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KAPTORIS

Operator's Manual

C O N T E N T S

INTRODUCTION	1
CHAPTER 1. SAD450 data acquisition interface	3
Introduction	3
Installation of the unit	8
Technical specifications	9
Unit accessories	11
CHAPTER 2. KAPTORIS Software	17
Introduction	17
Hardware and Software requirements	17
Installation	18
Uninstalling Kaptoris	22
CHAPTER 3. Operating norms	23
Starting the session	24
Examples of execution	24
Example 1	24
Example 2	36
CHAPTER 4. Configuration of inputs/outputs	41
Configuring a pick-up	41
Loading a configuration	44
Saving a configuration	45
How to change the appearance of the I/O window	45
Digital inputs	46
Analog inputs	47

Digital outputs	48
Pulse train	50
Pulse	50
Digital table	51
Analog outputs	52
Step	53
Senoidal	54
Ramp	55
Analog table	56
Table editor	57
Operations	58
Digital operations	58
Analog operations	60
Defining times	61
Filters	62
 CHAPTER 5. Pick-ups	 65
What a pick-up is	65
Programming a pick-up	65
Immediate pick-up	66
Delayed pick-up	67
Analog trigger	69
Digital trigger	71
Aborting a pick-up	73
Displaying a pick-up	75
Continuous display	76
Reading data	76
Testing the status of the SDA450 interface	78

CHAPTER 6. Results **81**

Pick-up files	81
Saving a pick-up	81
Saving a new document with no name	81
Saving an existing document	82
Saving a copy of the document	82
Opening a pick-up	82
Working with graphic representation	82
Understanding the signals display window	82
Selecting the signals to be displayed	84
Eliminating signals	85
Working with cursors	85
Activating the display window cursors	85
Disactivating the display window cursors	86
Using the display window cursors	86
Changing the appearance of the display	87
Adding signals from a file	88
Eliminating signals	90
Creating a new display window	90
Organising the windows	91
Closing the windows	92
Data table	93
Signals data	95
The signals calculator	97
Digital signals calculator	98
Analog signals calculator	100
Reports	101
Adding a comment	103
Working with texts	104

Exporting	106
BMP format	106
TXT format	107
WMF format	107
CHAPTER 7. User interface	109
General description	109
Menu	110
Tool bar	112
Extension of files.	114
Information windows	114
Warning windows	114
Confirmation windows	115
Exiting Kaptoris	115
Use of the help facility	116
CHAPTER 8. Practicals	117
Practical 1	117
Practical 2	126
Practical 3	135
Practical 4. Calculator and filters	138
ANNEX A SDA450 interface software	147
Introduction	145
Structure of the main programme	145
Communication with the PC	146

Commands	150
Testing presence and version of the unit	152
Status of the interface	152
Configuration of the analog inputs	153
Reading the input channels	154
Writing the output channels	155
Trigger pick-up programming	156
Immediate / delayed pick-up programming	158
Cancelling the pick-up	159
Reading the pick-up data: information	160
Reading the last sample	161
Fast-meter inputs	162
Activation of signals	164
Disactivation of signals	165

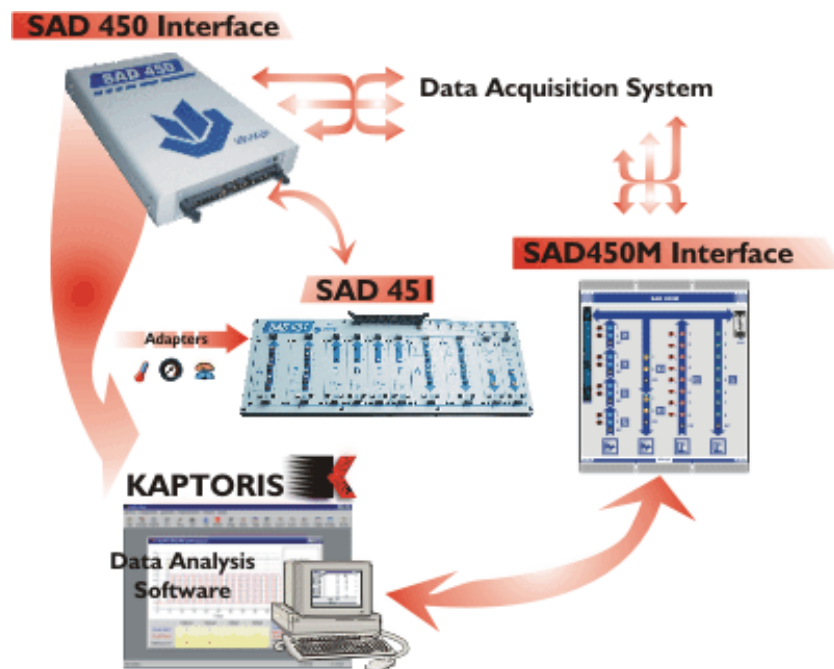
I N T R O D U C T I O N

One of the reasons why computers have become a popular feature of industrial activity is their ability to display and monitor signals from the real world. This ability allows us to obtain data from our surroundings swiftly and efficiently.

The unit shown in this manual composed of the **SAD450** or **SAD450M** interface and **KAPTORIS** software is a data acquisition system for general use.

This unit has been designed for use in laboratories / electrical or electronic labs for analysis of both digital and analog systems. It is so flexible that it can be used for a number of applications, as follows:

- Analysis of digital circuits.
- Analysis of analog circuits.
- Computer-controlled processes (digital and analog).
- ...etc.



The **KAPTORIS** programme has been developed for use as a tool which provides pick-up programming and the display and processing of analog and digital signals. The signals are picked up via the **SAD450** data acquisition system developed by Alecop.

Once they have been picked up, the signals may be subjected to a number of processing systems, and this allows them to be examined by a number of signal processing methods.

The results obtained may be displayed in a number of peripherals and in various formats.

The first part of this manual describes the characteristics and the installation of the SAD450 interface, the KAPTORIS software and its fittings.

The second part explains the general working guidelines to be observed for data pick-up with the SAD450 using KAPTORIS.

The following sections provide an explanation of each and every option in the programme.

The last section provides a number of working examples.

The annex dealing with the SAD450 interface programming commands allows the user to create his own software with ease.

Data acquisition interface

Introduction

The SAD450 series is composed of two data acquisition systems with similar technical specifications but in two different formats.

The first of these systems, the SAD450, is a table format (Figure 1) designed for applications of general use. Consists of the following:

- SAD450 Interface
- Power supply
- Connection cable to PC by means of an RS232C serial line
- Mains connection cable for power supply

Figure 1

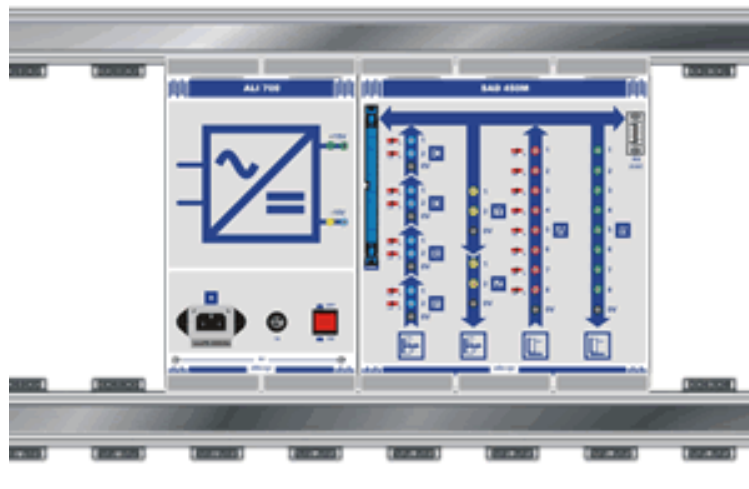


The system is equipped with a 64-point connector where are available all the inputs/outputs of the equipment. For its connection with the outside will have to be used some of the accessories designed by ALECOP, they are described ahead in this chapter or it will have to design some special accessory that can be connected with the application of the user.

The second system, the SAD450M, is in ALECOP module format and requires of a frame/stretcher for its installation. This equipment has the connections of inputs / outputs in 2mm connection sockets to be able to connect it quickly with the equipment to analyze. In addition to this, it hasn't got power supply because it take advantage of the power supply available in the frame which feeds the equipment in study. It consists of the following elements:

- SAD450M interface.
- Connection cable to PC by means of an RS232C serial line

Figure 2



As it can be seen in figure 3 the module is divided in 8 blocks or channels, each one of them with a different kind of inputs/outputs and different nomenclature if they are inputs or outputs (first letters of the alphabet for the inputs and last letters for the outputs):

- * A Channel: 8 digital inputs
- * C Channel: 2 analog inputs
- * D Channel: 2 analog inputs
- * E Channel: 2 analog inputs
- * F Channel: 2 analog inputs
- * W Channel: 8 digital outputs.
- * Y Channel: 2 analog outputs
- * Z Channel: 2 analog outputs

Each input channel, analog or digital, has a commutator to select if the input signal comes from the connection socket (position H) or from the 64-point connector (CN). The outputs do not have any selector and will be accessible from the connection sockets as well as from the 64-point connector at any moment.

Figure 3

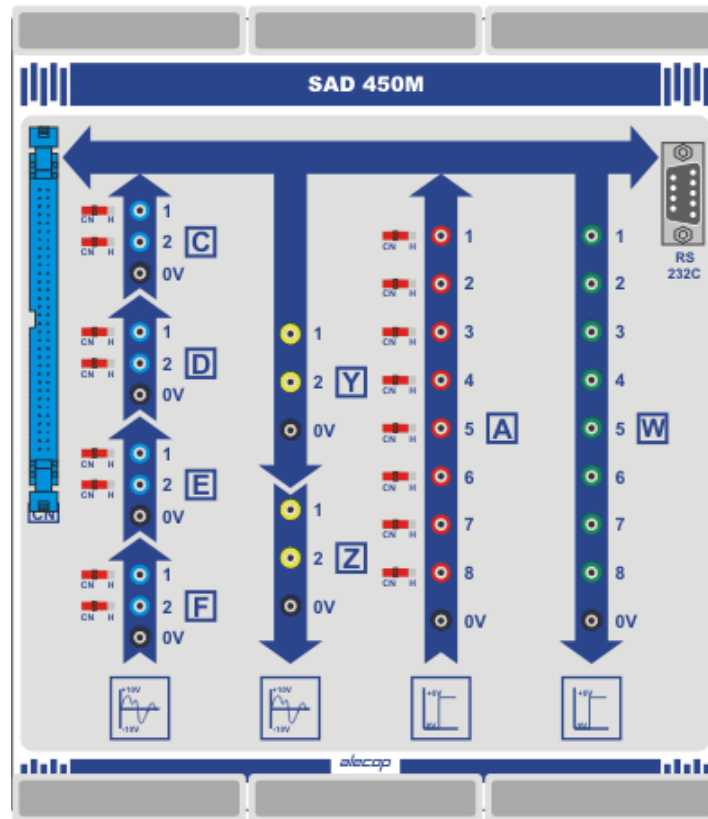
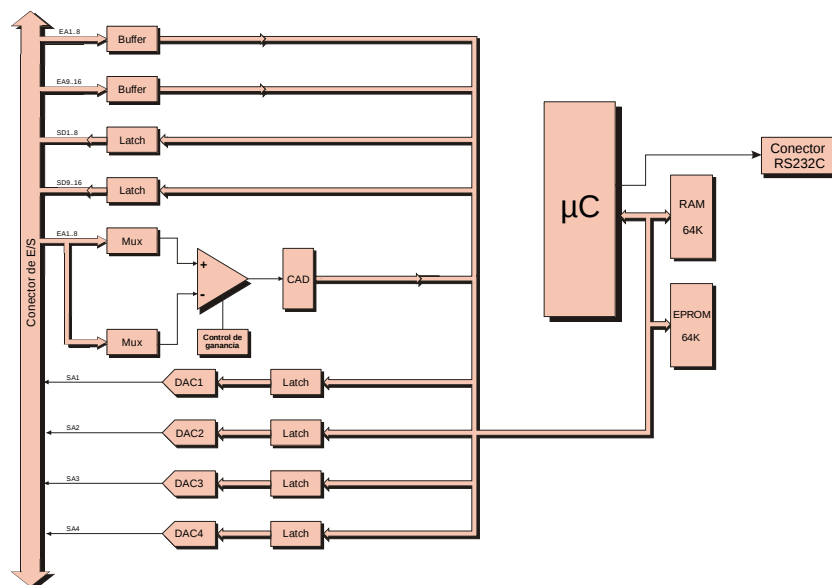


Figure 4 shows the internal clock diagram of the acquisition system in any one of its two versions.

Figure 4



The following are the main characteristics of the system (for more detailed information on the various inputs and outputs, consult the technical specifications in this chapter):

- **This is an “intelligent” SAD** controlled by a μ C Dallas 80C310 operating with a 22.1184 Mhz internal oscillator. This characteristic provides independence for pick-ups, and it is not necessary for the computer to be permanently connected to the unit.
- **Communication with the computer is via an RS232C serial line** and commands in ASCII codes. This makes it much easier to design specific new software applications which the user may wish to incorporate. The manual contains an annex with the description of the SDA450 interface's communications protocol.
- **The system has 64K bytes for data**, of which approximately 60K bytes are available to store pick-up data.

The arrangement of the inputs/outputs on the 64-point connector (Figure 3) is as follows:

Pin	Description	Pin	Description
1	+ 5 volts (output)	2	+ 15 volts (output)
3	+ 5 volts (output)	4	+ 15 volts (output)
5	+ 5 volts (output)	6	+ 15 volts (output)
7	Ground (digital GND)	8	- 15 volts (output)
9	Ground (digital GND)	10	Analog output 3 (channel Z.1)
11	Analog output 4 (channel Z.2)	12	Analog output 1 (channel Y.1)
13	Analog output 2 (channel Y.2)	14	Fast-count input 0
15	Fast-count input 1	16	Digital output 9 (channel X.1)
17	Digital output 10 (channel X.2)	18	Digital output 11 (channel X.3)
19	Digital output 12 (channel X.4)	20	Digital output 13 (channel X.5)
21	Digital output 14 (channel X.6)	22	Digital output 15 (channel X.7)
23	Digital output 16 (channel X.8)	24	Digital output 1 (channel W.1)
25	Digital output 2 (channel W.2)	26	Digital output 3 (channel W.3)
27	Digital output 4 (channel W.4)	28	Digital output 5 (channel W.5)
29	Digital output 6 (channel W.6)	30	Digital output 7 (channel W.7)
31	Digital output 8 (channel W.8)	32	Ground (analog GND)
33	Analog input 7 (channel F.1)	34	Ground (analog GND)
35	Analog input 8 (channel F.2)	36	Ground (analog GND)
37	Analog input 2 (channel F.1)	38	Ground (analog GND)
39	Analog input 1 (channel C.2)	40	Ground (analog GND)
41	Analog input 4 (channel D.2)	42	Ground (analog GND)
43	Analog input 3 (channel D.1)	44	Ground (analog GND)
45	Analog input 5 (channel E.1)	46	Ground (analog GND)
47	Analog input 6 (channel E.2)	48	Ground (analog GND)

49	Digital input 15 (channel B.7)	50	Digital input 16 (channel B.8)
51	Digital input 13 (channel B.5)	52	Digital input 14 (channel B.6)
53	Digital input 11 (channel B.3)	54	Digital input 12 (channel B.4)
55	Digital input 9 (channel B.1)	56	Digital input 10 (channel B.2)
57	Digital input 7 (channel A.7)	58	Digital input 8 (channel A.8)
59	Digital input 5 (channel A.5)	60	Digital input 6 (channel A.6)
61	Digital input 3 (channel A.3)	62	Digital input 4 (channel A.4)
63	Digital input 1 (channel A.1)	64	Digital input 2 (channel A.2)

Figure 5



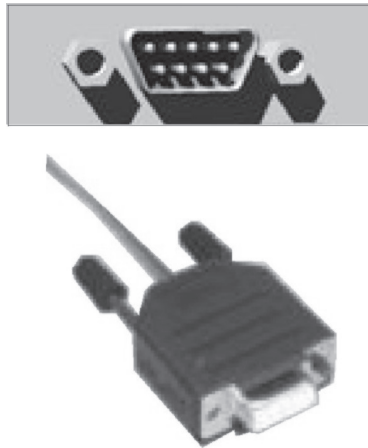
CONVERSION TIMES:

- Fmax 1 analog channel: 200 Khz
- Fmax 2 analog channels: 62.5 Khz
- Fmax N analog channels: $(1/((N*7mS)+10mS))$
- 3 channels: 32.2 Khz
- 4 channels: 26.1 Khz
- 5 channels: 22.2 Khz
- 6 channels: 19.2 Khz
- 7 channels: 16.9 Khz
- 8 channels: 15.1 Khz
- Fmax 1 digital channel: 333 Khz
- Fmax 2 digital channels: 166 Khz

Installation of the unit

The installation of the unit, in anyone of its two versions, is quiet simple, and the only requirement is a computer with a free RS232C serial line (figure 6).

Figure 6



SAD450 table system

The steps to follow for correct installation of the unit are as follows:

1. Connect the serial line cable to the SDA450 interface and the computer serial line (COM1 or COM2).
2. Connect the power supply to the SAD450 unit. The power supply connector is at the back of the unit (Figure 1).
3. If the user has the SAD451 adapter, this should be connected to the unit using the 64-point connector. If the user has another adapter, this should always be connected to the unit before the power supply is switched on to prevent damage to both units.
4. Finally, hook up the mains power supply and turn the unit on using the switch at the rear.

SAD450M module system

1. If you have a frame with power supply, turn off the power supply of the frame.
2. Hang the module in the frame.
3. Connect the serial line cable to the SAD450M interface and the computer serial line (COM1 or COM2).
4. Turn on the power supply that feeds the frame/stretcher.

Once it has been properly installed, KAPTORIS software should be installed as per chapter 2 of this manual.

Technical specifications

This technical specifications are valid for the two different versions of the system except the ones which are marked as specific properties of one of them.

Analog inputs:

- Number of channels: **8 Single Ended or 4 differentials**
- Type of ADC: **Successive approximations**
- Resolution: **12 Bits**
- Maximum sampling frequency: **200 Ks/sec.**
- Range of input voltages (may be selected via software)

Gain	Range
0.25	± 10 V.
0.5	± 5 V.
1.25	± 2 V.
2.5	± 1 V.
5	± 0.5 V.
12.5	± 0.2 V.

- Input coupling: **DC**
- Maximum operating voltage: **± 12 V. with respect to earth**
- Surge protection: **-20V , +40V with Power ON**
-35V , +55V with Power OFF
- Input impedance: **$10^{12} \Omega$, Power ON**
 $>5M\Omega$, Power OFF
- Recommended warm-up time: **15 minutes**
- Set-up time: **3 μ secs.**

Analog outputs:

- Number of channels: **4 channels**
- Resolution: **9 Bits (8 bits + Sign)**
- Maximum refresh frequency: **58 Ks/Sec.**
- Output range: **± 10 V.**
- Output impedance: **Maximum 1Ω (100 Khz)**
- Output current: **11 mA maximum**

- Protection: **Short circuit to ground**
- Set-up time: **3 μ Sec. for ± 1 LSB precision**
- Slew rate: **13 V/ μ Sec.**

Digital inputs:

- Number of channels: **2 x 8 bit channels (16 digital inputs). The SAD450M module version has only accessible one of these channels (8 digital inputs) through connection sockets. In the 64-point connector there are available the two channels.**
- Compatibility: **TTL/HCMOS**
- Maximum reading frequency: **333 Ks/Sec.**

Digital outputs:

- Number of channels: **2 x 8 bit channels (16 digital outputs). The SAD450M module version has only accessible one of these channels (8 digital outputs) through connection sockets. In the 64-point connector there are available the two channels.**
- Compatibility: **TTL/HCMOS**
- Maximum refresh frequency: **58 Ks/Sec.**

Consumption:

	SAD450	SAD450M
5V	210 mA	-
+15V	50 mA	162 mA
-15V	70 mA	-

Dimensions:

- **SAD450:** 230x35x145 mm (length x height x width)
- **SAD450M:** 215x250x147mm (length x height x width)

Connections with the exterior:

- **Connection to the PC:** RS232C serial line, 115200 Bauds
- **Power supply (SAD450):** DIN 41524 connector
- (SAD450M):** Frame's connector
- **I/O connector:** 64-point connector

Unit accessories

The following is a description of the various accessories currently available for the SAD450 data acquisition system. This cannot be a complete list of accessories since new accessories / conditions are constantly being developed for the unit. The user is advised to consult ALECOP for updated documentation.

Some of the accessories currently available for the unit are as follows:

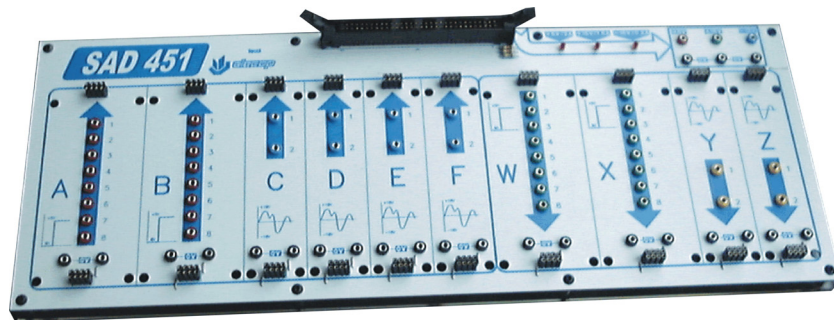
- **SAD451:** Adapter to 2 mm connection sockets for all the unit's inputs / outputs.
- **SAD452:** Adapter to 2 x 37-pin Delta connectors for all the unit's inputs / outputs.
- **SAD430:** Adapter to screw connection for a block of 8 digital inputs.
- **SAD431:** Adapter to screw connection for a block of 8 digital inputs.
- **SAD460:** Adapter for assembly of prototypes for analog inputs.
- **SAD461:** Adapter to screw connection for a block of 2 analog inputs.
- **SAD462:** Adapter to BNC connection for a block of 2 analog outputs.

SAD451

This interface is an adapter to 2 mm connection sockets for all the inputs and outputs in the SAD450 data acquisition system. Figure 5 shows the interface divided into 8 blocks or channels, each with a certain type of input and output, and with differing nomenclature depending on input or output (first three letters for inputs and the last three for outputs):

- Channel A: Corresponds to 8 digital inputs
- Channel B: Corresponds to 8 digital inputs
- Channel C: Corresponds to 2 analog inputs
- Channel D: Corresponds to 2 analog inputs
- Channel E: Corresponds to 2 analog inputs
- Channel F: Corresponds to 2 analog inputs
- Channel W: Corresponds to 8 digital outputs
- Channel X: Corresponds to 8 digital outputs
- Channel Y: Corresponds to 2 analog outputs
- Channel Z: Corresponds to 2 analog outputs

Figure 7



In addition to all the interface's input and output connections, the upper right-hand side of the unit has 3 mains outputs with ground connection sockets. These outputs may be used to power other applications the user wishes to connect to the data acquisition system without using another power supply. The electrical characteristics of these outputs are as follows:

- +5 Volts/2 Amps
- +15 Volts/1.5 Amps
- -15 Volts/0.2 Amps

and all the outputs have short circuit protection.

SAD452

Adapter to 2 x 37-pin Delta connectors for all the units inputs and outputs. This adapter will allow the user to prepare his own applications for swift connection to the data acquisition system. To do this, depending on the number of the application's inputs and outputs, the user uses one or two 37-pin DELTA connectors, with all inputs or outputs to be picked up or generated pre-cabled. the interface is supplied with two DELTA connectors for connection to the application.

Each DELTA connector has half the unit's inputs/outputs, i.e. 8 digital I/O, 4 Analog inputs, 2 Analog outputs and 1 fast-meter input.

The arrangement of the inputs/outputs on the connector is to be found on the module's plate.

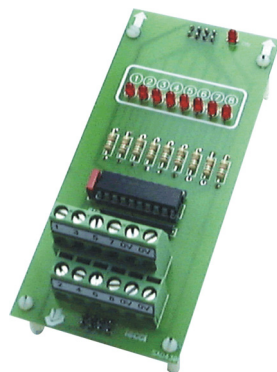
Figure 8



SAD430

Adapter to screw connection for a block of 8 digital inputs. This adapter allows connection of the signals to be picked up by screw terminals, and also has LEDs showing the status of the digital inputs.

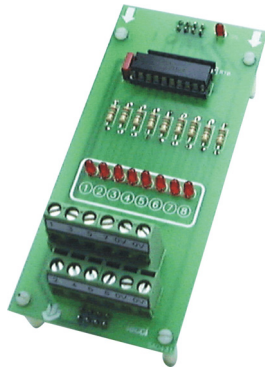
Figure 9



SAD431

Adapter to screw connection for a block of 8 digital outputs. This adapter allows connection of the signals to be picked up by screw terminals, and also has 8 LEDs showing the status of the digital outputs.

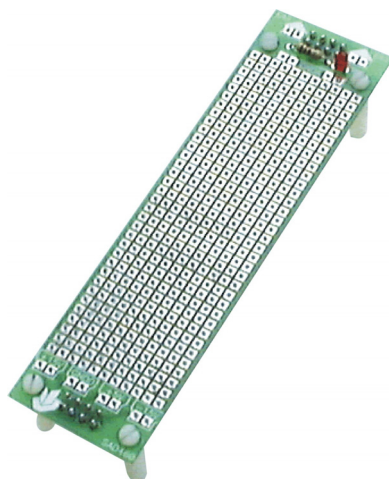
Figure 10



SAD460

Adapter for assembly of prototypes for a block of 2 analog inputs. This adapter allows the user to design conditioners for the analog inputs. The bottom section of the module shows where the +5V, +15V, -15V and GNDD supply signals are located (GNDD is the ground signal for the digital part). The top section shows the connection points for the two analog inputs, and the GNDA analog ground.

Figure 11



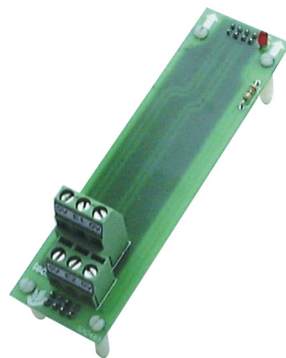
Particular care must be taken in the design of the conditioners with regard to use of the GNDD and GNDA grounds. Although both are connected to the power supply, they are separate with respect to the circuit to prevent, as far as possible, interference created by the digital circuit on the analog circuit.

It is for this reason that the design of the signal's conditioning circuit will use the analog ground. If for any reason a digital device is to be used for switching, this must take its ground from the GNDD digital ground.

SAD461

Adapter to screw connection for a block of 2 analog inputs. This adapter allows the user to connect the analog inputs using screw terminals.

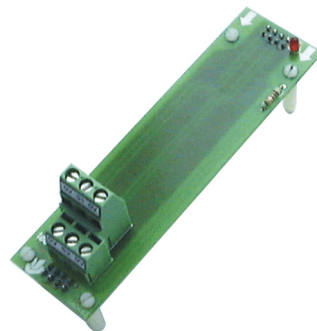
Figure 12



SAD462

Adapter to screw connection for a block of 2 analog outputs. This adapter allows the user to connect the analog outputs using screw terminals.

Figure 13



SAD463

Adapter to BNC connection for a block of 2 analog inputs. This adapter allows the user to connect the analog inputs using BNC connectors. The input impedance of this module has been adapted to $1\text{M}\Omega \pm 1\%$ and 20pF in order to use oscilloscope probes for entry of analog signals.

Figure 14



KAPTORIS Software

Introduction

The Kaptoris system has been designed to ease the configuration and programming of the SAD450 and SAD450M interfaces, and to carry out detailed analysis of the data using tables and numerical data, and also in graph format.

Some of its characteristics are as follows:

- It allows configuration of the of the SAD450 and SAD450M interfaces channels in simple visual fashion.
- The graphs showing the signals picked up adapt automatically to the data they contain, but they may also be configured manually.
- The user has easy access to all pick-up details.
- Kaptoris allows the user to work with no connection to the unit.
- The reports produced by Kaptoris may include the graph, data tables and specific comments for each pick-up.
- The programme allows the user to create new signals from those already existing, using a signals calculator.

Hardware and software requirements

These are the minimum requirements for the PC in which the KAPTORIS system is to be installed:

- 80486 processor or better
- 8 Mb of RAM

- 5 Mb of available memory on the hard disk.
- Operating system, Windows 95/98/NT
- SVGA graphics board. Resolution 800X600 pixels.
- The user is advised to configure over 256 colours for the screen.
- Serial line communications port available.

Installation

The KAPTORIS application is installed using CD supplied with the unit. (Figure 15)

Figure 15



The following steps must be observed for installation of the programme:

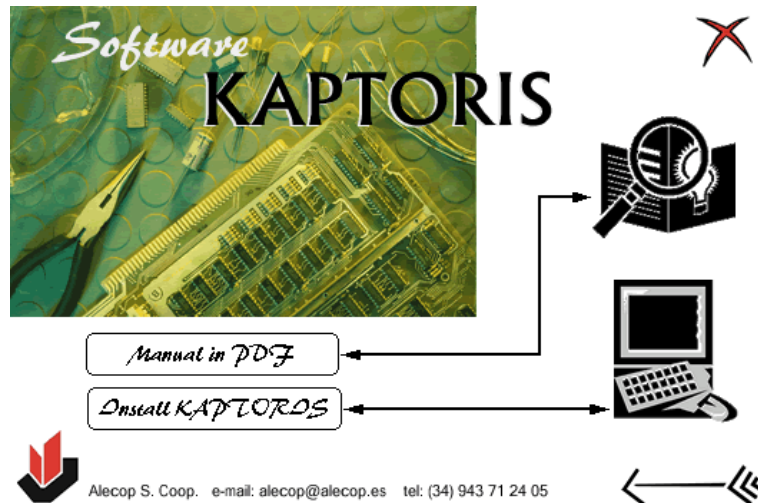
1. Put installation CD into the CD drive.
2. The application will be executed automatically when the CD is inserted.
3. In case this option is turned off, the "Install.exe" file must be executed.
4. The first step is to choose the language.

Figure 16



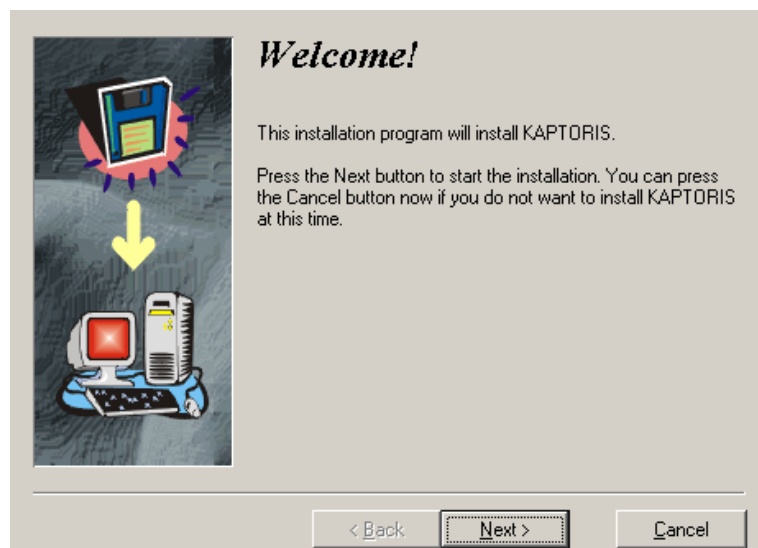
5. Choose “Install KAPTORIS”. You can also display user’s manual in PDF format. (Figure 17).

Figure 17



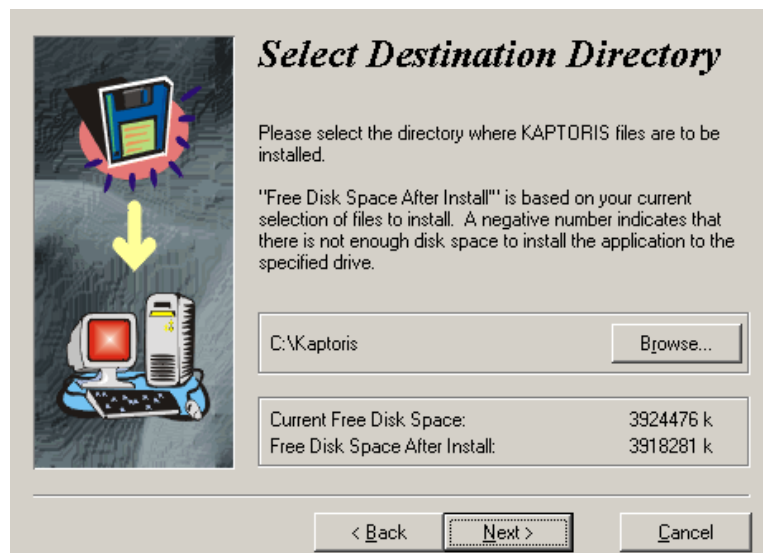
6. The second window informs the user that the system is proceeding with installation, and provides the cancel option again by clicking on **Cancel**. The third window appears when the user clicks on **Next** (Figure 18).

Figure 18



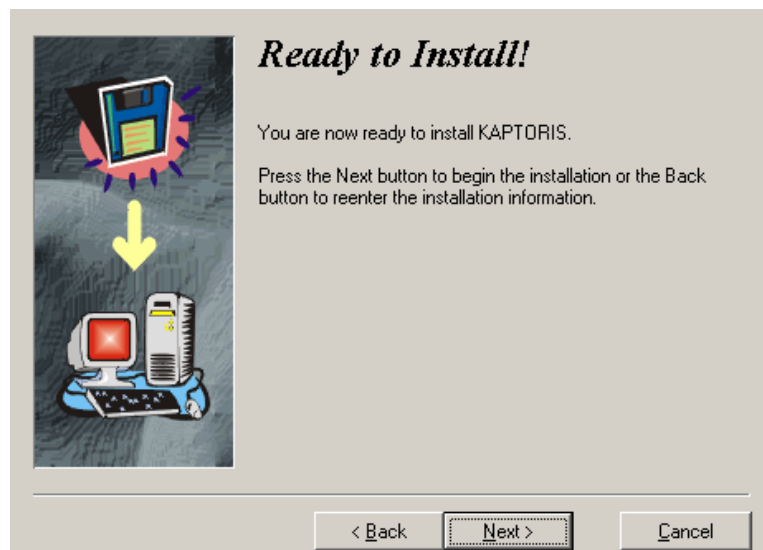
7. The third window shows the directory in which KAPTORIS is to be installed. If you wish to change this, click on **Search** to access the directory tree. Select the directory required and click on **Accept** to return to the third installation window. The directory selected will appear where the screen displayed “C:\Kaptoris” before. Click on **Next** for the fourth window (Figure 19).

Figure 19



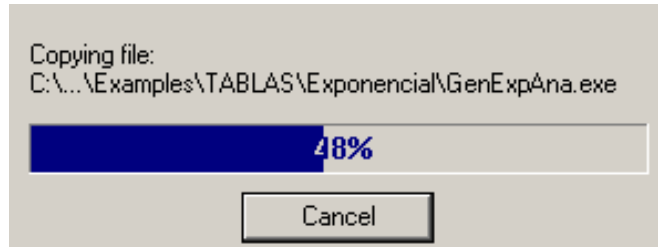
8. In the fourth window the installer is ready to begin copying the files to the hard disk. Click on **Next** to enter the window showing progression of the installation. Click on **Cancel** to exit installation (Figure 20).

Figure 20



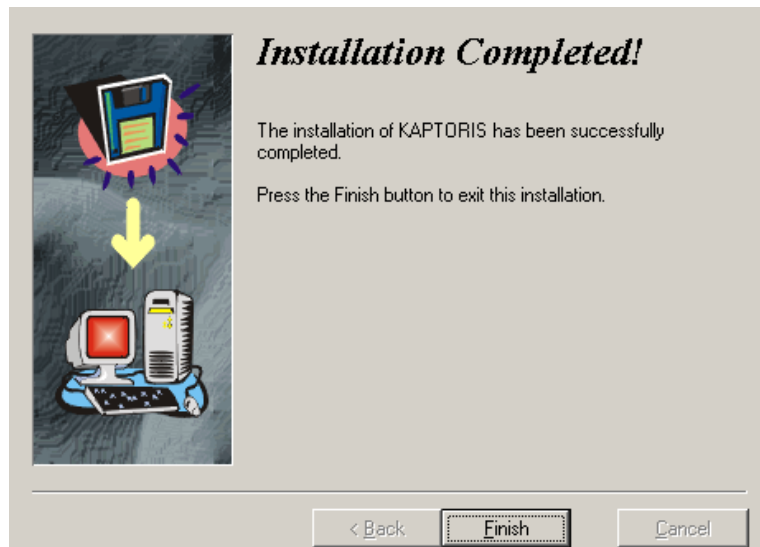
9. Copying the files to the hard disk may be cancelled by clicking on **Cancel** in the progression window (Figure 21).

Figure 21



10. When installation has been completed, the last window appears to confirm that the installation has been successfully completed (Figure 22).

Figure 22



10. In the event of an error during installation, start the process again from the beginning.
12. KAPTORIS has now been installed in the PC. The installer creates a group of programmes called “**ALECOP Kaptoris**”, and this menu contains three direct accesses.
 - **KAPTORIS**
 - **Kaptoris help**

Uninstalling KAPTORIS

KAPTORIS may be uninstalled in two ways, as follows:

- **Execute the “Unwise.exe” file** inside the directory of the programme.
- **Use the Windows “Add or eliminate programmes” option** on the control panel. Here the user must select “KAPTORIS” from the list of programmes and uninstall it by clicking on **Accept**.

Either of these methods may be used to completely eliminate KAPTORIS from your system.

Operating norms

Working with Kaptoris is a simple process, but the user should have an idea of the main steps to follow to allow him to use this programme before a detailed examination is provided of all its possibilities.

Kaptoris has been designed to help the user to analyse any type of system using the data picked up.

- A *pick-up* is a record of data collected at regular intervals of a certain duration.

Work with the data acquisition unit may be divided into four phases, as follows:

1. **Configuring**

Defining the channels of the of the SAD450, or SAD450M, interface which will take part in the pick-up and the time parameters (Analysis time and Sampling time).

2. **Programming the pick-up**

This consists of informing the SAD 450 or SAD450M interface as to the configuration defined for the channels. When a pick-up is programmed, its activation method is also defined. This may be carried out by a trigger or by a period of time.

3. **Displaying the result**

Once the SAD 450 or SAD450M interface has completed the pick-up procedure, the data obtained have been stored in its memory. To display the data and work with them, the user must read them. Once they have been read they are automatically transformed into signals on a graph.

4. **Working with the signals**

The user may work with the set of signals obtained by carrying out operations, displaying all their details, adding more signals from a file, printing reports etc.

N.B.: Kaptoris allows the signals obtained to be saved, and allows the user to work with them with no connection to the SAD 450 or SAD450M interface.

Starting the session

When the user starts a work session with Kaptoris, the software carries out a number of automatic tests, as follows:

- **Location of the serial port to which the SAD450/SAD450M interface is connected**

If the interface is not properly connected, the programme informs the user of this situation and provides two options: attempting to carry out the connection again or working with the section for analysis and processing of signals only. The latter option means that the user cannot carry out any further pick-ups or read interface data.

- **Status of the SAD 450/SAD450M interface**

Should communications be incorrect, the system carries out tests to check whether the interface is:

1. Picking up data, i.e., a pick-up is in progress.
 2. In stand-by mode with the data from the last pick-up stored in its memory.
 3. In stand-by mode with no data to be read in its memory.
- It also tests the amount of memory and the version of the interface.

Once the programme has completed the initial test procedure, the user may start work with Kaptoris.

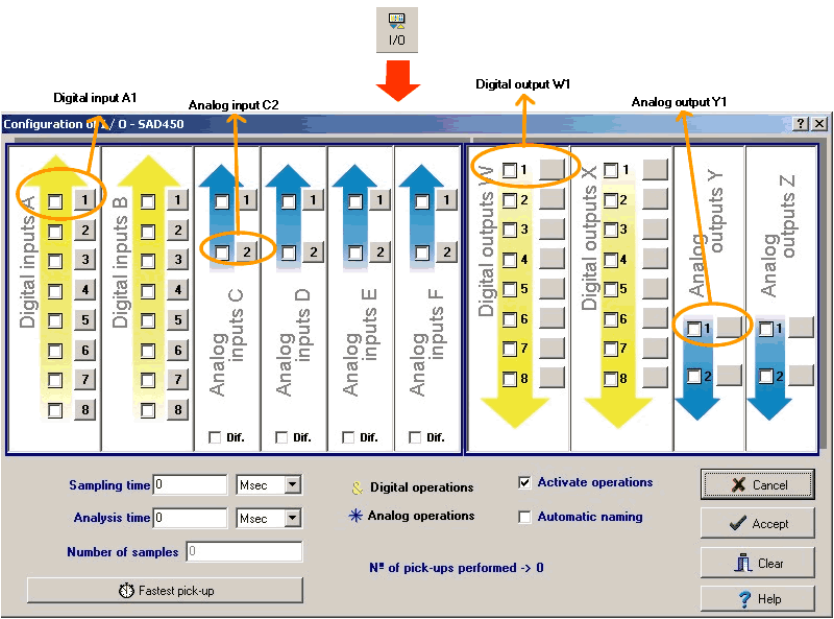
Examples of execution

Example 1

This example shows the steps to be followed to configure two input signals and two output signals, carry out the pick-up procedure and display the results thus obtained.

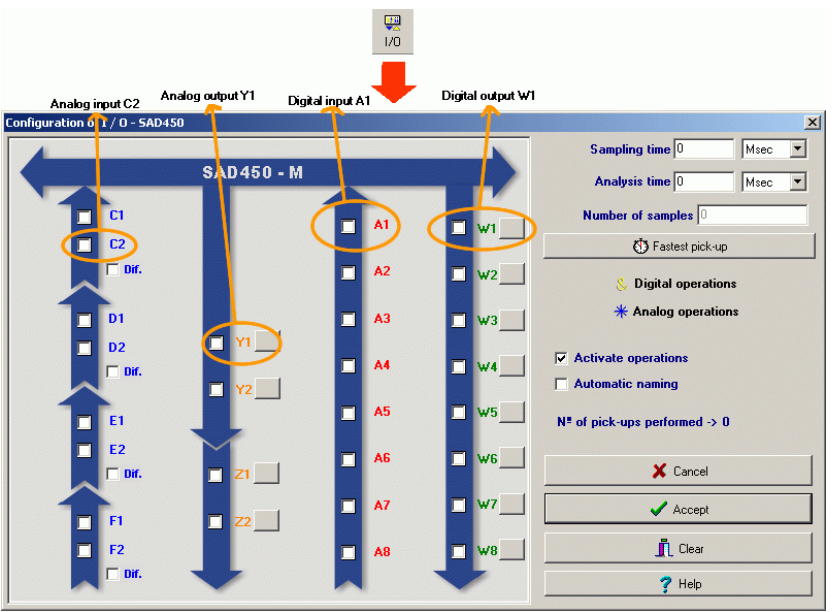
The user must first configure the inputs and outputs which will take part in the pick-up procedure. He selects the **Configure I/O** option on the **configuration** menu, or clicks on the **I/O** button on the tool bar. According to the type of interface which we are working with, will appear a window of configuration of inputs / outputs or other. In this window (Figure 23), there are represented all the inputs and outputs the SAD450 interface, divided in analogical and digital.

Figure 23



In this other window (Figure 24), there are represented all the inputs and outputs of the SAD450M interface divided also in digital and analogical.

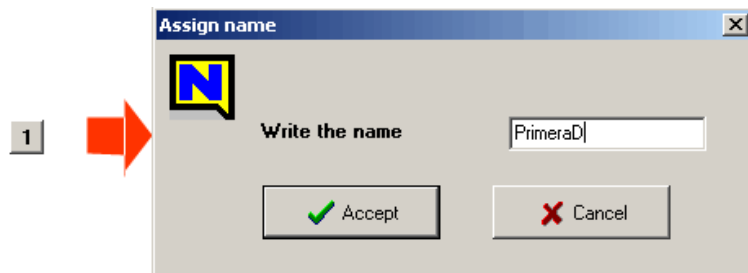
Figure 24



The inputs which will take part in the pick-up procedure are: digital input A1 and analog input C1.

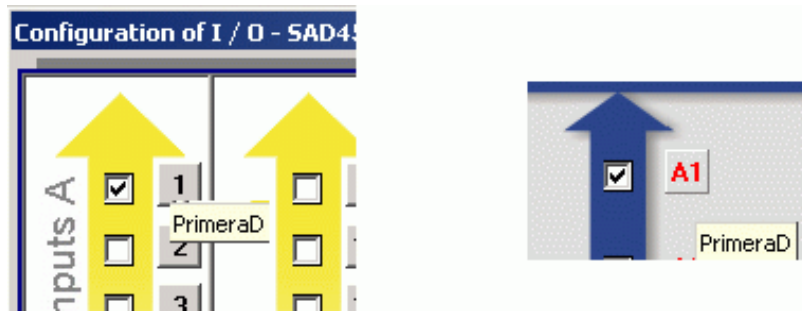
In both windows, on clicking the button “1” on the section dealing with digital inputs, and the name of the input appears by default, “indigA1” in this case. When renaming the signal, the new name should be of significance (Figure 25).

Figure 25



Write «PrimeraD» and click on **Accept** . Position the mouse pointer over the button, and the new name of the input appears in a small yellow box (Figure 26).

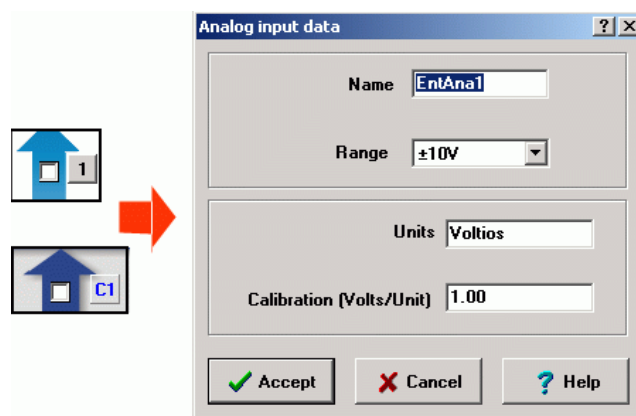
Figure 26



Finally, once the name of the signal has been defined, click on the verification box to activate the input (Figure 26).

To define the properties of the number C1 analog input, the user clicks on the appropriate button on the window section dealing with analog inputs. When the user clicks here, a window appears for definition of properties (Figure 27).

Figure 27



An analog input has four properties, as follows:

1. The **name**, to a maximum of eight characters.
2. The **range**, which limits the values of the signal. E.g.: if we select ± 5 , values over 5 volts or less than -5 volts will adapt to these threshold values.
3. **Units** is the name of the units in which the signal is measured. By default the units are Volts, but the user may change these by applying a conversion factor - calibration.
4. **Calibration** defines the value by which the signal will be multiplied to convert it into other units. The signals picked up are in volts, and to convert them to more representative units the user employs a multiplication factor. The calibration value is always a multiple of the value of the signal and will have a maximum of 7 digits, including the minus sign and the decimal point. By default its value is 1.

The only property we will change will be the name “SegundaA”. When the user clicks on **Accept**, the analog input is configured in volts with a range of ± 10 and a calibration value of 1, since the values are taken by default. The user must now click on the box to activate the input (Figure 28).

Figure 28

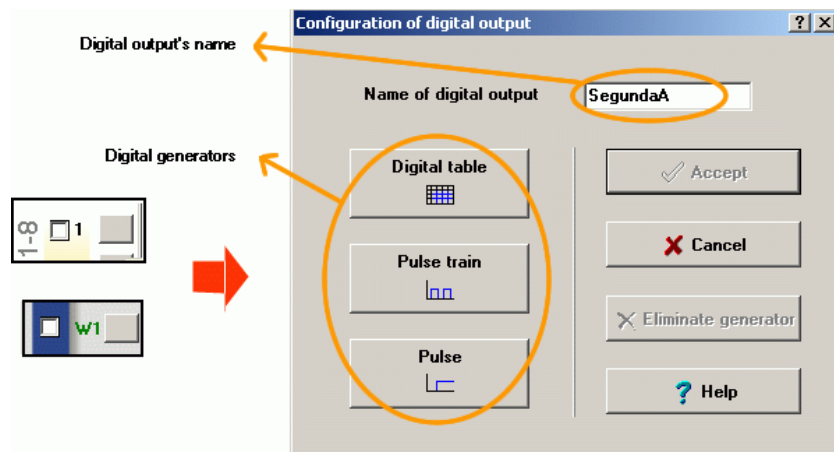


The next step is to define the output signals, the number W1 digital output and the number Y1 analog output.

The properties of an output may be defined in two ways: by clicking on the button associated with the output and, if the output has not been configured, by clicking on its verification box. In both cases Kaptoris shows the properties window.

The user clicks on the button associated with the number W1 digital output on the section of the window dealing with digital outputs W. A window opens showing the properties of the output (Figure 29).

Figure 29

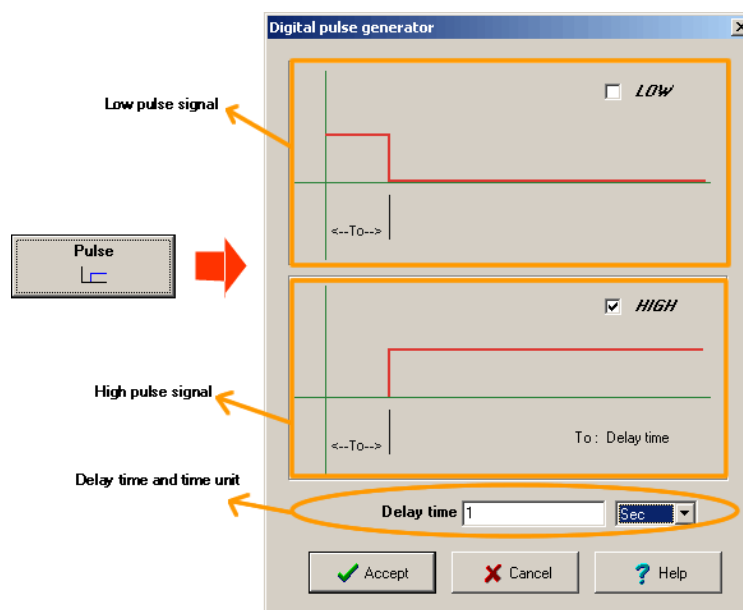


- A digital output has two properties, as follows:

1. The **name**, to a maximum of eight characters.
2. The **generator** defines the type of signal to be produced by the output. There are three types of digital generators: Train, Pulse and Table. A generator must be assigned in order to activate the output (the generators are explained in more detail in the manual's analog outputs section).

In the case of digital output W1, the name by default is "OutDiW1", and in this case it will not be changed. The generator to be assigned to this output will be the pulse type. To define the parameters for this generator, the user clicks on the **Pulse** button in the properties window (Figure 30).

Figure 30



A **high** pulse is a signal which, having remained at logical «0» over a delay time T_0 , moves to logical «1» until the analysis time has elapsed.

A **low** pulse is a signal which, having remained at logical “1” over a delay time T_0 , moves to logical “0” until the analysis time has elapsed.

In this case we must define a delay time of 1 second, and the type of pulse will be high. When the user clicks on **Accept**, the window showing the parameters of the pulse closes and the generator has been defined. An icon now appears on the button to show the type of generator selected (Figure 28).

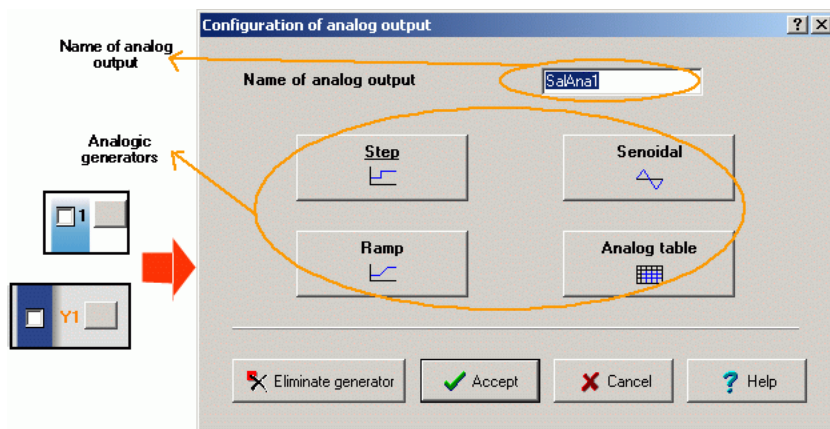
The user clicks on the verification box for digital output W1, and this activates (Figure 31).

Figure 31



Now the user must define analog output Y1. To display its properties, he clicks directly on the verification box. Since this output has not yet been defined, the properties window opens straightaway (Figure 32).

Figure 32

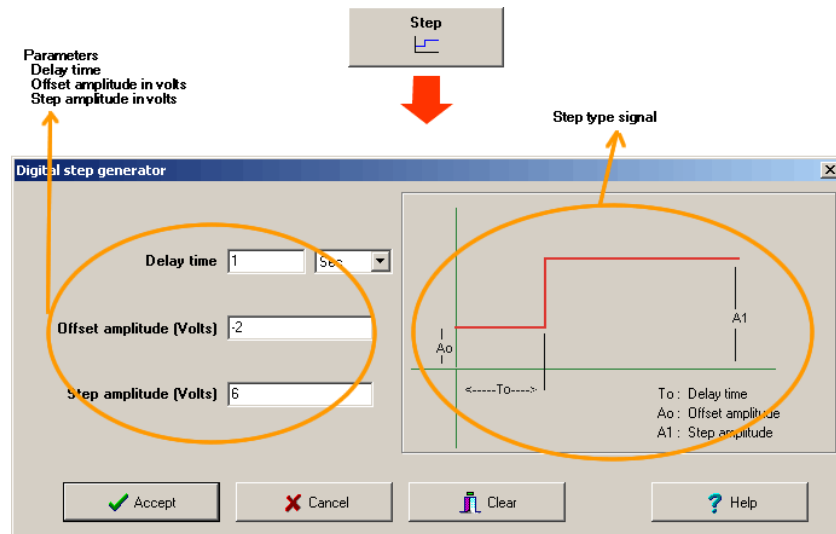


Analog outputs have two properties, as follows:

1. The **name**, to a maximum of eight characters.
2. The **generator** defines the type of signal to be produced by the output. There are four types of analog generator: Step, Seno, Ramp and Table. A generator must be assigned to allow the output to be activated.

In the case of analog output 1, the name “SalAna1” remains the same, and a step generator is defined. The user accesses its parameters by clicking on the **Step** button (Figure 33).

Figure 33



A **step** is a signal which, having remained at a value A_o over delay time T_o , suddenly changes to a value A_1 until the analysis time has elapsed.

In this case a value of 1 second must be assigned as delay time (T_o), -2 volts will be the offset amplitude (A_o), and 6 volts the step amplitude (A_1). The user clicks on **Accept** to define the output, and the system returns to the configuration window.

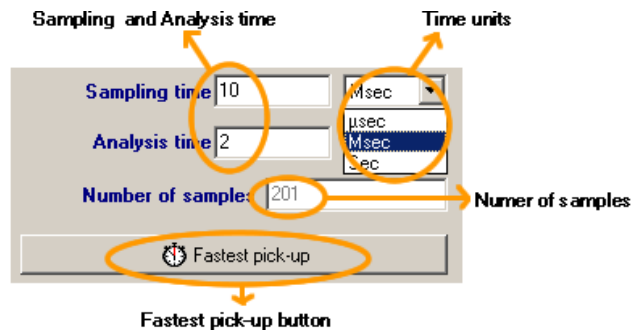
The next step is the definition of times. The user must define the total pick-up time for signals, known as **analysis time**, and the time between pick-up of one sample and the next, or **sampling time**. Beside each of these values there are two boxes showing a list of units with which the user may work (Figure 34). Definition of these two values allows each of the signals picked up to be defined by a number of data. The higher the number of data defining a signal, the higher the degree of accuracy, but the time for representation and calculation will also be longer.

Below these boxes is another box showing the number of samples. This value is automatically recalculated whenever a time changes (Figure 34).

The **Fastest pick-up** button calculates threshold times during which the SAD 450 may be configured (Figure 34).

The first example will define an analysis time of 2 seconds, and a sampling time of 10 milliseconds, and this will provide 201 data per signal (one more datum is added since pick-up is carried out for the first sample in second 0 - Figure 34).

Figure 34

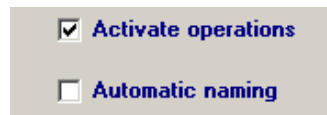


The two boxes which remain to be defined are:

- **Automatic naming:** if this is activated, every time we read the signals of a pick-up from the interface, the programme will name these automatically. The name consists of the channel from which the signal comes and the number of pick-ups we have carried out with the configuration defined.
- **Activate operations:** When this box is activated, every time we read pick-up data a signal will be generated for each operation defined (Operations are covered at a later stage in the manual).

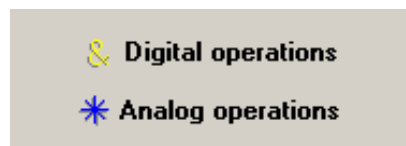
In this example it is not necessary to activate any of these boxes (Figure 35).

Figure 35



This window may also be used to define operations, but in this case we will not define any. The two operations buttons are used to activate this option (Figure 36).

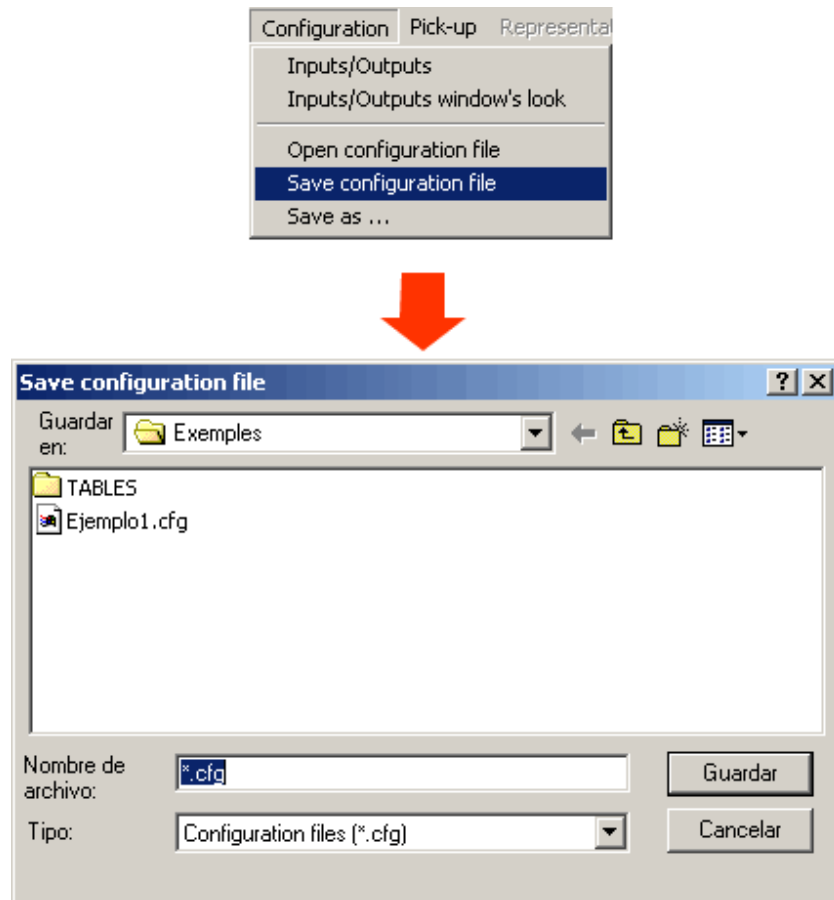
Figure 36



When the user clicks on **Accept** in this window, Kaptoris tests the configuration defined. In the event of an incompatibility or an error, a warning message appears and the user is taken to the configuration window again. If there is no problem, the window closes and the configuration has been completed.

To allow this configuration of inputs and outputs to be used for other examples, it is stored in the «ejemplo1.CFG» file. To store the configuration, click on **Save configuration** on the **Configuration** menu, and a Windows dialogue box appears. The user enters the name of the file «ejemplo1» and clicks on **Save** (Figure 37).

Figure 37



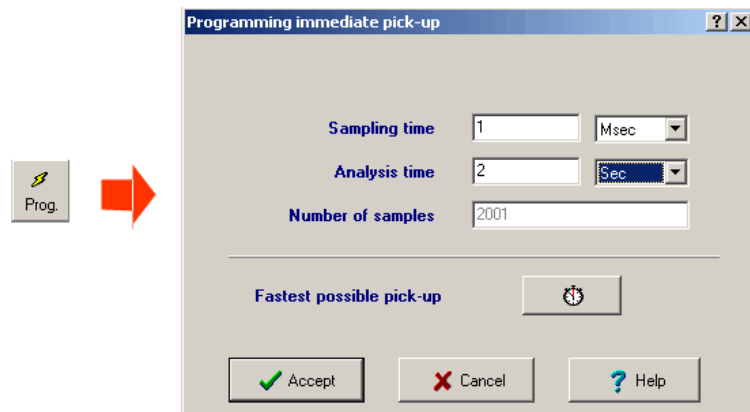
Once the configuration has been defined and stored, prior to carrying out pick-up of signals the user must ensure that the inputs and outputs are properly connected.

In this example, the input signals will be the same signals generated by the programme as output signals. Here the user must connect analog output Y1 to analog input C1, and digital output W1 to digital input A2.

Pick-up may now commence. We will carry out an immediate pick-up, and this means that pick-up commences as soon as it has been programmed. Kaptoris can also carry out delayed pick-ups or trigger-activated pick-ups – all these options are explained at a later stage in the manual.

There are two ways of activating the immediate pick-up window: by clicking on the **Prog.** button on the tool bar, or clicking on the **Immediate Pick-up** option on the **Pick-up** menu (Figure 38).

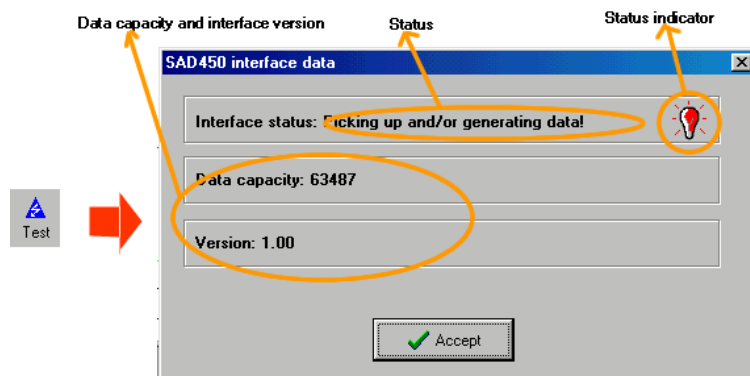
Figure 38



The **Immediate Pick-up** window shows the times configured, and these may be changed if the user so desires. In this case we will make no changes, and so the user merely clicks on **Accept**. The window closes and pick-up commences. In the event of a communications error with the SAD450, or SAD450M, Kaptoris informs the user of this using error windows.

Should the user wish to know if pick-up has been completed, he may check the status of the interface by clicking on the **Test** button on the tool bar, or on the **Test interface status** option in the **Pick-up** menu on the main window (Figure 39).

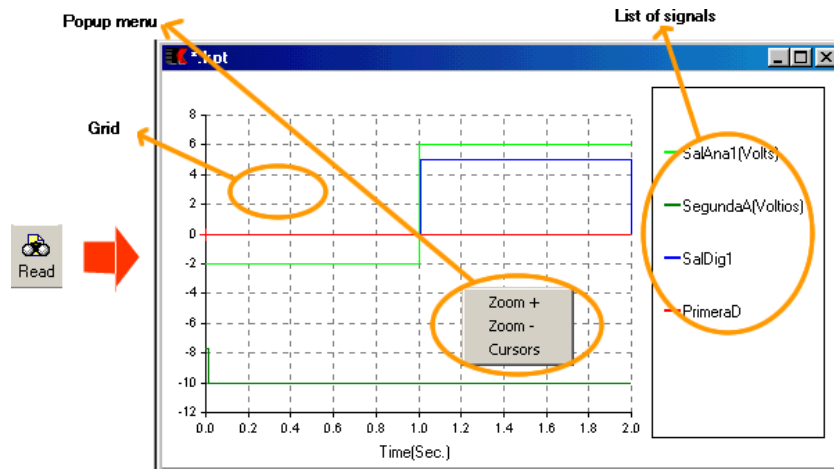
Figure 39



When the 2 seconds of the pick-up have elapsed, the user must collect the data from the interface memory. To do this, he may click on the **Read** button on the tool bar, or on the **Read results** option in the **Pick-up** menu. The cursor turns into an hour-glass until Kaptoris has completed its reading of the data via serial line (Figure 40).

Once the reading has been completed, a graph window opens automatically to show a colour representation of the four signals picked up. The names of the signals and the colour representing them are shown to the right (Figure 40). The user may modify the appearance of these graphs (grilles, scale, size of the pass etc.) by clicking on the **Define representation** option.

Figure 40

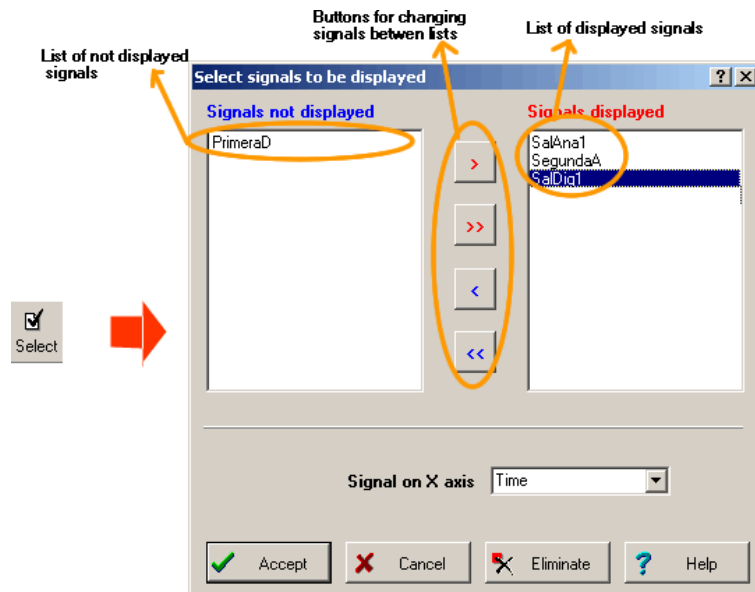


At this point the set of signals should consist of the following: *PrimeraD*, *SegundaA*, *SalDig1* and *SalAna2*.

The user may select the signals which appear on the active representation by clicking the **Select signals** option in the **Representation** menu or on the **Select** button on the tool bar. A window appears with two lists. The left-hand list contains the signals which do not appear on the active graphic representation. This list is empty.

The right-hand list contains the four signals picked up, and this is the list featuring the signals displayed (Figure 41). The user wishes to leave only the two analog signals on the representation, and so he selects the digital signals and clicks on the “<<” button. The two digital signals should now appear on the list of signals not displayed.

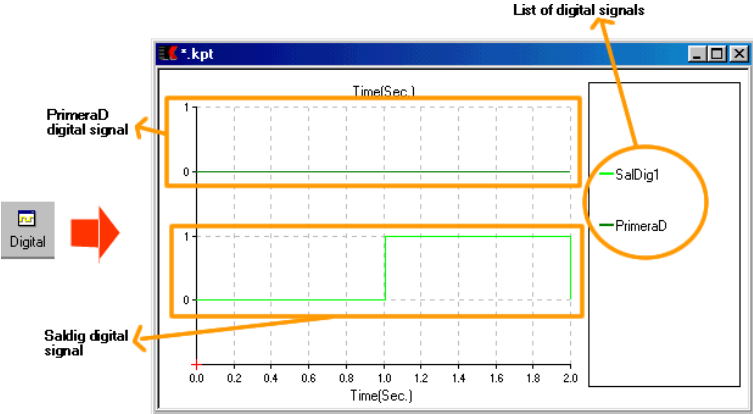
Figure 41



When the user clicks on **Accept**, the graph window refreshes and shows only the signals on the list of displayed signals.

There are two types of graph window: digital and analog. By default, the first window to be created is always analog (Figure 40). The user clicks on the **Digital** option on the tool bar or on the **New digital window** option in the **Window** menu, but in this case the system will show only the digital signals. *SalDig1* and *PrimeraD* will appear one on top of the other, with values 0 and 1 (Figure 41).

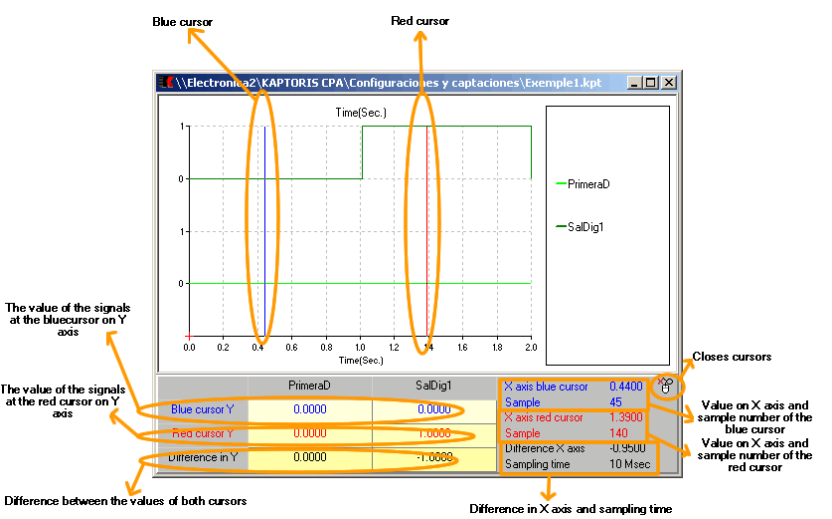
Figure 42



If the graphic representation windows are superimposed, the user may click the **Horizontal** option in the **Window** menu and the windows will organise themselves horizontally on screen.

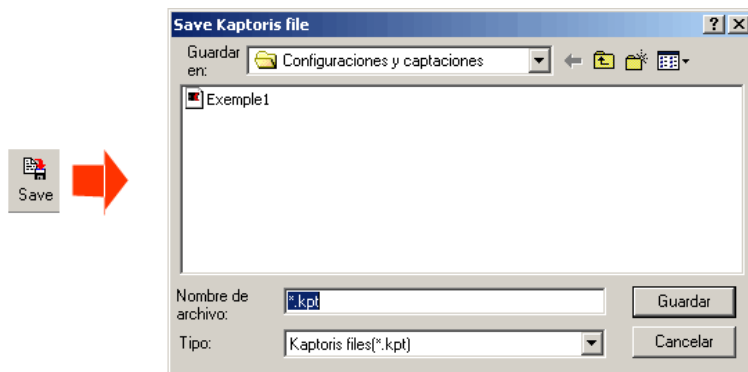
The graphic representation windows have an emerging menu which appears when the user clicks the right-hand button on the mouse. This small menu contains three commands. **Zoom -** and **Zoom +** allow the user to enlarge areas on the graph and then return to the normal graph size (Figure 40). The **Cursors** option activates a section of the window which was previously concealed (Figure 43).

Figure 43



- Each graphic representation has two cursors, one red and one blue. A cursor is a vertical line which may be positioned on any part of the graph. The value at which it cuts through the X axis and the value on the Y axis for each of the signals appear on the table at the bottom of the window. The red cursor is positioned by clicking the right-hand button on the graph, and the blue cursor using the left-hand button. The table also shows the difference between the values of both cursors (Figure 43).
- The user may wish to have more details concerning the data for the signals obtained, add more signals from a previous pick-up operation, export sample data or print out a report. All these options, among others, are possible within the Kaptoris system, and are discussed in other sections of the manual.
- The final stage of this example consists of saving the set of signals and the configuration in a KPT file, i.e. saving the pick-up.
- The user clicks on the **Save** button on the tool bar or on the **Save** option in the **File** menu, and the Windows **Save** dialogue box appears. The name of the file may be “ejemplo1”. When the user clicks on **Accept** the pick-up is saved for subsequent use (Figure 44).

Figure 44



Example 2

This second example defines the steps to be taken to display the signals.

In this pick-up mode the computer simulates operation of a memory oscilloscope by picking up the signal and displaying it simultaneously. When the display has been completed, the signals picked up are stored in the memory of the SAD 450/ SAD450M interface, and may thus be retrieved by Kaptoris.

The user requires an external signal generator for this example.

As in the previous example, the first step is configuration of the input and output channels which are to participate in the pick-up. To make the example easier, we will configure only one analog input.

The user selects the **Configure I/O** option in the configuration menu, or clicks on the **I/O** button on the tool bar ,and, if we are working with the SAD450 interface the “Configuration of I/O-SAD450M” appears (Figure 45), otherwise the n “Configuration of I/O-SAD450M” window will appear (Figure 46).

Figure 45

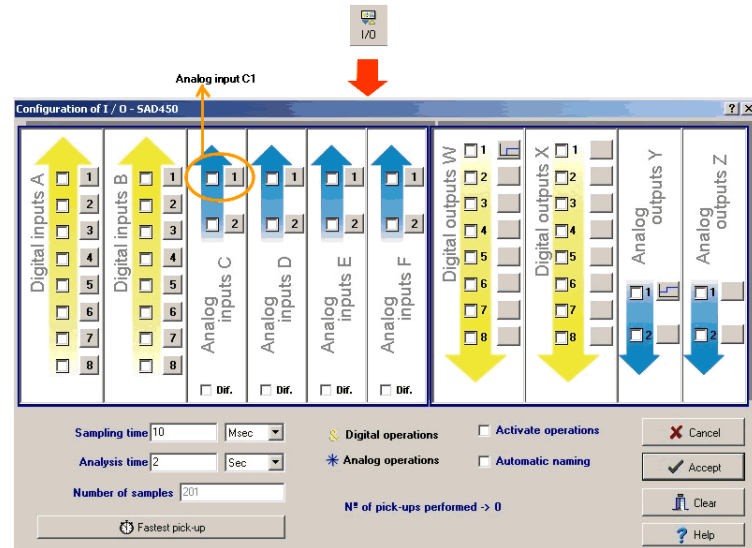
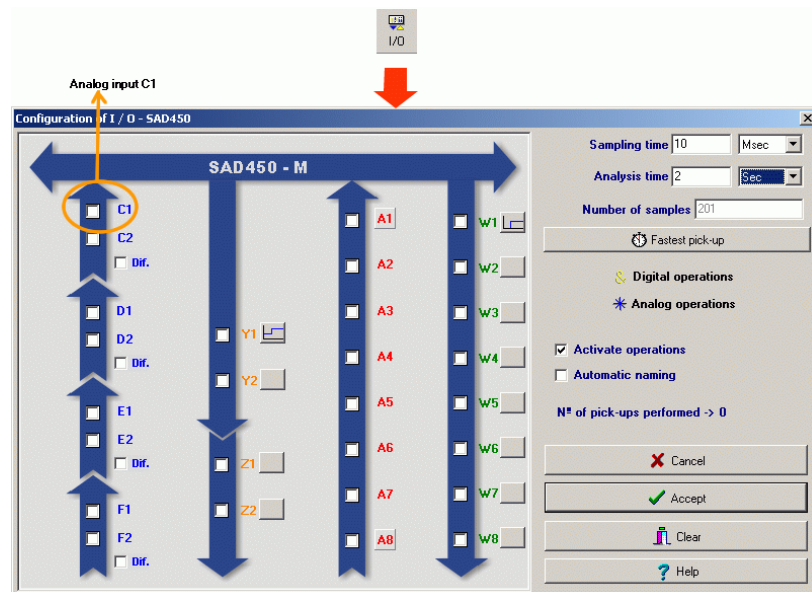


Figure 46



If the user has carried out example 1, analog input C1, digital input A1, digital output W1 and analog output Y1 will be active on the window. All active inputs and outputs must be deactivated except for analog input C1 by clicking on the boxes. If the user has only recently started to use the programme, the window will be clear with all inputs and outputs deactivated. In this case analog output Y1 must be activated by clicking on its box (Figure 47).

Figure 47

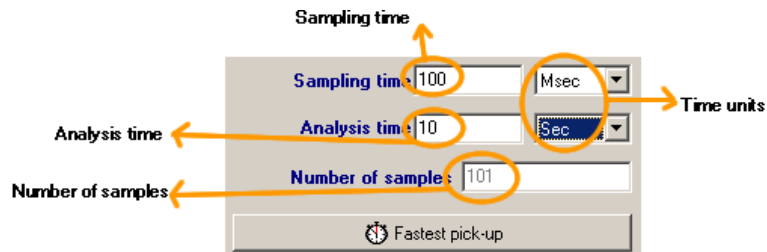


The next step involves definition of pick-up times.

*Continuous display programmes again and again the pick-up as defined, and shows the data being picked up on a graph. The display and programming loop terminates when the user presses **Close window** in the display window.*

The user wishes to define an analysis time of 10 seconds and a sampling time of 100 milliseconds. This gives a total of 101 samples in 10 seconds, meaning that the display graph will initialise again every 10 seconds (Figure 48).

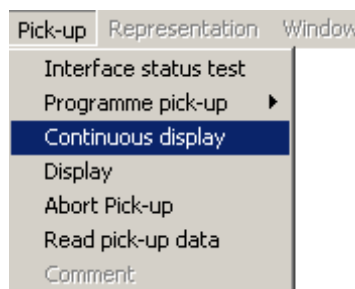
Figure 48



The analysis time depends on the display required for the signal to be picked up, i.e. when the analysis time as defined has elapsed, the window will be deleted and the system will begin to display the signal again from the left-hand side of the X axis.

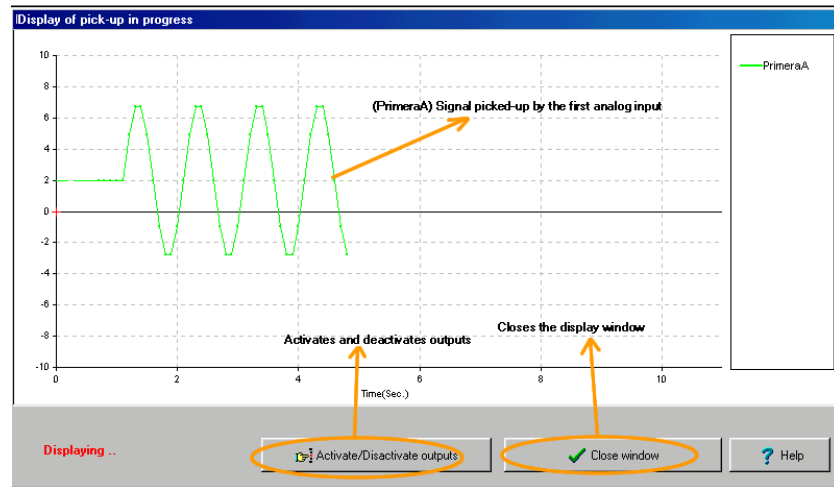
Once the times have been defined, the user must select the option of the programme for continuous display by clicking on **Continuous display** in the **Pick-up** menu (Figure 49).

Figure 49



A window then appears to inform the user that the pick-up is being programmed. Once the programming has been completed, the display window appears and display of the current pick-up begins (Figure 50).

Figure 50



When the user clicks on **Close window**, the display ends, but data from the last analysis time remain in the interface memory, and so these may be retrieved. Should the user wish to do so, he merely follows the procedure defined in the first example to read interface data.

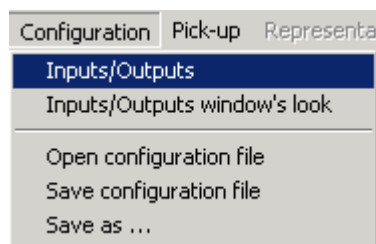
Configuration of inputs /outputs

Configuring a pick-up

Configuring a pick-up consists of defining the input and output channels to be used in data pick-up.

The user accesses the configuration window via the **Inputs/outputs** option on the **Configuration** menu.

Figure 51
"Inputs/Outputs option
on the Configuration
menu"



This window may also be accessed by clicking on **Configure I/O** on the tool bar.

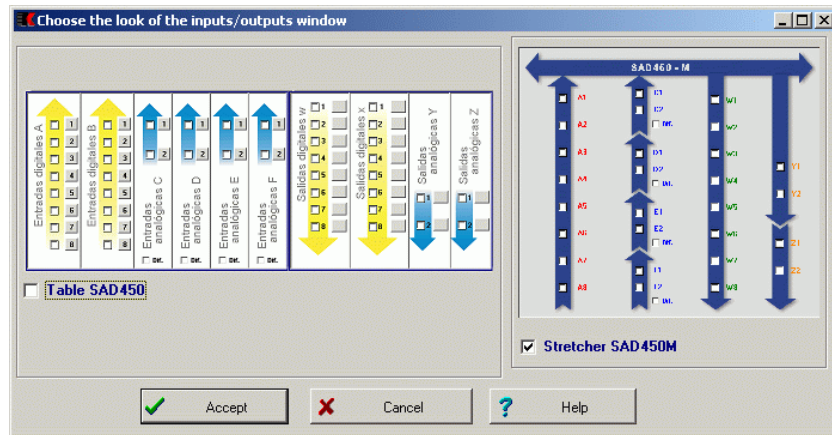
Figure 52
"Configure I/O" button



The first time this option is chosen, KAPTORIS shows this window (Figure 53), in which you have to choose the type of interface which you are going to work with by clicking on the corresponding option and then on the "OK" button.

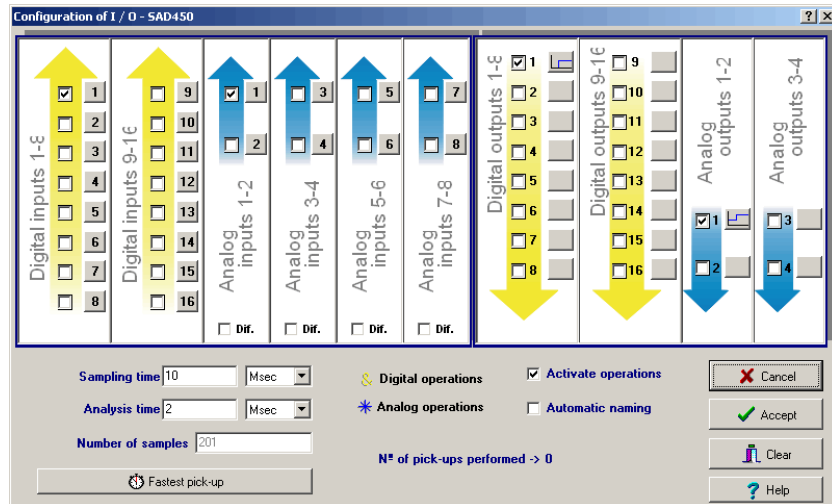
You can change this setting later. (See subject "How to change the appearance of the I/O window").

Figure 53



If we are working with SAD450 interface this window will appear, it represents all the channels and configuration options of the interface.

Figure 54
"Configuration of I/O-
SAD450" window

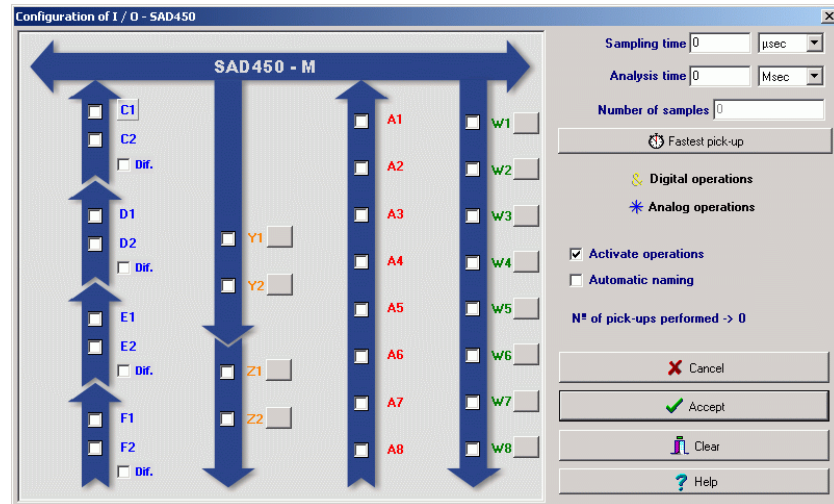


The channels are divided as follows:

- Digital inputs A 1-8
- Digital inputs B 1-8
- Analog inputs C 1-2
- Analog inputs D 1-2
- Analog inputs E 1-2
- Analog inputs F 1-2
- Digital outputs W 1-8
- Digital outputs X 1-8
- Analog outputs Y 1-2
- Analog outputs Z 1-2

In case you were working with SAD450M interface, the window would be this (Figure 55).

Figure 55



The channels are divided in:

- Digital inputs A 1-8
- Analog inputs C 1-2
- Analog inputs D 1-2
- Analog inputs E 1-2
- Analog inputs F 1-2
- Digital outputs W 1-8
- Analog outputs Y 1-2
- Analog outputs Z 1-2

To activate an input or output channel, the user must proceed as follows:

- Define its properties. The user accesses these by clicking on the button associated with each channel. The properties depend on the type of channel. All channels have a name by default, and this may be modified. The name of the channel will be that which the signals take once they have been picked up or generated by the SAD 450, or SAD450M.
- If more than one pick-up is to be carried out with the same configuration, the user must activate the **Automatic naming** box. In this way the programme will provide different names for signals picked up by the same channel automatically. The name of the signals consists of the channel from which the signal originates and the number of pick-ups carried out to date.
- Activate the channel. To do this, the user simply clicks on the appropriate verification box, whereupon a cross appears. To deactivate the channel, the user clicks the box again.

Figure 56
Image of button and box
associated with a
channel



To **configure the pick-up times**, the user must define the value of two parameters: the sampling time and the analysis time. With the SAD450 they are defined in the boxes on the left-hand lower section of the window, and with the SAD450M in the boxes on the right-hand top section of the window. (For more information, consult "Defining Times").

The lower section also features two buttons used to move on to definition of digital and analog operations.

- Operations may be activated or deactivated by clicking on the **Activate operations** box.

If the user clicks on the **Clear** button, all channels are deactivated, the names are deleted, and any generators we have defined for the outputs are removed. The entire configuration initialises.

The configurations may be stored in files for subsequent use, thus avoiding unnecessary repetition of the definition of the configuration.

If the user clicks on **Cancel**, he exits the window without saving the changes made to the configuration.

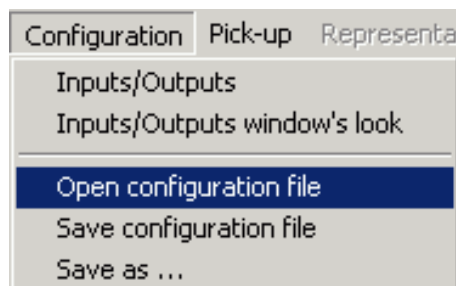
If the user clicks **Accept** and the configuration is correct, there are two possible reactions:

- If the configuration is compatible (the times do not change) with the previous configuration, or if we are defining it for the first time, the window closes and the configuration defined will be that available henceforth.
- If the configuration is not compatible, a warning window will appear to give the user the option of saving the configuration with which he was working.

Loading a configuration

To load a configuration from a file, the user must activate the **Open configuration file** option in the main menu.

Figure 57
"Open configuration
file" option on the
configuration menu



A dialogue box will appear, allowing the user to select the file whose configuration is to be loaded.

Configuration files have a **CFG** extension.

Once the right file has been selected and the user has pressed the *Open* button on the dialogue box, a check is run as to whether the configuration is valid for the current set of signals.

In the event of incompatibility, a message will appear asking the user whether he wishes to save the set of data and the current configuration.

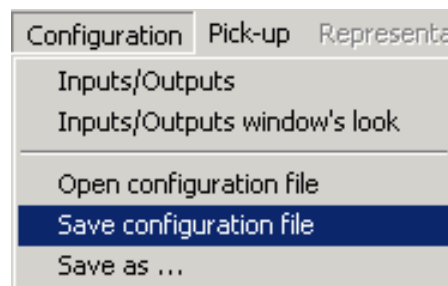
When the configuration is loaded, the inputs/outputs window appears automatically to show the contents of the file.

Saving a configuration

The configuration at any given time may either be saved together with the other data, or separately.

If the user only wishes to save the configuration of the SAD450, or SAD450M interface, he must select the menu option **Save configuration file** from the menu.

Figure 58
"Save configuration file" option on the configuration menu



A **Save** dialogue box appears to provide a name for the file, and the file is saved in the folder selected.

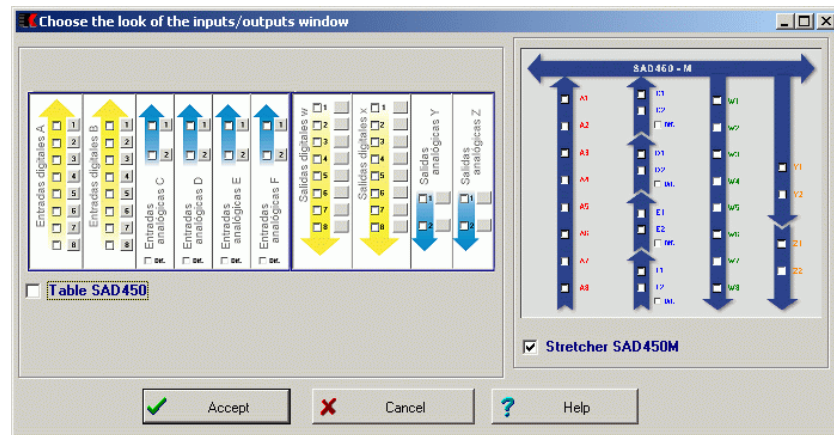
The configuration will be kept in a **CFG** file.

How to change the appearance of the I/O window

You can choose the appearance of the data acquisition system I/O configuration window. First time you choose the option that activate the I/O window, KAPTORIS shows you this other window (Figure 59) in which you have to choose the type of interface you will work with.

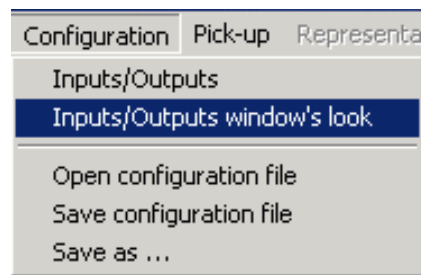
You have to click on the appropriate box and then on “OK” button.

Figure 59



You can also change the appearances of the I/O window whenever you want by clicking the “Appearance of I/O window” on the configuration menu (Figure 60).

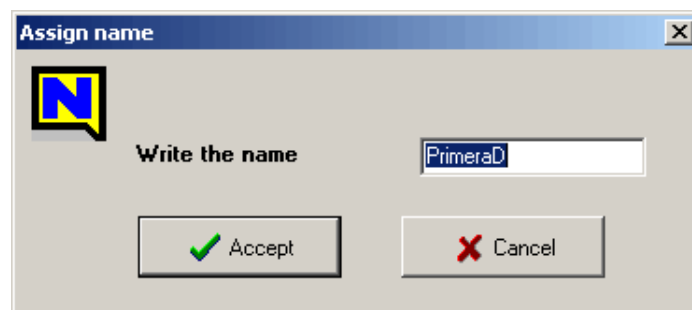
Figure 60



Digital inputs

Table SAD450 is equipped with 16 digital inputs, and SAD450M module is equipped with 8. When the user clicks on the associated buttons, a window appears to show the name currently used by the digital input.

Figure 61
"Assign name" window



To change the name of the input, the user simply writes the new name in the box and clicks on **Accept**.

If the name is a repeat, an information window appears to indicate this.

To activate the input, simply click on its box.

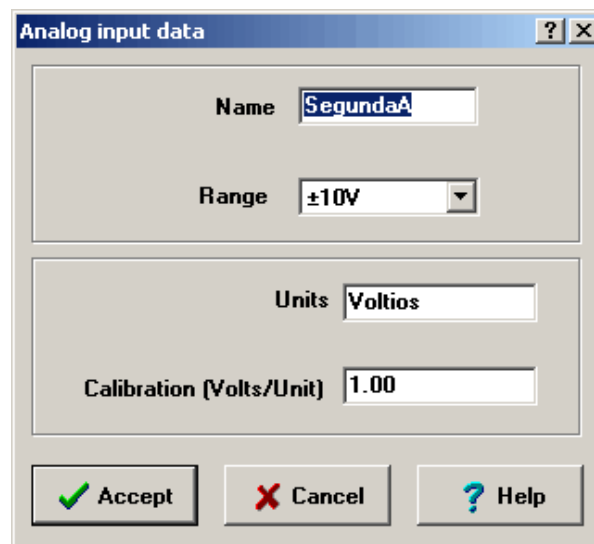
Figure 62
Box for digital input 1



Analog inputs

The both interfaces, SAD450 and SAD450M, are equipped with 6 analog inputs. When the user clicks on any of the buttons associated with the inputs, a window appears showing the properties of the channel.

Figure 63
"Analog input data"
window



Analog inputs have four properties, as follows:

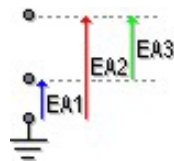
1. The **name** of the signal, to a maximum of eight characters.
2. The **range**, which limits the values of the signal.
3. **Units** is the name of the units in which the signal is measured. By default the units are volts, but they may be changed by applying a conversion factor to the signal, called calibration. The name of these units must be defined in this property.
4. **Calibration** defines the value by which the signal will be multiplied (in volts) to convert it to other units. Its value by default is 1.

It is also possible to carry out pick-up in differential mode by clicking on the **Diff.** box. This always disables the second input of each pair. When the user selects the first input, this creates a signal which will be the difference between the two channels.

Differential input

A single-ended input is an input with reference to ground. However, in the case of a differential input, a single-ended input refers to another single-ended input.

Figure 64



EA1, EA2: Single-ended

EA3: Differential

To activate an input, the user simply clicks on its box.

When the user clicks on **Cancel**, the changes made will not be saved in the configuration.

When the user clicks on **Accept**, if the name is a repeat a message will appear. If this is not the case, the window closes and the changes are made to the configuration.

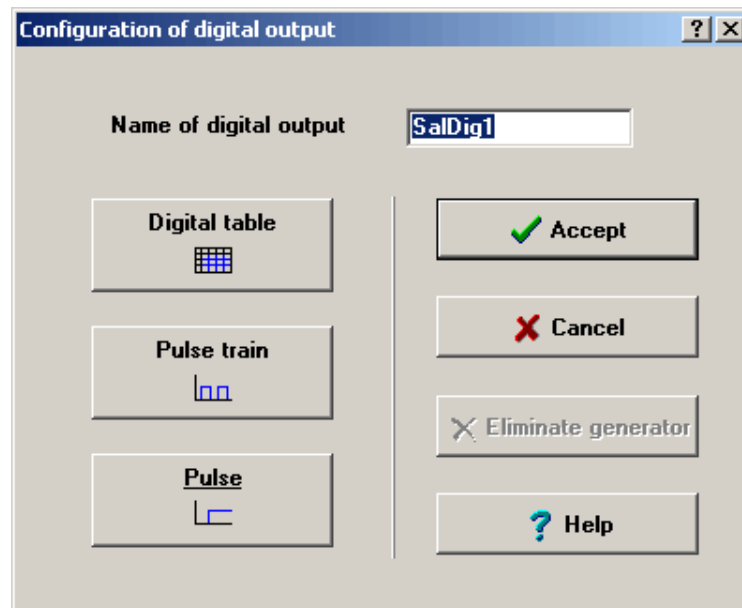
Digital outputs

Table SAD450 is equipped with 16 digital outputs, and SAD450M module is equipped with 8. Each of these has an associated button which displays the window showing its properties.

If the output has already been defined, the button will show a drawing of the type of signal which will be generated via that channel.

When the user clicks on the button the following window appears:

Figure 65
"Configuration of
digital output" window



The digital outputs have two properties to be defined, as follows:

1. The **name**, to a maximum of eight characters.
2. The **generator**, defining the type of signal to be produced by the output. There are three types of digital generators: Train, Pulse and Table. A generator must be assigned to allow the output to be activated.

When the user clicks on **Destroy generator**, any generator assigned to the output is removed.

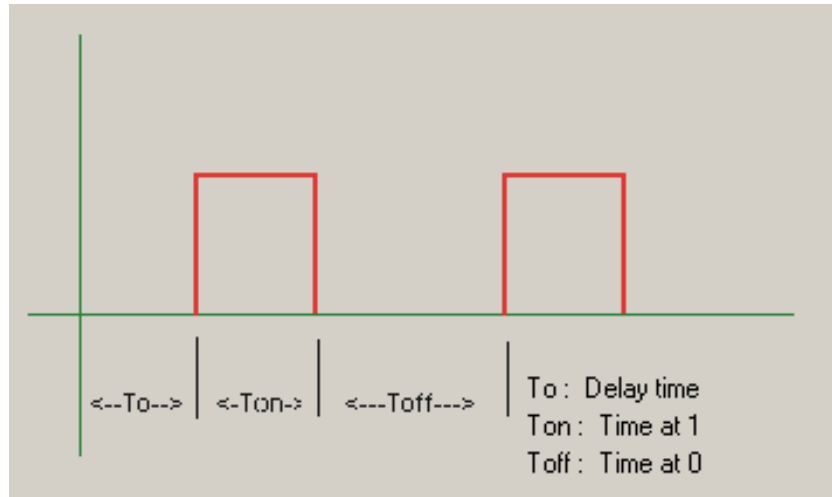
When user clicks on **Cancel**, the window closes and the changes are not made to the configuration.

When the user clicks on the **Accept** button, if all the properties are correct, the window closes and the changes are reflected in the configuration.

Pulse train

This is the format of a digital generator known as a pulse train.

Figure 66
"Pulse train"
representation



A pulse train is a square signal where times at 1 (logical) and at 0 (logical), respectively, are determined by T_{on} and T_{off} .

The square signal is preceded by a logical 0, the duration of which is equal to the delay time.

Total duration of the signal is the duration of the analysis time.

The parameters are as follows:

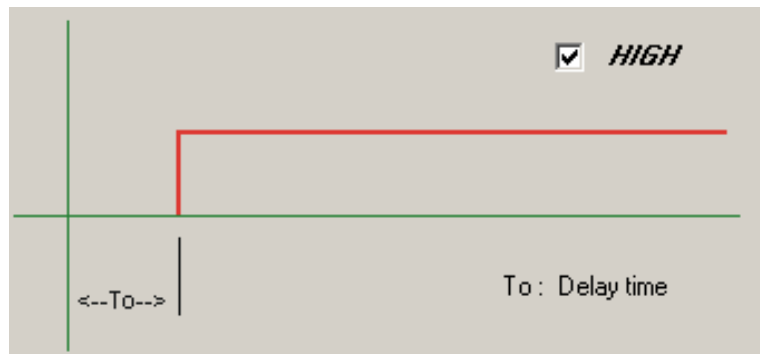
1. **Delay time (T_o):** this defines for how long the amplitude of the output is "0", and once this time has elapsed generation commences of the pulse train.
2. **Time at "1" (T_{on}):** this defines the time during which the value of the output is "1", or is "On".
3. **Time at "0" (T_{off}):** this defines the time during which the value of the output is "0" or is "Off".

Pulse

There are two types of pulse, as follows:

- **High:** this is a signal which, having remained at logical "0" over a delay time T_o , moves to logical "1" until the analysis time has elapsed.

Figure 67
"High-pulse"
representation



- **Low:** this is a signal which, having remained at logical "1" over a delay time T_0 , moves to logical "0" until the analysis time has elapsed.

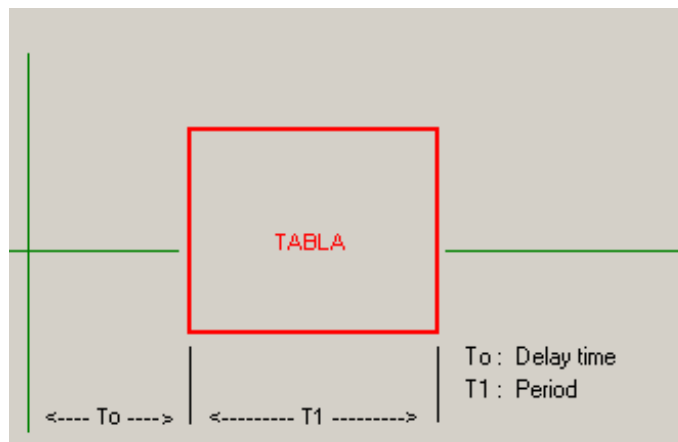
Figure 68
"Low-pulse"
representation



Digital table

A table-type digital generator consists of a number of values which may be 0 or 1.

Figure 69
"Digital table"
representation

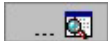


A delay time T_0 may also be defined.

The values on the table are applied periodically at the rate of one for each sampling time, after the delay time defined. Once all the values of the table have been emitted, the sequence begins again.

The signal finishes when the analysis time has elapsed.

The tables are files with a TBA extension.

To select a table, the user clicks on the  button. A dialogue box will appear to allow the user to select a file.

The file selected will appear in the *File name* box.

If the user wishes to edit or create a table, he must click on the Table editor button . This activates the table editor.

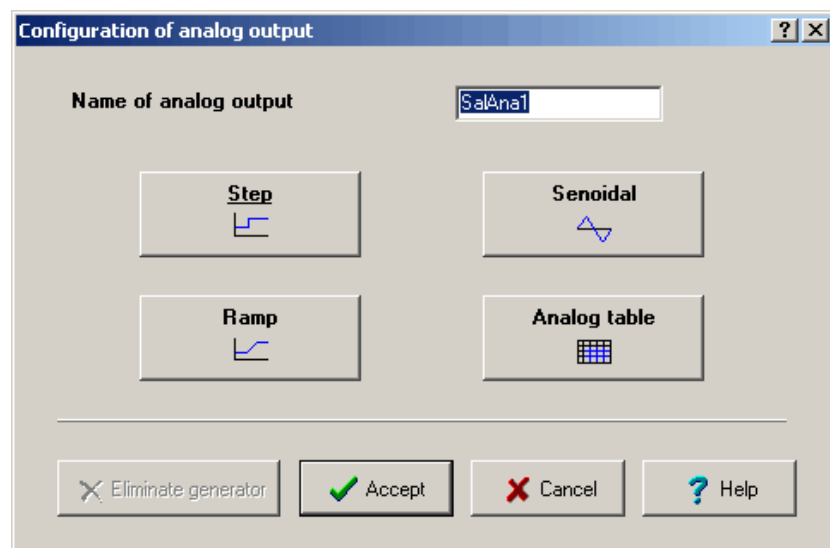
Analog outputs

The both interfaces, SAD450 and SAD450M, are equipped with 4 analog outputs. Each of these has an associated button to display the window showing its properties.

Should the output already be defined, the button will show a drawing of the type of signal which will be generated by that channel.

When the user clicks on the button, the following window appears:

Figure 70
"Configuration of
analog output" window



The digital outputs have two properties to be defined, as follows:

1. The **name**, to a maximum of eight characters.
2. The **generator** defines the type of signal to be sent out at the output. There are four types of analog generator: Step, Sino, Ramp and Table. A generator must be assigned to allow the output to be activated.

When the user clicks on **Destroy generator**, any generator assigned to the output is removed.

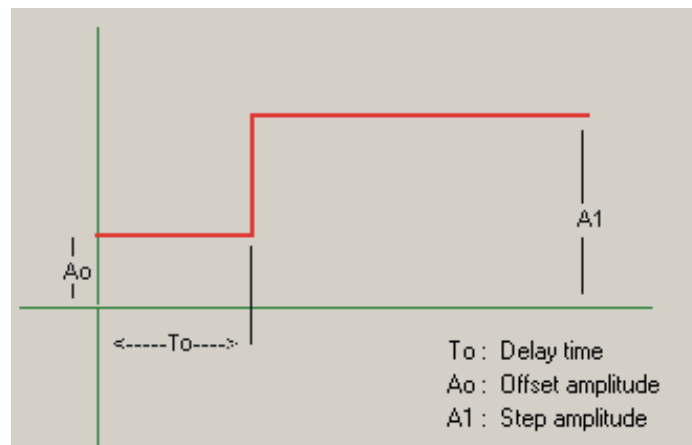
When the user clicks on **Cancel**, the window closes and the changes are not made to the configuration.

When the user clicks on **Accept**, if all the properties are correct, the window closes and the changes are reflected in the configuration.

Step

This is the format of a step-type analog signal.

Figure 71
"Step" representation



A step is a signal which, having remained at a value A_0 over the delay time T_0 , suddenly changes to a value A_1 until the analysis time has elapsed.

The parameters are as follows:

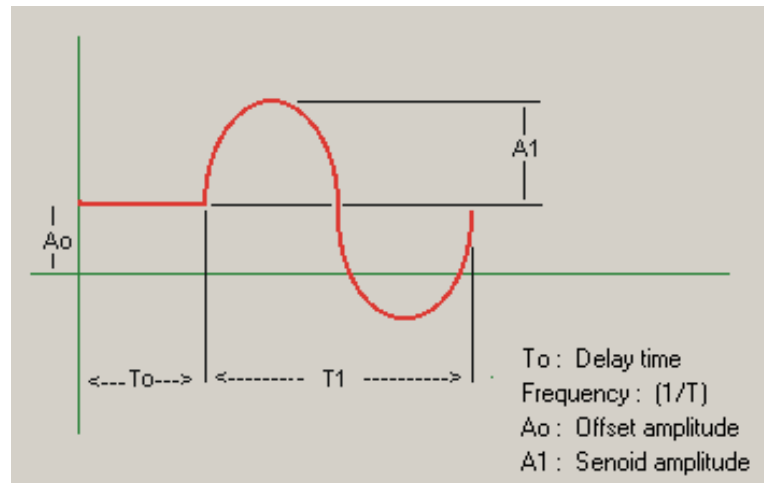
1. **Offset amplitude (A_0 in Volts):** this defines the amplitude of the step over the delay time (T_0). Its value will be a real number within the ± 10 volt range.
2. **Step amplitude (A_1 in volts):** once delay time (T_0) has elapsed, the step will take the value of this parameter. As in the case of the A_0 parameter, its value will be a real number within the ± 10 volt range.

3. **Delay (To):** this defines the period of time during which the amplitude of the step will be the value defined in Ao.

Senoidal

This is the senoidal-type analog signal.

Figure 72
"Senoidal"
representation



The values of the boxes are used to define a senoidal signal of amplitude A_1 , and period T_1 , preceded by a continuous component, value A_o , over delay time T_o .

The senoidal signal is assembled over the continuous component, and its duration is equal to the analysis time.

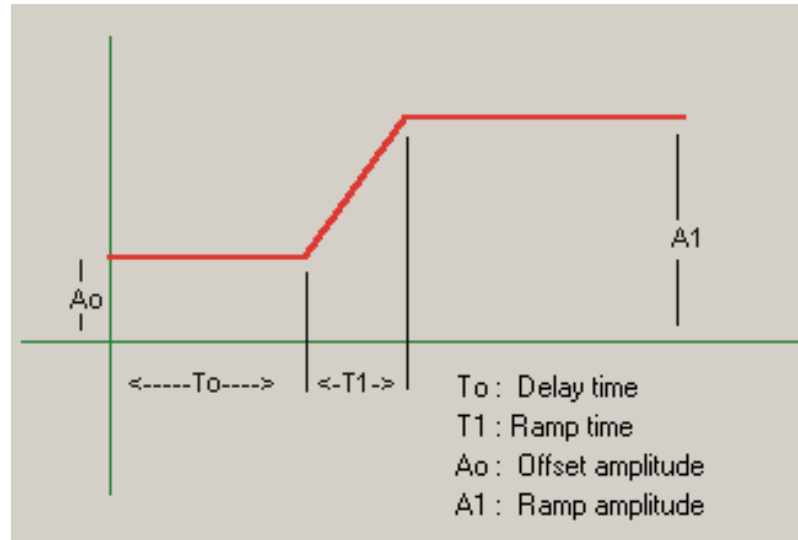
The parameters are as follows:

1. **Offset amplitude (A_o in volts):** this defines the amplitude of the output during the delay time (T_o). Its value must be a real number within the ± 10 volt range.
2. **Senoid amplitude (A_1 in volts):** once the delay time (T_o) has elapsed, a senoid is generated, the peak-to-peak amplitude of which is defined by double the value of this parameter. It must be a real number within the ± 10 volt range.
3. **Delay time (T_o):** this defines for how long the amplitude of the output signals is equal to the value defined as A_o .
4. **Frequency ($1/T_1$ hertz):** this parameter defines the senoid's frequency, and T_1 is its period.

Ramp

This is the format of a ramp-type analog signal.

Figure 73
"Ramp" representation



A ramp is a signal which, having remained at value A_0 over delay time T_0 , has gradually changed over a period T_1 until it reaches the value A_1 , where it remains until the analysis time has elapsed.

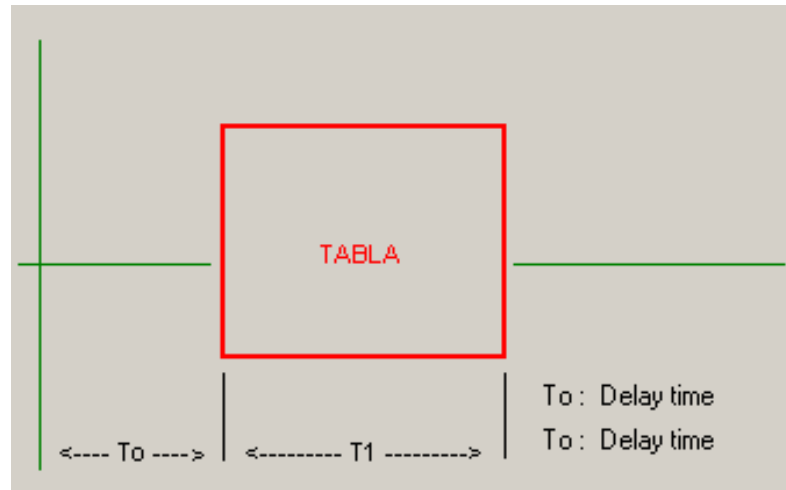
The parameters are as follows:

1. **Offset amplitude (A_0 in volts):** this defines the amplitude of the output during the delay time (T_0). Its value will be a real number within the ± 10 volt range.
2. **Ramp amplitude (A_1 in volts):** once the delay time (T_0) has elapsed, the value of the output will rise or fall with the slope in such a way that, when ramp time (T_1) is reached, it will have reached the value of this parameter, and remains at this value until pick-up has been completed. As in the case of the A_0 parameter, its value will be a real number within the ± 10 volt range.
3. **Delay time (T_0):** this defines for how long the amplitude of the output signal will be the value defined as A_0 .

Analog table

A table-type analog generator consists of a series of real numbers representing values between ± 10 Volts.

Figure 74
"Analog table"
representation



An initial delay time T_0 may likewise be defined.

The values of the table are applied periodically at the rate of one for every sampling time, once the delay time has been defined.

The tables are files with a TBA extension.

To select a table, the user clicks on the  button, and a dialogue box appears to allow a file to be selected.

The file selected will appear in the **File name** box.

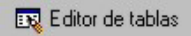
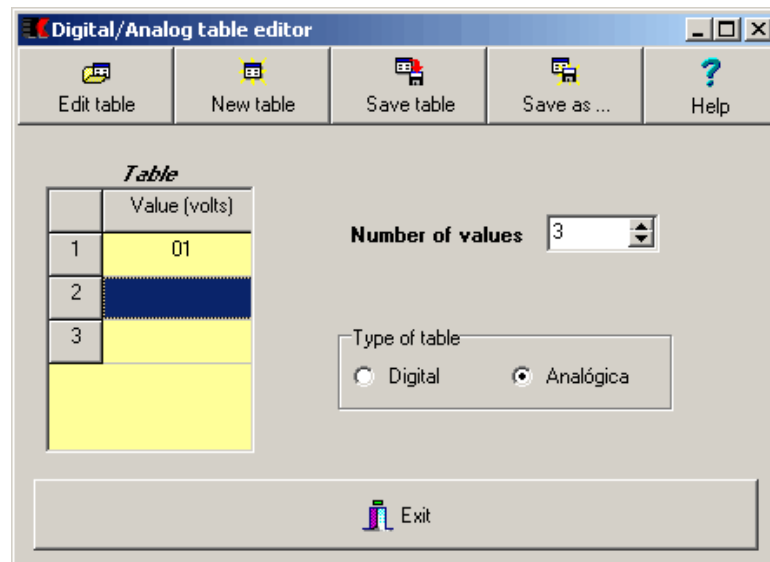
If the user wishes to edit or create a table, he must click on the Table editor button  Editor de tablas, and this activates the table editor.

Table Editor

The table editor is extremely reliable, and allows the user to create and edit tables with great ease.

Figure 75
"Editor of digital/
analog tables" window



The table editor has four options, as follows:

1. **Edit table** shows a dialogue box, **Open**, to allow the user to select the file to be edited. This may be edited once it appears on screen.
2. **New table** clears the screen and allows data to be entered, thus creating a new table.
3. **Save table** carries out the same procedure. In the case of a new table, it shows the **Save** dialogue box which allows the user to select the file name.
4. **Save as ...** always shows the **Save** dialogue box to give the file a new name and save the changes made.

The user clicks on **Exit** to close the table editor.

Defining the contents of the table

1. The **Number of values** box is used to specify the number of values which the table will have.
2. Enter the values in the table to the left, one value for each box.

3. Specify the type of table to be created in **Type of table**.
4. When this is saved, verification is carried out of the validity of the values, depending on the type of table with which we are working.

Operations

In addition to the signals from the SAD450 interface input and output channels, other signals may also be generated as the result of operations with the actual input and output signals.

Each time a reading is taken of data from a pick-up, we can automatically generate as many signals as operations we have defined.

Operations must always be between signals of the same type, i.e. an operation between analog signals or an operation between digital signals. These signals are generated during reading of the data, and thus cannot be used for pick-up.

If the **Activate operations** option in the configuration window is not activated, the operations defined will not generate signals.

If the **Activate operations** option is activated, for each pick-up we carry out a signal will be generated per operation defined.

These are affected by the automatic naming option (for more details, see Configuring a pick-up).

Both digital and analog operations may be defined; in each case with different operators between signals.

The difference between the **Signals calculator** and the operations is that the operations are generated dynamically, whereas the calculator operates with signals already picked up.

The user accesses definition of operations from the **Configure SAD450** window and clicking on the operations buttons.

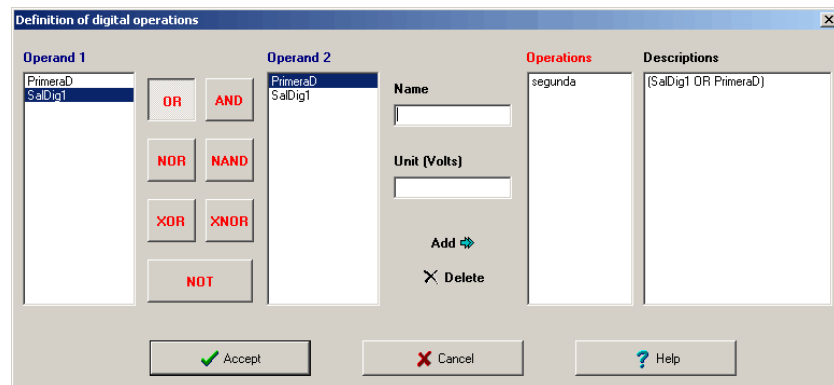
Figure 76
"Operations buttons"



Digital operations

The digital operations window is similar in appearance to a calculator.

Figure 77
"Definition of digital
operations" window



The two operand sections show the digital signals currently activated within the configuration.

The central section shows the operators which may be applied.

Digital operations which have been defined are shown to the right.

The various digital operations which may be carried out are as follows:

AND	OR	NOR	NAND	XOR	XNOR	NOT

The **Add** button adds the defined operation to the list of operations, whilst the **Delete** button eliminates operations which we no longer wish to use.

To exit without saving the operations defined, press **Cancel**.

To exit the window and save the operations defined, press **Accept**.

Defining a digital operation

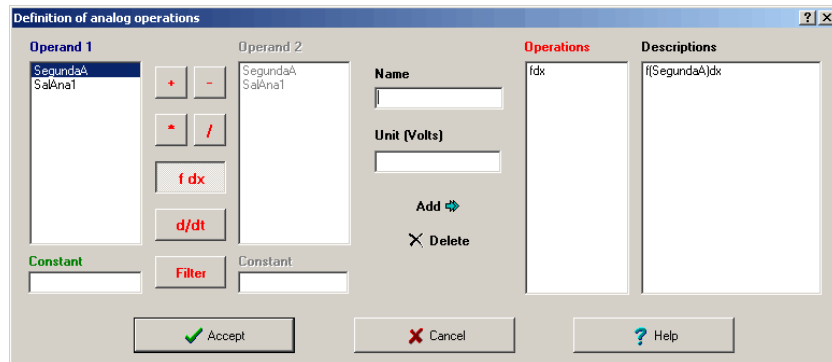
1. The user selects an operand from the **Operand 1** list.
2. The user then selects an operator by clicking on the appropriate button.
3. In the case of an operation involving more than one operand, an operand is selected from the **Operand 2** list.
4. The **Name** and **Unit** boxes are automatically activated, as is the **Add** button.
5. Define the name of the operation and the name of the units (Volts, by default).
6. When the user clicks on **Add**, the operation and the expression which represents it will appear in the list of **Operations** and **Descriptions**.

Analog operations

Deleting a digital operation

1. The user selects the operation from the **Operations** list, and clicks on the **Delete** button. The operation has been removed.

Figure 78
"Definition of analog operations" window



The two operand sections show all the analog signals currently active within the configuration.

The central section shows the operators which may be applied.

Digital operations which have been defined are shown to the right.

The various analog operations which may be carried out are as follows:

-	+	*	/	f dx	d/dt	Filters

The **Add** button adds the defined operation to the list of operations, whilst the **Delete** button eliminates operations we no longer wish to use.

To exit without saving the operations defined, press **Cancel**.

To exit the window and save the operations defined, press **Accept**.

Defining an analog operation

2. The user selects an operand from the **Operand 1** list, or enters a value in the **Constant** box.
3. The user clicks on the appropriate button to select an operator.
4. In the case of an operation involving more than one operand, an operand is selected from the **Operand 2** list, or a value is keyed into the **Constant** box.

5. The **Name** and **Unit** boxes are automatically activated, as is the **Add** button.
6. Define the name of the operation and the name of the units (Volts, by default).
7. When the user clicks on **Add**, the operation and the expression which represents it will appear in the list of **Operations** and **Descriptions**.

Deleting an analog operation

1. The user selects the operation from the **Operations** list, and clicks on the **Delete** button. The operation has now been eliminated.

Defining times

For any pick-up there are two time parameters, as follows:

- The analysis time or total time for the pick-up.
- The sampling time is the time which elapses between collection of one sample and the next.

For both configuration and programming of the pick-up, there is an option to change the sampling time and the analysis time.

The pick-up times or others selected will depend on the speed of the signal to be picked up. In other words, if the evolution of the signal is slow, the analysis time will be long, and vice-versa if its evolution is fast.

Figure 79
"Definition of times"
representation

The value of the **number of samples** is calculated each time a change is made to any of the two time parameters, and is the result of division of the analysis time between the sampling time plus 1 (another sample is added since samples are also taken during second 0 of the pick-up).

If the sampling time is short, the samples obtained are extremely close together on the signal, whereas if this is long, the samples will be more spaced out. In both cases we obtain an ordered collection of values.

The **units** of the time parameters may be selected from the pull-down lists to the right of the boxes in which the times are defined. The units may be: seconds, milliseconds, microseconds and, in the case of the analysis time, also minutes and hours.

If the times defined are not correct, a warning window will inform the user of the error.

Fastest possible pick-up

- When the user clicks on the **Fastest pick-up** button, the times are configured automatically.
- When this button is pressed the user cannot write in the boxes used to define the sampling time.
- The sampling time will adapt to the minimum time, depending on the configuration of inputs and outputs.
- The analysis time will adapt to allow the maximum number of samples depending on the memory of the interface.
- To disable this option, simply click on the button again.

Filters

The filters consist of specially designed systems which act on the signals to obtain a certain frequency response, with the common objective of restricting this response to a certain margin of interest.

The following are some of the most typical applications: suppression of undesirable frequencies in the signals measured (general noise), separation of components of a phenomenon for individual assessment, restriction of band pass for the use of other treatments at a later stage (integration, diversion etc).

Depending on the signal upon which it acts, a filter may be analog or digital. If the filter acts on an analog signal, it is called an “analog filter”. These filters consist of items such as resistors, capacitors, amplifiers etc. On the other hand, the term “digital filter” refers to the process or algorithm whereby a signal or sequence of numbers is transformed into a second sequence of numbers, and it is this type of filter which is used by the Kaptoris system.

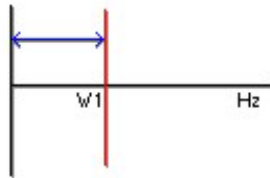
The digital filter used transforms the signal from the time domain to the frequency domain. In this domain, the components of the undesirable frequencies are removed by application of a filter, and the time domain is accessed again. This technique includes the use of the Fourier transforms and their implementation by means of “Fast Fourier Transform” (FFT).

A filter allows one or more frequency bands to be transmitted whilst rejecting signals whose frequency is not found on these bands. Definition of the pass bands allows the following classification to be made:

"Low pass" filters

These are filters which, above a given cut-off frequency, eliminate the magnitude of the signal, and transmit frequencies below the cut-off point unchanged

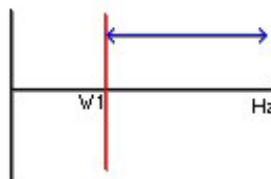
Figure 80
"Low-pass filter"
representation



"High pass" filters

These are filters which, below a given cut-off frequency, eliminate the magnitude of the signal, and transmit frequencies above the cut-off point unchanged.

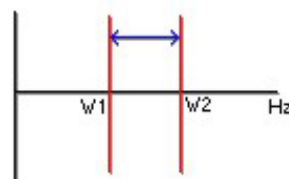
Figure 81
"High-pass filter"
representation



"Band pass" filters

When we combine the low pass filter with a high pass filter, we obtain what is known as a "band pass" filter. This type of filter transmits a certain band of frequencies, and removes the magnitude of the frequencies located outside the band.

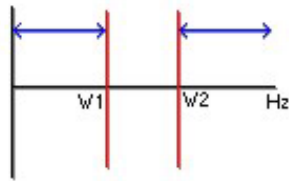
Figure 82
"Band-pass filter"
representation



"Stop band" filters

These filters may be used to remove the magnitudes of specific frequency bands

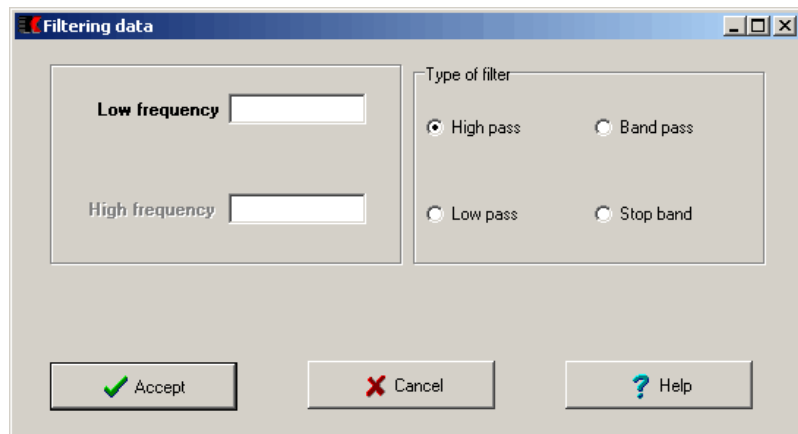
Figure 83
"Stop band filter"
representation



Once the signal has been filtered, the FFT inverse (IFFT) is used to move it to the time domain.

This is the window used to define the filter to be applied to the signal selected.

Figure 84



Following selection of the type of filter, a value must be provided for the frequency or frequencies which the user wishes to apply.

The filter is applied when the user clicks on **Accept**.

Pick-ups

What a pick-up is?

This section includes the steps taken from programming of the SAD450/SAD450M interface to reading of the data via serial line and its initial interpretation.

- When programming a pick-up, Kaptoris informs the SAD450/SAD450M interface as to the configuration which has been defined; i.e. the input / output channels to be activated and their properties, analysis and sampling times, and the way in which the pick-up is to be activated (by time or by trigger).
- When the SAD450/SAD450M has received all the configuration data, pick-up commences.
- Pick-up may be observed as it is being carried out using the Kaptoris display options.
- Once pick-up has been completed, the data are stored in the SAD450/SAD450M's memory, and so data reading must be carried out. Kaptoris requests the data from the interface, and the interface transmits the data via serial line. The programme automatically interprets the information received, and converts it into workable signals.

Programming a pick-up

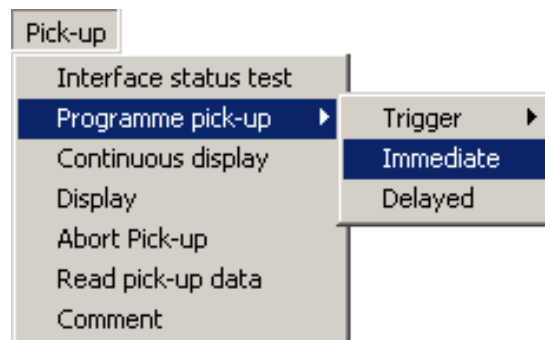
When a pick-up is to be programmed, whatever method is used, any other pick-up programmed is cancelled and any data stored are deleted. If this is the case, a window provides information with regard to the status of the SAD450/SAD450M interface and requests confirmation regarding continuity of the programming process.

Four different types of pick-up may be carried out depending on the activation method selected.

Immediate pick-up

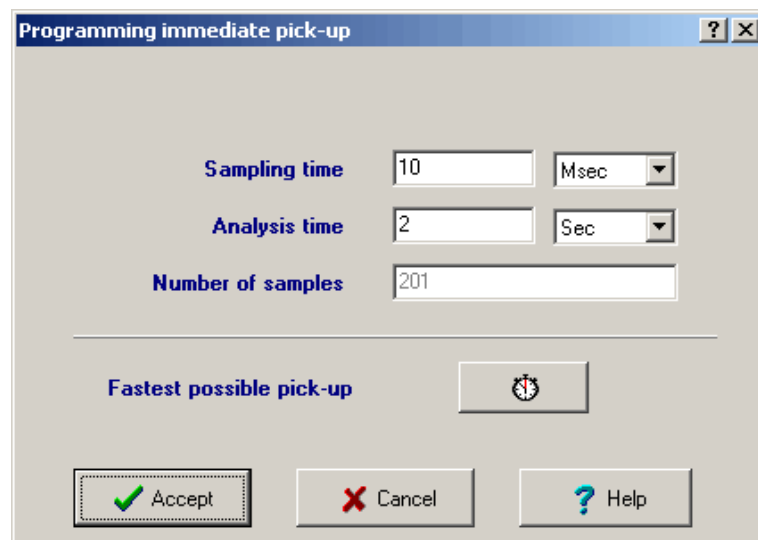
To access this type of pick-up, the user clicks on the **Prog.** button  on the tool bar, or on the **Programme pick-up** option and then on **Immediate** on the **Pick-up** menu.

Figure 85
"Programme immediate pick-up option" on the Pick-up menu



An immediate pick-up commences as soon as it has been programmed.

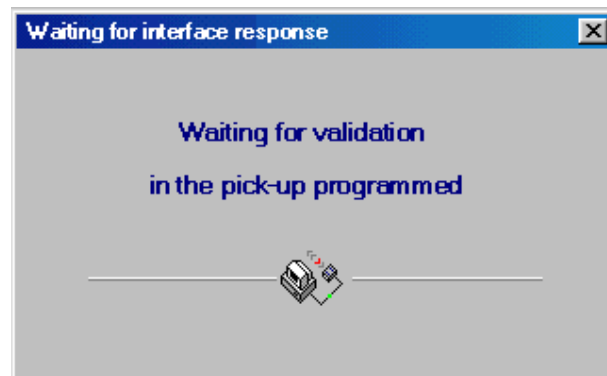
Figure 86
"Programme immediate pick-up" window



The window allows the user to redefine the times.

When the user clicks on **Accept**, a window appears requesting confirmation of the pick-up.

Figure 87
"Waiting for interface
response" window



This will disappear as soon as the programming has been validated by the SAD450 interface; otherwise a window will appear to indicate a communications error.

Between programming of an immediate pick-up and the first reading of the data, an icon appears on the status bar.

Figure 88



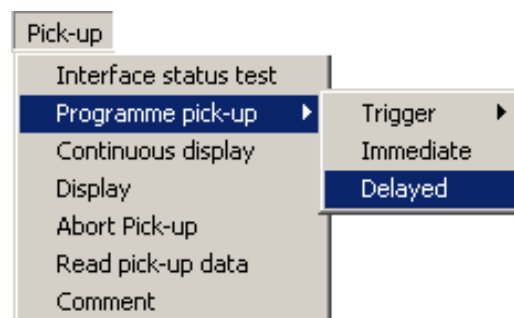
If the user wishes, he may display the pick-up whilst this is being carried out.

When the user clicks on **Cancel**, any changes made to the times will not be reflected in the configuration and the window duly closes.

Delayed pick-up

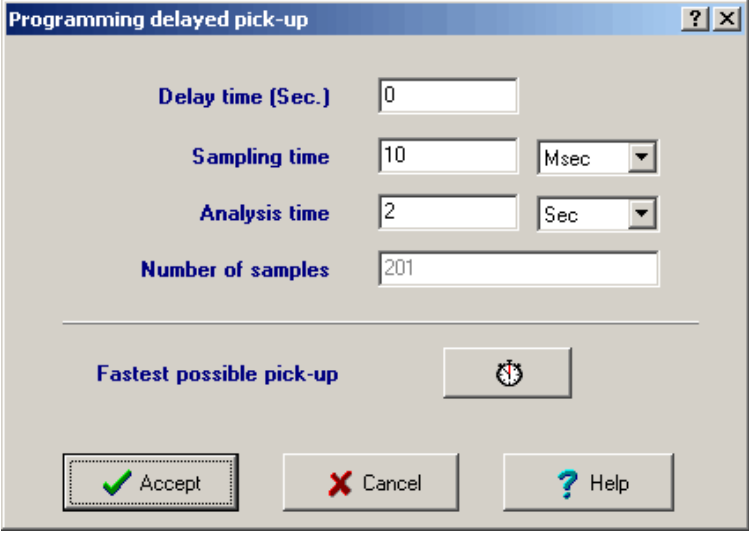
To access this type of pick-up the user clicks on the **Programme pick-up** option, and then on **Delayed** on the **Pick-up menu**.

Figure 89
"Programme delayed
pick-up" option on the
Pick-up menu



A delayed pick-up commences after a time delay To (in seconds) following programming.

Figure 90
"Programme delayed
pick-up" window

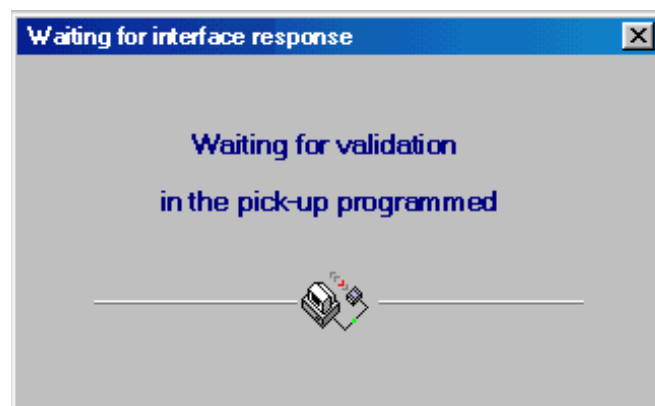


The top box is used to define the delay time in seconds. If a delay time of 0 seconds is programmed, this pick-up will be no different from an immediate pick-up.

The window may be used to redefine the times.

When the user clicks on **Accept**, a window appears to request confirmation of the pick-up.

Figure 91
"Waiting for interface
response" window



If all is well, this will disappear as soon as the programming has been validated by the SAD450 interface; otherwise a window will appear to indicate a communications error.

Between programming of a delayed pick-up and the first reading of the data, a chronometer icon appears on the status bar.

Figure 92



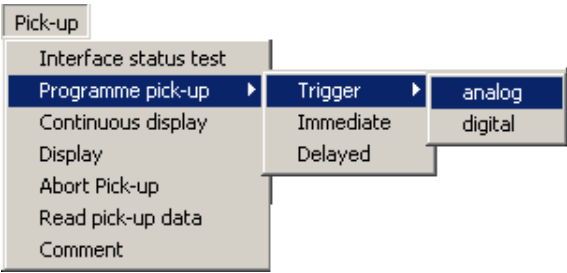
If the user wishes, he may display the pick-up whilst this is being carried out.

When the user clicks on **Cancel**, any changes made to the times will not be reflected in the configuration and the window duly closes.

Analog trigger

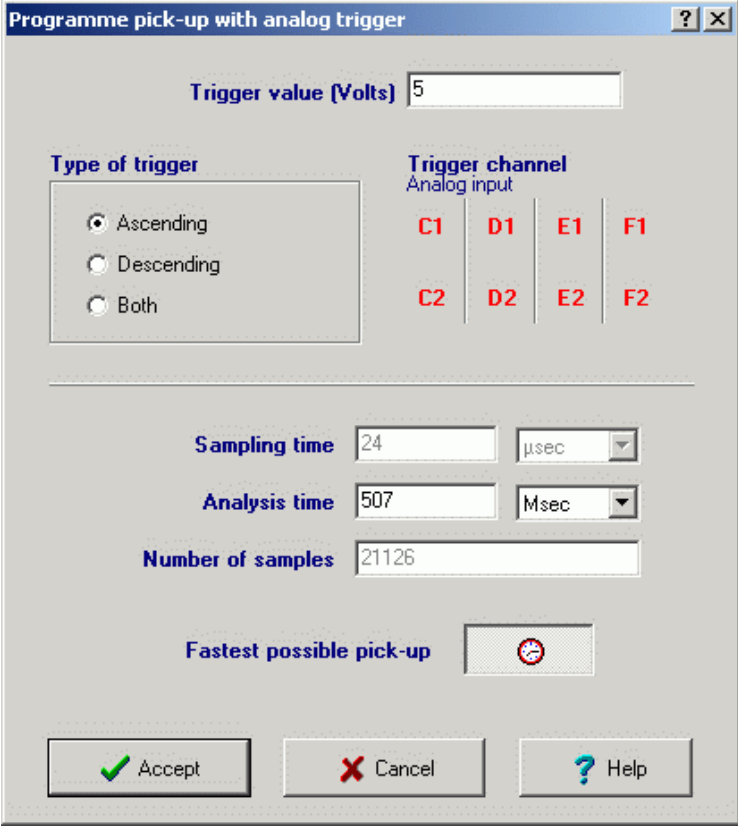
To access this type of programming, the user clicks on the **Programme pick-up** option, then on **Trigger**, and finally on **Analog** on the **Pick-up** menu.

Figure 93
"Programme analog pick-up" option on the Pick-up menu



An analog trigger pick-up commences when the analog channel selected as a trigger reaches the value specified.

Figure 94
"Programme analog
trigger pick-up"
window



Programme pick-up with analog trigger

Trigger value [Volts] 5

Type of trigger

☒ Ascending
☐ Descending
☐ Both

Trigger channel
Analog input

C1	D1	E1	F1
C2	D2	E2	F2

Sampling time 24 μsec

Analysis time 507 Msec

Number of samples 21126

Fastest possible pick-up

Accept Cancel Help

The value of the trigger is defined using the box in the top section (in volts).

The analog channel is defined by making a selection from the SAD450/SAD450M's eight analog inputs. Here the user simply clicks on one of the eight buttons representing the inputs.

There are three types of analog trigger, as follows:

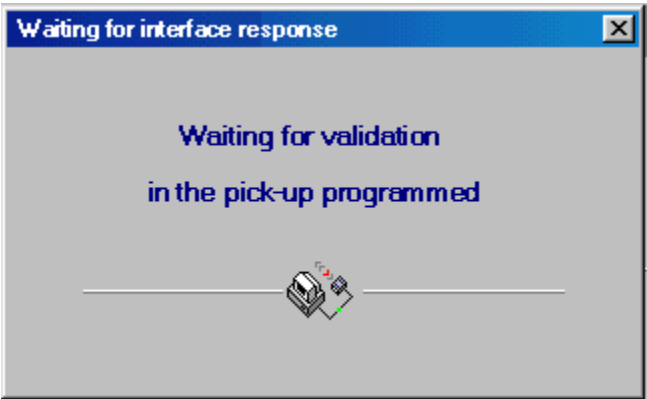
1. **Ascending** means that the previous value of the trigger must be lower than this value to activate the pick-up.
2. **Descending** means that the previous value of the trigger must be higher than this value to activate the pick-up.
3. **Both** means that when a value equal to that of the trigger arrives in the channel, the pick-up will activate.

To select the type of trigger, the user clicks on one of the three options in the **Type of trigger** group.

The window allows the user to redefine the times.

When the user clicks on **Accept**, a window appears to request confirmation of the pick-up.

Figure 95
"Waiting for interface response" window



If all is well, this will disappear as soon as the programming has been validated by the SAD450/SAD450M interface; otherwise a window will appear to indicate a communications error.

Between programming of a trigger pick-up and the first reading of the data, an icon appears on the status bar.

Figure 96



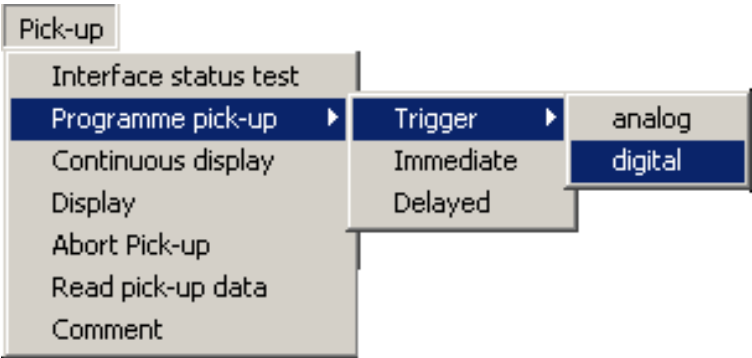
If the user wishes, he may display the pick-up whilst this is being carried out.

When the user clicks on **Cancel**, any changes made to the times will not be reflected in the configuration and the window duly closes.

Digital trigger

To access this type of programming, the user clicks first on the **Programme pick-up** option, then on **Trigger**, and finally on **Digital** on the Pick-up menu.

Figure 97
"Programme pick-up - digital trigger" option on the Pick-up menu



This type of pick-up commences when the digital channel selected changes in accordance with the type of trigger defined.

Figure 98
"Programme digital
trigger pick-up"
window

The trigger channel is defined by indicating the number of the SAD450/SAD450M digital input which is to be used. To do this, the user simply enters the number in the box on the top right-hand side of the window.

There are three types of digital trigger, as follows:

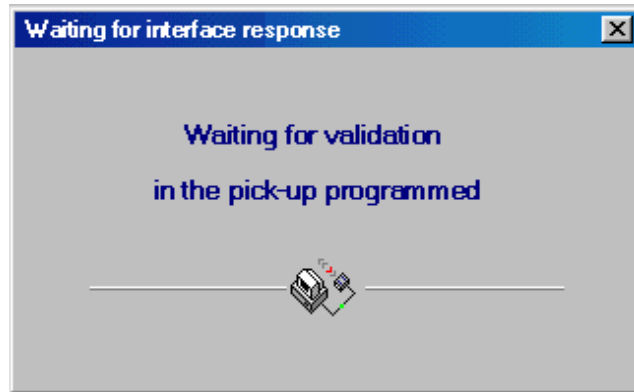
1. **Ascending** means that the pick-up will be activated on the first ascending flank arising in the trigger channel.
2. **Descending** means that the pick-up will be activated on the first descending flank arising in the trigger channel.
3. **Both** means that the pick-up will be activated on the first ascending or descending flank arising in the trigger channel.

To select the type of trigger, the user clicks on one of the three options in the **Type of trigger** group.

The window allows the user to redefine the times.

When the user clicks on **Accept**, a window appears to request confirmation of the pick-up.

Figure 99
"Waiting for interface
response" window



If all is well, this will disappear as soon as the programming has been validated by the SAD450/SAD450M interface; otherwise a window will appear to indicate a communications error.

Between programming of a trigger pick-up and the first reading of the data, an icon appears on the status bar.

Figure 100



If the user wishes, he may display the pick-up whilst this is being carried out.

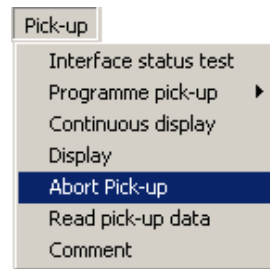
When the user clicks on **Cancel**, any changes made to the times will not be reflected in the configuration and the window duly closes.

Aborting a pick-up

When a pick-up has been programmed, and for some reason the user no longer wishes to carry this out, he may use the **Abort pick-up** option to cancel programming of the SAD450/SAD450M interface.

To abort a pick-up, the user simply clicks on the **Abort pick-up** option on the **Pick-up** menu.

Figure 101
"Abort pick-up" option
on the Pick-up menu

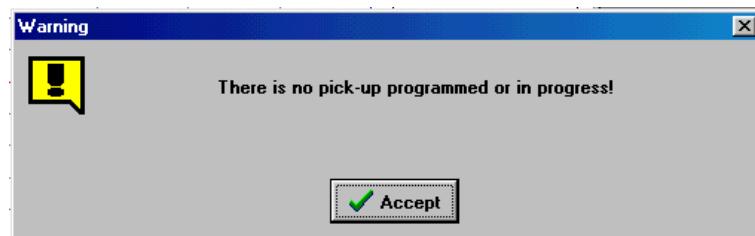


The pick-up may likewise be aborted by pressing the **Abort** button on the tool bar.



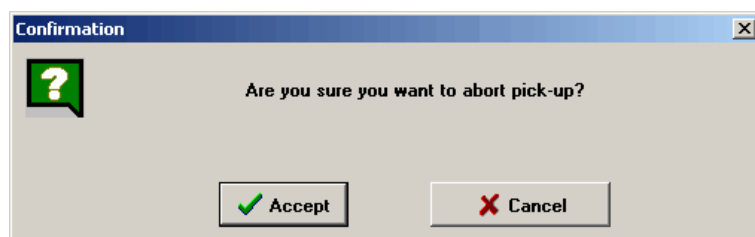
- If no pick-up has been programmed, the programme will show the next window to advise the user with regard to the status of the SAD450/SAD450M interface.

Figure 102
Warning window



- Kaptoris always shows a verification window, and asks if the user is sure he wishes to abort the pick-up.

Figure 103
Confirmation window



If the user selects **Accept**, the pick-up is cancelled, whereas **Cancel** continues with the pick-up.

N.B: If the pick-up had already commenced when the user aborts the procedure, the SAD450/SAD450M interface allows him to read any data picked up, but these may lack consistency.

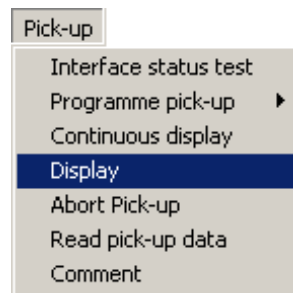
Displaying a pick-up

This option displays the signals whilst their data are picked up by the SAD450/SAD450M interface.

The display is carried out during the pick-up period, and the data appear on screen, sample by sample.

To display the data, the user presses **Display** on the main menu.

Figure 104
"Display" option on the
Pick-up menu



If, when the user wishes to display the data, no pick-up is being carried out or has been programmed, a warning window advises him of this situation.

If a pick-up is being carried out, a window appears to show the data being picked up.

When the user clicks on **Close window**, the display window closes.

A message is displayed on the bottom left of the window to inform the user when the pick-up has been completed.

Figure 105
"Pick-up complete"
button



Once the pick-up has been completed, the digital signals also acquire their final format.

Continuous display

This option is extremely useful when the user wishes to monitor the variation of a signal over an undefined period of time.

When the user clicks on **Continuous display** on the **Pick-up** menu, an immediate pick-up is automatically programmed with the configuration of inputs / outputs and times defined. The display window then activates and the programme starts to show the pick-up.

Once the analysis time has elapsed, the pick-up will reprogramme automatically and the display window will initialise to show again the signals being picked up.

The loop ends when the user presses **Close window** on the display window.

The recommended minimum analysis time for this programme command is 4 seconds. Shorter times would make Kaptoris reprogramme SAD450/SAD450M interface on a continuous basis.

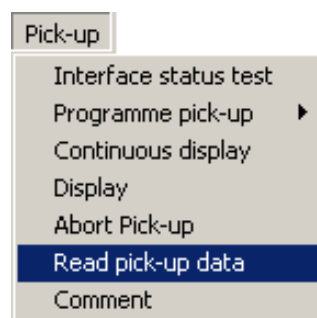
N.B.: The user may read off the last pick-up programmed during continuous display.

Reading data

To convert the data picked up into signals to allow the user to work with them in Kaptoris, a data reading must be carried out. Kaptoris requests the SAD450/SAD450M to send information with regard to the last pick-up, and interprets this by converting it into signals which may then be processed and analysed.

To obtain data concerning a pick-up from the SAD450/SAD450M interface, the user clicks on the **Read pick-up data** option on the **Pick-up** menu.

*Figure 106
"Read pick-up data"
option on the Pick-up
menu*

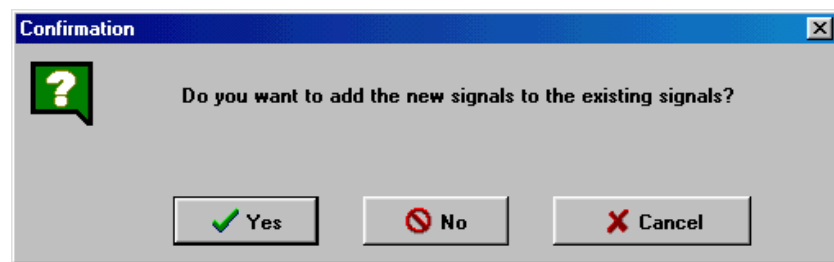


The user may also read the data by clicking on the **Read** button  on the tool bar.

If, when the user is reading the data, the set of signals is empty, an initial analog signal display window is created automatically, with a maximum of eight signals (for more information concerning signal display, consult Working with graphic representation).

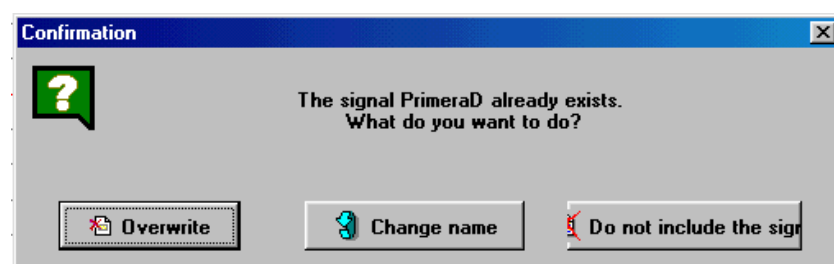
If, when the user is reading the new data, a set of signals already exists, the system will request confirmation with regard to how to proceed by means of a window which allows the user to choose between creating a new set of signals, discarding the existing signals, or adding the signals to the existing set.

Figure 107
Confirmation window



If the user wishes to add the signals, but the automatic naming option is not activated, it is possible that some signal names are repeats. This window will be shown for each repeat signal.

Figure 108
Confirmation window

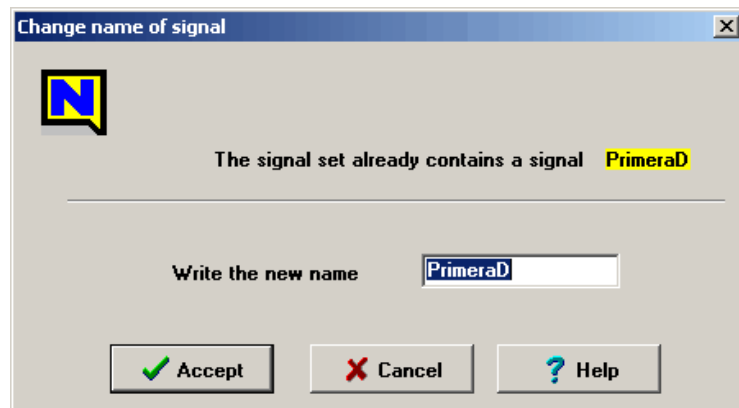


When the user clicks on **Overwrite**, the previous signal with this name will be replaced by the new signal.

When the user clicks on **Do not include the signal**, the signal will simply not be read and will not be included in the set of signals.

When the user clicks on **Change name**, he may use this window to change the name of the new signal.

Figure 109
"Change name of
signal" window



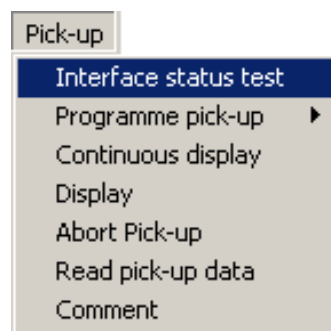
The user enters a new name in the box, clicks on **Accept**, and the new signal has been renamed. If the user presses **Cancel**, the signal will not be included in the set.

Testing the status of the SDA450 interface

This advises the user at any time of the status of the SAD450/SAD450M interface.

For the status of the interface, the user clicks on the **Test interface status** option of the **Pick-up** menu.

Figure 110
"Test interface status"
option on the Pick-up
menu

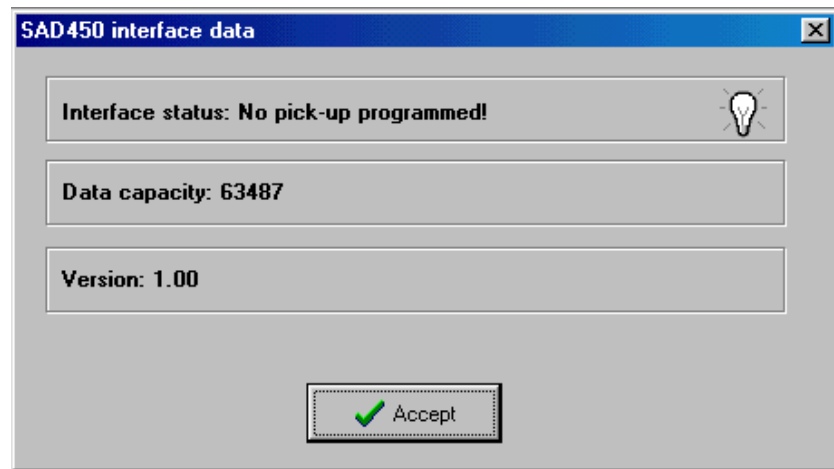


The user may also click on the **Test** button



on the tool bar.

Figure 111
"SAD 450 interface
status" window



Should the interface not respond, a message appears to advise the user that it has not proved possible to communicate with the interface. This may happen if the interface is not properly connected to the communications port or if it is simply not plugged in.

The SAD450/SAD450M interface has three possible statuses, as follows:

1. No pick-ups have been programmed and the interface memory contains no data for any pick-ups.
2. The interface is picking up data.
3. The interface has completed the last pick-up programmed, and the data are stored in its memory.

In addition to the interface status, the window also shows the interface memory in bytes, and its version.

Results

This section covers the options for processing of signals and data.

The SAD450/SAD450M interface does not need to be present to use these Kaptoris commands, since the operations are carried out using sets of signals which may have been picked up immediately, or could be from a pick-up file.

Pick-up files

Kaptoris allows the user to save the configuration and the set of signals with which he is working. He may also load a configuration and a set of signals obtained on a previous occasion.

This allows the user to work with sets of signals in the absence of the SAD450/SAD450M interface.

Working with no connection to the SAD450/SAD450M interface disables the pick-up options, but not the options for analysis and processing of signals.

The pick-up files have a **KPT** extension.

Saving a pick-up

When the user saves a pick-up in a KPT-extension file, this saves both the configuration and the total set of signals.

Saving a new document with no name

1. Click on the **Save** button  or on the **Save** option on the **File** menu.
2. To save the document in a different folder, click on a unit other than the **Save in** option, or double click on a different folder from the list.

3. Write a new name for the file in the **Name of file** box.

N.B.: Long descriptive names may be used for files if the user so desires.

Saving an existing document

Saving a copy of the document

1. Click on the **Save** button



or on the **Save** option in the **File** menu.

2. Click on **Save as** in the **File** menu
3. Write a new name for the file in the **Name of file** box.
4. Click on **Save**.

Suggestion: To save the copy in a different folder, click on another unit of **Save**, or click on a different name in the list of folders, or use both procedures.

Opening a pick-up

To open a Kaptoris file, proceed as follows:

1. Click on the **Open** button  or on the **Open** option of the **File** menu.
2. In **Search in**, click on the drive, folder or Internet site which contains the document.
3. In the list of folders, double click on the folders until the system opens the folder containing your document.
4. Double click on the document you wish to open.

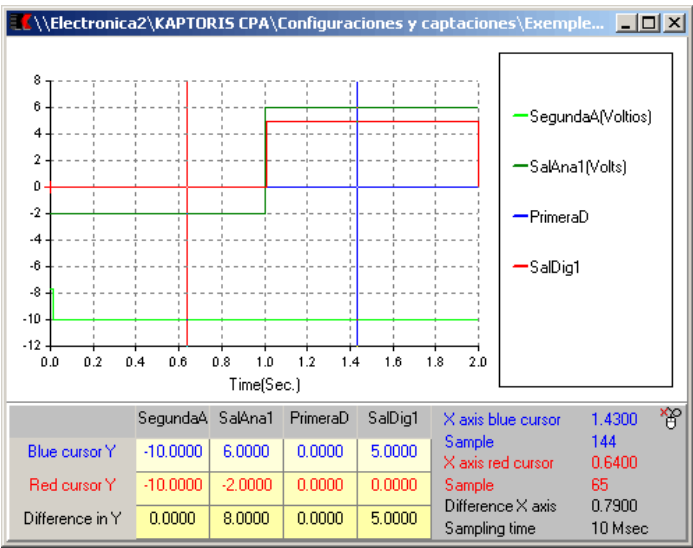
Working with graphic representation

Understanding the signals display window

These windows provide a graphic representation of data.

They can be of two types, depending on the type of signals displayed : digital or analog. The window functions in the same fashion whatever the signal type.

Figure 112
"Signal display"
window

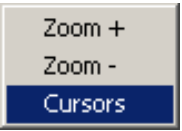


The digital signals are also displayed on the analog-type windows, with values between 0 and 5 volts.

The maximum number of signals represented in this type of window is eight. The right-hand side of the window shows the names of the signals, for ease of identification.

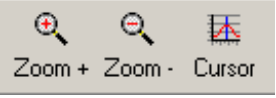
When the user clicks the mouse's right-hand button on the window, this menu appears with zoom options and cursor activation options.

Figure 113
Emerging menu



The same options are available on the tool bar, on the image buttons.

Figure 114
Graph representation
options



1. **Zoom +** enlarges the area selected by dragging the cursor.
2. **Zoom -** returns the window to its original appearance prior to activation of Zoom +.
3. **Cursors** activates the lower section of the window, highlighted in yellow (for more information, consult Cursors in the manual).

By default, the signals are represented as a function of time, but a signal may be represented as a function of another signal (for more information, consult *Selecting signals for display*).

The appearance of the signals may be modified using the menu option **Define representation**.

To select signals for display, click on **Select signals** from the **Representation** option on the main menu.

Selecting the signal to be displayed

If the user is in a signals display window and wishes, or does not wish, to see certain signals, he must choose the **Select signals** option on the menu, or click

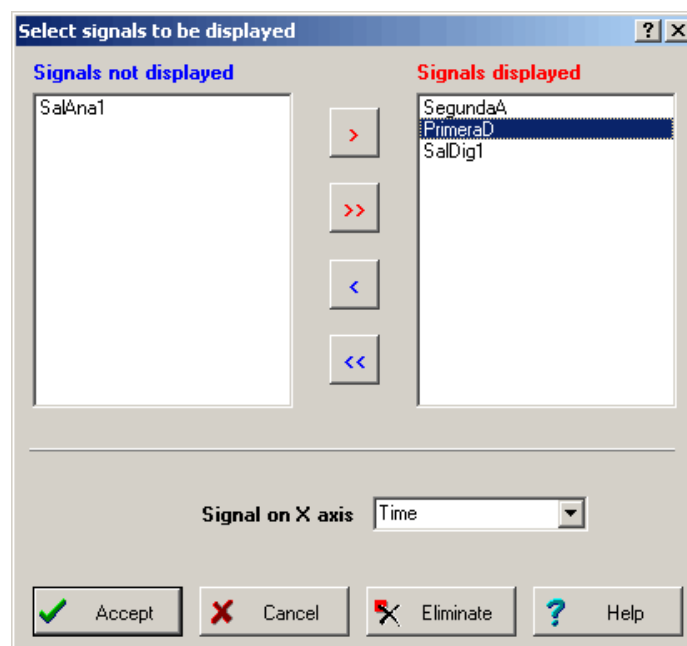
the **Select** button on the tool bar.



A window then appears with two lists. The list on the right-hand side shows the signals not included in the representation, whereas the left-hand list shows the signals included.

For selection of a signal, the user moves the signals he wishes to display to the right-hand side, and the signals he does not wish to see to the left-hand side.

Figure 115
"Select signals to be displayed" window

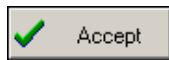


This window also allows us to eliminate signals. The lower box features the signal shown on the X axis. By default all the signals are represented as a function of time, but it is possible to represent a signal as a function of another signal by selecting it from the pull-down list which appears when the box button is clicked.

Eliminating signals

The “Select signals to be displayed” window is used for selection of signals.

1. Use the mouse or the keyboard to highlight the signals you wish to eliminate.
2. Click on the **Eliminate** button.
3. A message window will appear to request confirmation for elimination of the signals.
4. The signals will be permanently eliminated when the user clicks on **Accept**.



Working with cursors

A cursor is an indicator as to the values on the X and Y axes at a specific point on the graph. The values are shown on the table at the bottom of the screen. They are defined by the position of the cursor, i.e., in accordance with the part of the graph on which the user clicks the mouse.

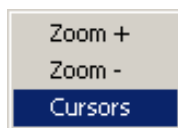
Each display window has two cursors in different colours.

The cursors are extremely useful for comparison of values at different points along the X axis.

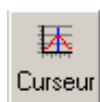
Activating the display window cursors

There are three ways of activating the cursors for a window, as follows:

1. By clicking the right-hand button of the mouse on the display window, and selecting the **Cursors** option.



2. By clicking the **Cursor** button on the tool bar.



3. By selecting the **Cursors** option on the **Representation** menu.

This activates the cursors on the signals display window in which the user is working.

The lower section of the window will show the data for the cursors.

Disactivating the display window cursors

The cursors may be deactivated in two ways, as follows:

1. By clicking on the  button at the bottom of the display window.
2. By clicking on the **Cursor** button  on the tool bar of the main menu.
3. By clicking on the **Cursors** option on the **Representation** menu.

Using the display window cursors

The blue cursor is positioned on the graph by clicking the right-hand button on the mouse. It is shown as a blue line perpendicular to the X axis, positioned at the clicking point.

The red cursor is positioned on the graph by clicking the left-hand button on the mouse. It is shown as a red line perpendicular to the X axis, positioned at the clicking point.

The table at the bottom of the window will show three values for each signal – the value on the Y axis of the blue cursor, of the red cursor and the difference between them.

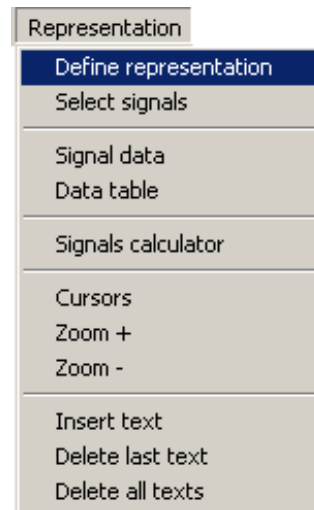
If the user keeps the button depressed and the mouse pointer is moved over the representation, the values update as the position changes.

N.B.: The direction keys may also be used to move the cursor over the graph.

Changing the appearance of the display

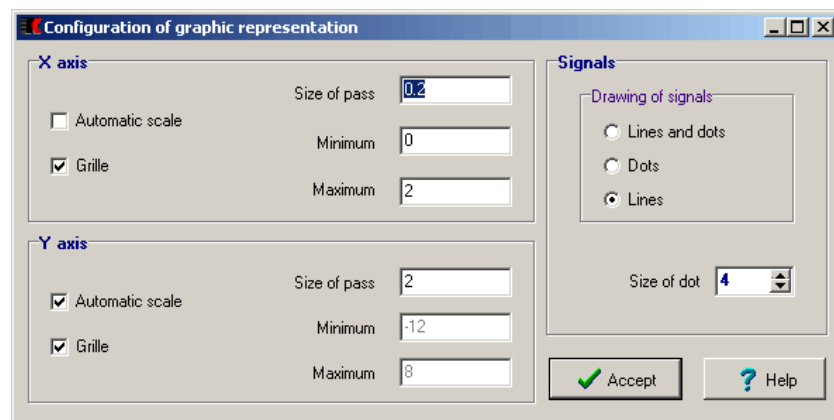
To change the appearance of a display window, select the **Define representation** option on the **Representation** menu.

Figure 116
"Define representation"
option on the
Representation menu



The following window appears:

Figure 117
"Configuration of graphic representation"
window



In this window the user may modify the way in which the signals are displayed:

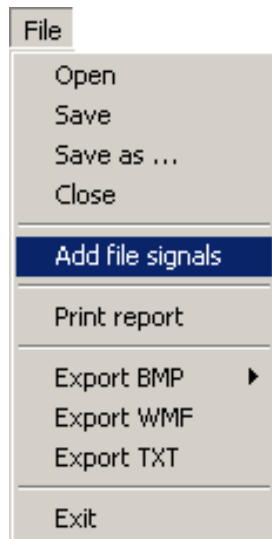
1. Changing the lines to dots in the **Drawing of signals** group.
2. Defining the size of the dots in the **Size of dot** box.
3. Activating or disactivating the **automatic scale** on both axes.
4. Activating or disactivating the **grille** on both axes.
5. If the automatic scale is disactivated, the user can manually define the **pass size** and the **maximum** and **minimum** values for both axes.

Adding signals from a file

Signals may be added from a file to the set of signals with which the user is working.

To carry this out, the user must have a set of signals and click on the **Add signals** option on the **File** menu.

Figure 118
"Add file signals"
option on the File menu

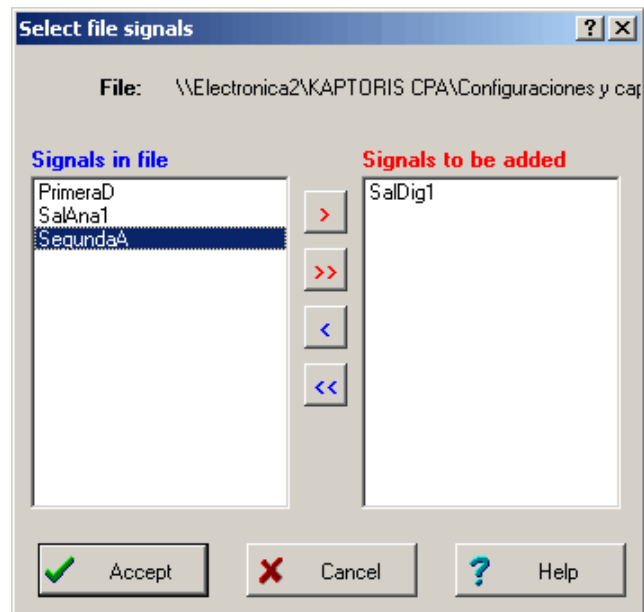


The system provides a typical dialogue box to allow the user to select any **KPT**-extension file.

Should the file selected and the current set of signals not prove compatible (their analysis and sampling times must be the same), an error message appears on screen.

A window appears to allow the user to select the signals we wish to add to the set from the file.

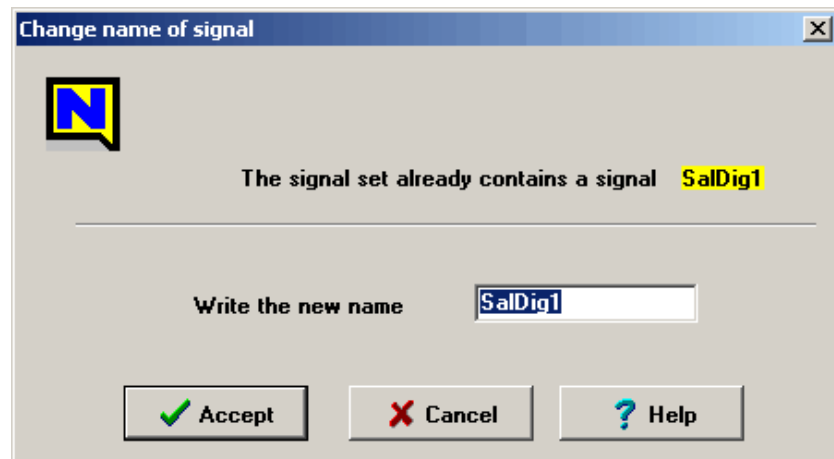
Figure 119
"Select file signals"
window



Once the signals have been selected, click on **Accept**.

If the name of one of the signals the user wishes to add is repeated within the current set of signals, a window appears to allow the user to give it a new name.

Figure 120
"Change signal name"
window



When the user clicks on **Cancel**, the signal will simply not be included in the set.

If the user clicks on **Accept**, the signal will be included under the new name written in the box.

Eliminating signals

The signals may be eliminated on the same window on which the signals the user wishes to view are selected. For information with regard to accessing the window, consult the help section “Working with graphic representation”.

Creating a new display window

Kaptoris can show a large number of display windows simultaneously, and the signals to be displayed from each of these may be selected.

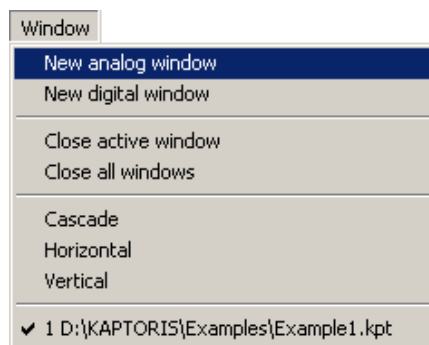
Should the user wish to add a display window to existing windows, he merely clicks on a button.

The user can create analog or digital display window, depending on the type of signals to be displayed.

The digital signals may be displayed in analog format but, should the user wish to see them in ‘0’ and ‘1’ logic values, they must be viewed in a digital display window.

To create a new analog display window, the user clicks on the **New analog window** option on the **Window** menu.

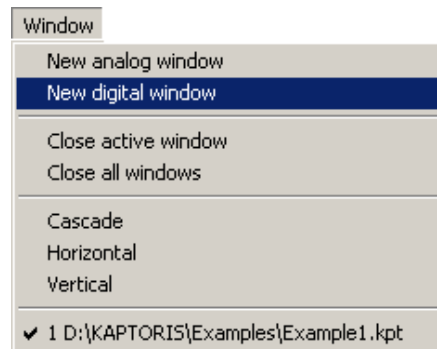
Figure 121
"New analog window"
option on the Window
menu



The user may also click on the **Analog** button  on the tool bar.

To create a new digital display window, the user clicks on the **New digital window** option on the **Window** menu.

Figure 122
"New digital window"
option on the Window
menu



The user may also click on the **Digital** button  on the tool bar.

The signals displayed initially are the first eight on the list.

The user may select the signals to be displayed. For more information, see Selecting signals.

Organising the windows

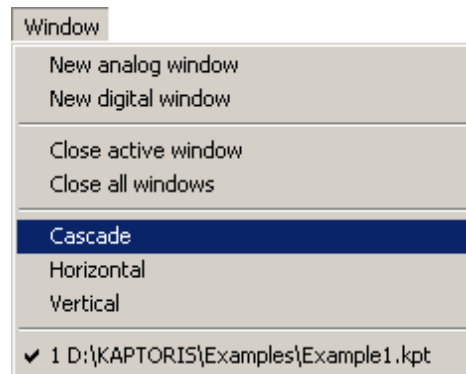
The display windows may be organised within the space available on screen. Their size and position may be changed manually, one by one or automatically.

The windows may be organised automatically in three different ways, as follows:

1. In cascade, by clicking on the menu's **Cascade** option.
2. Horizontally, by clicking on the menu's **Horizontal** option.
3. Vertically, by clicking on the menu's **Vertical** option.

The three options are to be found in the **Window** menu.

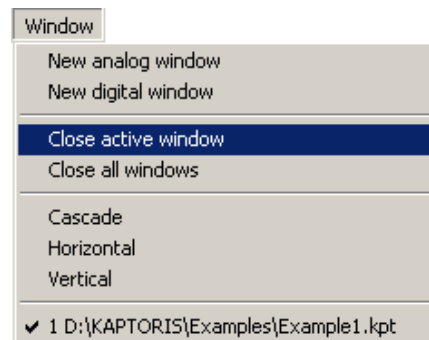
Figure 123
"Cascade",
"Horizontal" and
"Vertical" options on
the Window menu



Closing the windows

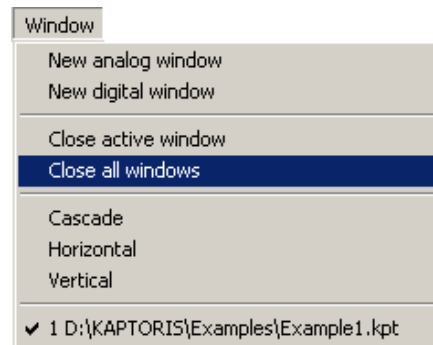
The active display window may be closed by clicking on the system icon  or clicking on the **Close active window** option on the Window menu.

Figure 124
"Close active window"
option on the Window
menu



The user may also close all display windows created, using the menu's **Close windows** option.

Figure 125
"Close all windows"
option on the Window
menu

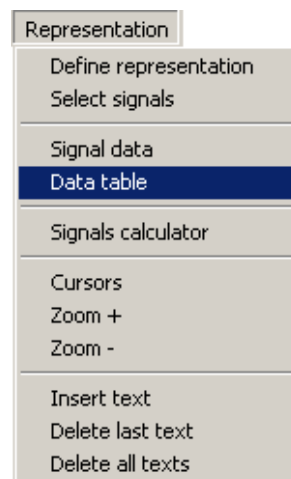


Data table

The data tables show in detail the values of each sampling process for the signals selected. The tables may be exported to text format and printed out.

To see the table, click on the **Data table** option on the **Representation** menu.

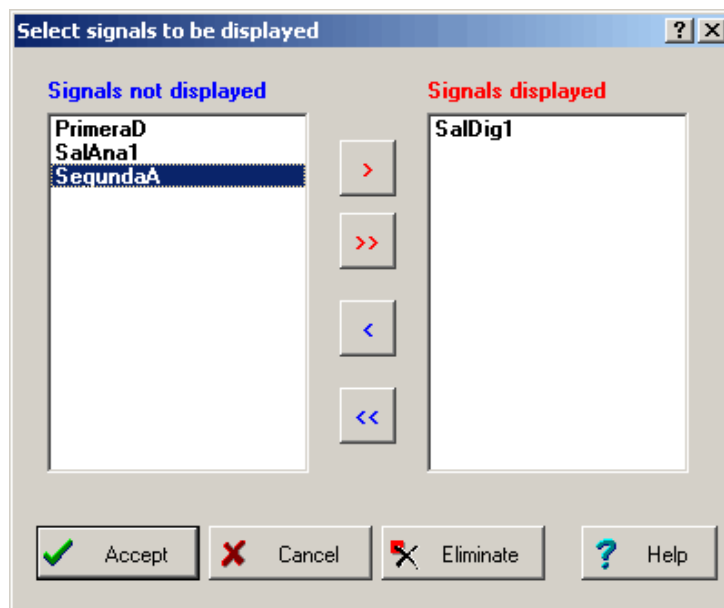
Figure 126
"Data table" option on
the Representation
menu



The user may also access the data table by clicking on the **Table** button  on the tool bar.

The user then selects the signals he requires. This is carried out by displaying the following window, which allows him to select, or eliminate, signals within the set.

Figure 127
"Select signals to be displayed" window



If no signal is selected, and the user clicks on **Accept**, a warning message appears.

Once the signals have been selected and the user clicks on **Accept**, the following window appears. The first row contains the names of the signals, whilst the first column shows the number of the sample.

Figure 128
Data table window

Data table				
Sample	SalDig1	PrimeraD	SalAna1	SegundaA
1	0	0	-2.0000	-7.6904
2	0	0	-2.0000	-10.0000
3	0	0	-2.0000	-10.0000
4	0	0	-2.0000	-10.0000
5	0	0	-2.0000	-10.0000
6	0	0	-2.0000	-10.0000
7	0	0	-2.0000	-10.0000
8	0	0	-2.0000	-10.0000
9	0	0	-2.0000	-10.0000
10	0	0	-2.0000	-10.0000

Export to TXT file
Print table
Help

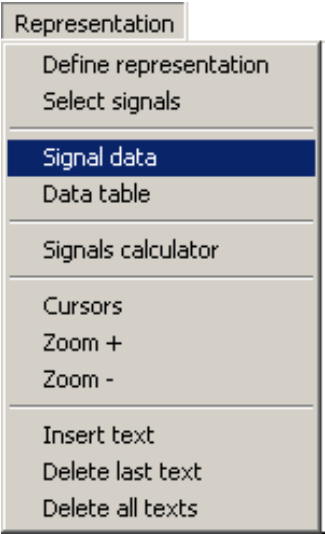
This window also allows the user to export signal data to text files by clicking on **Export to TXT file**, and to print them out by clicking on **Print table**.

To close the window, the user clicks on the system icon  or uses Ctrl+F4.

Signals data

If the user wishes to know other characteristics of the signals, such as their names or origin, he must click on the **Signals data** option on the main menu.

Figure 129
"Signal data" option on
the Representation
menu



The user may also access the data table by clicking on the **Data** icon  on the tool bar.

The window shows information concerning the characteristics of each signal.

Figure 130
"Signal data" window

The "Signal data" window displays configuration for a signal named "SalAna1". It is divided into several sections:

- Select a name:** A dropdown menu showing "SalAna1" and a refresh button.
- Origin:** A section for "Analog outputs 1".
- Form:** A section for "Step" form with parameters: Delay time: 1, Offset amplitude (Volts): -2, and Step amplitude (Volts): 6.
- Data:** A section showing signal statistics: Sampling time: 10 Msec, Number of samples: 201, Analysis time: 2 Sec, Type: Analog, Maximum: 6.00, Minimum: -2.00, Average: 2.02, and Integral: 4.04.

At the bottom, there are "Accept" and "Help" buttons.

The **Name** box shows the signal whose data are being displayed. To select another signal, the user clicks on the button on the box. A pull-down list appears, allowing the user to select from all the signals in the set.

The name of a signal may be changed by clicking on . The following window appears, allowing the user to rename the signal.

Figure 131
"Rename signal"
window

The "Rename signal" window prompts the user to enter a new name for the selected signal. It features a large "N" icon, a text input field labeled "Write the new name" containing "SalAna1", and "Accept" and "Cancel" buttons at the bottom.

The other data concerning the signal are as follows:

- The origin may be a signal picked up from the exterior or an output. The signal could also come from the calculator or from an operation.

- Depending on the origin, the bottom left-hand box will show data such as the type of generator for a digital output, or the input number where the signal was picked up. If the signal is from a calculator or a digital input, this box will be empty.
- The bottom right-hand box shows the values of a number of calculations which may be of interest to the user. In the case of an analog signal, the maximum, minimum, mean and integral values are shown, and in the case of a digital signal the number of ascending and descending flanks.
- The data on the top right-hand side are the same for any type of signal: sampling time, number of samples, analysis time and type of signal (analog or digital).

To exit this window the user clicks on **Accept**.

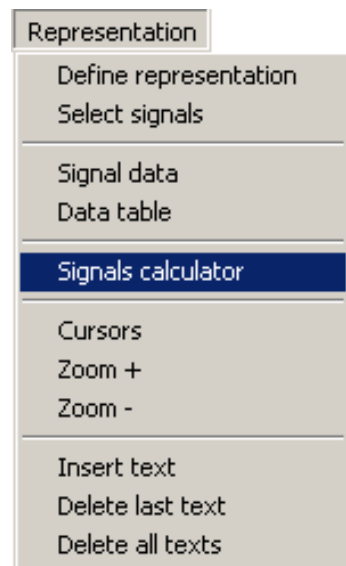
The signals calculator

This option allows the user to generate new signals from those already in the set of signals.

The calculator carries out calculations with analog and digital signals. It includes the same operators as the operations window, and the difference lies in that the signals generated by the calculator are isolated results. Each data reading generates a signal for each defined operation, and this is not the case for signals produced by the calculator.

The calculator is activated using the **Signals calculator** option on the **Representation** menu.

*Figure 132
"Signals calculator"
option on the
Representation menu*



The user may also access the data table by clicking on the **Calc.** icon on the tool bar.



on

The calculator allows the user to operate with signals of the same type, i.e. he may operate with analog or digital signals.

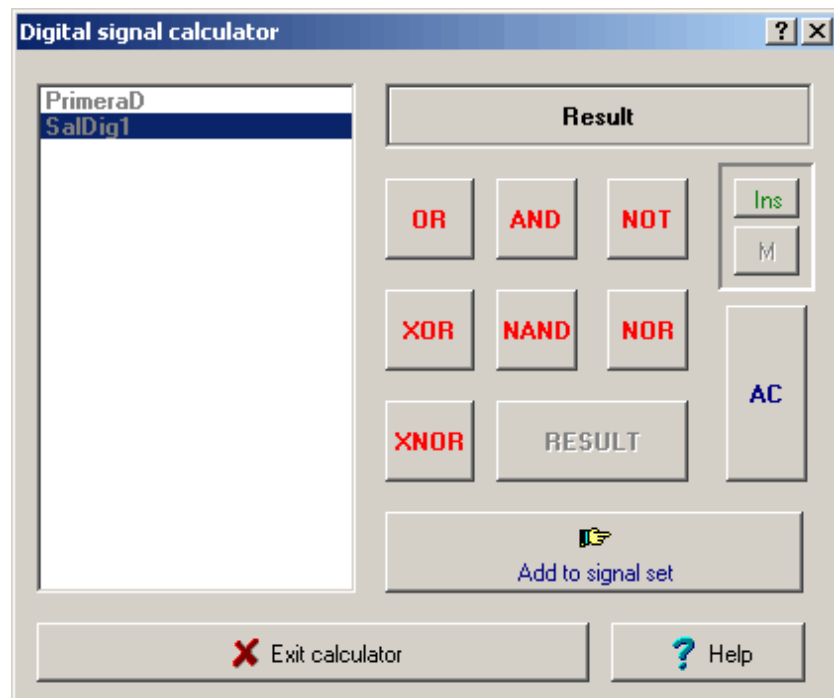
The type of calculator which appears when the signals calculator is activated depends on the type of graphic representation with which the user is working.

- If the user is working with a graphic representation of digital signals, the calculator activated will be a **digital signals calculator**.
- If, on the other hand, the user is working with a graphic representation of analog signals, the calculator activated will be an **analog signals calculator**.

Digital signals calculator

This type of calculator allows the user to perform calculations among the digital signals in the set of signals.

Figure 133
"Digital signals calculator"



The operations which can be carried out with the digital signals calculator are as follows: **OR, AND, XOR, XNOR, NOR, NAND** and **NOT**.

The result of an operation between signals is another signal. Once the calculation has been carried out, the user may select one of two procedures for the resultant signal, as follows:

1. Give it a name and add it to the set of signals.
2. Continue to operate with the resultant signal and another signal from the set.

The user exits the calculator by clicking on **Exit calculator**.

As of this moment, any signals generated in the calculator will be available in the set of signals.

Operating with the digital calculator

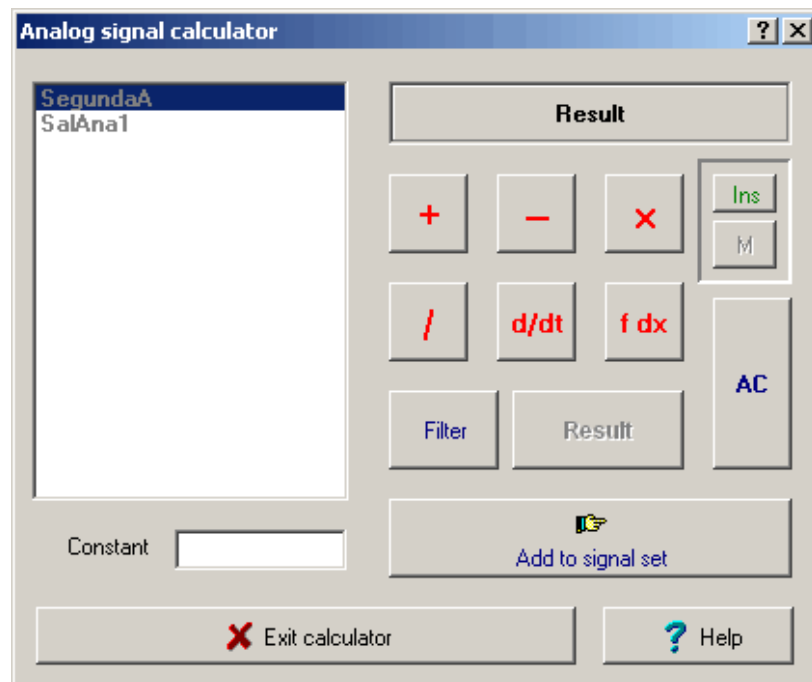
1. Select a signal from the list of digital signals. The name of the signal appears in the upper box, which shows the operations like a calculator as they are defined.
2. Click on the button showing the operation you wish to carry out.
3. Should another operand be taking part in the operation, select another signal from the list of digital signals.
4. All the operations buttons deactivate, and the **Result** button activates.
5. Click on **Result** to carry out the calculation for the operation defined.
6. The display shows the word "Result". The **Add to signal set** button activates.
7. If you wish to continue operations with the result, begin the sequence again from step 2.
8. Click on the **Add to signal set** button to move the "Result" signal to the set of signals.
9. A window appears requesting a name for the signal.
10. Click on **Accept** to add the signal to the calculator list and the set of signals with which you are working.

N.B.: The **AC** button clears the display like a normal calculator. The **Ins** and **M** buttons perform the memory functions of a normal calculator.

Analog signals calculator

This type of calculator allows the user to perform calculations among the analog signals in the set of signals.

Figure 134
"Analog signals
calculator"



The operations which can be carried out with the analog signals calculator are as follows: **add, subtract, multiply, divide, filter, integral and derivate.**

Operations may also be carried out between signals and constants.

The result of each operation between signals is another signal. Once the calculation has been carried out, the user may select one of two procedures for the resultant signal, as follows:

1. Give it a name and add it to the set of signals.
2. Continue to operate with the resultant signal and another signal from the set.

The user exits the calculator by clicking on **Exit calculator**.

As of this moment, any signals generated in the calculator will be available in the set of signals.

Analog signals calculator

1. Select a signal from the list of analog signals. The name of the signal appears in the upper box, which shows the operations like a calculator as they are defined.
2. Click on the button showing the operation you wish to carry out.
3. Should another operand be taking part in the operation, select the second operation signal or define a **Constant**.
4. All the operations buttons disactivate, and the **Result** button activates.
5. Click on **Result** to carry out the operation defined.
6. The display shows the word “Result”. The **Add to signal set** button activates.
7. If you wish to continue operations with the result, begin the sequence again from step 2.
8. Click on the **Add to signal set** button to move the “Result” signal to the set of signals.
9. A window appears requesting a name for the signal.
10. Click on **Accept** to add the signal to the calculator list and the set of signals with which you are working.

N.B.: The **AC** button clears the display like a normal calculator. The **Ins** and **M** buttons perform the memory functions of a normal calculator.

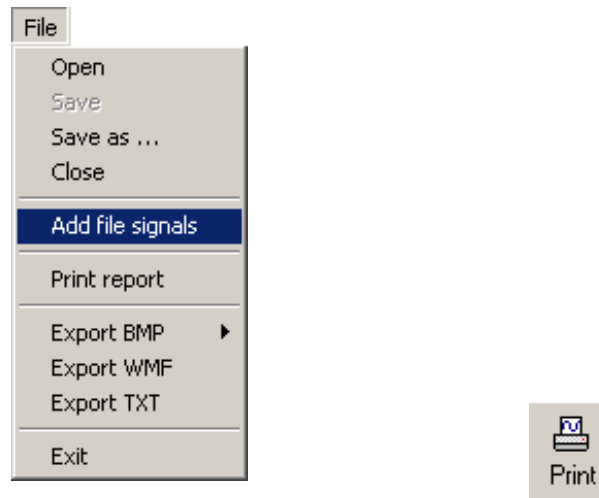
Reports

Kaptoris can print out reports which include the following:

- Graphic representation.
- Data table.
- Comments.

To access the reports window, click on the **Print report** option of the **File** menu.

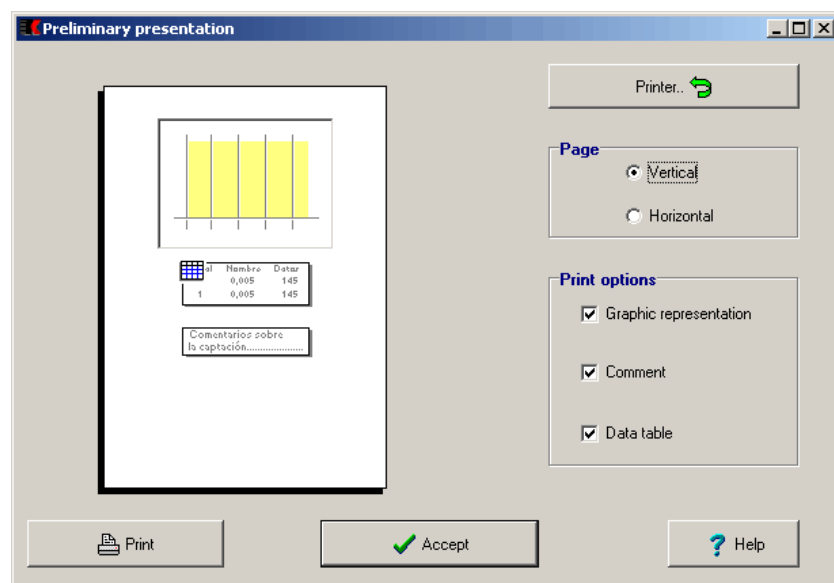
Figure 135
"Print report" option on
the File menu



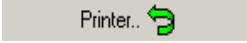
The user may also access the reports window by clicking on **Print** on the tool bar.

The window shows the appearance of the page, and the position of the various parts of the report on the page.

Figure 136
"Preliminary
presentation" menu



- The user may choose which parts of the report to print by selecting the appropriate verification boxes from the **Print options** group.

- The **Page** group is used to select either horizontal or vertical mode for the page.
- To see the properties of the printer, click on the **Printer** button , and the Windows printer dialogue box appears.
- Click on **Print** to print out the report.
- Click on **Accept** to close the window.

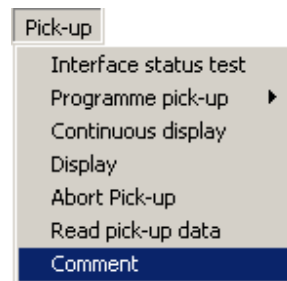
N.B.: If the user wishes to add personal data or data concerning the pick-up, these may be included using the comments section.

Adding a comment

The user may add a comment to the pick-up to provide more data, or to add personal data which may appear on the subsequent report.

To access the comment editor, click on the **Comment** option on the **Pick-up** menu.

*Figure 137
"Comment" option on
the Pick-up menu*



A window appears with a box for the user to write in comments, and a menu with three simple options.

Figure 138
"Comment on pick-up"
window



The menu commands are as follows:

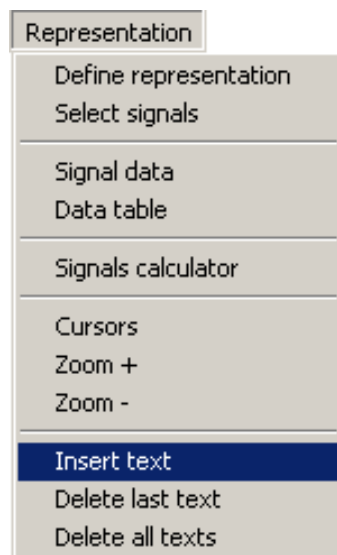
- **Clear** deletes all items written up to this point.
- **Open** shows the comment on the pick-up.
- **Save** saves the changes made to the comment.
- **Exit** closes the window and, should any changes have been made which have not yet been saved, the system provides the option of saving before the comment window closes.

Working with texts

It is possible to insert short texts into the graph, and position these as required.

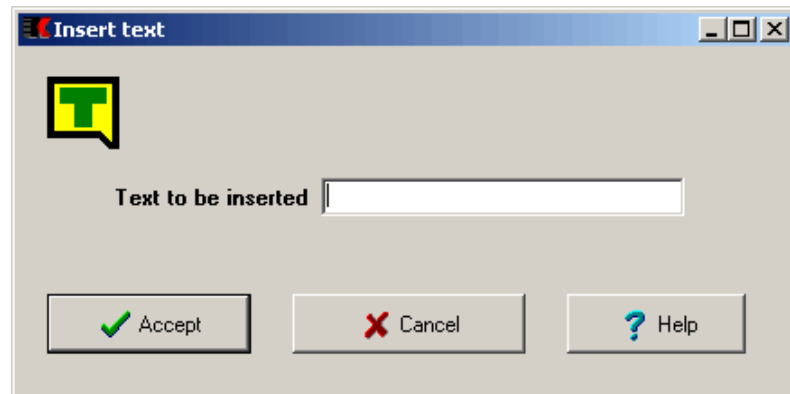
To insert an item into a text, click on **Insert text** on the **Representation** menu.

Figure 139
"Insert text" option on
the Representation
menu



A window appears with a box to write in the text to be inserted.

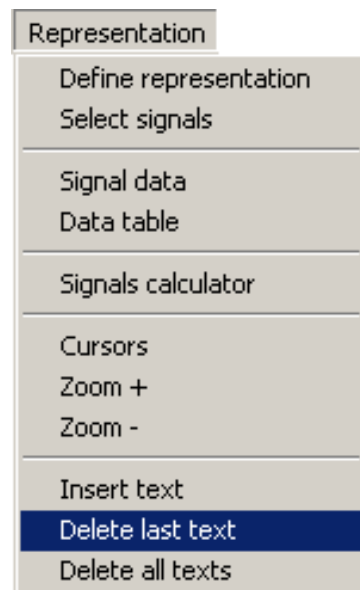
Figure 140
"Insert text" window



The user clicks on **Accept**, the text appears on the graph and may be positioned anywhere by using the mouse to drag it to the required position.

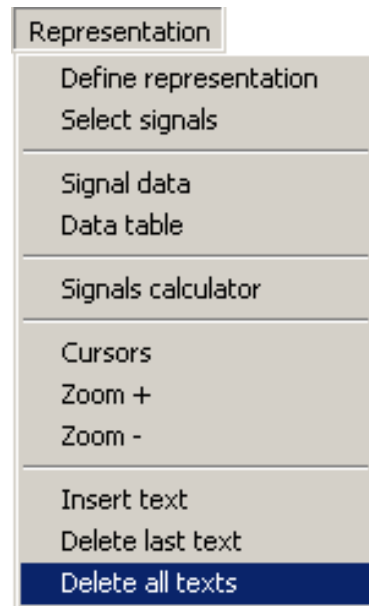
If the user wishes to eliminate the last text inserted, he simply clicks on the **Delete last text** option on the **Representation** menu.

Figure 141
"Delete last text" option
on the Representation
menu



If the user wishes to eliminate all text inserts from the graph, he clicks on **Delete all texts** on the menu.

Figure 142
"Delete all texts" option
on the Representation
menu



Exporting

Kaptoris allows the user to export data belonging to pick-ups which may be exported with graphic display as either Windows Bitmap (.BMP files) or Windows Metafile (.WMF files).

It is also possible to send the graphic display to the clipboard by clicking on the **Export .BMP** option, and then to **clipboard** on the **File** menu.

Detailed data for each sample and signal may be exported to text format (.TXT files).

.BMP format

1. To export a signal display, there must be first be a signal display window. Click on the **Export .BMP** option on the **File** menu.
2. A **Save** dialogue box appears. Write in the name you wish to give to the BMP file.
3. Click on **Accept**.

.TXT format

1. To export signal data, there must first be a set of signals. Click on the **Export .TXT** option on the **File** menu.
2. A **Save** dialogue box appears. Write in the name you wish to give to the TXT file.
3. Click on **Accept**.

.WMF format

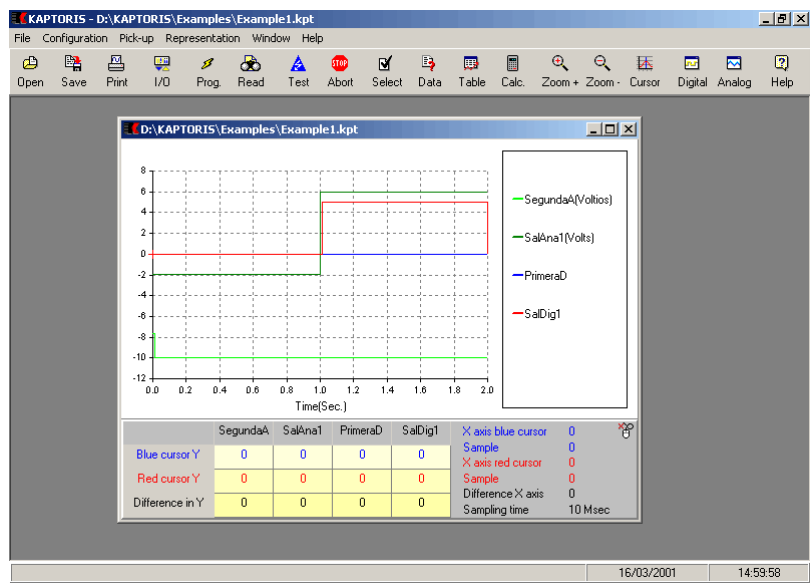
1. To export signal displays, there must first be a signal display window. Click on the **Export .WMF** option on the **File** menu.
2. A **Save** dialogue box appears. Write in the name you wish to give to the WMF file.
3. Click on **Accept**.

User interface

General description

The figure below shows the appearance of the main window for the Kaptoris application:

Figure 143
Main window



The window is divided into the following sections:

- **Menu**, showing all the Kaptoris commands.
- **Tool bar**, consisting of buttons which carry out the most frequent operations. Everything which can be carried out by clicking buttons on the tool bar can also be performed using the menu.
- **Signal visual display windows**. Any windows of this type may be opened, and they contain a graph section and a section of values which are activated by the cursor.

- **Status bar**, showing the date and time, with icons showing possible pick-ups and a line to explain the meaning of some buttons when the mouse arrow is positioned over them.

Menu

The following table shows all the menu commands and a brief description of the operations performed by them.

FILE menu

Open	Opens a Kaptoris .KPT extension file
Save	Saves the signals and the configuration in the file
Close	Closes the current set of signals and clears the configuration
Add file signals	Adds new signals to existing signals from a file
Print report	Provides a pre-display of the report to be printed out
Export BMP/ to file	Exports graphic representation to a BMP file
Export BMP/ to clipboard	Exports graphic representation to the clipboard
Exit	Closes the application

CONFIGURATION Menu

Inputs/outputs	Shows the configuration window for the inputs and outputs (I/O) belonging to the SAD450 interface
Appearance of I/O window	Shows a window where you can choose the kind of interface you will work with.
Open configuration file	Loads the configuration from a CFG file
Save configuration file	Saves the current configuration in a CFG file
Save as ...	Saves a copy of the CFG file under another name.

PICK-UP Menu

Test interface status	Tests the status of the SAD450 interface and shows the information
Programme pick-up/analog trigger	Programmes an analog trigger pick-up
Programme pick-up/digital trigger	Programmes a digital trigger pick-up
Programme pick-up	Programmes an immediate pick-up
Programme delayed pick-up	Programmes a delayed pick-up

Display	Displays the pick-up currently being performed
Continuous display	Programmes and displays the pick-up automatically until the user decides to halt the process
Abort pick-up	Aborts the pick-up programmed or being performed
Pick-up data read	Reads the SAD450 interface data and creates the signals
Comment	Opens the pick-up comment editor facility

REPRESENTATION Menu

Define representation	Defines the style of the graphic representation
Select signals	Selects the graphic representation signals
Signal data	Views the general characteristics of the signals
Data table	Shows the table with all samples for each signal
Signals calculator	Digital/analog calculator for most frequent operations
Cursors	Activates the cursors option for the active graphic representation
Zoom +	Enlarges the area selected on the graphic representation
Zoom -	Returns the graphic representation to its normal appearance
Insert text	Inserts a short text in the graphic representation
Delete last text	Deletes the last text inserted in the graphic representation
Delete all texts	Deletes all texts inserted in the graphic representation

WINDOW Menu

New analog window	Creates a new graphic representation window with analog signals
New digital window	Creates a new graphic representation window with digital signals
Close active window	Closes the graphic representation window activated
Close all windows	Closes all the graphic representation windows
Cascade	Organises the windows in a cascade
Horizontal	Organises the windows in horizontal format
Vertical	Organises the windows in vertical format

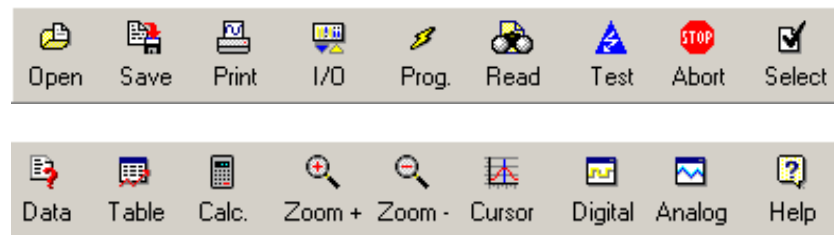
HELP Menu

Help topics	Opens the Kaptoris help facility and shows its contents
About Kaptoris	Shows the Kaptoris information window

Tool bar

The tool bar contains a subset of the operations which may be carried out using menu commands.

Figure 144
Tool bar



These buttons may be used to carry out the following operations:

	Opens a pick-up file.
	Saves the pick-ups' data and configuration.
	Prints out customised reports.
	Configures the SAD450 interface inputs and outputs.
	Tests the status of the SAD450 interface at any time.
	Programmes an immediate pick-up.



Read

Reads the data which the SAD450 interface contains.



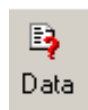
Abort

Aborts the pick-up being performed.



Select

Selects the signals appearing on the active graphic representation.



Data

Shows the characteristics of the signals.



Table

Displays, prints out and exports data from signal sampling.



Cursor

Displays values in accordance with cursors on graphic representation windows.



Zoom +

Enlarges the graphic representation.



Zoom -

Returns the graphic representation to its original size



Analog

Creates a new graphic representation window for analog signals.



Digital

Creates a new graphic representation window for digital signals.



Help

Provides access to the Kaptoris help facility.

Extension of files

The Kaptoris application features three types of files, as follows:

1. **KPT.** Kaptoris files which include configuration and signals.
2. **CFG.** Configuration files.
3. **TBA.** Files containing digital or analog tables

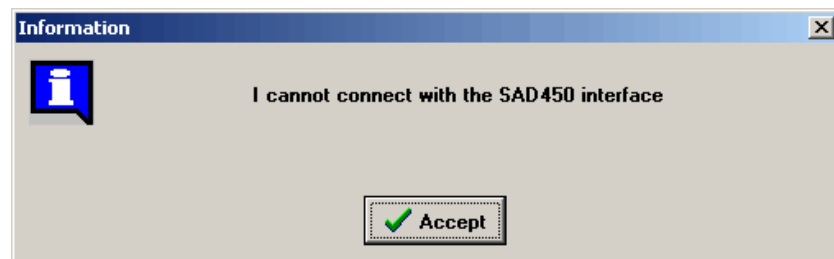
Data may also be exported in various formats, as follows:

- **BMP.** Graphic representation to a Windows bits map.
- **WMF.** Graphic representation to a Windows meta-file.
- **TXT.** Sample data table to text file

Information windows

These windows provide a warning message, and normally have only one button, **Accept**, which closes the window when it is clicked.

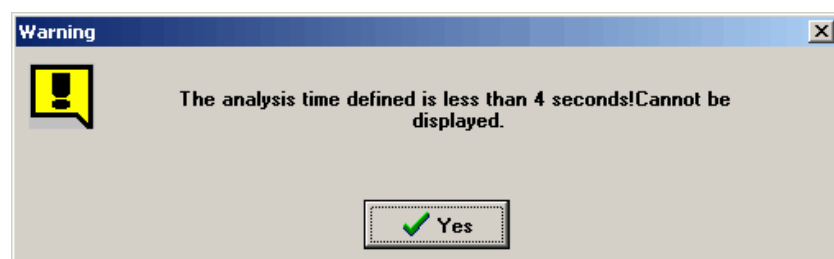
Figure 145
Information window



Warning windows

These windows show a message following an error, and normally have only one button, **Accept**, which closes the window when it is clicked.

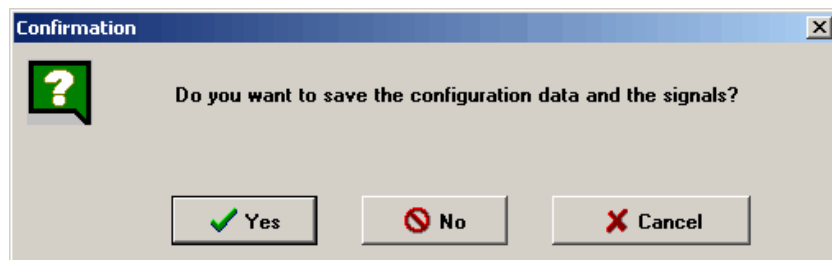
Figure 146
Warning windows



Confirmation windows

These windows request confirmation from the user with regard to the next operation to be carried out. Normally this type of window asks if the user wishes to save the changes.

Figure 147
Confirmation window

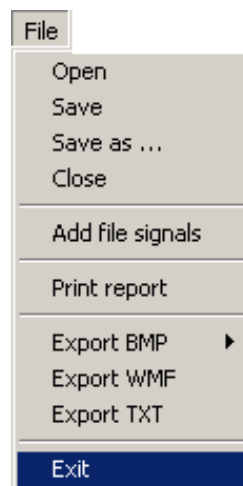


Exiting Kaptoris

The user can close the Kaptoris application in three ways, as follows:

1. By clicking on the system button  in the top right-hand corner of the main window.
2. By clicking on the **Exit** option on the **File** menu.

Figure 148
"Exit File menu" option



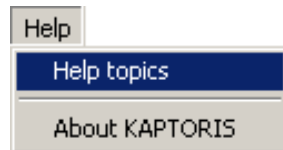
3. Using the Ctrl+F4 key combination.

N.B.: If the last changes have not been saved, the programme allows the user to save these before exiting.

Use of the help facility

The user may obtain help by following the normal procedure. He simply clicks on **Help topics** on the main Kaptoris menu. He then clicks on the **Contents** file to move around the help file's contents table. He can enter the **Index** file to carry out a topic search using the **Help** facility's index of topics, or he can use the **Search** file and its text search function to find specific words and phrases.

Figure 149
"Help topics" option on
the Help menu



? The suggestions show information concerning the various items which appear on screen. To see a suggestion relating to a dialogue box option, click on the question mark and then click on the option. To see the name of a tool bar button, place the mouse arrow over the button until the name appears.

Practicals

Practical 1

This practical will configure two inputs, two outputs and an operation. The system will perform a delayed pick-up, and then display the data table. The “Signal data” option is also involved in this practical.

The first step consists of configuring the inputs and outputs involved in the configuration.

The user must activate digital input A1 and digital analog C1, and this is carried out by clicking on the appropriate verification boxes.

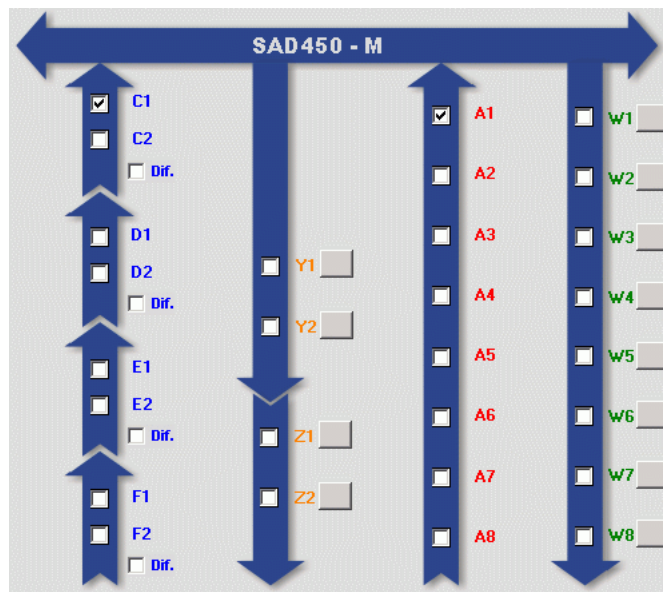
With SAD450:

Figure 150

Input Type	Input Label	Input 1	Input 2	Dif.
Digital inputs	A	☒	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
Digital inputs	B	☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
Analog inputs	C	☒	☐	☐
		☐	☐	☐
Analog inputs	D	☐	☐	☐
		☐	☐	☐
Analog inputs	E	☐	☐	☐
		☐	☐	☐
Analog inputs	F	☐	☐	☐
		☐	☐	☐

With SAD450M:

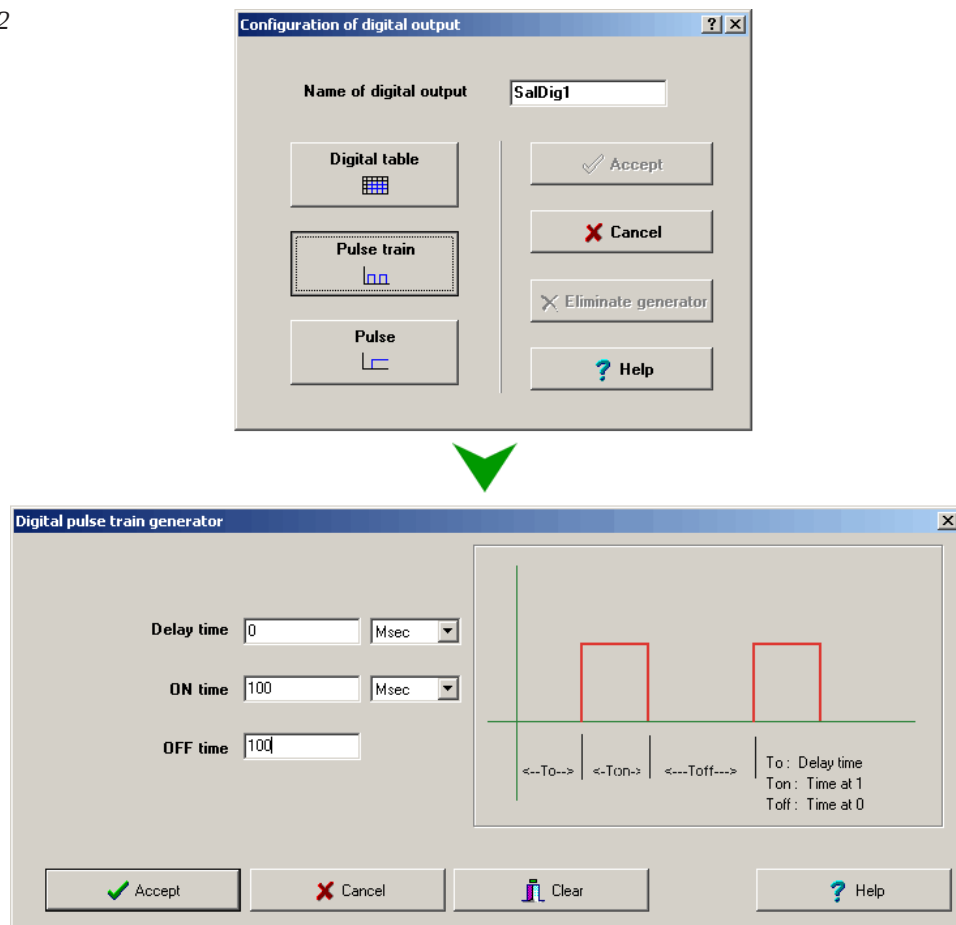
Figure 151



The user now defines two outputs with the following data:

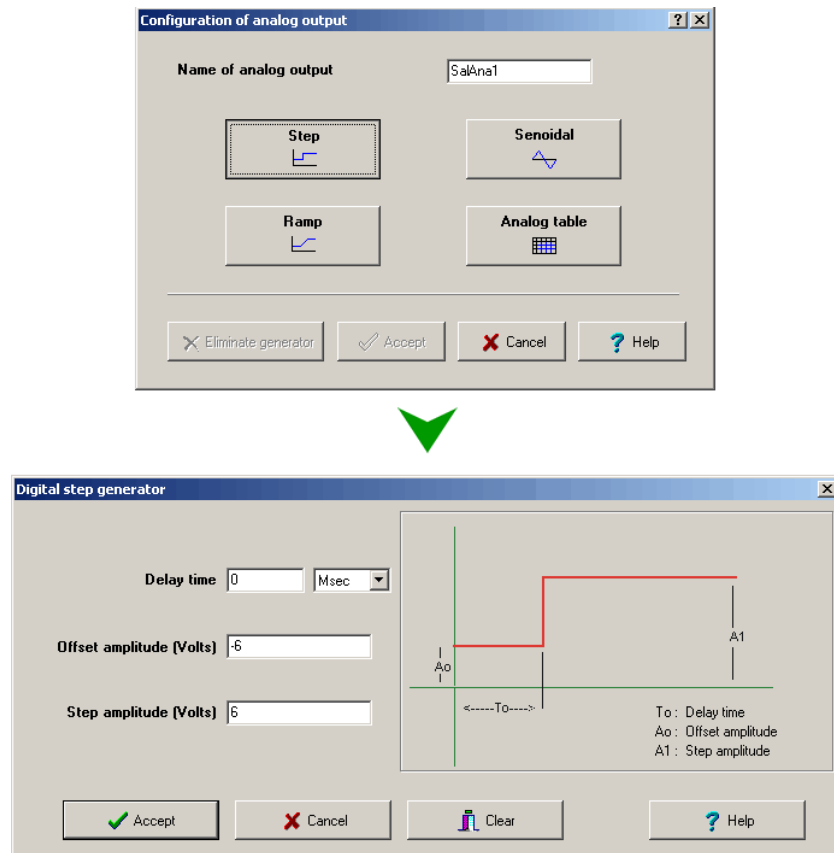
- Digital output W1
 - Name : *Saldig1*
- Generator : *Pulse train*
 - Delay time: *0 seconds*
 - Time at 1 (Ton): *100 milliseconds*
 - Time at 0 (Toff): *100 milliseconds.*

Figure 152



- Analog output Y1
 - Name : SalAna1
 - Generator: Step
 - Delay time: 1 second
 - Offset amplitude (Ao): -6 volts
 - Step amplitude: 6 volts

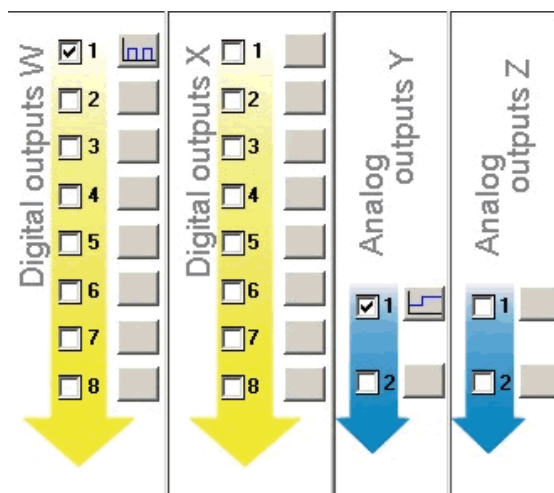
Figure 153



Once these two channels have been defined, the outputs section of the “Configuration of inputs/outputs window” looks like this:

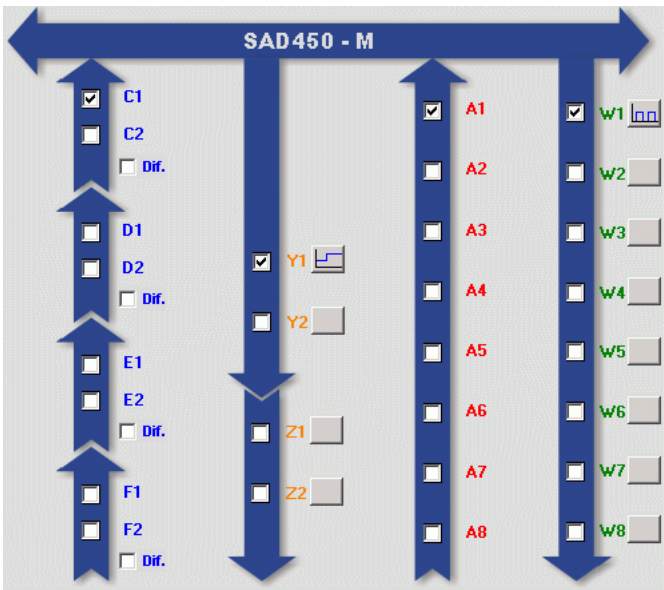
With SAD450:

Figure 154



With SAD450M:

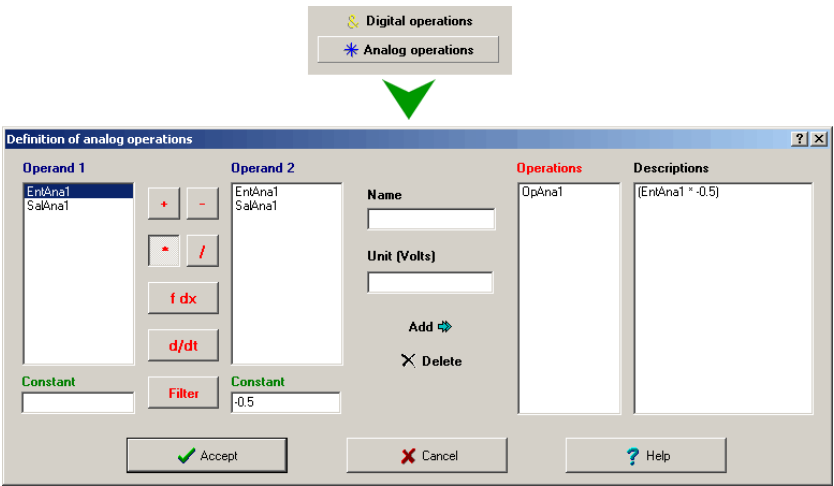
Figure 155



The user must now define an analog operation by clicking on the **Analog operations** button. The operations window appears, and the operation to be defined is as follows:

- Name: OpAna1
- Description : $EntAna1 * -0.5$

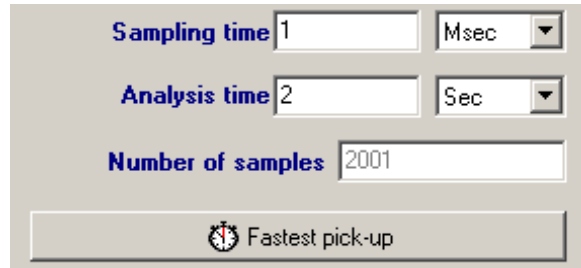
Figure 156



The user then defines the times:

- *Analysis time: 2 seconds*
- *Sampling times: 1 millisecond*
- *Number of samples: 2001*

Figure 157

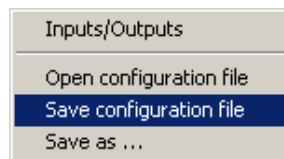


The screenshot shows a configuration dialog box with three input fields and a button. The first field is labeled 'Sampling time' with the value '1' and a unit dropdown set to 'Msec'. The second field is labeled 'Analysis time' with the value '2' and a unit dropdown set to 'Sec'. The third field is labeled 'Number of samples' with the value '2001'. At the bottom is a button with a clock icon and the text 'Fastest pick-up'.

The configuration has now been completed, and the user clicks on **Accept**.

If you intend to use this configuration, it must be saved. Click on the **Save configuration** option.

Figure 158

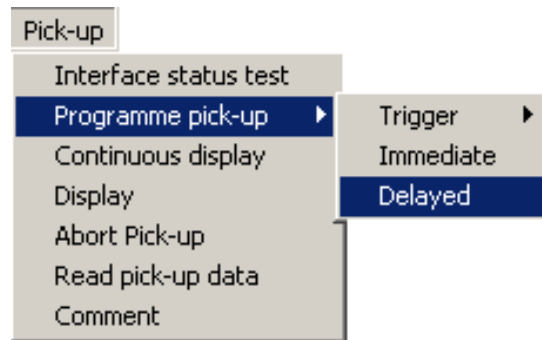


Now the user must prepare the connections for the channels which are to take part in the pick-up. On this occasion the outputs will be connected to the inputs as follows:

- *SalAna1 to EntAna1*
- *SalDig1 to EntDig1*

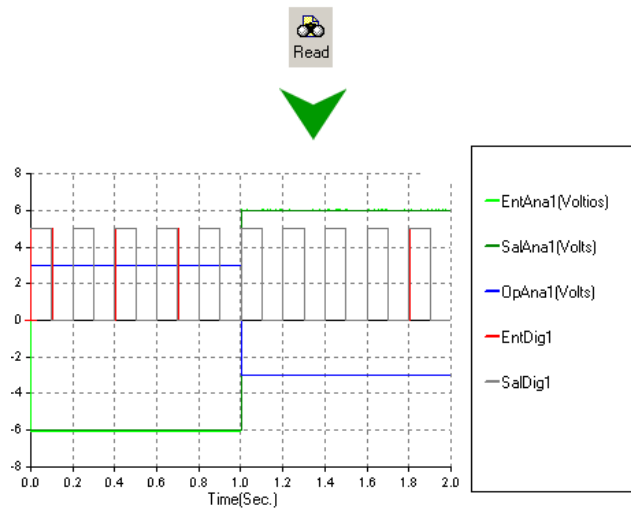
This time we are going to define a delayed pick-up, and so we click on **Delayed pick-up** on the **Pick-up** menu. We must define a delay time of 2 seconds and then click on **Accept**.

Figure 159



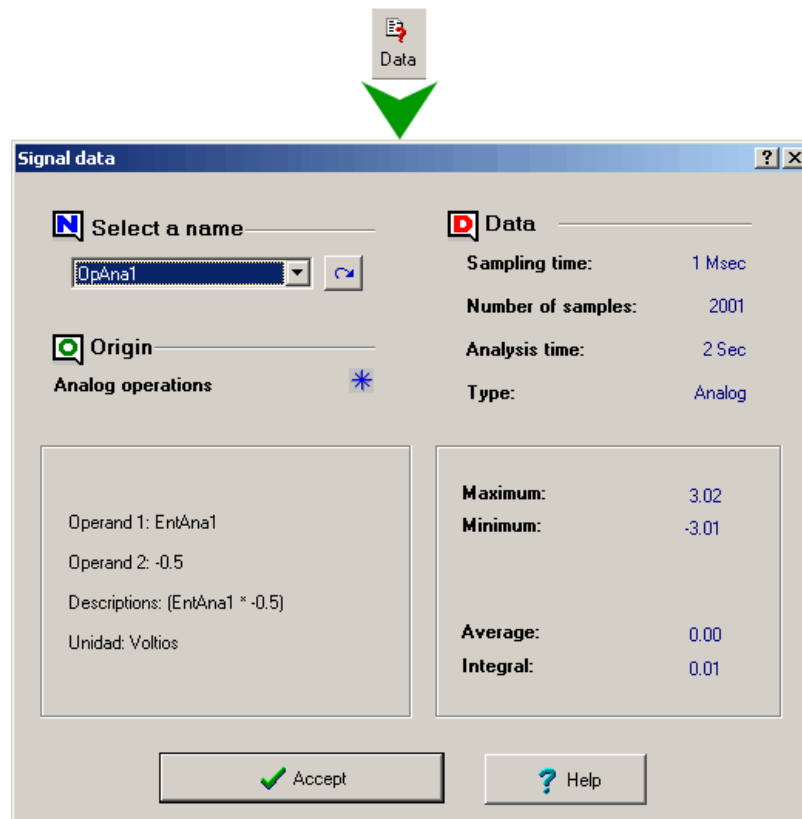
After 4 seconds, if all is well, the pick-up data will be stored in the SAD 450's memory. Click on **Read** on the tool bar to transfer the signals to Kaptoris, which displays a graphic representation window as follows:

Figure 160



The **Signal data** option on the **Representation** menu shows the origin of each signal and other data of interest. The window appears with data such as origin, times and a number of calculated values which will depend on the type of signal selected from the pull-down list.

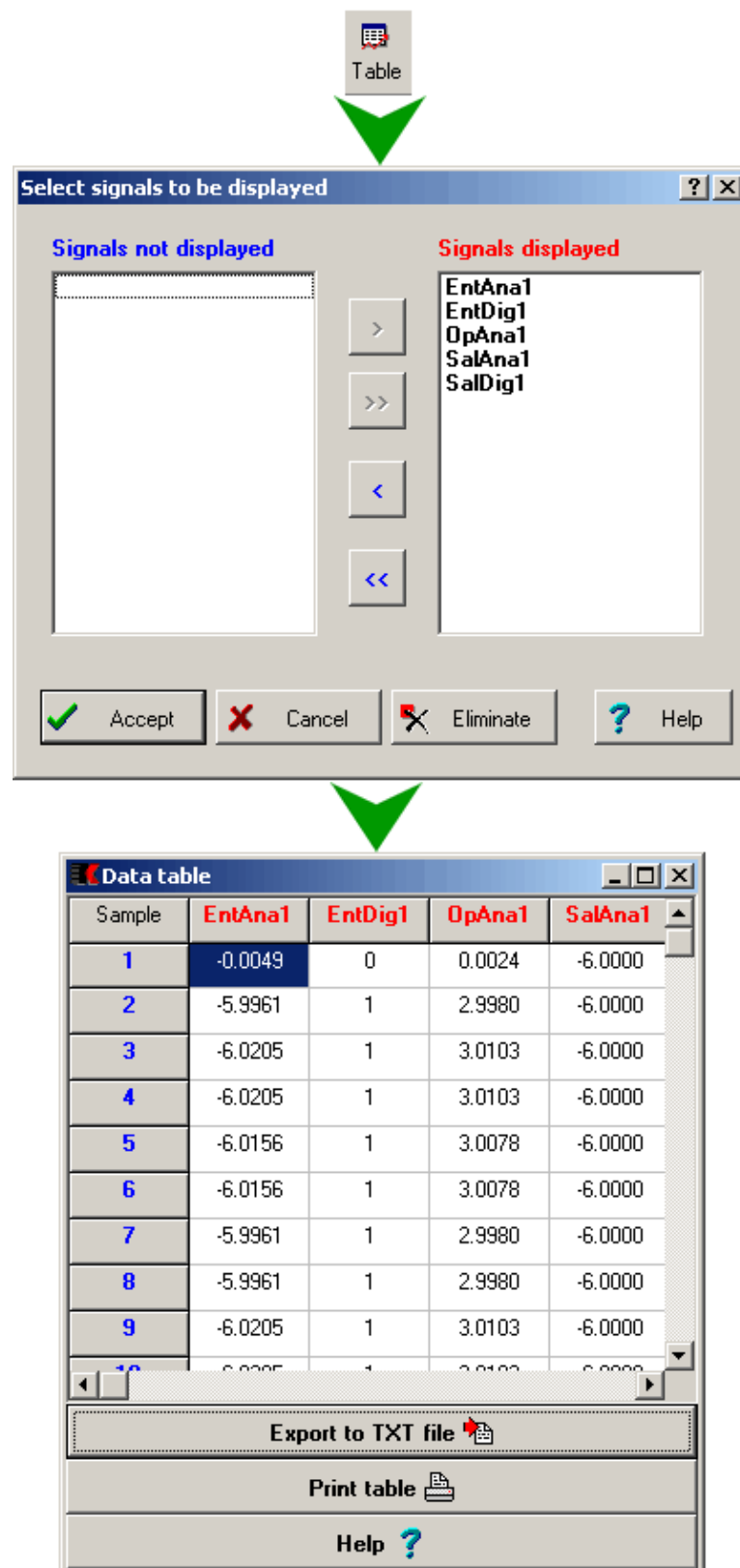
Figure 161



To view data from each sample, the best idea is to consult the data table. When the user clicks on the **Table** icon on the tool bar, a window appears to allow him to select the signals whose values he wishes to display. It is extremely important to select only signals of interest, particularly with regard to pick-ups with large volumes of data, since the time required to generate the table increases in proportion to data.

In this case it is not necessary to omit any signals. When the user clicks on **Accept**, the data table appears.

Figure 162



This window allows the user to export the table to a file, and to print it out.

To close the window, simply click on the  button in the top right-hand corner of the window.

To complete this first exercise, we must save the results obtained in a file. We click on **Save**, either on the tool bar or on the **File** menu.

If the user wishes to see the result of this exercise, the file is to be found in the following directory: 'KAPTORIS\Ejemplos\Ejemplo2.kpt'.

Practical 2

This practical generates “Table”-type analog and digital output signals. The signals are read and stored in such a way as to allow the user to view them together with the signals in the previous example.

The first step is to configure the outputs which are to take part in the pick-up. For this example, we assume that example 1 has been loaded.

We must activate digital output W3 and analog output Y2, selecting in both cases a Table-type generator and configuring it.

The tables are stored as text files. The first line shows the number of values of which the table is composed, and then one value per line is entered (the values must lie between +10 and -10 Volts):

Example of a table with 5 values

5
1.2567
1.0000
0.1250
0.0000
0.1000

How to create a table

- The table editor (for more information, consult “Table editor”) proves useful when we wish to edit or modify existing tables. We can also create new tables but, since this is carried out manually, there should be a small number of values.

- To create tables with many values (100 or more), it is advisable to use a compiling facility and use the code to automatically save in a file the values of the type of signal we wish to generate. The “KAPTORIS\Ejemplos\tablas\” directory contains two small applications which respectively implement an exponential signal and a digital signal.
- *GenExpAna*: This application uses a constant, the frequency of the signal and the sampling time to generate a table-type file for the function: $y = \exp(xt) - 1$.
- *GenDigital*: This application uses the frequency of the signal and the sampling time to generate a table-type file for the signal in the following format:

Figure 163



- In both applications, the number of points on the table is calculated in accordance with the following formula (where f_s = frequency of the signal and t_m = sampling time).

$$N^{\circ} \text{ data in base} = 1/(f_s * t_m)$$

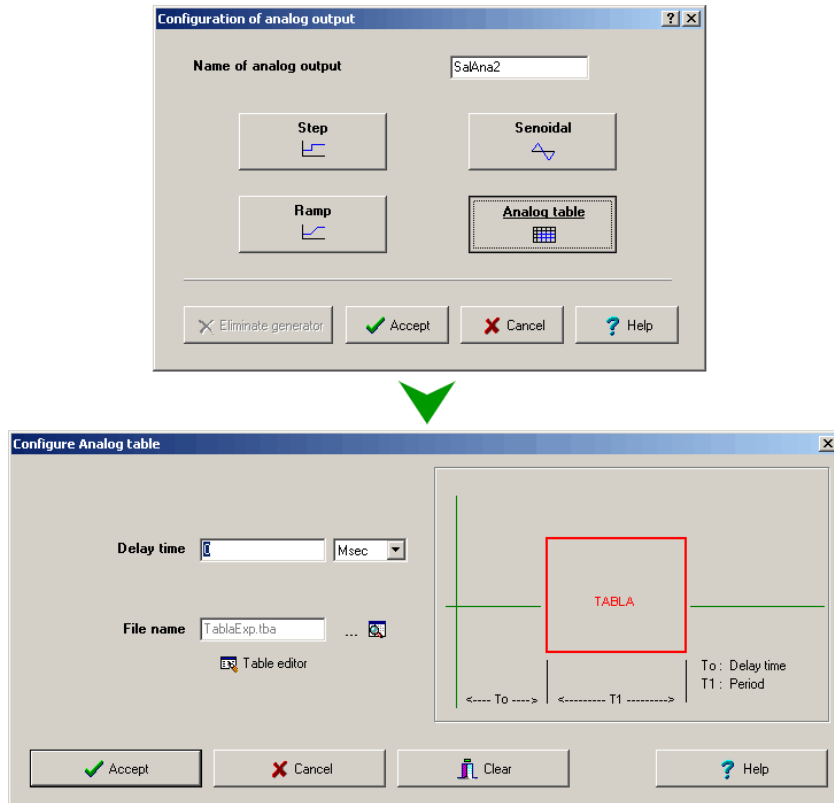
To generate the two tables to be used, we will use the two sample executions:

- For analog output X2, we must create a table with GenExAna. The values will be as follows:
 - *Name of the table file* = *TablaExp*
 - *Signal constant (x)* = 1.2
 - *Frequency of the signal (fs)* = 0.5
 - *Sampling time (tm)* = 0.001
- For digital output W3, we must create a table with GenDigital. The values will be as follows:
 - *Name of the table file* = *TablaDig*
 - *Frequency of the signal (fs)* = 0.5
 - *Sampling time (tm)* = 0.001

Once we know the names of the files in which the tables are stored, we can define the parameters of the outputs.

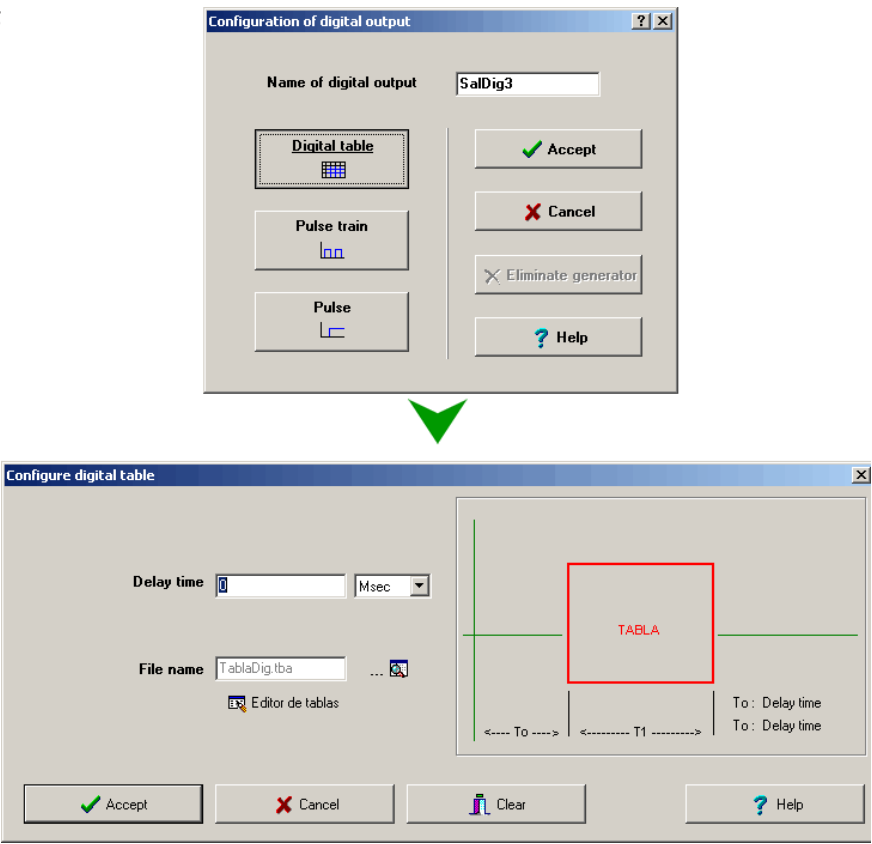
Configuring analog output X2

Figure 164



Configuring digital output W3

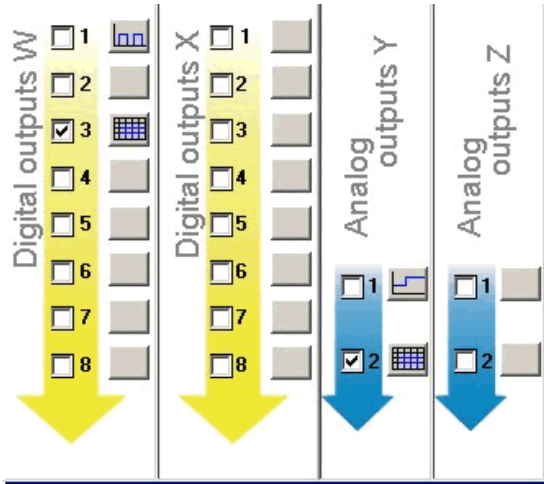
Figure 165



Once both outputs have been configured, this is the appearance of the outputs section in the inputs/outputs window:

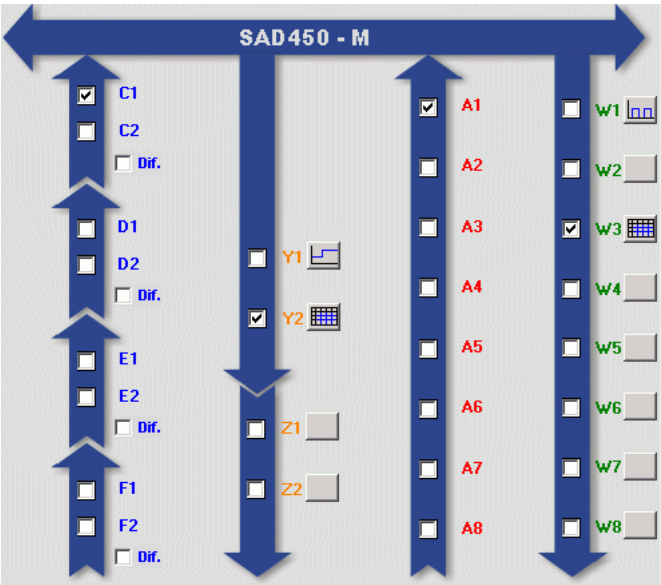
With SAD450:

Figure 166



With SAD450M:

Figure 167



The times to be configured are as follows

- Sampling time = 1 Msec.
- Analysis time = 2 Sec.

Figure 168

A configuration window with a light gray background. It contains three rows of controls: 'Sampling time' with a text box containing '1' and a dropdown menu set to 'Msec'; 'Analysis time' with a text box containing '2' and a dropdown menu set to 'Sec'; and 'Number of samples' with a text box containing '2001'. At the bottom, there is a button with a clock icon and the text 'Fastest pick-up'.

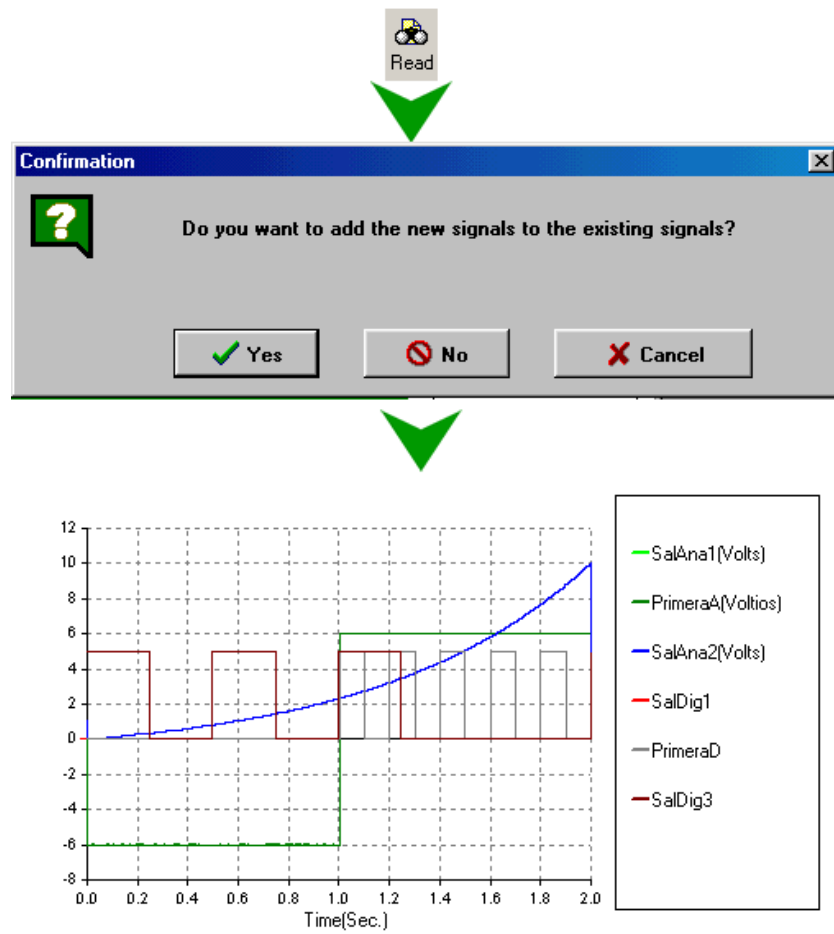
To carry out the pick-up, the user presses **Accept** to leave the configuration window. He then clicks on the **Prog.** icon on the tool bar. A window appears, “Programming immediate pick-up”, and pick-up commences when he clicks on **Accept**.

Figure 169

A diagram showing a 'Prog.' icon with a yellow lightning bolt, with a large green arrow pointing down to a window titled 'Programming immediate pick-up'. The window has a blue title bar with a question mark and close button. It contains the same configuration fields as Figure 168: 'Sampling time' (1 Msec), 'Analysis time' (2 Sec), and 'Number of samples' (2001). Below these fields is a button labeled 'Fastest possible pick-up' with a clock icon. At the bottom are three buttons: 'Accept' with a green checkmark, 'Cancel' with a red X, and 'Help' with a blue question mark.

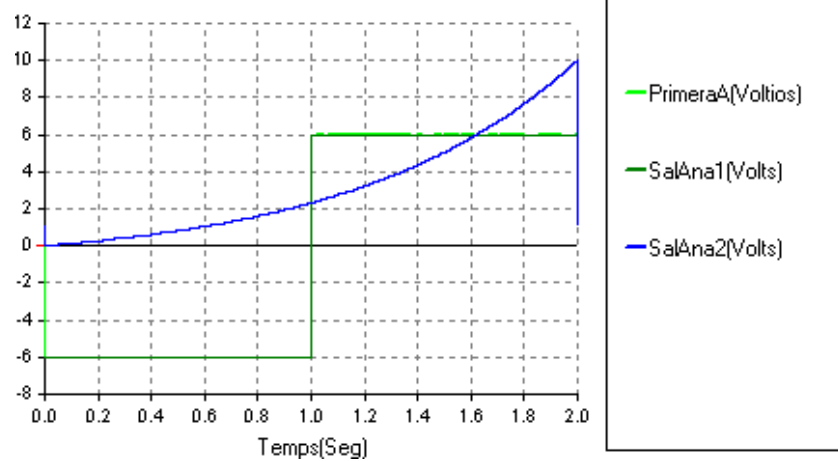
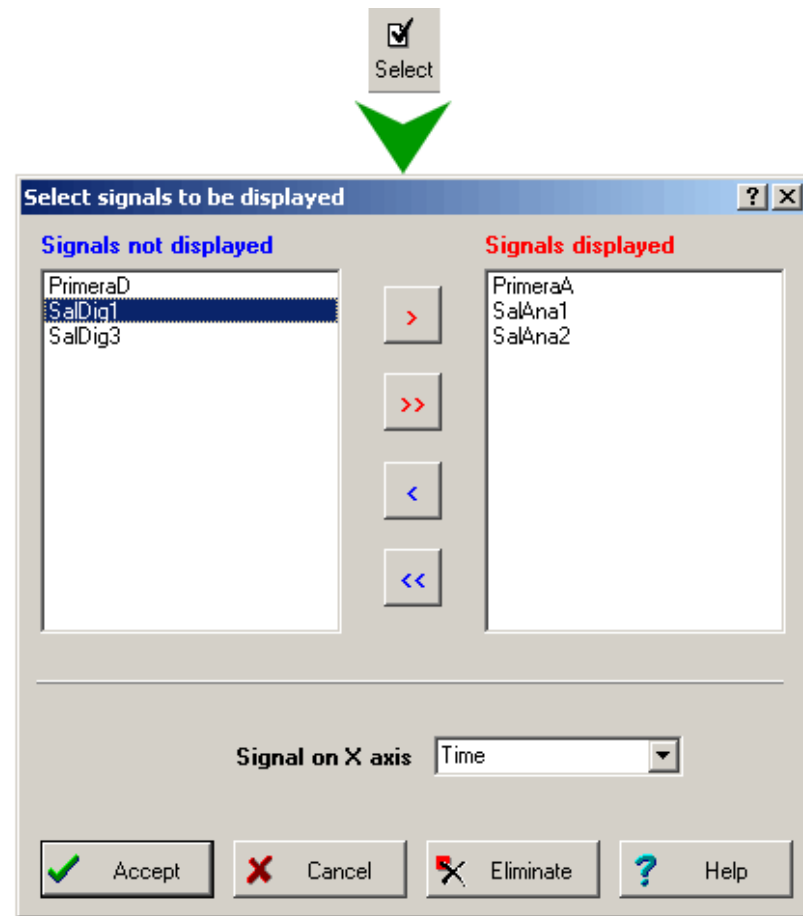
The next step, once the analysis time has elapsed, is to read the data in the memory of the SAD450 interface. To do this, simply click on the **Read** icon on the tool bar. The graphic representation which then appears shows the signals in example 1, in addition to the new features, *SalAna2* and *SalDig3*.

Figure 170



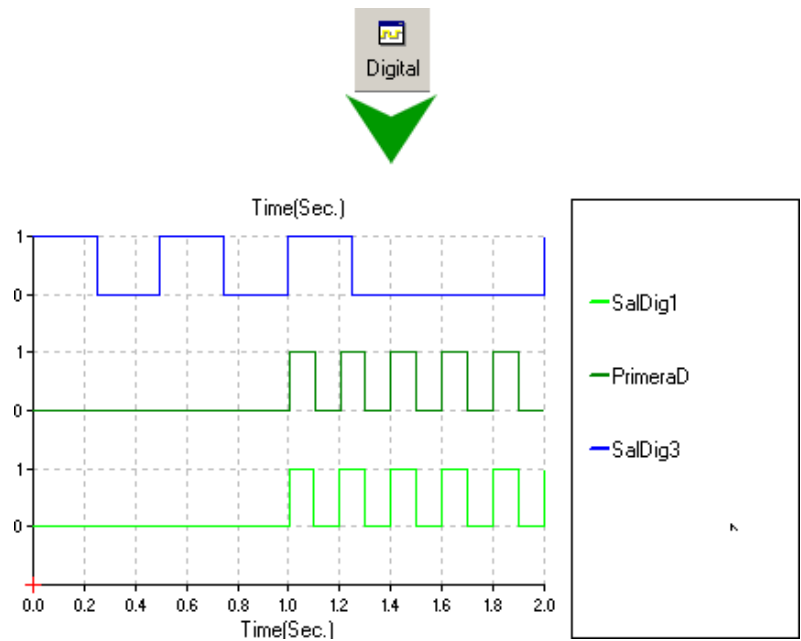
Since it may prove cumbersome to view all the analog and digital signals together (the digital signals have values of 0 and 5 Volts), the first thing to do is to display only the analog signals on the current graphic representation. To do this, click on the **Select** icon on the tool bar, and leave *SalAna2*, *SalAna1* and *PrimeraA* on the list of signals displayed. Click on **Accept** to see the signals more clearly.

Figure 171



To see the digital signals with logic values '1' and '0', we must move to a new digital graph window. Simply click on the **Digital** icon on the tool bar and a new graph appears showing only digital signals.

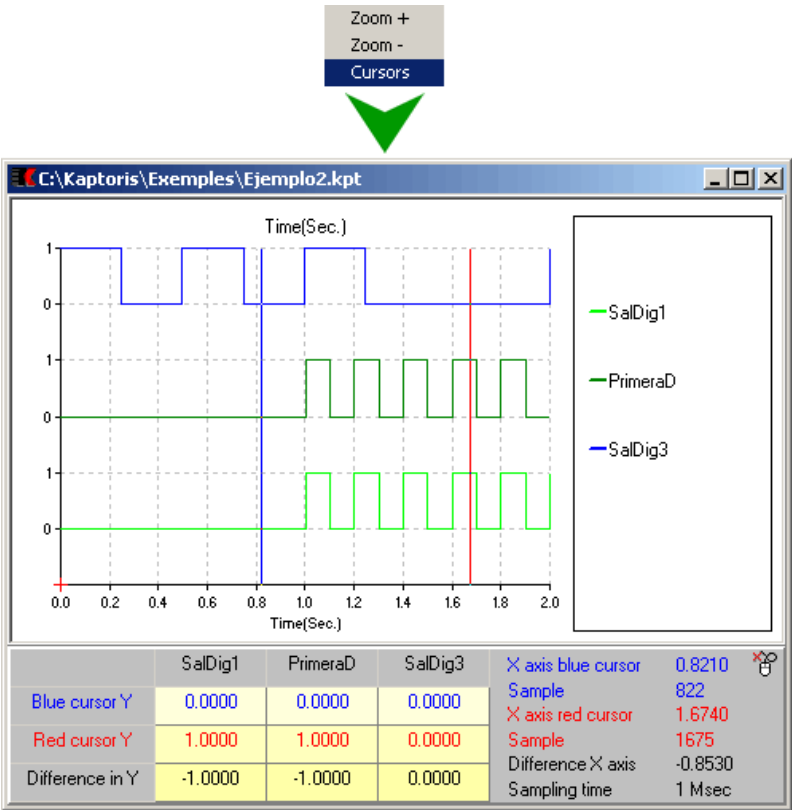
Figure 172



We use the **Cursors** option to obtain a specific value at a point on the graph shown in the digital representation window. Position the mouse on the point you wish to analyse, and the lower values table shows, for each signal, the time, the X and Y value, and, if the two cursors available have been defined (red and blue), the difference between them.

For this operation the cursors may also be moved using the direction keys on the keyboard, with the same result.

Figure 173



Finally, click on the **Save** option on the **File** menu, and save the file with a name of your choice.

The file for this example is to be found in the 'KAPTORIS\Examples\' directory.

Practical 3

This practical performs pick-up and display of an analog signal.

The signal is displayed on screen during pick-up, and its values are not stored in the memory.

The signal picked up must be generated in a unit or module external to the programme, since in this example no output signals will be generated. A commercial signal generator may be used.

We must first configure the analog input which will pick up the signal from the exterior. We must configure analog input C3, or any other we wish to use.

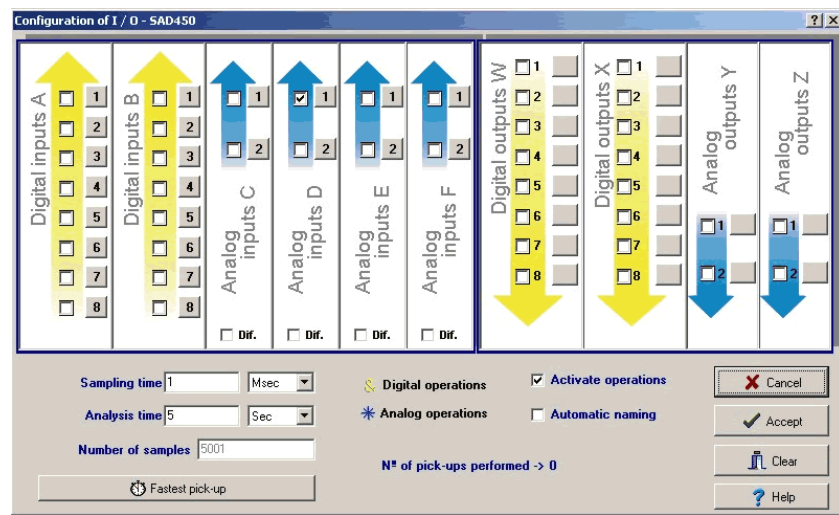
If any inputs with another configuration are activated, these must be deactivated.

Before carrying out the pick-up, we define the times with the following values:

- Sampling time : 1 Msec.
- Analysis time : 5 Sec.

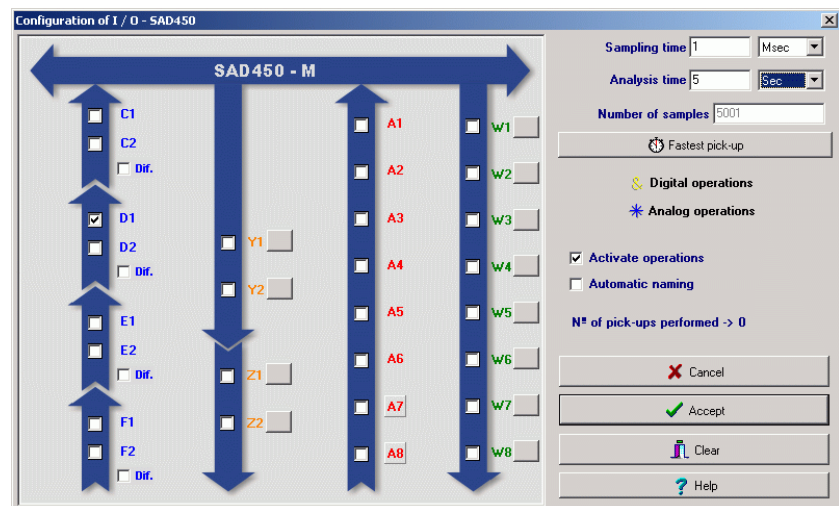
With SAD450:

Figure 174



With SAD450M:

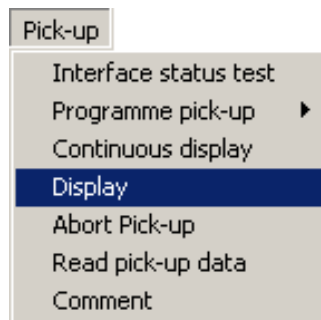
Figure 175



When we click on **Accept**, the configuration is completed. The next procedure is to programme an immediate pick-up, and so we click on **Prog.** on the tool bar and on **Accept** on the “Programming immediate pick-up” window.

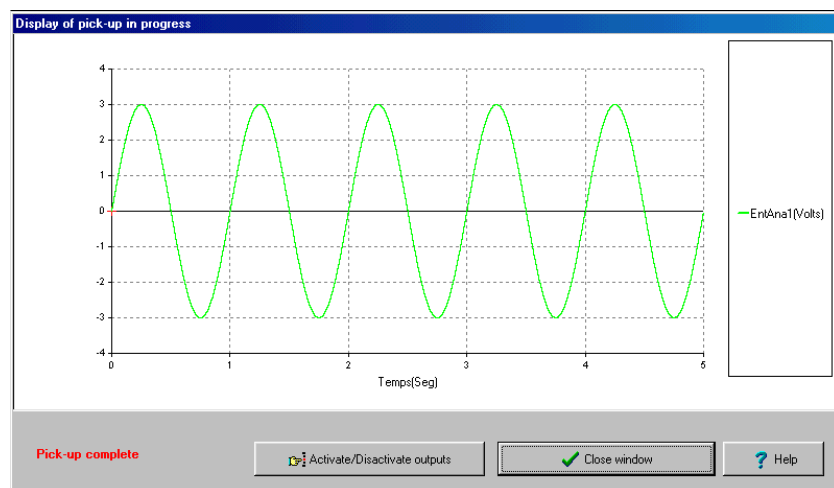
Now we must select the **Display** option on the **Pick-up** menu.

Figure 176



A window opens to show the signal being picked up by analog input 1, or any other selected.

Figure 177



The signal in the example was generated using an oscilloscope and its characteristics are as follows:

- *Type of signal : senoidal*
- *Frequency: 1Hz*
- *Amplitude: 6 volts (peak to peak).*

Once the analysis time has elapsed, in this case 5 seconds, the entire signal is displayed.

The user may stop display of the pick-up at any time by clicking on **Close window**.

When the display window has closed, the user may read off the data from the SAD450/SAD450M interface, since the last pick-up is stored here.

This example is to be found in the *KAPTORIS\Ejemplos\Ejemplo3.KPT* directory.

Practical 4. Calculator and filters

In this practical, we will work with analog operations and the signals calculator. Another aim of this practical is the use of filters in the case of senoidal signals of differing frequency.

Firstly, we must obtain three senoidal signals. The signals will have frequencies of 3, 5 and 10 Hz respectively. The signals may be obtained in several ways:

- They may be generated via analog outputs.
- They may be picked up via analog inputs using exterior signal generators.

The first method is as follows:

The following outputs must be configured with the values set out below:

- Analog output Y1
 - *Name: Seno3*
 - *Senoidal analog generator*
 - *Delay time = 0 seconds*
 - *Offset amplitude = 0 volts*
 - *Senoid amplitude = 2 volts*
 - *Frequency = 3 Hz*
 - *Phase shift = 0 degrees*
- Analog output Y2
 - *Name: Seno5*
 - *Senoidal analog generator*
 - *Delay time = 0 seconds*
 - *Offset amplitude = 0 volts*
 - *Senoid amplitude = 4 volts*
 - *Frequency = 5 Hz*
 - *Phase shift = 0 degrees*

- Analog output Z1
 - Name: Seno10
 - Senoidal analog generator
 - Delay time = 0 seconds
 - Offset amplitude = 0 volts
 - Senoid amplitude = 5 volts
 - Frequency = 10 Hz
 - Phase shift = 0 degrees

We will now configure an analog operation which consists of the sum by pairs of the analog outputs. The signals generated by the operations will be used a posteriori when we apply filters using the calculator.

Click on the **Analog operations** button on the “I/O Configuration” window to access the window for definition of analog operations.

The lists of operands show the three outputs defined. If these do not appear, we must check that the verification boxes for the three outputs are activated and that their generators have been properly defined.

Three operations will be defined, as follows:

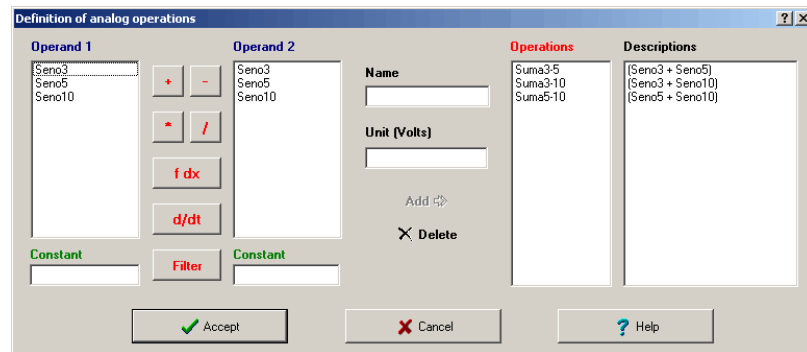
- $Suma3-5 = Seno3 + Seno5$
- $Suma3-10 = Seno3 + Seno10$
- $Suma5-10 = Seno5 + Seno10$

Here we will explain how to define the first operation, whilst the two remaining operations will be defined following the same procedure:

1. Select *Seno3* from the **Operand 1** list
2. Click on the “+” operator button
3. Select *Seno5* from the **Operand 2** list
4. Write the name *Suma3-5* in the Name box
5. Click on *Add*
6. The *Suma3-5* operation should now appear on the **Operations** list, and the expression “(Seno3 + Seno5)” on the **Descriptions** list.

We define the remaining operations in the same way. When we have completed the process, the operations window should look like the window below. Should any of the operations be incorrect, we can delete them by selecting them and clicking on **Delete**.

Figure 178



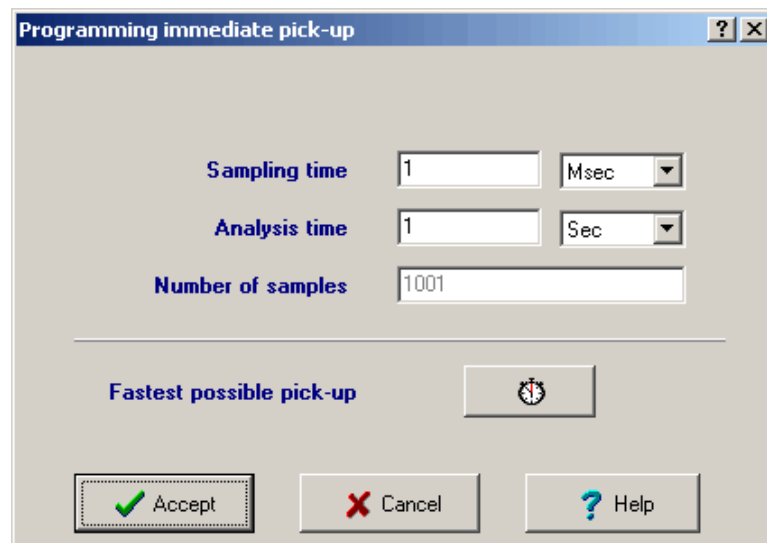
Now we must configure the analysis time and the sampling time. The following are the values to be entered:

- Sampling time = 1 millisecond
- Analysis time = 1 second
- Number of samples = 1001

Click on **Accept**, and the configuration window closes. Should the programme have detected an error, a warning window will open. In this case it is advisable to re-examine the entire configuration as defined.

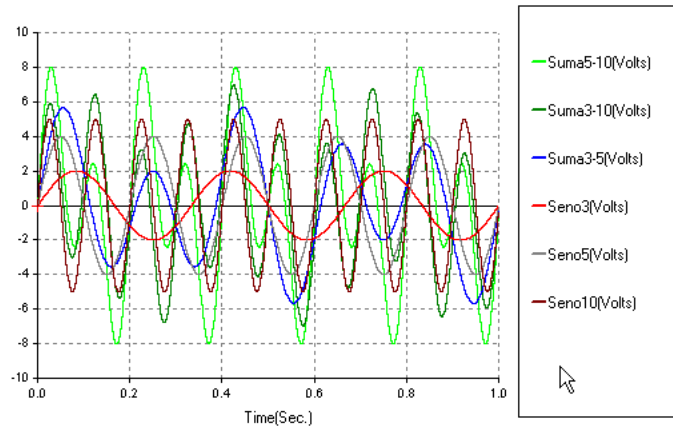
Next we carry out the pick-up, clicking first on the **Prog.** button to bring up the window for immediate pick-up. Click on **Accept**. The pick-up is programmed and is carried out on the SAD450/SAD450M interface.

Figure 179



The next step is to read the data for the signals. Click on the **Read** icon on the tool bar to obtain the output signals and those created by operations. The graph which appears should be as follows:

Figure 180



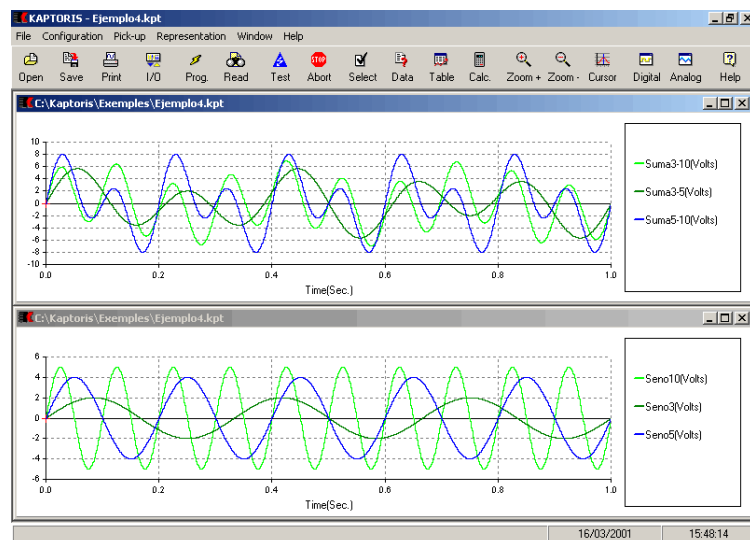
To ease our work with the signals, we will divide them between two analog display windows. For this operation we must create a new window by clicking on **Analog** on the tool bar.

A window appears on screen which is identical to the previous window. We use the **Select** option on the tool bar to select signals Seno3, Seno6 and Seno10 for the first window. The other window must display signals suma3-5, suma3-10 and suma5-10.

Finally, to improve window visibility we should click on **Horizontal** in the **Window** menu. This organises the windows more efficiently within the work space.

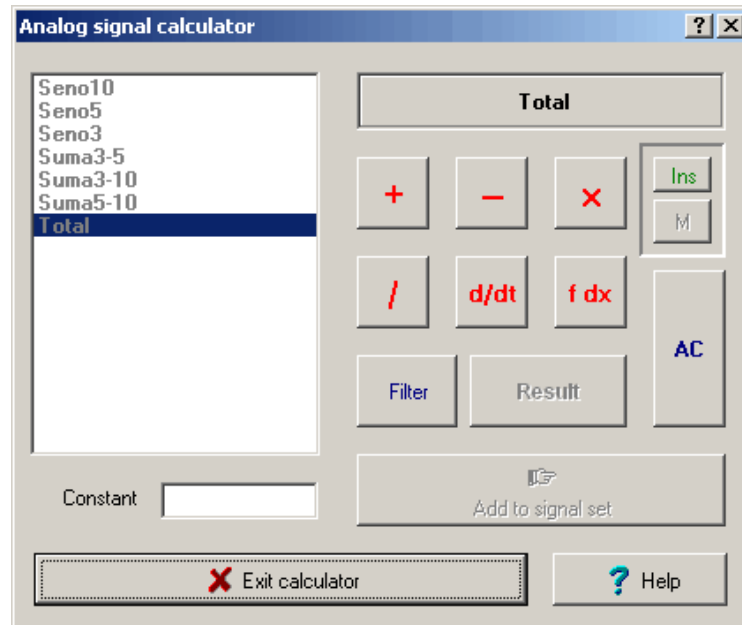
The screen should have the following appearance:

Figure 181



We must now activate the signals calculator by clicking on the **Calc.** icon on the tool bar. The calculator provides a list on the left-hand side of all the analog signals in the signals set - in this case, all of them.

Figure 182



The calculator will be used in this case to apply filters. The signal with which we will be working will be the sum of signals *Seno3*, *Seno5* and *Seno10*. We obtain the sum of these three signals as follows:

1. Select signal *Seno3*
2. Click on the + button
3. Select signal *Seno5*
4. Click on the **Result** button
5. Click on the + button
6. Select signal *Seno10*
7. Click on the **Result** button
8. Click on the **Add to signal set** button
9. Write in 'Total' in the name window
10. Click on **Accept**

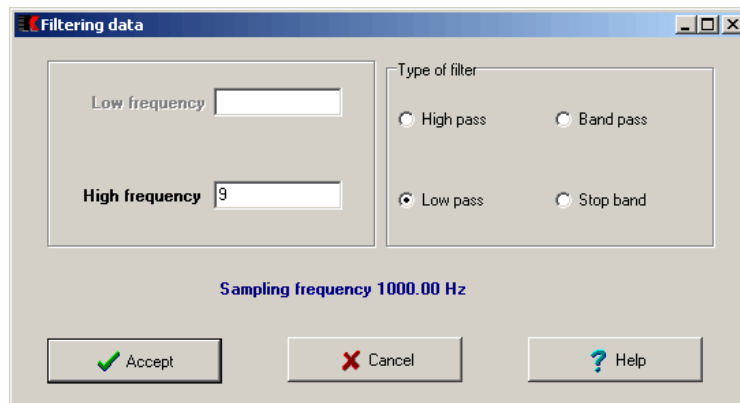
11. Now the Total signal should appear on the list of signals.

The first filter to be applied is a low pass filter with a cut-off frequency of 9 Hz. This means that the magnitude of values whose frequency exceeds 9Hz will be eliminated. When this filter is applied to the *Total* signal, the resultant signal should be similar to *Suma3-5*.

We proceed as follows for application of the filter:

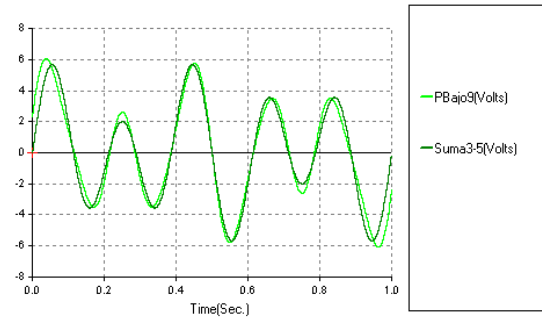
- Select the *Total* signal
- Click on the **Filter** button
- In the “Filter” window:
 - Select the type of filter **Low pass**
 - Write “9” in the **Low frequency** box
 - Click on **Accept**
- Click on **Result**
- Click on the **Add to signal set** button
- Write the name “Pbajo9” and click on **Accept**

Figure 183



To display the result, we must create another analog window, where only the *Pbajo9* and *Suma3-5* signals will be displayed. It will be observed that the signals are similar.

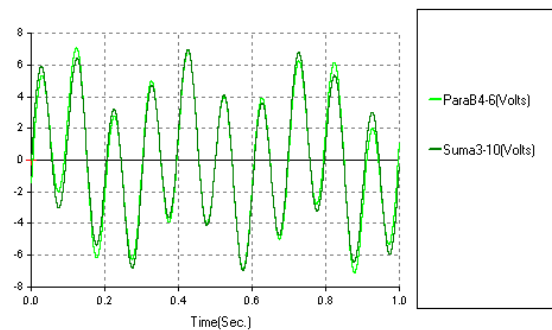
Figure 184



The following signals may be compared by way of an exercise:

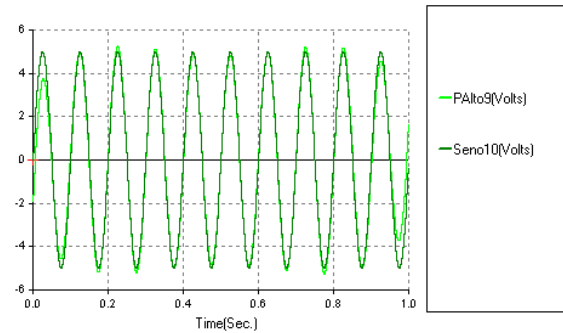
- Calculated signal
 - Signal over which we apply the filter = *Total*
 - Filter for band
 - *Low frequency* = 4
 - *High frequency* = 6
- Suma3_10 signal

Figure 185



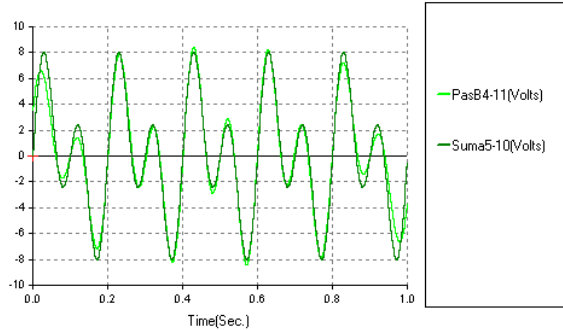
- Calculated signal
 - Signal over which we apply the filter = *Total*
 - High pass filter
 - *Cut-off frequency* = 9
- Seno10 signal

Figure 186



- Calculated signal
 - Signal over which we apply the filter = *Total*
 - Band pass filter
 - *Low frequency* = 4
 - *High frequency* = 11
 - *Suma5_10* signal

Figure 187



To save the operation carried out, click on **Save** and give the KPT file a name. This ensures that it will be available to work with at a later date.

SAD450 Interface software

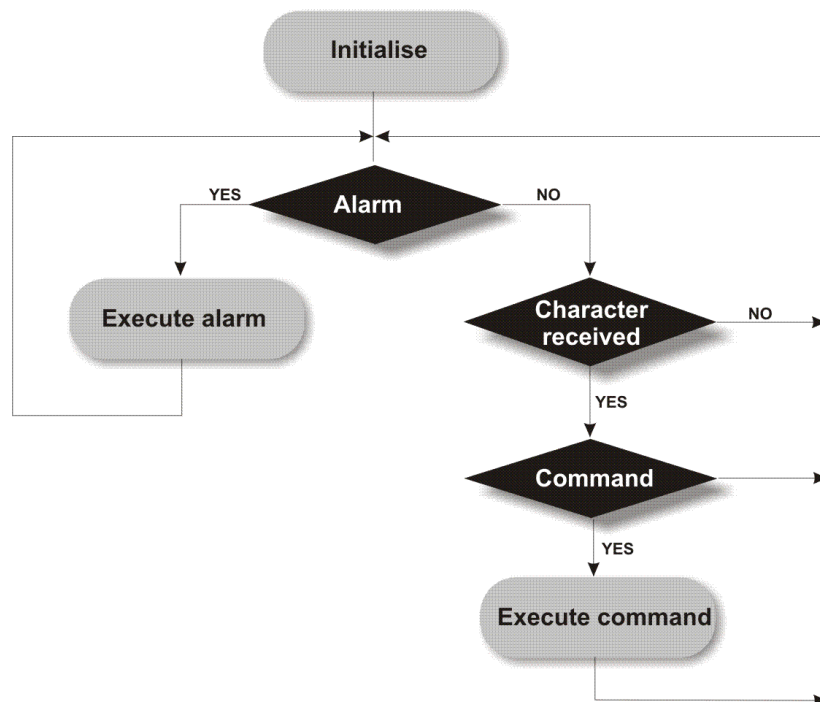
Introduction

To programme the SAD450 interface without using KAPTORIS, we must be familiar with its commands. This annex also provides a brief description of the operating structure of the SDA450 interface's internal software, and how communications are carried out with the PC.

Structure of the main programme

The structure of the SAD450 unit's main programme is as follows:

Figure 188



The programme is located in a loop in stand-by mode for events. The events to which the programme responds are as follows:

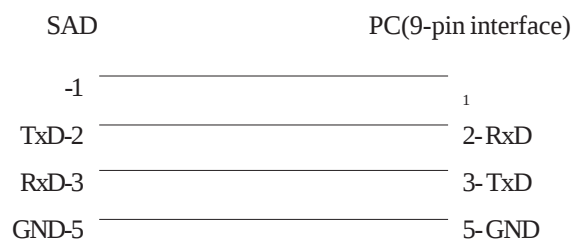
- An **alarm** is triggered: the alarm bit moves to 1 when an alarm triggers. The list of possible alarms is as follows:
 1. Pick-up start alarm.
 2. Programmed trigger alarm.
 3. Extra-fast pick-up programmed alarm.
 4. Pick-up finish alarm.
 5. Fast-count start alarm.
- A character reaches the serial line: this event is shown on the **cont_carac_recibidos** meter. Every time a character arrives the meter moves forward, and so we know how many characters remain to be read. If a command is detected during a reading of the characters, the system moves to deal with the command.

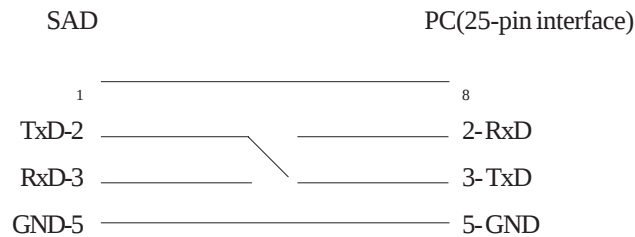
Communication with the PC

Communication with the PC is carried out via an RS-232C interface, using the XON/XOFF protocol at 115200 Bauds.

XON/XOFF is an extremely simple protocol which controls only the flow through the RS232. When the receiver realises that its reception buffer is filling up, it sends an XOFF to advise the transmitter to stop sending information. As the receiver reads through the buffer information, it releases it in such a way that, when it sees that it is ready to receive again, it can then send an XON to allow communication to continue.

The next figure shows the connections of the unit to the PC.





Communication between the PC and the unit is carried out by commands. Each command is composed of the following:

1. **Command N°:** Whole, in ASCII code.
2. **Parameters:** All the parameters required by the command will be in ASCII and separated by commas. This field can be zero and there may be no parameters.
3. **End of command:** The ASCII character “#” will indicate the end of the command.

Figure 176 shows the protocol to be followed for communication with the unit. This protocol must be observed for sound operation of the unit.

Some examples of commands are as follows:

1. “4,a#” è Reading of digital inputs.
2. “5,v,128#” è Writing digital outputs.

The unit’s response to a recognised command is the recognition character “&” followed by the response if the command requires this. The response information sent by the unit consists of the following:

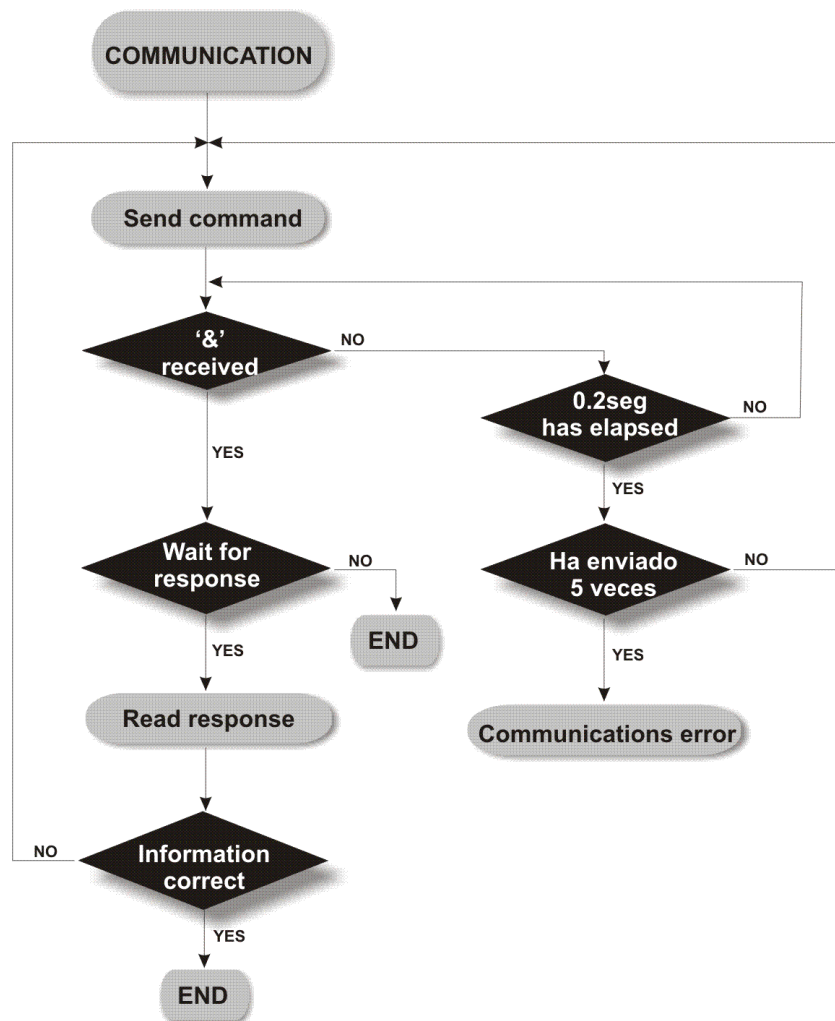
1. Fields of information separated by commas “,”.
2. The ASCII character “#” to indicate end of response.

If the computer detects an error in the information received, it will send the command to the unit again.

Example of a response:

Command: "4,a#"
 Responde: "&23#"

Figure 189



Commands

Before specifying the commands we must understand a number of points which will be dealt with below.

The SAD450 data acquisition unit has 4 analog outputs and 8 inputs, and 16 digital inputs and outputs.

The analog inputs may be differential or normal. If they are differential, each input pair will form a differential input, and so in differential mode there are 4 inputs and not 8.

Each input will be assigned an identification code to distinguish between them.

The following are the identification codes for inputs in normal mode:

Identification code	Channel
A	High byte, digital inputs
B	Low byte, digital inputs
C	1 st channel of analog inputs
D	2 nd channel of analog inputs
E	3 rd channel of analog inputs
F	4 th channel of analog inputs
G	5 th channel of analog inputs
H	6 th channel of analog inputs
I	7 th channel of analog inputs
J	8 th channel of analog inputs

In the case of the differential inputs:

Identification code	Channel
K	1 st channel of analog inputs (Channel C – Channel D)
L	2 nd channel of analog inputs (Channel E – Channel F)
M	3 rd channel of analog inputs (Channel G – Channel H)
N	4 th channel of analog inputs (Channel I – Channel J)
O	Fast-count input 1
P	Fast-count input 2

The outputs will also have identification codes. The following are the digital outputs' identification codes:

Identification code	Channel
U	High byte, digital outputs
V	Low byte, digital outputs
W	1 st channel of analog outputs
X	2 nd channel of analog outputs
Y	3 rd channel of analog outputs
Z	4 th channel of analog outputs

The following section teaches us how to use the unit's commands.

Testing presence and version of the unit

This command allows us to detect whether or not the unit is connected. If it is connected, we are informed as to the current version and size of the RAM.

Format of the command

- Command number: 1
- Parameters: None
- End of command: #

Format of the response

- Recognition of the command: &
- If there is no recognition, this means that the unit is disactivated.
- Parameters:
 1. Version of the unit. Format of the version: a whole number and two decimals (e.g. 1.02)
 2. Available RAM memory for pick-ups and for tables for signals to be generated. The value shows the maximum number of programmable bytes.
- End of the response: #

Example:

Example of the request for unit presence and version test.

"1#"

Response:

"&1.01,63487#"

Status of the interface

This command informs the user as to the status of the interface.

Format of the command

- Command number: 2
- Parameters: None
- End of command: #

Format of the response

- Recognition of the command: &
- Parameters:
 1. Interface status:
 - 0 → No pick-up has been programmed.
 - 1 → A pick-up has been programmed, but has not yet started.
 - 2 → Picking up and/or generating data.
 - 3 → Pick-up and/or generation completed. If data have been picked up, they will be available in the unit's memory.
- End of the response: #

Example:

Example of interface status request.

<i>Command</i>	<i>"2#"</i>
<i>Response</i>	<i>"&1#"</i> <i>A programmed pick-up has not yet started</i>

Configuration of the analog inputs

This command allows the user to configure the analog inputs. The maximum number of channels to be configured is 12 (8 single-ended channels and 4 differential channels). If the user attempts to configure more than 12 channels, the command will not be recognised.

Format of the command

- Command number: 3
- Parameters:
 1. Channel identifier: C-D-E-F-G-H-I-J-K-L-M-N. Channels C..J are normal analog channels, and channels K..N are analog channels in differential mode.

2. Range of the input signal:

0 → 10V < V > +10V

1 → 5V < V > +5V

2 → 2V < V > +2V

3 → 1V < V > +1V

4 → 0.5V < V > +0.5V

5 → 0.2V < V > +0.2V

- Sections 1 and 2 will be repeated for all the unit's channels. When the unit is initialised, all channels will acquire the configuration by default ($\pm 10V$). Once the unit has been initialised, the configuration cannot be changed unless the user gives this command.
- End of command: #

Format of the response

- Recognition of the command: &

Example:

Example of the configuration of the analog inputs.

Channel C and D (single-ended) with 10V inputs and channel L (differential) with 0.2 V inputs	"3,C,0,D,0,L,5#"
<i>Response</i>	"&"

Reading the input channels

This command allows the user to read the input channels, digital or analog.

Format of the command

- Command number: 4
- Parameters:
 1. Channel identifier: A..N. Channels A and B are digital, channels C..J are analog channels in single-ended mode, and channels K..N are analog channels in differential mode.

- Parameter 1 will be repeated for each of the input channels to be read.
- End of command: #

Format of the response

- Recognition of the command: &
- Parameters:
 1. Value of the reading: 0.255 for the digital channel and -2048..2047 for the analog channels.
- This parameter will be repeated for each input.
- End of response: #

Example:

Example of reading the digital inputs.

<i>Reading of inputs A,B and C</i>	"4,A,B,C#"
<i>Response</i>	"&1,16,2308#"

Writing the output channels

Format of the command

- Command number: 5
- Parameters:
 1. Channel identifier: U..Z Channels U and V are digital, and the rest are analog.
 2. Value of the writing. 0.255 for the digital channel and -255..255 for the analog channels.
- Points 1 and 2 will be repeated as many times as channels which the user wishes to write.
- End of command: #

Format of the response

- Recognition of the command: &

Example:

Example of writing the analog outputs.

<i>Writing channels U and Z</i>	"5,U,200,Z,245#"
<i>Response</i>	"&"

Trigger pick-up programming

This command allows the user to programme a pick-up which begins following an external trigger signal. The external trigger may be either analog or digital. If outputs are configured, signals will also be generated. Prior to this, the tables must be loaded.

Format of the command

- Command number: 6
- Parameters:
 1. N° of data to be picked up or generated. This parameter will determine the number of samples for the pick-ups and the length of the table for generation of the signals.
 2. Number of input channels which take part in the pick-up 0..9. If a 0 is entered in this parameter, this means that no signal will be picked up.
 3. Identifier of the channels: A..N. Channels A and B are digital, channels C..J are analog channels, and channels K..N are analog channels in differential mode.

Parameter 3 will be repeated for each channel. Should the number of inputs be 0, this parameter will not be sent.
 4. N° of output channels which are to be used to generate the signals. Should this parameter be 0, this means no 0..5 signals will be sent.
 5. Identifiers of the output channels through which the signals are to be generated.
U..V. Digital output channel.
W..Z. Analog output channels.
 6. Table data. If the data correspond to an analog channel, the range of values will be -2048 to 2047. If they correspond to a digital channel, these will be -255 to 255.

Parameters 5 and 6 will only be valid if an output has been programmed. These parameters will be sent for each output. As for the inputs, if the number of output channels is 0, these parameters will not be sent.

7. Trigger channel: A..N. Channels A and B are digital, channels C...J are analog channels, and channels K..N are analog channels in differential mode.
8. Trigger value/ trigger bit. Should the trigger channel be an analog channel, this parameter will contain the value of the analog signal upon which the trigger activates (-2048..2047). However, if the channel is digital, this parameter will contain the bit n° which activates the trigger 0..7.
9. Status during which the trigger is activated. This parameter will have different meanings, depending on whether the trigger is digital or analog, as follows:

If the trigger is digital:

- 0 → Descending flanks. When the signal moves from 1 to 0.
- 1 → Ascending flanks. When the signal moves from 0 to 1.
- 2 → Ascending and descending flanks. When the signal moves from 1 to 0 or from 0 to 1.

If the trigger is analog:

- 0 → When the signal moves down from the pre-set value.
- 1 → When the signal moves up from the pre-set value.
- 2 → When the signal is other than the pre-set value.

10. Identifier of the sampling time.

- 0 → µSeg
- 1 → mseg
- 2 → Seconds

11. Sampling time: 1..65535.

- End of command: #

Format of the response

- Recognition of the command: &

Example:

Example of programming a trigger pick-up

<i>Channels B, D and H participating. The trigger is analog, and occurs when the input in channel F exceeds 243. No signal is generated. The sampling time is 1 millisecond, and number of samples is 50.</i>	<i>"6,50,3,B,D,H,0,F,243,1,1,1#"</i>
<i>Response</i>	<i>"&"</i>

Immediate/ delayed pick- up programming

This command allows the user to programme a delayed pick-up. This type of pick-up begins after a period defined by the user has elapsed. If the period set is zero, pick-up will begin as soon as the command is received. If outputs are configured, signals will also be generated.

Format of the command

- Command number: 7
- Parameters:
 1. N° of data to be picked up or generated. This parameter will determine the number of samples for the pick-ups and the length of the table for generation of signals.
 2. Number of input channels taking part in pick-up 0..9. If a 0 is used in this parameter, this means that no signal will be picked up.
 3. Identifier of the channels: A..N. Channels A and B are digital, channels C..J are analog channels, and channels K..N are analog channels in differential mode.

Parameter 3 will be repeated for each channel. Should the number of inputs be 0, this parameter will not be sent.
 4. N° of output channels which will be used to generate the signals. If this parameter is 0, this means that no signal 0..5 will be generated.
 5. Identifiers of the output channels via which the signals will be generated.
U..V. Digital output channels.
W..Z. Analog output channels

6. Table data.
Parameters 5 and 6 will only be valid if an output has been programmed. These parameters will be sent for each output. As in the case of the inputs, if the number of output channels is 0, these parameters will not be sent.

7. Delay time. 0..65535 seconds. (18h 12 min 15 seconds)

8. Identifier of the sampling time.

0 → µSeg

1 → mseg

2 → Seconds

9. Sampling time: 1..65535.

- End of command: #

Format of the response

- Recognition of the command: &

Example:

Example of programming a delayed pick-up.

<i>Programming of a pick-up delayed for 20 seconds in 1 channel with 50 samples, and a sampling time of 10 milliseconds.</i>	"7,50,1,C,0,20,1,10#"
<i>Response</i>	"&"

Cancelling the pick-up

This command allows the user to cancel the pick-up activated. When this is cancelled, all data pertaining to the pick-up are stored in the memory. If a new pick-up is programmed, these data will be lost.

Format of the command

- Command number: 8

- Parameters: None

- End of command: #

Reading the pick-up data: information

Format of the response

- Recognition of the command: &

This command allows the user to read off the sample data. This command does not delete the data from the memory.

If no input is being picked up in the pick-up programmed, the command returns the number of samples generated to date.

Format of the command

- Command number: 9
- Parameters: None
- End of command: #

Format of the response

- Recognition of the command: &
- The response to this command will depend on whether or not pick-up exists.

A → Pick-up does not exist

- Recognition of the command:&
- Parameters: None
- End of response:#

B → Pick-up exists. Response will be different, in accordance with whether or not an input channel is being picked up:

B.1 → Picking up data:

- Recognition of the command:&
- Parameters:
 1. N° of samples picked up to date. If this value is zero, this means that the pick-up has been programmed but has not yet commenced.
 2. Information data.
- End of the response:#

B.2 → Only generation is taking place, with no pick-ups.

- Recognition of the command:&
- Parameters:
 1. N° of samples generated to date. If this value is zero, this means that generation has been programmed but has not yet commenced.
- End of the response:#

Example:

<i>Command</i>	"9#"
<i>Response</i>	"&2,50,78#"

Reading the last sample

This command allows the user to read the last datum taken from the pick-up taking place. It also provides information with regard to the sample number. If no analog input is being picked up, this command will return the number of samples generated to date. This command will be used to display data from the pick-up being carried out.

Format of the command

- Command number: 10
- Parameters: None
- End of command: #

Format of the response

A → A pick-up exists with inputs.

- Recognition of the command: &
- Parameters:
 1. Sample number. This value shows the number of samples sent. If this value is 0, the other parameters are not sent. This value shows that there is no pick-up activated or, if it has been programmed, that it has not yet begun.

2. Value of the last sample. This parameter will be repeated as many times as there are channels taking part in the pick-up.

- End of response: #

B → No input is being picked up. Only the signal is being generated.

- Recognition of the command: &
- Parameters:
 1. Number of samples generated to date. If this value is 0, this means that there is no pick-up activated or, if it has been programmed, that it has not yet begun.
- End of response: #

Example:

Example of reading when there is no pick-up activated.

<i>Command</i>	"10#"
<i>Response</i>	"&0#"

Example of reading when there is a pick-up activated with two channels.

<i>Command</i>	"10#"
<i>Response</i>	"&25,-1305,135#"

Fast-count inputs

This command allows the user to carry out speedy counting of pulse trains.

All commands used for pick-ups covered up to this point are also valid for fast-count inputs.

Format of the command

- Command number: 11
- Parameters:
 1. N° of samples to be picked up or generated.
 2. N° of inputs. This parameter shows the number of fast-count inputs which are to be programmed (1-2).
 3. Identifier of the inputs: O-P

4. Type of command: This parameter is used to distinguish the way in which the count begins.

0 → Immediate

2 → By trigger.

5. Trigger channel (A-B). The trigger channel will be digital.
6. Trigger value.(0..7). Corresponds to the position of the bit which will act as a trigger.
7. Trigger status.

0 → Descending flank.

1 → Ascending flank.

2 → Flanks.

Parameters 5, 6 and 7 will only be valid if the command type is trigger.

8. Type of count: This parameter allows the user to distinguish between the operating mode for the fast-count inputs.

0 → N° of pulses per time unit. We may use this count mode to determine the frequency. The maximum count frequency depends on the number of inputs programmed.

$$f_{\max} = \frac{100\text{Khz}}{\text{N}^{\circ} \text{ entrada}}$$

1 → Time between pulses: This count mode is used to determine the speed of any object which produces pulses while in movement (encoder etc). In this case we only have one input channel.

$$f_{\min} = 1.28\text{e} - 3\text{Hz}, f_{\max} = 50\text{Khz}$$

9. Identifier of the sampling time:

1 → millisecond

2 → seconds

10. Sampling time: 1..65535

- End of command: #

Format of the response

- Recognition of the command: &

Example:

Example of programming for an immediate fast-count input.

<i>Immediate programming of the fast-count input "0", count type "N° of pulses per unit of time". The sampling time is 10 milliseconds, and the number of samples is 30.</i>	"11,30,1,o,0,0,1,10#"
<i>Response</i>	"&"

Activation of signals

This command allows the user to activate the generation of signals previously activated. If we attempt to activate a signal which has not previously been activated or even defined, either because no pick-up command has been sent, or because this has been received but no signal has been associated with the identifier of the channel requested by this command, the command will return recognition of the command but will not carry out any operations.

Format of the command

- Command number: 12
- Parameters:
 1. Number of signals to be activated. (1..6).
 2. Identifier of the output channel to be activated.(U..Z)
This command will be repeated for each signal to be activated.

If the identifier of the channels is U-V:

3. N° of bits to be activated 1..8
4. The number showing the position of the bit within the digital output byte 0..7

This parameter will be repeated for each of the bits to be activated.

- End of command: #

Format of the response

- Recognition of the command: &

Disactivation of signals

This command allows the user to deactivate the signals. When a signal is deactivated, the channel moves to 0v. When the signal is reactivated, the channel will load the value it would have had if the signal had not been deactivated. If the user attempts to deactivate a signal which has not been activated (e.g.: waiting for a trigger) or which has not been defined either because the pick-up command has not yet been received, or because this has been received but no signal has been associated with the identifier of the channel requested by this command, the command will return recognition of the command but will not carry out any operations.

Format of the command

- Command number:13
- Parameters:
 1. Number of signals to be deactivated. (1..6)
 2. Identifier of the signal to be deactivated.(U..Z)

This parameter will be repeated for each signal to be deactivated.

If the identifier of the channels is U-V:

3. N° of bits to be deactivated.1..8
4. The number showing the position of the bit within the within the digital output byte 0..7

This parameter will be repeated for each bit to be deactivated.

- End of command:#

Format of the response

- Recognition of the command:&

Example

Example of disactivation of analog channel W and of bits 0 and 1, digital channel V

<i>Disactivation of analog channel W and of bits 0 and 1 in the digital channel V</i>	"13,2,w,v,2,0,1#"
<i>Response</i>	"&"



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