IEC 62282-6-400

Edition 1.0 2019-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Fuel cell technologies –
Part 6-400: Micro fuel cell power systems – Power and data interchangeability

Technologies des piles à combustible –
Partie 6-400: Systèmes à micropiles à combustible – Interchangeabilité de la puissance et des données

IEC 62282-6-400:2019-05(en-fr)

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CONTENTS

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FUEL CELL TECHNOLOGIES –

Part 6-400: Micro fuel cell power systems – Power and data interchangeability

FOREWORD

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International Standard IEC 62282-6-400 has been prepared by IEC technical committee 105: Fuel cell technologies.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
105/721/FDIS	105/724/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62282 series, published under the general title *Full cell technologies*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,
- replaced by a revised edition, or
- amended.

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FUEL CELL TECHNOLOGIES –

Part 6-400: Micro fuel cell power systems – Power and data interchangeability

1 Scope

This part of IEC 62282 covers the interchangeability of power and data between micro fuel cell power systems and electronic devices to provide the micro fuel cell power system compatibility for a variety of electronic devices while maintaining the safety and performance of the micro fuel cell system. For that purpose, this document covers power interfaces and their connector configuration. The power management circuitry and power sharing methodology are also provided.

This document also covers the data communication protocol and its data specification. Operation modes and alert conditions are also provided for the means to comply with the power control requirements of the electronic device.

A micro fuel cell power system and micro fuel cell power unit block diagram is shown in Figure 1. Micro fuel cell power systems and micro fuel cell power units are defined as devices that are wearable or easily carried by hand, providing DC outputs that do not exceed 60 V DC and power outputs that do not exceed 240 VA. This document covers the power and data interfaces between the micro fuel cell power unit and electronic device.

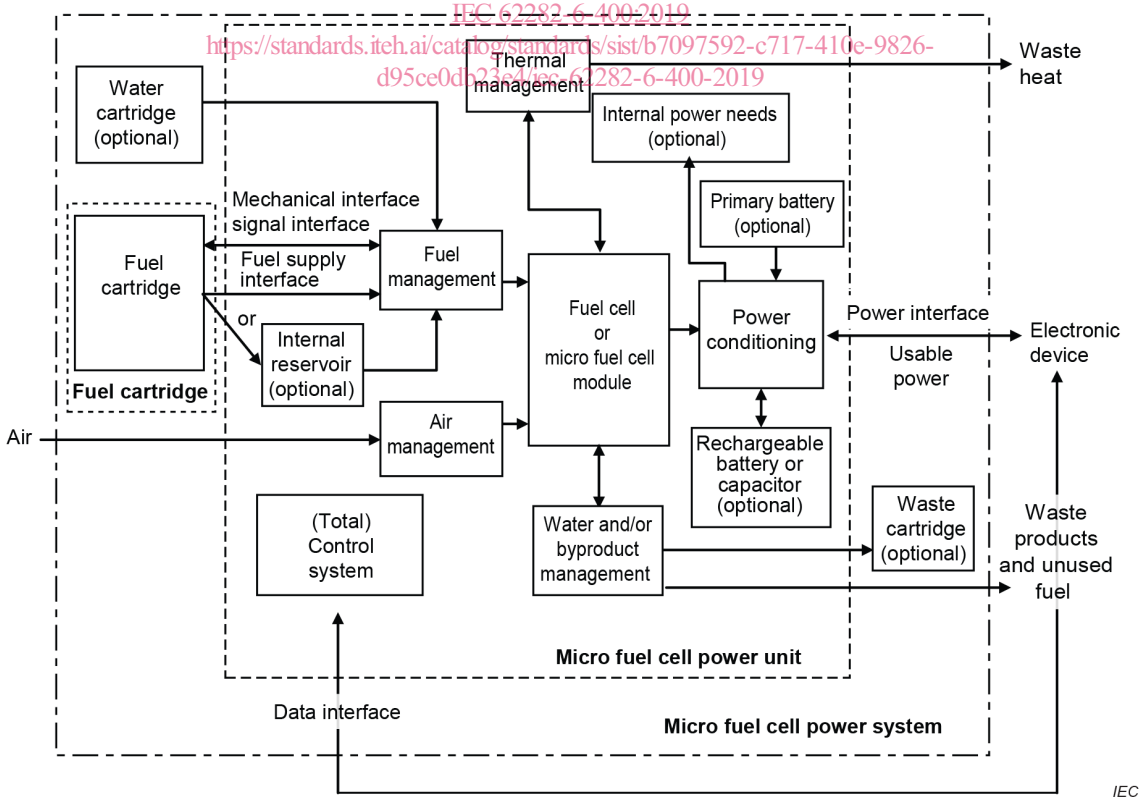

Figure 1 – Micro fuel cell power system and micro fuel cell power unit block diagram

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TS 62282-1, *Fuel cell technologies – Part 1: Terminology*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 62282-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
stand-alone micro fuel cell power system
micro fuel cell power system intended to provide power to an electronic device by way of a cable or other external connection

3.1.2
semi-integrated micro fuel cell power system
micro fuel cell power system intended to be removably installed in an electronic device, for example in a battery port

Note 1 to entry: This type of micro fuel cell power system may be directly connected to the electronic device, and may have a volume externally protruding from the electronic device.

3.1.3
integrated micro fuel cell power system
micro fuel cell power system that is permanently installed within an electronic device, either at the time of manufacture, or as an aftermarket feature

Note 1 to entry: This type of micro fuel cell power system may have a permanently installed, refillable internal reservoir for storage of fuel, or it may have a removable cartridge for storage of fuel.

3.1.4
electronic device
device such as cellular phone, music player, digital camera, camcorder, personal digital assistant (smartphone, laptop, tablet), mobile game machine or mobile PC, that uses a micro fuel cell power unit/system

3.1.5
micro fuel cell charger
charger that uses a micro fuel cell power unit/system

3.2 Abbreviated terms

The abbreviated terms are given in Table 1.

Table 1 – Abbreviated terms

Abbreviated term	Definition
BMS	Battery management system
FMS	Fuel cell management system
BOP	Balance of plant
CAN	Controller area network
EPS	External power supply
MFC	Micro fuel cell
PDA	Personal digital assistant
SBDS	Smart battery data specification
SMBC	Server message block clock
SMBD	Server message block data
SOC	State of charge

4 Power interface

4.1 Configuration of micro fuel cell power system

Electronic devices such as notebook PCs and cellular phones generally have four options available for sourcing power to operate the device:

a) AC adapter port: sources relatively high current, but generally does not enable any data communication functions;

b) DC adapter port: sources relatively high current, but generally does not enable any data communication functions;

c) battery port: sources current in the main battery port, or in the auxiliary battery port (optional), and can provide data communication functions in addition to facilitating provision of electricity to the device;

d) USB port: sources relatively low current, and generally provides data communication functions in addition to facilitating provision of electricity to or from the device.

NOTE There is no option for power to be fed in through the serial or parallel ports of any presently known electronic devices.

Consequently, there are three general types of configuration for power and data communication between a micro fuel cell power system and an electronic device, as shown in Figure 2, contemplated in this document:

1) stand-alone micro fuel cell power system: connected to the electronic device by way of an external connection, such as a cord or connection interface; can function in a similar manner as an AC adaptor, or must provide power (and/or data) by way of the USB port;

2) semi-integrated micro fuel cell power system: can operate in cooperation with a main battery, or with an auxiliary battery in an electronic device, or can function as a removable battery replacement;

3) integrated micro fuel cell power system: a micro fuel cell power system that is permanently installed in an electronic device. This type of micro fuel cell power system is outside of the scope of this document.

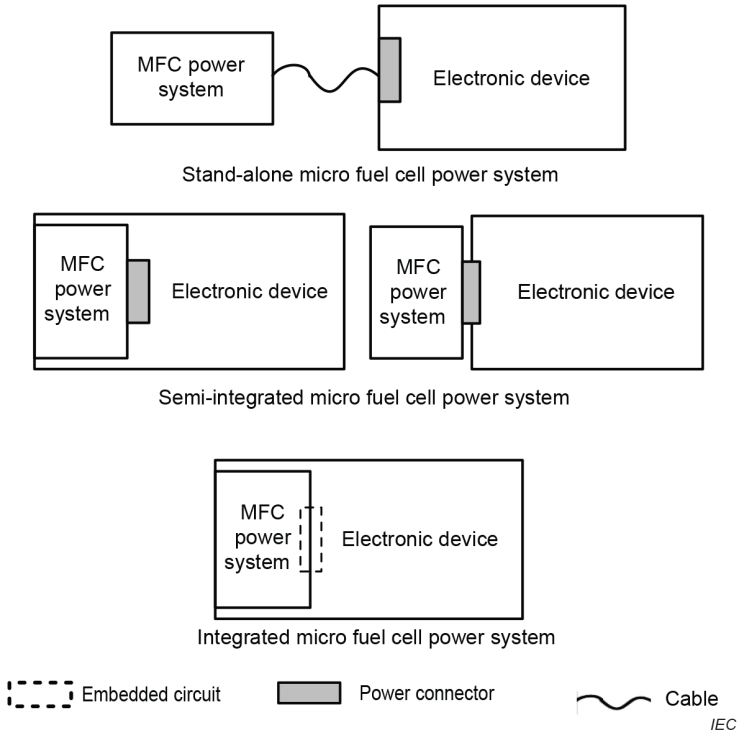

Figure 2 – Micro fuel cell power system configuration

4.2 Type of power hybridization

4.2.1 General

Subclause 4.2 applies only to the hybridization of micro fuel cell power systems and does not apply to micro fuel cell power systems that are not hybridized.

4.2.2 Micro fuel cell power system with internal battery

In this case, the micro fuel cell power system utilizes an internal battery within its enclosure. The micro fuel cell power system can operate as a stand-alone power generator or as an independent power source. For start-up, the internal battery shall be rated for the power required to start the micro fuel cell power system. If the internal battery is discharged, the micro fuel cell power system will prevent start-up until the internal battery is recharged or sufficient power is provided by an external source.

There are two methods to acquire the start-up power for the micro fuel cell power system:

a) an external charging port inside a compartment within the micro fuel cell power system. The external charging port can be used to charge the internal battery as well as provide power to start the micro fuel cell;

b) the required start-up power can be directly obtained from the internal battery; when dependent on the internal battery for start-up, the MFC power system shall monitor the battery SOC.

Four types of internal battery power configurations are shown in Figure 3.

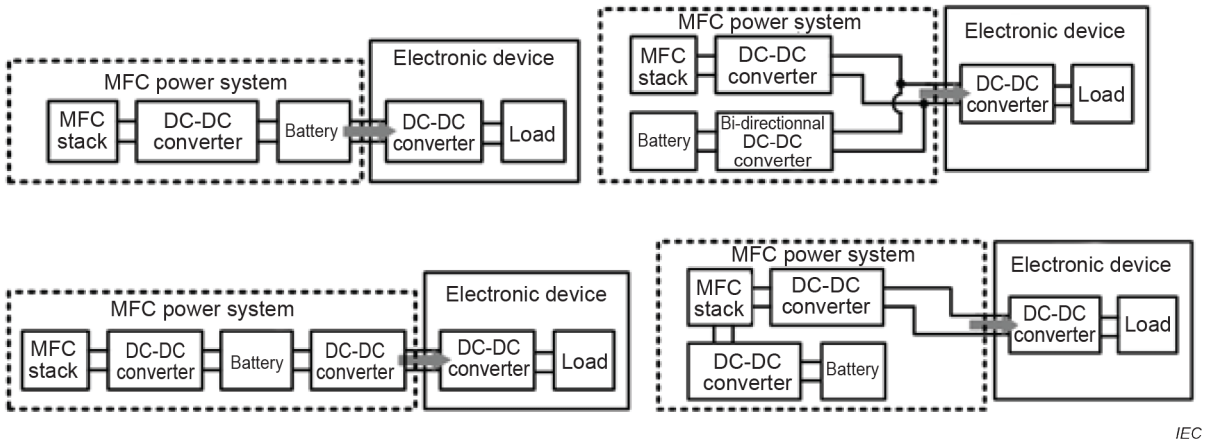

Figure 3 – Power hybridization of micro fuel cell power system with internal battery

4.2.3 Micro fuel cell power system without internal battery

Subclause 4.2.3 does not apply to micro fuel cell power systems where the input of any external power for start-up is not necessarily required, even without an internal battery as mentioned in 4.3.2.

A micro fuel cell power system may be connected to the electronic device for start-up purposes. If the micro fuel cell power system requires the input of external power for start-up, it shall draw power for start-up from the electronic device. In such a case, the micro fuel cell power system can monitor the available power and can prevent start-up if sufficient power is not available.

Two types of external battery power configurations are shown in Figure 4.

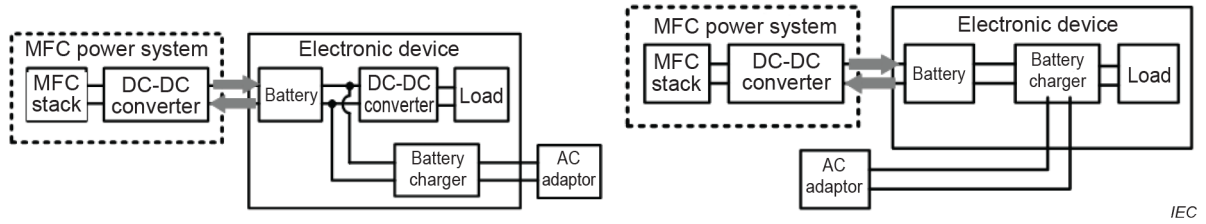

Figure 4 – Power hybridization of micro fuel cell power system without internal battery

4.3 Type of power connector

4.3.1 Micro fuel cell power system as battery replacement

A micro fuel cell power system is designed to have the same power connector configuration as a power connector in a battery system in electronic devices. The power manager in electronic devices can control power from three sources: an internal battery, an AC adaptor, and a micro fuel cell power system. The micro fuel cell power system can be mounted internally in the electronic devices or as an external system, but should include the power interface characteristics of a battery, such as the BMS.

An example of a block diagram between a micro fuel cell power system and electronic devices is described in Figure 5.

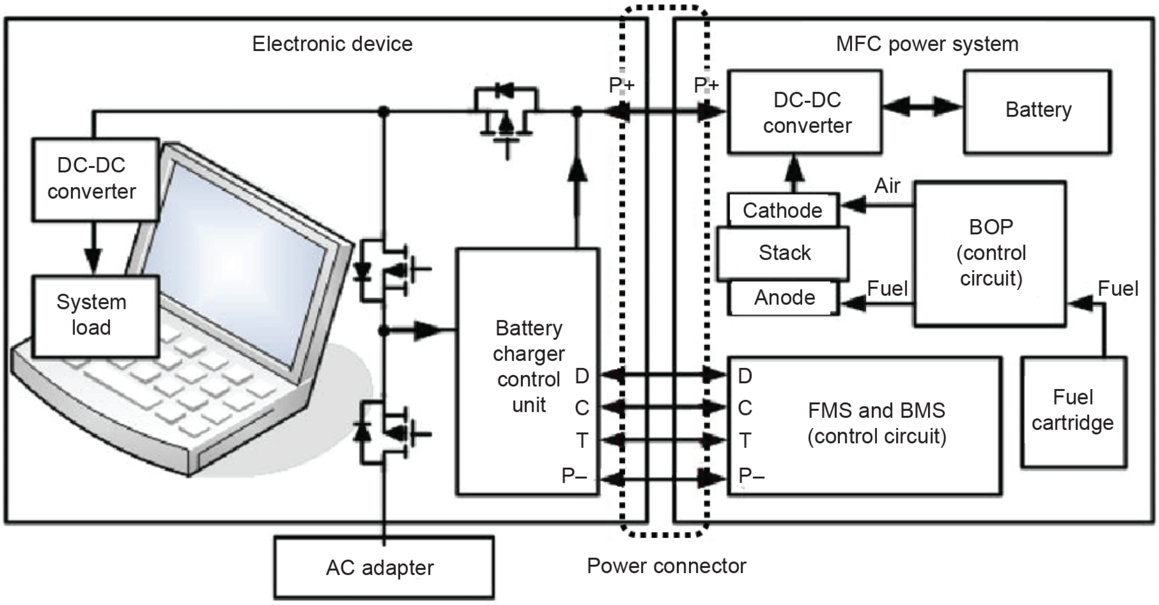

Figure 5 – Schematic diagram of power connection in the case of battery replacement

The fuel cell stack consists of multiple cells and the output voltage will vary with fuel flow, air flow and its operating temperature. The BOP consists of fuel pumps, fans, air compressors, sensors and other components needed to operate the fuel cell stack. The battery is used to power the BOP components during start-up and is recharged by the micro fuel cell power system after reaching operational conditions. The fuel cell controller manages the fuel and air to the stack through the BOP control circuit and protects the fuel cell stack by limiting the load so that the maximum fuel cell power limit is not exceeded. The fuel cell stack temperature is recorded by the temperature signals. The DC/DC converter is designed to maintain a constant power output when the current or voltage of the fuel cell stack is changed. The fuel cartridge can include memory components that act as a measurement of the fuel gauge level so that the fuel cell controller knows the fuel level in the cartridge. In this case, the power connector between the micro fuel cell power system and electronic device shall be designed with a battery connector as shown in Figure 6.

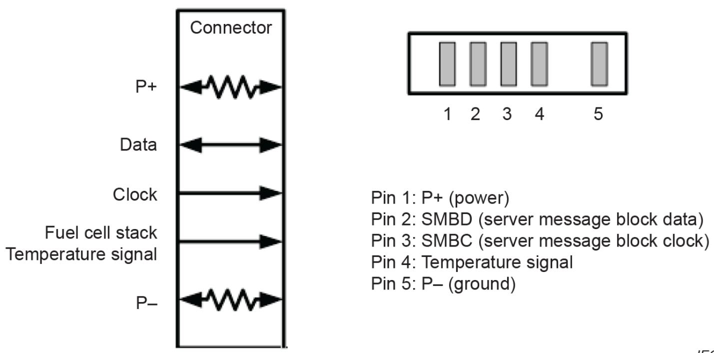

Figure 6 – Power connector of micro fuel cell power system as battery replacement

With regard to data communication between the micro fuel cell power system and electronic devices, the fuel cell controller is designed to have a communication port and data protocols. The details of the data interface are given in Clause 5.