CONNECTING TO A KPV200 VIBRATION SENSOR

1. Introduction

The KPV200 vibration sensor provides precise vibration monitoring and on-board signal processing for industrial and commercial applications. Equipped with integrated Fast Fourier Transform (FFT) capabilities, the sensor performs real-time frequency domain analysis directly within the device, eliminating the need for external processing hardware.

This advanced functionality allows for the early detection of mechanical issues such as imbalance, misalignment, or bearing wear by identifying characteristic vibration signatures. The sensor features a broad frequency response range, high sensitivity, and a rugged design suitable for demanding environments.

This application note describes how to interface a KPV200 sensor to a Senquip device to enable remote vibration monitoring. The end application will:

- read the current vibration profile,
- provide an option to enable the learning of a typical profile,
- show the current profile and alarm profile on a bar chart,
- show the current alarm status,
- allow alarms to be cleared.

Figure 1- KPV200 Vibration Sensor

Extensive use of the Senquip scripting language will be used in this application note. Further details on the Senquip scripting language can be found in the [Device Scripting Guide].

2. Connection the KPV200 to a Senquip Device

A Senquip QUAD-C2 was used in this application.

An RS485 to USB converter was used to connect the KPV200 to a PC. We also connected the RS485 network to the QUAD. Having the PC on the network allowed us to run the sensor supplier software and then later run a terminal program to monitor traffic on the bus.

A vibration motor with an offset weight was attached to the vibration sensor, and the frequency was tuned to approximately 70Hz by changing the supply voltage.

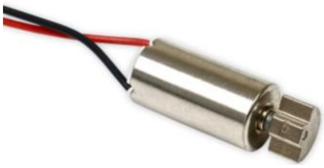


Figure 2 - Vibration Motor

The Senquip QUAD was supplied with 24V, and the QUAD internal voltage generator was used to provide 12V to the vibration sensor through IO5. The voltage and current supplied to the sensor on IO5 were monitored.

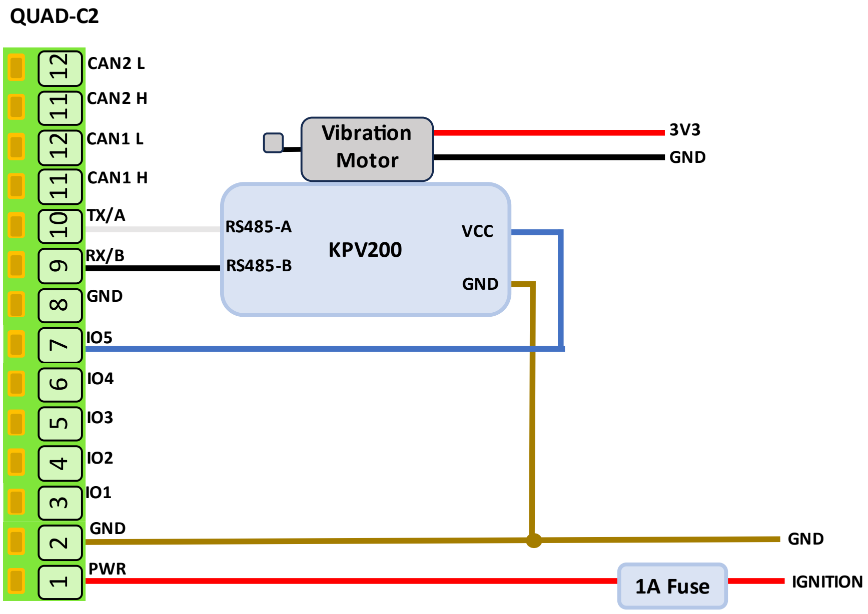


Figure 3 – Vibration Sensor Connection to Senquip QUAD

The Senquip QUAD was configured with a *Base Interval* of 10 seconds and the serial port was set to RS485, with a baud rate of 115200, 8 bits, even parity, and 1 stop bit. The serial port *Mode* was set as scripted as the serial port will be completely controlled within a script.

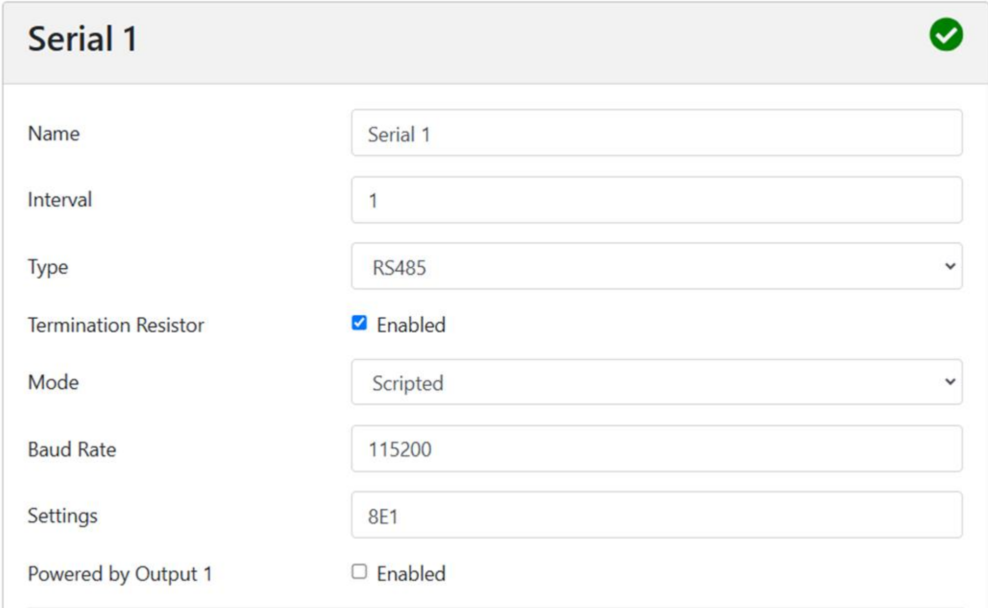


Figure 4 - Serial Port Settings with Even Parity

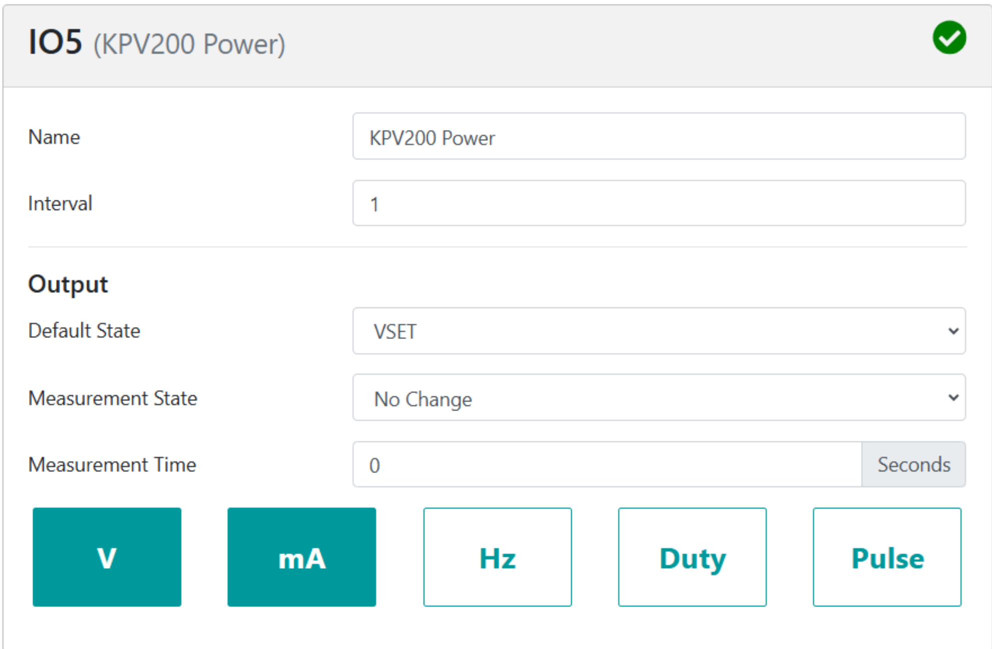


Figure 5 - IO5 Providing 12V and Monitoring Voltage and Current

3. Getting to Know the KPV200 Sensor

Kjaerulf Pedersen, the sensor suppler, provide LabVIEW based software that shows live data and allows for settings updates.

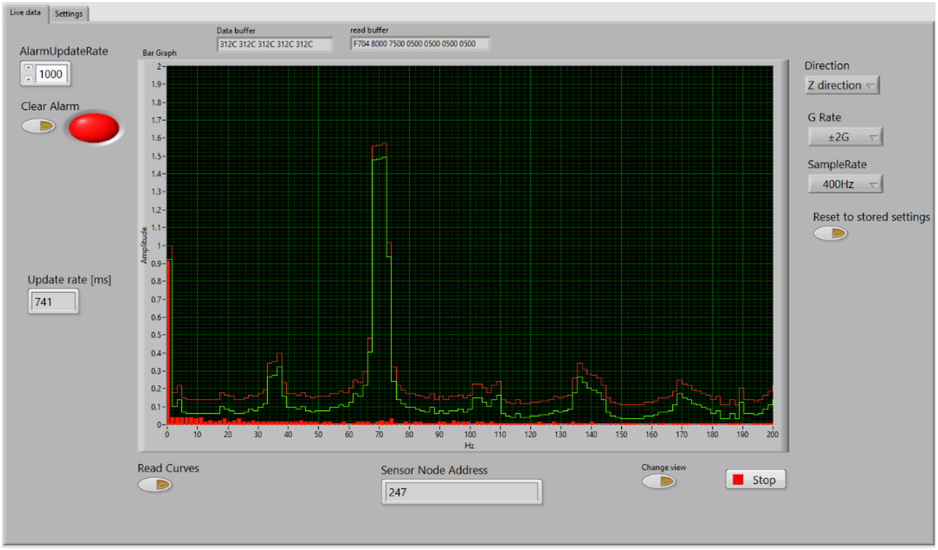


Figure 6 - Supplier Provided Software Showing Live Vibration Data

Using the software, the sensor was configured as shown in Figure 7. A sampling frequency of 400Hz was chosen to allow a maximum frequency of 200Hz to be measured. For more information on sampling frequencies, see this article on Nyquist frequency. Note the even parity.

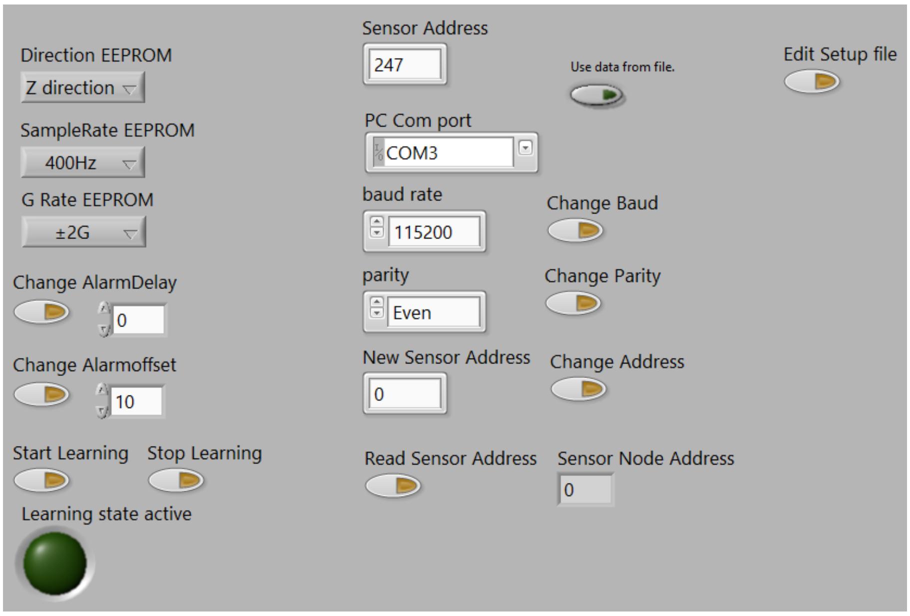
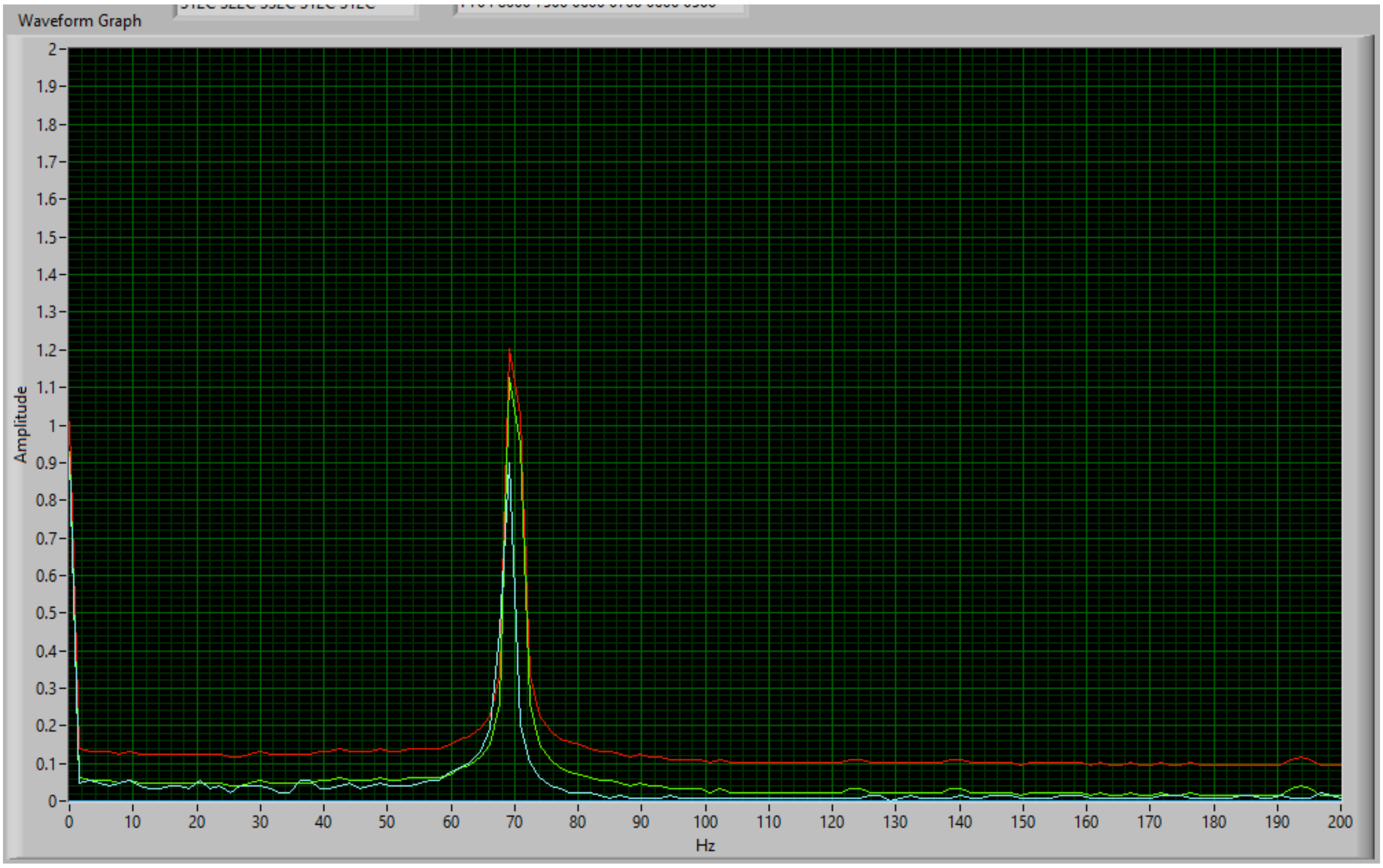


Figure 7 - KPV200 Settings

To test the functionality of the sensor, we started the learning function and ran it for 10 minutes. After that time, we could see that an alarm profile had been built that matched the envelope of vibration and had a 10mG offset as configured. We noticed that once cleared, the alarm would stay off for a short while and then turned back on. Because of this, we left the sensor in learning mode for an hour. After an hour, the alarm could be cleared, and it would stay cleared.



To better understand the interface to the sensor, we then moved to requesting Modbus data from the KPV200 using [Realterm](), a serial monitor program. The [KPV200 User Guide]() contains a Modbus register map for the sensor which is duplicated in

Appendix II – KPV200 Register Description.

As a sanity check, the baud rate was read back from the sensor.

	Device Address	Function Code	Register Address		Number of Registers		Checksum	
	1 byte	1 byte	2 bytes		2 bytes		2 bytes	
Request	0xF7 (247)	0x03	0x01 (MSB)	0xF9 (LSB)	0x00 (MSB)	0x01 (LSB)	0x41 (MSB)	0x51 (LSB)

	Device Address	Function Code	Bytes to Follow	Data		Checksum	
	1 byte	1 byte	1 byte	2 bytes		2 bytes	
Response	0xF7 (247)	0x03	0x02	0x04 (MSB)	0x80 (LSB)	0x73 (MSB)	0x31 (LSB)

In RealTerm, the green text shows the command, and the yellow is the response. Looking at the response data 0x0480 = 1152 or a baud rate of 115200 as expected.

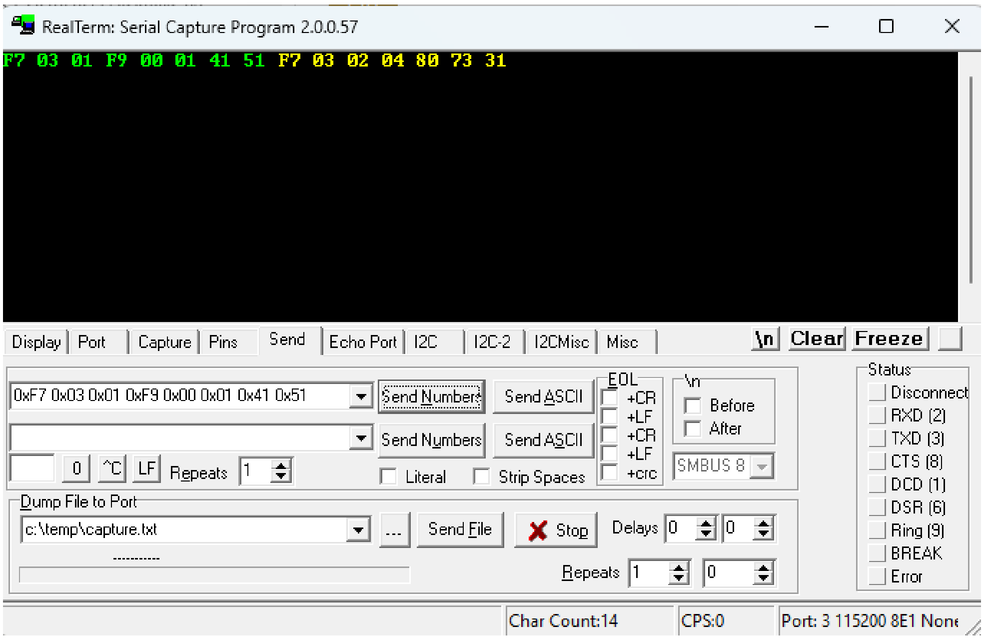


Figure 8- Baud Rate Read in RealTerm

3.1. Reading Vibration Data

Current vibration data is held in 128 input (function code 4) registers of type unsigned int.

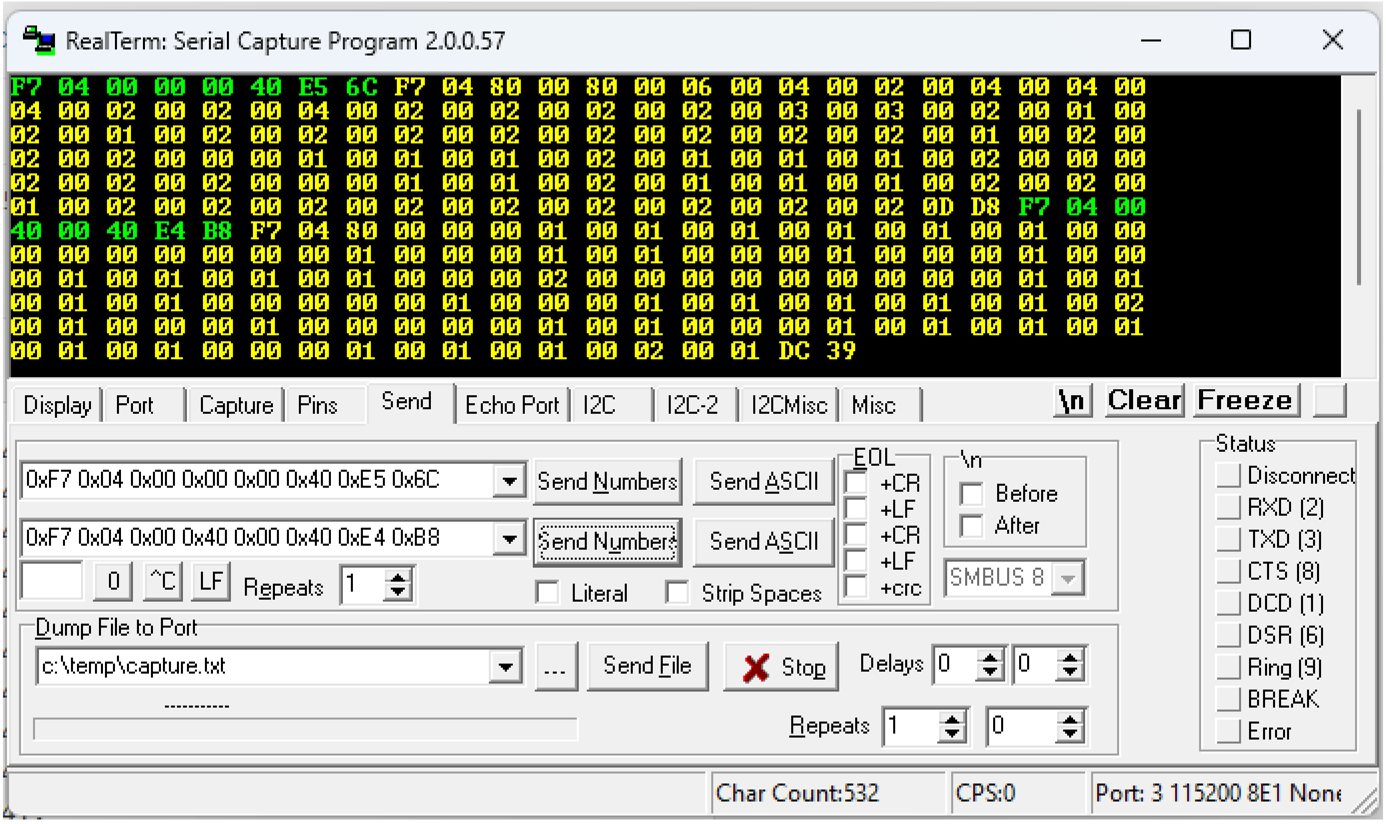
Data Address	Description	Data Type	Value range
0	Vibration data first bin	Unsigned int	0-255
127	Vibration data last bin	Unsigned int	0-255

The Modbus RTU standard allows for a maximum message length of 256 bytes. Given that each register is 2 bytes, not all registers can be read in a single read. Either two reads must be done, or some of the registers must be forfeited, resulting in a lower maximum frequency. We will do two reads to retrieve all 128 register values.

The read commands for reading the first 64 and second 64 registers are shown below.

	Device Address	Function Code	Register Address		Number of Registers		Checksum	
	1 byte	1 byte	2 bytes		2 bytes		2 bytes	
First 64 bins	0xF7 (247)	0x04	0x00 (MSB)	0x00 (LSB)	0x00 (MSB)	0x40 (LSB)	0xE5 (MSB)	0x6C (LSB)
Last 64 bins	0xF7 (247)	0x04	0x00 (MSB)	0x40 (LSB)	0x00 (MSB)	0x40 (LSB)	0xE4 (MSB)	0xB8 (LSB)

The read requests were tested in RealTerm and resulted in 64 registers (128 bytes) being returned for each request.



Similarly, the learned frequency profile, referred to as the Known Curve in the documentation, and the alarm profile, can be read as below. The Modbus CRC can be calculated using this online CRC Calculator. Note that the CRC bytes need to be flipped as the endianness of the calculator is different to the Modbus standard. In the final application, the CRC's will be calculated in the script on the Senquip device.

	Device Address	**Function Code**	**Register Address**		**Number of Registers**		**Checksum**	
	1 byte	1 byte	2 bytes		2 bytes		2 bytes	
Learned Profile First 64 bins	0xF7 (247)	0x03	0x00 (MSB)	0x00 (LSB)	0x00 (MSB)	0x40 (LSB)	0x50 (MSB)	0xAC (LSB)
Learned Profile Last 64 bins	0xF7 (247)	0x03	0x00 (MSB)	0x40 (LSB)	0x00 (MSB)	0x40 (LSB)	0x51 (MSB)	0x78 (LSB)
Alarm Profile First 64 bins	0xF7 (247)	0x03	0x00 (MSB)	0x80 (LSB)	0x00 (MSB)	0x40 (LSB)	0x51 (MSB)	0x44 (LSB)
Alarm Profile Last 64 bins	0xF7 (247)	0x03	0x00 (MSB)	0xC0 (LSB)	0x00 (MSB)	0x40 (LSB)	0x50 (MSB)	0x90 (LSB)

3.2. Writing to the Sensor

To start and stop the learning function, and to clear alarm data, we need to be able to write to registers on the KPV200 sensor. Writing to the sensor is achieved with the write multiple function code (dec 16, hex 0x10).

	Device Address	**Function Code**	**Register Address**		**Number of Registers**		**Number of Bytes**	**Data Bytes**		**Checksum**	
	1 byte	1 byte	2 bytes		2 bytes		1 byte	2 bytes		2 bytes	
Start Learning	0xF7 (247)	0x10	0x02 (MSB)	0xBE (LSB)	0x00 (MSB)	0x01 (LSB)	0x02	0x00 (MSB)	0x01 (LSB)	0x70 (MSB)	0xEA (LSB)
Stop Learning	0xF7 (247)	0x10	0x02 (MSB)	0xBF (LSB)	0x00 (MSB)	0x01 (LSB)	0x02	0x00 (MSB)	0x00 (LSB)	0xB0 (MSB)	0xFB (LSB)
Clear Alarm	0xF7 (247)	0x10	0x02 (MSB)	0xBC (LSB)	0x00 (MSB)	0x01 (LSB)	0x02	0x00 (MSB)	0x01 (LSB)	0x71 (MSB)	0x08 (LSB)

4. The Scripted Application

The scripted application will

- read the current vibration profile,
- allow an alarm profile to be learned,
- show the current profile and alarm profile on a bar chart,
- show the current alarm status,
- allow alarms to be cleared.

The script starts by issuing a Modbus command to the sensor. Based on the response to this command, further commands are issued. The process of issuing a command and receiving the feedback is asynchronous. Once the Modbus command is issued, the script continues on. This allows the Senquip device to continue with other functions while it is waiting for the sensor to respond and prevents the device freezing if the sensor never responds. A new callback function, *modparse_cb*, triggers when a valid Modbus response is detected on the serial port. The *modparse_cb* function checks the length of the message and CRC to ensure valid Modbus data before being executed.

Looking at the script, firstly, libraries are included, and variables are declared to store vibration, alarm data, and indicators as to whether the sensor is in a learning state and an alarm state.

Since the alarm profile does not change much over time, to save on transmitted data, it will only be sent periodically. The variables *cycle* and *dispatchAlarmProfile* are used to track when the alarm profile should be sent.

A debug function that sends data over Wi-Fi via UDP was used to assist in debugging. The UDP endpoint needs to be configured in the *Endpoint Settings* and a UDP client used to view the data. For more information on debugging with UDP, see Application Note AN002 – Connecting a Senquip Device to a UDP Server over Wi-Fi.

```
load('senquip.js');
load('api_config.js');
load('api_serial.js');
load('api_timer.js');
load('api_endpoint.js');

let vibration = []; // vibration profile
let alarm = [];      // goal profile
let command = '';   // commands to be sent to the sensor
let learnstate = '';    // learn status of sensor
let alarmstate = 0;     // alarm state of sensor

let cycle = 0;
let dispatchAlarmProfile = false;

function debug(s) {UDP.send(s);}
```

A structure that contains all the Modbus requests that will be used is created. The requests are sent to the sensor using the *modbusSend* function that receives the command, adds a CRC, and sends it via the serial port. Note the additional *SERIAL.LOOPBACK* flag that allows transmitted serial data to be routed to the *modparse_cb* callback function to allow it to then look for a valid Modbus response.

A helper function, *nextRead*, is defined that uses a timer to schedule the next Modbus read after an interval. The function is used to schedule the next Modbus command based on the result of the latest response. For instance, when we have finished reading the first 64 registers of the current vibration data, we can schedule the read of the next 64 registers after a delay that allows for the processing of the first 64 to be completed and the processing function to be exited.

```
let modbusCommand = {
  'value0' : '\xF7\x04\x00\x00\x00\x40',  // read first 64 vibration values
  'value1' : '\xF7\x04\x00\x40\x00\x40',  // read second 64 vibration values
  'alarm0' : '\xF7\x03\x00\x80\x00\x40',  // read first 64 alarm values
  'alarm1' : '\xF7\x03\x00\xC0\x00\x40',  // read second 64 alarm values
  'alarmstate' : '\xF7\x04\x00\x80\x00\x01', // read the current alarm state
  'startlearn': '\xF7\x10\x02\xBE\x00\x01\x02\x00\x01', // start learning the vibration profile
  'stoplearn' : '\xF7\x10\x02\xBF\x00\x01\x02\x00\x00', // stop learning the vibration profile
  'clearalarm': '\xF7\x10\x02\xBC\x00\x01\x02\x00\x01' // clear alarms
};

function modbusSend(cmd_str) {
  let crc = SQ.crc(cmd_str);
  let crc_str = SQ.encode(crc, -SQ.U16);
  let modbus_str = cmd_str + crc_str;
  SERIAL.write(1, modbus_str, modbus_str.length, SERIAL.LOOPBACK);
}

function nextRead(next_cmd, delay_ms) {
  // Pass index to the timer function as the userdata parameter
  Timer.set(delay_ms, 0, function(next_cmd) {
      modbusSend(next_cmd);
  }, next_cmd);
}
```

The *data_handler* runs at the end of every base interval. It first checks if any requests have been issued by the user to start or stop learning, or to clear alarms. If a command has been issued, the Modbus command to execute this request is sent to the sensor. If no commands are pending, the first register to be requested from the sensor is the alarm status. Once the first Modbus command has been issued, the script continues to dispatch state information and exits. When a response to the Modbus request is received, the *modparse_cb* callback function will be triggered.

```
SQ.set_data_handler(function()
{
  if (command === 'startlearn'){
    modbusSend(modbusCommand.startlearn);
  }
  else if (command === 'stoplearn'){
    modbusSend(modbusCommand.stoplearn);
  }
  else if (command === 'clearalarm'){
    modbusSend(modbusCommand.clearalarm);
  }
  else {
    dispatchAlarmProfile = cycle % 10 === 0;
    modbusSend(modbusCommand.alarmstate);
    cycle++;
  }

  if (learnstate === 'Learning profile') {alarmstate = 'Monitoring off during learning';}
  SQ.dispatch(3,learnstate);
  SQ.dispatch(4,alarmstate);

}, null);

SQ.set_trigger_handler(function(tp) {
  if (tp === 1) { command = 'startlearn'; }  // start learning
  if (tp === 2) { command = 'stoplearn'; }   // stop learnig
  if (tp === 3) { command = 'clearalarm'; }  // clear the alarm flag
  }, null);
```

The *modparse_cb* function is configured and starts to monitor serial traffic on serial channel 1. In this instance, the function is configured to trigger when Modbus data is detected that completes a previous Modbus request. If no response is received after 350msec, the function will stop looking for a valid response.

```
// Possible Modbus parsing modes:
// 0 = Disabled
// 1 = Callback triggers for all requests and responses
// 2 = Callback triggers for only requests
// 3 = Callback triggers for valid responses that complete a request (sniffer bus data)
let mode = 3;
let timeout_ms = 350;
let serial_ch = 1;
SERIAL.set_modparse(serial_ch, mode, modparse_cb, timeout_ms, null);
```

The parsing of Modbus responses, and the issuing of subsequent Modbus requests is performed in the *modparse_cb* callback function. When triggered, the slave address, function code, register address, length of data, and the actual data are passed to the function. The function code and register address are used to identify which Modbus request is being responded to, and based on this, the data is parsed, and the next Modbus request is made. For instance, if a response to the alarm state request has been received, the alarm status is set, and the Modbus request for the first 64 vibration values is requested. If the first 64 vibration values response has been received, the vibration data is loaded into an array and the next 64 values are requested, and so on.

```
// This callback fires when a valid Modbus request or response is detected (depending on the mode)// The
CRC, function code and length are used to check the message is valid
function modparse_cb(slave_addr, func, reg_addr, data_len, data) {
  let s = '';
  if (data !== null) {
    s = mkstr(data, data_len);
    debug(JSON.stringify({addr: slave_addr, f: func, reg: reg_addr, l: data_len}));

    if (func === 16 && reg_addr === 0x02BE) {  // start learning
      learnstate = 'Learning profile';
      command = '';
      nextRead(modbusCommand.value0, 400); // read first 64 registers of current value
    }
    else if (func === 16 && reg_addr === 0x02BF) { // stop learning
      learnstate = 'Learning complete';
      command = '';
      dispatchAlarmProfile = true;  // get the learned profile on this cycle
      nextRead(modbusCommand.alarmstate, 400); // read first 64 registers of current value
    }
    else if (func === 16 && reg_addr === 0x02BC) { // clear alarm
      command = '';
      nextRead(modbusCommand.alarmstate, 400); // read first 64 registers of current value
    }
    else if (func === 4 && reg_addr === 0x80) { // alarm state
      SQ.dispatch(5,s);
      if (s === '\x01\x00') {alarmstate = 'Alarm';} else {alarmstate = 'Ok';}
      nextRead(modbusCommand.value0, 400); // read first 64 registers of current value
    }
    else if (func === 4 && reg_addr === 0x00) {
      vibration = [];
      for (let i = 0; i < 64; i++) {
        vibration[i] = data[i*2+1];
      }
      nextRead(modbusCommand.value1, 400); // read second 64 registers of current value
    }
    else if (func === 4 && reg_addr === 0x40) {
      for (let i = 0; i < 64; i++) {
        vibration[i+64] = data[i*2+1];
      }
      SQ.dispatch(1,JSON.stringify(vibration));
      if (dispatchAlarmProfile) {
          nextRead(modbusCommand.alarm0,400); // read first 64 registers of alarm value;
      }
    }
    else if (func === 3 && reg_addr === 0x80) {
      alarm = [];
      for (let i = 0; i < 64; i++) {
        alarm[i] = data[i*2+1];
      }
      nextRead(modbusCommand.alarm1,400); // read second 64 registers of alarm value;
    }
    else if (func === 3 && reg_addr === 0xC0) {
      for (let i = 0; i < 64; i++) {
        alarm[i+64] = data[i*2+1];
      }
      SQ.dispatch(2,JSON.stringify(alarm));
    }
  }
}
```

5. Setting Up the Display

Vibration data is dispatched to the Senquip Portal as a stringified JSON array of numbers. By default, the when the Portal detects data formatted in this way, it will display it as a bar chart in a standard widget.

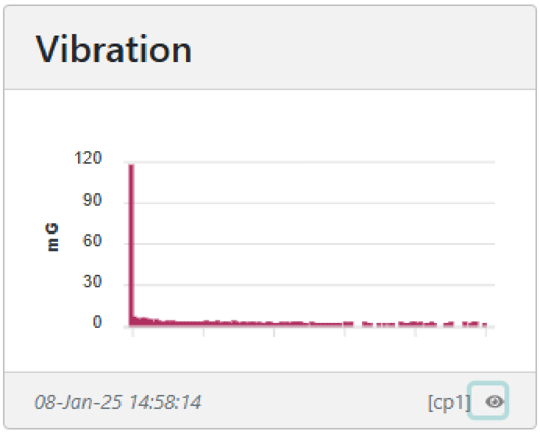


Figure 9 - Default Display for a Stringified Array of Numbers

To see the actual data being sent, use the *eye* icon at the bottom right of the widget to change the display format to HEX.

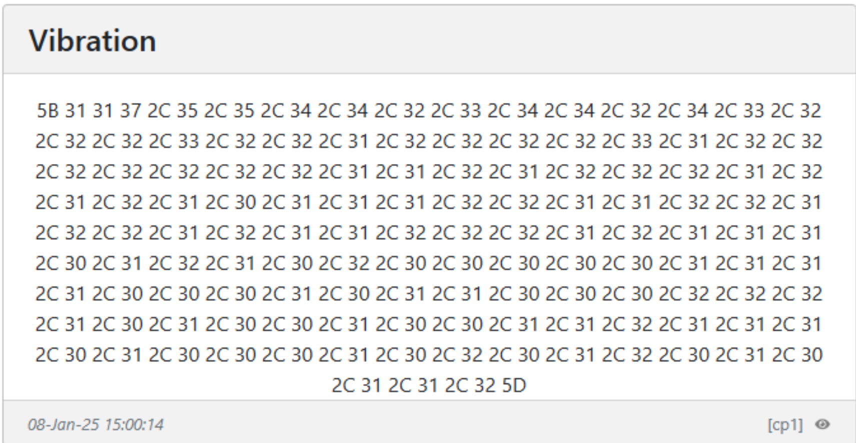


Figure 10 - Stringified Array of Numbers Shown as Hex

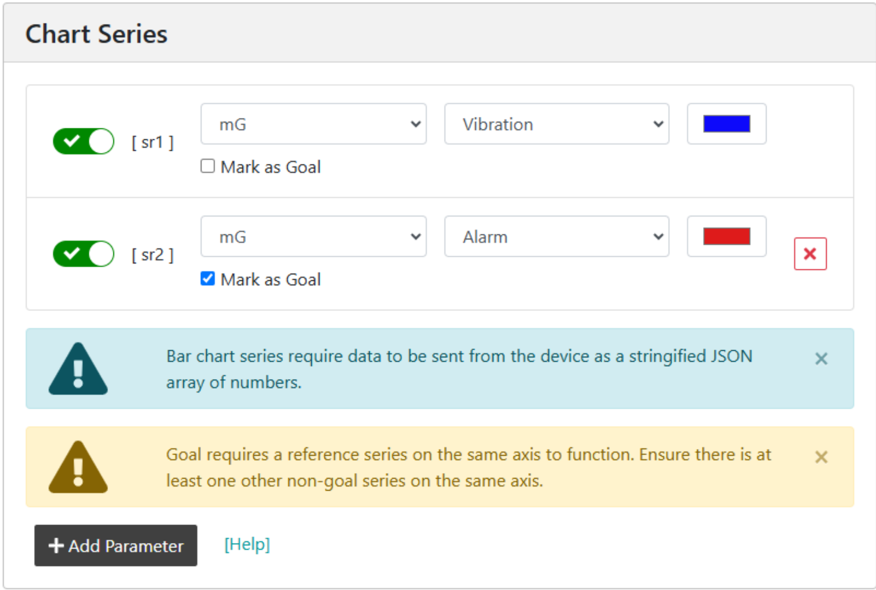
5.1. Displaying the Vibration and Alarm Data on a Chart

Use the *Add Custom Chart* option in the device display settings menu to create a new bar chart.

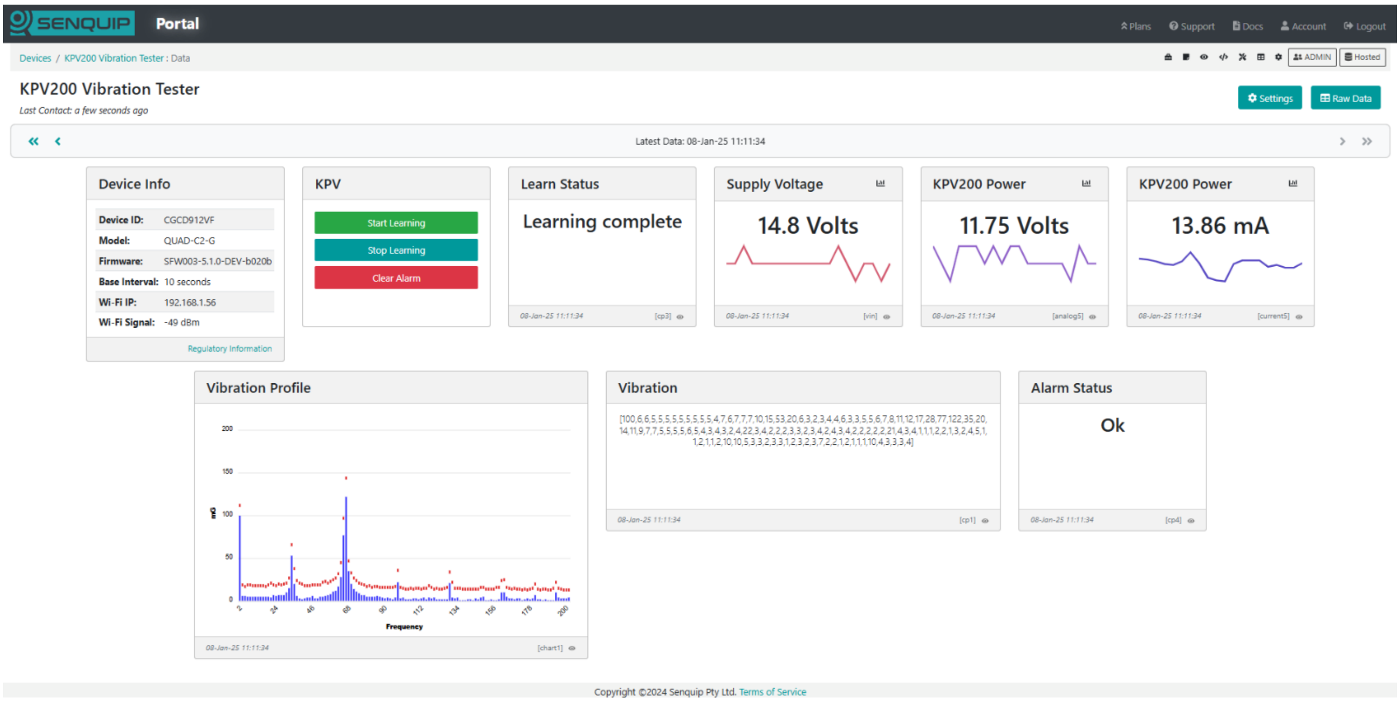
In this example, a Bar chart of width 2 and height 2 is chosen. The x-axis is named Frequency, and the axis is scaled so that the 128 data points map to an x-axis scale of 0-200.

A y-axis called mG is added and the range is set between 0 and 200mG.

The Vibration Data and Alarm data are added as series on the chart. The Alarm data is set as being a *Goal* series. The *Goal* series will always appear in front of the other series, and it only needs to be refreshed every 600 cycles. This is done to save the amount of data that has to be transmitted on every cycle.

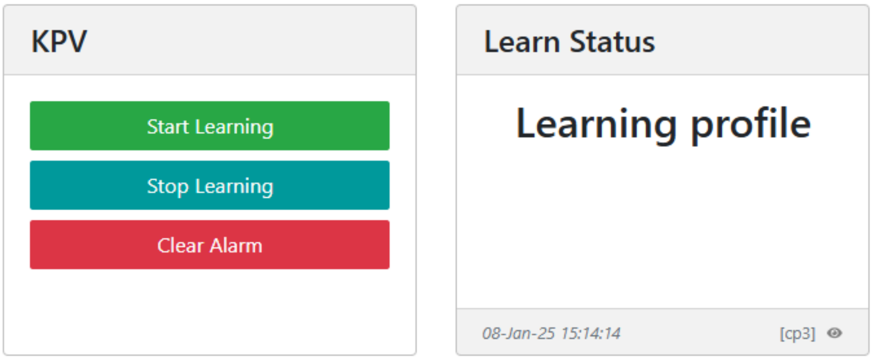


The device page will now show the vibration data as a list of numbers, and the vibration and alarm values on a bar chart.

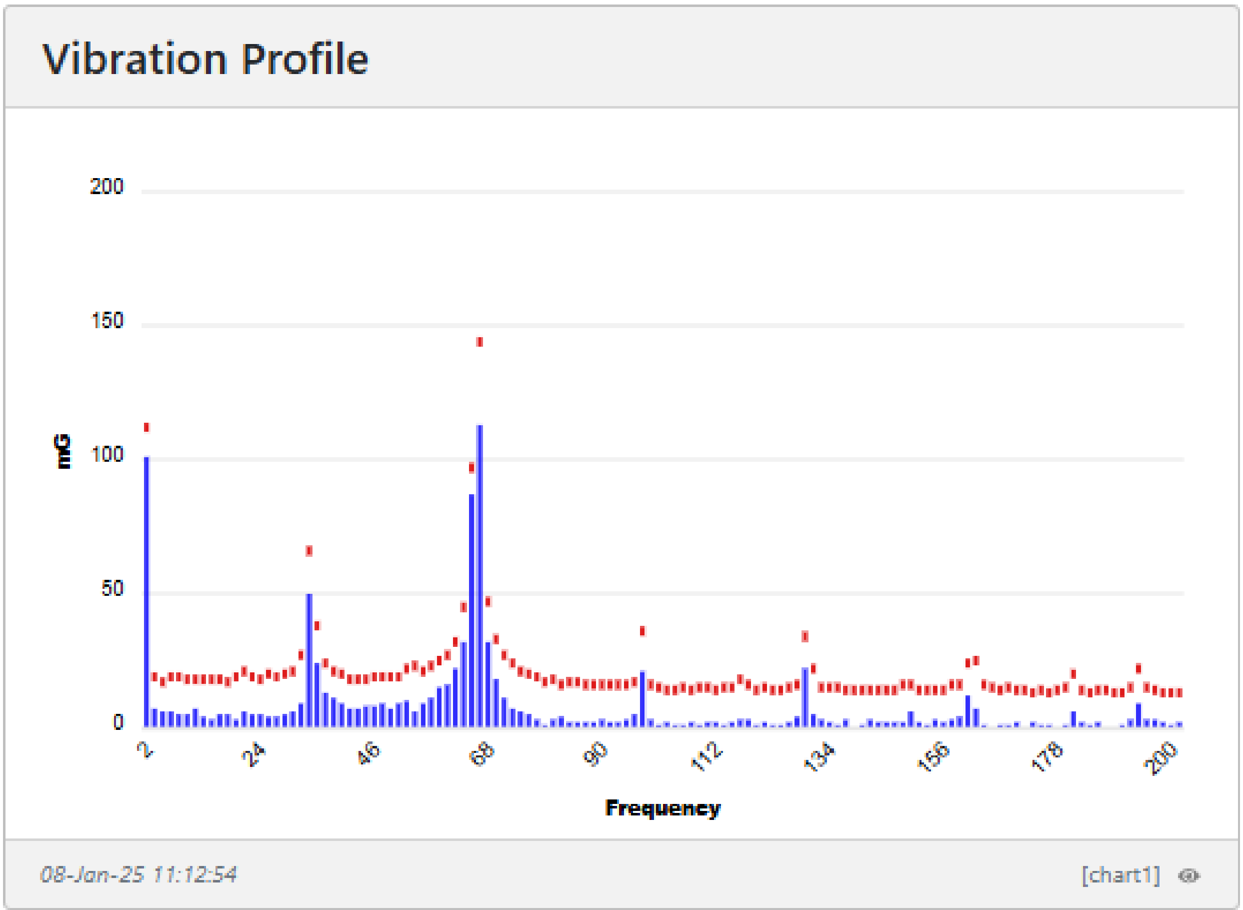


6. Results

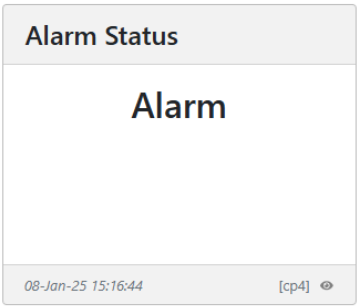
With the sensor and vibration motor connected and data being received, the *Start Learning* function was initiated.



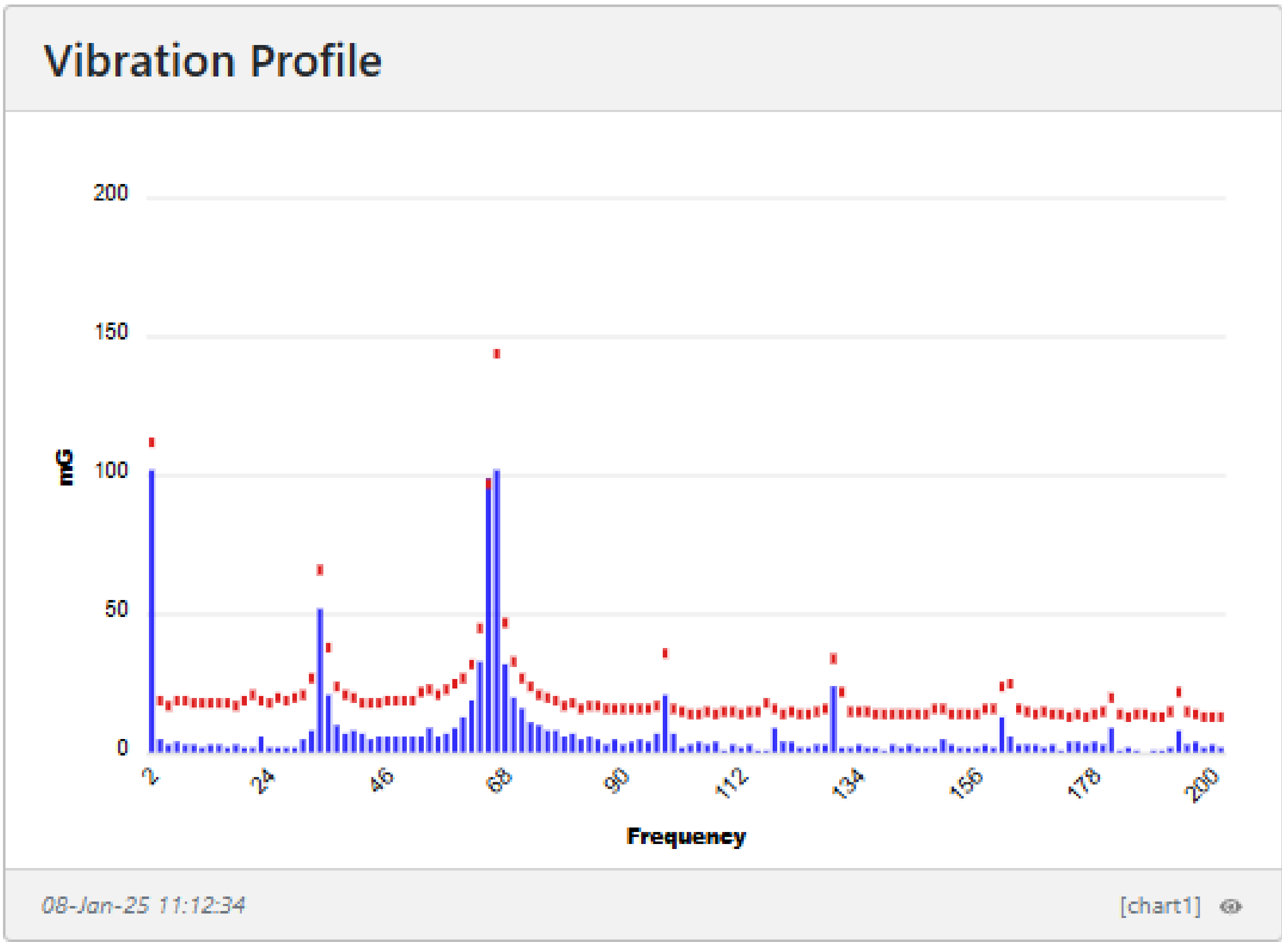
After a few minutes, the learning was terminated. The vibration data was seen to be below the alarm threshold in all cases.



After a short while, the Alarm Status widget change to "Alarm".



It was noted that a single frequency bin at around 67Hz has exceeded the alarm threshold.



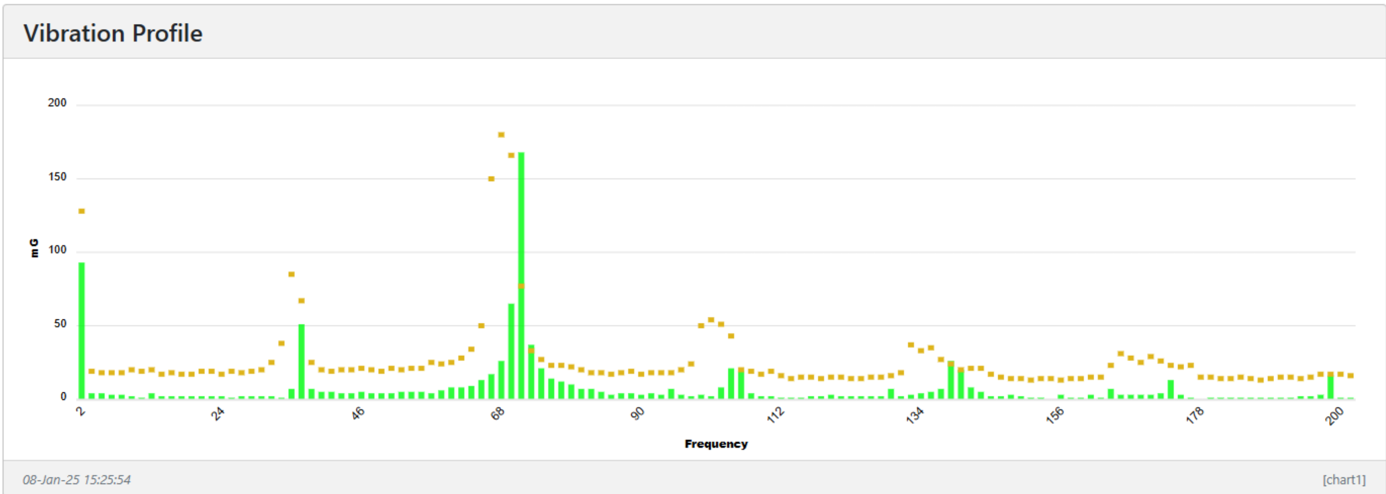
Learning was initiated for a while longer and after having cancelled the alarm, it did not re-appear until the frequency of the motor was changed.

7. Conclusions

The KPV200 vibration sensor was integrated with a Senquip QUAD to enable the following features:

- read the current vibration profile,
- provide an option to enable the learning of a typical profile,
- show the current profile and alarm profile on a bar chart,
- show the current alarm status,
- allow alarms to be cleared.

The integration was simple, with the sensor being powered by an output from the Senquip device. The new *modparse_cb* callback function allowed an asynchronous application to be written that allows the Senquip device to continue operating even when the volume of Modbus data being transferred is high.



8. Appendix I – Example Script

```
load('senquip.js');
load('api_config.js');
load('api_serial.js');
load('api_timer.js');
load('api_endpoint.js');

let vibration = []; // vibration profile
let alarm = [];     // goal profile
let command = '';   // commands to be sent to the sensor
let learnstate = '';    // learn status of sensor
let alarmstate = 0;     // alarm state of sensor

let cycle = 0;
let dispatchAlarmProfile = false;

function debug(s) {UDP.send(s);}

let modbusCommand = {
  'value0' : '\xF7\x04\x00\x00\x00\x40',  // read first 64 vibration values
  'value1' : '\xF7\x04\x00\x40\x00\x40',  // read second 64 vibration values
  'alarm0' : '\xF7\x03\x00\x80\x00\x40',  // read first 64 alarm values
  'alarm1' : '\xF7\x03\x00\xC0\x00\x40',  // read second 64 alarm values
  'alarmstate' : '\xF7\x04\x00\x80\x00\x01', // read the current alarm state
  'startlearn': '\xF7\x10\x02\xBE\x00\x01\x02\x00\x01', // start learning the vibration profile
  'stoplearn' : '\xF7\x10\x02\xBF\x00\x01\x02\x00\x00', // stop learning the vibration profile
  'clearalarm': '\xF7\x10\x02\xBC\x00\x01\x02\x00\x01' // clear alarms
};

function modbusSend(cmd_str) {
  let crc = SQ.crc(cmd_str);
  let crc_str = SQ.encode(crc, -SQ.U16);
  let modbus_str = cmd_str + crc_str;
  SERIAL.write(1, modbus_str, modbus_str.length, SERIAL.LOOPBACK);
}

function nextRead(next_cmd, delay_ms) {
  // Pass index to the timer function as the userdata parameter
  Timer.set(delay_ms, 0, function(next_cmd) {
      modbusSend(next_cmd);
  }, next_cmd);
}

// This callback fires when a valid Modbus request or response is detected (depending on the mode)// The CRC,
function code and length are used to check the message is valid
// slave_addr: (int) the slave address
// func: (int) the function code
// reg_addr: (int) the register address
// data_len: (int) the length of the register data in bytes
// data: (void*) the register data from the request or response
function modparse_cb(slave_addr, func, reg_addr, data_len, data) {
  let s = '';
  if (data !== null) {
    s = mkstr(data, data_len);
    debug(JSON.stringify({addr: slave_addr, f: func, reg: reg_addr, l: data_len}));

    if (func === 16 && reg_addr === 0x02BE) {  // start learning
      learnstate = 'Learning profile';
      command = '';
      nextRead(modbusCommand.value0, 400); // read first 64 registers of current value
    }
    else if (func === 16 && reg_addr === 0x02BF) { // stop learning
      learnstate = 'Learning complete';
      command = '';
      dispatchAlarmProfile = true;  // get the learned profile on this cycle
```

```
      nextRead(modbusCommand.alarmstate, 400); // read first 64 registers of current value
    }
    else if (func === 16 && reg_addr === 0x02BC) { // clear alarm
      command = '';
      nextRead(modbusCommand.alarmstate, 400); // read first 64 registers of current value
    }
    else if (func === 4 && reg_addr === 0x80) { // alarm state
      SQ.dispatch(5,s);
      if (s === '\x01\x00') {alarmstate = 'Alarm';} else {alarmstate = 'Ok';}
      nextRead(modbusCommand.value0, 400); // read first 64 registers of current value
    }
    else if (func === 4 && reg_addr === 0x00) {
      vibration = [];
      for (let i = 0; i < 64; i++) {
        vibration[i] = data[i*2+1];
      }
      nextRead(modbusCommand.value1, 400); // read second 64 registers of current value
    }
    else if (func === 4 && reg_addr === 0x40) {
      for (let i = 0; i < 64; i++) {
        vibration[i+64] = data[i*2+1];
      }
      SQ.dispatch(1,JSON.stringify(vibration));
      if (dispatchAlarmProfile) {
          nextRead(modbusCommand.alarm0,400); // read first 64 registers of alarm value;
      }
    }
    else if (func === 3 && reg_addr === 0x80) {
      alarm = [];
      for (let i = 0; i < 64; i++) {
        alarm[i] = data[i*2+1];
      }
      nextRead(modbusCommand.alarm1,400); // read second 64 registers of alarm value;
    }
    else if (func === 3 && reg_addr === 0xC0) {
      for (let i = 0; i < 64; i++) {
        alarm[i+64] = data[i*2+1];
      }
      SQ.dispatch(2,JSON.stringify(alarm));
    }
  }
}

// Possible Modbus parsing modes:
// 0 = Disabled
// 1 = Callback triggers for all requests and responses
// 2 = Callback triggers for only requests
// 3 = Callback triggers for valid responses that complete a request (sniffer bus data)
let mode = 3;
let timeout_ms = 350;
let serial_ch = 1;
SERIAL.set_modparse(serial_ch, mode, modparse_cb, timeout_ms, null);

SQ.set_data_handler(function()
{
  if (command === 'startlearn'){
    modbusSend(modbusCommand.startlearn);
  }
  else if (command === 'stoplearn'){
    modbusSend(modbusCommand.stoplearn);
  }
  else if (command === 'clearalarm'){
    modbusSend(modbusCommand.clearalarm);
  }
  else {
    dispatchAlarmProfile = cycle % 10 === 0;
```

```
    modbusSend(modbusCommand.alarmstate);
    cycle++;
  }

  if (learnstate === 'Learning profile') {alarmstate = 'Monitoring off during learning';}
  SQ.dispatch(3,learnstate);
  SQ.dispatch(4,alarmstate);

}, null);

SQ.set_trigger_handler(function(tp) {
  if (tp === 1) { command = 'startlearn'; }  // start learning
  if (tp === 2) { command = 'stoplearn'; }   // stop learnig
  if (tp === 3) { command = 'clearalarm'; }  // clear the alarm flag
  }, null);
```

9. Appendix II – KPV200 Register Description

FUNCTION CODE 03 - READ Holding REGISTERS								
Register	Data Address	Description	Data Type	Value range	System Value	Factory settings	Destination	Read write mode.
30001	0	Known curve First FFT BIN	Unsigned int	0-255		127	Eeprom	Read
…	…							
30128	127	Known curve Last FFT BIN	Unsigned int	0-255		127	Eeprom	Read
30129	128	Alarm curve First FFT BIN	Unsigned int	0-255		137	Eeprom	Read
…	…							
30256	255	Alarm curve Last FFT BIN	Unsigned int	0-255		1.0	Eprom	

FUNCTION CODE 03 - READ HOLDING REGISTERS (Holding registers, Settings) Eeprom registers FUNCTION CODE 16 – WRITE MULTIPLE REGISTERS (Holding registers, Settings)								
Register	Data Address	Description	Data Type	Value range	System Value	Factory settings	Destination	Read write mode.
30501	500	Spare						
30502	501	Spare						
30503	502	Spare						
30504	503	Spare						
30505	504	Firmware version				1.0		
30506	505	Baudrate	Unsigned int	Value= baudrate 96 = 9600 192 = 19200 384 = 38400 576 = 57600 1152 = 115200		115200	Eeprom	Read / write
		Address						
30508	507	Parity	Unsigned int	0 = No parity 1 = Odd parity 2 = Even parity		Even	Eeprom	Read / write
30509	508	Spare				-		
30510	509	Spare				-		
30511	510	Direction. Choose X, Y or Z direction.	Unsigned int	0 = X 1 = Y 2 = Z		Z direction.	Eeprom	Read / write
30512	511	Samplerate	Unsigned int	10 = 100 Hz 11 = 200 Hz 12 = 400 Hz 13 = 800 Hz 14 = 1600 Hz 15 = 3200 Hz		3200Hz	Eeprom	Read / write
30513	512	G-Rate	Unsigned int	0 = ±2G 1 = ±4G 2 = ±8G 3 = ±16G		±2G	Eeprom	Read / write
30514	513	AlarmOffset	Unsigned int	0 - 255		10	Eeprom	Read / write
30515	514	AlarmDelay	Unsigned int	0 - 65535		0	Eeprom	Read / write

FUNCTION CODE 03 – READ HOLDING REGISTERS (Holding registers, Settings) Dynamic registers FUNCTION CODE 16 – WRITE MULTIPLE REGISTERS (Holding registers, Settings)								
Register	Data Address	Description	Data Type	Value range	System Value	Factory settings	Destination	Read write mode.
30701	700	Clear Alarm	Unsigned int	1	0	0	Code	Write
30702	701	Reset to stored settings	Unsigned int	1	0	0	Code	Write
30703	702	Start Learning	Unsigned int	1 = Start Learning		0	Code	write
30704	703	Stop Learning	Unsigned int	0 = Stop Learning		0	Code	write
30705	704	Change Direction	Unsigned int	0 = X 1 = Y 2 = Z		Z direction.	Code	Read / write
30706	705	Change Samplerate	Unsigned int	10 = 100 Hz 11 = 200 Hz 12 = 400 Hz 13 = 800 Hz 14 = 1600 Hz 15 = 3200 Hz		3200Hz	Code	Read / write
30707	706	Change G-rate.	Unsigned int	0 = ±2G 1 = ±4G 2 = ±8G 3 = ±16G		±2G	Code	Read / write

FUNCTION CODE 04 – READ INPUT REGISTERS								
Register	Data Address	Description	Data Type	Value range	System Value	Factory settings	Destination	Read write mode.
40001	0	Vibration Data First Bin	Unsigned int	0-255	0	0	Code	read
40128	127	Vibration Data Last Bin	Unsigned int	0-255	0	0	Code	read
40129	128	Alarm Flag	Unsigned int	0 to 1	0	0	Code	read