INTERNATIONAL STANDARD

ISO 26021-5

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

Part 5: Additional communication line with pulse width modulated signal

Véhicules routiers — Activation de fin de vie des dispositifs pyrotechniques embarqués —
Partie 5: Ligne de communication additionnelle avec signal modulé par largeur d'impulsion

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 26021-5 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*

Introduction

Worldwide, nearly all new vehicles are equipped with one or more safety systems. This can include advanced protection systems based on pyrotechnic actuators. All components which contain pyrotechnic substances can be handled in the same way.

Recycling these vehicles demands a new process to ensure that the deactivation of airbags is safe and cost-efficient. Due to the harmonization of the on-board diagnostic (OBD) interface, there is a possibility of using it for on-board deployment, which is based on the same tools and processes.

Representatives of the global automobile industry agreed that automobile manufacturers

— do not support reuse as an appropriate treatment method for pyrotechnic devices,

— believe treatment of pyrotechnic devices is required before shredding, and

— support in-vehicle deployment as the preferred method.

Based on this agreement, the four big associations of automobile manufacturers (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 objective is that in the future a dismantler will use only one tool without any accessories to deploy all pyrotechnic devices inside an end-of-life vehicle (ELV) by using an existing interface to the car.

Because of different requirements and safety concepts an additional communication line (ACL) is added to the basic controller area network (CAN) communication method. In this part of ISO 26021 ACL is used to mean an additional communication line with pulse width modulated signal. This direct hardware (HW) connection is used for systems with a specific safing concept, to bypass it and then enable the deployment of such systems.

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Part 5:
Additional communication line with pulse width modulated signal

1 Scope

This part of ISO 26021 defines the requirements of redundancy hardware or software systems independent from the CAN line which are activated by the ACL hardware line.

It also describes the additional sequences of the deployment process, and the technical details for the direct hardware connection between pyrotechnic device deployment tool (PDT) and pyrotechnic control unit (PCU).

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

SO 14230-1, *Road vehicles — Diagnostic systems — Keyword Protocol 2000 — Part 1: Physical layer*

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 15031-5, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 5: Emissions-related diagnostic services*

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

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
PWM
pulse width modulation
signal linked by the ACL to the independent hardware path in the PCU

NOTE The PWM signal is active during the deployment session.

4 Abbreviated terms

ACL	additional communication line
GND	ground signal
HW	hardware
µC	microcontroller
OBD	on-board diagnostics
PCU	pyrotechnic control unit
PDT	pyrotechnic device deployment tool

5 Conventions

ISO 26021 is based on the conventions discussed in the OSI service conventions (ISO/IEC 10731) as they apply for diagnostic services.

6 Pyrotechnic device deployment via on-board diagnostic architecture

6.1 Vehicle system description

ISO 26021 is based on an envisaged diagnostic network architecture in combination with the PCU deployment architecture, as described in this subclause.

ISO 26021-2 defines the mandatory vehicle-interface of the PCU and PDT. The PCU is connected with the vehicle diagnostic connector and the communication specifications comply with ISO 15765-3 and ISO 15765-4. The PDT communicates with the PCU on CAN_H and CAN_L and enables deployment with the pulse width modulated signal.

Depending upon the vehicle-specific architecture, the mandatory link of the PCU may be connected via a gateway to the OBD connector, thus a CAN interface in the PCU for the mandatory link may not be required.

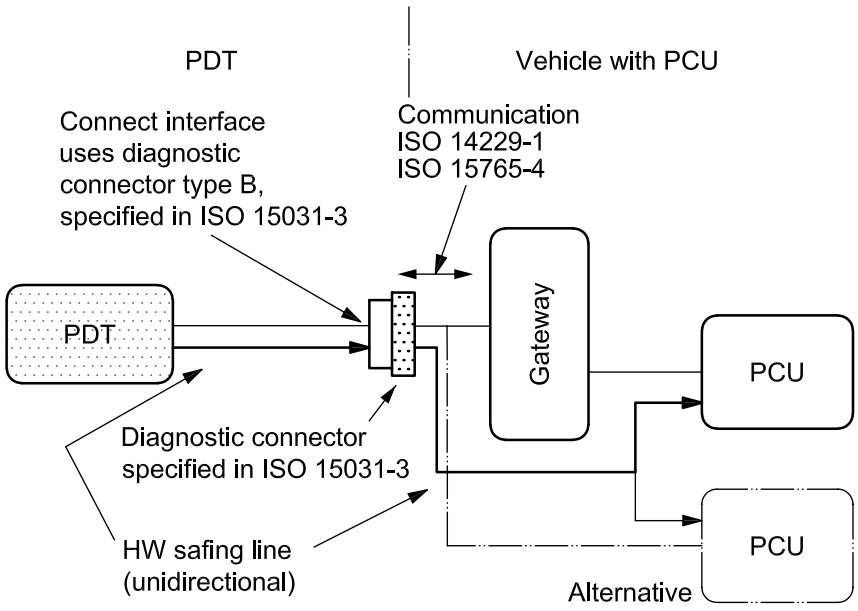


Figure 1 — Access to the vehicle via diagnostic connector

6.2 Example of in-vehicle hardware and software provision

To execute the on-board deployment via the diagnostic link, the PCU software shall have full access to the output driver stage, which controls the deployment loops. To achieve this, the safing path is controlled via the ACL line with a PWM signal.

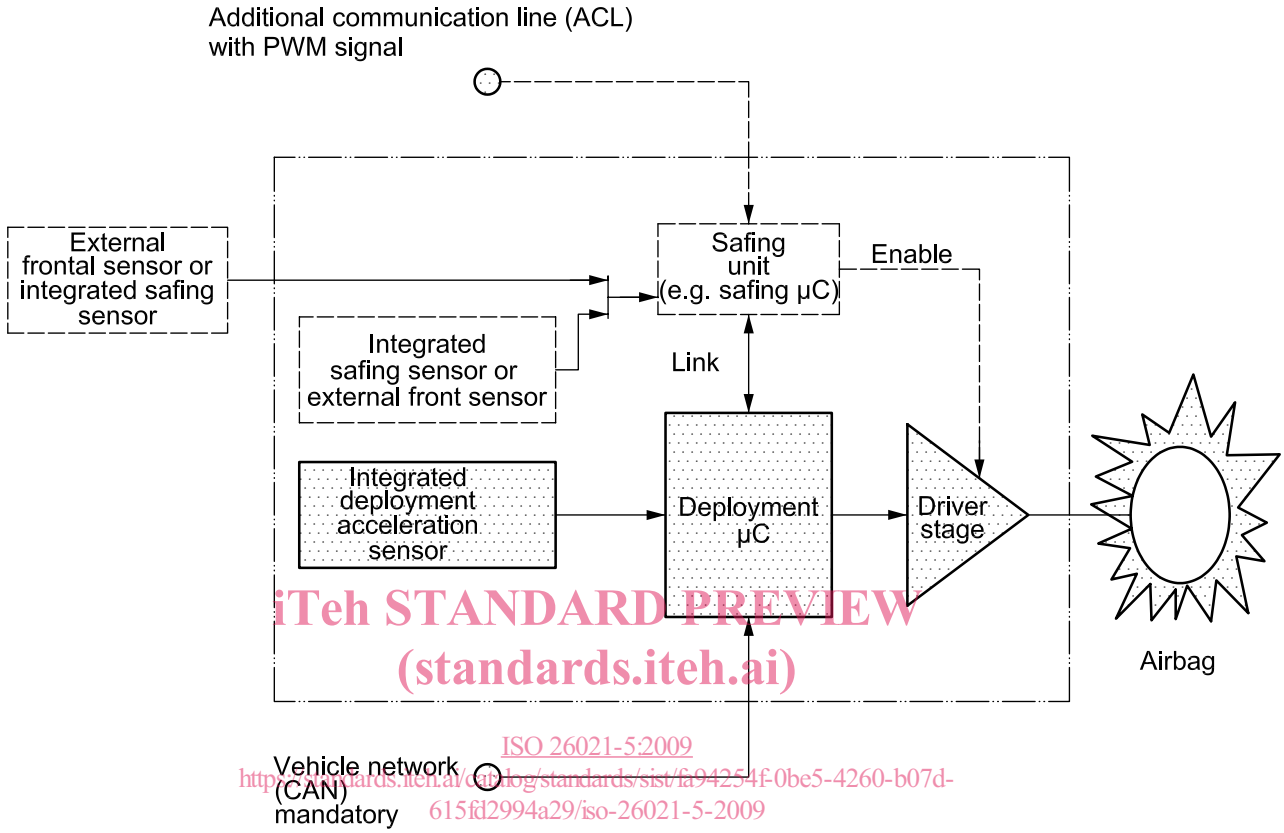


Figure 2 — Overview of hardware and software provision

6.3 Additional communication line

Depending on the hardware architecture of the PCU the additional signal is used. General requirements for the interface between deployment sequence and ACL sequence are given in Clause 7.

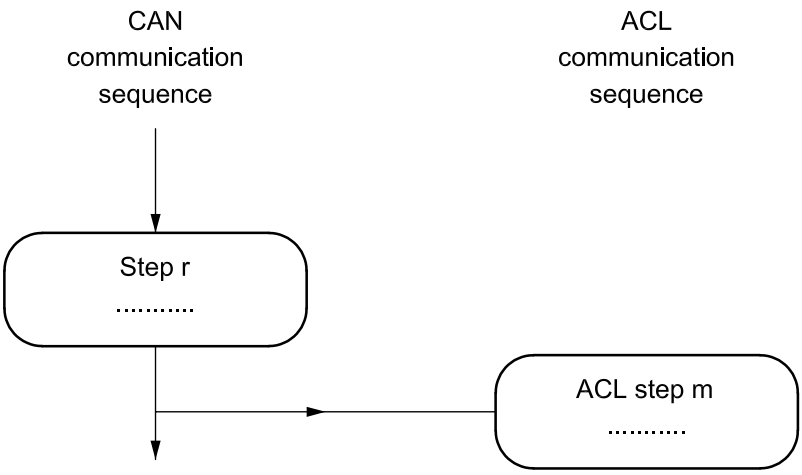


Figure 3 — Integration of ACL communication into deployment process

The standardized steps specify the diagnosis sequence. The ACL communication step m is the specified place to enable the hardware safing possibility.

7 ACL with PWM specification

7.1 Hardware description

The total impedance and capacitance of the ACL input circuit of the PCU shall be compliant with ISO 14230-1.

The PDT generates a PWM signal (see 7.4) that is connected over the diagnostic connector to the ACL input at the PCU. In previous systems this pin at the diagnostic connector was the L communication line.

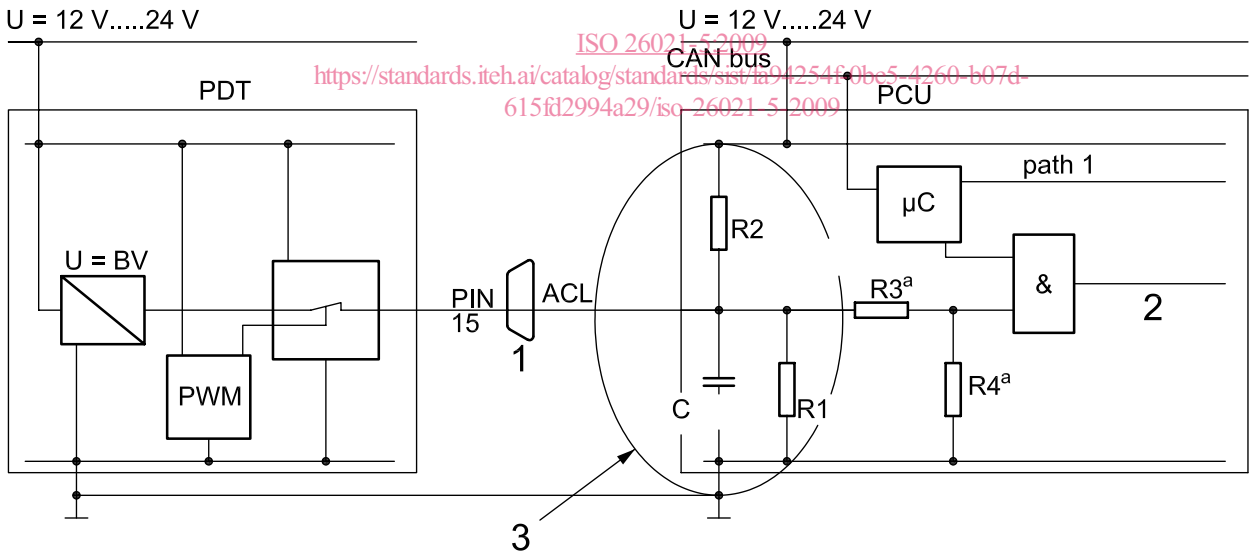
The signal level in the PCU can be adapted to the control unit's specific levels by an additional circuit (for example, voltage divider R3, R4).

The total ACL input resistance of $\geqslant 50\ \text{k}\Omega$ and the input capacitance of less than 500 pF shall not be influenced by this internal circuit.

To protect against interferences by any scan tool, the ACL can optionally be AND-gated with an enable signal generated by the CAN disposal mode.

In case of AND-gate use, when the PCU is not in the disposal mode, the PWM signal will be ignored as long as there is no disposal signal detected on the CAN bus.

The output stage of the PDT has to provide up to 10 disposal devices and it has to be short-circuit-proof to GND and plus.



Key

1 OBD connector
2 redundancy path
3 K/L line in accordance with ISO 14230-1

[a] Optional.

Figure 4 — Example of a hardware interface

7.2 PCU hardware compatibility to the L line

The ACL uses on the diagnostic connector the same pin as the L communication line in older devices for the diagnostic function. The hardware of the ACL input circuit fulfils the requirements of the L line specification ISO 14230-1, so there is no influence on any scan tool in the field.

If used, an AND-gate decouples the PWM signal from the PCU in normal mode. Not until the disposal information from the CAN bus is changed to a logic signal and led to the AND-gate will the PWM signal be transferred to the redundancy path of the PCU.

This prevents the PCU from switching in the disposal mode when a signal very similar to the PWM signal appears on the ACL line.

It is possible to mix control units with L line communication and/or control units with ACL without any interference.

7.3 Allowed supply voltage

The allowed supply voltage at the PCU depends on the voltage system that is used. The supply voltage must be higher than, or equal to, the nominal voltage of the airbag system but within the allowed limits. In case of a 12 V system the supply voltage must be higher than, or equal to, 12 V.

The ground offset between the PDT and the PCU must not be greater than 0,5 V.

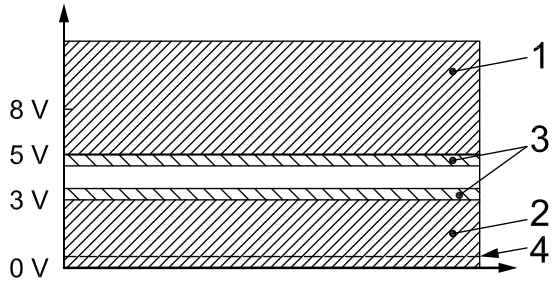
7.4 Signal description

The ACL signal is a continuous PWM voltage signal from the PDT which switches between low level and high level of the signal to be transferred.

In the PCU a voltage range from 0 V to 3 V is interpreted as low level and a voltage equal to or above 5 V is interpreted as high level (see Figure 5, parts labelled 1 and 2). The recommended tolerance range for the low level is 3 V to 3,5 V and, for the high level, is 4,5 V to 5 V. The voltage above 3 V + 0,5 V and below 5 V – 0,5 V shall not be interpreted as a valid signal by the PCU.

NOTE The recommended tolerance range of 0,5 V can vary depending on the hardware that is used, but an invalid voltage range can be introduced so there is no direct transition from high- to low-level voltage.

The signal voltage is defined as a fixed voltage, as the PCU and PDT can be provided by different supply voltages and are only connected by the GND line and the ACL.



Key

1 high level
2 low level
3 tolerance range 0,5 V
4 maximum 0,5 V offset

Figure 5 — PCU input level