DynaLabs DYN-30 Series USB/RS232 Interface User Manual

DynaLabs

Model DYN-30XXXX-XX
Range [g]: 2, 4, 8, 10, 20, 40
USB/RS232 Interface
Product Manual

Contents

Product Support

If at any time you have questions or problems with the DYN-30XXXX-XX sensors, please contact a Dynalabs engineer at:
Phone: +90 312 386 21 89 (9 a.m. to 5 p.m., UTC +3)
E-mail: info@dynalabs.com.tr

Warranty

Our products are warranted against defective materials and workmanship for one year. Defects arising from user errors are not covered by the warranty.

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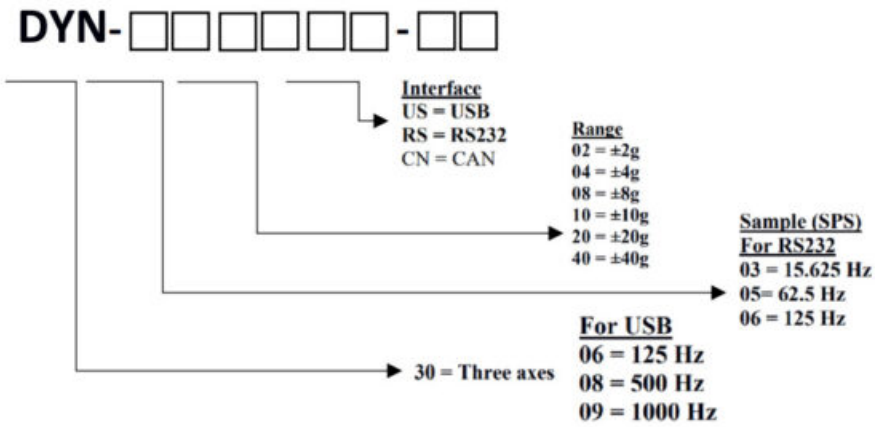
This publication may contain inaccuracies or typographical errors. Dynalabs Ltd. will periodically update the material for inclusion in new editions. Changes and improvements to the product described in this manual may be made at any time.

Introduction

Capacitive accelerometers are based on proven micro-electro-mechanical systems (MEMS) technology. These accelerometers are reliable, long-term stable, and precise. MEMS technology facilitates the precise measurement of both static (DC) and continuous accelerations, allowing for the calculation of the velocity and displacement of moving objects.
The sensor is designed with three digital interfaces (RS232, USB, CAN) and can detect dynamic (AC) accelerations with amplitudes ranging from ±2g to ±40g. It has a speed of up to 4000 samples per second and a resolution close to 4 µg in three axes. Users can choose the appropriate sensor based on their specific needs.
The power supply voltage is flexible, ranging from 5 to 16 VDC. The triaxial accelerometers allow for quick and easy mounting.

NOTICE

We offer two hardware configurations for USB and RS232 Digital Interface accelerometers:
8g Se**n**sor: Users can select 2g, 4g, or 8g via sending a message to the sensor.
40g Sensor: Users can select 10g, 20g, or 40g via sending a message to the sensor.
Marking:



Example: DYN-300840-US is a
Triaxial, 500SPS , ±40g, Capacitive Accelerometer with USB Interface.
DYN-XXXXXX-XX sensors offer the following options.

- Customize Range
- Customize Frequency
- Customize Connector
- Customize Cable Length
- Customize Aluminum or Steel

Hardware General Information

2.1) Unpacking and Inspection
Dynalabs products provide adequate protection for undamaged products to be transported. Document the damage that occurred indirectly during transportation and contact the customer representative.
2.2) System Components
The DYN-30XXXX-XX has the following components:
– MEMS Sensor
– Calibration Certificate
– Product Manual
2.3) Specifications
Table 1 General Specifications

		Sensitivity		0 g Offset			Noise	Non Linea rity	Resolution
Range		**Sensitivity**	**Change/°C**	**Min**	**Typ**	**Max**	**Typ**	**Typ**	**1 LSB**
Unit	**g**	**µg/LSB**	**%/°C**	**mg**			**µg/√Hz**	%	**µg**
	±2	3,90625	±0.01	—75	±25	75	25	0,1	4
	±4	7,8125	±0.01	—75	±25	75	25	0,8	8
	±8	15,625	±0.01	—75	±25	75	25	1,6	16
	±10	0,195313	±0.01	—375	±125	375	75	0,1	20
	±20	0,390625	±0.01	—375	±125	375	85	0,5	40
	±40	0,78125	±0.01	—375	±125	375	90	1,3	80

Table 2 Electrical, Environment and Physical Specifications

Operating Voltage	5V – 16 V
Operating Power/Current	1 W/62.5 mA
Operating Temperature	-40 °C to + 85 °C
Shock Limit	5000 g
Protection Level	IP 68
Mounting	Adhesive or screw holes
Housing Material	Anodized Aluminum
Weight (without cable)	80 g
Connector at Sensor (open ended) RS232	Pin 2 ……RXD ……Green Pin 3 ……TXD ……White Pin 5 ……GND ……Black Pin 9 ……5V…… Red
Connector at Sensor (open ended) USB	Pin 1 ……+5V ……Red Pin 2 ……D- ……White Pin 3 ……D+ ……Green Pin 4…… GND ……Black

Pinout:

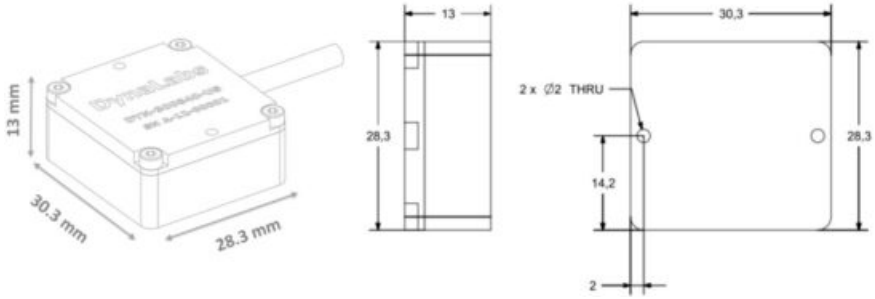
Table 3 SPS – LPF (Hz)

USB SPS (Sample per second)	Low-Pass (Hz)
125	31.25
500	125
1000	250

Table 4 SPS – LPF (Hz)

RS232 SPS (Sample per second)	Low-Pass (Hz)
15.625	4.
62.5	15.62
125	31.25

2.4) Outline Drawing
The dimensional properties of the DYN-30XXXX-XX sensors are given below.



Operation and Installation

3.1) General
After connecting the sensor to the PC (power connection) it will be in initisetting mode and will start sending data via USB or RS232.
Initial setting for ±2, 4, 8g Sensor USB:

- Triaxial and Temp is ON
- Measurement Range: ±8g (Max)
- Sample Rate: 1000 SPS (Max)

Initial setting for ±10, 20, 40g Sensor USB:

- Triaxial and Temp is ON
- Measurement Range: ±40g (Max)
- Sample Rate: 1000 SPS (Max)

Initial settings for ±2g, 4g, 8g Sensor RS232:

- Triaxial and Temp is ON

- Measurement Range: ±8g (Max)
- Sample Rate: 125 SPS (Max)

Initial settings for ±10g, 20g, 40g Sensor RS232:

- Triaxial and Temp is ON
- Measurement Range: ±40g (Max)
- Sample Rate: 125 SPS (Max)

To prepare the sensor for use, first configure it or use with initial setting.
Configurable setting for ±8g Sensor USB:

- ON/OFF X, Y, Z and Temp
- Select Range: ±2g, ±4g and ±8g
- Select Sample Rate: 0, 125, 500, 1000 SPS

Configureable setting for ±40g Sensor USB:

- Triaxial and Temp is ON
- Select Range: ±10g, ±20g and ±40g
- Select Sample Rate: 0, 125, 500, 1000 SPS

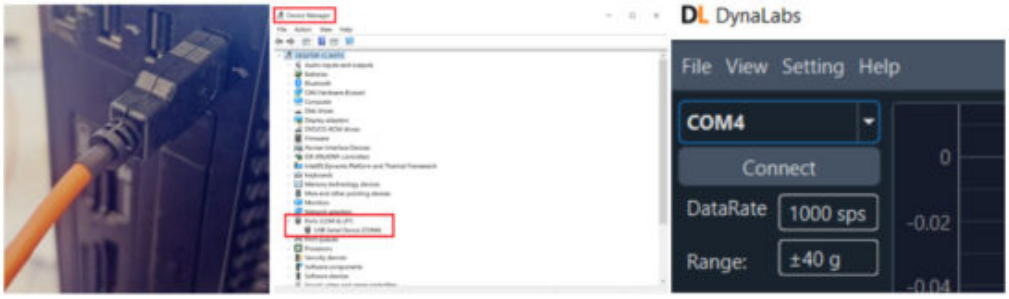
Configurable settings for ±8g Sensor RS232:

- ON/OFF X, Y, Z and Temp
- Select Range: ±2g, ±4g and ±8g
- Select Sample Rate: 0, 15, 60, 125 SPS

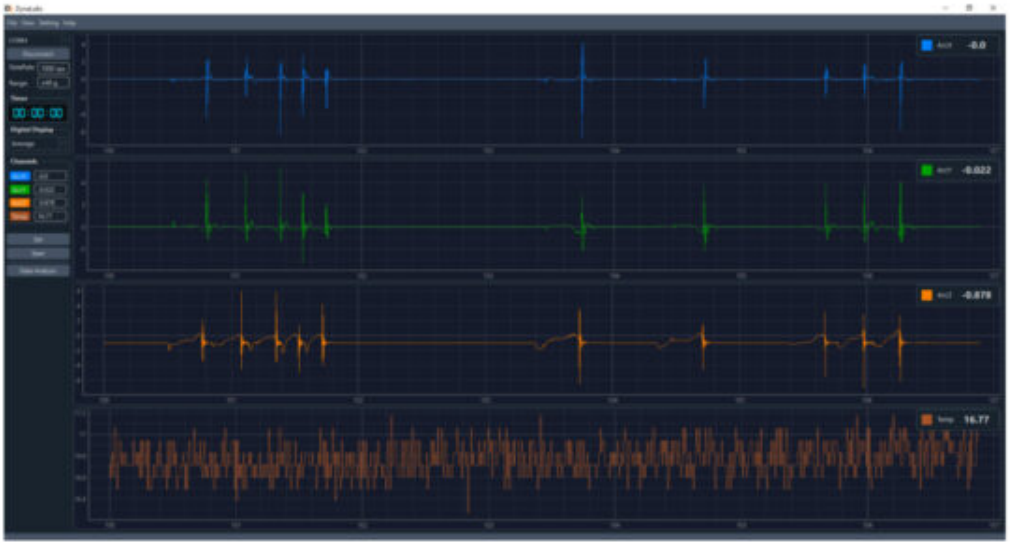
Configurable settings for ±40g Sensor RS232:

- ON/OFF X, Y, Z and Temp
- Select Range: ±10g, ±20g and ±40g
- Select Sample Rate: 0, 15, 60, 125 SPS

Connect the device to the system through the USB port. To ensure that the device is recognized by the computer and to know the Port number, go to the device manager of the computer.



3. Select the detected port number in the connection part and press the connect button. The software will be connected to the device and will start drawing the graph, start and set buttons will be activated. In the first connection, all specifications are in their initial state. You can press the set button for any changes.



It is not necessary to connect to the device with its own software, and you can connect with another Serial Port Terminal program and receive data or set the device. You can use Other analytical software's that have connect to the serial port option.
First, select the correct 'Port' and 'Baud Rate' in the software. Refer to section 3.2) for configuration instructions and a sample configuration message.
To separate incoming serial messages, follow the instructions in section 3.2) for data reading. When receiving serial messages, use the software to separate them as explained in section 3.2.1) , taking note of the instructions in Table 5 and Table 6.

3.2 DYN message

After connecting the device to the PC, we will have two general messages.

1. Message that the computer receives from the device and will have acceleration data. This message is received on the PC several times per second according to the sample rate.
2. A message that goes from the PC to the device that has configuration data. This message is sent from PC to the device whenever new settings are needed.

Table 5 Notes on RS232 and USB protocol

Start of protocol	End of protocol	Separation
"$"	"*"	","

3.2.1 DYN Received message:

An example of received (in pc) message: $DYN, -0.01, 0.02, -1.05, g, 22.69, C,*

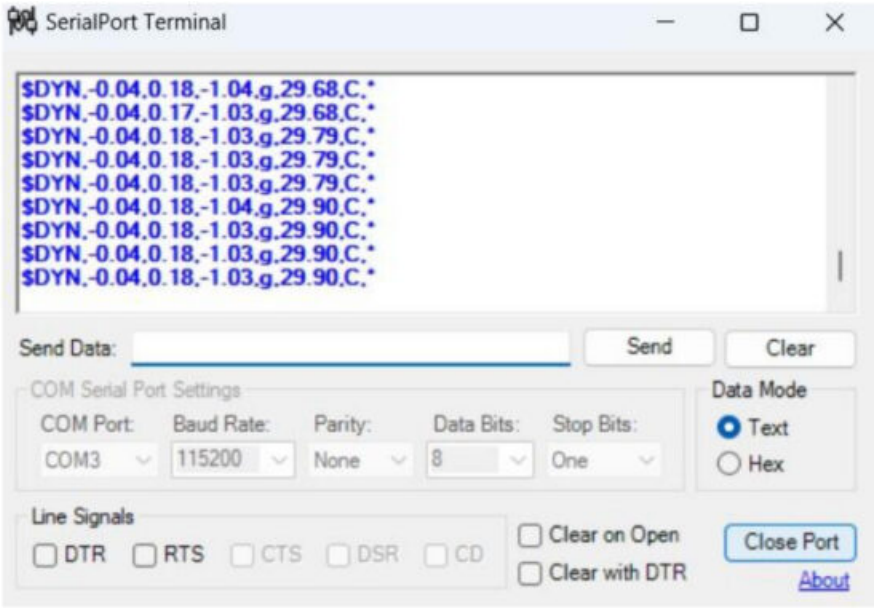
In this message:

X = -0.01 g
Y = 0.02 g
Z = -1.05 g
Temp = 22.69C
Acc. Unit = g
Temp Unit = C

Table 6 Example data template

<$DYN>	<X-axis g>	<Y-axis g>	<Z-axis g>	<Unit of acc>	<Temp>	<Unit of temp>	<*>
$DYN,	-0.01,	0.02,	-1.05,	g,	22.69,	C,	*

SerialPort Terminal (Windows)



3.2.2 DYN Configuration message:
Tablo 6 Configuration settings

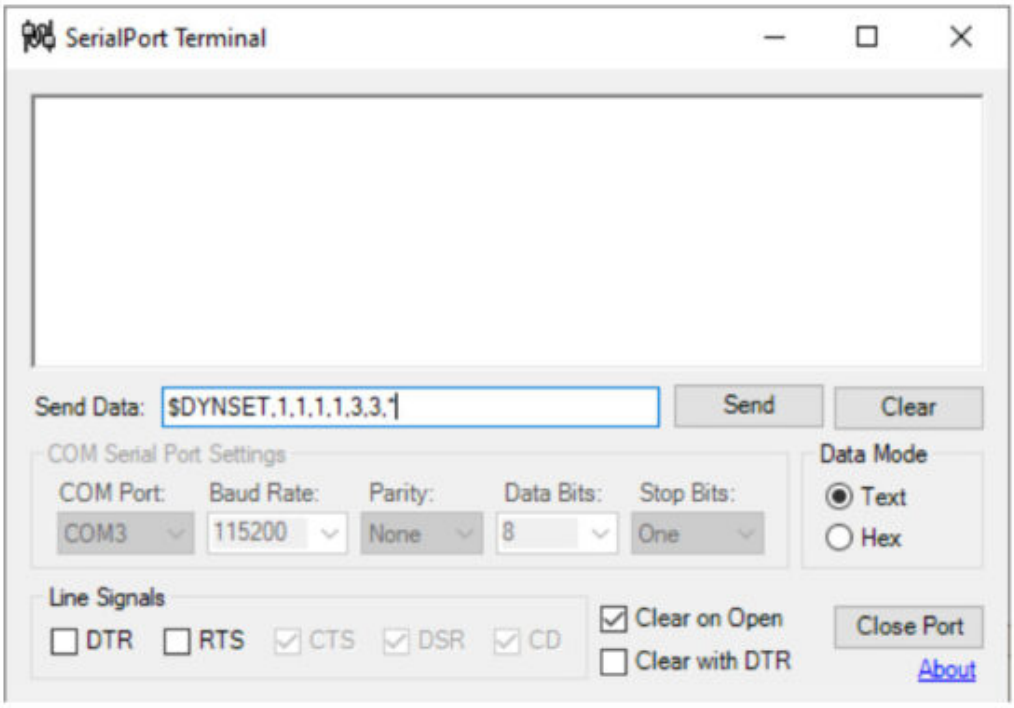
<table>
<tr><td colspan="4">$DYNSET,<X-axis>,<Y-axis>,<Z-axis>,<Temperature>,<Sample Rate>,<Acc Range>,*</td></tr>
<tr><td colspan="2"><X-axis></td><td rowspan="4">0: Off</td><td rowspan="4">1: On</td></tr>
<tr><td colspan="2"><Y-axis></td></tr>
<tr><td colspan="2"><Z-axis></td></tr>
<tr><td colspan="2"><Temperature></td></tr>
<tr><td rowspan="5"><Sample Rate></td><td>Sample Rate Value</td><td>RS232</td><td>USB</td></tr>
<tr><td>0</td><td colspan="2">Off</td></tr>
<tr><td>1</td><td>15 Hz</td><td>125 Hz</td></tr>
<tr><td>2</td><td>62 Hz</td><td>500 Hz</td></tr>
<tr><td>3</td><td>125 Hz</td><td>1000 Hz</td></tr>
<tr><td rowspan="5"><Acc Range></td><td>Acc Range Value</td><td>8g</td><td>40g</td></tr>
<tr><td>0</td><td colspan="2">Off</td></tr>
<tr><td>1</td><td>2g</td><td>10g</td></tr>
<tr><td>2</td><td>4g</td><td>20g</td></tr>
<tr><td>3</td><td>8g</td><td>40g</td></tr>
</table>

An example of a configuration message to sensor: $DYNSET,1,0,1,0,3,2,*
In this message:

X = ON
Y = OFF

Z = ON
Temp = OFF
Sample Rate = 1000 SPS
Range = ±20g
Table 7 Example configuration settings

<$DYNSET>	<X-axis>	<Y-axis>	<Z-axis>	<Temperature>	<Sample Rate>	<Acc Range>	<*>
$DYNSET,	1,	1,	1,	1,	3,	3,	*



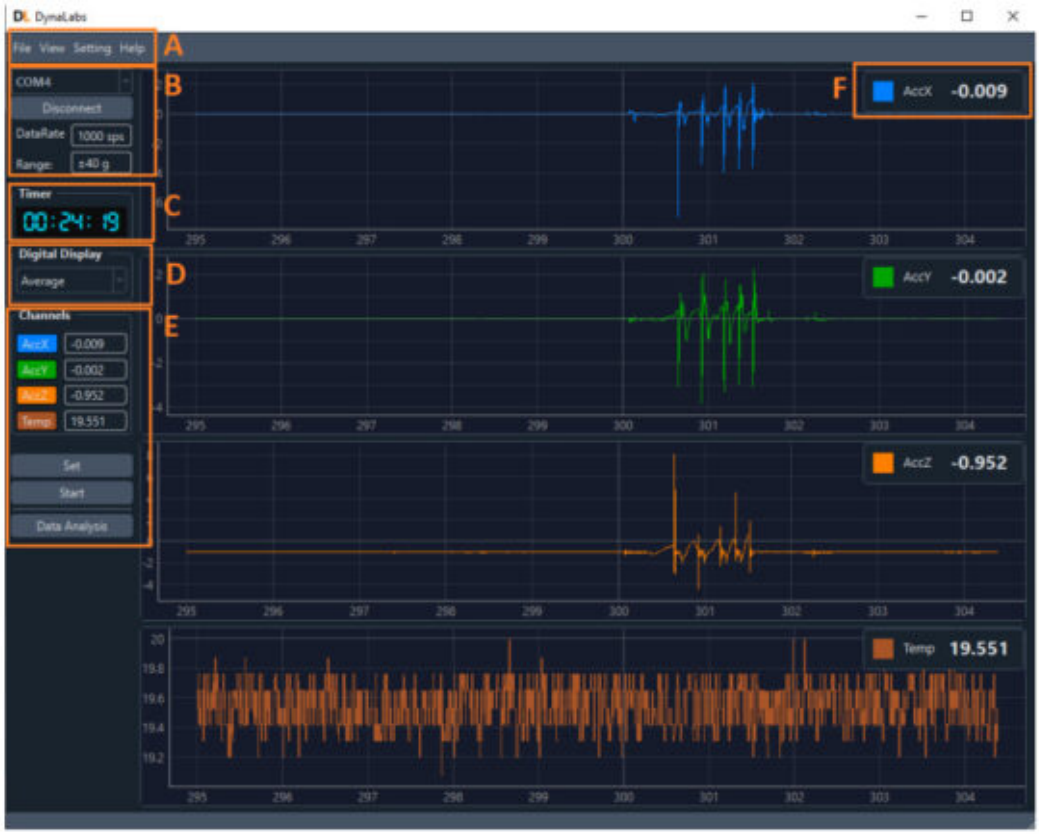
In the above example configuration:
X-axis data acquisition is on,
Y-axis data acquisition is on,
Z-axis data acquisition is on,
Temperature data acquisition is on,
Sample rate: 1000Hz,
Acc range: 40g.

Software General Information

4.1 Overview

Dynalabs Digital Accelerometer Software is a customized powerful software for Digital Accelerometer. It has a professional tool for time and frequency analyses of Accelerometer Data. It supports the USB Digital Accelerometer and Rs232 Digital Accelerometer of DynaLabs Company.
With this software, you can receive the X, Y, and Z acceleration data as well as the temperature data of DynaLabs Digital Accelerometer device and view it online.
Change hardware and software settings and send to the relevant device. The software has two Data Record and Data Analysis window. record the data and check it in the analysis window.
In the Data Analysis window Analys the data graphically, apply the necessary offsets, downsample and average the graphs, Analys the diagram in FFT. Finally, you can export your work in four different formats: .CSV, .MAT, .TXT, and .PNG.

4.2 Data Record window



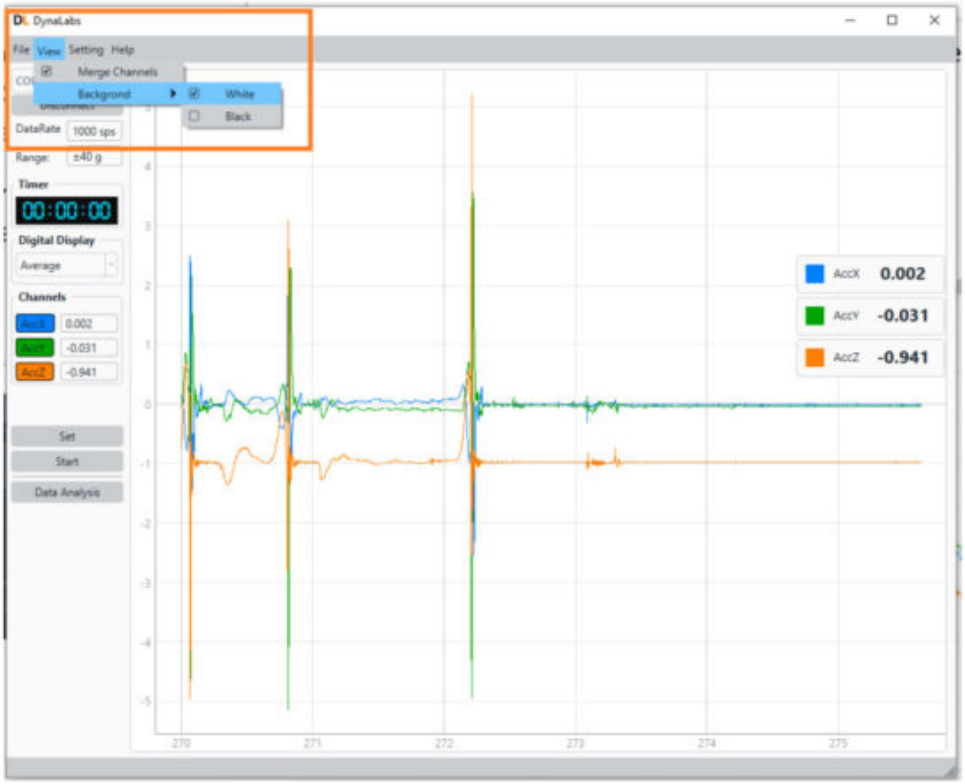
After opening the software, you will see the above window but to see the data and activate the set part, you must connect to the device.

A. Menu bar : We have following 4 sections to help the user in this menu

A.1 File : To open previously saved data

A.2 View : You can use this section to Merge the graph and change the **Background** color

A.3 Setting : This part is for applying calibration



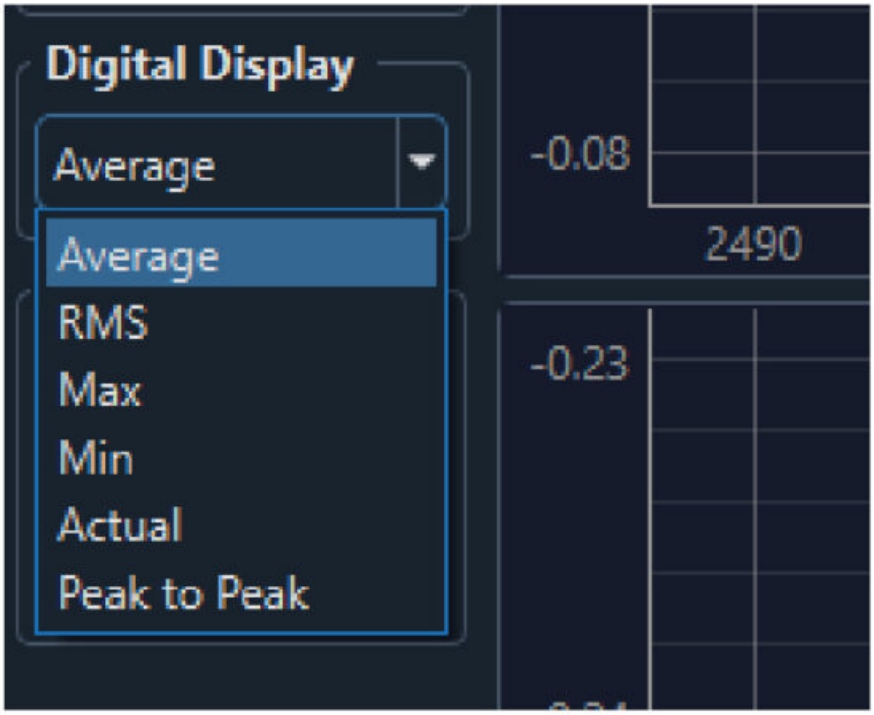
A.5 Help : Information about the company and its contact details can be found.

Also, User Document is available in Help.

B. Connect to device: Select the port and connect to the device.

C. Timer: Shows data recording time.

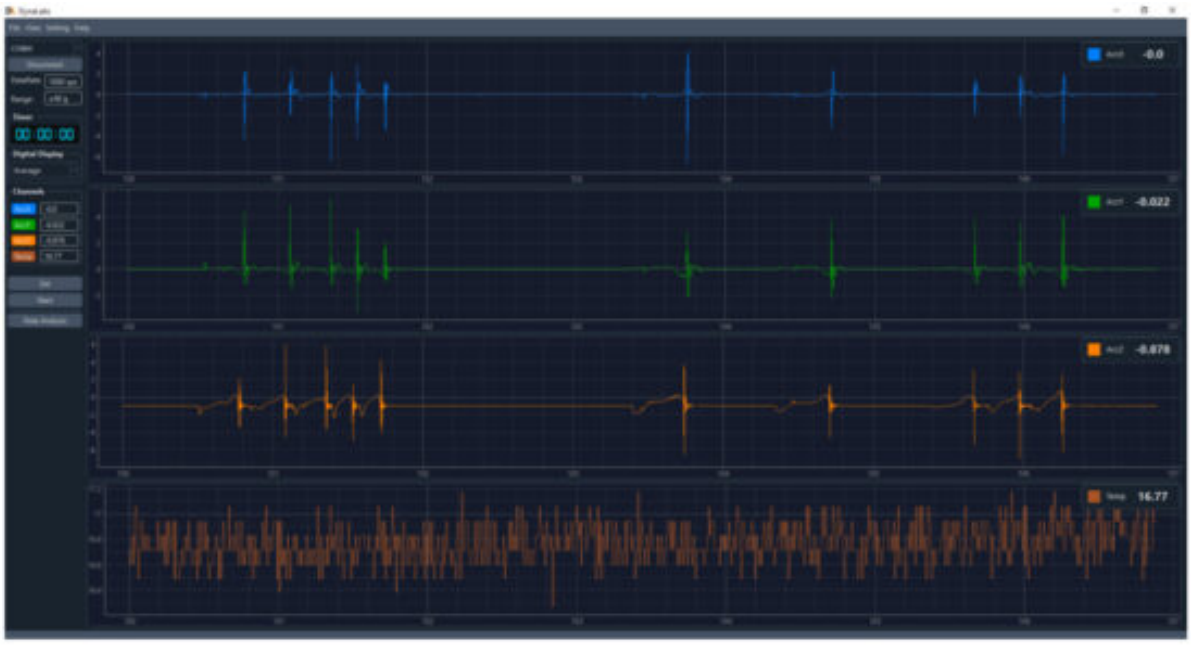
D. Digital Display: You can choose what to display in the digital meter (F in the picture). Notice that the last one second of data is considered for measurement.



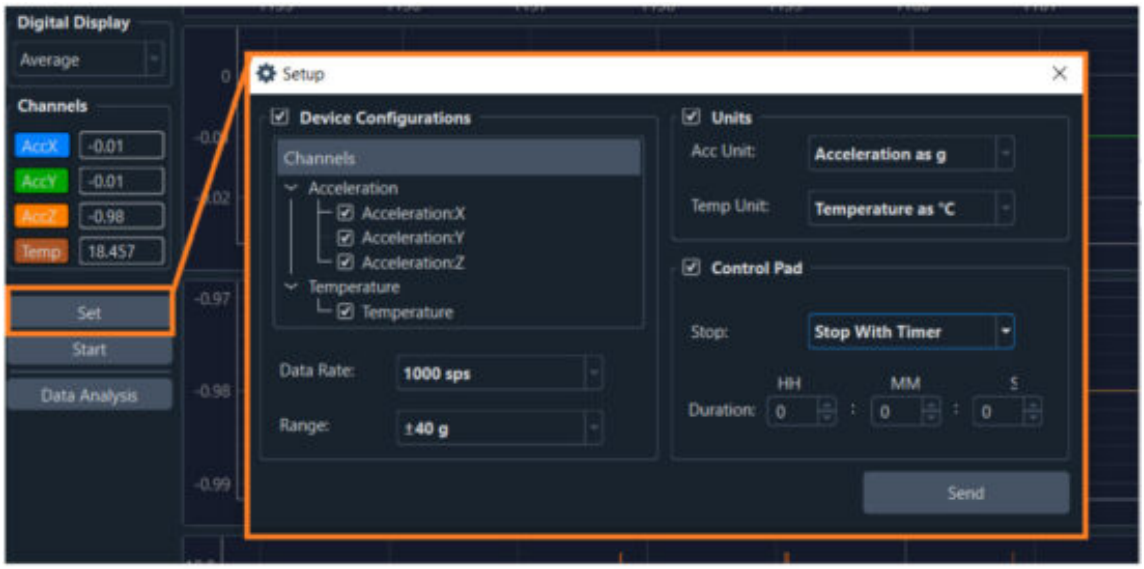
E. Control buttons:
E.1 Set: Change device settings.
E.2 Start: Start and Stop of Data Recording.
E.3 Data Analysis: Go to Analysis window.
4.2.1 Connect to device

1. Connect the device to the system through the USB port.
2. To ensure that the device is recognized by the computer and to know the Port number, go to the device manager of the computer.
3. Select the detected port number in the connection part and press the connect button.

The software will be connected to the device and will start drawing the graph, start and set buttons will be activated. In the first connection, all the specifications are in their initial state. You can press the set button for any change.



4.2.2 Set the device



There are settings you can make before starting to record data. Some of these settings are sent to the hardware and some are applied in the software itself. The settings you can change are as follows.

1. Data rate 1000, 500 and 125 samples per second can be selected. (Send to Hardware)
2. Range 40g, 20g and 10g range can be selected. (Send to Hardware)
3. X, Y, Z and Temperature Activation. (Send to Hardware)
4. Acc Unit g and m/s2 unit can be selected. (Applied in the software)
5. Temp Unit C, F and K unit can be selected. (Applied in the software)
6. Stop: In this section, you will specify whether data record ends by pressing stop or after a certain time.

If you select Stop With Button. After pressing the start button in Data Record window, the same button will become a stop button and the data will continue to be record until you press it. Also, the timer display will count up.
If you select Stop With Timer, the Duration part will be activated to set the data collection time. After pressing the start button in Data Record window, the same button will become a stop button and the data will continue to be record until you press it or the set time ends. Also, the timer display will count Down.

4.2.3 Calibration

In the uncalibrated mode and initial settings, the device data has an accuracy of 0.02 G. This number may change with the time and use. In any case, the device needs calibration. This work can be done by calibration companies or DynaLabs company itself so that the measurement can be done with very high accuracy.

To calibrate each of the data, including the temperature data, we will need a slope and an offset. Since the output data of the device is as linear as possible, these values will be sufficient.

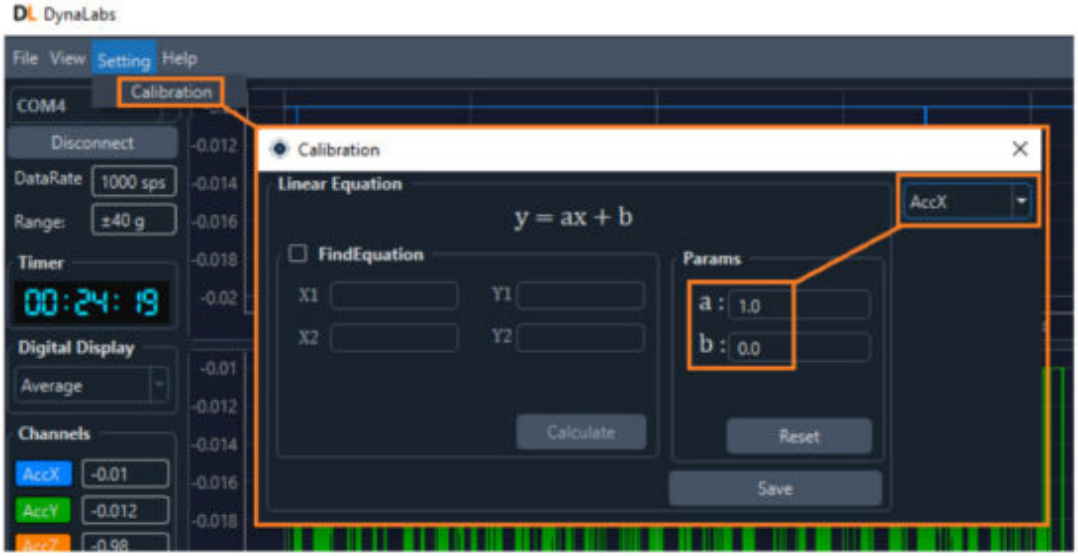
Y = aX + b

a is the slope , b is the Y-intercept or offset

The calibration company will give us the value of a and b for each of the data.

You can find a Calibration Document in the device box, these numbers are for the calibration of the DynaLabs company and will be accepted for a period of one year.

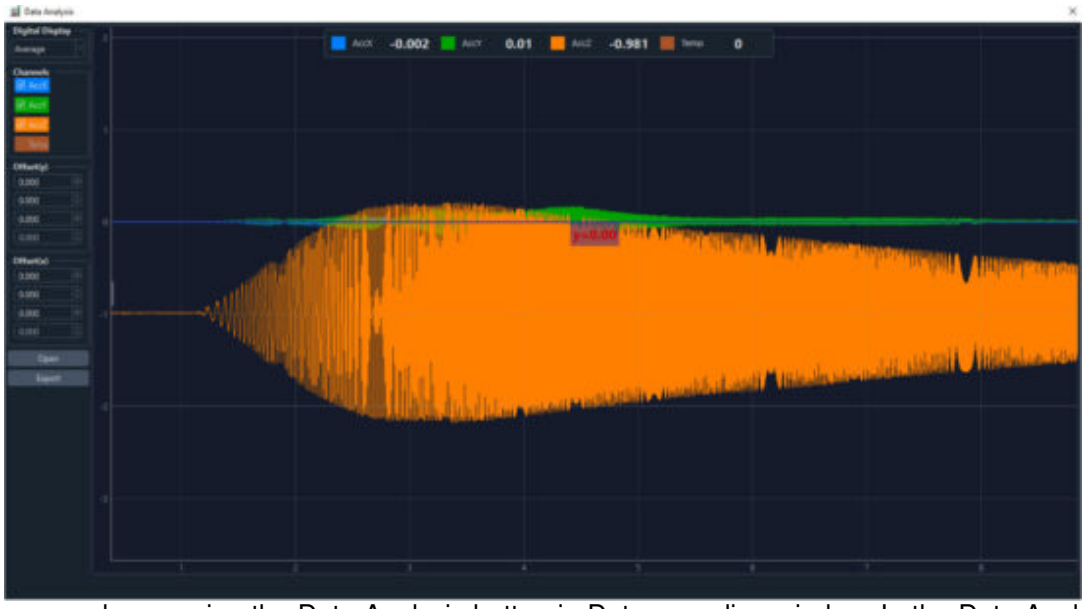
With these numbers, you can enter the special numbers for each signal in the Calibration window.



If you want to find a and b by yourself, by comparing the data of the device and a calibrated device, part FindEquation will help you calculate them. Just enter the measurements of the two points seen by the device in the X section and enter the measurements of those two points in the calibration device in the Y section than press Calculate button.

Save changes before exit.

4.3 Data Analysis window

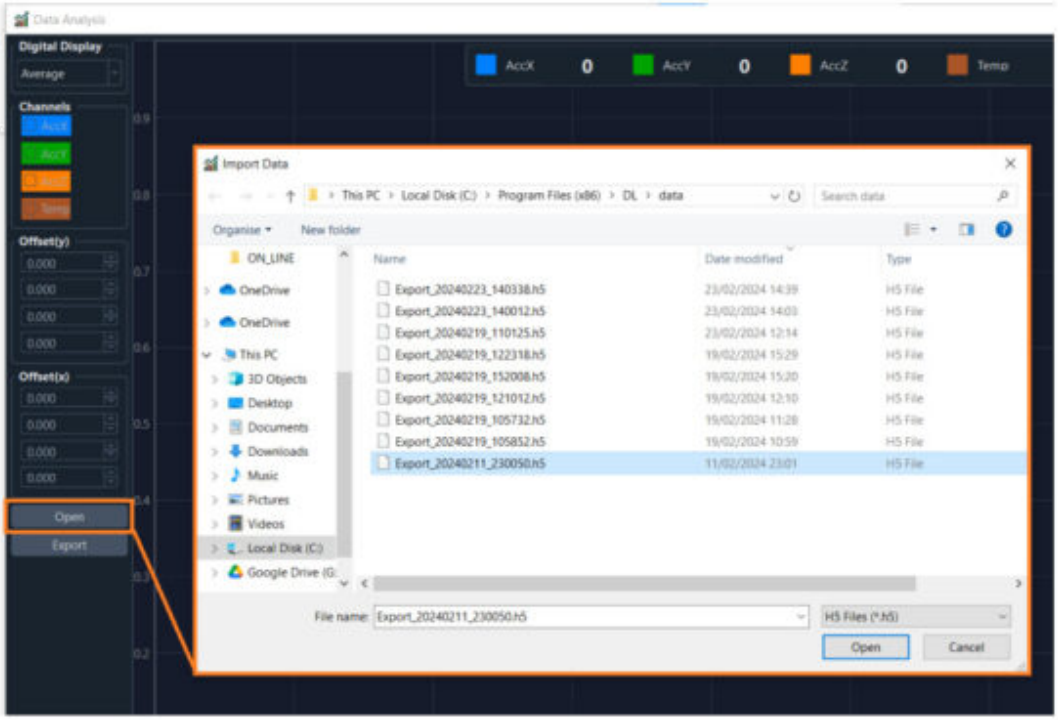


This window opens by pressing the Data Analysis button in Data recording window. In the Data Analysis window Analys the data graphically, apply the necessary offsets, downsample and average the graphs, Analys the diagram in FFT. Finally, you can export your work in four different formats: .CSV, .MAT, .TXT, and .PNG.

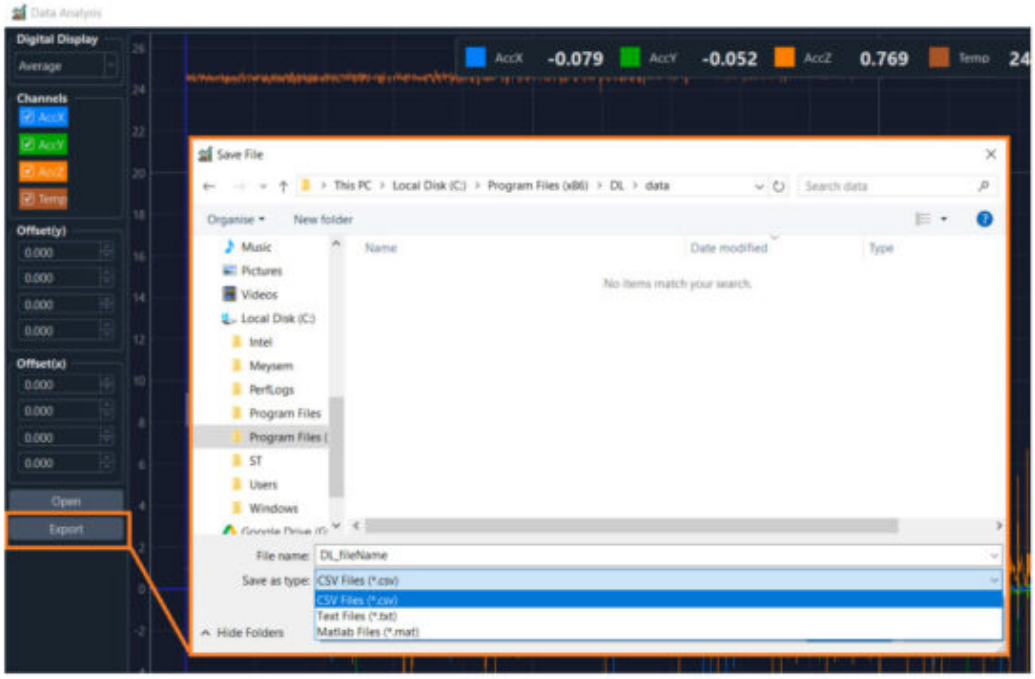
4.3.1 Open Button:

When you enter this window, the last saved data will be opened and ready for analysis. To open and analyse previously saved data, you must press the open button. You can open one of the previous data saved by this software.

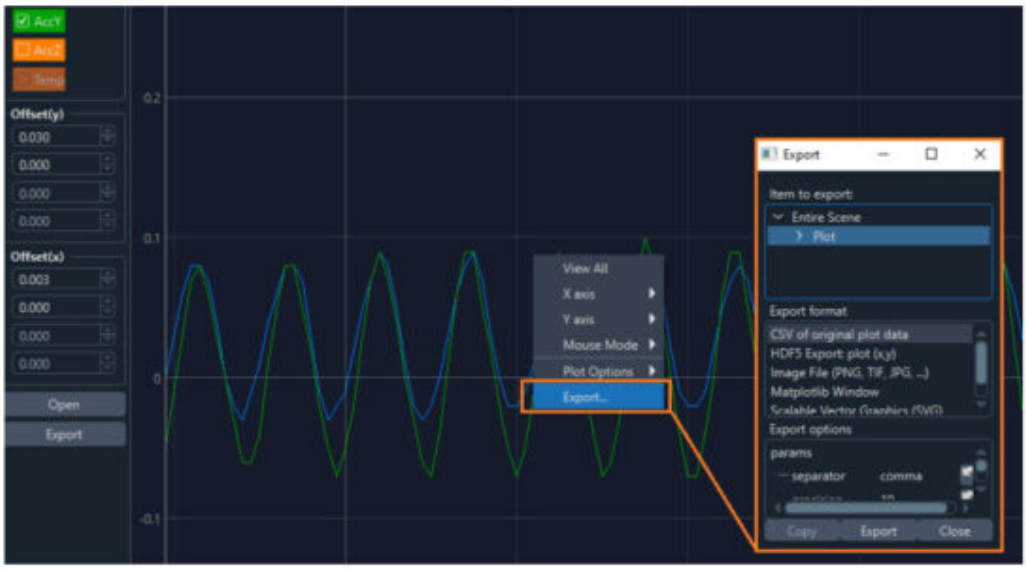
Notice that the file format must be .h5.



4.3.2 Export: To export data, press this button and choose one of the following formats: .CSV, .TXT, or .MAT. If needed, you can change the file name before saving.



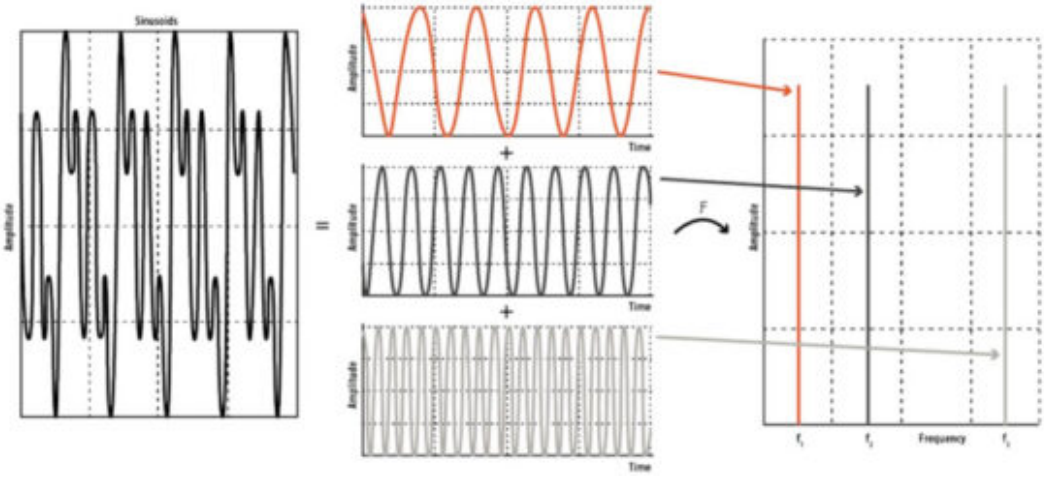
To export the image, right-click on the graph and select Export. In the opened page, select the image and save it.



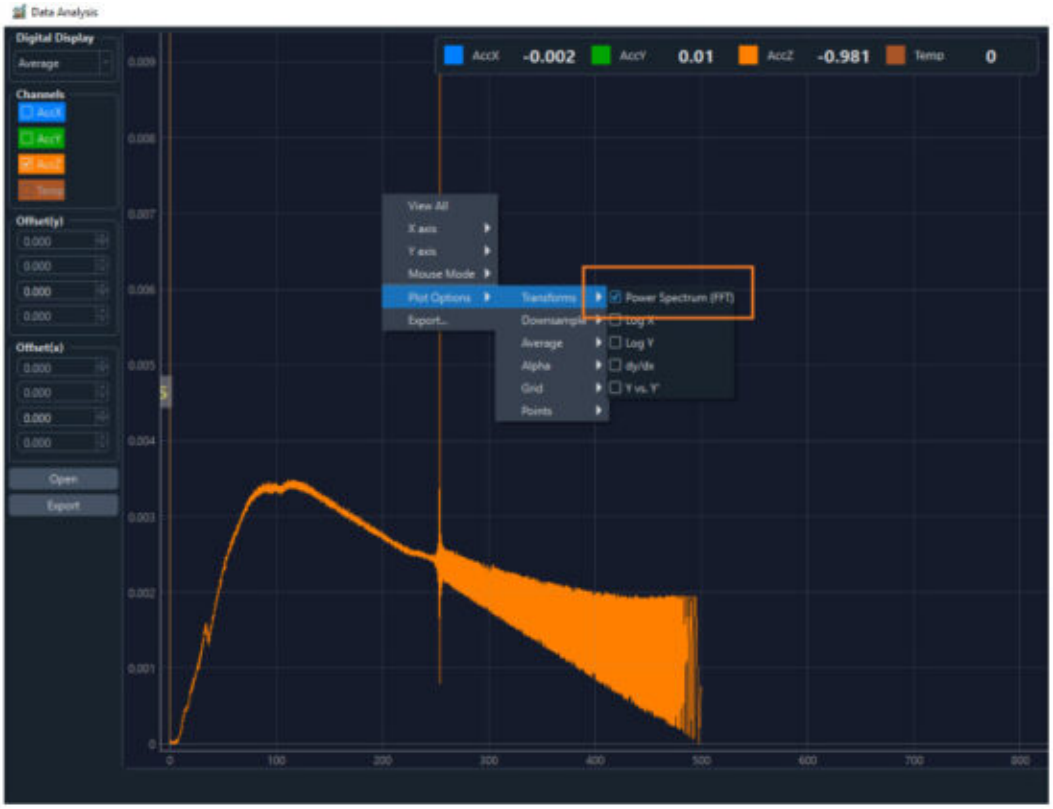
4.3.3 Offset: To Analys and compare two signals in this part, you can add an offset to each of the signals separately in the Y or X direction. Notice that the changes will not be applied in the export data.

4.3.4 FFT (Fast Fourier Transform): FFT analysis is one of the most used techniques when performing signal analysis across several application domains.

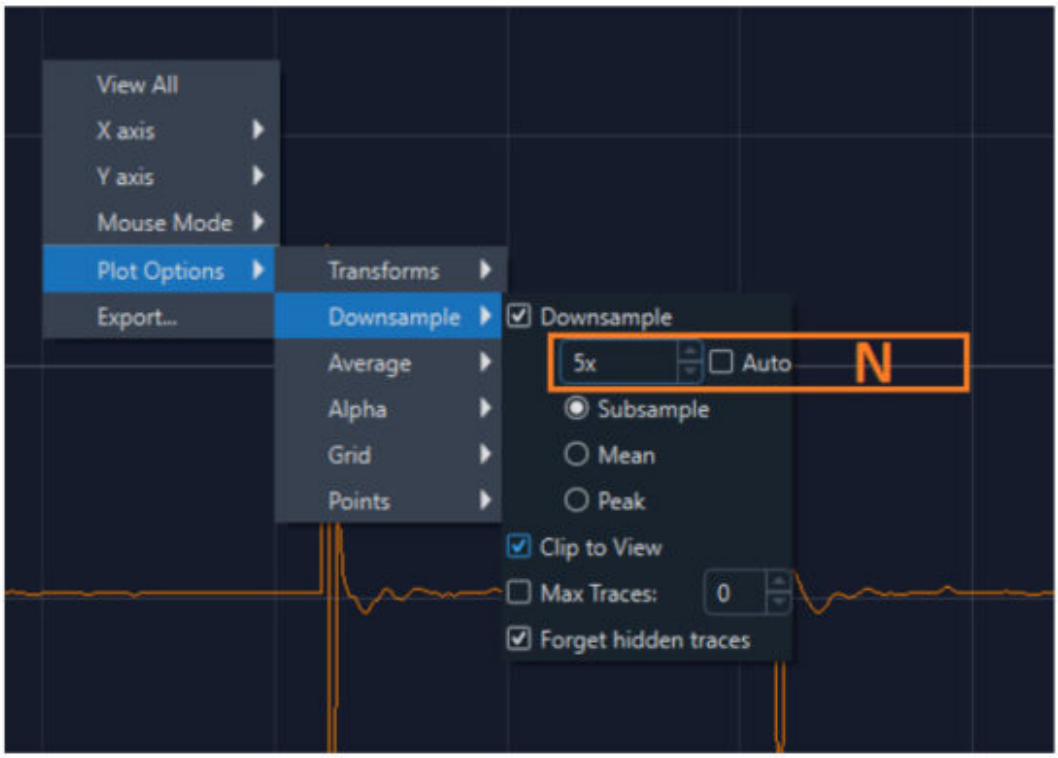
FFT transforms signals from the time domain to the frequency domain. FFT is the abbreviation of Fast Fourier Transform.
Using FFT analysis, numerous signal characteristics can be investigated to a much greater extent than when inspecting the time domain data. In the frequency domain, the signal characteristics are described by independent frequency components, wherein the time domain it is described by one waveform, containing the sum of all characteristics.



To get started with FFT analysis, time data has to be acquired. This data may have been collected before or during FFT analysis. This means that you can use this feature on both data recording and data analysis windows.
To see the signal's FFT diagram, just right click on the graphs and select FFT in Plot options.

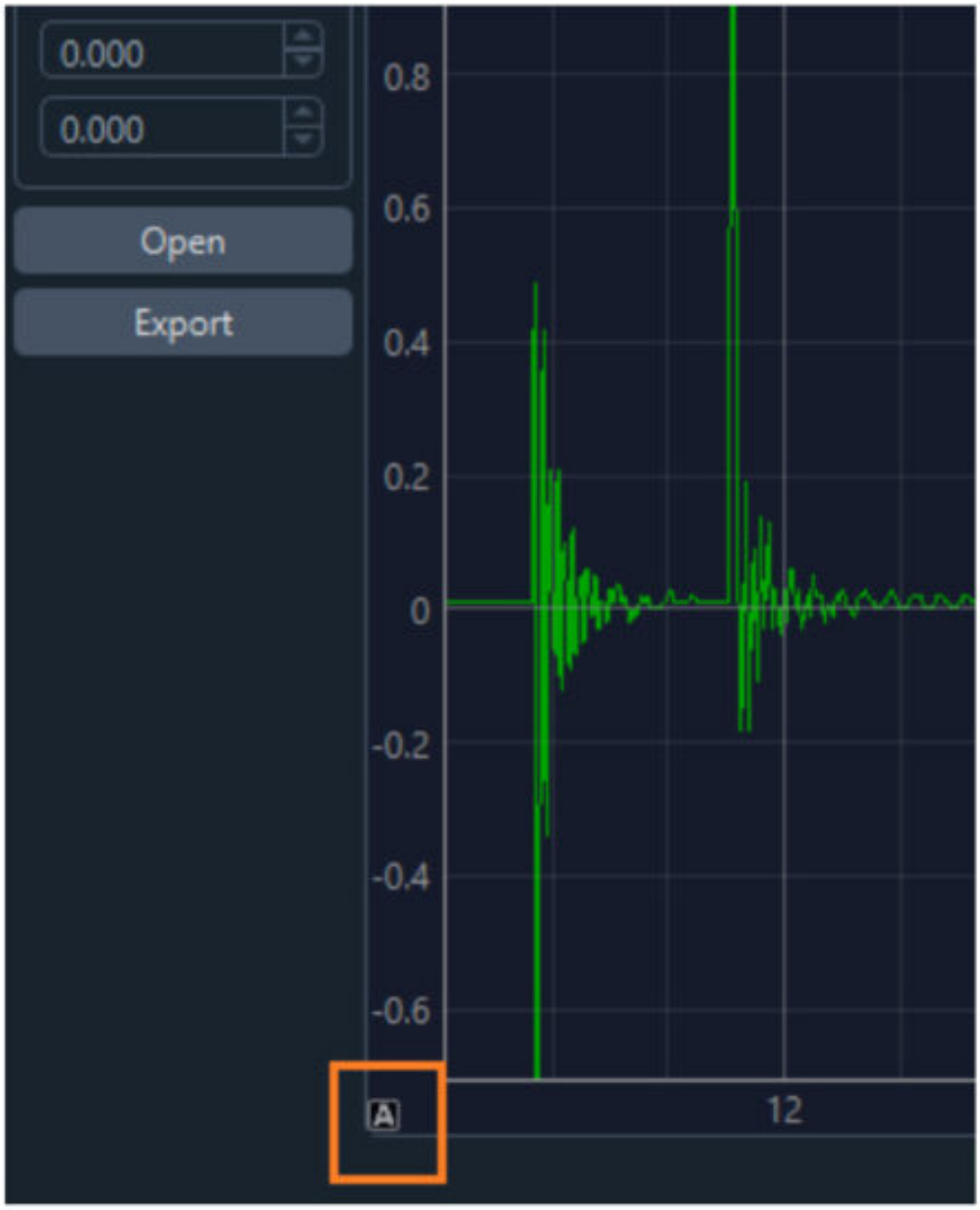


4.3.5 Downsample: To downsample the signal's, just right click on the graphs and select Downsample in Plot options. You will have several choices including:
(Write N first)
Subsample: Downsample by taking the mean of N samples
Mean: Downsample by taking the first of N samples
Peak: Downsample by drawing a saw wave that follows the min and max of the original data.
And more



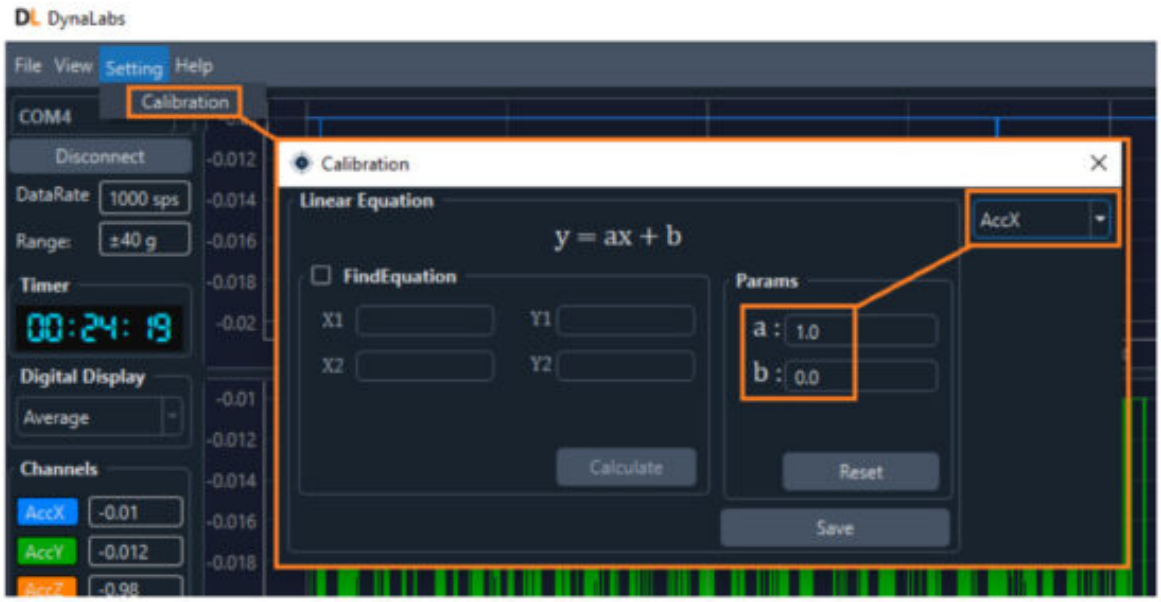
4.3.6 Average: Display averages of the curves displayed in the plot. Removeany of the graphs that you want not to be averaged from the display to see the signal's Average diagram, just right click on the graphs and select Average in Plot options.

Auto Scaling: To see the graph in the appropriate scale use Auto Scaling. To apply Auto Scaling Just press the letter A in the corner of the graphs.



Sensor Static Calibration Verification

Using gravity, voltage values are measured in the + and – directions, providing a value of 1 g.
In the uncalibrated mode and initial settings, the device data has an accuracy of 0.02 G. This number may change with the time and use. In any case, the device needs calibration. This work can be done by calibration companies or DynaLabs company itself so that the measurement can be done with very high accuracy.
To calibrate each of the data, including the temperature data, we will need a slope and an offset. Since the output data of the device is as linear as possible, these values will be sufficient .
Y = aX + b a is the slope, b is the Y-intercept or offset
The calibration company will give us the value of a and b for each of the data.you can find a Calibration Document in the device box, these numbers are for the calibration of the DynaLabs company and will be accepted for a period of one year.
With these numbers, you can enter the special numbers for each signal in the Calibration window.



If you want to find a and b by yourself, by comparing the data of the device and a calibrated device, part FindEquation will help you calculate them. Just enter the measurements of the two points seen by the device in the X section and enter the measurements of those two points in the calibration device in the Y section than press Calculate button.
Be sure to save your changes before exiting.
If you use other analytical software such as MATLAB, you can easily apply the given calibration numbers within as well.
Remember that sensor shows -1 g with the effect of gravity, which is in the direction of the axis to be calibrated.

When the sensor is positioned in the opposite direction to the axis to be calibrated, the arrow shows +1g as shown below under the effect of gravity.

You can perform this calibration test for all three axes.

Declaration of Conformity

CE This declaration of conformity is issued under the sole responsibility of the manufacturer. The product(s) are developed, produced and tested according to following EC- directives:

- 2014/35/EU – Low Voltage Directive (LVD)
- 2006/42/EU – Machinery Safety Directive
- 2015/863/EU – RoHS Directive

Applied standards:

- EN 61010-1:2010
- EN ISO 12100:2010
- MIL-STD-810-H-2019 (Test Methods: 501.7 – High Temperature, 502.7 – Low Temperature, 514.8 – Vibration, 516.8 – Shock)

DYNALABS MÜHENDİSLİK SANAYİ TİCARET LİMİTED ŞİRKETİ declares that above mentioned products meet all the requirements of the above mentioned standards and regulations.

DynaLabs

Canan Karadeniz, General Manager
Ankara, 15.07.2021

Documents / Resources

	DynaLabs DYN-30 Series USB/RS232 Interface [pdf] User Manual DYN-30 Series USB RS232 Interface, DYN-30 Series, USB RS232 Interface, RS232 Interface, Interface

References

- User Manual