BRITISH STANDARD

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Road vehicles — End-of-life activation of on-board pyrotechnic devices —

Part 1: General information and use case definitions

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BSI
British Standards

National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Road vehicles — End-of-life activation of on-board pyrotechnic devices —

Part 1: General information and use case definitions

Véhicules routiers — Activation de fin de vie des dispositifs pyrotechniques embarqués —

Partie 1: Informations générales et définitions de cas d'usage

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Foreword

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ISO 26021-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO 26021 consists of the following parts, under the general title *Road vehicles — End-of-life activation of on-board pyrotechnic devices*:

— *Part 1: General information and use case definitions*

— *Part 2: Communication requirements*

— *Part 3: Tool requirements*

— *Part 4: Additional communication line with bidirectional communication*

— *Part 5: Additional communication line with pulse width modulated signal*

NOTE Additional parts will be introduced as necessary to take into account requirements not yet covered by the standard.

Introduction

ISO 26021 describes a method for the in-vehicle deployment of pyrotechnically activated components (also referred to as pyrotechnic components or pyrotechnic devices) in cars.

Worldwide, nearly all new vehicles are equipped with one or more safety systems. Advanced protection systems using pyrotechnic actuators are becoming more common. All components which contain pyrotechnic substances should be handled in the same way.

Recycling of these vehicles requires a new process which ensures that the deployment of all the pyrotechnic components will be safe and cost-efficient. Based on the harmonization of the on-board diagnostics (OBD) interface, there is an opportunity to use this interface for on-board deployment, utilizing the same tools and processes.

The representatives of the global automobile industry have decided the following:

— automobile manufacturers do not support reuse as an appropriate treatment method for pyrotechnic devices;

— automobile manufacturers believe treatment of pyrotechnic devices is required before shredding;

— automobile manufacturers support in-vehicle deployment as the preferred method.

Based on this decision, the four major automobile manufacturer associations (ACEA, Alliance, JAMA and KAMA) started to develop a method for the in-vehicle deployment of pyrotechnic components in cars with the pyrotechnic device deployment tool (PDT). The vision is that, one day, a dismantler will need only one tool without any accessories in order to deploy all the pyrotechnic devices inside an end-of-life vehicle (ELV). The target is to use an existing interface to the car.

This International Standard has been developed in order to define common requirements for communication between the tool and the pyrotechnic control unit (PCU) when deploying pyrotechnic devices. This communication should use earlier standardized hardware and software. Based on emissions-related diagnostics (see ISO 15031-3), the physical layer specified for legislated OBD and the diagnostic connector was defined. The software used is an implementation of diagnostic services and transaction protocols on CAN.

Because of the automobile manufacturers' specific requirements and safety concepts, an additional communication line (ACL) may be used beside the basic CAN communication method. This line is usable in two different ways:

— as an additional communication line with bidirectional communication for additional communication functions;

— as an additional communication line with a pulse width modulated signal for hardware safing.

Although primarily intended for airbag deployment systems, ISO 26021 has also been developed to meet requirements for other pyrotechnically activated systems.

To achieve this, this International Standard makes use of on-board diagnostics and is based on the open systems interconnection (OSI) basic reference model in accordance with ISO/IEC 7498-1 and ISO/IEC 10731 which structures communication systems into seven layers. When mapped on this model, the services used by a diagnostic tester (client) and an electronic control unit (ECU) (server) are broken down in accordance with Table 1, as follows:

— a pyrotechnic devices deployment application using application services, specified in this International Standard;

— application services (layer 7), specified in ISO 14229-1;

— communication services (layers 1 to 6).

Table 1 — Deployment of pyrotechnic devices — Specifications applicable to the OSI layers

Applicability	OSI layer	Airbag deployment application
Seven layers in accordance with ISO/IEC 10731	User application	ISO 26021-1
	Application (layer 7)	ISO 14229-1/ISO 15765-3
	Presentation (layer 6)	—
	Session (layer 5)	ISO 14229-1
	Transport (layer 4)	ISO 15765-2
	Network (layer 3)	ISO 15765-2
	Data link (layer 2)	ISO 11898/ISO 26021-4 and ISO 26021-5
	Physical (layer 1)	ISO 11898/ISO 26021-4 and ISO 26021-5

For the deployment of pyrotechnic devices via on-board diagnostics by a dismantler, it is required that future modifications to this International Standard provide long-term backwards compatibility.

Road vehicles — End-of-life activation of on-board pyrotechnic devices —

Part 1:
General information and use case definitions

1 Scope

This part of ISO 26021 gives an overview of the structure of ISO 26021 and the way it has been divided into parts, as well as showing the relationship between the parts. In addition, it outlines the use case scenarios in which the ISO 26021 document set will be used. It also defines terminology that is used throughout the ISO 26021 document set.

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.

ISO/IEC 7498-1, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*

ISO/IEC 10731, *Information technology — Open Systems Interconnection — Basic Reference Model — Conventions for the definition of OSI services*

ISO 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Specification and requirements*

ISO 15031-3, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 3: Diagnostic connector and related electrical circuits, specification and use*

ISO 15765-2, *Road vehicles — Diagnostics on Controller Area Networks (CAN) — Part 2: Network layer services*

ISO 15765-3, *Road vehicles — Diagnostics on Controller Area Networks (CAN) — Part 3: Implementation of unified diagnostic services (UDS on CAN)*

ISO 15765-4, *Road vehicles — Diagnostics on Controller Area Networks (CAN) — Part 4: Requirements for emissions-related systems*

ISO 26021-2, *Road vehicles — End-of-life activation of on-board pyrotechnic devices — Part 2: Communication requirements*

ISO 26021-4, *Road vehicles — End-of-life activation of on-board pyrotechnic devices — Part 4: Additional communication line with bidirectional communication*

ISO 26021-5, *Road vehicles — End-of-life activation of on-board pyrotechnic devices — Part 5: Additional communication line with pulse width modulated signal*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14229-1 and the following apply.

3.1
activation/deployment of pyrotechnic devices
burning off all pyrotechnic substances inside an end-of-life vehicle to activate/deploy the devices concerned, the aim being to avoid any device containing such substances coming into the shredding process

3.2
emissions-related diagnostic
specific element of the on-board diagnosis in accordance with ISO 14229-1 and ISO 15031-3

3.3
end-of-life vehicle
ELV
vehicle prepared to be scrapped [e.g. as defined in Article 1(a) of Directive 75/442/EEC], but containing all essential components necessary for normal usage

NOTE This means that the communication network and the power supply to the pyrotechnic devices in the vehicle are functioning.

3.4
pyrotechnic control unit
PCU
electronic control unit in the vehicle network which controls the activation of pyrotechnic devices

3.5
pyrotechnic device deployment tool
tool designed to be plugged into the OBD interface in order to communicate via the internal computer network in an end-of-life vehicle with all control units which are able to activate pyrotechnic devices

NOTE This tool will comprise e.g. a computer, a connection between the computer and the diagnostic connector, and some software.

3.6
safing
mechanism whose primary purpose is to prevent an unintended functioning of the PCU processor prior to detection of a crash situation

3.7
safing unit
part of the PCU (e.g. an electromechanically operated switch or a separate processor) that allows the pyrotechnic component deployment microprocessor (µP) to deploy the pyrotechnic devices via the driver stage

4 Symbols and abbreviated terms

ACL additional communication line

CAN controller area network

ELV end-of-life vehicle

OBD on-board diagnostics

PCU pyrotechnic control unit

PDT pyrotechnic device deployment tool

RAM random access memory

SRS supplementary restraint system

µP microprocessor

5 Conventions

ISO 26021 is based on the conventions for the definition of OSI services (see ISO/IEC 10731) as they apply to diagnostic services.

6 Document overview

The ISO 26021 document set provides an implementer with all documents and references required to support the end-of-life activation of on-board pyrotechnic devices in accordance with the requirements of relevant national legislation for the handling and storage of pyrotechnic devices in vehicles.

— ISO 26021-1 (this part) gives general information and use case definitions. It provides an overview of the document set along with use case definitions and a common set of resources (definitions, references) for use with all subsequent parts.

— ISO 26021-2 gives a description of the general communication requirements when no additional communication line (ACL) is used. The general purpose is communication between tool and control unit by standard diagnostic services.

— ISO 26021-3 specifies the requirements for the PDT, based on the functionality of the PCU and the communication network. In addition, it defines the functionality test method (hardware/software).

— ISO 26021-4 specifies an additional communication line with bidirectional communication and describes the specific requirements for this communication method which uses a direct HW connection between tool and PCUs.

— ISO 26021-5 specifies an additional communication line with a pulse width modulated signal. It uses the direct HW connection described in ISO 26021-4 for systems with a specific safing concept.

7 Use case descriptions

7.1 Overview

The end-of-life activation of on-board pyrotechnic devices is, apart from actual removal, the only method of making sure that no pyrotechnical substances are left in an ELV. On-board activation is deemed to be the most effective and the safest method. To avoid a dismantler needing different tools, or at least different adapters, for different vehicles, the diagnostic connector was selected as the hardware connector to the vehicle.

To have visual and audible verification that activation has been carried out successfully, it is necessary to deploy the pyrotechnic devices one by one. In the case of dual-stage devices, it may nevertheless not be possible after activation to detect whether both stages have been deployed.

To make sure that this sequential activation is only performed by authorized persons with a specific deployment tool, several security mechanisms are included in this International Standard:

— the concept defined in this International Standard assumes that full access is only granted to the vehicle via an adequate identification method (e.g. ignition key, keyless entry unit);

— the PCU deployment software is stored in a non-executable form during normal operational conditions;

— access to the communication between the PDT and the PCU to make the software executable and to execute it is subject to a defined level of security;

— a minimum set of preconditions has to be met for the PCU to enable the deployment process (for a detailed description, see ISO 26021-2);

— if technically required by the PCU hardware, alternative security mechanisms (as defined in ISO 26021-4 or ISO 26021-5) can be performed via the ACL.

The principles described cover vehicles with a supply voltage of 12 V or 24 V.

All types of vehicle (including heavy-duty vehicles) which comply with ISO 14229-1 and the relevant parts of ISO 15765, irrespective of the underlying internal CAN network architecture (e.g. SAE J1939), come within the scope of this specification.

7.2 End-of-life activation of on-board pyrotechnic devices — Use cases

7.2.1 Use case summary

The following is a summary of the use cases applicable to pyrotechnic device systems:

— **Use case 1: Information about standard communication** — The purpose of this use case is to describe activation without any direct hardware connector to the PCUs.

— **Use case 2: Information about use of the ACL as a data communication line** —The purpose of this use case is to specify the additional requirements needed for this method of communication.

— **Use case 3: Information about use of the ACL as a signal wire** — The purpose of this use case is to describe the signal used for hardware safing.

Any combinations of these three use cases are valid. Thus the following combinations are allowed:

— use case 1;

— use cases 1 and 2;

— use cases 1 and 3;

— use cases 2 and 3;

— use cases 1, 2 and 3.

7.2.2 Use case 1: Information about standard communication

For the deployment of all the pyrotechnic devices in an ELV, it is necessary to cause all PCUs in the vehicle to activate the pyrotechnic devices. Because it is not certain that, in future, the functions related to pyrotechnic devices will be concentrated in specific hardware components, it is necessary to communicate with all relevant ECUs in a vehicle in a defined way. The same principles of communication will be used as in on-board diagnosis. This ensures no additional costs are incurred.

7.2.3 Use case 2: Information about use of the ACL as a data communication line

Some specific PCUs require additional communication for pyrotechnic device activation. Therefore, an ACL is used for this additional communication.

7.2.4 Use case 3: Information about use of the ACL as a signal wire

Some specific PCUs require an additional electric signal for pyrotechnic device activation. This so-called hardware safing is used to meet specific technical requirements.

8 Airbag deployment via on-board diagnostic architecture

8.1 Configuration

ISO 26021 is based on a vision of the airbag deployment network architecture that is described below.

The airbag deployment network, taken as a whole, contains all the clients and servers that can communicate with each other. This airbag deployment network is based on the diagnostic network architecture defined in ISO 14229-1. The connection from the client to the server in the vehicle is ensured by a physical CAN which fulfils the requirements of airbag deployment and legislative OBD and is connected to the diagnostic connector.

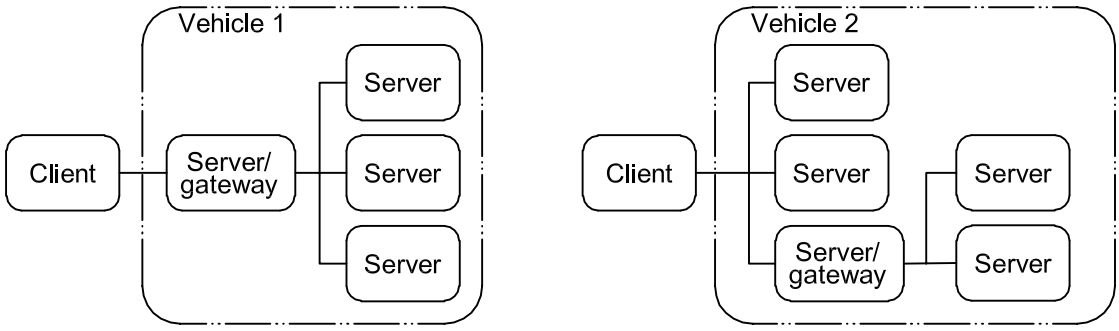
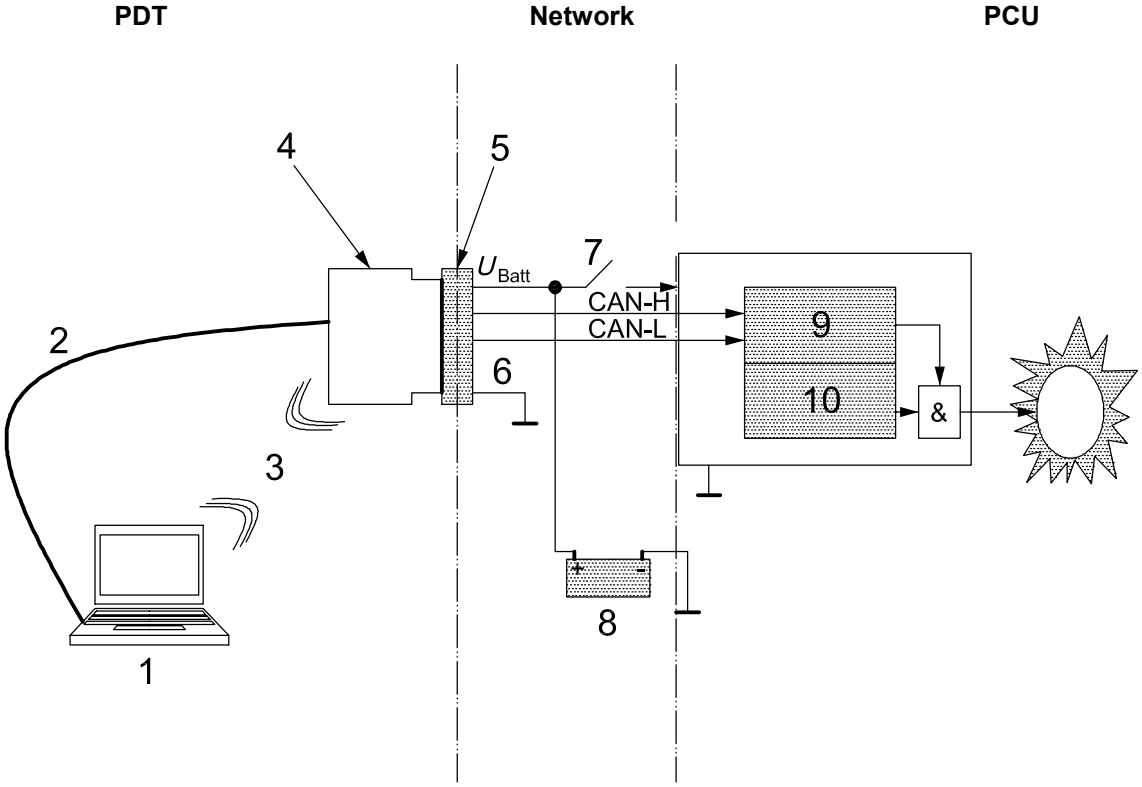


Figure 1 — Example of a vehicle diagnostic architecture

An airbag deployment network can range from a simple point-to-point connection between a client and a server to a complex distributed network architecture with several physical sub-networks connected together by diagnostic gateways.

8.2 Example of a basic configuration

An example of a basic configuration of an airbag deployment network with a single point-to-point connection is shown in Figure 2.



Key

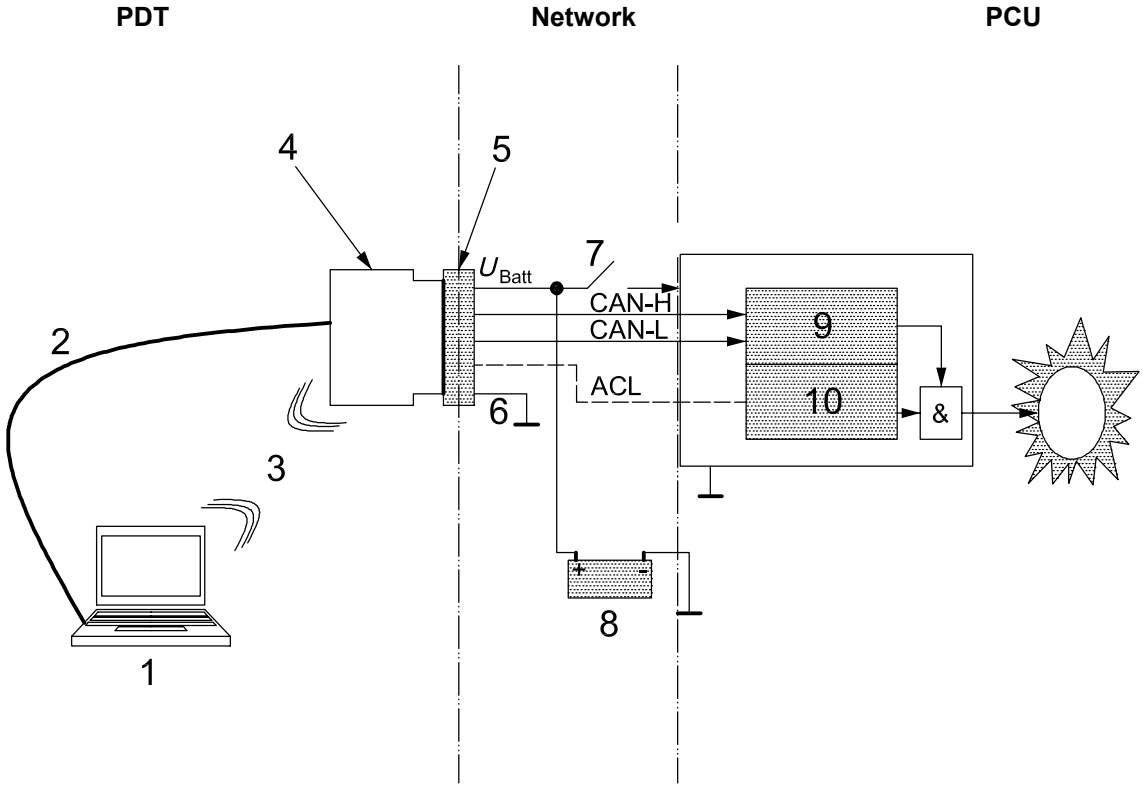
1 user interface (PC-based or separate unit)
2 wire connection
3 wireless link (optional)
4 PDT connection interface
5 diagnostic connector
6 to ground
7 ignition key, for instance
8 vehicle battery or external power source
9 main microprocessor
10 safing unit

Figure 2 — Typical configuration with PDT and PCU

8.3 Additional communication line

8.3.1 Example of a hardware configuration with an ACL

For specific system requirements, an ACL signal can be used, as shown in Figure 3.



Key

1 user interface (PC-based or separate unit)
2 wire connection
3 wireless link (optional)
4 PDT connection interface
5 diagnostic connector
6 to ground
7 ignition key, for instance
8 vehicle battery or external power source
9 main microprocessor
10 safing unit

Figure 3 — Typical configuration with PDT, PCU and ACL

8.3.2 Use of the ACL as a bidirectional communication line

ISO 26021-4 defines the requirements for a special communication line which will ensure that all pyrotechnic components are deployed.

8.3.3 Use of the ACL for pulse width modulated signals

ISO 26021-5 defines the requirements of redundant hardware or software systems independent of the CAN line which are activated by the ACL hardware line.

Bibliography

[1] ISO 11898 (all parts), *Road vehicles — Controller area network*

[2] Council Directive 75/442/EEC of 15 July 1975 on waste

[3] SAE J1939, *Recommended Practice for a Serial Control and Communications Vehicle Network*

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