

**AUTOMOTIVE INDUSTRY STANDARD OF THE
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**Compatibility of on-board battery swap system for battery
electric passenger vehicles - Part 4: Battery swap pack
(English Translation)**

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1 Scope

This document specifies the type, technical requirements, and test methods for refuelling communication protocol of fuel cell electric vehicles.

This document applies to fuel cell electric vehicles that use compressed gaseous hydrogen.

2 Normative references

The following referenced documents are indispensable for the application 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.

GB/T 24548, Fuel cell electric vehicles - Terminology

GB/T 26779, Hydrogen fuel cell electric vehicle refuelling receptacle

GB/T 34425, Fuel cell electric vehicles hydrogen refuelling nozzle

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 24548, GB/T 26779, GB/T 34425 as well as the followings apply.

3.1

refuelling communication protocol

During the hydrogen refuelling process, the communication specifications followed by the signal transmission between the fuel cell electric vehicle and the hydrogen refuelling machine via infrared devices.

NOTE: See Figure A.1 in Annex A for a schematic diagram of hydrogen refuelling communication.

3.2

infrared transmitter

A device used to convert serial data signals into infrared light signals for transmission.

3.3

infrared receiver

A device used to convert infrared light signals into serial data signals for reception.

3.4

bit error ratio

The ratio of the number of error bits in the data stream of a channel due to noise, interference, loss, or bit synchronization errors to the total number of bits transmitted over a period of time.

4.1 Abbreviations

The following abbreviations apply to this document.

Application Data. data packet

BOF. frame start character

CE. escape control character

EOF. end of frame character

FC. filling command

FCS. frame check sequence

ID. protocol identifier

MP. measured pressure

MT. measured temperature

OD. optional data

RT. hydrogen filling port type

TV. total nominal volume of hydrogen cylinder

VN. data communication software version number

XBOF. additional frame start character

4.2 Symbols

dn. Reference distance from the end face of the infrared receiver to the Z-plane.

dv. Reference distance from the end face of the infrared transmitter to the Z-plane.

rn. Distance between the center of the infrared receiver and the axis of the hydrogen refuelling nozzle.

rv. Distance between the center of the infrared transmitter and the axis of the hydrogen refuelling port.

alpha. Effective half-angle of the infrared transmitter.

beta. Effective half-angle of the infrared receiver.

gamma. Adjacent angles of the infrared receivers inside the infrared receiver.

5.1 Modulation method

A reverse return-to-zero modulation scheme is used. An optical pulse represents "0".

No optical pulse represents "1". The maximum pulse duration is 3/16 of the bit time, plus a tolerance of 0.6 μ s.

The working waveform is shown in Figure 1.

5.2 Byte frame

Each byte frame shall have one asynchronous start bit, eight data bits, and one stop bit.

Data bits are transmitted serially, starting with the least significant bit and ending with the most significant bit. The baud rate is 38400 b/s.

The byte frame format is shown in Figure 2.

6.1 Control characters

Control characters include XBOF, BOF, EOF, and CE.

6.2 Frame verification sequence

Data transmission is verified using a CRC-16 checksum. The frame check sequence field stores the CRC check value. The frame check sequence shall be transmitted with the least significant byte first, followed by the most significant byte.

6.3 Data link frame

Data packets are transmitted within data link frames. Each data link frame transmission shall contain 5 XBOF characters. A single BOF character shall be transmitted at the beginning of the data frame. Data packets shall begin transmission immediately after the BOF character. The frame check sequence field is sent immediately after the data packet, and the transmission ends with the EOF character.

The data link frame format is shown in Figure 3.

6.4 Escape characters

Before transmitting data link frames, the sending end shall escape any characters in the data bytes and frame check sequence field that are identical to control characters such as XBOF, BOF, EOF, and CE into non-control characters. If the receiving end receives the escaped control character CE (defined as 0x7D) in the data packet, it shall reverse the escape sequence.

The sending and receiving of control characters shall be escaped and unescaped in accordance with Annex C.

7.1 Data types

All transmitted data shall be in ASCII format.

7.2 Separators

Use the "|" delimiter to separate data segments. All valid data shall be contained between the two delimiters.

See Table 1 for a data example.

7.3 Tags

The two characters following the separator shall be a defined data label. All labels shall be case-sensitive. The third character following the separator shall be "=".

7.4 Character data

All defined character data shall exactly match the defined values and be case-sensitive.

7.5 Digital data

All defined numerical data shall be sent in a fixed format. Empty spaces shall be filled with "0". Data containing extra spaces or characters, or exceeding the defined range, shall be considered invalid.