

## Serial Monitor for Analog Signal.

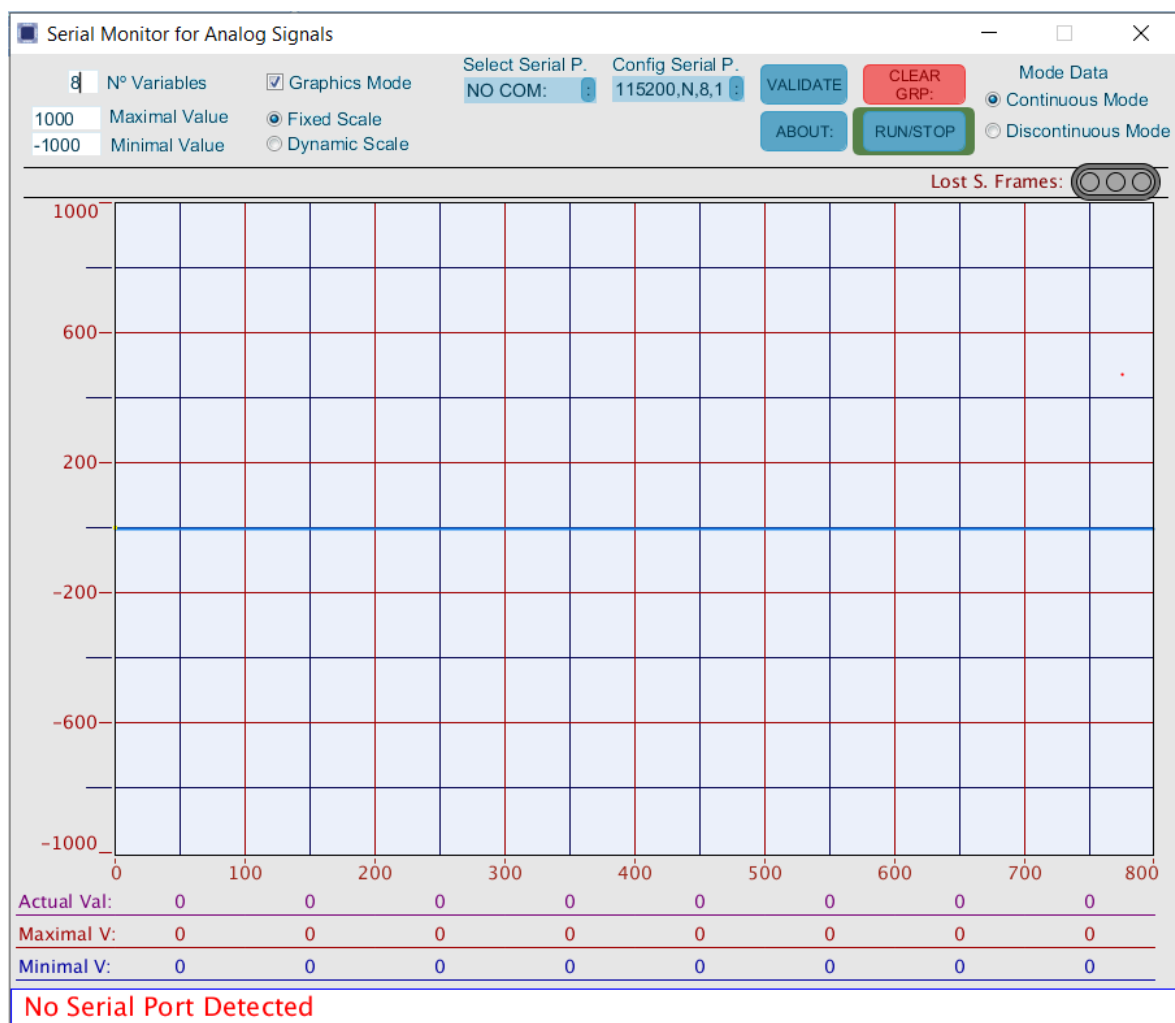
This application is developed in Processing version 3.5.4 (<https://processing.org/>) to communicate by a serial port or usb serial port with another device such as a microcontroller, for example Arduino type and to be capable of reading by the serial port up to 8 analog signals for display in a bar graph or a graphical curve.

The objective of this project is to demonstrate the possibilities of Processing to intercommunicate our PCs with the systems with microcontrollers.

We can run the application from the Processing IDE, if we have the source files, or run the application directly in executable format.

For the development of the application, the "Serial" libraries have been used to communicate with the serial port and the "G4P" library for the development of the application's graphic user interface (GUI) (<http://www.lagers.org.uk/g4p/index.html>).

When the application is started, a window is displayed on the screen:

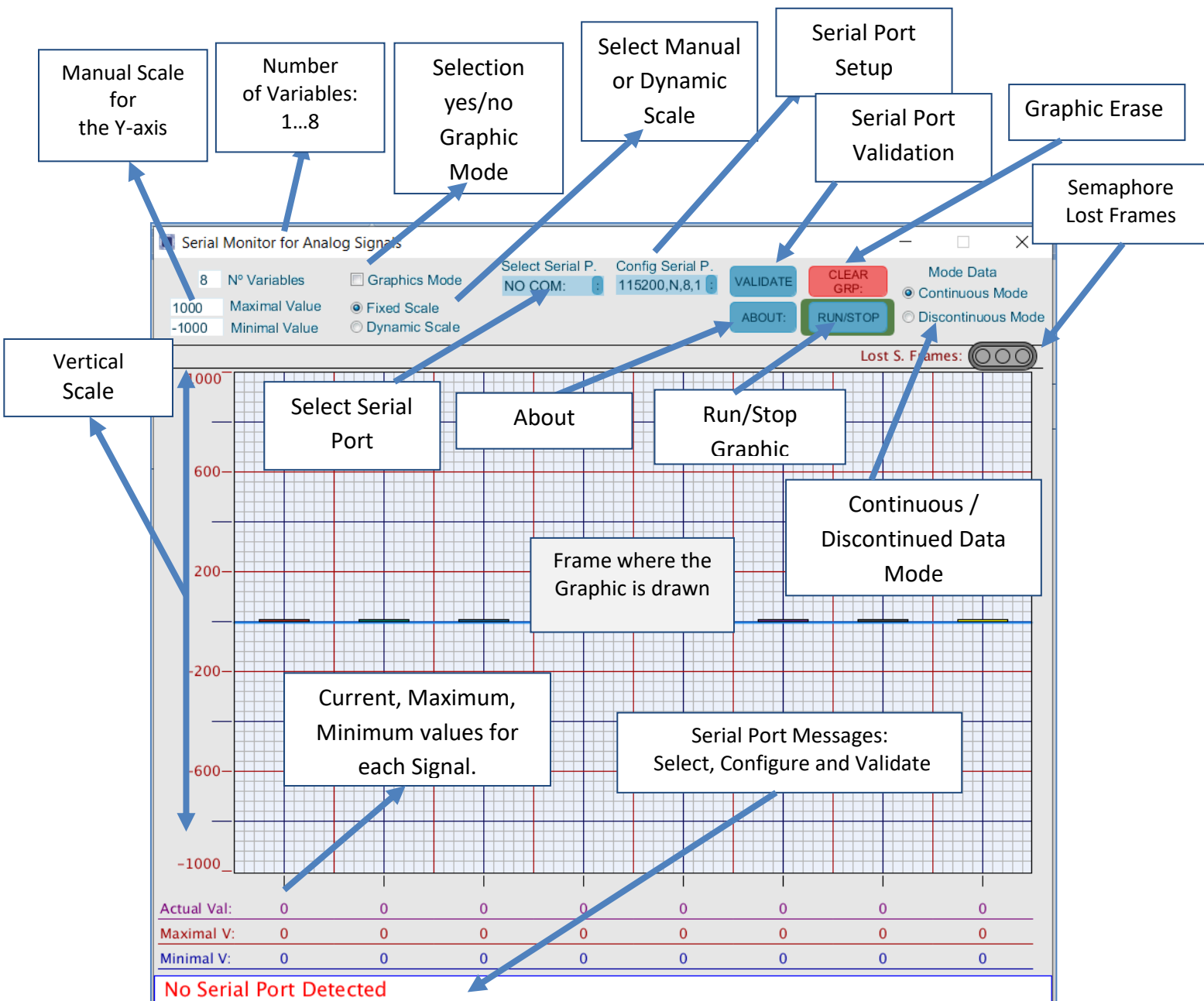


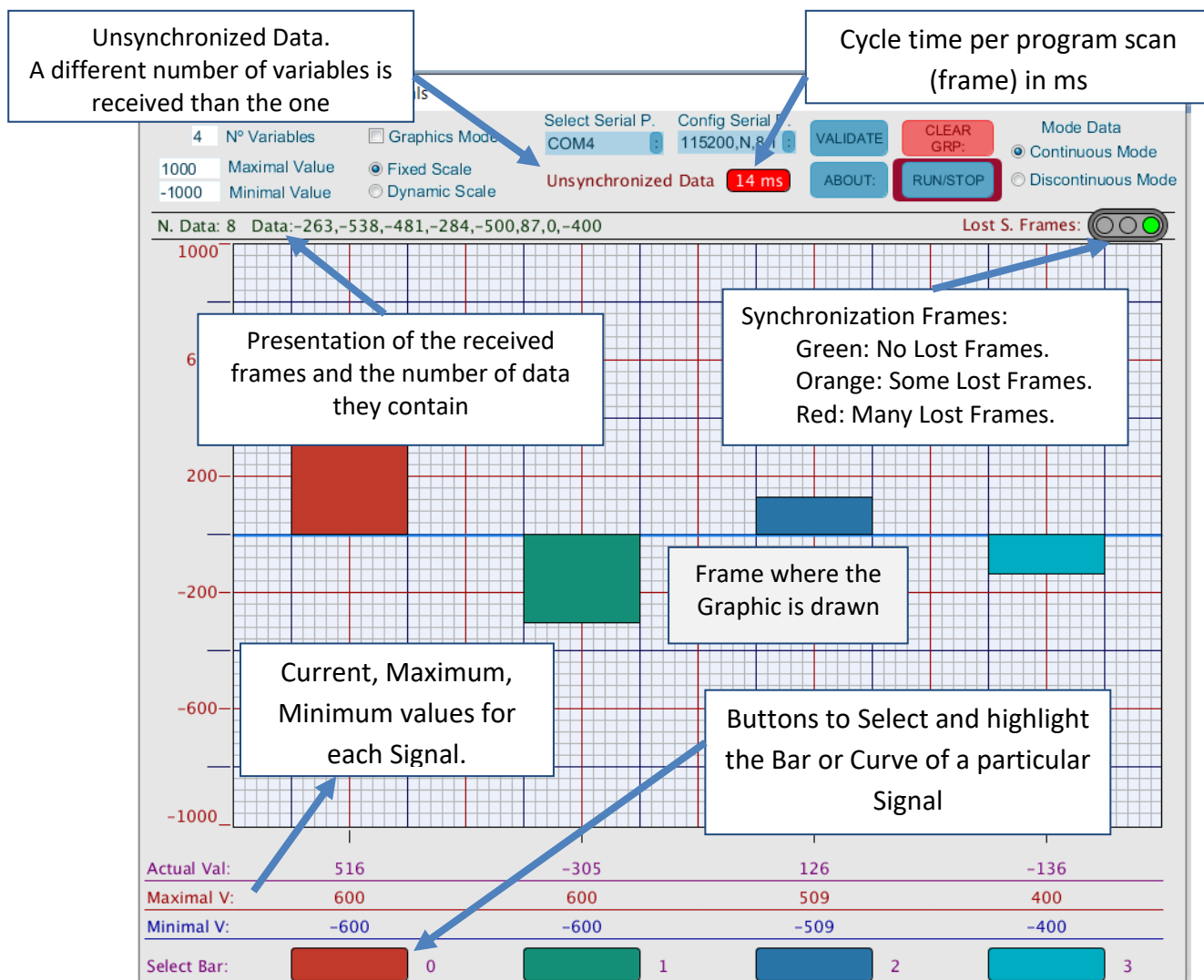
At the top there are a series of controls to select the serial port, its configuration and validation. The number of signals to be displayed, the maximum and minimum values, if we use a fixed or dynamic scale, if we want to have a bar display or a graphical display of

the curve type, if we are going to work in continuous or discontinuous mode and if we want to freeze the display.

In the central part is the graphic window where bars or curves are shown according to the selected mode.

At the bottom are the current, maximum and minimum values of each signal, the initial messages about the detection and validation of the serial port with which the application will communicate. In this same area there will appear some coloured buttons that will allow to highlight the bar or curve of a signal over the others that are being displayed simultaneously.





It must be said that this application is not an analog oscilloscope, the internal reception buffers of the serial port, as well as the non-fixed timing of the scan of the Processing program make the scale of the X axis may not be constant in time, this scale may vary with many factors, depending on the speed of the serial port, the amount of signals to be represented and the computer where the application is running. The traffic light in the upper right part of the screen will show us with its signaling when frames are lost. Buttons to Select and highlight the Bar or Curve of a particular Signal.

In the graphic mode, the received frame number is represented on the scale of the X axis. In any case, the application is used to display the waveforms of the signals sent by the serial port, to explore the maximum and minimum values of the signals, as well as to display the value of the signals. Also, in bar mode if we select with the buttons at the bottom we can highlight a bar with respect to the others and see the value of it as instantaneous, if we are in graphic mode the buttons at the bottom allow us to highlight a signal with respect to the others.

## Serial Ports:

The application only detects the serial ports when it starts, if you connect the usb ports after starting the application, you have to close it and run it again. If no serial port is detected, the message appears at the bottom of the application window:

No Serial Port Detected

If only a single serial port is detected, the message appears at the bottom of the application window:

Validate Serial Port Detected

If multiple serial ports are detected, the message appears at the bottom of the application window:

Select Serial Port Before Validating

In the above part of the application window, we can select, the serial port and configure the speed of it.

Select Serial P.	Config Serial P.
COM4	115200,N,8,1
COM4	9600,N,8,1
COM15	19200,N,8,1
COM16	38400,N,8,1
	56700,N,8,1
	115200,N,8,1

Once the port have been selected and its configuration, click on the validate button.

Select Serial P.	Config Serial P.	
COM4	115200,N,8,1	VALIDATE

Frames would immediately start to be received on the serial port if the connected device or controller is sending frames.

The format of the frames, is simply a set of values separated by commas and terminated by a new line character "\n".

If the received frame has the same number of data as the text input field (No. of Variables), the message: Synchronized Data with time marker per scan program in Green will appear:

Select Serial P.	Config Serial P.
COM4	115200,N,8,1
Synchronized Data 4 ms	

If the number of data received in the frame is different from the number of Variables entered in the text entry field (No. of Variables), the message: Unsynchronized Data will appear with the time marker per program scan in Red:

Select Serial P.	Config Serial P.
COM4	115200,N,8,1
Unsynchronized Data 15 ms	

The text input field (No. of Variables) can be changed at any time (it will only allow us to enter values between 1 and 8).

8 N° Variables

Each time a data frame is received by the serial port, it is displayed on the line for this purpose on the application screen:

N. Data: 8 Data:-403,443,23,212,500,-141,521,0

Where it shows us the number of data received and their values separated by commas.

On the right side of this line is the traffic light that gives us an indication of if we are losing data frames, frames that are sent by the microcontroller device and that does not give time to the application to capture them.



If the traffic light is green it indicates that all or almost all frames are received, if it is orange it indicates that at some moment some data frames are lost, if it is red it indicates that many data frames are been lost.

### Graphics Mode / Bars Mode.

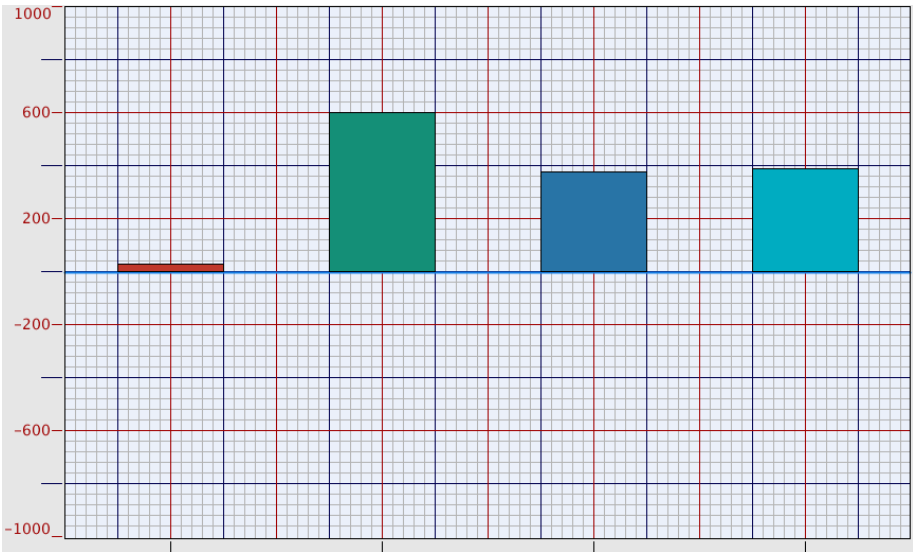
There are two modes of presenting the received information, in the graphic mode (default) the waveform of the data received by the serial port is shown:



The vertical scale is for viewing the amplitude value of the received data waveforms, the horizontal scale shows the number of frames received and drawn on the graph and is a representation of the time that is elapsing in units of frames received. In bargraph mode (not graphical mode), information is displayed in bargraph mode whose height changes with the received data.

To activate the bar mode, deselect in the selection box Graphic Mode:

☐ Graphics Mode



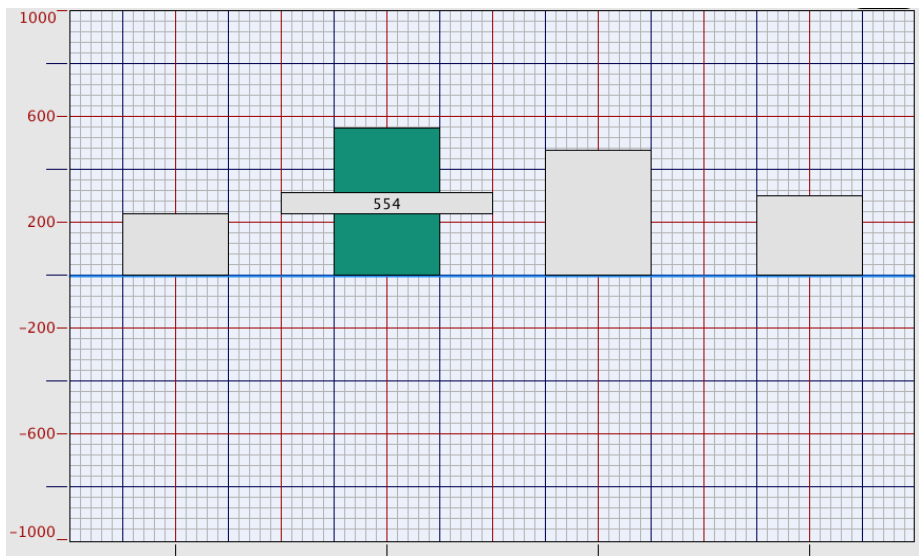
In this mode the horizontal scale only has the purpose of the order in which the different variables of the received frames are drawn, up to a maximum of variables as it appears in the text box (Nº Variables), the maximum number of variables to be shown is 8.

In both modes, the lower part of the screen shows the current, maximum and minimum values per variable and a series of buttons that allow you to highlight one graph or bar above the others.

Actual Val:	0	-600	-360	-400
Maximal V:	600	600	509	400
Minimal V:	-600	-600	-509	-400
Select Bar:	<div></div> 0	<div></div> 1	<div></div> 2	<div></div> 3

Each bar or graph is associated with a different color.

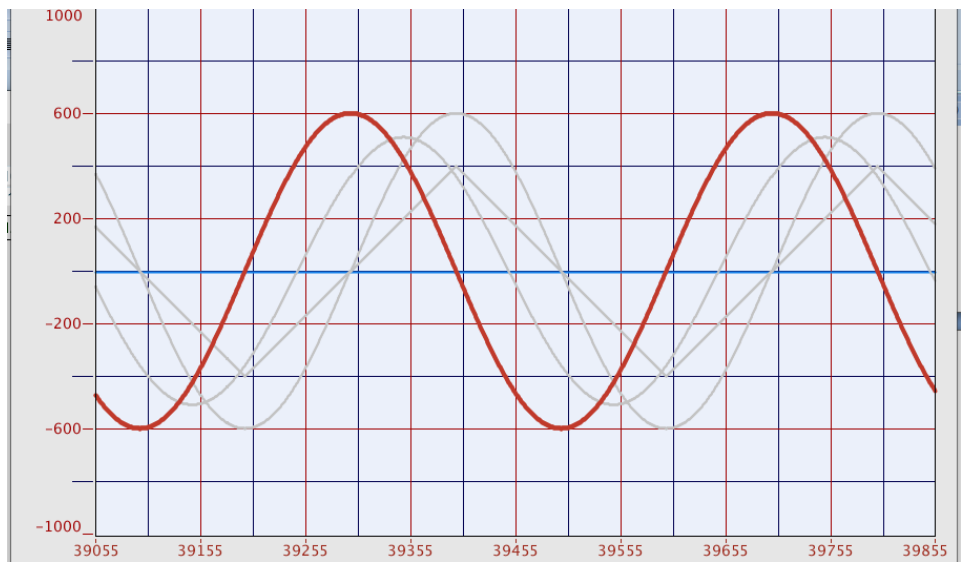
If we click on the dark green button ("1"), in bar mode:



We see the green bar highlighted over the other represented bars and the current value of the associated variable, shown over the same bar.

In the graphic mode what is done is to highlight the waveform of the variable corresponding to the pulsed color button with respect to the others represented.

If we click on the lower dark red button ("0").



### Fixed Scale/ Dynamic Scale.

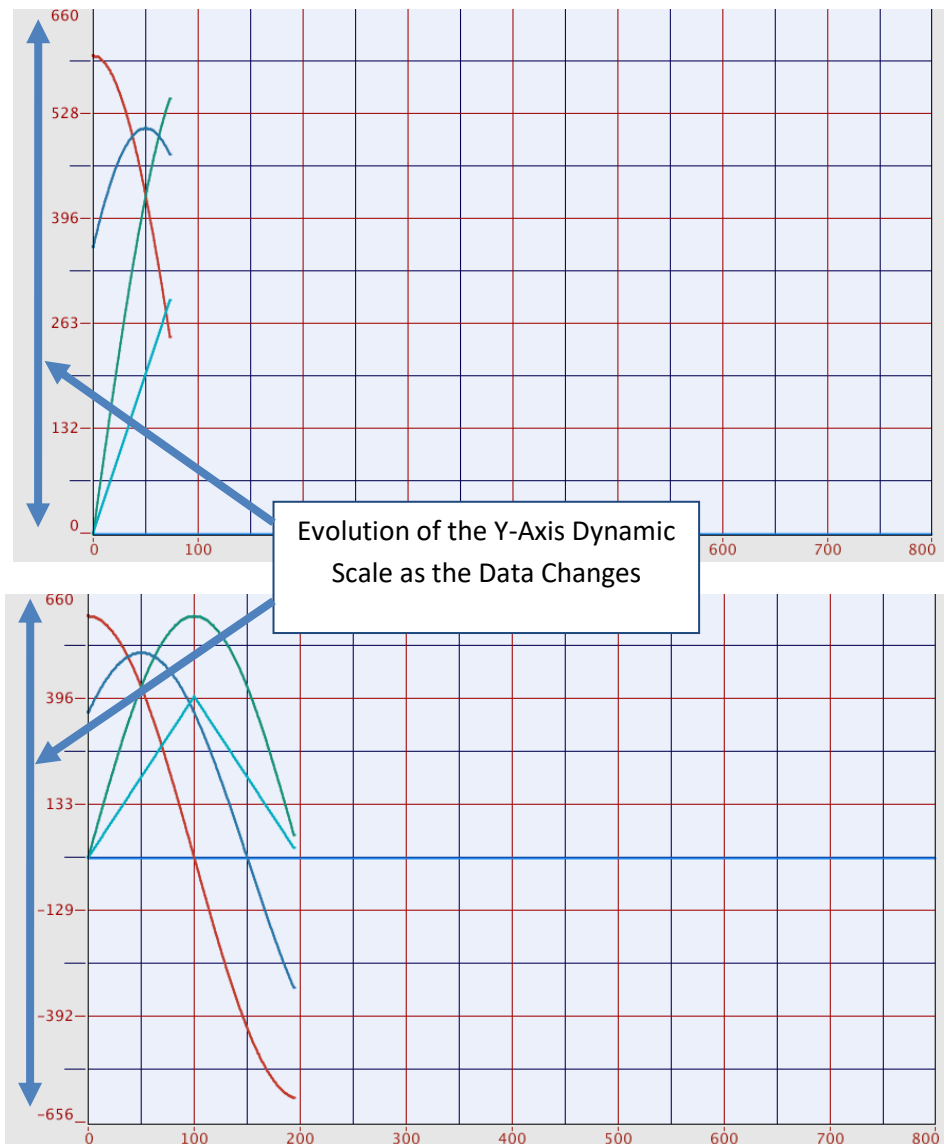
Both in graphic and bar mode, the data received can be represented according to fixed scale values that can be configured, or on the base of a dynamic scale according to the maximum and minimum values of the group of variables to be displayed.

1000	Maximal Value	<input checked="" type="radio"/> Fixed Scale
-1000	Minimal Value	<input type="radio"/> Dynamic Scale

By default the program starts with a fixed scale operating mode, with default values for the maximum 1000 and for the minimum -1000, these two values can be changed in the corresponding input field.

The maximum and minimum values that can be entered are +9999999, -9999999, if very large values are entered with respect to the received values the bars and graphs will not be seen , if on the opposite hand very small values are entered with respect to the received values the bars and graphs will be cut off at the maximum and minimum values entered.

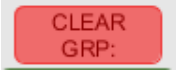
If we set the dynamic scale radio button, the scale value will be set to the current maximum and minimum values of all the values to be represented. If the maximum and minimum values of all the variables have many fast changes it will be difficult to appreciate the temporal evolution of the received data.





### Button Clear GRP.

The button Clear GRP.



Clears the window where the bars or waveforms of the received data are drawn and starts again, in the case of the graph mode, this starts again from the left side, until the window is filled again and then continues to move the graph.

### Button Run/STOP.



The RUN/STOP button allows you to freeze (Stop) the evolution of the bars/Graph, or on the opposite, make it change as the data arrives through the serial port (Run).

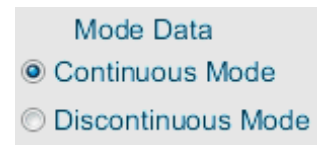
While in Stop mode, the background around the button is shown in dark red and if we are in Run mode the background is shown in dark green.

While we are in Stop mode, what occurs is that the received data is not displayed but you can still receive data on the serial port.

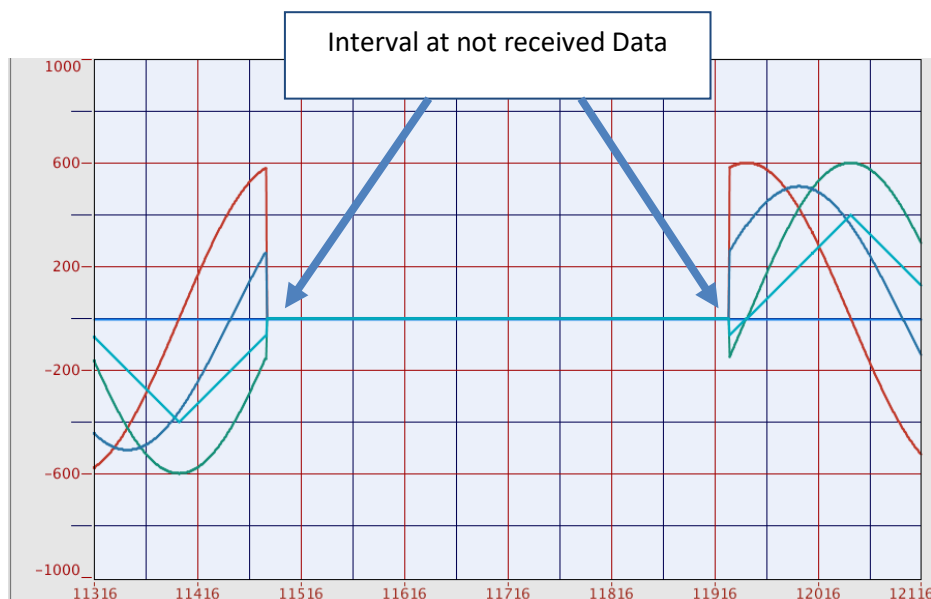
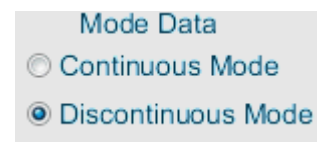
### Data Mode: Continuous and Discontinuous.

These two modes refer to how the waveform or bar graphs change if no more data is received on the serial port and then data is received later.

In Continuous Mode, if you Stop receiving data the graph freezes and when you start receiving again the graph continues at the same point where it stopped.



In Discontinuous Mode, if you stop receiving data, the graph goes to zero and continues to progress to zero until data is received again and represented according to the values received.



Info About button:

ABOUT:

The About button opens a new window with the information of this application.

