**Title:** Pressure Sensor App Communication Protocol and steps

**Date:** 2/23/2021

**Revision:** X01

BLE GATT Database:

Configuration Service: CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:D4:8C:AD:8A

-Settings Characteristic: 06:0D:00:CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:AA:46:AD:8A

Data type: uint8\_t [10]

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bluetooth Header | Module | Sub Message #1 | Sub Message #2 | Sub Message #3 | Sub Message #4 | Sub Message #5 | Sub Message #6 | Sub Message #7 | Bluetooth Footer |

-Response Characteristic: 12:0F:00:CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:AB:46:AD:8A

Data type: uint8\_t [4]

|  |  |  |  |
| --- | --- | --- | --- |
| Response #1 | Response #2 | Response #3 | Response #4 |

Pressure Service: CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:D7:8C:AD:8A

-Pressure Characteristic: 12:1D:00:CE:13:10:B0:F0:74:3E:A1:EE:45:30:38:B0:46:AD:8A

Data type: uint8\_t [12]

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CIN #1 [0] | CIN #1 [1] | CIN #1 [2] | CIN #2 [0] | CIN #2 [0] | CIN #2 [1] | CIN #2 [2] | CIN #3 [0] | CIN #3 [1] | CIN #3 [2] | CIN #4 [0] | CIN #4 [1] | CIN #4 [2] |

1. Connect to Device.
   1. Device name: SG-P-X01
   2. Manufacturer name: GT-BITNG
2. Discover all attributes and services.
3. Enable all characteristic notifications.
4. Write the following command to the SETTINGS CHARACTERISTIC
   1. Enable the measurement channel for the FDC1004.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | FDC1004 MODULE | FDC1004 ENABLE CHANNEL COMMAND | CHANNEL | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X09 | 0X0C | X | 0 | 0 | 0 | 0 | 0 | 0XBB |

\* The X values signify an input value. The channel is a uint8\_t data type accepting numbers 1-4 corresponding to CIN1 - CIN4.

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Set the offset capacitance measurement for the measurement channels used.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | FDC1004 MODULE | FDC1004 SET CAPDAC COMMAND | CHANNEL | CAPDAC | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X09 | 0X09 | X | X | 0 | 0 | 0 | 0 | 0XBB |

\* The X values signify an input value. The channel is a uint8\_t data type accepting numbers 1-4. The CAPDAC is a uint8\_t data type. This value sets the offset capacitance. This is the single-ended measurement capacitance offset: C\_offset = CAPDAC x 3.125 pF. This value needs to be tuned per pressure sensor. This value will vary as each pressure sensor is unique. Do this for each pressure sensor used.

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Set the gain for each measurement channel used.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | FDC1004 MODULE | FDC1004 SET GAIN CALIBRATION COMMAND | CHANNEL | INTEGER | DECIMAL MSB | DECIMAL  LSB | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X09 | 0X04 | X | X | X | X | 0 | 0 | 0XBB |

\* The X values signify an input value. The channel is a uint8\_t data type accepting numbers 1-4. The integer is a uint8\_t data type containing 2 bits. This value sets the integer portion of the offset capacitance. This decimal is a uint8\_t [2] array containing 14 bits. The first sets the MSB and the second sets the LSB. This register contains a gain factor correction in the range of 0 to 4 that can be applied to each channel to remove gain mismatch due to external circuitry. I have found that a gain value of 0.5 works well. However, this value needs to be tuned per pressure sensor used.

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Start instant pressure data recording transfer.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | FDC1004 MODULE | FDC1004 START DATA COLLECTION COMMAND | 0 | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X09 | 0X0E | 0 | 0 | 0 | 0 | 0 | 0 | 0XBB |

\* This command is to set internal variables to monitor the transmission of data from the FDC1004 to the nRF52.

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Change the sampling rate if you desire.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | NRF52 MODULE | NRF52 RTC CLOCK COMMAND | NRF52 RTC SENSOR SET COUNTER | COUNTER[0] | COUNTER[1] | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X01 | 0X04 | 0X08 | X | X | 0 | 0 | 0 | 0XBB |

The X values signify a byte in an unit16\_t data type. Counter[0] is the MSB and Counter[1] is the LSB. The counter / 8 = seconds per sample.

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Start the internal timer to regulate the sampling rate.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | NRF52 MODULE | NRF52 RTC CLOCK COMMAND | NRF52 RTC SENSOR START | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X01 | 0X04 | 0X09 | 0 | 0 | 0 | 0 | 0 | 0XBB |

\* Only call this function once to start the timer to regulate the sampling rate.

Data is will written to the pressure characteristic above at the desired sampling rate. After data is written to the characteristic, a notification is sent to the BLE Client.

To stop data transfer of pressure, send the following commands:

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Stop instant pressure data recording.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | FDC1004 MODULE | FDC1004 STOP DATA COLLECTION COMMAND | 0 | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X09 | 0X0F | 0 | 0 | 0 | 0 | 0 | 0 | 0XBB |

\* This function only stops pressure data being transferred. It does not stop other types of data collection methods going on.

1. Write the following command to the SETTINGS CHARACTERISTIC
   1. Stop the internal timer that regulates the sampling rate.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BLUETOOTH HEADER | NRF52 MODULE | NRF52 RTC CLOCK COMMAND | NRF52 RTC SENSOR STOP | 0 | 0 | 0 | 0 | 0 | BLUETOOTH FOOTER |
| 0XBA | 0X01 | 0X04 | 0X10 | 0 | 0 | 0 | 0 | 0 | 0XBB |

\* Only call this function once to stop all timer enabled sensor data collection.