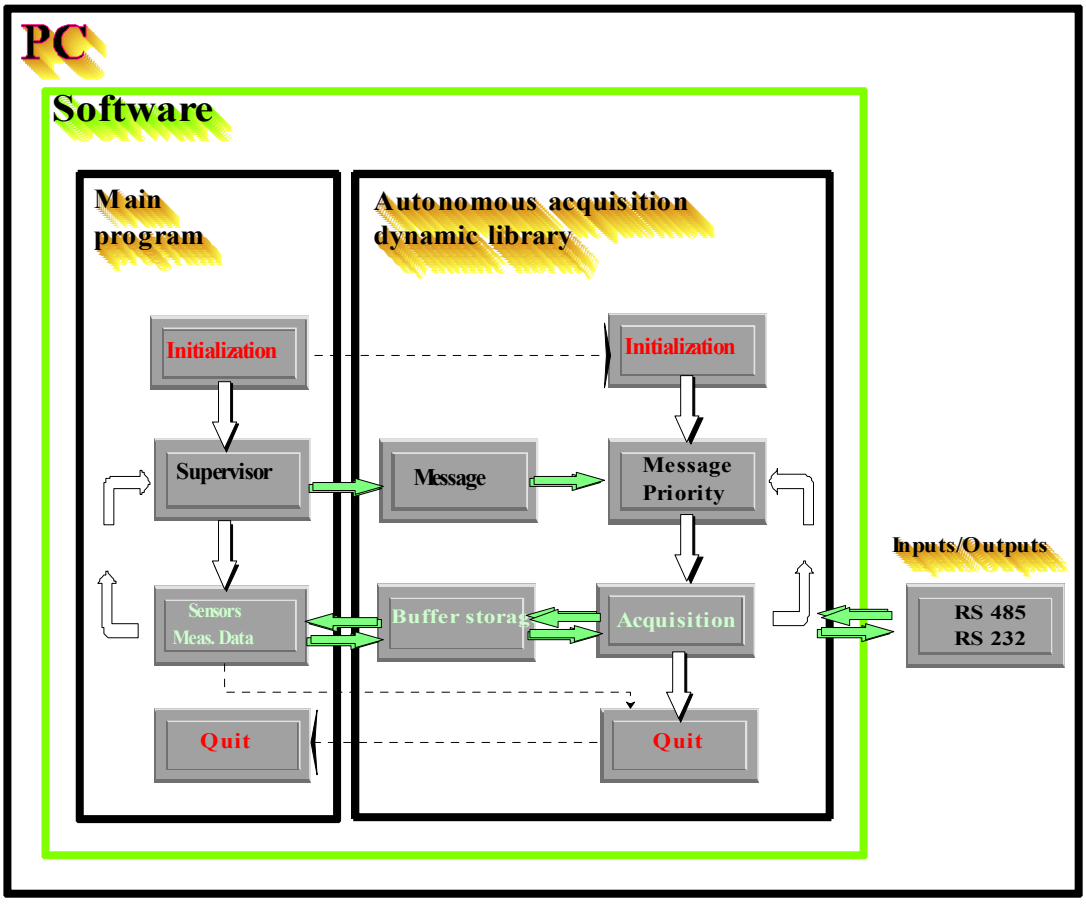
The dynamic link library was developed so as to allow a low level management of the Rack 8µp acquisition system. Its functions are the following :

- management of the communication protocole RS485/RS232,
- installation management by configuration files,
- multi-racks management with priority loop (maximum 60 racks),
- system settings configuration and backup,
- acquisition of the sensors data,
- data linearization, management and storage,
- permanent consulting of the installation.

Communication with the different racks includes a priority messages management : as an example, the deconnection of a rack has the priority on data acquisitions.



The DLL gives access to additional functions that allows the user to activate or unactivate a given rack under interrogation. The following drawing shows the DLL operation with calling functions and the positioning of these calling functions : initialization, supervision, data acquisition. The library can interrogate one or several racks. At present, the maximum interrogation rate is 10 racks per second.



3.2. The adapation module

The instruments and actuators have the same location order on the Customer's installation and on the visualization synoptic. The actuators state can thus be directly seen and the measurement data of each sensor can be interrogated by positioning the mouse on the icone of the desired sensor.

4. Description of the software windows and functions

Four main windows or modules allows to access different functions of the software. They will be successively described in the present documentation. They are :

- the *Demo* window,
- the *Alarm* window,
- the *Control screen* window,
- the *Group screen* window.

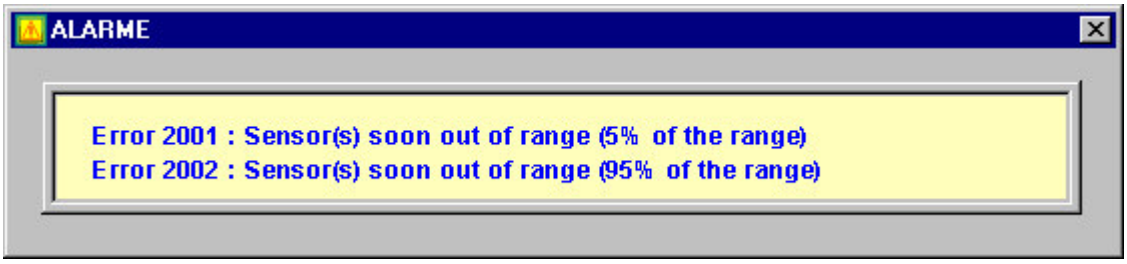
4.1. *Demo* window

This main window allows to get to other windows or to quit the running application. The software name and version are given at the top left.

Clicking on the right button of the mouse bouton, once in the window, makes a « *popup* » menu appear. It allows to reduce the window, to quit the main program and to select the other windows (*Control screen* or *Group screen*).

4.2. *Alarm* window

This window warns the user that a dysfunction of the system has been detected.



This window displays the number of the last detected error(s) and the corresponding error message(s). Error messages are removed when dysfunctions have been solved.

For screen update and dialogs management reasons, the update period of the *alarm* window is equal to 5 s * RIA racks number in the network.

Example :

If two RIA racks are in the network, the dialog update will appear every

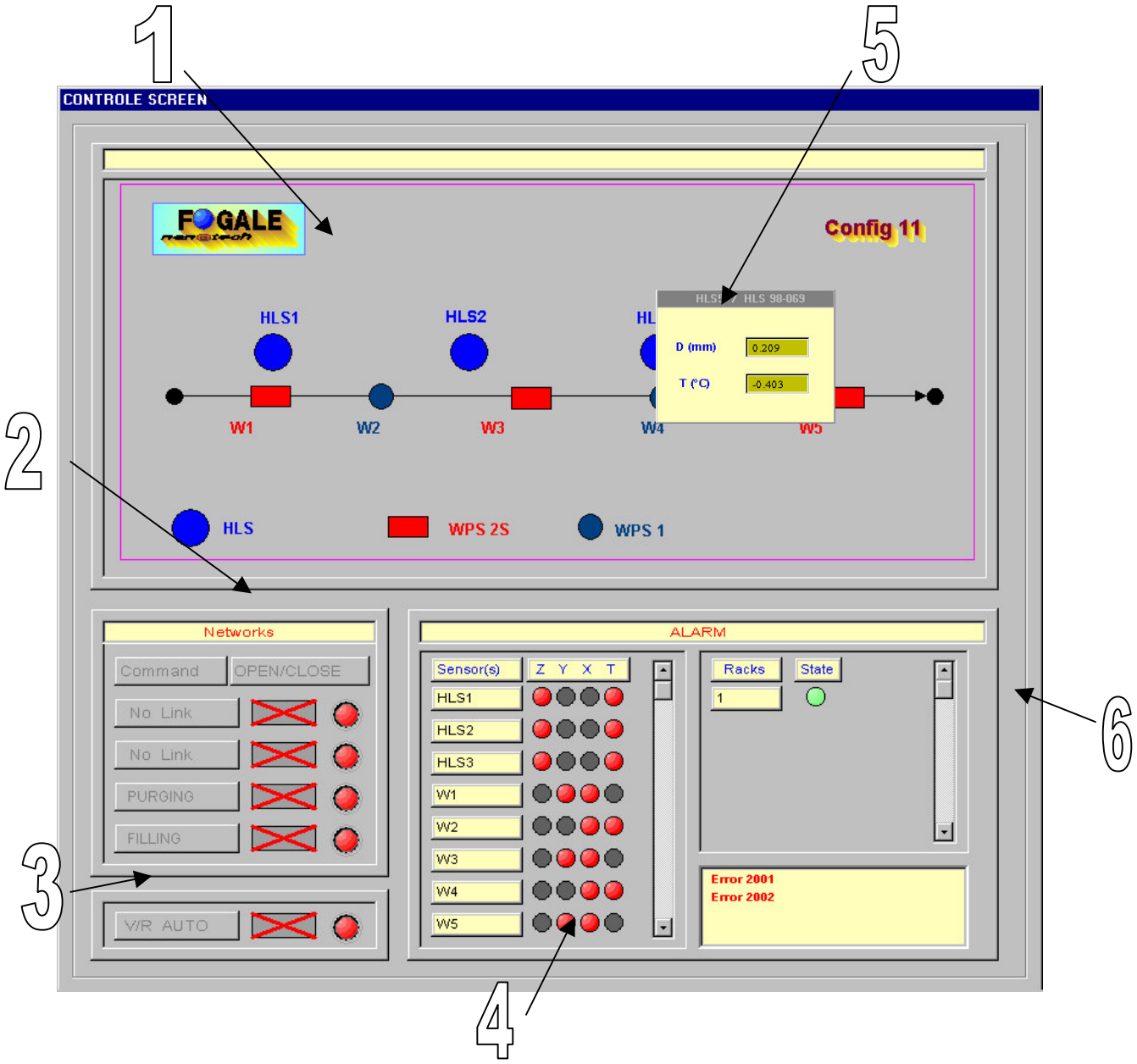
2 * 5 = 10 seconds.

Error numbers are associated to the following messages :

- error 2001 : sensor soon out of range (5% of the range)
- error 2002 : sensor soon out of range (95 % of the range)
- error 2010 : no rack
- error 2011 : problem on the system (communication)
- error 2016 : rack released (sensor short-circuited or in contact with the target
- error 2018 : error during data saving (Division / Zero)
- error 3001 : ABNORMAL levels on VR1 system
- error 3002 : ABNORMAL levels on VR2 system
- error 3003 : FAULTY STATE of level sensors of VR1 system
- error 3004 : FAULTY STATE of level sensors of VR2 system
- error 4001 : Depression/Leak in the hydraulic web
- error 4002 : Overpressure in the hydraulic web

4.3. *Control screen* window

This window displays the operation state of the instruments and their measurement data by means of a dynamic window.
When a system includes actuators commands (taps, pumps etc ….), parts 2 and 3 are active.



Clicking on the right button of the mouse in the window gives access to the *popup* menu that allows to get to the other windows of the application and to reduce the *Control screen* window.

1 Installation synoptic

The installation synoptic is peculiar to each project (see Appendix 2 : Example of synoptic) ; it is designed by FOGALE Nanotech according to the information given by the customer about his installation.
It allows to visualize :

- the sensors developed by FOGALE Nanotech : HLS, WPS1, WPS2, TMS, DOMS, or other sensors. The measurement data of a sensor appear when the mouse is pointed at it while the *Shift* button is pressed.
- *Specific to the HLS system* : the various parts which make the hydraulic network with, for example, electro-taps and filling/purging tanks.
- *Specific to the HLS system* : state variations of the hydraulic network parts.

Specific to the HLS system

The taps state (symbol ⋈) is directly displayed on the circuit synoptic, as follows :

→ the red color means closed tap.
→ the orange color means tap in transition state (between open state and close state).
→ the red color means open tap.
→ the grey color means no tap state control.

The state of the filling/purging device, (symbol  is directly displayed on the circuit synoptic, as follows:

→ the blue color means tank full.
→ the green color means tank normally filled up.
→ the yellow color means tank empty.
→ the red color means normal state of the filling/purging device or abnormal state of the purging tank.

- As far the pump is concerned (symbol ◯)
  → the red color means pump stopped.
  → the green color means pump in operation.

2 *Command* window

This window allows to monitor the installation actuators, particularly for the control of the hydraulic network taps of the HLS system. The opening / closing is possible by means of a switch. The indicator light located at the switch right confirms the open state (green) or close state (red).

3 *VR Manuel* funcion (of the *command window*)

This function allows the manual control of the filling/purging device during a filling or purging period predetermined by the user in the *PARAM.INI* configuration file. In the case of several filling/purging devices, choose in the *groupe VISU* window the network in which the concerned filling/purging device is installed. Click on the filling or purging icon according to the desired function.

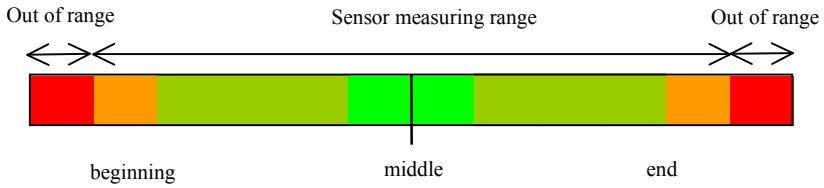
This function allows to carry out filling and purging tests so as to control the sensors good operation.

4 States window

Color indicator lights show the measurement situation within the instrumentation measuring range. The four indicator lights types (X, Y, Z and T) correspond to the four possible measurement types a positioning sensor can carry out. For each sensor an indicator light has a peculiar meaning :

- for the HLS sensors : Z (displacement) and T (temperature)
- for WPS1 sensors : X (displacement) and T (temperature)
- for WPS2 sensors : X (radial displacement) and Z (vertical displacement).

The following graph shows the alarm colors as a function of the sensors measuring range.



Each rack includes an indicator light that warns if the rack is in operation or if it is inhibited (State).

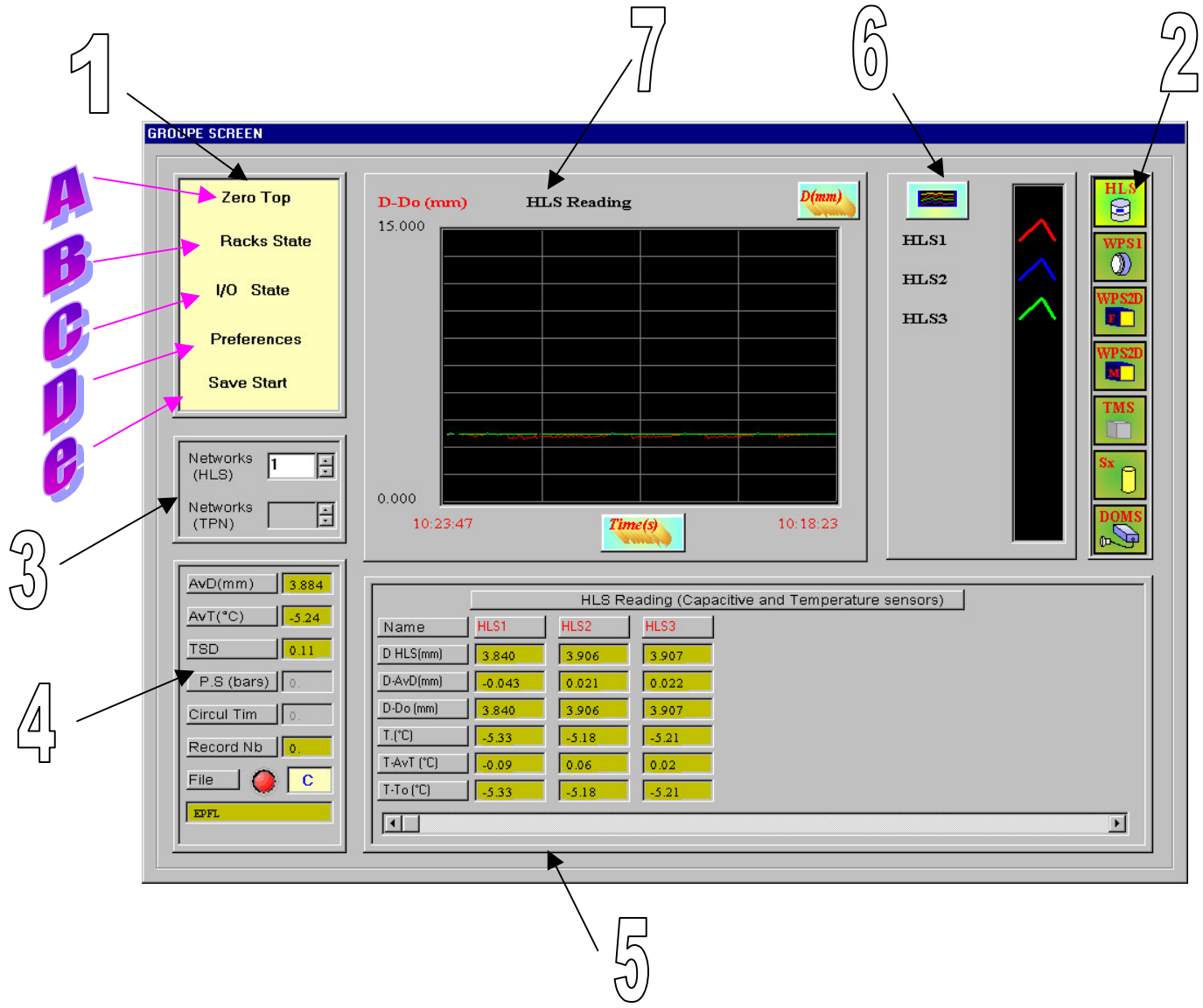
- green : normal operation,
- red : no rack (no communication or rack absent).

5 Dynamic display window

In order to see the measurement data of an instrument by using the installation synoptic, point the mouse pointer on the concerned instrument and press the *SHIFT* button. The dynamic display window showing the measurement data appears. It is removed when the *SHIFT* button is released.

4.4. *Groupe Visu* window

This window displays the measurement data of the sensors and the associated statistical calculations. It gives also access to the measurement data saving, to options concerning the acquisition and the racks operation.



4.4.1. Functions table

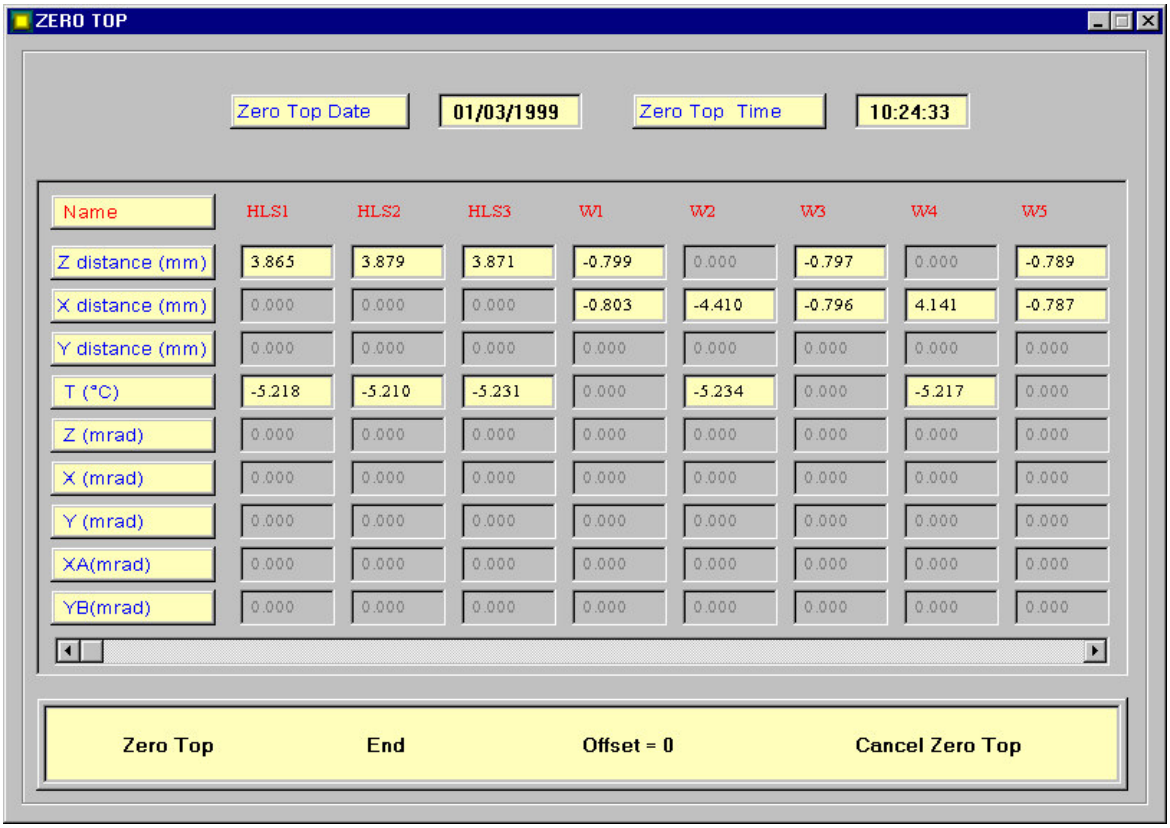
Various functionalities are available :

Zero Top window

The *Zero Top* window allows to trace the measurements stability with respect to a reference time. Clicking on *Zero Top* allows to memorize all sensors values and to substract them to the dynamic value (see line D-Do of table 4 in *Group screen)*.
This function applies to all sensors of the selected network (see table 3).

There are four possibilities :

Zero Top :	to memorize the instant sensor values in D_0
End :	to quit the *Zero Top* screen and valid the top
Cancel Zero Top:	to cancel last choice
Offset = 0	to initialize the reference values to zero



NB : The *Zero Top* is only used for the measurements visualization. The values saved on file are always absolute measurement values.

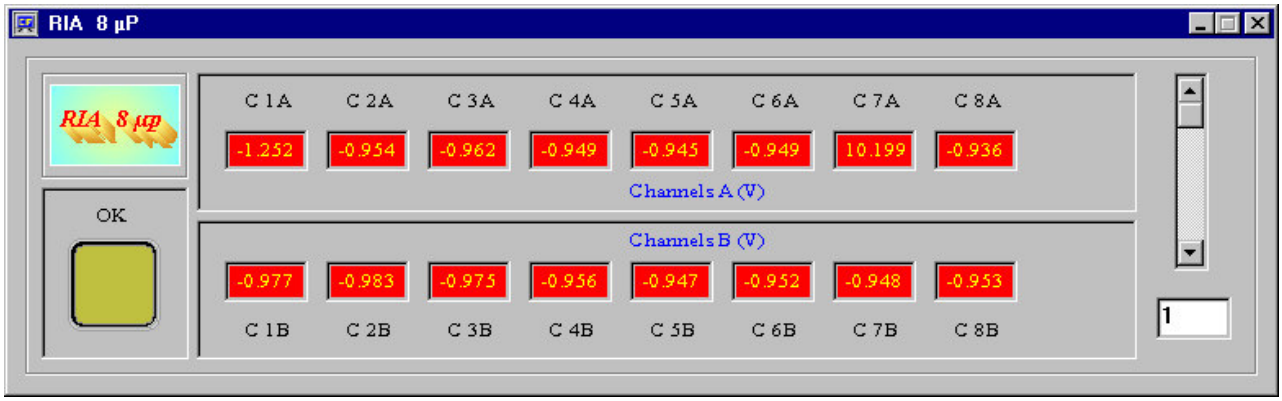
Racks state window

Clicking on *Rack state* makes the rack physical representation appear. Each rack has in standard 16 channels, i.e. 2 channels per connected sensor (channels A and B). The rack restart button is located on the left of the front panel.

When the installation consists of several racks, the scrolling allows to see the state of the different racks.

The two following displays are possible. They depend on the type of rack :

- display for a RIA 8µp rack without option :

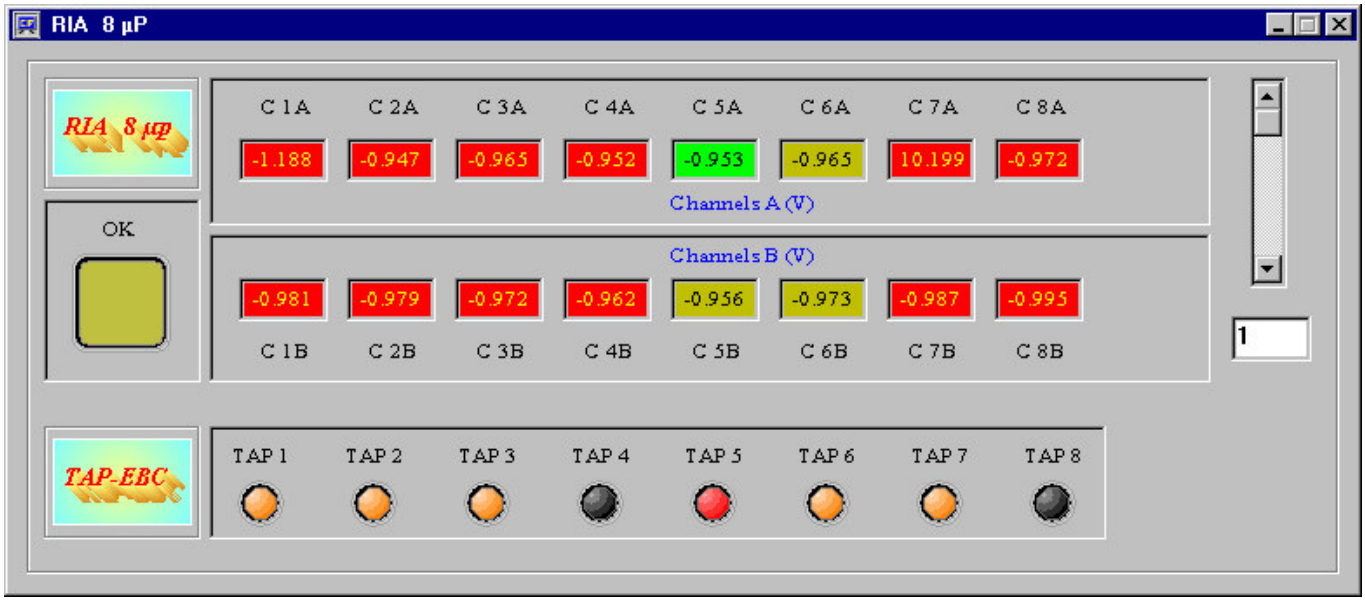


Specific to the HL S system :

The RIA 8 µP rack is equipped with a breaker insuring the protection of the HLS sensors electrode in case a vessel is flooded. When voltages are inferior to –10 V, the protection system gets active and the rack cuts the sensors supply. The voltages display background is then yellow.

Control the liquid level in each vessel and clean the wet sensors. Once the problem has been solved, the rack can be restarted by using the adequate button.

- display for a 8µp rack with I/O option



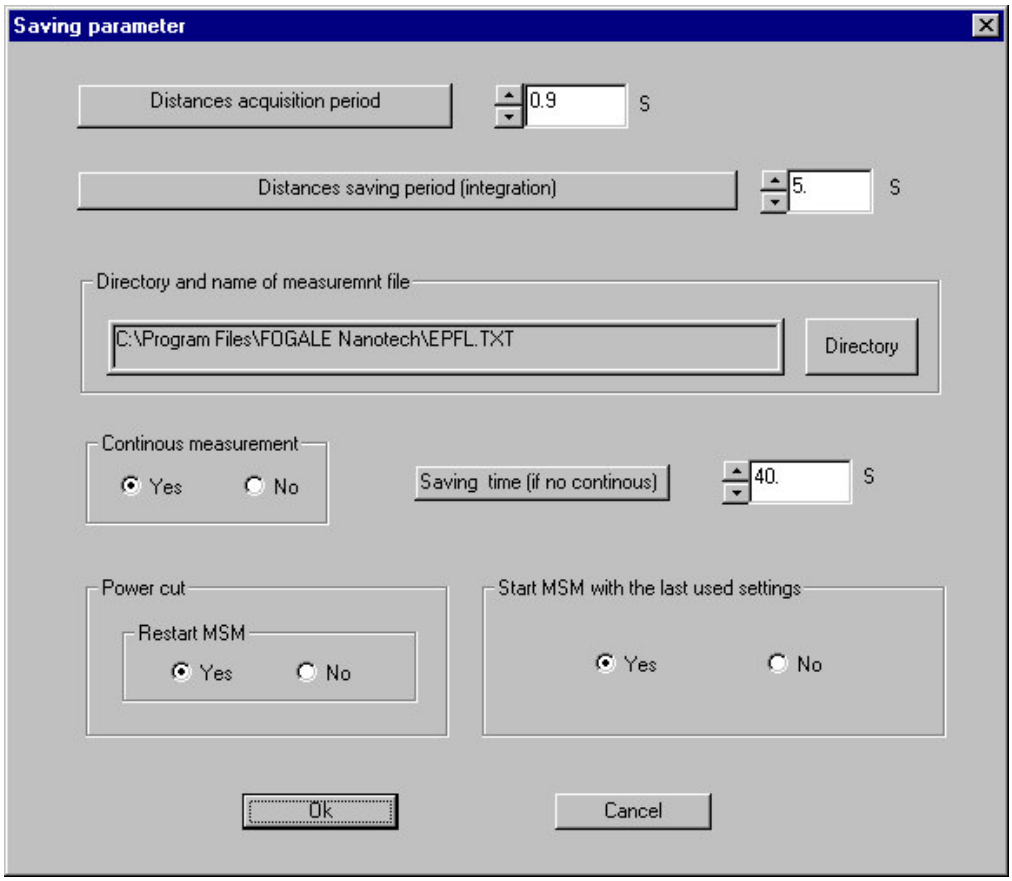
The indicator lights TAP1 to TAP8 show the state of the eight actuators connected to the TAP EBC rack, particularly taps in the case of a HLS system. State colors are described in section 4.2.

I/O state window

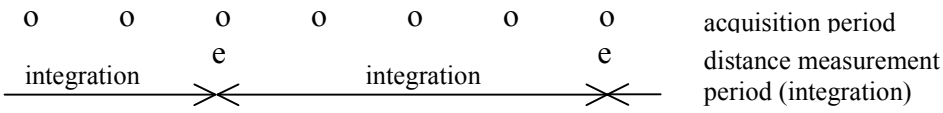
The I/O (TAP EBC) window allows a manual control of the actuators present in the installation, particularly taps in the case of a HLS system.
The TAP EBC rack can be accessed by the user.
The TAP EBC window allows a manual control of the taps for maintenance.

Settings

This dialog allows to display and modify the various pre-selected acquisition and saving settings.



The following drawing shows the different measurement and acquisition periods.



Acquisition period : It defines the time interval between the acquisition of two measurements.

Distance measurement period (integration) : It defines the time interval between two savings. The saved value is the mean of the values acquired during the acquisition period.

The calculation of the saved standard deviation of each sensor is based on this period.

Continuous measurement :
→ click on *Yes* for continuous measurements
→ click on *no* for measurements during a given period (see measurement time).

Measurement time (for non continuous measurement) : It is the saving duration that one wants to program when the option non continuous measurement is chosen. The saving is completed when the measurement time has gone by.

Main cut :
Automatic restart of the software in case of power cut.

Restart MSM :
→ click on *yes* so that *NT* automatically start the *Administrator* and launch *MSM* after a main cut.
→ click on *no* to avoid that *NT* start the *Administrator* and *MSM* by itself.

Start MSM with the last used settings :
Save parameters entered by the user.
→ click on *yes* so as to save all the software settings and use them as default settings when *MSM* is next runned.
→ click on *no* to avoid the software settings backup. When *MSM* is next runned, it will use the default parameters (manufacturer's settings) .

 **Start saving / Stop saving**

Clicking on this function launches or stops the measurement data saving. If the saving is running, the indicator light located over the small box showing the file name is green, otherwise it is red.

4.4.2. Sensors table 2

The icons, located in the sensors table, allow to choose the type of measurement one wants to display in table 5 and graph 7 :

Icon of the HLS system

Icon of the WPS1 system

Icon of the WPS2 system : fixed sensor, moving wire

Icon of the WPS2 system : moving sensor, fixed wire

Icon of the TMS system

Icon of the INCLINOMETER system

Icon of the DOMS system

4.4.3. Network table 3

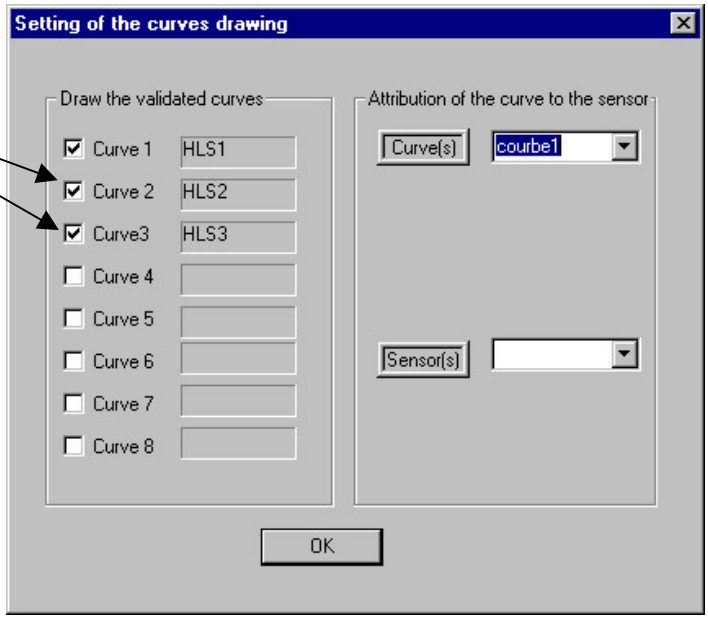
The sensors making up the installation can be grouped in networks according to their type, their location... Such a grouping allows to display readings, Zero Top, savings per network... The composition of each network is made up by Fogale when the adaptation module (to the customer's project) has been ordered.

Specific to HLS : Networks are particularly used when a hydraulic circuit is composed of several hydraulic networks, for example, in the case of two hydraulic networks 1 and 2, separated by taps managed by the software.

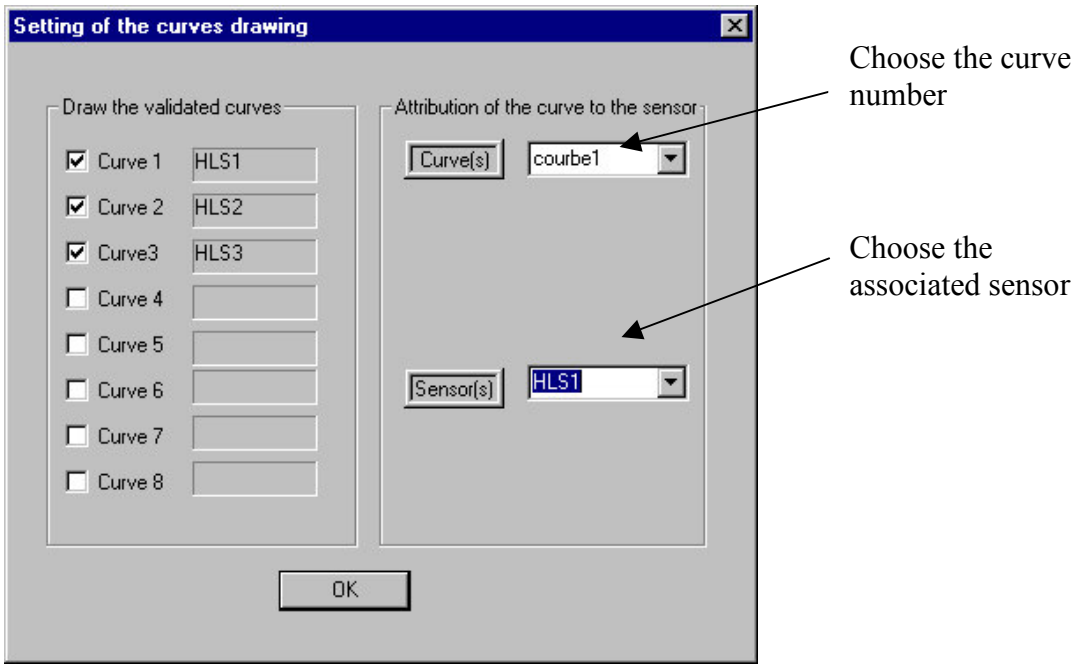
4.4.4. Curve icon 

This icon gives access to a dialog box in which the number of curves associated with given sensors (maximum 8) are selected..

Click in the squares to unactivate the selectioned curves

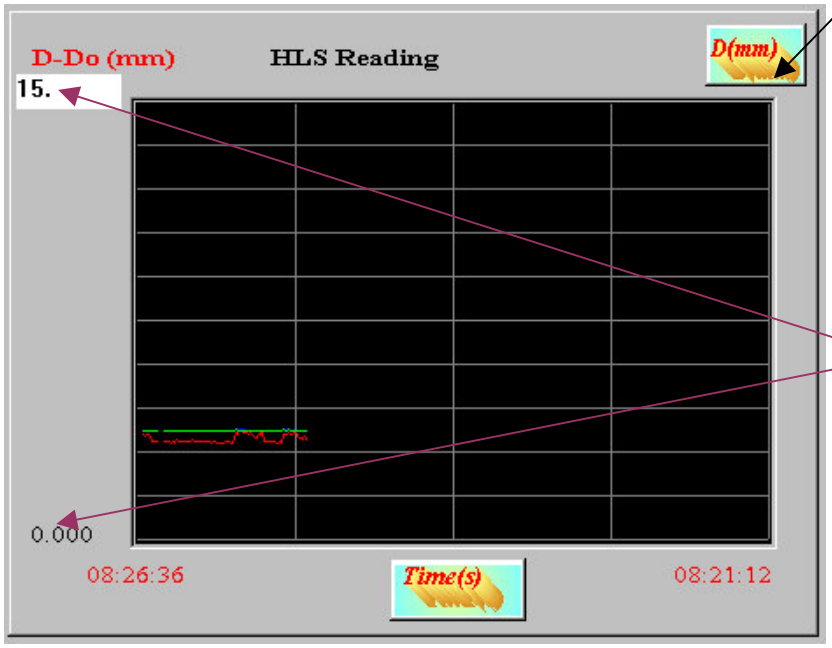


In standard, the first eight sensors are automatically associated with the eight first curves.
The *Setting of the curves drawing* dialog allows to associate a specific curve to a given sensor.



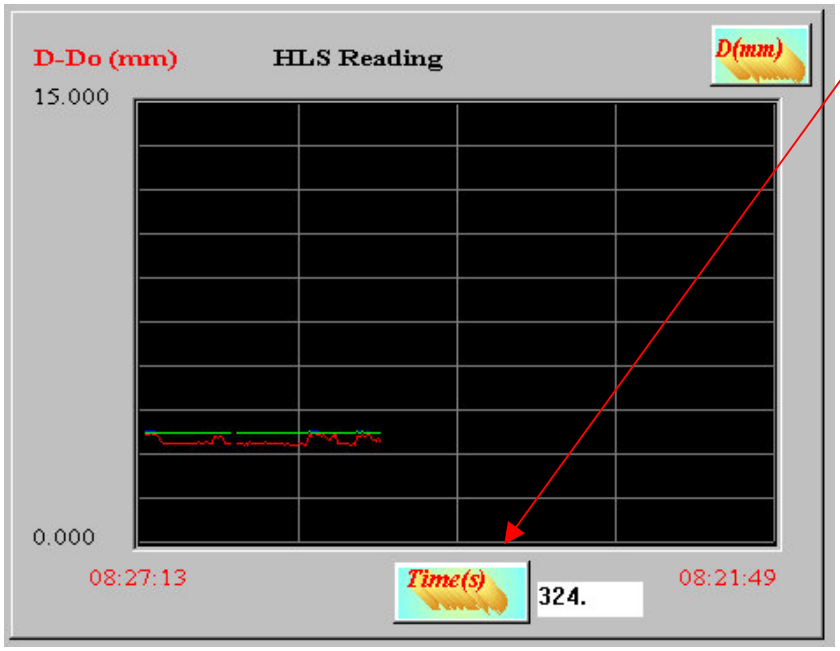
4.4.5. Sensors graph 7

The graph of this window allows to trace in time the measurement data of the instruments corresponding to the icon selected in the sensors table and to modify the readings and time scales.
The distance or temperature readings on the graph can be chosen by clicking on the D/T (°C) icon.



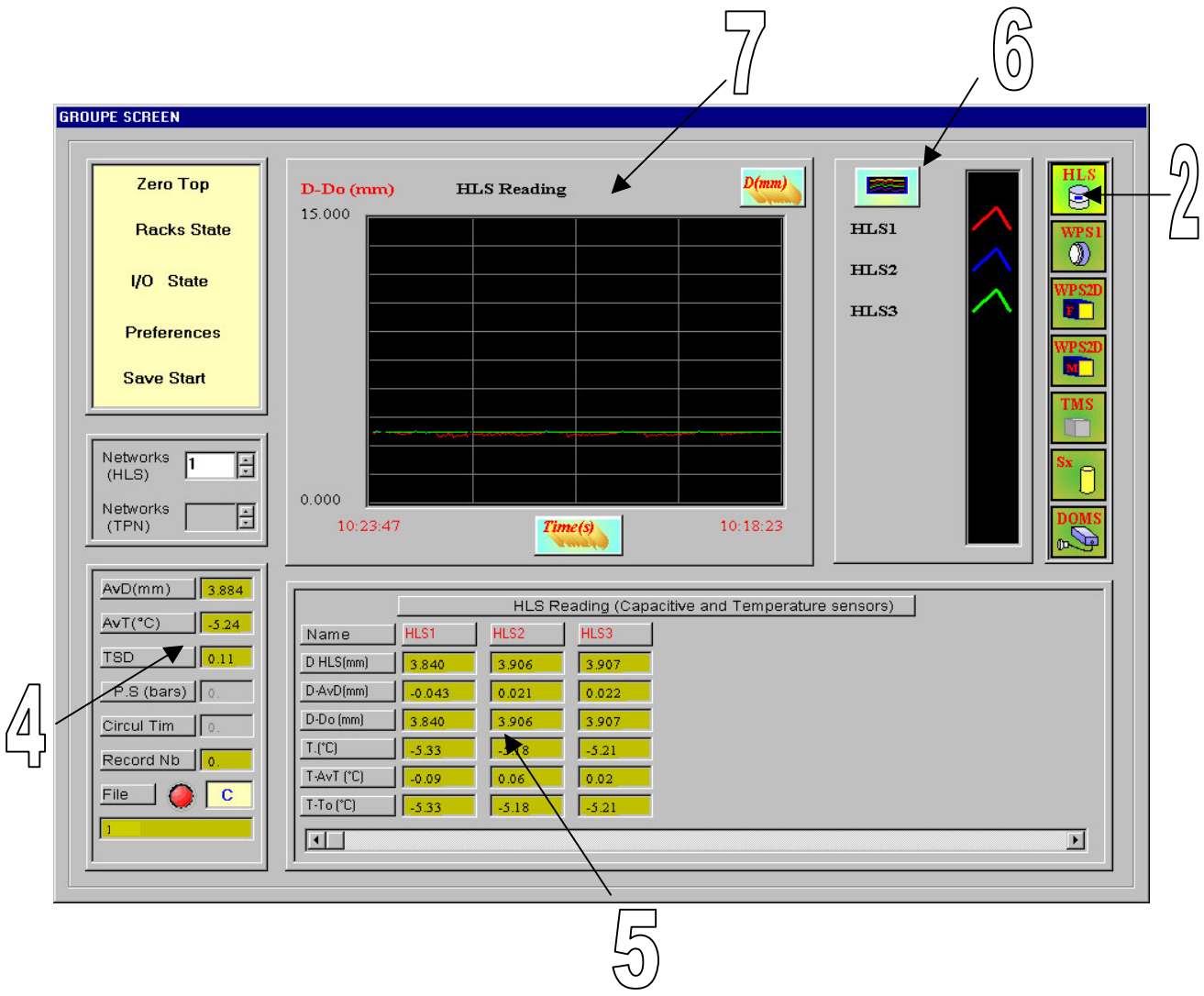
By clicking on this icon, you can choose to display distance readings D or temperature readings T(°C)

To modify the amplitudes scale, click directly on the upper and down limits and replace the value



Click on the icon Temps to set the scale

4.4.6. Selection of the HLS icon



Clicking on the HLS icon of the sensors table (table 2) allows to display all HLS measurement data on graph 7 and tables 5 and 6.

4 Statistics

Av D(mm) : average of HLS measurement data of the corresponding network

Av T(°C) : average of HLS temperatures (in Celcius degrees) of the corresponding network

T.SD : temperatures standard deviation

PS (bars) : pressure measurement

Circul tim : circulation time (network with water circulation)

Record nb : number of savings in the active file

File : file name

5 Measurements

Name : sensor number

D HLS (mm) : distance in millimeters measured by the sensor

D-AvD (mm) : difference between the measurement D of the considered sensor and the distances average value AvD

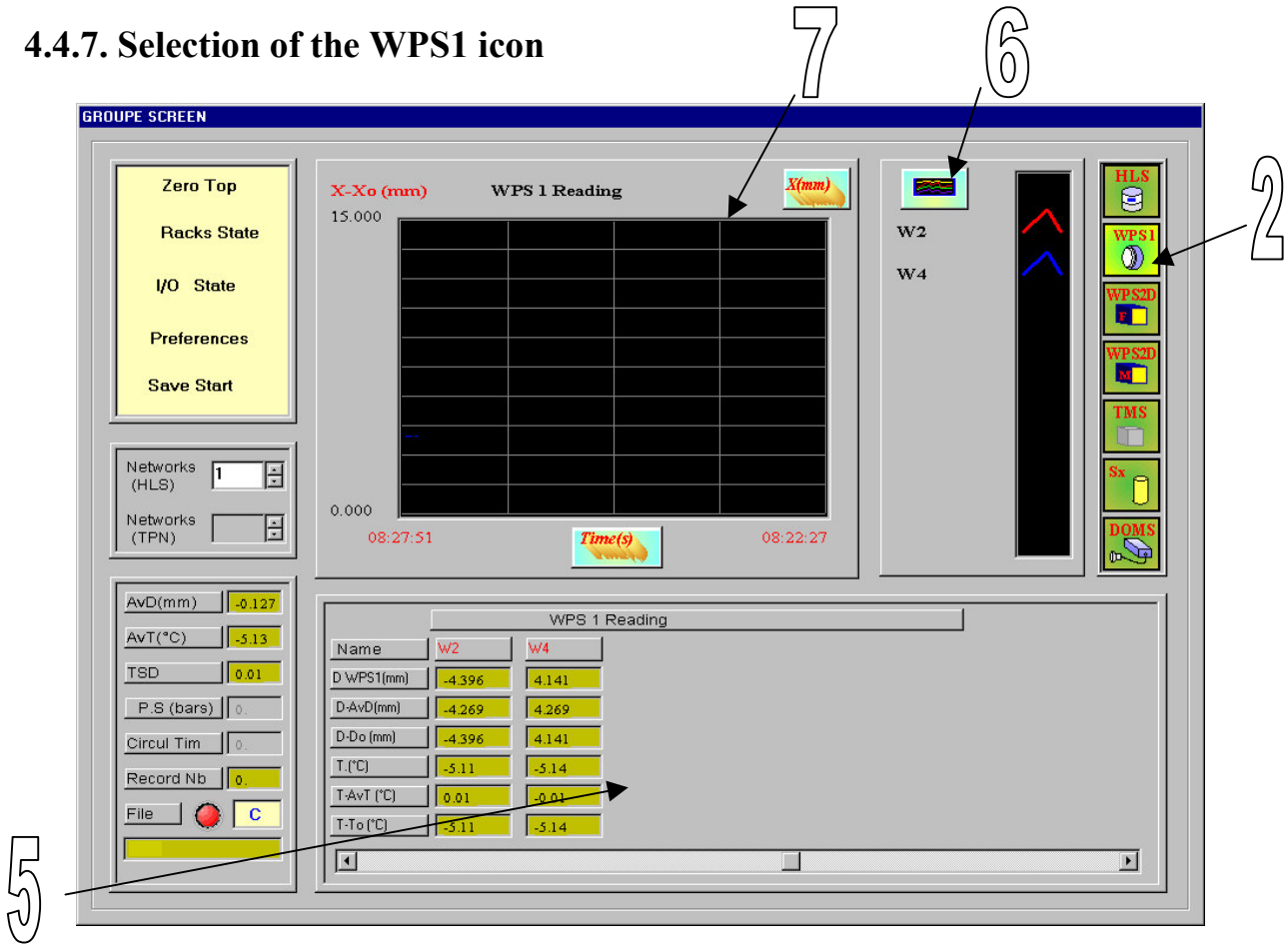
D-Do (mm) : difference between the sensor measurement and the reference value Do given by the Zero Top

T (°C) : sensor temperature

T-AvT (°C) : difference between the temperature of the considered sensor and the sensors temperatures average value

T-To(°C) : difference between the temperature of the considered sensor and the Zero Top value of this same sensor

4.4.7. Selection of the WPS1 icon

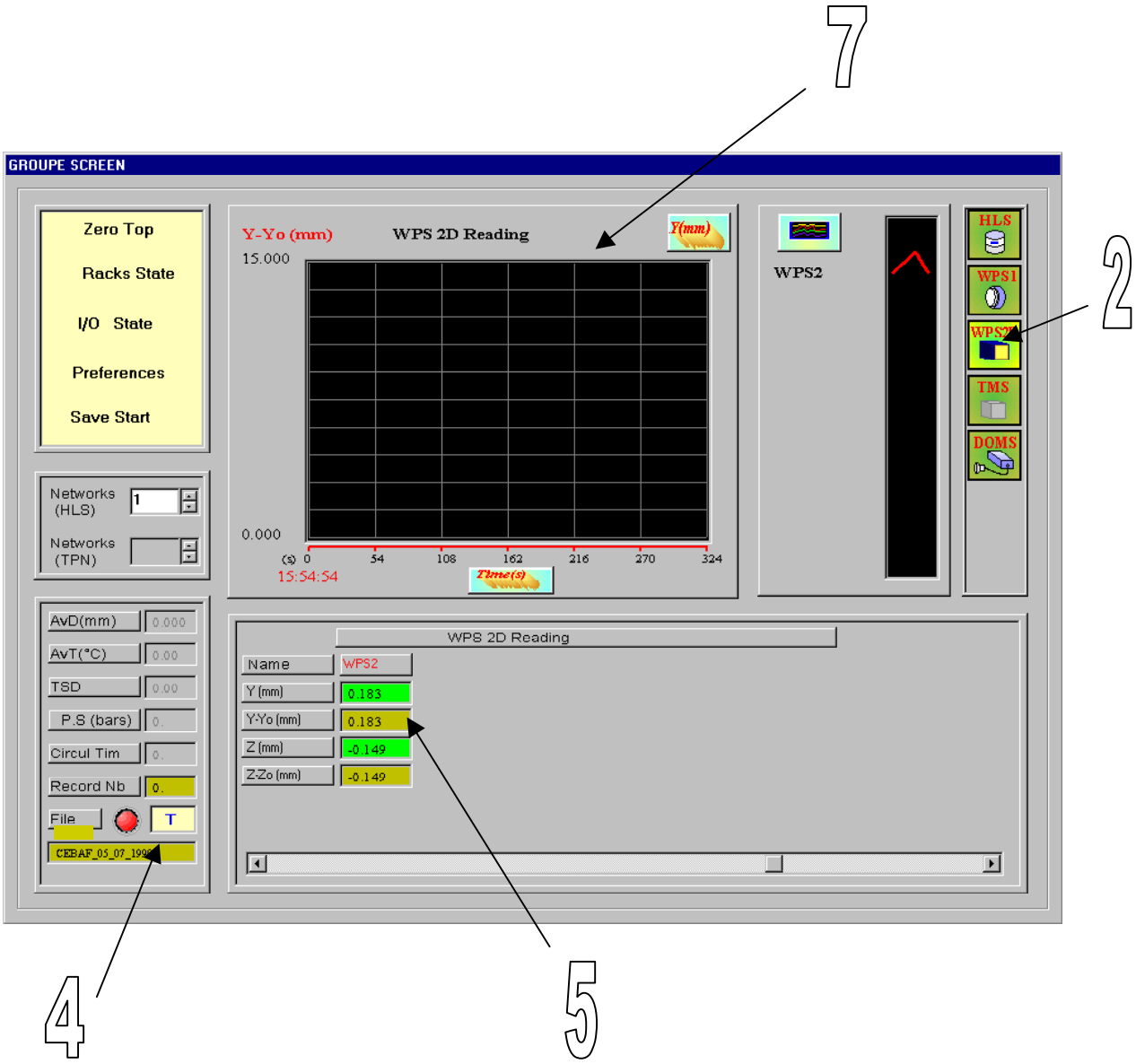


Clicking on the WPS1 icon of the sensors table (table 2) allows to display all WPS measurement data on graph 7 and tables 5 and 6.

5 **Measurements**

Name :	sensor number
DWPS1 (mm) :	distance in millimeters measured by the sensor
D-AvD (mm) :	difference between the measurement D of the considered sensor and the distances average value AvD
D-Do (mm) :	difference between the sensor measurement and the reference value Do given by the Zero Top
T (°C) :	sensor temperature
T-AvT (°C) :	difference between the temperature of the considered sensor and the sensors temperatures average value
T-To (°C) :	difference between the temperature of the considered sensor and the Zero Top value of this same sensor

4.4.8. Selection of the WPS 2D icon



Clicking on the WPS 2D icon of the sensors table (tableau 2) allows to display all WPS 2D measurement data on graph 7 and table 5.

5 Measurements

Name : sensor number

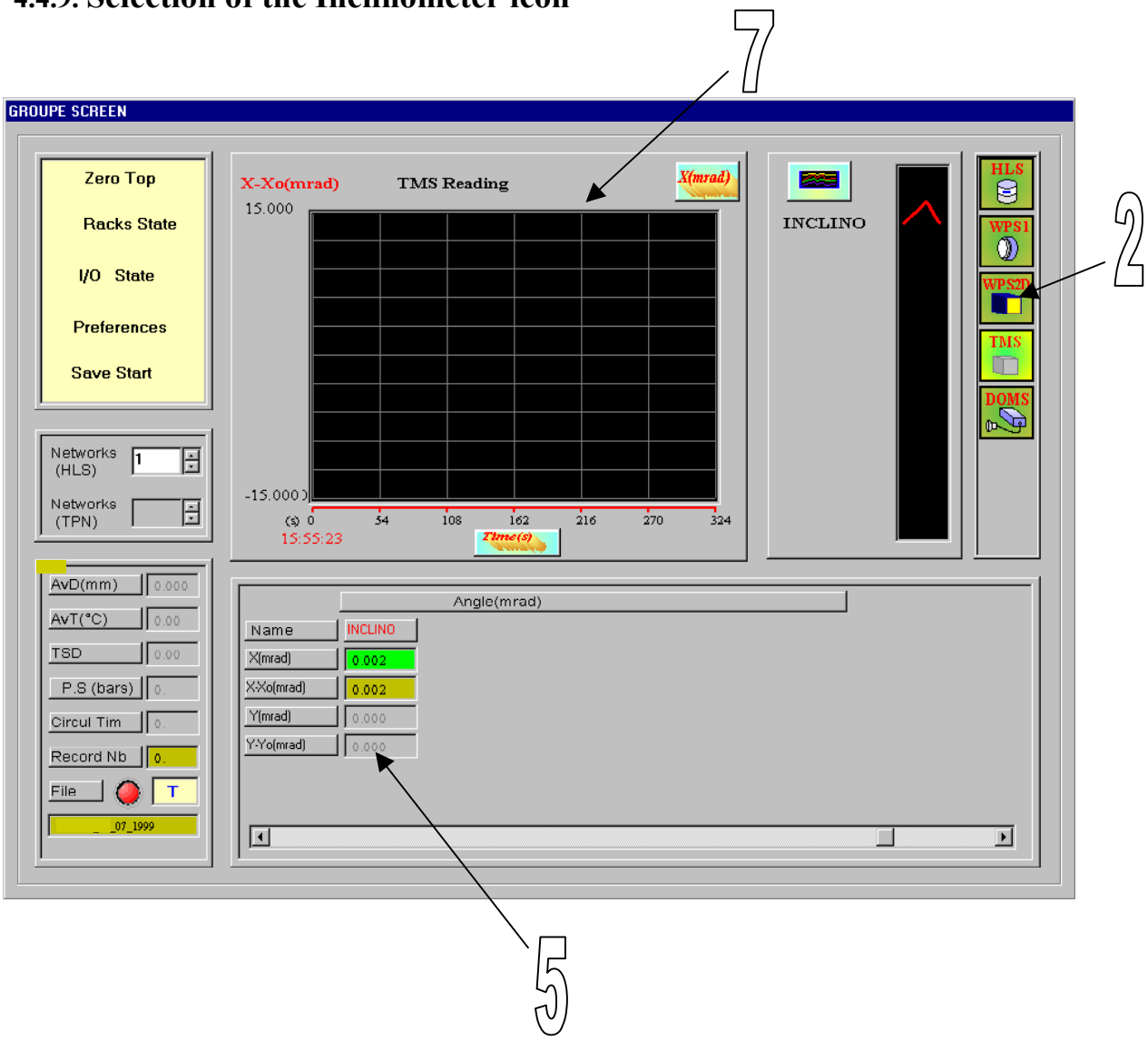
X (mm) : horizontal distance in millimeters measured by the sensor

X-Xo (mm) : difference between the measured distance X and the Zero Top value

Z (mm) : vertical distance in millimeters measured by the sensor

Z-Zo (mm) : difference between the measured distance Z and the Zero Top value

4.4.9. Selection of the Inclinometer icon



Clicking on the Inclinometer icon of the sensors table (tableau 2) allows to display all Inclinometer measurement data on graph 7 and tables 5 and 6.

5 Measurements

Name : sensor number

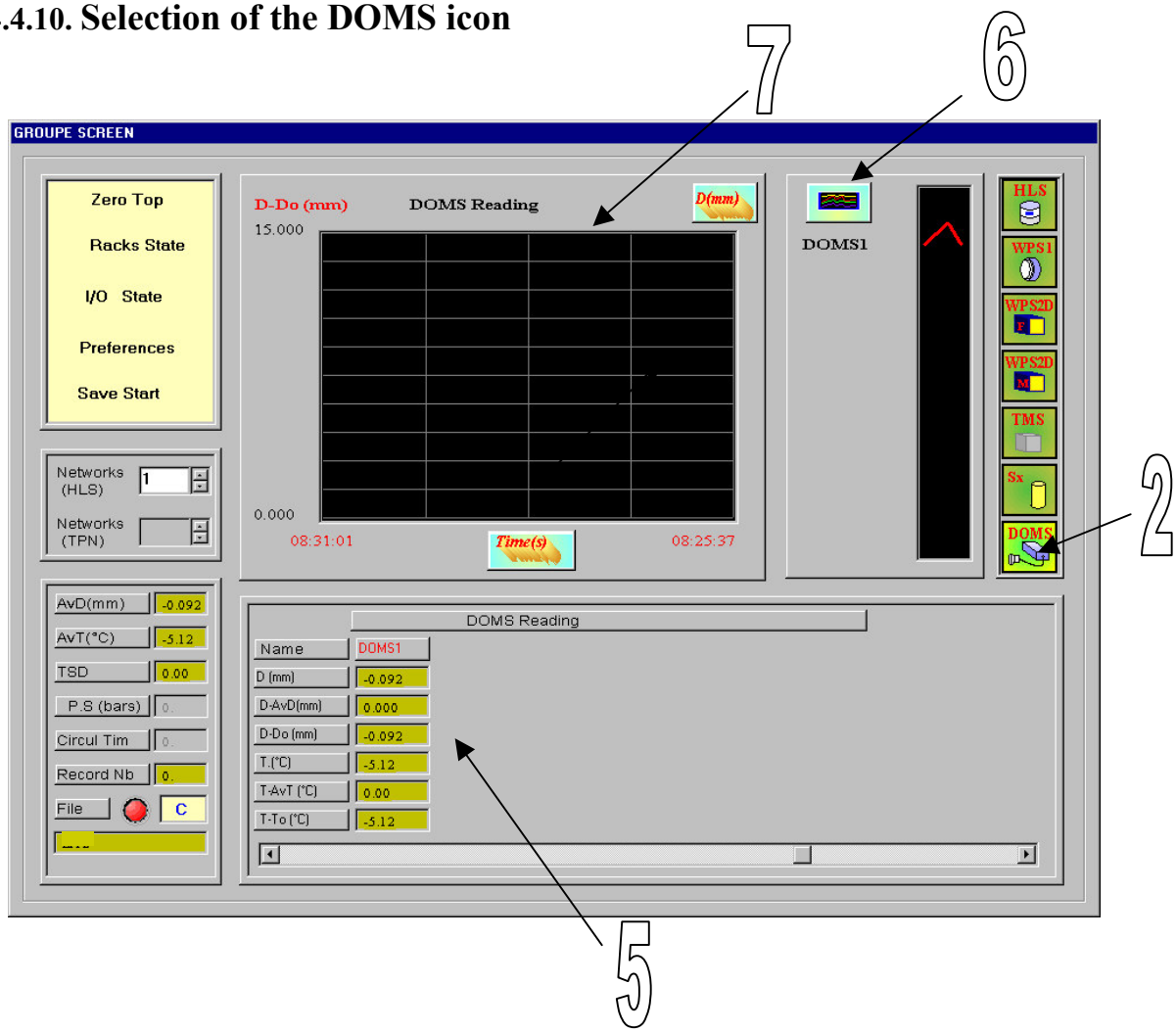
XA (mrad) : angle in grad. measured by the sensor (Channel A)

XA-Xo (mrad) : difference between the measured angle and the Zero Top value

YA (mrad) : angle in grad. measured by the sensor (Channel B)

YA-Yo (mrad) : difference between the measured angle and the Zero Top value

4.4.10. Selection of the DOMS icon



Clicking on the DOMS icon of the sensors table (tableau 2) allows to display all DOMS measurement data on graph 7 and tables 5 and 6.

5 **Measurements**

Name :	sensor number
D (mm) :	distance in millimeters measured by the sensor
D-AvD (mm) :	difference between the measurement D of the considered sensor and the distances average value AvD
D-Do (mm) :	difference between the measured distance and the Zero Top value
T (°C) :	sensor temperature
T-AvT (°C) :	difference between the temperature of the considered sensor and the average value of the sensors temperatures
T-To (°C):	difference between the temperature of the considered sensor and the Zero Top value

4.5 Format of the saving file

The file is saved in text format which can be read by simple word processing. It is better to open it by spreadsheet and use a tabulation as separator so as to be able to make calculations. In that case, it may be necessary to replace all points of the float values (or double) by commas (american or european unit system).

The file is organized as follows :

The two first lines contain the sampling period and the saving period so as to know the measurement conditions.
Then come the data headers :

- 1st column: record number
- 2nd column: date
- 3rd column: time
- 4th column: network 1 (empty column)
- 5 th column: Distance measurement sensor 1 (average value)
- 6 th column: Distance standard deviation measurement sensor 1 (standard deviation on average value)
- 7 th column: Temperature measurement sensor 1 (average value)
- 8 th column: Temperature standard deviation measurement sensor 1 (standard deviation on average value)
-
-
-

- X th column: Rack (Empty column)
- X+1 th column: R_1 (Number of points to calculate the standard deviation)
- X+2 th column : I/O_1 state (if TAP EBC is associated to rack 1)
- X+3 th column : I/O_2 state (if TAP EBC is associated to rack 1)
- X+4 th column : I/O_3 state (if TAP EBC is associated to rack 1)
- X+5 th column : I/O_4 state (if TAP EBC is associated to rack 1)
- X+6 th column : I/O_5 state (if TAP EBC is associated to rack 1)
- X+7th column : I/O_6 state (if TAP EBC is associated to rack 1)
- X+8th column : I/O_7 state (if TAP EBC is associated to rack 1)
- X+9th column : I/O_8 state (if TAP EBC is associated to rack 1)

Example : Record of a HLS measurement, with D1 for distance and T1 for temperature.

Sampl P	1 s							
Acqui P	15 s			(mm)	(rms)	(°C)	(RMS)	nb
Number	Date	Time	Network_1	D_D1	E_D_D1	T_D1	E_T_D1	R_1
1	12/05/98	10:52:00		4,2930	0,0043	23,6388	0,0038	15
2	12/05/98	10:52:15		4,2839	0,0042	23,6376	0,0018	15
3	12/05/98	10:52:30		4,2813	0,0046	23,6395	0,0051	15
4	12/05/98	10:52:45		4,2789	0,0037	23,6393	0,0028	15
5	12/05/98	10:53:00		4,2763	0,0039	23,6376	0,0058	15

The standard deviation is calculated with the following formula :

$$\sqrt{\frac{\sum X^2}{N} - \left(\overline{X}\right)^2}$$

APPENDIX 1 :

Cable layout

APPENDIX 2 :

Example of synoptic

FOGALE nanotech

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