JASO

Automobiles - Clock Extension Peripheral Interface (CXPI) -Part 4: Unified Diagnostic Services on Clock Extension Peripheral Interface (UDSonCXPI)

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FOREWARD

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There are following part in the **JASO D015**.

JASO D 015-1 Part1：General Information and Use Cases Definition
JASO D 015-2 Part2：Transport Protocol and Network Layer Services
JASO D 015-3 Part3：Protocol Specification
JASO D 015-4 Part4：Unified Diagnostic Services on Clock extension peripheral interface (UDSonCXPI)
JASO D 015-5 Part5：Protocol Conformance Test Specification

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Japanese Automobile Standard

JASO
D 015-4: 2016

Automobiles - Clock Extension Peripheral Interface(CXPI)

- Part 4: Unified diagnostic services on Clock Extension Peripheral Interface (UDSonCXPI)

INTRODUCTION

The objective of this standard "Clock Extension Peripheral Interface" (abbreviation: CXPI) communication protocol is to define a specification which enables the arbitration without destructing even if the protocol sends the PWM (Pulse Width Modulation) waveform which is superimposed the data and clock on communication bus and also the multiple peripherals send the UART (Universal Asynchronous Receiver Transmitter) at the same time.

1 SCOPE

This standard defines the CXPI communication protocol for mainly HMI (Human Machine Interface) of road vehicles electric system. UDSonCXPI defines how to implement the diagnostic data transfer between a client and CXPI slave nodes via CXPI master node.

2 REFERENCES

The following standards contain sections which, through reference in this text, constitute sections of this standard. For dated references, it shall apply the version but not the revised version (including the supplemental version). For the undated references, the latest edition of the normative document referred to applies (including the supplemental version).

JASO D 015-2:2016 Automobiles - Clock Extension Peripheral Interface (CXPI) - Part 2: Transport Protocol and Network Layer Services

JASO D 015-3:2015 Automobiles - Clock Extension Peripheral Interface (CXPI) - Part 3: Protocol specification

JASO D 015-5:2015 Automobiles - Clock Extension Peripheral Interface (CXPI) - Part 5: Protocol conformance test specification

JIS X 0001: 1994 Glossary of terms used in information processing - Fundamental terms

JIS X 0005: 2002 Glossary of terms used in information processing (Representation of data)

JIS X 0009: 1997 Glossary of terms used in information processing (Data communication)

JIS X 0025: 1994 Glossary of terms used in information processing (Local area networks)

JIS X 0026: 1995 Glossary of terms used in information processing (Open Systems Interconnection)

ISO 11898-1, Road vehicles - Controller area network (CAN) - Part1: Data link layer and physical signalling

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ISO 14229-1:2013, Road vehicles - Unified diagnostic services (UDS) - Part 1: Specification and requirements

ISO 14229-2:2012, Road vehicles - Unified diagnostic services (UDS) - Part 2: Session layer services

ISO 15765-2, Road vehicles - Diagnostics over Controller area network (DoCAN) - Part2 ： Transport protocol and Network Layer Services

3 TERMS AND DEFINITIONS

For the purposes of this standard, the following terms and definitions, other than those given in **JIS X 0001**, **JIS X 0005**, **JIS X 0009**, **JIS X 0025**, **JIS X 0026** and **JASO D 015** (all parts) apply.

4 SYMBOLS AND ABBREVIATED TERMS

4.1 Abbreviated Terms

AE	Address Extension
ID	IDentifier
NAD	Node ADdress for slave nodes
SF	Single Frame
UART	Universal Asynchronous Receiver Transmitter

5 UDSonCXPI implementation requirements

5.1 General

This clause defines how the diagnostic services, as defined in **ISO 14229-1**, are applied on CXPI.

To allow a common implementation of application layer and session layer for **JASO D 015** and other communications this part of **JASO D 015** uses the session layer protocol as defined in **ISO 14229-2** and focuses on necessary modifications and interfaces to adopt it to **JASO D 015** series documents.

The sub-function parameter definitions take into account that the most significant bit is used for the suppressPosRspMsgIndicationBit parameter as defined in **ISO 14229-1**.

It is the vehicle manufacturer’s responsibility to setup the CXPI master and slave nodes to exchange UDSonCXPI information according to **JASO D 015** series documents.

5.2 Definition of diagnostic classes

5.2.1 General

Architectural, diagnostic communication performance and transport protocol requirements of slave nodes are accommodated by classifying diagnostic services functionality into three diagnostic classes.

Therefore, a diagnostic class is assigned to each slave node according to its level of diagnostic functionality and complexity.

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5.2.2 Diagnostic class I

Smart and simple devices like intelligent sensors and actuators, requiring none or very low amount of diagnostic functionality. Actuator control, sensor reading and fault memory handling is done by the master node, using signal carrying frames. Therefore, specific diagnostic support for these tasks is not required. Fault indication is always signal based.

5.2.3 Diagnostic class II

A diagnostic class II slave node is similar to a diagnostic class I slave node, but it provides node identification support. The extended node identification is normally required by vehicle manufacturers. Testers or master nodes use **ISO 14229-1** diagnostic services to request the extended node identification information. Actuator control, sensor reading, and fault memory handling is done by the master node, using signal carrying frames. Therefore, specific diagnostic support for these tasks is not required. Fault indication is always signal-based.

5.2.4 Diagnostic class III

Diagnostic class III slave nodes are devices with enhanced application functions typically performing their own local information processing (e.g. function controllers, local sensor/actuator loops). The slave nodes execute tasks beyond the basic sensor/actuator functionality and, therefore, require extended diagnostic support. Direct actuator control and raw sensor data are often not exchanged with the master node and, therefore, not included in signal carrying frames. **ISO 14229-1** diagnostic services for I/O control, sensor value reading, and parameter configuration (beyond node configuration) are required.

Diagnostic class III slave nodes have internal fault memory, along with associated reading and clearing services. Optionally, reprogramming (flash/NVRAM reprogramming) of the slave node is possible. This requires an implementation of a boot loader and necessary diagnostic services to unlock the device initiate downloads and transfer data, etc.

The primary difference between diagnostic class II and diagnostic class III is the distribution of diagnostic capabilities between the CXPI master node and the CXPI slave node for diagnostic class II while for a diagnostic class III CXPI slave node, no diagnostic application features of the CXPI slave node are implemented in the CXPI master node.

5.3 CXPI node requirements

5.3.1 Master node requirements

5.3.1.1 Master message routing

The master node usually is a high performance ECU and, in most implementations, supports the **ISO 14229-1** diagnostic services. The master node and the external test equipment are connected through a backbone bus (e.g. **ISO 11898-1**). The master node shall receive all diagnostic requests addressed to the slave nodes from the backbone bus and route them to the appropriate CXPI cluster (s). Responses from the slave nodes shall be routed back to the backbone bus through the master node.

All diagnostic request and response messages addressed to the slave nodes can be routed in the network layer (i.e.

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no application layer routing). The master node shall implement the CXPI transport protocol (see **JASO D 015-2**) as well as the transport protocols used on the backbone busses (e.g. **ISO 15765-2**).

5.3.1.2 Master node fault management, sensor reading, I/O control

Diagnostic class I and diagnostic class II slave nodes (see **JASO D 015-2**) provide signal-based fault information and sensor, I/O access through signal carrying frames. The CXPI master node is responsible to handle the slave nodes signal based faults and handle the associated DTCs. The CXPI master node serves UDS requests directly to the client/tester and acts as a diagnostic application layer gateway. UDS services provide access to the sensor/actuator signals on the CXPI bus.

Diagnostic class III slave nodes (see **JASO D 015-2**) are independent diagnostic entities. The CXPI master node does not implement diagnostic services for the diagnostic capabilities of its diagnostic class III slave nodes.

5.3.2 Slave node requirements

Slave nodes are typically electronic devices that are not involved in a complex data communication. Also, their need of distributing diagnostic data is low. However, most slave nodes shall transmit simple diagnostic information such as error indications in signal carrying frames.

Although diagnostics and node configuration services use the same frame IDs, i.e. 0x1F (master request frame) and 0x5F (slave response frame), different services are used for configuration and diagnostics. Node configuration can be performed by the master node independently while diagnostic services are always routed on request from external or internal test equipment. Only slave nodes have an NAD. The NAD is also used as the source address in a diagnostic slave response frame.

NOTE There is a one-to-many mapping between a physical node and a logical node and it is addressed using the NAD.

5.4 Signal-based diagnostics

5.4.1 Slave implementation

Signal-based diagnostics are implemented by slave nodes (diagnostic class I and II), which do not implement a fault memory and the diagnostic protocol to directly access this fault memory from an external test tool.

There are two types of failure transmission through signal carrying frames.

a) Type 1 failure information is periodically transmitted and encoded into an existing signal (e.g. upper values of signal range used to indicate specific failure conditions) by the slave node. A type 1 failure use case-specific and defined by vehicle manufacturers and is not part of this International Standard.

b) Type 2 failure information is not periodically transmitted for components which do not generate a signal that is periodically transmitted (e.g. slave node internal failure). Additional signal-based failure transmission shall be

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implemented for type 2 failures (i.e. if a slave node is capable of locally detecting faults which are not transmitted through the associated signal in signal carrying frames already).

Each slave node shall transmit the failure status information that is monitored by the slave node to the master node through signal carrying frames. The status information shall contain the current failure status of the slave nodes' components. The signal shall support the states as defined in **Table 1**.

Table 1 - Signal-based fault states

Test result	Description
No test result	no test execution available, default, initialization value
Failed	-
Passed	-

If a slave node implements more than one independent function, a status signal can be assigned to each function. In this case only the failing function could be disabled by the application.

The fault state signals are set in the status management (See **JASO D 0152-2**).

5.4.2 Master implementation

A failure status signal shall be assigned for each failure that would result in a separate DTC in the master node.

This information is used to indicate a failure of one of the components to the master node's application, which can then store the associated DTC. There should be one signal per replaceable component to simplify repair and maintenance of the vehicle.

5.5 Tool suite support

The implementation of diagnostic services in CXPI nodes, using the transport protocol and network layer services, may be supported by a tool suite, which is compatible with the requirements stated in **JASO D 015-2**, **JASO D 015-3**, and **JASO D 015-5**.

6 Unified diagnostic services implementation on CXPI

6.1 UDSonCXPI services overview

The purpose of **Table 2** is to reference all unified diagnostic services as they are applicable for an implementation of UDSonCXPI. The table contains the sum of all applicable services. For reference **Annex A** describes $P2_{CAN_Client}$ setting guideline for applied service according to the communication data rate, number of slave nodes, and CXPI Data field length. Certain applications using this part of **ISO 14229** to implement UDSonCXPI may restrict the number of useable services and may categorize them in certain application areas/diagnostic sessions (default session, programming session, etc.). The restriction of CXPI Data field length for all diagnostic services applies (see chapter 7).

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