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Health informatics — Personal health device communication —

Part 10442: Device specialization — Strength fitness equipment

Informatique de santé — Communication entre dispositifs de santé personnels —

Partie 10442: Spécialisation des dispositifs — Équipement de mise en forme musculaire

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Institute of Electrical and Electronics Engineers, Inc
3 Park Avenue, New York
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stds.ipr@ieee.org
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IEEE Std 11073-10442™-2008

Health informatics—Personal health device communication

Part 10442: Device specialization—Strength fitness equipment

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Abstract: Within the context of the ISO/IEEE 11073 family of standards for device communication, this standard establishes a normative definition of the communication between personal strength fitness devices and managers (e.g., cell phones, personal computers, personal health appliances, and set top boxes) in a manner that enables plug-and-play interoperability. It leverages appropriate portions of existing standards including ISO/IEEE 11073 terminology and information models. It specifies the use of specific term codes, formats, and behaviors in telehealth environments restricting optionality in base frameworks in favor of interoperability. This standard defines a common core of communication functionality for personal telehealth strength fitness devices. In this context, strength fitness devices are being used broadly to cover strength fitness devices that measure musculo-skeletal strength-conditioning activities.

Keywords: medical device communication, personal health devices, strength fitness equipment

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Introduction

This introduction is not part of IEEE Std 11073-10442-2008, Health informatics—Personal health device communication—Part 10442: Device specialization—Strength fitness equipment.

ISO/IEEE 11073 standards enable communication between medical devices and external computer systems. This document uses the optimized framework created in IEEE Std 11073-20601[a] and describes a specific, interoperable communication approach for strength fitness equipment. These standards align with and draw on the existing clinically focused standards to provide easy management of data from either clinical or personal health devices.

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Karsten Aalders
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Manfred Aigner
Murtaza Ali
Deepak Ayyagari
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Carole C. Carey
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Silviu Chiricescu
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Todd Cooper
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Matthew d'Entremont
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Jakob Ehrensvard
Roger M. Ellingson
Michihiro Enokida
Mika Erkkilä
Javier Escayola Calvo
Leonardo Estevez
Laurent Falconieri
Gear Fisher
Julie N. Fleischer
Joeseph W. Forler
Eric Freudenthal
Miguel Galarraga
John Garguilo
Igor Gejdos
Chris Gough
Channa Gowda
Niclas Granqvist
Jeff Guttmacher
Christian Habermann
Michael Hagerty
Rickey L. Hampton
Sten Hanke
Jack Harrington
Kai Hassing
Hiroshi Hayashi
Torstein Heggebø
Ron Hegli
Rose Higgins
Kaoru Hiramatsu
Allen Hobbs
Alex Holland
Kirsten Howard
Robert Hoy
Robert D. Hughes
Nick Hunn
Yutaka Ikeda
Philip Isaacson
Ho-In Jeon
Chris Johnson
Krishna Jonnalagadda
Akiyoshi Kabe
Steve Kahle
Tomio Kamioka
Kyung Hee Kang
Ulf Karlsson
Andy Kaschl
Junzo Kashihara
Kohichi Kashiwagi
Ralph Kent
Kurt Kermes
Ikuo Keshi
John Keys
Alfred Kloos
Jeongmee Koh
Alexander Kraus
Falko Kuester
Nandu Kushalnagar
Daniel Lager
Pierre Landau
Sungkee Lee
Yonghee Lee
Kathryn A. Lesh
Qiong Li
Wei-Jung Lo
Sandra Martinez
Miguel Martínez de Espronceda Cámara
Jim McCain
Richard McPartland
Jinsei Miyazaki
Brian Møller
Darr Moore
Joe Morrissey
Yoshihiko Motohashi
Alex Neefus
Michael E. Nidd
Hiroaki Niwamoto
Thomas Norgall
Yoshiteru Nozoe
Mikey Paradis
Jayant Parthasarathy
Phillip E. Pash
Thomas Plasa
Arif Rahman
Robert E. Ranslam
Barry Reinhold
Melvin I. Reynolds
Jeffrey S. Robbins
Timothy Robertson
Michael B. Robkin
Bill Saltzstein
Stefan Sauermann
Naveen Saxena
Paul S. Schluter
Lars Schmitt
Mark Schnell
Richard A. Schrenker
Aravind Seshagiri
Marco Sgroi
Mazen Shihabi
Robert Smith
Motoki Sone
Emily Sopensky
Ryan Spring
Nick Steblay
Lars Steubesand
John (Ivo) Stivoric
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Haruyuyki Tatsumi
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Thomas Blackadar
Douglas P. Bogia
Lyle G. Bullock, Jr.
Randy Carroll
Keith Chow
Malcolm Clarke
Rick A. Cnossen
Julie N. Fleischer
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Health informatics—Personal health device communication

Part 10442: Device specialization—Strength fitness equipment

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1. Overview

1.1 Scope

Within the context of the ISO/IEEE 11073 family of standards for device communication, this standard establishes a normative definition of the communication between personal strength fitness devices and managers (e.g., cell phones, personal computers, personal health appliances, and set top boxes) in a manner that enables plug-and-play interoperability. It leverages appropriate portions of existing standards, including ISO/IEEE 11073 terminology and information models. It specifies the use of specific term codes, formats, and behaviors in telehealth environments restricting optionality in base frameworks in favor of interoperability. This standard defines a common core of communication functionality for personal telehealth strength fitness devices. In this context, strength fitness devices are being used broadly to cover strength fitness devices that measure musculo-skeletal strength-conditioning activities.

1.2 Purpose

This standard addresses a need for an openly defined, independent standard for controlling information exchange to and from personal health devices and managers (e.g., cell phones, personal computers, personal health appliances, and set top boxes). Interoperability is the key to growing the potential market for these devices and to enabling people to be better-informed participants in the management of their health.

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1.3 Context

See IEEE Std 11073-20601™ for an overview of the environment within which this standard is written.

This document, IEEE Std 11073-10442 defines the device specialization for the strength fitness device, being a specific agent type, and it provides a description of the device concepts, its capabilities, and its implementation according to this standard.

This standard is based on IEEE Std 11073-20601, which in turn draws information from both ISO/IEEE 11073-10201:2004 [B3][1] and ISO/IEEE 11073-20101:2004 [B4]. The medical device encoding rules (MDER) used within this standard are fully described in IEEE Std 11073-20601.

This standard reproduces relevant portions of the nomenclature found in ISO/IEEE 11073-10101:2004 [B2] and adds new nomenclature codes for the purposes of this standard. Between this standard and IEEE Std 11073-20601, all required nomenclature codes for implementation are documented.

NOTE—In this standard, IEEE Std 11073-104zz is used to refer to the collection of device specialization standards that utilize IEEE Std 11073-20601, where zz can be any number from 01 to 99, inclusive.[2]

2. Normative references

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IEEE Std 11073-20601™-2008, Health informatics—Personal health device communication—Part 20601: Application profile—Optimized exchange protocol.[3, 4]

See Annex A for all informative material referenced by this standard.

3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this standard, the following terms and definitions apply. The *Authoritative Dictionary of IEEE Standards Terms* [B1] should be referenced for terms not defined in this clause.

3.1.1 agent: A node that collects and transmits personal health data to an associated manager.

3.1.2 class: In object-oriented modeling, a class describes the attributes, method, and events that objects instantiated from the class utilize.

3.1.3 compute engine: *See*: **manager.**

3.1.4 device: A term used to refer to a physical apparatus implementing either an agent or a manager role.

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3.1.5 handle: An unsigned 16-bit number that is locally unique and identifies one of the object instances within an agent.

3.1.6 manager: A node receiving data from one or more agent systems. Some examples of managers include a cellular phone, health appliance, set top box, or a computer system.

3.1.7 obj-handle: *See:* **handle.**

3.1.8 object: In object-oriented modeling, a particular instantiation of a class. The instantiation realizes attributes, methods, and event from the class.

3.1.9 personal health device: A device used in personal health applications.

3.1.10 personal telehealth device: *See:* **personal health device.**

3.2 Acronyms and abbreviations

APDU	application protocol data unit
ASN.1	Abstract Syntax Notation One
DIM	domain information model
EUI-64	extended unique identifier (64 bits)
ICS	implementation conformance statement
MDC	medical device communication
MDER	medical device encoding rules
MDS	medical device system
MOC	medical object class
OID	object identifier
PDU	protocol data unit
PHD	personal health device
RT-SA	real-time sample array
VMO	virtual medical object
VMS	virtual medical system

4. Introduction to ISO/IEEE 11073 personal health devices

4.1 General

This standard and the remainder of the series of ISO/IEEE 11073 personal health device (PHD) standards fit in the larger context of the ISO/IEEE 11073 series of standards. The full suite of standards enables agents to interconnect and interoperate with managers and with computerized health-care information systems. See IEEE Std 11073-20601 for a description of the guiding principles for this series of ISO/IEEE 11073 personal health device standards.

IEEE Std 11073-20601 supports the modeling and implementation of an extensive set of personal health devices. This standard defines aspects of the strength fitness device. It describes all aspects necessary to implement the application layer services and data exchange protocol between an ISO/IEEE 11073 PHD strength fitness agent and a manager. This standard defines a subset of the objects and functionality contained in IEEE Std 11073-20601 and extends and adds definitions where appropriate. All new definitions are given in Annex B in Abstract Syntax Notation One (ASN.1). Nomenclature codes referenced in this standard, which are not defined in IEEE Std 11073-20601, are normatively defined in Annex C.

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4.2 Introduction to IEEE 11073-20601 modeling constructs

4.2.1 General

The ISO/IEEE 11073 series of standards, and in particular IEEE Std 11073-20601 is based on an object-oriented systems management paradigm. The overall system model is divided into three principal components: the domain information model (DIM), the service model, and the communications model. See IEEE Std 11073-20601 for a detailed description of the modeling constructs.

4.2.2 Domain information model

The DIM is a hierarchical model that describes an agent as a set of objects. These objects and their attributes represent the elements that control behavior and report on the status of the agent and data that the agent can communicate to the manager. Communication between the agent and the manager is defined by the application protocol in IEEE Std 11073-20601.

4.2.3 Service model

The service model defines the conceptual mechanisms for the data exchange services. Such services are mapped to messages that are exchanged between the agent and the manager. Protocol messages within the ISO/IEEE 11073 series of standards are defined in ASN.1. The messages defined in IEEE Std 11073-20601 can coexist with messages defined in other standard application profiles defined in the ISO/IEEE 11073 series of standards.

4.2.4 Communication model

In general, the communication model supports the topology of one or more agents communicating over logical point-to-point connections to a single manager. For each logical point-to-point connection, the dynamic system behavior is defined by a connection state machine as specified in IEEE Std 11073-20601.

4.2.5 Implementing the models

An agent implementing this standard shall implement all mandatory elements of the information, service, and communication models as well as all conditional elements where the condition is met. The agent should implement the recommended elements, and it may implement any combination of the optional elements. A manager implementing this standard shall utilize at least one of the mandatory, conditional, recommended, or optional elements. In this context, “utilize” means to use the element as part of the primary function of the manager device. For example, a manager whose primary function is to display data would need to display a piece of data in the element in order to utilize it.

5. Strength fitness device concepts and modalities

5.1 General concepts

Strength fitness agents measure the extent to which a person can perform a certain motion with a given resistance. The agents in this category are varied, and they range from single exercise machines, such as a leg press, to multi-function agents that can be used to perform a variety of exercises. While these agents may take a variety of forms, the measurements they capture are largely the same.

Agents in this category operate in a store and forward mode. Exercise is measured for a period of time, and sometime after the exercise period has ended, the agent transfers all the measurements to the manager. This period of exercise measurement is called a set.

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5.2 Set

A set is an episode of a strength training exercise performed on a single agent at the same resistance. A set includes the time that it was started, the muscle group engaged, and optionally, the duration. A set may also have other measurements associated with it, such as the repetition count, details for each repetition, resistance, exercise laterality, exercise grip, exercise position, and exercise movement.

5.3 Repetition

A repetition is an instance of a given strength exercise. Each repetition is associated with a set and defines when the repetition was performed. Additionally, the repetition may specify the duration and/or the distance of the repetition.

5.4 Repetition count

The repetition count is the number of time an exercise had been performed within an associated set.

5.5 Resistance

The resistance is a representation of the amount of force applied to accomplish the exercise.

5.6 Exercise position

The position employed to perform the exercise.

5.7 Exercise laterality

Exercise laterality identifies which side of the body engaged in the exercise.

5.8 Exercise grip

The grip employed to perform the exercise.

5.9 Exercise movement

The movement employed in the exercise.

6. Strength fitness domain information model

6.1 Overview

This clause describes the domain information model for strength fitness equipment.

6.2 Class extensions

In this standard, no class extensions are defined with respect to IEEE Std 11073-20601.

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6.3 Object instance diagram

The object instance diagram of the strength fitness domain information model, defined for the purpose of this standard, is shown in Figure 1.

The objects of the DIM, as shown in Figure 1, are described in 6.4 to 6.11. This includes the medical device system (MDS) object (see 6.5), the numeric objects (see 6.6), the real-time sample array (RT-SA) objects (see 6.7), the enumeration objects (see 6.8), the PM-store objects (see 6.9), and the scanner objects (see 6.10). See 6.11 for rules for extending the information model beyond elements as described in this standard. Each clause that describes an object of the strength fitness contains the following information:

— The nomenclature code used to identify the class of the object. One example of where this code is used is the configuration event, where the object class is reported for each object. This allows the manager to determine whether the class of the object being specified is a numeric, real time sample array, enumeration, scanner, or PM-store class.

— The attributes of the object. Each object has attributes that represent and convey information on the physical agent and its data sources. Each object has a Handle attribute that identifies the object instance within an agent. Attribute values are accessed and modified using methods such as GET and SET. Attribute types are defined using ASN.1. The ASN.1 definitions for new attribute types specific to this standard are in Annex B, and the ASN.1 definitions for existing attribute types referenced in this standard are in IEEE Std 11073-20601.

— The methods available on the object.

— The potential events generated by the object. Data are sent to the manager using events.

— The available services such as getting or setting attributes.

The attributes for each class are defined in tables that specify the name of the attribute, its value, and its qualifier. The qualifiers mean M – Attribute is Mandatory, C – Attribute is Conditional and depends on the condition stated in the Remark or Value column (if IEEE Std 11073-20601 is referenced, then it contains the conditions), R – Attribute is Recommended, NR – Attribute is Not Recommended, and O – Attribute is Optional. Mandatory attributes shall be implemented by an agent. Conditional attributes shall be implemented if the condition applies and may be implemented otherwise. Recommended attributes should be implemented by the agent. Not recommended attributes should not be implemented by the agent. Optional attributes may be implemented by the agent.

The attributes can be either static, meaning that they shall remain unchanged after the configuration is agreed upon, or dynamic, meaning that the attribute may change at some point after configuration.

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