

計劃代號 _____

產品型號 _____

撰寫者 Darrell Lin撰寫日期 2012/03/14

Overall Protocol and Device Behavior Description

iPad and Android apps will connect to devices (Treadmill etc.) via Bluetooth. RFCOMM/SPP is used as a transport protocol. (Baud rate: 57600bps and data format: 8, N, 1). Initialization includes pairing of devices. After pairing devices are ready to go.

Every command must contain exactly 5 bytes. First byte is a command ID, other content depends on a command and described below. If command contains less than 5 bytes, the rest is filled with zeroes.

Every response must contain exactly 6 bytes. First byte is echo command ID, and the second byte is always a result code. Other 4 bytes depend on the command. Result code can be:

- 0xAA — OK
- 0xFF — FAIL
- 0xEE — WRONG PARAMETER (corresponding “set” command parameter is out of possible device range)

Timeout is 5 seconds. If we did not get any response in 0.5 seconds, we will try to send command again. If failed and over 5 seconds — show alert to user and stop the program.

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Overall command sending logic is (FAIL is showing alert and stopping current program):

- Sending command
 - If failed — try to check engagement status.
 - If it's “disengaged”, then engage external control
 - If failed — try to engage external control again
 - If failed — FAIL
- Try to send command again
 - If failed — FAIL

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Device Command Sequences

•Connecting to device and initializing

- User first pair the mobile device to equipment
- Then we execute the "Engage External Control mode" command
- Then we execute the "Device Identification" command
- Then we execute the "Get Firmware Version" command
- Then we execute the "Reset all Counters" command

•Starting workout

- We execute the "Reset all Counters" command
- For standard program we set up the speed/incline/resistance for the first segment, for Manual mode we set up some default initial settings.
- Then we execute the "Start Motor" command.

•Pausing workout

- We execute the "Pause Motor" command. Equipment stores speed/incline/resistance itself.

•Resuming workout

- We execute the "Start Motor" command. Equipment restores speed/incline/resistance itself.

•Stopping workout

- We set up speed/incline/resistance to 0.
- Then we execute the "Pause Motor" command.

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- Changing speed
 - We execute "Set Treadbelt Speed" command with the appropriate parameters
 - We execute "Get Variable" to get the target speed command
- Changing incline and resistance
 - Exactly like changing speed
- Application went to background
 - Continue sending "get commands" for 5 seconds, and then stop sending all commands.
- Application terminated
 - Stop sending all commands.

Binary Command Reference

Comments:

- 0xAA in response means "OK" (or "YES" if command returns result, "Command Accepted", if there is no data in the result)
- 0xFF in response means "Fault" (or "NO", if command is intended to return a result)
- 0xEE (only in some of "set" commands) indicates that argument that was passed to a system was out of possible range.

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Command	Code	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Device Identification	0x02	0x00 0x00 0x00 0x00	0x02	0xAA 0xFF	Device ID Model ID 0x00 0x00 (See Appendix A)	Required after external control mode. Specifically, this command must be issued when the tablet app is started after Bluetooth pairing has occurred. The application should then configure itself for the correct device.
Engage External Control mode	0x04	0x00 0x00 0x00 0x00	0x04	0xAA 0xFF	0x00 0x00 0x00 0x00	This Command must be issued after the app has started and the device has been paired. It should get back an acknowledgment (0xAA) that External control is engaged. The micro controller should then disable user program selection from the manufacturer's console. At this time the readout on the equipment should only display speed and incline values. All data Speed distance, calories, pulse, incline level must be calculated by the equipment and sent to the device for display.

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Command	Code	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Disengage External Control mode	0x05	0x00 0x00 0x00 0x00	0x05	0xAA 0xFF	0x00 0x00 0x00 0x00	This Command must set equipment back into Equipment computer mode (Treadmill, elliptical etc.), and disable the Bluetooth module.
Engagement Status	0x08	0x00 0x00 0x00 0x00	0x08	0xAA 0xFF	Status 0x00 0x00 0x00	Status=AA means external control engaged. Status=FF means external control DISengaged.
Get Firmware Version	0xC2	0x00 0x00 0x00 0x00	0xC2	0xAA 0xFF	Major Minor Patch 0x00	This command lets you read the firmware version number.
Get Variable	0xA1	Variable ID 0x00 0x00 0x00 (See Appendix B)	0xA1	0xAA 0xFF	See Appendix D	This command lets you read a 16-bit variable from the Controller the requested variable is transmitted as two bytes.
Set Treadbelt Speed	0xD0	Integral Fractional 0x00 0x00	0xD0	0xAA 0xFF 0xEE	0x00 0x00 0x00 0x00	Integral byte can be from 0x00 to 0xFF. Fractional part can be from 0x00 to 0x63. Maximum speed should be limited by "Max Possible Speed"
Set Incline	0xD2	Incline Level 0x00 0x00 0x00 (See Appendix C)	0xD2	0xAA 0xFF 0xEE	0x00 0x00 0x00 0x00	Values 0–50 represents actual Integral values of Incline. 51 means -1, 100 means -50.

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BT Control Protocol Design Spec (DRAFT)

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Command	Code	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Set Resistance	0xD3	Major Byte Minor Byte 0x00 0x00 (See Appendix C)	0xD3	0xAA 0xFF 0xEE	0x00 0x00 0x00 0x00	Values 0–400 represents actual Integral values of Resistance. Example: 200Watt would be: 0x00 0xC8
Motor Pause	0xE0	0x00 0x00 0x00 0x00	0xE0	0xAA 0xFF	0x00 0x00 0x00 0x00	When pause mode is uninterrupted for 5 minutes or longer the external control will be disengaged automatically on the equipment.
Motor Start	0xE1	0x00 0x00 0x00 0x00	0xE1	0xAA 0xFF	0x00 0x00 0x00 0x00	Start Command

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Command	Code	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Reset all Counters	0xE2	0x00 0x00 0x00 0x00	0xE2	0xAA 0xFF	0x00 0x00 0x00 0x00	Calories, Distance and Time counters must be reset to zero on equipment.
Set User Weight	0xE4	Major Byte Minor Byte 0x00 0x00	0xE4	0xAA 0xFF	0x00 0x00 0x00 0x00	Sets user weight. Data byte 1 and 2 should be COMBINED into a 2 byte Hex value. If 0x01 is sent for data byte 1, and 0x5E is sent for data byte 2, the combine hex value would be 0x015E, or 350lbs.
Set User Age	0xE6	Age 0x00 0x00 0x00	0xE6	0xAA 0xFF	0x00 0x00 0x00 0x00	Sets user age. Data byte 1 represents age.

Please refer to Appendix E for IHP workout commands.

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- Treadmill: 0x11
- Bike: 0x22
- Elliptical: 0x44
- Stepper: 0x88

Model IDs:

Treadmill		Elliptical		Bike	
01		01		01	
02		02		02	
03		03		03	
04		04		04	
05		05		05	
06		06		06	
07		07		07	

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- Max Possible Speed 0x71
- Max Possible Resistance 0x73
- Max Possible Incline 0x75
- Min Possible Incline 0x76
- Unit of Measure: 0x81
- Treadbelt Speed: 0x82
- Incline: 0x83
- Resistance: 0x84
- Distance traveled since reset: 0x85
- Current Heart Pulse Rate: 0x86
- Calories since reset: 0x87
- Steps 0x88
- Workout Time 0x89
- RPM 0x8A
- PACE 0x8B
- Safety key Status: 0x90

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For Incline values 0–50 represents actual Integral values of Incline. 51 means “-1”, 100 means “-50”.

For Resistance values 0–400 represents actual Integral values of Resistance. (Watts)

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Appendix D. Get Variable Responses

Command	Variable ID	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Max Possible Speed	0x71		0xA1	0xAA 0xFF	Integral Fractional 0x00 0x00	Result shows maximum value of Treadbelt speed in “general” format, used for get/set motor speed commands. SetTreadbelt Speed command should return 0xEE if app is trying to set speed that exceeds MaxPossibleSpeed.
Max Possible Resistance	0x73		0xA1	0xAA 0xFF	Major Byte Minor Byte 0x00 0x00	Result shows maximum equipment resistance. SetResistance command should return 0xEE if app is trying to set resistance that exceeds MaxPossibleResistance.
Max Possible Incline	0x75		0xA1	0xAA 0xFF	Integral 0x00 0x00 0x00	Result shows maximum equipment incline. SetIncline command should return 0xEE if app is trying to set incline that exceeds MaxPossibleIncline.
Min Possible Incline	0x76		0xA1	0xAA 0xFF	Integral 0x00 0x00 0x00	Returns shows minimum equipment incline. SetIncline command should return 0xEE if app is trying to set incline below MinPossibleIncline.

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Command	Variable ID	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Unit of measure	0x81		0xA1	0xAA 0xFF	0xAA 0x00 0x00 0x00 for Metric 0xFF 0x00 0x00 0x00 for Imperial	0xAA: Metric 0xFF: Imperial
Treadbelt Speed	0x82		0xA1	0xAA 0xFF	Integral Fractional 0x00 0x00	Exactly like setting speed. Integral byte can be from 0x00 to 0xFF. Fractional part can be from 0x00 to 0x63. Example, 0x12, 0x63, the speed would be "18.99"
Incline	0x83		0xA1	0xAA 0xFF	Value 0x00 0x00 0x00	Values 0-50 represents actual Integral values of Incline. 51 means -1, 100 means -50.
Resistance	0x84		0xA1	0xAA 0xFF	Major Byte Minor Byte 0x00 0x00	Values 0-400 represents actual Integral values of Resistance. Example: 200Watt would be: 0x00 0xC8
Distance traveled since workout start	0x85		0xA1	0xAA 0xFF	Integral Fractional 0x00 0x00	First response byte one (0x00 (0)-0xFF (255)): whole number 0x5 = (5 miles or Kilometers) Second response byte (0x00-0x63).

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Command	Variable ID	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Current heart pulse rate	0x86		0xA1	0xAA 0xFF	Value 0x00 0x00 0x00	0x00 (0)-0xFF (255). Maximum being 220 BPM anything above 210 should shut down the machine.
Calories burned since start of workout	0x87		0xA1	0xAA 0xFF	Major Byte Minor Byte 0x00 0x00	Example: 2000K calories would be: 0x07 0xD0
Steps	0x88		0xA1	0xAA 0xFF	Major Byte Minor Byte 0x00 0x00	Example: 2000 steps would be: 0x07 0xD0
Workout Time	0x89		0xA1	0xAA 0xFF	Hours / Minutes Seconds 0x00	Hours: 0x00 – 0x17 Minutes: 0x00 – 0x3B Seconds: 0x00 – 0x3B
RPM	0x8A		0xA1	0xAA 0xFF	Major Byte Minor Byte 0x00 0x00	Example: 60 RPM would be: 0x00 0x3C
PACE	0x8B		0xA1	0xAA 0xFF	Hours / Minutes Seconds 0x00	Hours: 0x00 – 0x17 Minutes: 0x00 – 0x3B Seconds: 0x00 – 0x3B
Safety Key Status	0x90		0xA1	0xAA 0xFF	0xAA / 0xFF 0x00 0x00 0x00	0xAA — Key in Place, 0xFF — Key is Missing.

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Appendix E. Workout Data

Command	Code	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Set Workout Date	0x60	Byte1 Byte2 Byte3 0x00	0x60	0xAA 0xFF	0x00 0x00 0x00 0x00	Byte1: Workout Year-2000; 0xFF: if workout data does not exist Byte2: Workout Month; 0xFF: if workout data does not exist Byte3: Workout Day; 0xFF: if workout data does not exist
Set Workout Name	0x61	Byte1 Byte2 Byte3 0x00	0x61	0xAA 0xFF	0x00 0x00 0x00 0x00	Byte1: Sequential Number (copied from device's command) Byte2: Workout name character (Upper case, fill with 0 when end of name string) Byte3: Workout name character (Upper case, fill with 1 when end of name string)
Set Workout Subclass	0x62	Byte1 Byte2 Byte3 0x00	0x62	0xAA 0xFF	0x00 0x00 0x00 0x00	Byte1: Sequential Number (copied from device's command) Byte2: Workout subclass character (Upper case, fill with 0 when end of name string) Byte3: Workout subclass character (Upper case, fill with 0 when end of name string)

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Command	Code	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Set Workout Duration Time	0x63	Byte1 Byte2 Byte3 0x00	0x63	0xAA 0xFF	0x00 0x00 0x00 0x00	Byte1: workout duration time high byte. 0xFF: if workout profile does not exist. Byte2: workout duration time low byte, 0xFF: if workout profile does not exist Byte3: 0x01: if workout duration time data is missing in workout profile. Don't care: if workout duration time exists in workout profile
Set Workout Warmup	0x64	Byte1 Byte2 Byte3 0x00	0x64	0xAA 0xFF	0x00 0x00 0x00 0x00	Byte1: workout warmup high byte. 0xFF: if workout profile does not exist. Byte2: workout warmup low byte. Byte3: 0x01: if workout warmup data is missing in workout profile. Don't care: if workout warmup exists in workout profile

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Command	Code	Request (byte 1 byte 2 byte 3 byte 4)	Echo Code	Possible Response Codes	Response (byte1 byte2 etc.)	Description
Set Workout Cooldown	0x65	Byte1 Byte2 Byte3 0x00	0x65	0xAA 0xFF	0x00 0x00 0x00 0x00	Byte1: workout cooldown high byte. 0xFF: if workout profile does not exist. Byte2: workout cooldown low byte. Byte3: 0x01: if workout cooldown data is missing in workout profile. Don't care: if workout cooldown exists in workout profile
Set Workout Level	0x66	Byte1 0x00 0x00 0x00	0x66	0xAA 0xFF	0x00 0x00 0x00 0x00	Byte1: Workout Level
Set Workout Audio Name	0x67	Byte1 Byte2 Byte3 0x00	0x67	0xAA 0xFF	0x00 0x00 0x00 0x00	Byte1: Sequential Number (copied from device's command). Byte2: Workout audio name character (Upper case, fill with 0 when end of name string). Byte3: Workout audio name character (Upper case, fill with 1 when end of name string).

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