



SURFACE VEHICLE RECOMMENDED PRACTICE

J2534™-2/18_0500

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Pass-Thru Extended Feature - TCP CLIENT

RATIONALE

This specification is new functionality being added to support diagnostics over IP (DoIP, ISO 13400) and is compatible with SAE J2534-1_0500 (API version 05.00).

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1. SCOPE

This SAE Recommended Practice is part of the SAE J2534-2/X_0500 set of documents that extends the SAE J2534-1_0500 API (version 05.00) specification and defines how to implement transmission control protocol (TCP) within the SAE J2534 API framework. This document details only the changes from SAE J2534-1_0500 and items not specifically detailed in this document are assumed to have not changed.

An SAE J2534-2/18_0500 interface shall be compliant to the TCP CLIENT feature only when all the required functionality in this SAE Recommended Practice is implemented. Any functionality not required for compliance will be specifically marked as “optional” in this document.

This document must be used in conjunction with the SAE J2534-2/13_0500 (ethernet), SAE J2534-2/16_0500 (IPv4), SAE J2534-2/15_0500 (IPv6), SAE J2534-2/BA_0500, and SAE J2534-2/RE_0500 documents.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J2534-1_0500	Recommended Practice for Pass-Thru Vehicle Programming (API version 05.00)
SAE J2534-2/BA_0500	Pass-Thru Extended Features - Base Document (API version 05.00)
SAE J2534-2/RE_0500	Pass-Thru Extended Features - Resource Document (API version 05.00)
SAE J2534-2/13_0500	Pass-Thru Extended Features - Ethernet (API version 05.00)
SAE J2534-2/15_0500	Pass-Thru Extended Features - IPv6 (API version 05.00)
SAE J2534-2/16_0500	Pass-Thru Extended Features - IPv4 (API version 05.00)
SAE J2534-2/17_0500	Pass-Thru Extended Features - UDP (API version 05.00)

2.1.2 Other Documents

IETF RFC 793	Transmission Control Protocol
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3. DEFINITIONS

ACTIVE MESSAGE: Refers to a message that has started the transmission process on the physical vehicle bus but has not completed it.

LOGICAL COMMUNICATION CHANNEL: A specific path through the pass-thru interface to the physical vehicle bus that uses an existing physical communication channel but adds the network and transport layers (as defined by OSI).

PASS-THRU DEVICE: Refers only to the hardware portion of the SAE J2534 interface.

PASS-THRU INTERFACE: Refers to all components of a SAE J2534 interface, including both physical hardware and software.

PHYSICAL COMMUNICATION CHANNEL: A specific path through the pass-thru interface to the physical vehicle bus that encompasses the physical layer and data link layer (as defined by OSI) and includes all the associated physical resources (such as the data link controller, connector, pins, etc.) in the pass-thru device.

QUEUED MESSAGE: Refers to a full message from the application that has been accepted by the pass-thru interface (via the API) for transmission, which is intended to become an active message at some point in the future.

TERMINATE A MESSAGE: Refers to the process of stopping reception or transmission of a message by the pass-thru interface.

TRANSMITTED MESSAGE: Refers to a message that has been successfully placed on the physical vehicle bus.

4. ACRONYMS

API Application Programming Interface

DLL Dynamic Link Library

IOCTL Input/Output Control

IP Internet Protocol

IPv4 Internet Protocol V4

IPv6 Internet Protocol V6

TCP Transmission Control Protocol

UDP User Datagram Protocol

5. DOCUMENTATION CONVENTIONS

In the document body and in tables:

- All SAE J2534 API functions shall be in bold print (for example, **PassThruOpen**).
- All SAE J2534 API variables shall be enclosed in "<>" (for example, <DeviceID>).
- All SAE J2534 API DEFINES shall be in upper-case print (for example, STATUS_NOERROR).
- All numbers shall be in decimal unless otherwise indicated. (Hexadecimal values have a leading "0x"; for example, 0x7AF or 0x800 are hexadecimal values.)

6. PASS-THRU INTERFACE REQUIREMENTS

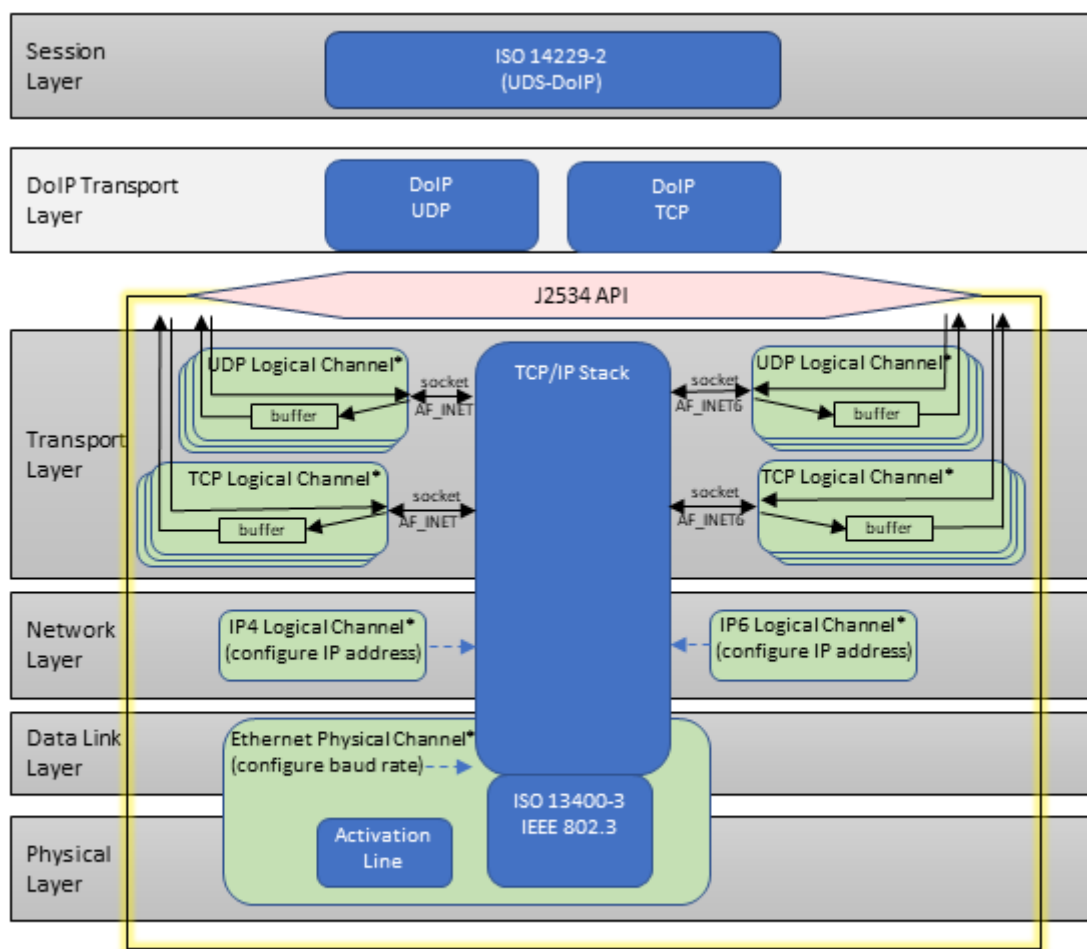
The TCP CLIENT feature shall be implemented as a logical communication channel that is created on top of an IPv4 or IPv6 logical communication channel. The TCP CLIENT logical channel gives access to the TCP transport layer of OSI seven-layer model, as seen in [Table 1](#). This feature specifically defines the common method of supporting the TCP transport protocol as defined in IETF RFC 793. This feature gives the application access to the transport (layer 4) transmission control protocol of the ethernet stack. In keeping with the socket programming paradigm, each SAE J2534-2/18_0500 TCP CLIENT logical channel has a single socket associated with it. For the TCP CLIENT feature, a stream socket is created by the pass-thru interface when the TCP CLIENT logical channel is created.

To implement diagnostics over internet protocol, the additional SAE J2534-2/17_0500 logical communication channel UDP will have to be connected over an IPv4 or IPv6 logical channel, the IPv4 or IPv6 logical channels communicate through an ethernet physical communication channel.

Table 1 - OSI seven layer model

Applicability	OSI Seven Layers	Vehicle Manufacturer Enhanced Diagnostics
Seven layers according to ISO/IEC 7498-1 and ISO/IEC 10731	Application (layer 7)	ISO 14229-1/ISO 14229-5
	Presentation (layer 6)	Vehicle manufacture specific
	Session (layer 5)	ISO 14229-2
	Transport (layer 4)	SAE J2534-2/18_0500 TCP, SAE J2534-2/17_0500 UDP
	Network (layer 3)	SAE J2534-2/16_0500 IPv4, SAE J2534-2/15_0500 IPv6
	Data link (layer 2)	SAE J2534-2/13_0500 ethernet
	Physical (layer 1)	

Figure 1 shows how the ethernet stack for DoIP is constructed in the pass-thru interface.



* Created by the application using the J2534 API.

Figure 1 - Ethernet stack construction

6.1 Specific Protocol Requirements

A pass-thru interface that supports the TCP CLIENT feature shall:

- Implement TCP CLIENT as specified in IETF RFC 793.

6.1.1 Interaction with IP and the Ethernet Physical Channel

A TCP CLIENT logical channel is created on top of an IPv4 or IPv6 logical channel which in turn is created on top of an ethernet physical communication channel. The physical link status from the ethernet physical channel underlying the IP4 or IP6 channel must be available to the TCP CLIENT channel.

6.2 Pin Usage

Pin usage shall be determined by the physical communication channel.

6.3 Data Buffering

6.3.1 Message Reception

The TCP CLIENT feature shall provide a receive buffer as specified in [Table 2](#) and shall be capable of receiving and buffering data from the stream socket while the receive buffer is not full. This capability shall be available on each channel.

Table 2 - Minimum receive buffer size

Maximum Size of One Message	Minimum Receive Buffer Size
Receive Buffer Size	2000000 bytes

6.3.2 Message Transmission

The TCP CLIENT feature uses **PassThruQueueMsgs** to write data to the network stack through the channel's socket so there is no need for a local buffer.

Table 3 - Minimum transmit buffer size

Maximum Size of Each Message	Minimum Transmit Buffer Size
65535 bytes	NA

6.4 Error Handling

6.4.1 Device Not Connected

As defined in SAE J2534-1_0500.

6.4.2 Receive Buffer Overflow

As defined in SAE J2534-1_0500.

6.4.3 Message Termination

TCP CLIENT is based on a stream socket where there are no packets or messages just a stream of data. Thus, message termination does not apply.

6.4.4 Network Errors

The pass-thru interface shall be capable of detecting transmit and receive errors. To deal with these errors, recovery strategies have been defined SAE J2534-1_0500. [Table 4](#) details the types of errors to be detected and the associated recovery strategy as well as the required user notification that shall occur at the end of the designated recovery strategy.

Table 4 - Network errors

Error	Application Notification Mechanism	Recovery Strategy
Overrun error	Set BUFFER_OVERFLOW in <RxStatus>	Drop strategy as defined in SAE J2534-1_0500

7. WIN32 APPLICATION PROGRAMMING INTERFACE

7.1 API Changes

[Table 5](#) summarizes the changes to the SAE J2534-1_0500 API functions for this feature. The pass-thru API DLL must include entry points for all functions, regardless of whether or not the API function call is used for this feature.

Table 5 - SAE J2534 API functions

Function	Description
PassThruScanForDevices	Function implementation independent of this feature
PassThruGetNextDevice	Function implementation independent of this feature
PassThruOpen	Defined in SAE J2534-1_0500
PassThruClose	Defined in SAE J2534-1_0500
PassThruConnect	Defined in SAE J2534-1_0500
PassThruDisconnect	Defined in SAE J2534-1_0500
PassThruLogicalConnect	Added new return codes, channel descriptor definition
PassThruLogicalDisconnect	Defined in SAE J2534-1_0500
PassThruSelect	Defined in SAE J2534-1_0500
PassThruReadMsgs	Different because of TCP buffer stream
PassThruQueueMsgs	Different because of TCP buffer stream
PassThruStartPeriodicMsg	This function shall always return an error (applicable error values defined in SAE J2534-1_0500)
PassThruStopPeriodicMsg	Defined in SAE J2534-1_0500
PassThruStartMsgFilter	This function shall always return an error (applicable error values defined in SAE J2534-1_0500)
PassThruStopMsgFilter	Defined in SAE J2534-1_0500
PassThruSetProgrammingVoltage	Function implementation independent of this feature
PassThruReadVersion	Function implementation independent of this feature
PassThruGetLastError	Defined in SAE J2534-1_0500
PassThruIoctl	Added discovery mechanism and configuration

7.2 Message Structure

7.2.1 C/C++ Definition

The PASSTHRU_MSG structure, defined in SAE J2534-1_0500, shall be used for messages on a TCP CLIENT logical channel.

```
typedef struct {
    unsigned long ProtocolID;
    unsigned long MsgHandle;
    unsigned long RxStatus;
    unsigned long TxFlags;
    unsigned long Timestamp;
    unsigned long DataLength;
    unsigned long ExtraDataIndex;
    unsigned char *DataBuffer;
    unsigned long DataBufferSize;
} PASSTHRU_MSG;
```