Fitness Machine Profile

***Bluetooth*® Profile Specification**

- **Revision:** v1.0.1
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- **Group Prepared By:** Sports & Fitness Working Group

Abstract:

This Bluetooth profile enables a Collector device to connect and interact with a Fitness Machine intended for sports/fitness applications.

Revision History

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V1.0	2017-Feb-14	Adopted by the Bluetooth SIG Board of Directors.
v1.0.1	2024-10-01	Adopted by the Bluetooth SIG Board of Directors.

Version History

Versions	Changes
v1.0 to v1.0.1	Incorporated errata 15788, 17170, 18750, 18981, 22595, 23325.

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Document Terminology

The Bluetooth SIG has adopted portions of the IEEE Standards Style Manual, which dictates use of the words ***"shall"***, ***"must"***, ***"will"***, ***"should"***, ***"may"***, and ***"can"*** in the development of documentation, as follows:

- The word ***"shall"*** is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (shall equals is required to).
- The use of the word ***"must"*** is deprecated and shall not be used when stating mandatory requirements; must is used only to describe unavoidable situations.
- The use of the word ***"will"*** is deprecated and shall not be used when stating mandatory requirements; will is only used in statements of fact.
- The word ***"should"*** is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain course of action is deprecated but not prohibited (should equals is recommended that).
- The word ***"may"*** is used to indicate a course of action permissible within the limits of the standard (may equals is permitted).
- The word ***"can"*** is used for statements of possibility and capability, whether material, physical, or causal (can equals is able to).

1 Introduction

The Fitness Machine Profile is used to enable a data collection device to obtain data from a Fitness Machine that exposes the Fitness Machine Service. The Fitness Machine Profile may also be used to control a Fitness Machine (e.g., set the targeted speed or set the targeted expended energy for a training session).

The currently supported types of Fitness Machine are listed below.

1. Treadmill
2. Cross Trainer
3. Step Climber
4. Stair Climber
5. Rower
6. Indoor Bike

The Fitness Machine Profile also provides recommendations for Fitness Machines that are designed for use in a private environment (e.g., a home) and for Fitness Machines that are designed for use in public environments (e.g., a gym).

1.1 Profile Dependencies

This profile requires the Generic Attribute Profile (GATT).

1.2 Conformance

Each capability of this specification shall be supported in the specified manner. This specification may provide options for design flexibility, because, for example, some products do not implement every portion of the specification. For each implementation option that is supported, it shall be supported as specified.

1.3 Bluetooth Specification Release Compatibility

This specification is compatible with the following:

- Bluetooth Core Specification v4.2 or later [2] with the Bluetooth Core Specification Supplement v11 or later [3]

2 Configuration

2.1 Roles

The profile defines two roles: Fitness Machine and Collector.

The Fitness Machine is the device that reports training-related data to a Collector. The Collector is the device (e.g., a mobile phone) that receives the training-related data from a Fitness Machine. If supported by the Fitness Machine, the Collector may also control the Fitness Machine (e.g., set the targeted speed or set the targeted expended energy for a training session).

- The Fitness Machine shall be a GATT Server.
- The Collector shall be a GATT Client.

2.2 Profile – Service Relationship

Figure 2.1 shows the relationships between services and the two profile roles.

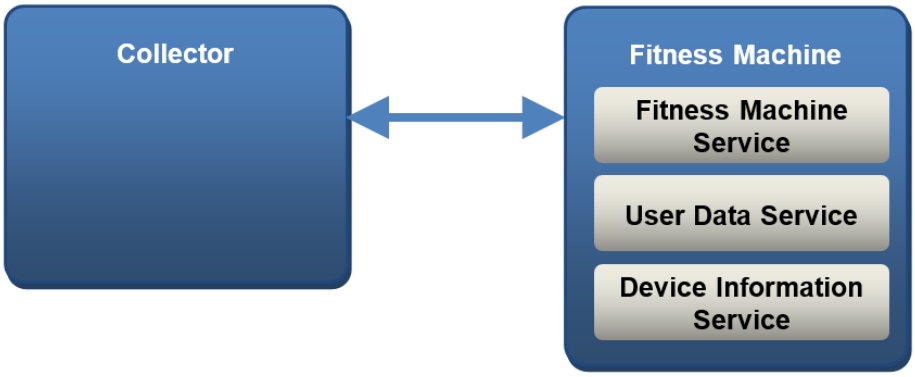

Figure 2.1: Relationships between services and profile roles for the Fitness Machine profile

Note: Profile roles are represented by blue boxes and the services are represented by gray boxes.

A Fitness Machine instantiates the Fitness Machine Service [1] and may also expose the User Data Service [8] and the Device Information Service [9].

2.3 Concurrency Limitations/Restrictions

This profile does not impose any concurrency limitations or restrictions for the Collector and the Fitness Machine.

2.4 Topology Limitations/Restrictions

2.4.1 Topology Limitations/Restrictions for Low Energy

This section describes topology limitations and restrictions when the profile is used over Low Energy transport.

The Fitness Machine shall use the GAP Peripheral role.

The Collector shall use the GAP Central role.

2.4.2 Topology Limitations/Restrictions for BR/EDR

There are no topology limitations or restrictions when the profile is used over the BR/EDR (Basic Rate/Enhanced Data Rate) transport.

2.5 Transport Dependencies

There are no transport restrictions imposed by this profile specification.

Where the term BR/EDR is used in this document, it also includes the optional use of AMP.

3 Fitness Machine Role Requirements

The Fitness Machine shall instantiate one and only one Fitness Machine Service [1]. See specific recommendations in Section 3.1.

The Fitness Machine Service shall be instantiated as a «Primary Service».

The User Data Service [8], if supported, shall be instantiated as a «Primary Service». See additional requirements in Section 3.2.

The Fitness Machine may instantiate the Device Information Service [9]. See additional requirements in Section 3.3.

Service	Fitness Machine
Fitness Machine Service [1]	M
User Data Service [8]	O
Device Information Service [9]	O

Table 3.1: Fitness Machine Service Requirements

In addition to the Fitness Machine requirements in this section, refer to Sections 5.1 and 6.1 for additional Fitness Machine requirements for the low energy transport and to Sections 5.3 and 6.3 for additional Fitness Machine requirements the BR/EDR transport.

3.1 Incremental Fitness Machine Service Requirements

This section describes additional requirements beyond those defined in the Fitness Machine Service.

3.1.1 Additional Requirements for the Low Energy Transport

This section describes additional Fitness Machine requirements beyond those defined in the Fitness Machine Service [1] when using this profile over the low energy transport.

3.1.1.1 Service UUIDs AD Type

While in a GAP Discoverable Mode for initial connection to a Collector, the Fitness Machine should include the Fitness Machine Service UUID (defined in [4]) in the Service UUIDs AD type field of the advertising data. This enhances the user experience by enabling the Collector to identify a Fitness Machine before it initiates a connection.

3.1.1.2 Local Name AD Type

For an enhanced user experience, a Fitness Machine should include the Local Name (containing either the complete or shortened value of the Device Name characteristic as defined in [2]) in its Advertising Data or Scan Response Data.

3.1.1.3 Writable GAP Device Name Characteristic

The Fitness Machine may support the write property for the Device Name characteristic in order to allow a Collector to write a device name to the Fitness Machine.

3.1.1.4 Appearance AD Type

For an enhanced user experience, a Fitness Machine should include the value of the Appearance characteristic (defined in [4]) in its Advertising data or Scan Response data.

3.1.1.5 Service Data AD Type

In order to facilitate the connection between a Fitness Machine and a Collector, a Fitness Machine should support the Service Data AD Type.

When the Fitness Machine is using Connectable Undirected Advertising, it should include the Service Data AD Type in its Advertising Data to reduce unwanted connection requests by unintended Collectors.

The Service Data payload (defined in [1]) includes a Flags field and a Fitness Machine Type field.

See Sections 5.1.4 and 5.2.2 for additional requirements.

3.2 Incremental User Data Service Requirements

This section describes additional requirements beyond those defined in the User Data Service [8].

A Fitness Machine should expose the UDS characteristics defined in Table 3.2.

UDS Characteristic	Requirement
First Name	O
Weight	O
Gender	O
Height	O
Age	O
Date of Birth	O
Heart Rate Max	O
Resting Heart Rate	O
Maximum Recommended Heart Rate	O
VO_2 Max	O
Language	O
Two Zone Heart Rate Limits	O
Three Zone Heart Rate Limits	O
Five Zone Heart Rate Limits	O

Table 3.2: User Data Service Requirements

If the Date of Birth characteristic exists in the User Data Service, a value of 0 for Year shall not be used, but a value of 0 for Month and Day may be used for privacy reasons.

A Fitness Machine designed for use in a private environment (e.g. a home) should support the User Data Retention feature defined in [1], and therefore, the support for multiple users should also be supported. In this case, the Fitness Machine shall store the user data for each supported user for a later use, as defined in [8].

A Fitness Machine designed for use in a public environment (e.g. a gym) should not support the User Data Retention feature defined in [1]. This recommendation is applicable in any situation where privacy issues require that the user's data not be stored in the equipment after the user has completed the training session.

For both types of Fitness Machine, when the user data is deleted (e.g. either with the Delete User Data procedure defined in Section 4.5.2.2.3 or after a disconnection), the UDS characteristics exposed by the Fitness Machine shall be set to their default values, and the User Index characteristic shall be set to 0xFF.

If two or more Collectors are connected to the same Fitness Machine, refer to [8], Section 1.5.1, for requirements on how to handle this situation.

If a user has configured the Fitness Machine with their user data (for example, via the UI of the Fitness Machine) before a connection is established, and if a Collector initiates a connection and attempts to access the user data (see Section 4.8), the user should be prompted (via the UI of the Fitness Machine) to select the source of the user data for the Fitness Machine to use.

3.3 Incremental Device Information Service Requirements

This section describes additional requirements beyond those defined in the Device Information Service [9].

In order to allow the Collector to log the type of equipment used in a training session, the Fitness Machine should instantiate the Device Information Service characteristics defined in Table 3.3.

Device Information Service Characteristic	Requirement
Manufacturer Name String	O
Model Number String	O

Table 3.3: Device Information Service Requirements

4 Collector Role Requirements

The Collector shall support the Fitness Machine Service [1].

The Collector should support the User Data Service [8] as well as Device Information Service [9].

Profile Requirement	Section	Support in Collector
Service Discovery	4.2	M
• Fitness Machine Service [1] Discovery	4.2	M
• User Data Service [8] Discovery	4.2	O
• Device Information Service [9] Discovery	4.2	O
Characteristic Discovery	4.3	M
• Fitness Machine Service [1] Characteristic Discovery	4.3.1	M
• User Data Service [8] Characteristic Discovery	4.3.2	O
• Device Information Service [9] Characteristic Discovery	4.3.3	O

Table 4.1: Profile Requirements for the Collector Role

4.1 GATT Sub-Procedure Requirements

This section describes a minimum set of requirements for a Collector. Other GATT sub-procedures may be used if supported by both Client and Server.

The table below summarizes additional GATT sub-procedure requirements beyond those required by all GATT Clients.

GATT Sub-Procedure	Collector Requirements
Discover All Primary Services	C.1
Discover Primary Services by Service UUID	C.1
Discover All Characteristics of a Service	C.2
Discover Characteristics by UUID	C.2
Discover All Characteristic Descriptors	M
Read Characteristic Value	M
Read Long Characteristic Values	M
Write Characteristic Value	C.3
Write Long Characteristic Values	C.4

GATT Sub-Procedure	Collector Requirements
Read Characteristic Descriptors	M
Write Characteristic Descriptors	M

Table 4.2: Additional GATT Sub-Procedure Requirements

C.1: Mandatory to support at least one of these Service Discovery sub-procedures when using the LE transport. Excluded when using the BR/EDR transport, because the Service Discovery Protocol (SDP) must be used in this case.
C.2: Mandatory to support at least one of these Characteristic Discovery sub-procedures.
C.3: Mandatory if the writing of UDS characteristics or the GAP Device Name characteristic is supported (see Section 3.1.1.3).
C.4: Mandatory if the Collector writes UDS characteristics, over the low energy feature of Bluetooth that are UTF8 strings; otherwise Optional.

4.2 Service Discovery

When using the Low Energy transport, the Collector shall perform primary service discovery using either the GATT *Discover All Primary Services* sub-procedure or the GATT *Discover Primary Services by Service UUID* sub-procedure.

The Collector shall discover the Fitness Machine Service and may also attempt to discover the User Data Service and the Device Information Service.

When using the BR/EDR transport, the Collector shall initiate service discovery by retrieving the SDP record of the Fitness Machine Service as defined in [1].

4.3 Characteristic Discovery

As required by GATT, the Client/Collector must be tolerant of additional optional characteristics in the service records of services used with this profile.

Where a characteristic is discovered that can be indicated or notified, the Collector shall also discover the associated *Client Characteristic Configuration* descriptor.

4.3.1 Fitness Machine Characteristic Discovery

The Collector shall use either the GATT *Discover All Characteristics of a Service* sub-procedure or the GATT *Discover Characteristics by UUID* sub-procedure to discover the characteristics of the service.

The Collector shall use the GATT *Discover All Characteristic Descriptors* sub-procedure to discover the characteristic descriptors.

The discovery requirements for the Collector are shown in Table 4.3.

Characteristics	Discovery Requirements for Collector
Fitness Machine Feature	M
Treadmill Data	O
Cross Trainer Data	O

Characteristics	Discovery Requirements for Collector
Step Climber Data	O
Stair Climber Data	O
Rower Data	O
Indoor Bike Data	O
Training Status	M
Supported Speed Range	O
Supported Inclination Range	O
Supported Resistance Level Range	O
Supported Power Range	O
Supported Heart Rate Range	O
Fitness Machine Control Point	O
Fitness Machine Status	O

Table 4.3: Discovery Requirements for the Collector

4.3.2 User Data Characteristic Discovery

If the Collector supports the User Data Service, the Collector shall discover the characteristics of the User Data Service.

In order for the Collector to discover the characteristics of the User Data Service, it shall use either the GATT *Discover All Characteristics of a Service* sub-procedure or the GATT *Discover Characteristics by UUID* sub-procedure to discover all characteristics of this service.

If the Collector supports the User Data Service, the requirements for the Collector are shown in Table 4.4.

Characteristics	Discovery Requirements for Collector
Database Change Increment	M
User Data Control Point	M
User Index	M
First Name	O
Weight	O
Gender	O
Height	O

Characteristics	Discovery Requirements for Collector
Age	O
Date of Birth	O
Heart Rate Max	O
Resting Heart Rate	O
Maximum Recommended Heart Rate	O
VO_2 Max	O
Language	O
Other UDS Characteristics	O

Table 4.4: Discovery Requirements for a Collector That Supports the User Data Service

Table 4.4 includes some common optional User Data Service characteristics in the context of the Fitness Machine Profile, but other User Data Service characteristics, not listed here, may also be used.

4.3.3 Device Information Characteristic Discovery

The Collector may discover the characteristics of the Device Information Service.

In order for the Collector to discover the characteristics of the Device Information Service, it shall use either the GATT *Discover All Characteristics of a Service* sub-procedure or the GATT *Discover Characteristics by UUID* sub-procedure to discover all characteristics of this service.

4.4 Fitness Machine Service Characteristics

4.4.1 Fitness Machine Feature

The Collector shall read the Fitness Machine Feature characteristic to determine the supported features of the Fitness Machine in order to understand its capabilities.

In many cases, this will allow the Collector to adapt to the supported features of the Fitness Machine (for example, unsupported features will not be shown on the UI of the Collector) as defined in [1]. If one of the features bit is set to 1 (meaning this feature is supported), the Collector shall assume that the related bits of the Flags fields are used by the Fitness Machine and the associated value might be shown on the UI of the Collector. Otherwise, it is unnecessary for the Collector to expect a value related to an unsupported feature.

If the Collector reads a Fitness Machine Feature characteristic with Reserved for Future Use (RFU) bits that are non-zero, the Collector shall ignore those bits and continue to process the Fitness Machine Feature characteristic in the same way as if all the RFU bits had been zero. This is to enable compatibility with future Fitness Machine Service updates.

If the Fitness Machine supports indication of the Fitness Machine Feature characteristic, the Collector may configure this characteristic for indications. When the Collector receives an indication of the Fitness Machine Feature characteristic the Collector shall use the indicated value to determine the supported features again. Alternatively, the Collector may read the Fitness Machine Feature characteristic each time

after connecting with the Fitness Machine. A Collector shall enable indications of the Fitness Machine Feature characteristic, or it shall read the Fitness Machine Feature characteristic on each connection.

4.4.2 Treadmill Data

The Collector shall configure notifications of the Treadmill Data characteristic (i.e. via the *Client Characteristic Configuration* descriptor).

The Collector shall be able to receive multiple notifications of the Treadmill Data characteristic from a Fitness Machine for the case where the Fitness Machine has training-related data to send (typically during a training session).

The Collector shall determine the contents of the Treadmill Data characteristic based on the contents of the Flags field. This allows the Collector to determine whether or not the optional fields are present.

For low energy devices, and as defined in [1], a Data Record may be split and transmitted in multiple notifications if the payload exceeds the ATT_MTU size; therefore, the Collector shall be able to handle Data Records that are sent in one or more notifications. This requirement does not affect BR/EDR devices.

If the Collector receives a Treadmill Data characteristic with Reserved for Future Use (RFU) bits of the Flags field that are non-zero, the Collector shall ignore those bits and any additional data that the packet contains and continue to process the Treadmill Data characteristic in the same way as if all the RFU bits had been zero.

If the Collector receives a Treadmill Data characteristic with additional unrecognized octets, the Collector shall ignore the unrecognized octets. This is to enable compatibility with future service updates for the case where available octets in the characteristic are specified for optional use.

The Collector shall be tolerant and behave appropriately (i.e., the Collector shall be able to continue to process commands and/or receive data normally) if receiving the special values for optional fields meaning “Data Not Available”, as defined in the Fitness Machine Service [1].

4.4.3 Cross Trainer Data

The Collector shall configure notifications of the Cross Trainer Data characteristic (i.e., via the *Client Characteristic Configuration* descriptor).

The Collector shall be able to receive multiple notifications of the Cross Trainer Data characteristic from a Fitness Machine for the case where the Fitness Machine has training-related data to send (typically during a training session).

The Collector shall determine the contents of the Cross Trainer Data characteristic based on the contents of the Flags field. This allows the Collector to determine whether or not the optional fields are present.

For low energy devices, and as defined in [1], a Data Record may be split and transmitted in multiple notifications if the payload exceeds the ATT_MTU size; therefore, the Collector shall be able to handle Data Records that are sent in one or more notifications. This requirement does not affect BR/EDR devices.

If the Collector receives a Cross Trainer Data characteristic with Reserved for Future Use (RFU) bits of the Flags field that are non-zero, it shall ignore those bits and any additional data that the packet contains

and continue to process the Cross Trainer Data characteristic in the same way as if all the RFU bits are zero.

If the Collector receives a Cross Trainer Data characteristic with additional unrecognized octets, the Collector shall ignore the unrecognized octets. This is to enable compatibility with future service updates for the case where available octets in the characteristic are specified for optional use.

The Collector shall be tolerant and behave appropriately (that is, the Collector shall be able to continue to process commands and/or receive data normally) if receiving the special values for optional fields meaning “Data Not Available”, as defined in the Fitness Machine Service [1].

4.4.4 Step Climber Data

The Collector shall configure notifications of the Step Climber Data characteristic (i.e. via the *Client Characteristic Configuration* descriptor).

The Collector shall be able to receive multiple notifications of the Step Climber Data characteristic from a Fitness Machine for the case where the Fitness Machine has training-related data to send (typically during a training session).

The Collector shall determine the contents of the Step Climber Data characteristic based on the contents of the Flags field. This allows the Collector to determine whether or not the optional fields are present.

For low energy devices, and as defined in [1], a Data Record may be split and transmitted in multiple notifications if the payload exceeds the ATT_MTU size; therefore, the Collector shall be able to handle Data Records that are sent in one or more notifications. This requirement does not affect BR/EDR devices.

If the Collector receives a Step Climber Data characteristic with Reserved for Future Use (RFU) bits of the Flags field that are non-zero, the Collector shall ignore those bits and any additional data that the packet contains and continue to process the Step Climber Data characteristic in the same way as if all the RFU bits had been zero.

If the Collector receives a Step Climber Data characteristic with additional unrecognized octets, the Collector shall ignore the unrecognized octets. This is to enable compatibility with future service updates for the case where available octets in the characteristic are specified for optional use.

The Collector shall be tolerant and behave appropriately (that is, the Collector shall be able to continue to process commands and/or receive data normally) if receiving the special values for optional fields meaning ”Data Not Available”, as defined in the Fitness Machine Service [1].

4.4.5 Stair Climber Data

The Collector shall configure notifications of the Stair Climber Data characteristic (i.e. via the *Client Characteristic Configuration* descriptor).

The Collector shall be able to receive multiple notifications of the Stair Climber Data characteristic from a Fitness Machine for the case where the Fitness Machine has training-related data to send (typically during a training session).

The Collector shall determine the contents of the Stair Climber Data characteristic based on the contents of the Flags field. This allows the Collector to determine whether or not the optional fields are present.

For low energy devices, and as defined in [1], a Data Record may be split and transmitted in multiple notifications if the payload exceeds the ATT_MTU size; therefore, the Collector shall be able to handle data records that are sent in one or more notifications. This requirement does not affect BR/EDR devices.

If the Collector receives a Stair Climber Data characteristic with Reserved for Future Use (RFU) bits of the Flags field that are non-zero, the Collector shall ignore those bits and any additional data that the packet contains and continue to process the Stair Climber Data characteristic in the same way as if all the RFU bits had been zero.

If the Collector receives a Stair Climber Data characteristic with additional unrecognized octets, the Collector shall ignore the unrecognized octets. This is to enable compatibility with future service updates for the case where available octets in the characteristic are specified for optional use.

The Collector shall be tolerant and behave appropriately (that is, the Collector shall be able to continue to process commands and/or receive data normally) if receiving the special values for optional fields meaning “Data Not Available”, as defined in the Fitness Machine Service [1].

4.4.6 Rower Data

The Collector shall configure notifications of the Rower Data characteristic (i.e., via the *Client Characteristic Configuration* descriptor).

The Collector shall be able to receive multiple notifications of the Rower Data characteristic from a Fitness Machine for the case where the Fitness Machine has training-related data to send (typically during a training session).

The Collector shall determine the contents of the Rower Data characteristic based on the contents of the Flags field. This allows the Collector to determine whether or not the optional fields are present.

For low energy devices, and as defined in [1], a Data Record may be split and transmitted in multiple notifications if the payload exceeds the ATT_MTU size; therefore, the Collector shall be able to handle Data Records that are sent in one or more notifications. This requirement does not affect BR/EDR devices.

If the Collector receives a Rower Data characteristic with Reserved for Future Use (RFU) bits of the Flags field that are non-zero, it shall ignore those bits and any additional data that the packet contains and continue to process the Rower Data characteristic in the same way as if all the RFU bits had been zero.

If the Collector receives a Rower Data characteristic with additional unrecognized octets, the Collector shall ignore the unrecognized octets. This is to enable compatibility with future service updates for the case where available octets in the characteristic are specified for optional use.

The Collector shall be tolerant and behave appropriately (that is, the Collector shall be able to continue to process commands and/or receive data normally) if receiving the special values for optional fields meaning “Data Not Available”, as defined in the Fitness Machine Service [1].

4.4.7 Indoor Bike Data

The Collector shall configure notifications of the Indoor Bike Data characteristic (i.e., via the *Client Characteristic Configuration* descriptor).

The Collector shall be able to receive multiple notifications of the Indoor Bike Data characteristic from a Fitness Machine for the case where the Fitness Machine has training-related data to send (typically during a training session).

The Collector shall determine the contents of the Indoor Bike Data characteristic based on the contents of the Flags field. This allows the Collector to determine whether or not the optional fields are present.

For low energy devices, and as defined in [1], a Data Record may be split and transmitted in multiple notifications if the payload exceeds the ATT_MTU size; therefore, the Collector shall be able to handle data records that are sent in one or more notifications. This requirement does not affect BR/EDR devices.

If the Collector receives an Indoor Bike Data characteristic with Reserved for Future Use (RFU) bits of the Flags field that are non-zero, the Collector shall ignore those bits and any additional data that the packet contains and continue to process the Indoor Bike Data characteristic in the same way as if all the RFU bits had been zero.

If the Collector receives an Indoor Bike Data characteristic with additional unrecognized octets, the Collector shall ignore the unrecognized octets. This is to enable compatibility with future service updates for the case where available octets in the characteristic are specified for optional use.

The Collector shall be tolerant and behave appropriately (i.e. the Collector shall be able to continue to process commands and/or receive data normally) if receiving the special values for optional fields meaning “Data Not Available”, as defined in the Fitness Machine Service [1].

4.4.8 Training Status

The Collector should configure notifications of the Training Status characteristic (i.e. via the *Client Characteristic Configuration* descriptor).

The Collector shall be able to receive multiple notifications of the Training Status characteristic from a Fitness Machine for the case where the Fitness Machine has training status-related data to send (e.g. typically during a training session).

The Collector shall determine the contents of the Training Status characteristic based on the contents of the Flags field. This allows the Collector to determine whether or not the optional fields are present.

If the Extended String bit of the Flags field is set to 1, meaning that the Training Status String exceeds the maximum size that can be transmitted in a notification, the Collector should use the GATT Read Long procedure to retrieve the remaining octets of this characteristic.

If the Collector receives a Training Status characteristic with Reserved for Future Use (RFU) bits of the Flags field that are non-zero, it shall ignore those bits and any additional data that the packet contains and continue to process the Training Status characteristic in the same way as if all the RFU bits had been zero.

If the Collector receives a Training Status characteristic with additional unrecognized octets, the Collector shall ignore the unrecognized octets. This is to enable compatibility with future service updates for the case where available octets in the characteristic are specified for optional use.

4.4.9 Supported Speed Range

The Collector should read the Supported Speed Range characteristic in order to determine the minimum and maximum speed values that can be used to set the target speed of the Fitness Machine (using the Set Target Speed of the Fitness Machine Control Point defined in Section 4.4.14.2.3).

4.4.10 Supported Inclination Range

The Collector should read the Supported Inclination Range characteristic in order to determine the minimum and maximum inclination values that can be used to set the target inclination of the Fitness Machine (i.e., using the Set Target Inclination of the Fitness Machine Control Point defined in Section 4.4.14.2.4).

4.4.11 Supported Resistance Level Range

The Collector should read the Supported Resistance Level Range characteristic in order to determine the minimum and maximum resistance level values that can be used to set the target resistance level of the Fitness Machine (i.e., using the Set Target Resistance Level of the Fitness Machine Control Point defined in Section 4.4.14.2.5).

4.4.12 Supported Power Range

The Collector should read the Supported Power Range characteristic in order to determine the minimum and maximum power values that can be used to set the target power of the Fitness Machine (i.e., using the Set Target Power of the Fitness Machine Control Point defined in Section 4.4.14.2.6).

4.4.13 Supported Heart Rate Range

The Collector should read the Supported Heart Rate Range characteristic in order to determine the minimum and maximum heart rate values that can be used to set the target heart rate of the Fitness Machine (i.e. using the Set Target Heart Rate of the Fitness Machine Control Point defined in Section 4.4.14.2.7).

4.4.14 Fitness Machine Control Point

Before it performs a Fitness Machine Control Point procedure, the Collector shall configure the Fitness Machine Control Point characteristic for indications (i.e., via the *Client Characteristic Configuration* descriptor).

In order to perform any of the supported control procedures, the Collector shall request the control of the Fitness Machine by using the Request Control procedure defined in Section 4.4.14.2.1.

If the Request Control procedure succeeds, the Collector may perform a write to the Fitness Machine Control Point to request a desired procedure. A procedure begins when the Collector writes a particular Op Code to the Fitness Machine Control Point to perform some desired action, and the procedure ends when the Collector sends a confirmation to acknowledge the Fitness Machine Control Point indication sent by the Fitness Machine at the end of the procedure. This indication includes: the Response Code, the Requested Op Code, and the Response Value as defined in [1]. Otherwise, the control is not permitted, and the Fitness Machine will respond to any requests from the Collector with the appropriate error response.

4.4.14.1 Fitness Machine Control Point Procedure Requirements

Table 4.5 shows the requirements for the Fitness Machine Control Point procedures (Op Codes) in the context of this profile.

Procedure (Op Code)	Requirement
Request Control	M
Reset	M
Set Target Speed	O
Set Target Inclination	O
Set Target Resistance Level	O
Set Target Power	O
Set Target Heart Rate	O
Start or Resume	O
Stop or Pause	O
Set Targeted Expended Energy	O
Set Targeted Number of Steps	O
Set Targeted Number of Stride	O
Set Targeted Distance	O
Set Targeted Training Time	O
Set Targeted Time in Two Heart Rate Zones	O
Set Targeted Time in Three Heart Rate Zones	O
Set Targeted Time in Five Heart Rate Zones	O
Set Indoor Bike Simulation Parameters	O
Set Wheel Circumference	O
Spin Down Control	O
Set Targeted Cadence	O

Table 4.5: Fitness Machine Control Point Procedure Requirements for the Collector

4.4.14.2 Fitness Machine Control Point Behavioral Description

The Collector shall write to the Fitness Machine Control Point characteristic using one of the supported Op Codes in Table 4.5 to request that a Fitness Machine perform a procedure. This may include a parameter that is valid within the context of that Op Code, as defined in [1].

4.4.14.2.1 Request Control Procedure

To request the control of the Fitness Machine (i.e. to use the Fitness Machine Control Point procedures defined in Section 4.4.14.2.2–4.4.14.2.20), the Collector shall use the *Request Control* Op Code, as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

Note that the control is permitted after the Request Control procedure succeeds until a disconnection occurs or until the Fitness Machine Status characteristic is notified by the Fitness Machine with the Op Code value set to Control Permission Lost (0xFF).

4.4.14.2.2 Reset Procedure

To reset the Fitness Machine, the Collector shall use the *Reset* Op Code, as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.3 Set Target Speed Procedure

To set the target speed of a Fitness Machine, the Collector shall use the *Set Target Speed* Op Code followed by an UINT16 parameter value that represents the Target Speed as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.4 Set Target Inclination Procedure

To set the target inclination of a Fitness Machine, the Collector shall use the *Set Target Inclination* Op Code followed by an SINT16 parameter value that represents the Target Inclination as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.5 Set Target Resistance Level Procedure

To set the target resistance level of a Fitness Machine, the Collector shall use the *Set Target Resistance Level* Op Code followed by an UINT8 parameter value that represents the Target Resistance Level as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.6 Set Target Power Procedure

To set the target power of a Fitness Machine, the Collector shall use the *Set Target Power* Op Code followed by an SINT16 parameter value that represents the Target Power as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

See Section 4.7 for general error handling procedures.

4.4.14.2.7 Set Target Heart Rate Procedure

To set the target heart rate of a Fitness Machine, the Collector shall use the *Set Target Heart Rate* Op Code followed by aUINT8 parameter value that represents the Target Heart Rate as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.8 Start or Resume Procedure

To start (or resume) the Fitness Machine, the Collector shall use the *Start or Resume* Op Code, as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.9 Stop or Pause Procedure

To stop (or pause) the Fitness Machine, the Collector shall use the *Stop or Pause* Op Code followed by a UINT8 parameter value that represents the Control Information (i.e., whether a stop or a pause command is requested), as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.10 Set Targeted Expended Energy Procedure

To set the targeted expended energy for a training session, the Collector shall use the *Set Targeted Expended Energy* Op Code followed by a UINT16 parameter value that represents the Targeted Expended Energy as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.11 Set Targeted Number of Steps Procedure

To set the targeted number of steps for a training session, the Collector shall use the *Set Targeted Number of Steps* Op Code followed by a UINT16 parameter value that represents the Targeted Number of Steps as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.12 Set Targeted Number of Strides Procedure

To set the targeted number of strides for a training session, the Collector shall use the *Set Targeted Number of Strides* Op Code followed by a UINT16 parameter value that represents the Targeted Number of Strides as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.13 Set Targeted Distance Procedure

To set the targeted distance for a training session, the Collector shall use the *Set Targeted Distance* Op Code followed by a UINT24 parameter value that represents the Targeted Distance as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.5.2.3.

4.4.14.2.14 Set Targeted Training Time Procedure

To set the targeted training time for a training session, the Collector shall use the *Set Targeted Training Time* Op Code followed by a UINT16 parameter value that represents the Targeted Training Time as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.15 Set Targeted Time in Two Heart Rate Zones Procedure

To set the targeted time in two heart rate zones for a training session, the Collector shall use the *Set Targeted Time in Two Heart Rate Zones* Op Code followed by two UINT16 parameter values that represent the Targeted Time in each heart rate zone, as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.16 Set Targeted Time in Three Heart Rate Zones Procedure

To set the targeted time in three heart rate zones for a training session, the Collector shall use the *Set Targeted Time in Three Heart Rate Zones* Op Code followed by three UINT16 parameter values that represent the Targeted Time in each heart rate zone, as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.17 Set Targeted Time in Five Heart Rate Zones Procedure

To set the targeted time in five heart rate zones for a training session, the Collector shall use the *Set Targeted Time in Five Heart Rate Zones* Op Code followed by five UINT16 parameter values that represent the Targeted Time in each heart rate zone, as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.18 Set Indoor Bike Simulation Parameters

To set the indoor bike simulation parameters during a training session (wind speed, grade, coefficient of rolling resistance, and wind resistance coefficient), the Collector shall use the *Set Indoor Bike Simulation Parameter* Op Code followed by the Wind Speed, Grade, Coefficient of Rolling Resistance (Crr), and Wind Resistance Coefficient (Cw) parameters, as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.4.14.3.

4.4.14.2.19 Set Wheel Circumference

To set the wheel circumference of the indoor bike (typically used for bike simulation), the Collector shall use the *Set Wheel Circumference* Op Code followed by the UINT16 parameter that represents the Wheel Circumference parameter, as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.5.2.3.

4.4.14.2.20 Spin Down Control

To control the spin down procedure, the Collector shall use the *Spin Down Control* Op Code followed by the UINT8 parameter that represents the Control Parameter, as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.5.2.3.

If the Spin Down Control procedure succeeds with the Control Parameter value set to Start, the Collector should use the parameters received along with the success response in order to provide guidance to the user for the spin down procedure.

If the Collector receives a spin down request from the Fitness Machine (a Fitness Machine Status notification with the Op Code 0x13 followed by the Spin Down Status value set to 0x01), the Collector may either ignore the request or initiate the spin down procedure, as defined in [1].

4.4.14.2.21 Set Targeted Cadence Procedure

To set the targeted cadence for a training session, the Collector shall use the *Set Targeted Cadence* Op Code followed by a UINT16 parameter value that represents the Targeted Cadence as defined in [1].

The Collector shall wait for the Fitness Machine Control Point Indication with the Response Value set to *Success*, indicating successful operation, an error response value as described in Section 4.7, or the procedure to time out according to the procedure time-out operation described in Section 4.5.2.3.

4.4.14.3 Procedure Timeout

In the context of the Fitness Machine Control Point characteristic, a procedure is started when the Collector writes a particular Op Code to the Fitness Machine Control Point to perform some desired action

and ends when the Collector sends a confirmation to acknowledge the Fitness Machine Control Point indication sent by the Fitness Machine at the end of the procedure with the Op Code set to *Response Code*.

In the context of the Fitness Machine Control Point characteristic, a procedure is not considered started and not queued in the Fitness Machine when a write to the Fitness Machine Control Point results in an ATT Error Response.

A procedure is considered to have timed out if a Fitness Machine Control Point indication is not received within the ATT transaction timeout, defined as 30 seconds in [2] Volume 2, Part F, Section 3.3.3, from the start of the procedure.

If the link is lost while a Fitness Machine Control Point procedure is in progress, then the procedure shall be considered to have timed out.

Thus, a Collector shall start a timer with the value set to the ATT transaction timeout after the write response is received from the Fitness Machine. The timer shall be stopped when a Fitness Machine Control Point indication is received and the Op Code is set to Response Code. If the timer expires, then the procedure shall be considered to have failed.

If a Fitness Machine Control Point procedure times out, then no new Fitness Machine Control Point procedure shall be started by the Collector until a new link is established with the Fitness Machine. To ensure a good user experience, if a Fitness Machine Control Point procedure times out, the Collector should disconnect and then reconnect.

4.4.15 Fitness Machine Status

The Collector should configure notifications of the Fitness Machine Status characteristic (i.e. via the *Client Characteristic Configuration* descriptor).

The Collector shall be able to receive multiple notifications of the Fitness Machine Status characteristic from a Fitness Machine for the case where the Fitness Machine has status-related data to send (typically during a training session).

The Collector shall be able to decode the Parameter field of the Fitness Machine Status, if present, as defined in [1].

4.5 User Data Service Characteristics

The Collector may read and write the value of User Data Service characteristics. Note that for UDS characteristics that may exceed the negotiated ATT_MTU size (e.g., UTF8-based characteristics), the Collector should use the GATT *Read Long Characteristic Value* and GATT *Write Long Characteristic Value* sub-procedures, respectively.

If the Fitness Machine does not support the User Data Retention feature, the Collector shall use the Register New User procedure defined in Section 4.5.2.2.1, along with a Consent Code defined by the user (or automatically generated by the Collector) in order to write the User Data characteristics each time a connection is established.

If the Fitness Machine supports the User Data Retention feature, when the Collector initiates a connection to a known Fitness Machine, the Collector should use the Consent procedure defined in Section 4.5.2.2.2, along with the Consent Code defined during the registration procedure, in order to read or write the User Data characteristics.

Refer to Section 4.8 for more information about the user data access methods.

4.5.1 Database Change Increment

This characteristic is used to perform synchronization functions (e.g., if the Fitness Machine allows the user to update his data through its UI, the Collector will be informed of this update).

If supported by the Fitness Machine, the Collector shall configure notifications of the Database Change Increment characteristic (i.e., via the *Client Characteristic Configuration* descriptor) in order to enable the User Data Synchronization procedure defined in Section 4.5.4.

If the Collector receives a notification of the Database Change Increment characteristic, this is designed to alert the Collector that a change to at least one of the values has occurred and the Collector should read the UDS characteristic values that it supports.

After the Collector has completed writing to UDS characteristics, the Collector shall write an incremented value to the Database Change Increment characteristic (i.e., the Collector shall increment the current value by 1).

The Collector may read the Database Change Increment characteristic to determine whether or not the value cached in the Collector is equal to, greater than, or less than the value in the Fitness Machine.

A rollover of the value of the Database Change Increment characteristic is extremely unlikely over the life of the device, but if a rollover occurs, this can be handled in an implementation specific way (e.g., the implementation can ask the user to confirm the values via the UI).

Refer to Section 4.8 for more information on the user data access methods.

4.5.2 User Control Point Characteristic

Before performing a User Control Point procedure, the Collector shall configure the User Control Point characteristic for indications (i.e., via the *Client Characteristic Configuration* descriptor).

The Collector may perform a write to the User Control Point to request a desired procedure. A procedure begins when the Collector writes a particular Op Code to the User Control Point to perform some desired action, and it ends when the Collector sends a confirmation to acknowledge the User Control Point indication sent by the Fitness Machine at the end of the procedure. This indication includes: the Response Code, the Requested Op Code, and the Response Value and may also include a Response Parameter as defined in [8].

Refer to Section 4.8 for more information on the User Data access methods.

4.5.2.1 User Control Point Procedure Requirements

Table 4.6 shows the requirements for the User Control Point procedures (Op Codes) in the context of this profile.

Procedure (Op Code)	Requirement
Register New User	M
Consent	M
Delete User Data	M

Table 4.6: User Control Point Procedure Requirements

4.5.2.2 User Control Point Behavioral Description

The Collector shall write to the User Control Point characteristic using one of the supported Op Codes in Table 4.6 to request a Fitness Machine to perform a procedure. This may include a parameter that is valid within the context of that Op Code as defined in [8].

4.5.2.2.1 Register New User Procedure

To register a new user in the Fitness Machine, the Collector shall use the *Register New User* Op Code followed by a parameter value that represents the Consent Code defined by the user (or automatically generated by the Collector) as defined in [8].

Collectors should not cache the Consent Code nor the User ID for later use, since the user data will be deleted by the Fitness Machine when the connection is terminated.

The Collector shall wait for the *Response Code* User Control Point indication with the Response Value set to *Success,* indicating successful operation, with a Response Parameter value that represents the User Index assigned by the Fitness Machine for the new user, or for the procedure to time out according to the procedure time-out operation described in Section 4.5.2.3. When the procedure is successful, the Fitness Machine will return a *Response Code* containing the User Index.

See Section 4.7 for general error handling procedures.

4.5.2.2.2 Consent Procedure

To request the consent of a Fitness Machine user in order to access their UDS characteristics, the Collector shall use the *Consent* Op Code followed by an array of 3 UINT8 parameter values that represents the User Index (1 octet) followed by the Consent Code (2 octets) defined by the user as defined in [8].

The Collector shall wait for the *Response Code* User Control Point indication with the Response Value set to *Success,* indicating a successful operation, with a Response Parameter value that represents the User Index assigned by the Fitness Machine for the new user, or the procedure to time out according to the procedure time out operation described in Section 4.5.2.3. When the procedure is successful, the Fitness Machine will return a *Response Code* containing the User Index.

See Section 4.7 for general error handling procedures.

4.5.2.2.3 Delete User Data Procedure

To request the deletion of the UDS characteristics of the Fitness Machine, the Collector shall use the *Delete User Data* procedure.

The Collector shall wait for the *Response Code* User Control Point indication with the Response Value set to *Success*, indicating successful operation, or for the procedure to time out according to the procedure time-out operation described in Section 4.5.2.3.

See Section 4.7 for general error handling procedures.

4.5.2.3 Procedure Timeout

In the context of the User Control Point characteristic, a procedure is started when the Collector writes a particular Op Code to the User Control Point to perform some desired action, and it ends when the Collector sends a confirmation to acknowledge the User Control Point indication sent by the Fitness Machine at the end of the procedure with the Op Code set to Response Code.

In the context of the User Control Point characteristic, a procedure is not considered started and is not queued in the Fitness Machine when a write to the User Control Point results in an ATT Error Response.

A procedure is considered to have timed out if a User Control Point indication is not received within the ATT transaction timeout, defined as 30 seconds in [2] Volume 2, Part F, Section 3.3.3, from the start of the procedure.

If the link is lost while a User Control Point procedure is in progress, then the procedure shall be considered to have timed out.

Thus, a Collector shall start a timer with the value set to the ATT transaction timeout after the write response is received from the Fitness Machine. The timer shall be stopped when a User Control Point indication is received and the Op Code is set to Response Code. If the timer expires, then the procedure shall be considered to have failed.

If a User Control Point procedure times out, then no new User Control Point procedure shall be started by the Collector until a new link is established with the Fitness Machine. To help ensure a good user experience, if a User Control Point procedure times out, the Collector should disconnect and then reconnect.

4.5.3 Other User Data Service Characteristics

If the Collector supports remote updating of user data to the Fitness Machine (e.g., First Name, Height, Gender, Age, or Date of Birth values), the Collector shall support reading and writing to the corresponding User Data Service characteristics as defined in [8].

4.5.4 User Data Synchronization Procedure

The User Data Synchronization procedure is optional. If it is supported, the requirements in this section apply.

When a connection is established to a Fitness Machine supporting the User Data Retention feature, with a previously registered user, and the Consent procedure has succeeded, the Collector shall read the Database Change Increment characteristic value and compare it to its local (cached) value. Based on the comparison between these two values, the Collector shall perform the appropriate action defined in Table 4.7. After the synchronization procedure is completed, the Collector and the Fitness Machine will have the same UDS characteristic and Database Change Increment values.

Condition	Action Requirement
Database Change Increment values are equal in both the Collector and the Fitness Machine.	The databases are synchronized and do not require any action by the Collector.
The Database Change Increment value in the Fitness Machine is greater than the value in the Collector (i.e., the user data at the Fitness Machine is more recent).	The Collector shall read and cache all the UDS characteristics supported by the Collector. The Collector shall also cache the Database Change Increment value for future use.
The Database Change Increment value in the Fitness Machine is less than the value in the Collector (i.e., the user data at the Collector is more recent).	The Collector shall write updated UDS characteristics to the Fitness Machine. After the user data is updated, the Collector shall also write its local Database Change Increment value to the Fitness Machine in order to complete the synchronization procedure.

Table 4.7: User Data Synchronization Procedure Action Requirements

If notifications of the Database Change Increment characteristic are supported by the Fitness Machine, the Collector shall configure it for notifications.

When the Collector updates the cached UDS characteristics while not in a connection (e.g., through its UI), it shall increment by 1 the value of the cached Database Change Increment characteristic. This is to synchronize the UDS characteristics values with the Fitness Machine at the next connection.

When a Collector that supports the update of UDS characteristics (e.g., through its UI) is connected to a Fitness Machine, and when the Collector updates one or more UDS Characteristics values exposed by the Fitness Machine, the Collector shall increment its local Database Change Increment value by 1 and write the incremented value of the Database Change Increment characteristic to the Fitness Machine.

4.6 Device Information Service Characteristics

The Collector may read the value of Device Information Service characteristics.

4.7 General Error Handling

The Collector shall be tolerant and behave appropriately (i.e., the Collector shall be able to continue to process commands and/or receive data normally) when receiving the following Control Point error codes defined in [8]:

- Op Code Not Supported
- Invalid Parameter
- Operation Failed
- Control Not Permitted
- User Not Authorized

The Collector shall also be tolerant and behave appropriately (i.e., the Collector shall be able to continue to process commands and/or receive data normally) when receiving the following Application ATT error code defined [8]:

- User Data Access Not Permitted

The Collector shall also be tolerant and behave appropriately (i.e., the Collector shall be able to continue to process commands and/or receive data normally) when receiving the following ATT error codes:

- Procedure Already In Progress
- Client Characteristic Configuration Descriptor Improperly Configured

4.8 User Data Access Methods

If the Collector supports the User Data Service, depending on the capabilities of the Fitness Machine, the Collector may use one of the procedures defined in Table 4.8 to access user data of the Fitness Machine.

Condition	Action Requirement
The Fitness Machine does not support the User Data Retention feature.	The Collector shall use the Register New User procedure defined in Section 4.5.2.2.1 each time a new connection is established, followed by the Consent procedure defined in Section 4.5.2.2.2, in order to access the user data of the Fitness Machine.
The Fitness Machine supports the User Data Retention feature, and the user has not been registered.	The Collector shall use the Register New User procedure defined in Section 4.5.2.2.1, followed by the Consent procedure defined in Section 4.5.2.2.2, in order to access the user data of the Fitness Machine.
The Fitness Machine supports the User Data Retention feature, and the user is registered	The Collector shall use the Consent procedure defined in Section 4.5.2.2.2 in order to access the user data of the Fitness Machine. If the Consent procedure succeeds, the Collector should initiate the User Data Synchronization procedure defined in Section 4.5.4. If the Consent procedure fails, the Collector shall assume that the user data no longer exists on the Fitness Machine (for example, the data has been deleted via the UI of the Fitness Machine) and should reinitiate the Register procedure defined in in Section 4.5.2.2.1.

Table 4.8: User Data Synchronization Procedure Action Requirements

After the Consent procedure has succeeded, the Collector should write the user data to the Fitness Machine.

For privacy reasons, the Collector should use the Delete User procedure defined in Section 4.5.2.2.3 before terminating the connection with a Fitness Machine that does not support the User Data Retention feature (e.g., a Fitness Machine designed for use in a public environment).

If the connection is terminated because of a link loss, the Collector should attempt to reinitiate the connection. If the connection is reestablished within a short period of time (typically five seconds), the Collector should use the Consent procedure defined in Section 4.5.2.2.2 to access the user data.

5 Connection Establishment Procedures

This section describes the procedures for establishing and terminating connections that are used by a Fitness Machine and Collector in typical scenarios.

5.1 Fitness Machine Connection Establishment for Low Energy Transport

This section describes connection procedures that a Fitness Machine should follow to initiate a connection with a Collector using a low energy transport.

- Section 5.1.1 describes the connection procedure that is used when the Fitness Machine does not support bonding, or if the Fitness Machine supports bonding but is not bonded with any Collectors.
- Section 5.1.2 describes the connection procedure that is used when the Fitness Machine is bonded with one or more Collectors.
- Section 5.1.3 describes the connection procedure that is used when the established connection is broken after a link loss and a reconnection is required.
- Section 5.1.4 describes the connection procedure that is used when the advertisement packet includes the Service Data AD Type.

5.1.1 Connection Procedure for Unbonded Devices

This procedure is used for connection establishment when the Fitness Machine is not bonded with any Collectors and ready for connection (for example, when the Fitness Machine is initially powered on).

If a connection is not established within a certain period of time, which is defined by the manufacturer, the Fitness Machine either may continue sending background advertising, to reduce power consumption, for as long as it chooses, or it may stop advertising. The advertising interval and the time to perform advertising are implementation specific and should be configured with consideration for user expectations of connection establishment time using the GAP timers defined in [2] Volume 3, Part C, Section 9.3.11.

If a connection is not established within a time limit defined by the Fitness Machine, the Fitness Machine may exit the GAP Connectable Mode.

Table 5.1 summarizes the recommended connection procedure if the Fitness Machine is not bonded to any Collectors.

Recommended GAP Modes	Recommended Filter Policy	Remarks
General Discoverable Mode Undirected Connectable Mode Bondable Mode	Attempt to connect to any Collectors	

Table 5.1: Recommended Connection Procedure for Unbonded Devices

A Fitness Machine that is designed for use in a public environment should not request the bonding procedure with the Collector.

A Fitness Machine that is designed for use in a private environment may request the bonding procedure with the Collector.

When a bond is created, refer to recommendations in Section 5.1.2.

When the Fitness Machine no longer requires a connection, it should perform the GAP Terminate Connection procedure.

If the Fitness Machine has no data to transfer or a training session is terminated, and the connection is idle, the Fitness Machine should wait at least longer than the maximum connection interval (e.g., 5 seconds) before performing the GAP Terminate Connection procedure. This allows the Collector to perform any additional required actions (e.g., set new targeted value, read and write to UDS characteristics, or delete the user data). For devices that support man-in-the-middle (MITM) protection, a longer duration may be needed to allow the pairing sequence to complete.

5.1.2 Connection Procedure for Bonded Devices

Table 5.2 summarizes the recommended procedure if the Fitness Machine is bonded with one or more Collectors.

Recommended Time	Recommended GAP Modes	Recommended Filter Policy	Remarks
First 10 seconds	Non-Discoverable Mode Undirected Connectable Mode	Attempt to connect to only bonded Collectors in the Filter Accept List.	The Filter Accept List should be used in order to accept connection requests only from the relevant bonded Collector.
After 10 seconds	General Discoverable Mode Undirected Connectable Mode Bondable Mode	Attempt to connect to any Collectors.	This allows bonding with a new Collector. The connection procedure for unbonded devices is described in Section 5.1.1.

Table 5.2: Recommended Connection Procedure for Bonded Devices

If a Fitness Machine requires a connection to a Collector that did not use a resolvable private address during bonding, the Fitness Machine may use Low Duty Cycle Directed Advertisements in order to advertise to only the Collector for which it has data. When a Collector used a resolvable private address during bonding, and the Fitness Machine requires a connection to that Collector, the Fitness Machine should use the Undirected Connectable Mode along with the Service Data AD Type described in Section 3.1.1.5 to reduce unwanted connection requests.

If a connection is not established within T_{GAP}(adv_fast_period), the Fitness Machine may either continue sending background advertising to reduce power consumption for as long as it chooses, or stop advertising.

The advertising interval and the time to perform advertising are implementation specific and should be configured with consideration for user expectations of connection establishment time using the GAP timers defined in [2] Volume 3, Part C, Section 9.3.11.

If a connection is not established within a time limit defined by the Fitness Machine, the Fitness Machine may exit the GAP Connectable Mode.

When the Fitness Machine is disconnected and the Fitness Machine is ready for reconnection (e.g., when commanded by the user), the Fitness Machine should reinitiate the connection procedure (e.g., start advertising).

If the Fitness Machine has no data to transfer or a training session is terminated, and the connection is idle, the Fitness Machine should wait 5 seconds (the idle connection timeout interval) before performing the GAP Terminate Connection procedure. This allows the Collector to perform any additional required

actions (e.g., read and write to UDS characteristics). For devices that support man-in-the-middle (MITM) protection, a longer duration may be needed to allow completion of the pairing sequence.

5.1.3 Link Loss Reconnection Procedure

When a connection is terminated due to link loss, the Fitness Machine should attempt to reconnect to the Collector by entering the GAP Connectable Mode.

5.1.4 Use of Service Data AD Type

This section outlines an optional procedure that is applicable when a Fitness Machine uses the Undirected Connectable Mode and the Service Data AD Type.

The Service Data AD Type, described in Section 3.1.1.5, provides a mechanism to reduce unwanted connection requests by unintended Collectors when Undirected Connectable Mode is used and when a Fitness Machine is available for new connection. Refer also to Section 5.2.2 for the procedure from the Collector perspective.

When a Fitness Machine uses undirected connectable advertisements, it should include the Service Data AD Type in its Advertising Data as defined in [1]. This is to provide a mechanism to differentiate the Fitness Machines that may be present in the same area based on their type (such as a treadmill or cross trainer) and to avoid Collectors that do not support a particular type of Fitness Machine to initiate an unwanted connection. This also allows Collectors to sort the Fitness Machines that are advertising based on their type.

If the Fitness Machine needs to send advertisements but is not available for a new training session, the Fitness Machine should set the Fitness Machine Available bit to 0 (Fitness Machine not available) so Collectors should not initiate a connection to this particular Fitness Machine.

5.2 Collector Connection Establishment for Low Energy Transport

This section describes connection procedures a Collector should follow to initiate a connection with a Fitness Machine using a low energy transport.

The Collector should use the GAP General Discovery procedure to discover a Fitness Machine.

A Collector may use one of the GAP connection procedures based on its connectivity requirements as described in Table 5.3.

Recommended Time	Recommended GAP Modes	Recommended Filter Policy
General Connection Establishment	Allowed	Allowed
Direct Connection Establishment	Allowed	Allowed
Auto Connection Establishment	Not Allowed	Allowed
Selective Connection Establishment	Not Allowed	Allowed

Table 5.3: Allowed GAP Connection Procedure

If a connection is not established within T_{GAP}(scan_fast_period), the Collector may either continue background scanning to reduce power consumption or stop scanning.

The connection interval, scan interval, scan window, and time to perform scanning are implementation specific and should be configured with consideration for user expectations of connection establishment time using the GAP timers defined in [2] Volume 3, Part C, Section 9.3.11.

If a connection is not established within a time limit defined by the Collector, the Collector may exit the connection establishment procedure.

When the connection is established, the Collector may bond with the Fitness Machine, if requested by the Fitness Machine.

Upon initial connection, the Collector may initiate the Register New User procedure defined in Section 4.5.2.2.1 and may configure the new user data by writing to UDS characteristics.

The Collector should terminate the connection when the measurement session is terminated at the Collector by the user.

When the Collector is disconnected, the Collector may continue scanning for advertisements from the Fitness Machine and may initiate a new connection.

5.2.1 Link Loss Reconnection Procedure

When a connection is terminated because of link loss, the Collector should attempt to reconnect to the Fitness Machine using any of the GAP connection procedures that use the connection establishment timing parameters defined in [2] Volume 3, Part C (GAP), Section 9.3.11 and the connection interval timing parameters defined in [2] Volume 3, Part C (GAP), Section 9.3.12.

5.2.2 Use of Service Data AD Type

This section outlines an optional procedure that is applicable when a Collector supports the use of the Service Data AD Type for the Fitness Machine Service.

The Service Data AD Type described in Section 3.1.1.5 provides a mechanism to reduce unwanted connection requests by unintended Collectors when the Undirected Connectable Mode is used and when a Fitness Machine is available for new connection. Refer to Section 5.1.4 for the procedure from the Fitness Machine perspective.

When a Collector receives an undirected connectable advertisement from a Fitness Machine that includes the Service Data AD Type in its advertising data, the Collector shall read the Fitness Machine Type field of the Service Data AD Type to determine the type of Fitness Machine that is advertising. If the value of Fitness Machine Type field matches the Fitness Machine type supported by the Collector, the Collector may initiate a connection to that particular Fitness Machine (e.g., typically directed by the user via its UI). This mechanism may also be used to sort the different types of Fitness Machines that may be present in the same area.

5.3 Connection Establishment for BR/EDR

This section describes the procedures for establishing and terminating connections used by a Fitness Machine and Collector using a BR/EDR transport. Unlike the low energy connection procedures, which describe specific connection parameters, BR/EDR connection establishment does not state requirements beyond those described in GAP based on potential interactions with other BR/EDR profiles operating concurrently on the Fitness Machine and/or Collector.

When using BR/EDR, devices can utilize sniff mode and sniff subrating to reduce power consumption; however, no particular parameters are recommended, and the requirements of other profiles may need to be considered.

5.3.1 Connection Procedure

The procedures for establishing a connection between a Fitness Machine and a Collector that do not have an existing bond and for re-establishing a connection between bonded devices use the inquiry, discovery, paging, pairing and security procedures described in Generic Access Profile of the Core Specification [2] and any additional GAP requirements enumerated in Sections 6 and 7.

5.3.1.1 Connection Procedure for Unbonded Devices

The Fitness Machine shall use the GAP General or Limited Discoverable Mode when it is not bonded with any Collectors and is ready for a connection (e.g., when commanded by the user).

The Collector should use the GAP General Discovery procedure to discover a Fitness Machine and establish a connection to a Fitness Machine to which it is not bonded.

Either the Fitness Machine or the Collector can establish a BR/EDR link to a remote peer device.

After a link is established, the Collector shall discover the Fitness Machine Service using SDP procedures before it establishes a GATT connection.

After the Fitness Machine Service is discovered and a GATT connection is established, the Collector shall discover the Fitness Machine Service characteristics exposed by this service using GATT Discovery procedures.

Once connected, the Collector shall configure any Fitness Machine Service characteristics that require indications or notifications.

The Collector should terminate the connection when the measurement session is terminated at the Collector by the user.

When the Fitness Machine no longer has data to send, it may disconnect the link, depending on the use cases of the devices and other profiles connected on either device.

5.3.1.2 Connection Procedure for Bonded Devices

The Fitness Machine shall use the GAP Link Establishment Procedure to connect to any bonded Collectors when it is ready for a connection (e.g., when commanded by the user).

The Collector shall be Connectable to accept a connection from a Fitness Machine to which it is bonded.

Either the Fitness Machine or the Collector can establish a BR/EDR link to a remote peer device.

Upon initial connection, the Collector may initiate the Register New User procedure defined in Section 4.5.2.2.1 and may configure the new user data by writing to UDS characteristics.

If a higher layer determines the bond no longer exists on the remote device, the local device must reconfigure the remote device after the following conditions are met:

- User interaction confirms that the user wants to pair with the remote device again,
- Re-bonding has been performed, and
- Service discovery has been performed. (If the local device had previously determined that the remote device did not have the «Service Changed» characteristic, then service discovery may be skipped because the service is not allowed to change per the Core Specification.)

When the Fitness Machine no longer has data to send, it may disconnect the link, depending on the use cases of the devices and other profiles connected on either device.

The Collector should terminate the connection when the measurement session is terminated at the Collector by the user.

When the Fitness Machine is disconnected and it is ready for reconnection (e.g., when commanded by the user), the Fitness Machine should initiate a connection with the Collector.

If the Fitness Machine has no data to transfer (or no further data to transfer) and the connection is idle, the Fitness Machine should wait 5 seconds (the idle connection timeout interval) before performing the GAP Terminate Connection procedure. This allows the Collector to perform any additional required actions (e.g., read and write to UDS characteristics). For devices that support man-in-the-middle (MITM) protection, a longer duration may be needed to allow completion of the pairing sequence.

5.3.2 Link Loss Reconnection Procedure

When a connection is terminated due to link loss, a Fitness Machine should reconnect to the Collector by attempting, for an implementation-specific time, to reestablish an ACL link between the two devices. The Collector should remain Connectable for an implementation-specific time so that a Fitness Machine can reestablish an ACL link.

6 Security Considerations

This section describes the security considerations for a Fitness Machine and Collector.

6.1 Fitness Machine Security Considerations for Low Energy

This section describes the security requirements for the Fitness Machine for a low energy transport.

- All supported characteristics specified by the Fitness Machine Service except the Fitness Machine Control Point shall be set to LE Security Mode 1 and Security Level 1 or higher.
- The Fitness Machine Control Point shall be set to LE Security Mode 1 and Security Level 2 or higher.
- If used, all characteristics exposed by the User Data Service for use by this profile should be set to the same security mode and level as the Fitness Machine Control Point characteristic.
- If present and writable, the Device Name descriptor should support authentication.
- A Fitness Machine that is designed for use in a public environment should not request bonding.
- A Fitness Machine that is designed for use in a private environment may request bonding.
- If the Fitness Machine has a UI or any other mechanisms enabling a higher security level (e.g., Out of Band using NFC), the Fitness Machine may request MITM protection (Security Mode 1, Level 3).

6.2 Collector Security Considerations for Low Energy

This section describes the security requirements for the Collector for a low energy transport.

- The Collector shall support bonding in case it is requested by the Fitness Machine.
- The Collector shall accept any request by the Fitness Machine for LE Security Mode 1 and Security Level 2 or higher.

6.3 Security Considerations for BR/EDR

As required by GAP, Security Mode 4 (service-level enforced security) shall be used for connections by the Fitness Machine and the Collector.

- The Fitness Machine may initiate Dedicated Bonding with the Collector. However, if the Fitness Machine supports multiple users, then it shall initiate Dedicated Bonding and shall support as many bonds as the number of supported users.
- The Collector shall support bonding in case it is requested by the Fitness Machine.
- If the Fitness Machine has a UI or any other mechanisms enabling a higher security level, the Fitness Machine may request MITM protection.

7 Generic Access Profile for BR/EDR

This section defines the support requirements for the capabilities as defined in the Generic Access Profile of the Core Specification [2] when BR/EDR is used.

7.1 Modes

The Mode procedures as defined in GAP describe requirements for both Fitness Machines and Collectors. This profile further refines the requirements.

- Discoverable Mode shall be supported by Fitness Machines supporting BR/EDR.
- Bondable Mode should be supported by Fitness Machines and Collectors.

Table 7.1 shows the support status for GAP Modes in this profile.

Procedure	Support in Fitness Machine	Support in Collector
Discoverable Mode	M	N/A
Bondable Mode	O	O

Table 7.1: Modes

7.2 Idle Mode Procedures

The Idle Mode procedures as defined in GAP describe requirements for both Fitness Machines and Collectors involved. This profile further refines the requirements.

- General Inquiry shall be supported by all Collectors.
- General Bonding should be supported by all Fitness Machines and Collectors.

Table 7.2 shows the support status for Idle Mode procedures within this profile.

Procedure	Support in Fitness Machine	Support in Collector
General Inquiry	N/A	M
General Bonding	O	O

Table 7.2: Idle Mode Procedures

8 Acronyms and Abbreviations

Abbreviation	Meaning
BR/EDR	Basic Rate/Enhanced Data Rate
GAP	Generic Access Profile
GATT	Generic Attribute Profile
LE	Low Energy; the low energy feature of Bluetooth
MITM protection	Man-in-the-middle protection
NFC	Near Field Communication

Table 8.1: Acronyms and Abbreviations

9 References

[1] Fitness Machine Service

[2] Bluetooth Core Specification, v4.2 or later

[3] Bluetooth Core Specification Supplement, v11 or later

[4] Bluetooth Assigned Numbers, https://www.bluetooth.com/specifications/assigned-numbers/

[5] Document Naming Procedure, Bluetooth SIG (BARB Approved)

[6] Bluetooth Documentation Review Guidelines, V10r04, 20 January 2004

[7] ITU-T Recommendation Z.120, Message Sequence Chart (MSC)

[8] User Data Service

[9] Device Information Service