KPV100 AND BLUEGATE USER GUIDE VER. 2.0

Kjaerulf Pedersen A/S

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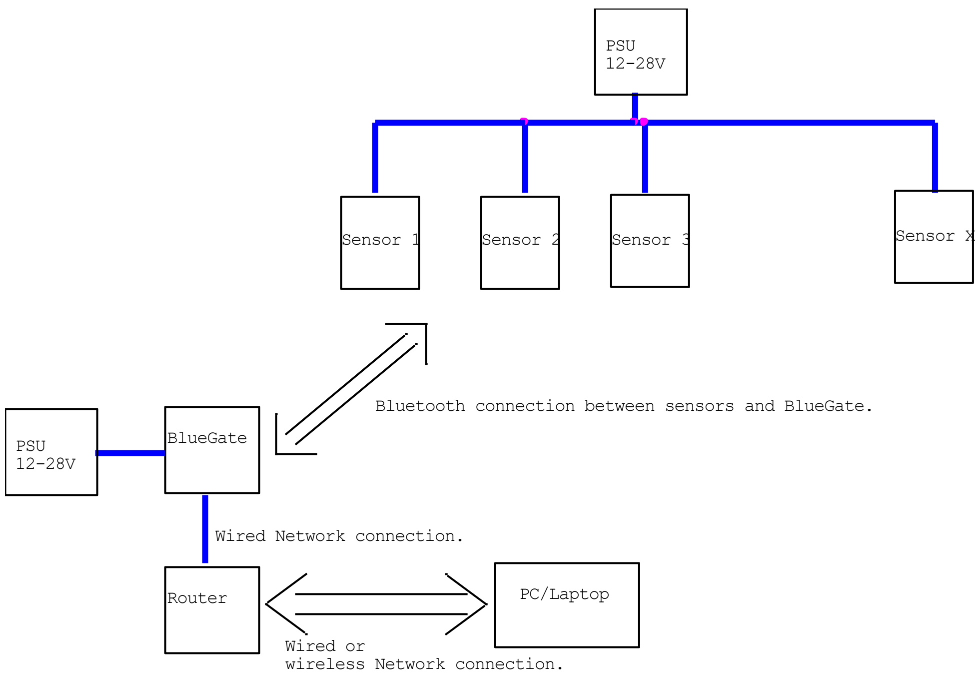
KPV100 and Bluegate.

The KPV100 is a Vibration sensor. The sensor can be used in combination with the BlueGate PCB. BlueGate is a Bluetooth to network gateway.
The Bluegate communicates with the KPV100 sensors through a Bluetooth connection. The user can connect to BlueGate with a Labview software distribution provide by KP A/S.

Hardware setup

Minimum requirements for use of the vibration sensors together with the KPV100 LabVIEW software is:

1. A KPV100 vibration sensor.
2. A BlueGate, Bluetooth to network gateway.
3. A power supply. The sensor can be sourced from 10V to 28V.
4. M12 cables. The sensor comes with a M12 connector.
5. A router with a wired connection for the BlueGate board.
6. A PC on the same network as the BlueGate.



From the sensor to the RS485 bus a cable with M12 connector must be used. For this Users Guide a Lumberg cable is used, see Figure 1.

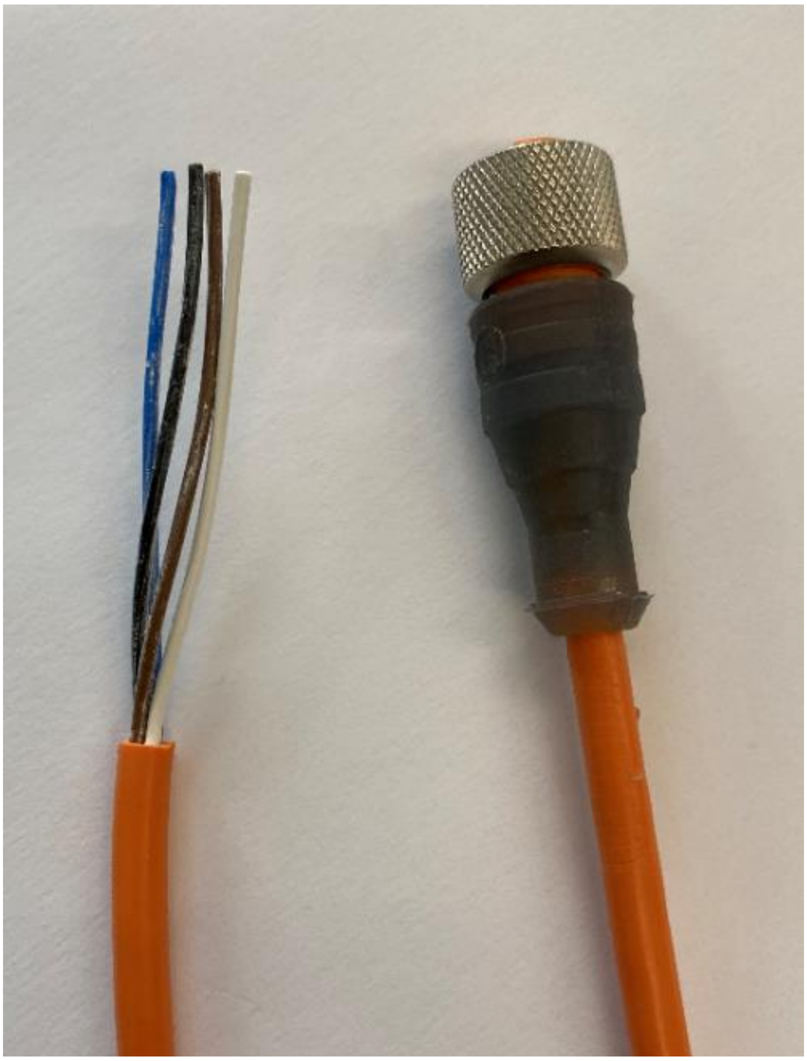


Figure 1 Lumberg cable.

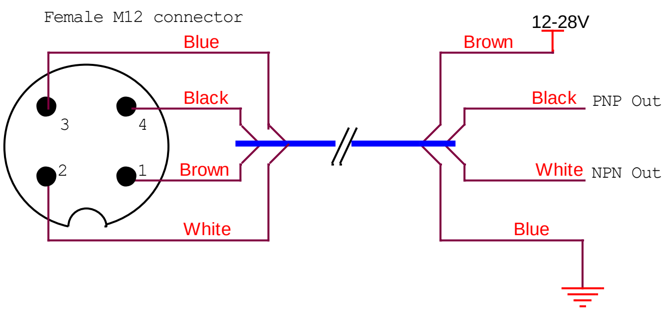


Figure 2 Connections in the Lumberg Cable.

Beside the Bluetooth communication the sensor also contains two alarm signals in the connector. These outputs follow the alarm signal in the sensor. One output is setup as a PNP output and the other is setup as an NPN output.

Bluegate

A gateway between the vibration sensors and a network has been developed. The gateway is called Bluegate. Bluegate can communicate data on Bluetooth between a sensor and itself and communicate on data a network to data collecting system.

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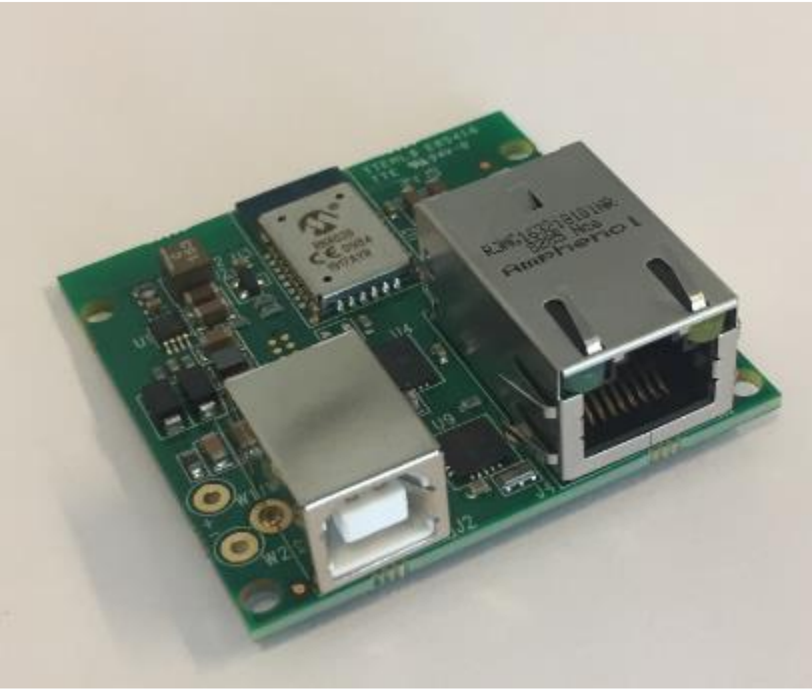


Figure 1 BlueGate board

Figure 3 BlueGate with PSU and i casing.

The BlueGate software contains a configuration menu for setting up network. To get access to this menu a simple terminal program and a computer with an USB port is needed.
For this description Terra Term has been used. But many other terminal programs can be used.

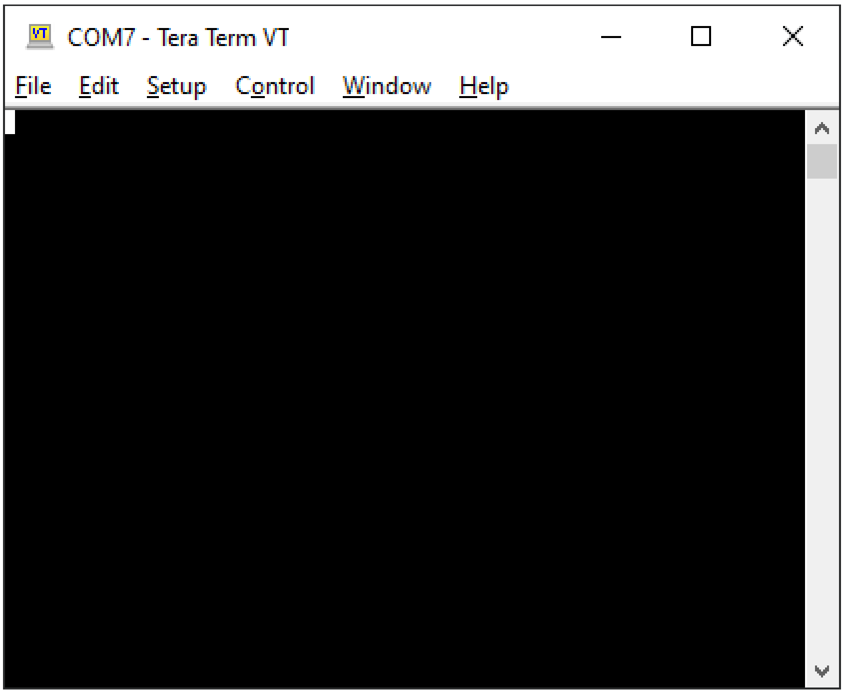


Figure 2 Terra term main page.

The comport needs to be set correct.

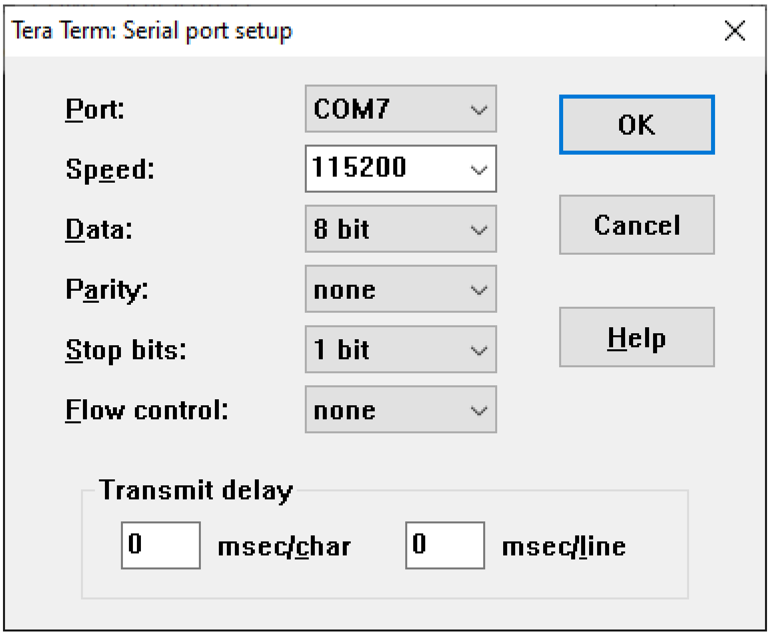


Figure 3 Serial port settings.

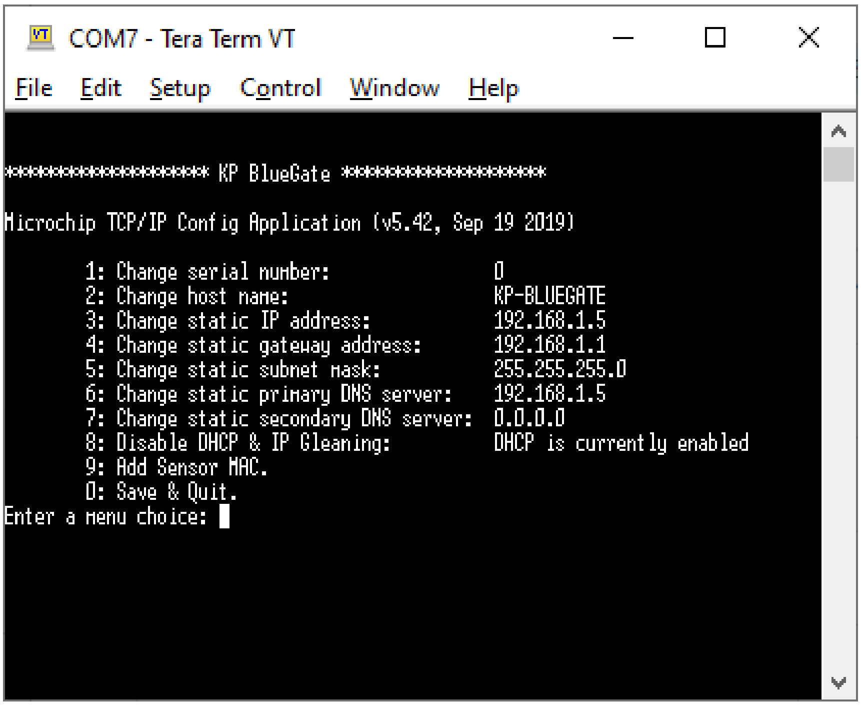


Figure 4 Bluegate configuration menu, default setting.

When the system powered on the configuration menu appears on the terminal.
If nothing is done the menu times out in 30 seconds.

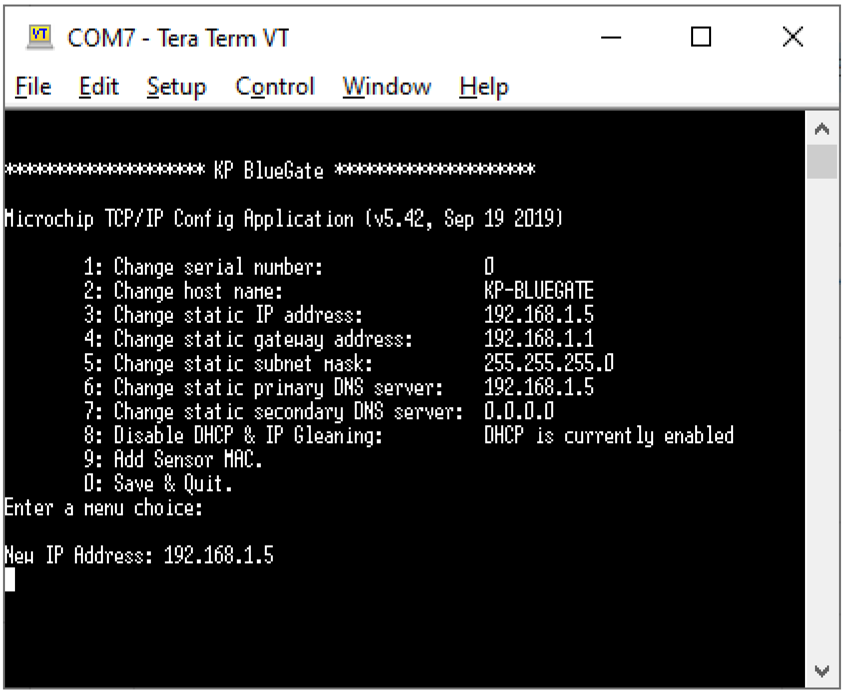


Figure 5 Menu timed out. IP address from default settings is used.

If a new IP address is needed it can be typed in.

1. Choose 3 from the menu.
2. Type in the address when New setting: appears on the screen. In this example 192.168.1.7 is used.
3. If nothing else needs to be changed, type 0 to save.

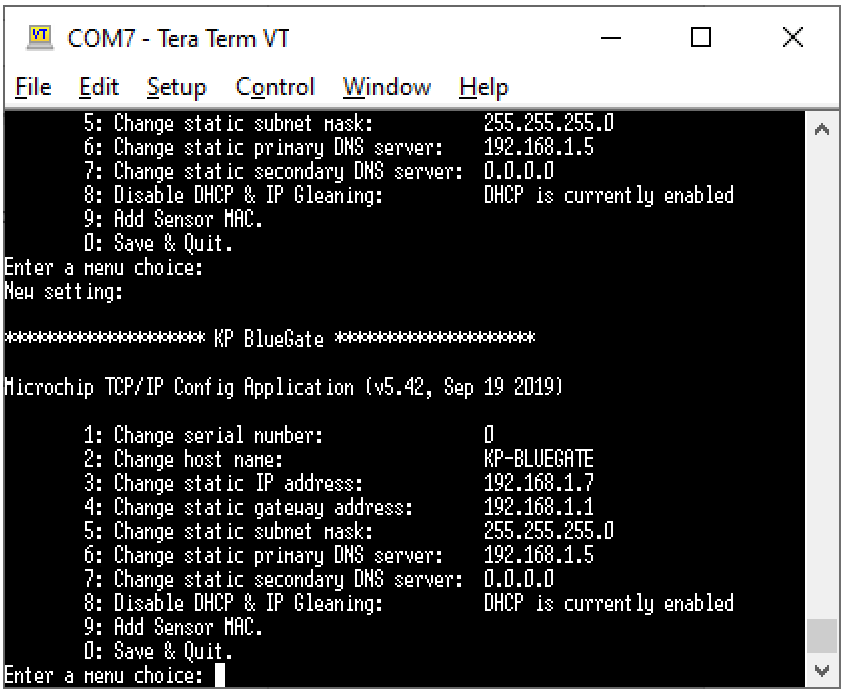


Figure 6 IP address changed to 192.168.1.7

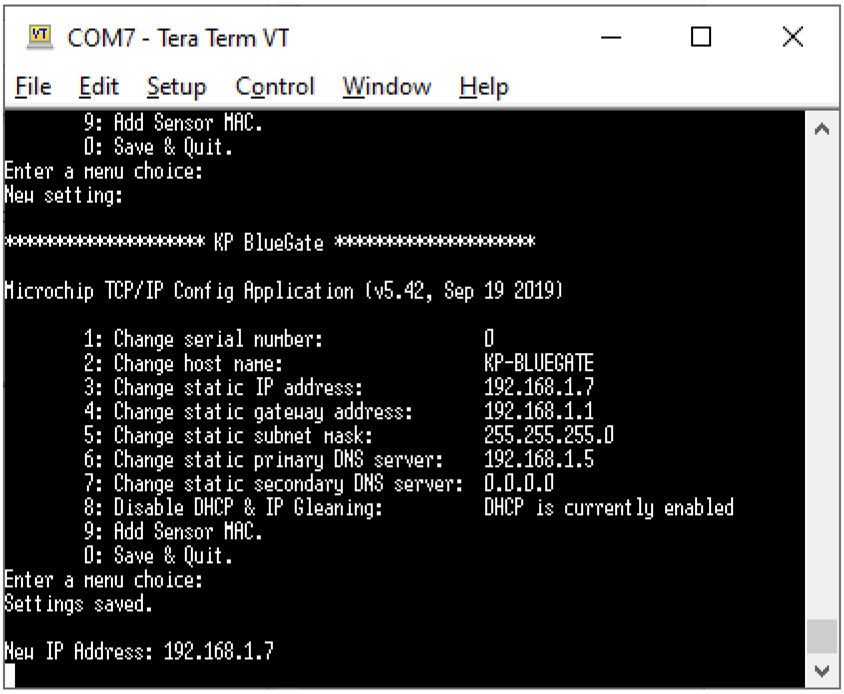


Figure 7 0 has been typed to save and quit.

KPV100 BlueGate Software.

The KPV100 BlueGate software is a package that lets the user communicate with the vibration sensors through the BlueGate gateway.

Bluegate is a Bluetooth to network gateway. With Bluegate it is possible to communicate with the vibrations which is in range of the Bluetooth connection. It could be two sensors, or it could be 100 sensors. It is only the distance between Gateway and the sensor that matters. The sensor must be in range of the Bluetooth signal.
The Gateway software is a package developed in Labview. It runs on a Windows environment. The software uses a Telnet connection to communicate with the BlueGate. Onboard the BlueGate is a wired network connection.

To run the software, the user must provide a router and a network IP address. The default network address of the BlueGate is 192.168.1.5. But this can be changed via a service port in the BlueGate. See

Bluegate.
On Figure 4 KPV100 BlueGate software a screenshot of the KPV100 BlueGate software is present. In the following pages the use of the software will be described.

KPV100 BlueGate software installation

The software is developed in LabVIEW 2018.
The software comes on an USB stick. When received it is owned by the company and can be used for all your own installations. The software cannot be sold to third parties.

Installation.

To use the software, you need to have administrator rights on the computer. Or at least, one with administrator rights needs to install the software before it can be used.
The software will run on Windows 7 and up.
It has been tested on:
OPR: WIN7 Proff. 64 Bit
CPU: I5, 2.80GHz.
6 GB RAM.
And on:
OPR: WIN10 Proff. 64 Bit
CPU: I7, 1.80GHz.
32GB RAM.
No issues found.
Find the install.exe on the USB stick.
Run the installation. Follow the recommendations from the installation software . The software will install all the needed National Instruments drivers, install the KPV100 software and create a Library for the KPV100 software and install a setup file in this library. See "**Fejl! Henvisningskilde ikke fundet.**" for more information.

Be aware that the software must run on a local machine.

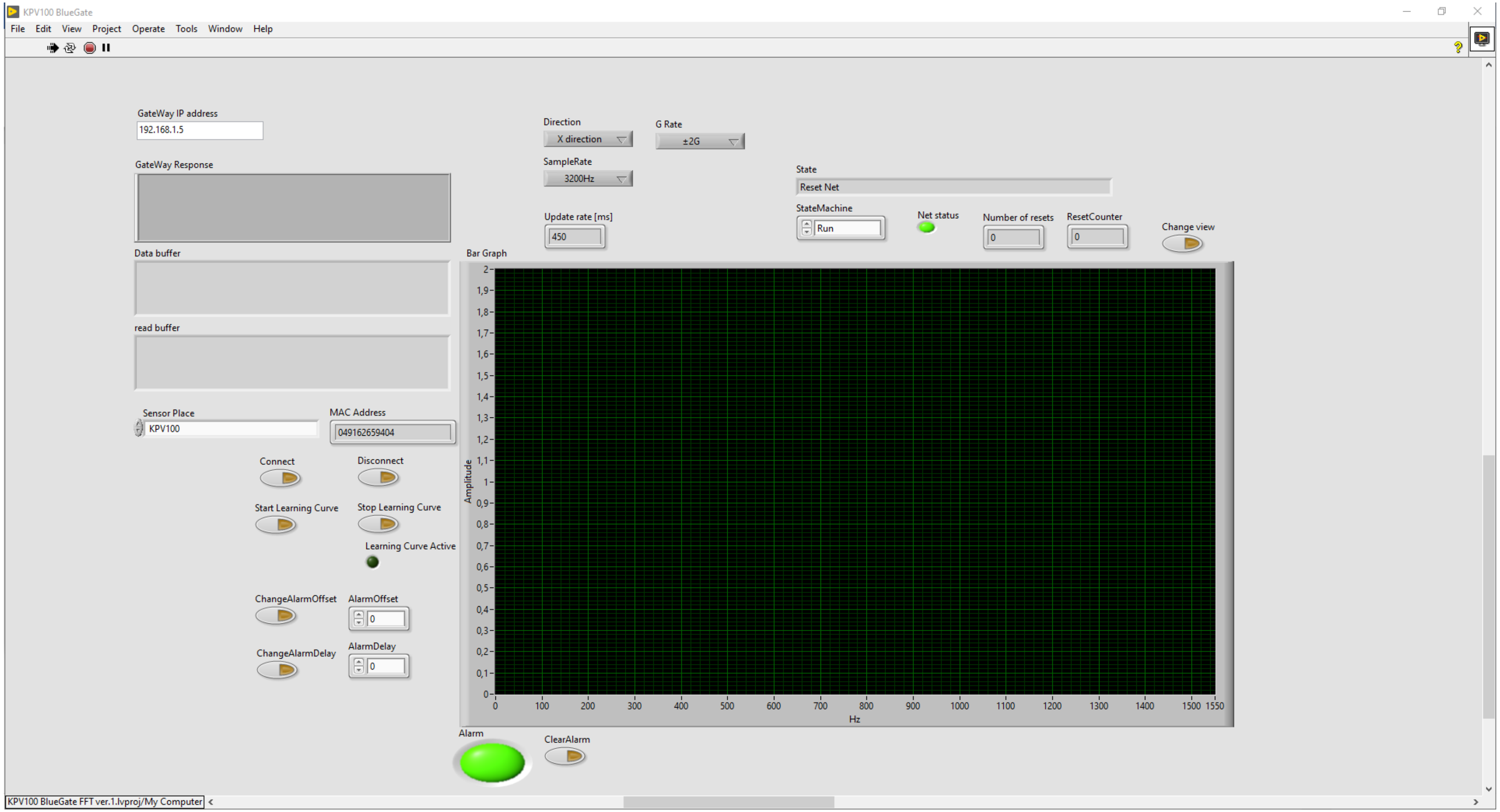


Figure 4 KPV100 BlueGate software

Before the software can be used a valid IP address must be provided to the BlueGate. This can be setup through the service port on the BlueGate. The Computer software must know this IP address to be able to astablish connection. This can be changed in the ”SensorList.txt” file installed in the library c:\BlueGateSupport Files\.

Text file setup.

A text file is installed toghether with the software. The file ”SensorList.txt” is installed in
c:\BlueGateSupport Files\
This file contains all information regarding sensor adresses and names. It also contain the IP address used for the gataway.
The file needs normaly to be opdated in a new installation.
One need to put in sensor information and correct IP address for the BlueGate.
The contents of the file could be like this:

SensorList:
04916265909A, KPV100 0001
04916265934D, KPV100 0002
001EC06EAF9C, KPV100 0003
001EC06EA95F, KPV100 0004
001EC06EAF9A, KPV100 0005
001EC06EAFBC, KPV100 0006

TCPIP_Info:
192.168.1.5

Where the sensorlist contains information regarding sensors. And TCPIP_Info is the IP address used for the BlueGate hardware.
The sensor has each an unique MAC address for the BlueTooth module.
04916265909A, KPV100 0001
04916265909A is the MAC address. This address is the most important.
The sensors will look like this in the software.

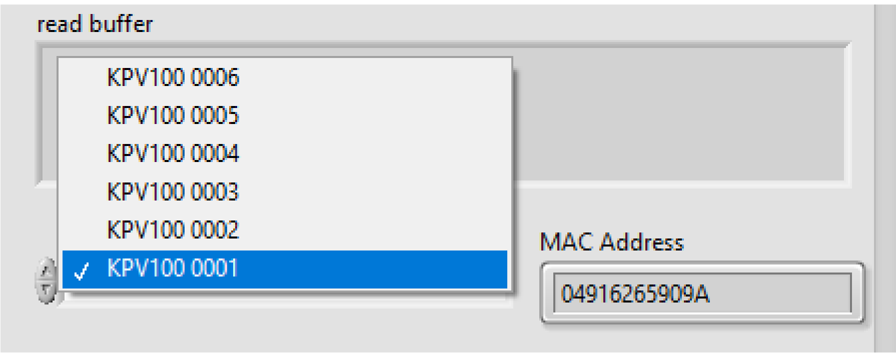


Figure 5 Sensors from "SensorList.txt" in the software.

KPV100 0001 is a name. One can choose whatever needed.
It could be: 04916265909A, Conveyor Belt_1

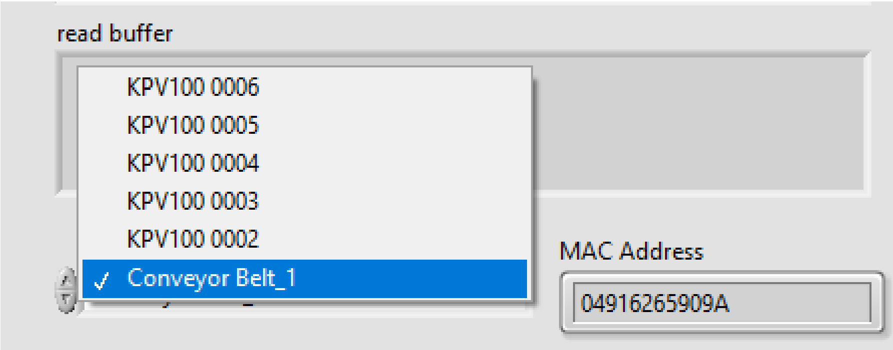


Figure 6 Sensors from changed "SensorList.txt" in the software.

One just needs to edit the file. It's a good idea to make a copy of the file before start.
Also important is to use this notification:
<MAC Address><,> <Space><Sensor Name><CR/LF>
04916265909A, KPV100 0001
where

04916265909A	is <MAC Address>.
,	is <,>
	Is <Space> (The comma followed by a space)
KPV100 0001	is <Sensor Name>
	<CR/LF> (new line in file)

In future versions of the software it will be possible to edit this file from inside the software package.

Establish connection to BlueGate through Network.

When the network is connected and the adresses is correct in the BlueGate and the GateWay software one should get a response like this in the window called GateWay Response, when starting the program.

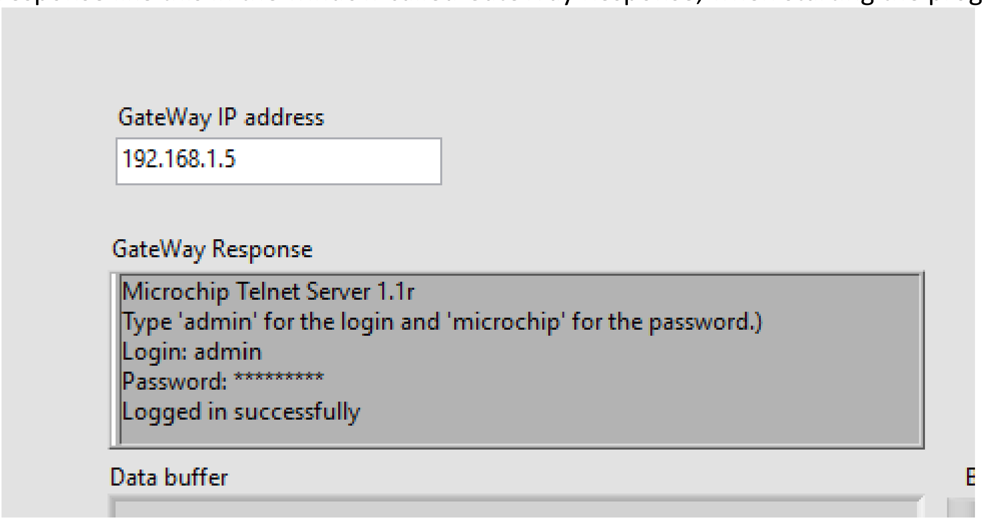


Figure 7 KPV100 BlueGate software connected to BleGate module.

Now the computer is connected to the BlueGate through a Telnet connection.

Establish connection to a sensor.

The drop-down list “Sensor Place” contains the names for the sensors present in the system.
Choose one of the sensors and push the connect button. Then the software starts to communicate with the sensor.
When data starts flowing read buffer window and data will be present in the Var Graph window.
Then communication is established.

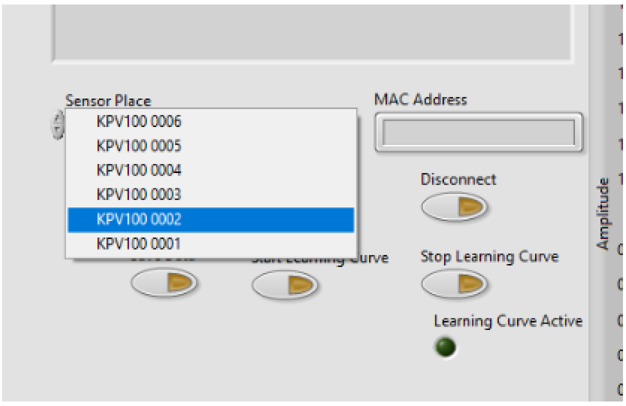


Figure 8 Sensor drop down list.

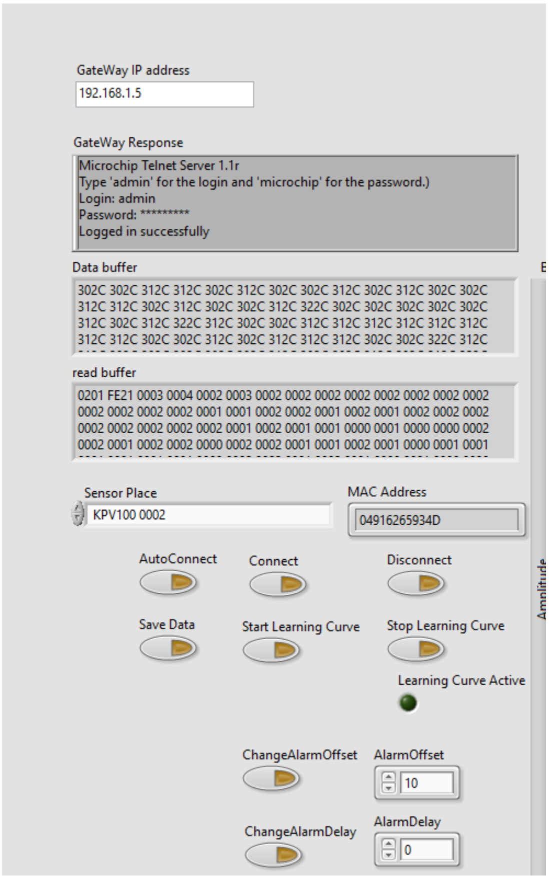


Figure 9 Comunication establised.

Establish connection to another sensor.

If the BlueGate is connected to at sensor push Disconnect. The choose another sensor from the list and push connect.

Live data.

On the live screen all the graphs and FFT data are monitored. The system has two graphs and FFT data. The data on the screen is related to the sensor monitored. The sensor name and the sensor address can be seen at the bottom of the screen.

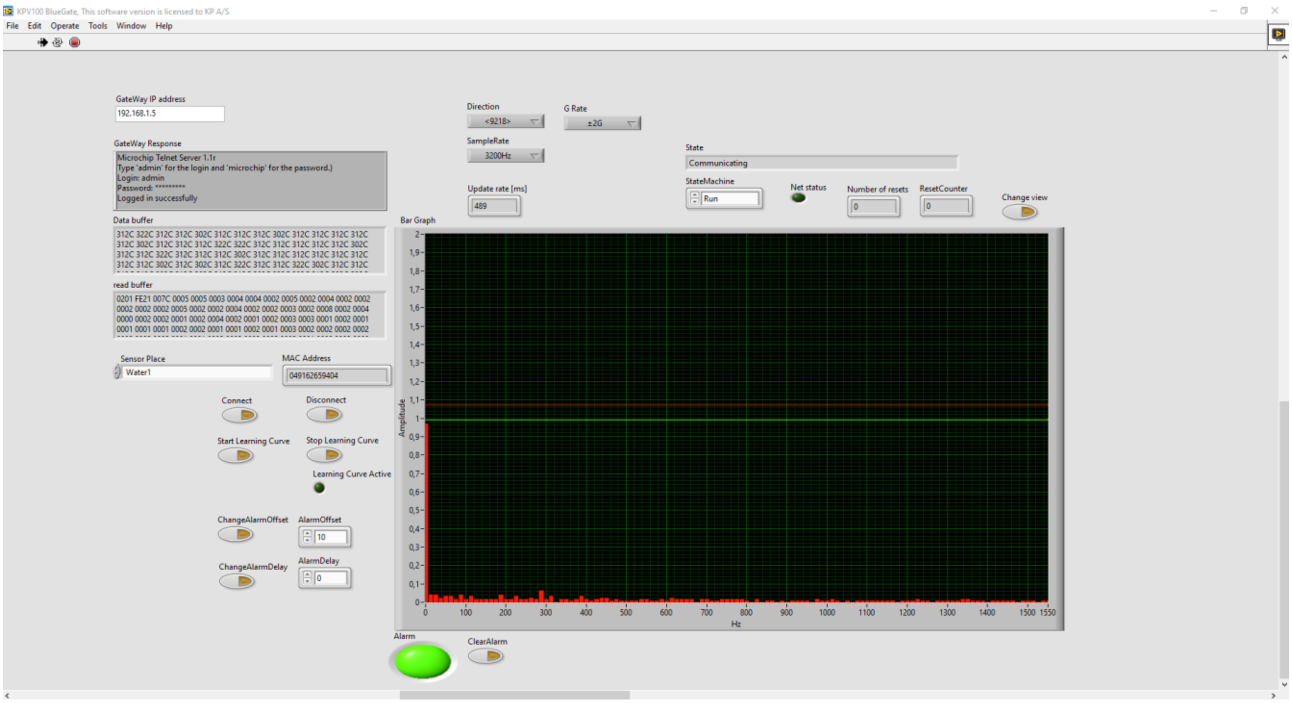


Figure 10 Live data screen.

On the screen the Alarms are monitored. If an alarm is set light green "lamp" will turn red. The Alarm can be cleared by pushing clear alarm button

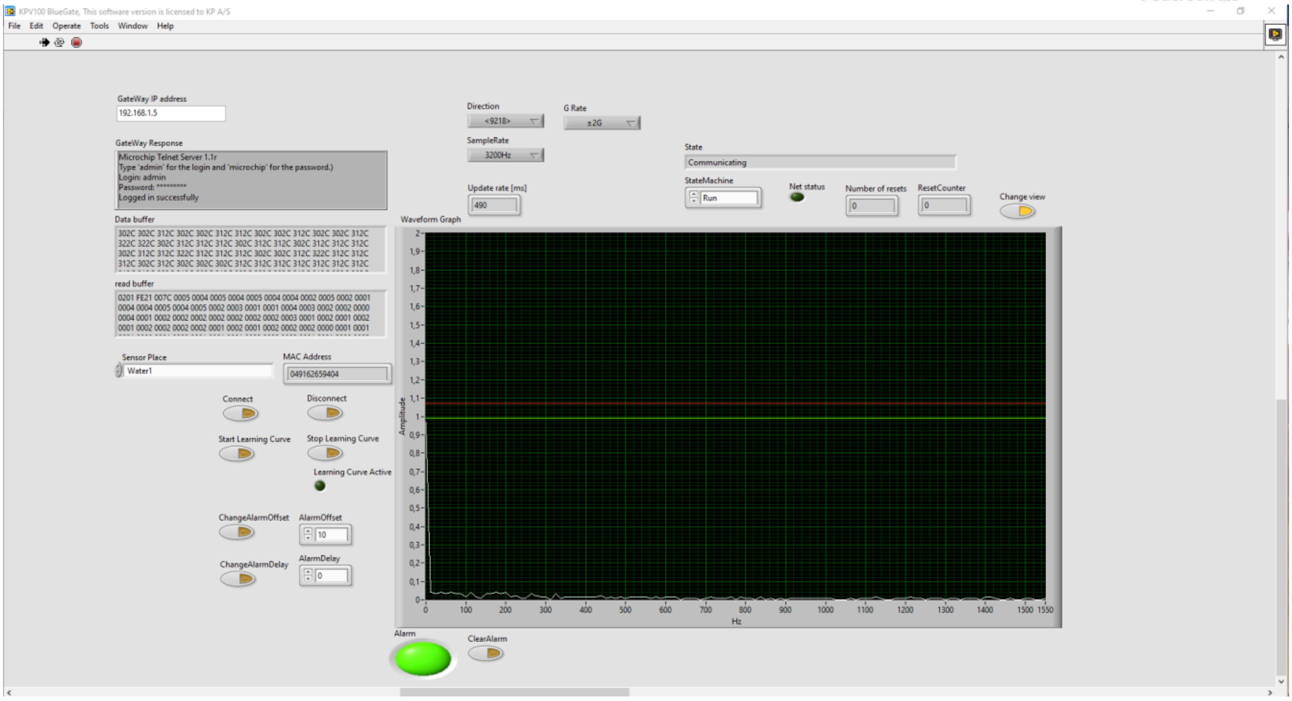
The Direction button changes the direction of the measurement, see "**Fejl! Henvisningskilde ikke fundet.** The only different is that that a change here is not stored in the memory. It is possible to make a lot of changes here. It is always possible to return to stored settings.

The G_Rate button changes the amplitude of the measurement, see "**Fejl! Henvisningskilde ikke fundet.**" for details. The only different is that that a change here is not stored in the memory. It is possible to make a lot of changes here. It is always possible to return to stored settings.

The SampleRate button changes the sample rate of the measurement, see "**Fejl! Henvisningskilde ikke fundet.Fejl! Henvisningskilde ikke fundet.**" for details. The only different is that that a change here is not stored in the memory. It is possible to make a lot of changes here. It is always possible to return to stored settings.

When you make these changes an alarm could get set. You can always return to stored settings by pushing the button "Reset to stored settings".

If you don't like bars you can push "Change View". Then the appearance changes.



The curves on the GUI.

Two curves and FFT data are shown on the screen. The curves are Known curve, which is the characteristic of the sensor placed in its specific place. If the sensor is moved this characteristic is changed. The characteristic is measured by starting a “Learning Curve”. See “**Fejl! Henvisningskilde ikke fundet.** for details. The other curve is the Alarm Curve. The alarm curve is generated by adding an offset to the known curve.

See Figure 11.

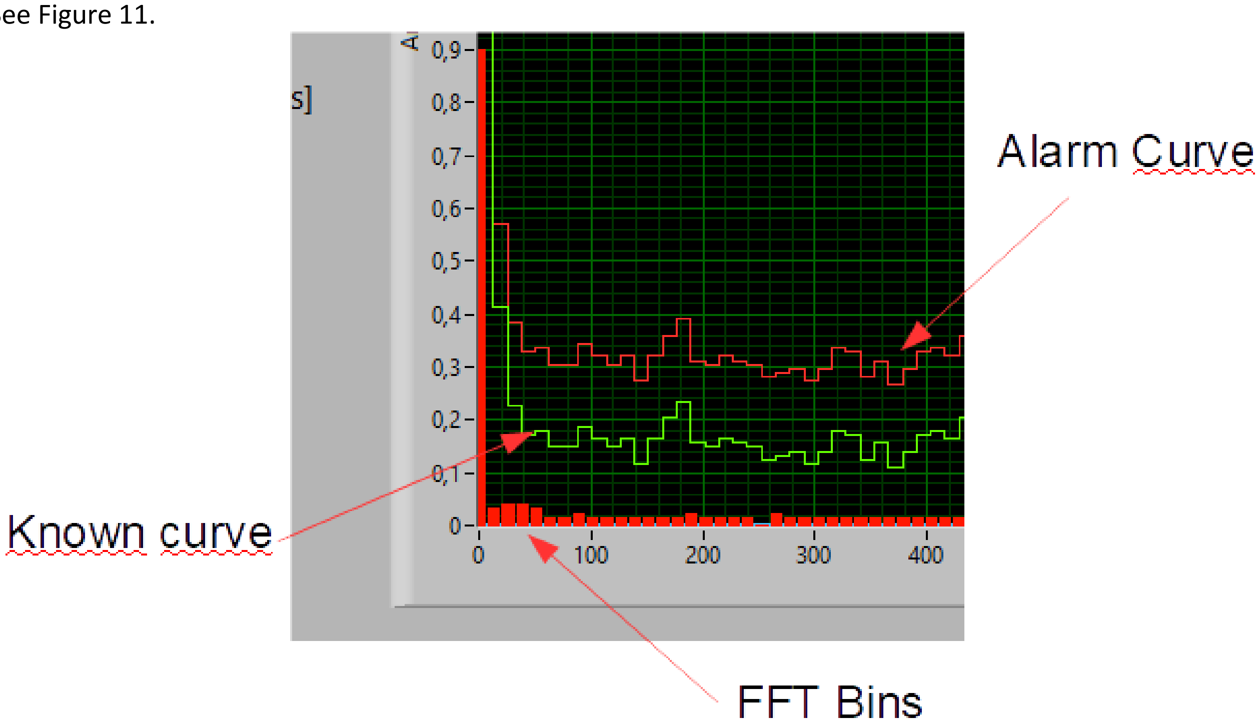


Figure 11 The FFT data and curves.

The FFT Bins is the frequency response from the FFT algorithm in the sensor.

The alarmcurve is the base for generating an alarm. If one of the 128 FFT bins is higher than the alarmcurve and alarm can be generated. Generating this alarm is also depended of the alarm delay. See the section regarding "**Fejl! Henvisningskilde ikke fundet.** For a detailed description.
In Figure 12 an alarm is generated due to this permanent high FFT Bin.

Figure 12 Alarm is generated.

Learning curves.

The sensor can learn how a "normal" behavior looks like. Push "Start Learning curve". Then the sensor will start to learn the characteristic of the system where it is placed. It is recommended to keep the sensor in Learning mode for several days, to be sure that every scenario is covered.
When finished measuring push "Stop Learning Curve". Now it can be observed that the red and green curves have changed. The green is the normal characteristic of the system where the actual sensor is placed. The red curve is used for setting an alarm.
The data is stored locally in the specific sensor. It will always remember the curve generated.

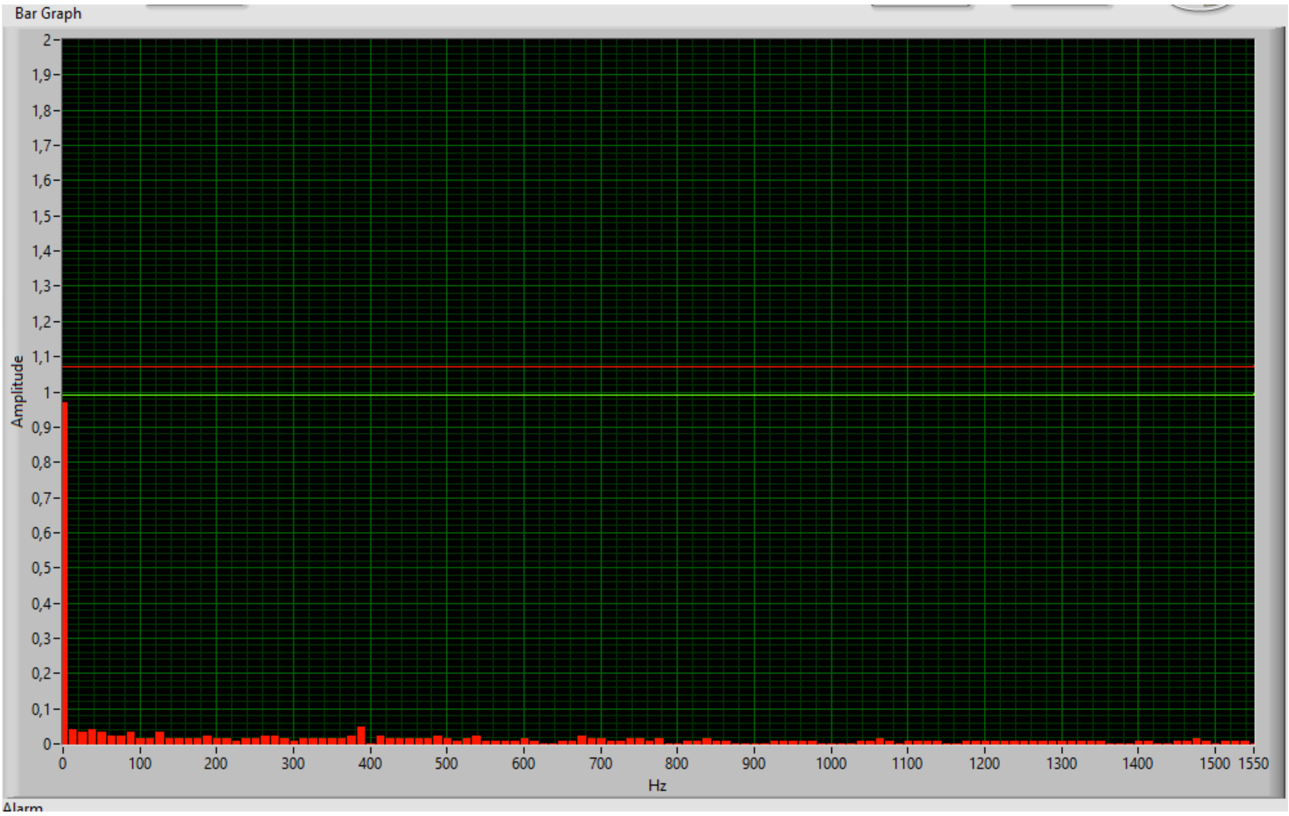


Figure 13 Data in the bar graph window, before pushing" Start Learning curve".

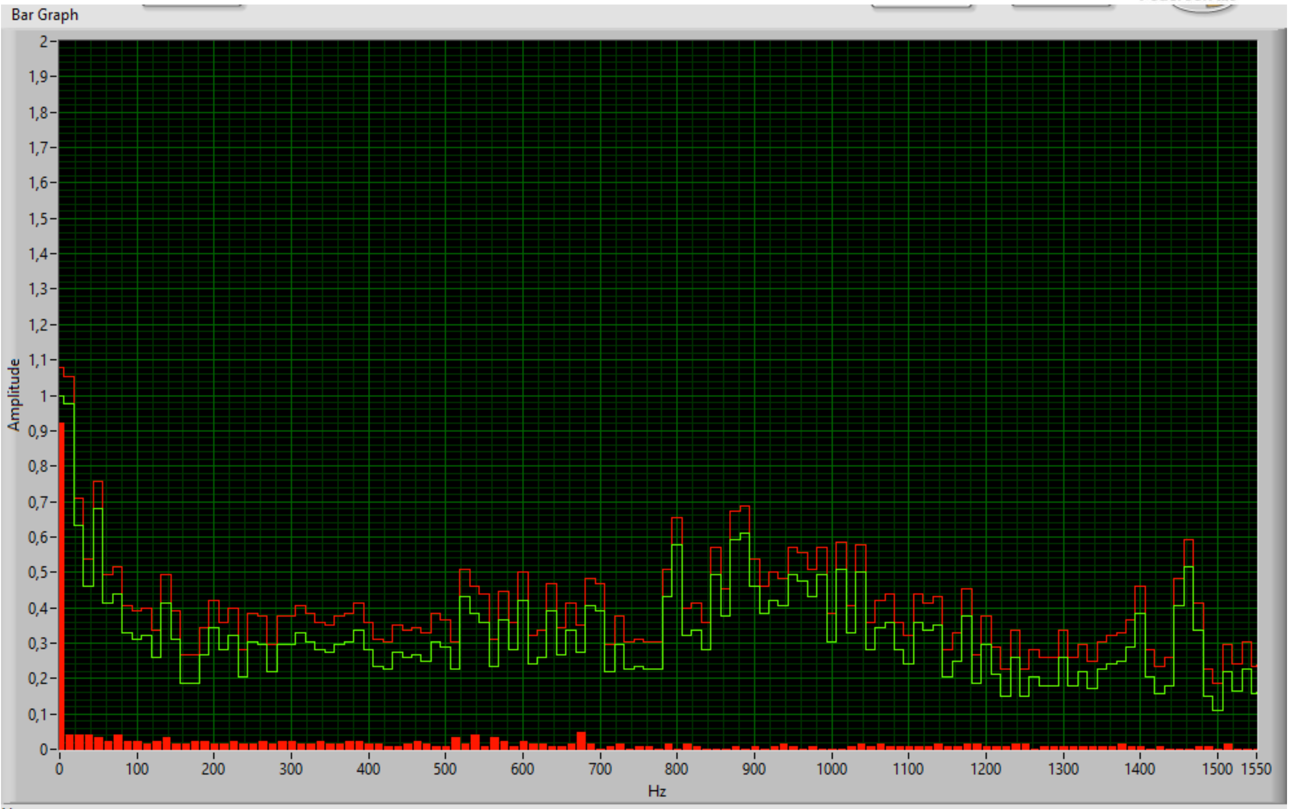


Figure 14 Same window after pushing "Stop Learning curve".

Generating an alarm.

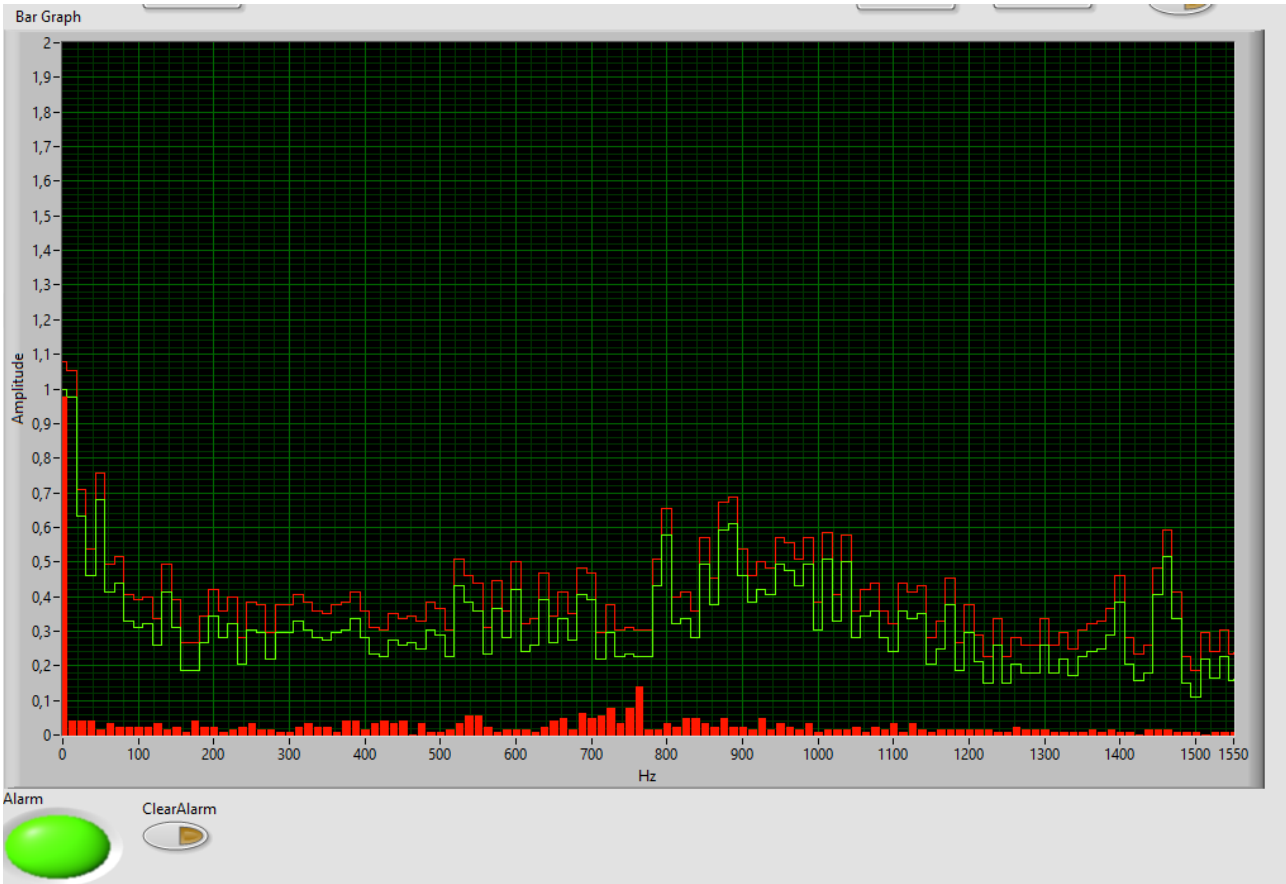


Figure 15 System running everything seems OK. No alarm.

On Figure 15 System running everything seems OK. No alarm.everything seems OK. No alarm is generated. The bars is below the red curve which is the alarm curve.
On Figure 16 An alarm has been generated.some high spikes are seen at 110-1200 Hz. These spikes are the reason for the alarm.

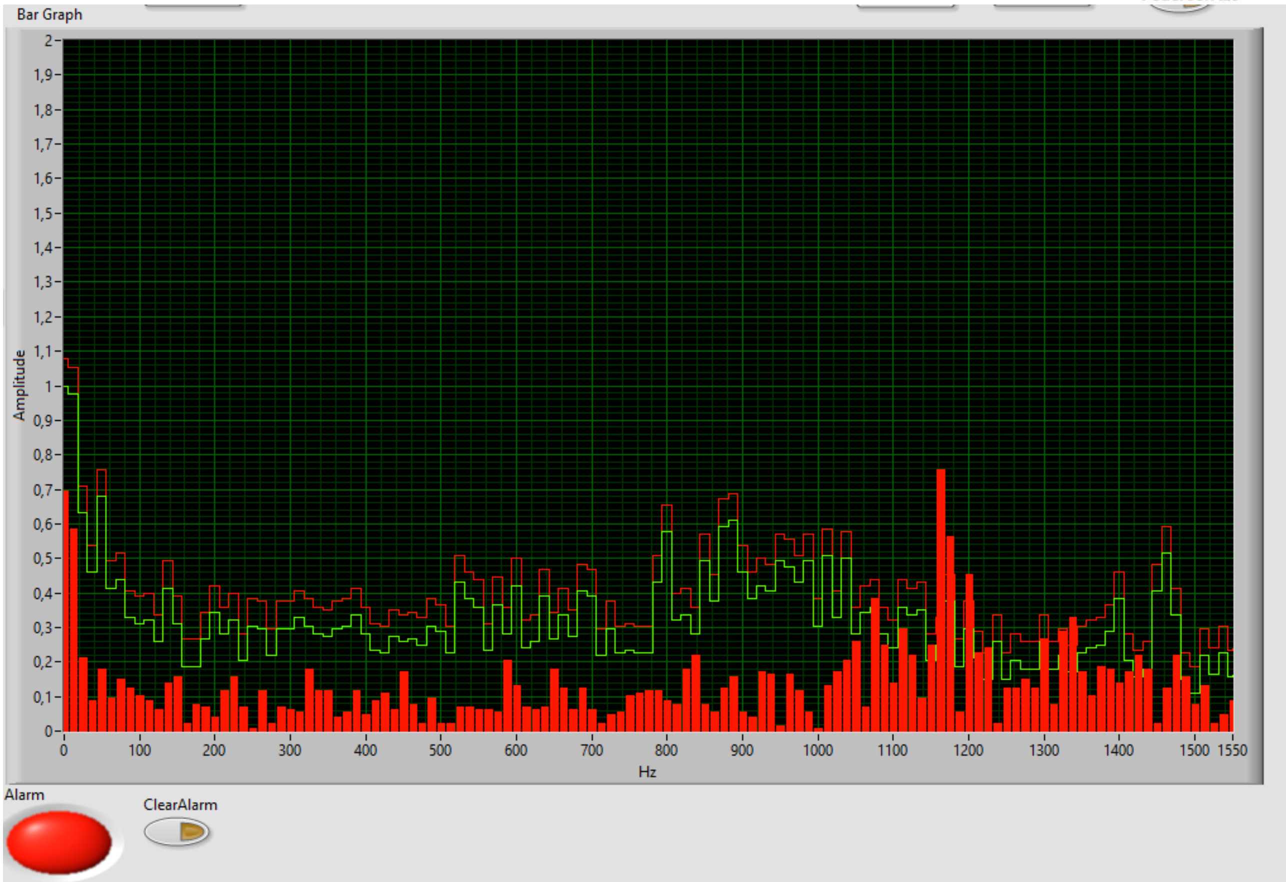


Figure 16 An alarm has been generated.

To clear the alarm, push “ClearAlarm” button.

Change alarm offset.

It is possible to change the alarm offset. This can be done by typing in a value in the text field “AlarmOffset”, and the pushing the button “ChangeAlarmOffset”.

It can now be seen that the distance between the green and the red curve becomes larger. The noise must be greater to generate an alarm.

Figure 17 Alarmoffset set to 30.

Change Alarm Delay.

It is also possible to allow the sensor to have more than one sample to generate an alarm. Sometimes a single high sample doesn't matter. Then it is possible to put in a delay. This is convenient when using a system with a lot "noise". Adding a delay allows the system to several "too high " samples in a row before setting the alarm.

Changing the AlarmDelay can be done by typing in a value in the text field "AlarmDelay", and the pushing the button "ChangeAlarmDelay".

Changing direction.

The direction button is for setting the direction of the data used for the FFT calculation.

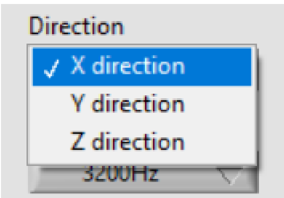


Figure 18 Direction

The sensor can measure in three directions. X, Y and X. There can be huge different in vibration amplitude depended of the measurement direction.

Figure 19 Directions on KPV100 vibration sensor.

On Figure 20 a vibration sensor is mounted on top of an electrical engine. One sees a belt from a pulley mounted on the engine shaft. The forces in the Z directions will be higher than the forces in the X direction.

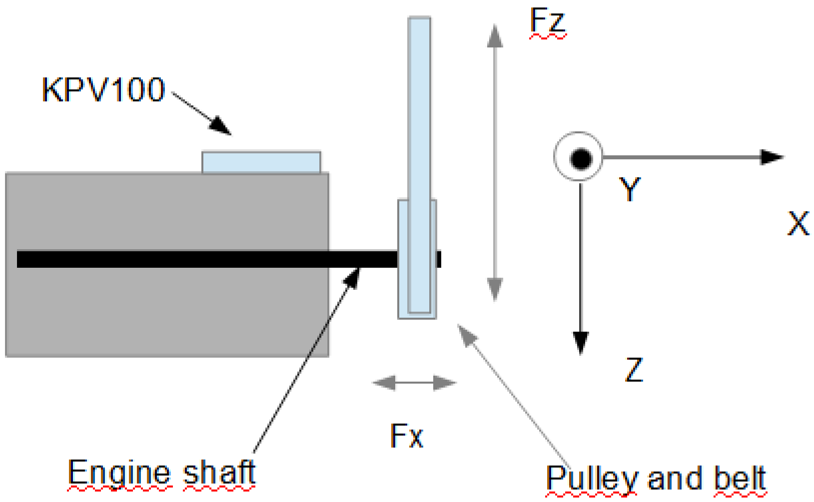


Figure 20 Model of engine with KPV100 mounted on the top.

One must be aware of the it does matter which direction is used for the measurement. Vibrations measured will vibrations from the system and vibration from the engine. Vibrations from the engine will typically be frequency's that somehow corresponds to the speed of the engine. Vibrations from the system can be very random.

Changing Sample rate.

The sample rate button is used for adjusting the speed of the samplings.

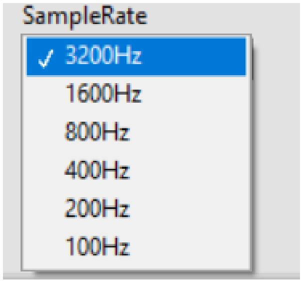


Figure 21 Sample rates

As it can bee seen on Figure 21 KPV100 has six different sampling rates. Going from 3200Hz down to 100Hz. Measuring with 3200Hz gives a spectrum of 1600Hz due to the Nyquist criteria. In KPV100 via have 128 bins. A bin is “frequency container”.

If a signal the one in Figure 22 it is easy to see that this signal contains many frequencies. It is not a clean sinus. The signal can be treated in an FFT algorithms. This algorithm gives a response of the frequency content of the signal.
On Figure 23 the processed signal can be seen. Each red bar represents as frequency bin. At 3200Hz sampling rate a measurement range of 1600Hz can be made. Each bin represents 1600/128 12,5Hz.

Sample rate [Hz]	Range [Hz]	Hz / bin [Hz]
3200	1600	12,5
1600	800	6,25
800	400	3,125
400	200	1,5625
200	100	0,78125
100	50	0,390625

Table 1 Sample rates vs Hz/bin.

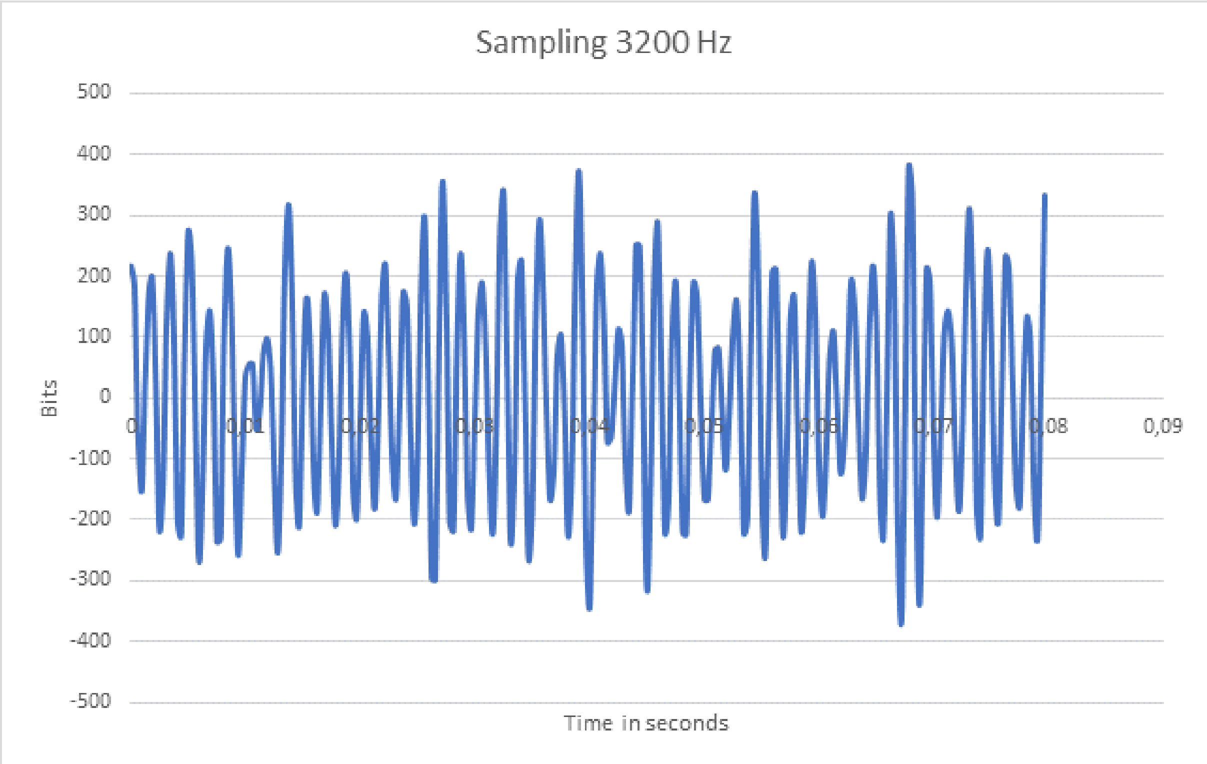


Figure 22 Signal measured at 3200 Hz.

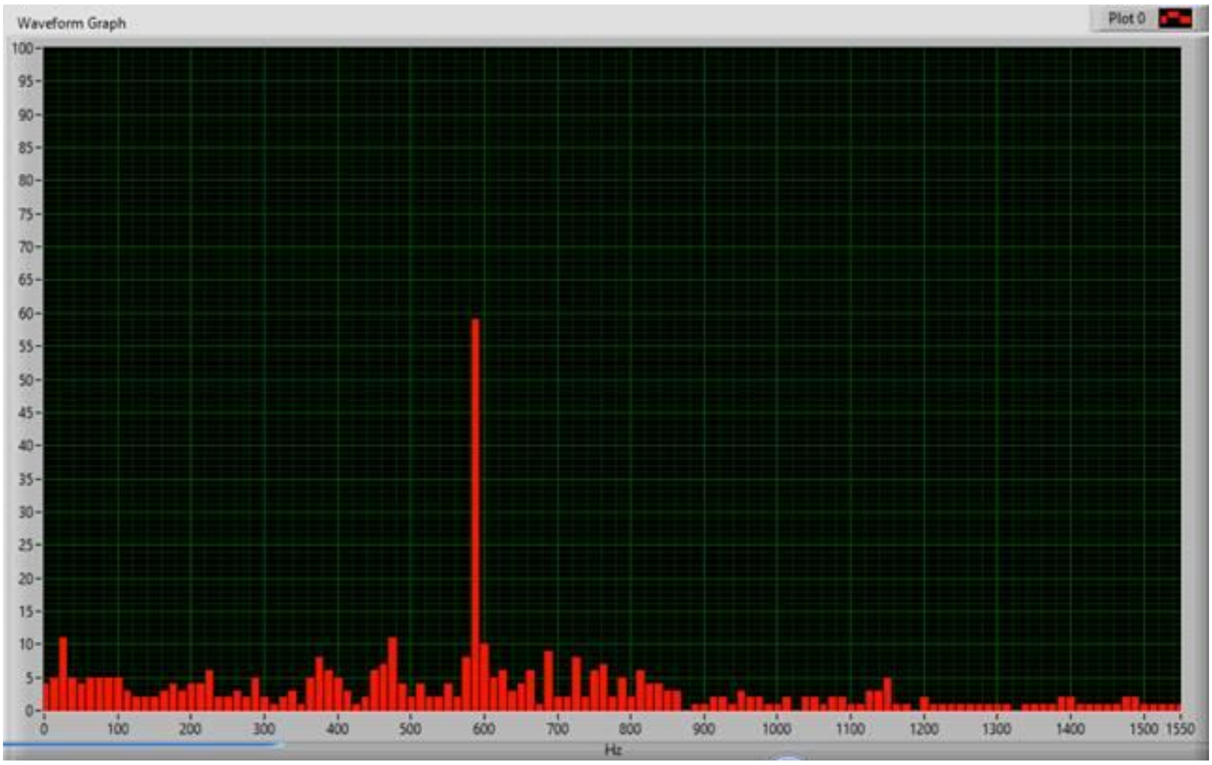


Figure 23 The processed signal.

Changing G-Rate.

The G Rate button is used for adjusting the strength in the signal. 16G is a very strong signal, 2G is less strong.

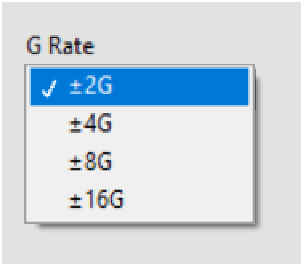


Figure 24 Adjustments for G Rate.

The sensor has four levels of G Rates. Normally 2 or 4 G is used. But again, it depends of the system.