Polar Measurement Data Specification for 3rd Party

Abstract

This document specifies BLE communication for Polar SDK. Reader should have a good knowledge about BLE and GATT.

Introduction

This document is intending to explain the measurement data flow on top of Polar proprietary Polar Measurement Data (PMD) service.

Gatt Service and Characteristics Declaration

Service Name	Characteristic Name	Property	Optional Property	Security Permission	UUID
PMD Service	NA				FB005C80-02E7-F387-1CAD-8ACD2D8DF0C8
	PMD Control Point	Read, Write, Indicate		None	FB005C81-02E7-F387-1CAD-8ACD2D8DF0C8
	PMD Control Point Client Characteristic Configuration Descriptor	Read, Write		None	
	PMD Data MTU Characteristic	Notify	Indicate	None	FB005C82-02E7-F387-1CAD-8ACD2D8DF0C8
	PMD Data MTU Client Characteristic Configuration Descriptor	Read, Write		None	

PMD Measurement Types

Measurement Types	Description	Unit	Static Requirements
0	ECG	Volt (V)	Lifetime
1	PPG		Lifetime
2	Acceleration	Force per unit mass (g)	Lifetime
3	PP Interval	Second (s)	Lifetime
4	Reserved for Future Use		Lifetime
5	Gyroscope	Degrees per second (dps)	Lifetime
6	Magnetometer	Gauss (G)	Lifetime
7-255	Reserved for Future Use	Not defined	Not defined

Control Point Error Codes

Value	Description	Usage
0	SUCCESS	Response when sent Control Point Command is handled with success.
1	ERROR INVALID OP CODE	Response when sent Control Point Command is not supported by device.
2	ERROR INVALID MEASUREMENT TYPE	Response when requested measurement is not known by the device.
3	ERROR NOT SUPPORTED	Response when requested measurement is not supported by the device.
4	ERROR INVALID LENGTH	Response when given length of doesn't match the received number of data.
5	ERROR INVALID PARAMETER	Response when request contains parameters that prevents handling the request.
6	ERROR ALREADY IN STATE	Response when device already in requested state.
7	ERROR INVALID RESOLUTION	Response when requested measurement with a resolution that is not supported by device.
8	ERROR INVALID SAMPLE RATE	Response when requested measurement with a sample rate that is not supported by device.
9	ERROR INVALID RANGE	Response when requested measurement with a range that is not supported by device.
10	ERROR INVALID MTU	Response when connection MTU is not matching the device required MTU.
11	ERROR INVALID NUMBER OF CHANNELS	Response when measurement request contains invalid number of channels.
12	ERROR INVALID STATE	Response when device in invalid state.
13	ERROR DEVICE IN CHARGER	Response when device is in charger and doesn't support requested command in the current state.
14 - 255	RFU	Reserved for Future Usage.

Frame types ACC

Frame type	Size	Unit	Description
0	3B	mG	x, y, z 8-bit
1	6B	mG	x, y, z 16-bit
2	9B	mG	x, y, z 24-bit
128	n	mG	Delta frame
3..127, 129..255			RFU

Frame types Magnetometer

Frame type	Size	Unit	Description
128	n	Gauss	Delta frame
0..127, 129..255			RFU

Frame types Gyroscope

Frame type	Size	Unit	Description
128	n	dps	Delta frame
0..127, 129..255			RFU

Frame types PPG

Frame type	Size	Description
0	12B	Bytes 0..2: ppg0 Bytes 3..5: ppg1 Bytes 6..8: ppg2 Bytes 9..11: ambient0
128	n	Delta frame
1..127, 129..255		RFU

Frame types ECG

Frame type	Size	Unit	Description
0	3B	µV	Electrocardiogram
1..255			RFU

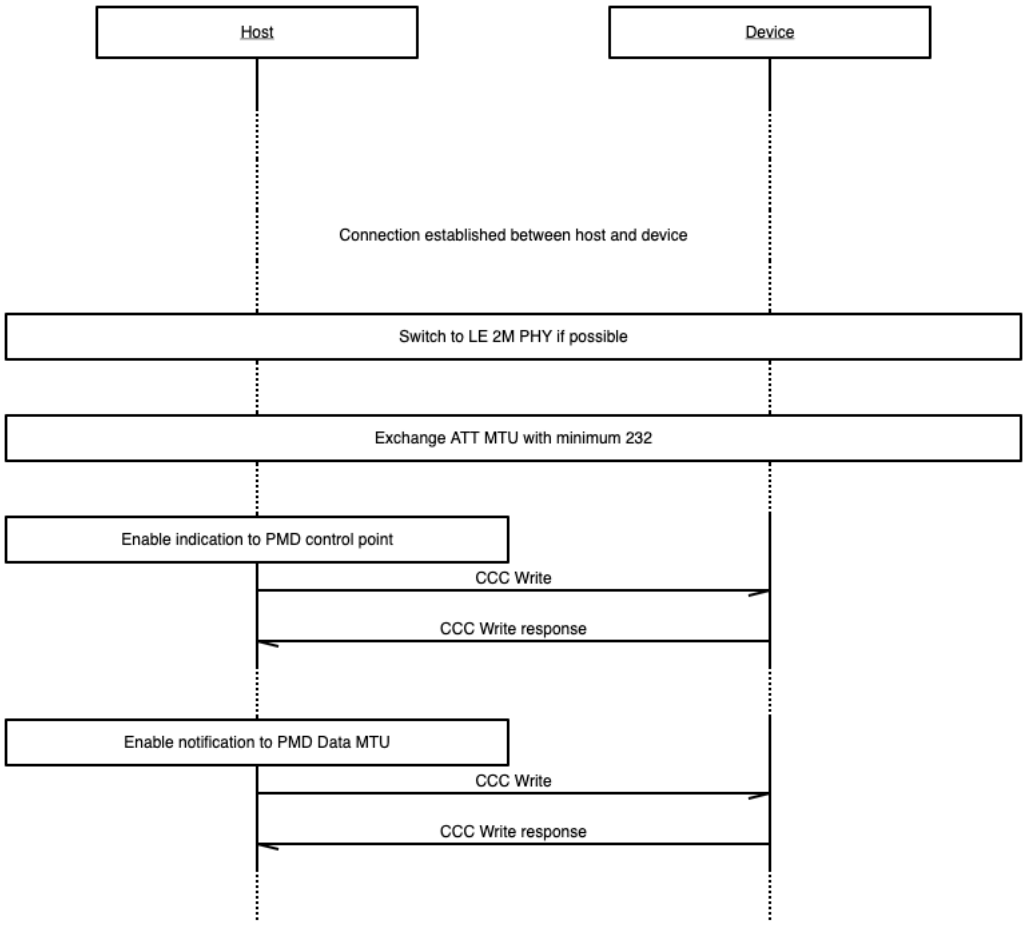
Frame types PPI

Frame type	Size	Description
0	6B	Byte 0: Heart rate in bpm Bytes 1..2: Peak to peak in milliseconds Bytes 3..4: Error estimate Byte 5: Flags. bit0: error bit. If true then PP measurement is invalid for some reason. bit1: skin contact status bit2: skin contact status supported
1..255		RFU

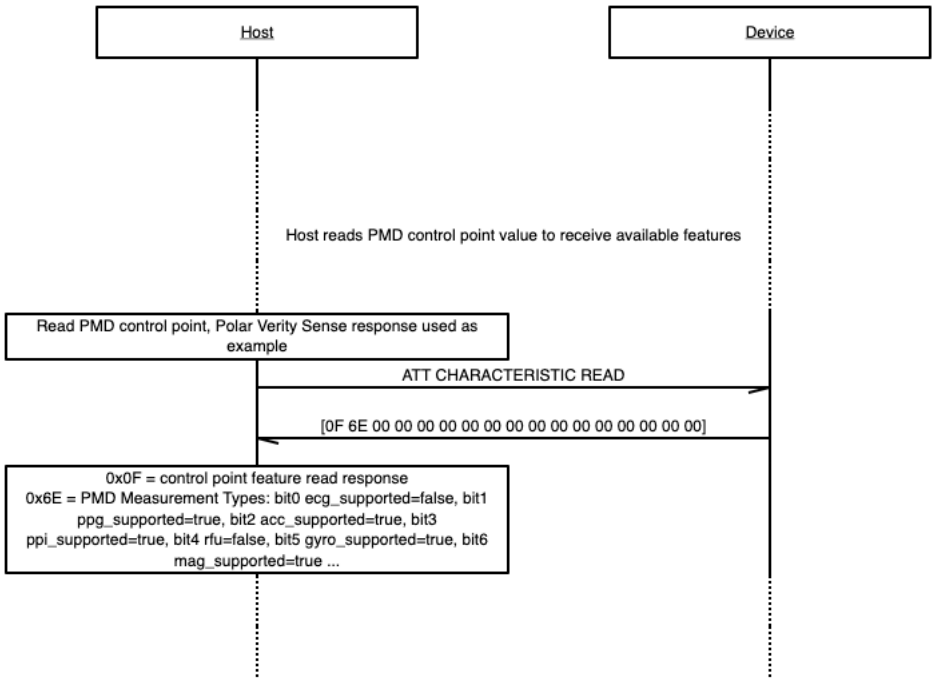
Delta frame sample example from Polar Verity Sense (Acc data as example)

Index	Size	Name	Sample data hex	Description
0	Requested measurement resolution * number of channels	Reference sample	D0 FF 65 01 E4 0F	When resolution = 16bit and number of channels = 3 then x channel: 0xFFD0 = -48, y channel: 0x0165 = 357, z channel: 0x0FE4 = 4068
..	1B	Delta size in bits	08	Each delta value is 8 bits in length
..	1B	Delta samples count	1D	Samples count is 29.
..	Math.ceil((Delta size in bits * number of channels)/8)	Delta sample	FC 07 FF	delta sample 0: x channel: 0xFFD0 + 0xFC = 0xFFCC => -52 y channel: 0x0165 + 0x07 = 0x016C => 364 z channel: 0x0FE4 + 0xFF = 0x0FE3 => 4067
..	Math.ceil((Delta size in bits * number of channels)/8)	Delta sample	0C 13 F2	delta sample 1: x channel: 0xFFCC + 0x0C = 0xFFD8 => -40 y channel: 0x016C + 0x13 = 0x017F => 383 z channel: 0x0FE3 + 0xF2 = 0x0FD5 => 4053
..		Delta sample	...	delta sample 2: ..

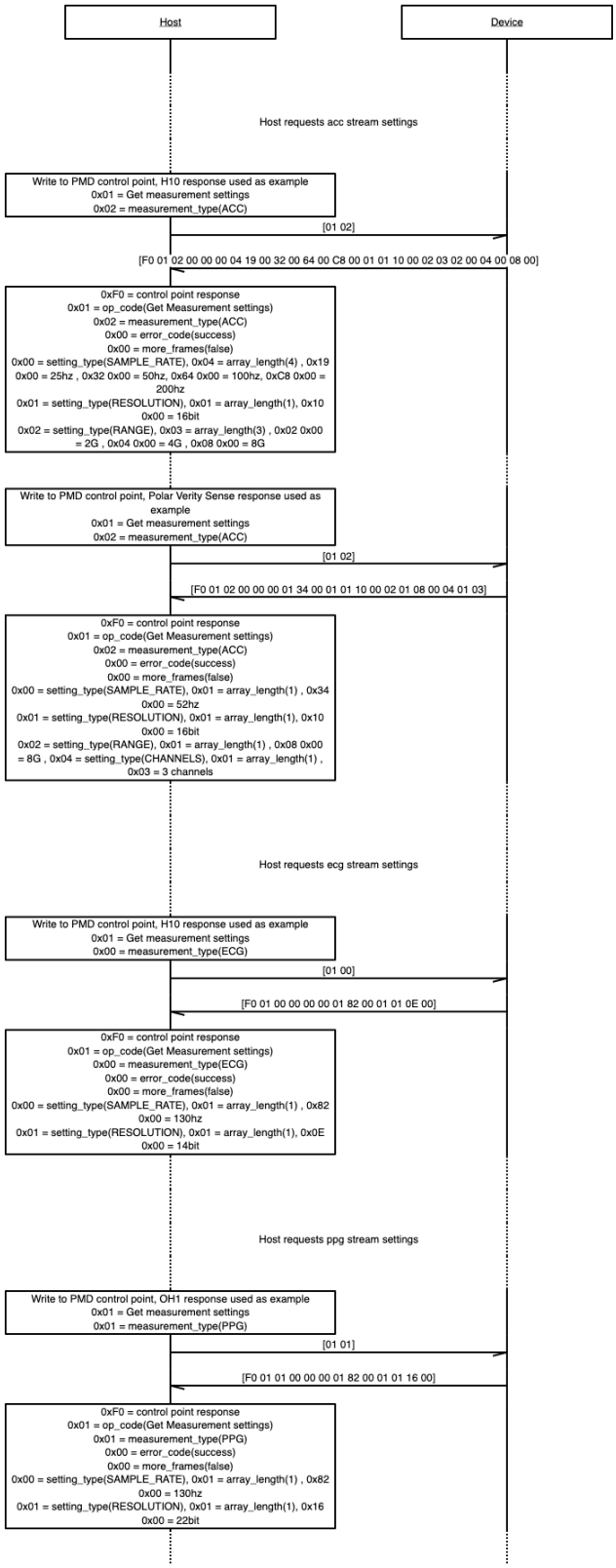
Prerequisite



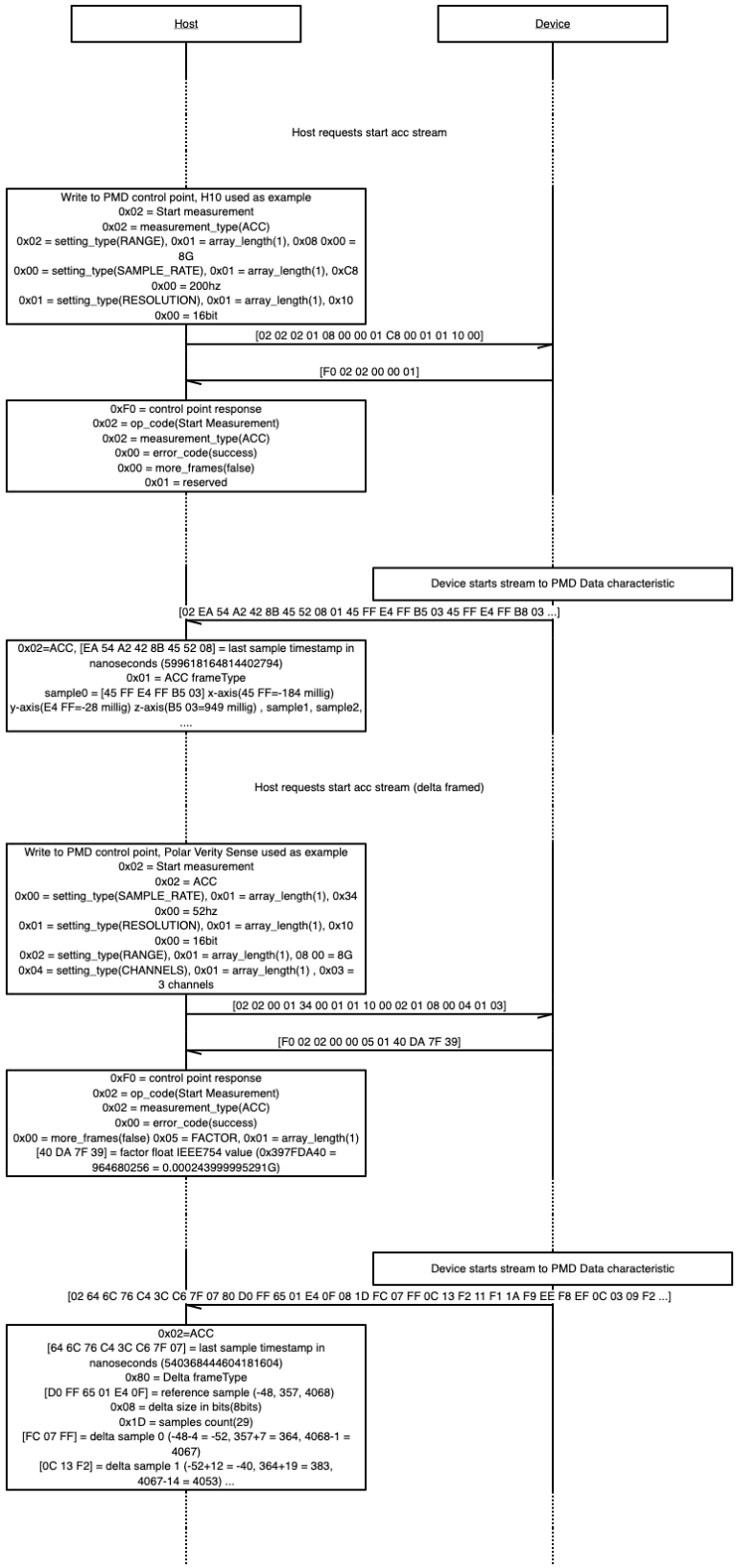
Read Features from device



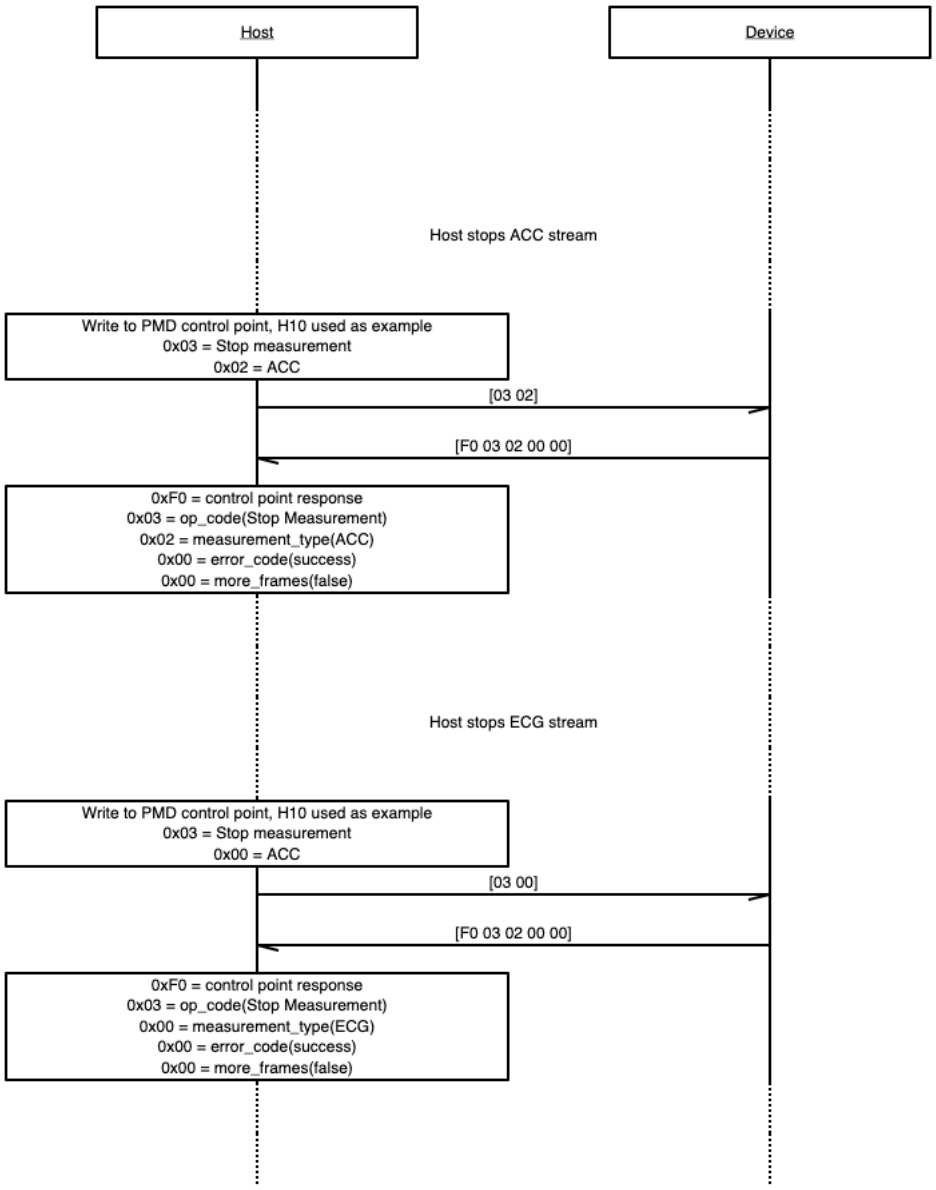
Request Stream Settings



Start Stream



Stop Stream


Host
Device
Host stops ACC stream
Write to PMD control point, H10 used as example
0x03 = Stop measurement
0x02 = ACC
[03 02]
[F0 03 02 00 00]
0xF0 = control point response
0x03 = op_code(Stop Measurement)
0x02 = measurement_type(ACC)
0x00 = error_code(success)
0x00 = more_frames(false)
Host stops ECG stream
Write to PMD control point, H10 used as example
0x03 = Stop measurement
0x00 = ACC
[03 00]
[F0 03 02 00 00]
0xF0 = control point response
0x03 = op_code(Stop Measurement)
0x00 = measurement_type(ECG)
0x00 = error_code(success)
0x00 = more_frames(false)

Abbreviations

Acronyms and Abbreviations	Meaning
PMD	Polar Measurement Data
BLE	Bluetooth Low Energy
GATT	Generic Attribute Profile
MTU	Maximum Transmission Unit
ACC	Acceleration
ECG	Electrocardiogram
PPG	Photoplethysmogram
PPI (or PP Interval)	Peak-to-Peak interval
dps	degrees per second
RFU	Reserved for future use