SURFACE VEHICLE INFORMATION REPORT

J3005™	DEC2021

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Superseded by J3005-1 and J3005-2

Permanently or Semi-Permanently Installed
Diagnostic Communication Devices

RATIONALE

It was agreed by the Vehicle E E Sysetm Diagnostic Standards Committee to cancel this standard, as it has been split into two documents—SAE J3005-1 and SAE J3005-2—which are the current documents.

CANCELLATION NOTICE

This Technical Report has been declared “CANCELLED” as of December, 2021 and has been superseded by SAE J3005-1 and SAE J3005-2. By this action, this document will remain listed in the respective index, if applicable. Cancelled Technical Reports are available from SAE.

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FOREWORD

The SAE J1962 connector was developed as a standardized connector for use in passenger cars, light duty, medium duty and heavy duty trucks which, since mandated in 2008 MY, utilize ISO 15765-4 as OBD protocol, to access on-board diagnostic information by “generic” test equipment. The access was anticipated to be for short term use in a controlled environment to facilitate a maintenance procedure, e.g.,, the “generic” test equipment is installed in the vehicle in a workshop and is removed before the vehicle leaves the workshop.

Over time, other devices are making use of the standardized connector and (SAE J1979) data in a more or less permanent installation to collect and use standardized data for purposes other than a temporary maintenance procedure.

There are some areas where this can be a problem:

- If the vehicle is equipped with internal clients (e.g., telematics gateways, data loggers), these devices will prioritize requests made with the standardized OBD CAN IDs in order to fulfill the SAE J1979 timing requirements. The internal clients will therefore not get the data they are supposed to store, possibly causing built in customer functions to stop working (updating information) as long as the external devices are connected.

- If the attached devices send diagnostic services, this may disturb the vehicle functionality, e.g., sending a ClearDTC request while the engine is running may cause diagnostic monitors to make incorrect judgment (set DTCs) and warn for overheated engine.

- If the attached devices include a split-cable (i.e., a possibility to add, from the vehicle point of view) two external devices may be connected at the same time utilizing the same CAN-identifier. If those devices do not detect the presence of the other device and try to communicate at same time they may cause CAN collisions which will cause Bus off operations. The devices will also receive unsolicited messages because they will see the responses for the request the other device has sent or no response since each ECU in the vehicle can only handle one request per time (i.e., if tool #1 has sent a request, the ECUs may not be able to handle a request from tool #2 before completing the first request).

The intention of SAE J3005 is to provide guidelines to device vendors in order to minimize the risk of these problems.

CONTENTS

1. SCOPE

1.1 Purpose

The scope of the document is to define communication best practices in order to minimize problems for the vehicle owner when installing equipment which has a permanently or semi-permanently diagnostic communication device connected to the SAE J1962 connector or hardwired directly to the in-vehicle network.

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 724-776-4970 (outside USA), www.sae.org.

SAE J1979 E/E Diagnostic Test Modes

SAE J1979-DA Digital Annex of E/E Diagnostic Test Modes

SAE J1978 OBD II Scan Tool - Equivalent to ISO/DIS 15031-4:December 14, 2001

SAE J2012 Diagnostic Trouble Code Definitions

SAE J1962 Diagnostic Connector Equivalent to ISO/DIS 15031-3:December 14, 2001

SAE J1699/2 OBD-II Related SAE Specification Verification Test Procedures

SAE J1699/4 OBD-II Communications Anomaly List

2.1.2 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, Tel: 212-642-4900, www.ansi.org.

ISO 11898-2 Road Vehicles - Controller Area Network (CAN) - Part 2: High-Speed Medium Access Unit

ISO 14229-2 Part 2: Session Layer Services

ISO 15031-3 Diagnostic Connector and Related Electrical Circuits, Specification and Use

ISO 15031-4 External Test Equipment

ISO 15031-5 Emission Related Diagnostic Services

ISO 15031-6 Diagnostic Trouble Code Definitions

ISO 15765-4 Requirements For Emissions-Related Systems

ISO 27145-2 Road Vehicles - Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) Communication Requirements – Part 2: Common Data Dictionary

ISO 27145-3 Road Vehicles - Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) Communication Requirements – Part 3: Common Message Dictionary

ISO 27145-6 Road Vehicles - Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) Communication Requirements – Part 6: External Test Equipment

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

Remote OBD Guidance - September 2010: http://www.obdclearinghouse.com/index.php?body=wireless

PEMS (Euro VI) R49 Annex 2 http://ec.europa.eu/enterprise/sectors/automotive/environment/eurovi/

PEMS (US): 40 CFR Part 1065, Subpart J - Field Testing and Portable Emission Measurement Systems

3. TERMS AND DEFINITIONS

3.1 DEFINITIONS

3.1.1 CALID (CALIBRATION IDENTIFICATION)

A part number (or similar) is used to identify the firmware or calibrations.

3.1.2 CLASS A

Class A is a malfunction which causes the emissions to exceed the OBD Threshold limit during emission tests.

3.1.3 CLASS B1

Class B1 is a malfunction which causes the emissions to increase and may exceed the OBD Threshold limit during some emission tests.

3.1.4 CLASS B2

Class B2 is a malfunction which causes the emissions to increase but not exceed the OBD Threshold limit.

3.1.5 CONTINUOUS-MI (Continuous Malfunction Indicator)

Continuous-MI is when the MIL is commanded to be on for an emission relevant fault of Class A or if an emission relevant fault of Class B1 has been detected during 200 engine operation hours.

3.1.6 CVN (CALIBRATION VERIFICATION NUMBER)

Checksum of the emission related part of the application firmware in the ECU or the calibration data set.

3.1.7 DID (DATA IDENTIFIER)

A DID is a fixed pointer to a parameter in the firmware, it can be read, written to or controlled.

3.1.8 ECU (ELECTRONIC CONTROL UNIT)

An ECU is an on-board (in vehicle network) computer for vehicle functions.

3.1.9 GTR (GLOBAL TECHNICAL REGULATION)

GTR is the regulation which has been the base document for the Euro VI regulation for heavy duty vehicles.

3.1.10 I/M (INSPECTION AND MAINTENANCE)

Periodic inspection is a cyclic inspection of the vehicle, this includes emission check.

3.1.11 ITID (INFORMATION TYPE IDENTIFIER)

A type of DID which contains static or semi-static information as defined by SAE J1979-DA.

3.1.12 ND (Nomadic device)

A nomadic device is a portable/mobile communication device, e.g., smartphone or tablet (e.g., Ipad).

3.1.13 NV memory (Non-volatile memory)

Non-volatile memory keeps its data when there is no supply voltage, e.g., flash memory.

3.1.14 PEMS (PORTABLE EMISSION MEASUREMENT SYSTEM)

As defined in 40 CFR, Part 1065, subpart K;
Portable emission measurement system (PEMS) means a measurement system consisting of portable equipment that can be used to generate brake-specific emission measurements during field testing or laboratory testing.

3.1.15 PERMANENTLY CONNECTED DIAGNOSTIC COMMUNICATION DEVICE

Refers to a device which is hardwired into the in-vehicle wire harness (e.g., in taxi vehicles) for a long time, i.e., it is connected for days not hours and during normal vehicle operation. The permanently connected diagnostic communication device can often only be removed by a service technician.

3.1.16 PID (PARAMETER IDENTIFIER)

PID is an older term for DID, defined in SAE J1979-DA.

3.1.17 REMOTE DEVICE

A remote device is a device which gathers data and sends it to a remote location utilizing wireless technology.

3.1.18 SEMI-PERMANENTLY CONNECTED DIAGNOSTIC COMMUNICATION DEVICE

Refers to a device which is plugged in into the SAE J1962 connector during normal vehicle operation while a scan tool primarily is connected in the service workshop. The difference between a permanently connected device and a semi-permanently connected diagnostic communication device is that the latter may be removed after some time by just disconnecting it from the SAE J1962 connector.

3.1.19 SHORT-MI (Short Malfunction Indicator)

Short-MI is when the MIL is commanded to be on for an emission relevant fault of Class B1 or B2. The MIL is just illuminated for a short time during engine start.

3.1.20 TELEMATICS

Telematics typically is any integrated use of telecommunications and informatics for sending, receiving and storing information via telecommunication devices in conjunction with affecting control on remote objects and in this context, the integrated use of telecommunications and informatics, for application in vehicles and with control of vehicles on the move.

3.1.21 VIN (VEHICLE IDENTIFICATION NUMBER)

Number used to identify a vehicle according to ISO 3779.

3.1.22 INFRASTRUCTURE

The term Infrastructure is used by this document as the equipment used to receive the data sent by the remote OBD devices, transport the information and to store it in a database used by regulatory. It is the term for handling the information Off-board.

3.2 SYMBOLS

Deg: degrees

g/s: grams per second

Hz: Hertz

KPa: kilopascal

ms: milliseconds

mW: milliwatt

µA: microampere

Nm: Newton meter

%: percent

RPM: revolutions per minute

V: Volt

4. TECHNICAL RECOMMENDATIONS

4.1 Mechanical Recommendations

The size of the connected part of the device should fit into the space defined by SAE J1962.

The device should not interfere with normal driving, i.e., the size must be such that it does not interfere with the vehicle operations or cause injuries during collision.

4.2 Electrical Recommendations

The device should adhere to the electrical requirements of the SAE J1962 connector and for CAN, the electrical requirements in ISO 15765-4 and the electrical characteristics as defined in ISO 11898-2. The device manufacturer is recommended to respect the maximum cable length, the capacitance and the physical termination of the CAN bus.

OBD defined pins in SAE J1962 are allowed to be used. The device vendor should utilize equipment with high Impedance for all other pins or contact the vehicle manufacturer.

The device should go into a low power mode when the vehicle is in power save mode. When in this mode the device should not exceed an average current consumption of 100 µA at 12 V permanent voltage (i.e., average wattage of 1.2 mW).

There are a variety of methods that can be used by the remote device to determine when it should enter a ‘low power’ mode. The exact method(s) will be application specific, but here are some examples:

- No responses are received to requests.
- No messages are detected for 1000 ms.
- The information in the response indicating engine RPM=0 and vehicle speed=0.
- There is no movement measured for a period measured by the accelerometers in the nomadic device or in the wireless interface.
- The device can monitor if battery voltage is less than e.g., 13V.
- There is no connection to the nomadic device.
- If the vehicle manufacturer can submit ignition key information (i.e., ignition on/off information) on one of the pins in the diagnostic connector then this could be used to control the device to enter or exit low power mode.

It is only possible to connect one external device, which sends diagnostic requests, to the diagnostic connector at a given time, i.e., a split cable with two diagnostic communication devices attached will not work if the cable doesn't include logic to disable one of the external devices or if the second device is just used for bus monitoring, i.e., not sending any CAN-frames, see 4.4

4.3 Communication Recommendations (vehicle communication)

The device should fulfill the requirements of SAE J1978/ISO 15031-4 and SAE J1699/2 in order to not disturb the in vehicle communication and should utilize the initialization sequence of ISO 15765-4 in order to establish communication before sending diagnostic requests. This is should be done also after cranking.

NOTE: The reason is that on-board clients may check for the initialization sequence in order to stop their communication if an external client is connected.

It is recommended for a device communicating on CAN to fulfill the timing requirement as specified in ISO 15765-4.

The device should limit the time when it requests data in order to let other internal clients access the in-vehicle network, i.e., not requesting data when the user/operator is not using the device. If the device does not retrieve data from the vehicle for more than 10 min, a new initialization sequence according to ISO 15765-4 should be executed if the vehicle is not responding as expected.

NOTE: The on-board clients can check for a pause in the transmission of diagnostic requests and if that pause is longer than e.g.,10 minutes then the on-board client may start its own diagnostic requests and continue until it detects a new initialization.

The device should utilize the P2 reload scheme as defined in ISO 14229-2 for robust communication.

The device may utilize a P2 timeout of 500ms to ensure robust communication.

The usage of enhanced services (i.e., non SAE J1979/ISO 15031-5/ISO 27145-3 services) should be used with care; additional information may be needed from the vehicle manufacturer in order to have a robust solution.

There are many ways a device can cause disturbances to a vehicle. It can overload the bus if the update frequency is too high or the device could access a service that directly affects the behavior of the vehicle. Care should be taken to determine what the capabilities of the vehicle are before using the device. The device manufacturer should consult with the vehicle manufacturer to get the relevant communication timers (e.g., $P2_{Client}$, $P3_{Client}$ as defined by ISO 14229-2, if used), use those services with care (i.e., analyze hazardous situations), and warn the user.

Many diagnostic services or diagnostic routines have been developed to be used by a skilled service technician and in the controlled environment as in a workshop and are not intended to be used while the vehicle is moving. The detection of pre-conditions for using those diagnostic routines can vary between vehicle manufacturers and also between ECUs in a vehicle, e.g., an ISO 14229-1 Service 0x11 ECUReset while the vehicle is moving may cause one ECU to execute the service and making a Reset while another ECU sends a negative response indicating that it will not make the reset. The ECU making the reset may not be fully operational for a short time, usually some seconds and this may affect the behavior of the vehicle.

The recommended general sampling frequency, if not otherwise stated, is 1Hz for dynamic data and static information should only be requested once per operation cycle. Data which will not change rapidly (e.g., barometric pressure, ambient air temperature) can be requested at lower frequency.

The reason for the low sampling frequency is that the in-vehicle data bus should not be overloaded but also to ensure that the device gets data at fixed points (fixed sample rate). The theoretical maximum sampling frequency is 20Hz for single frame messages, for segmented messages the sampling rate is lower and fixed sampling time can’t be guaranteed.

4.4 Split-Cables in CAN Applications

Split-cables or boxes which allow more than one external tool to be connected and transmitting CAN-frames to the vehicle should be able to disconnect one client while the other client is communicating (i.e., transmits CAN-frames) otherwise communication problems may occur. Split-cables used in situations as for monitoring the bus is not a problem.

Another type of split-cable is when an external (or non-OEM) client is hard-wired into the electrical network without using the diagnostic connector (e.g., installing a telematics gateway in a taxi or rescue vehicle). In that case the situation is the same as for split-cables and the client has also to check the communication bus for communication from an external client and to stop the communication if an external client is connected. The electrical characteristics of the split-cable should follow the recommended characteristics for that specific data link, e.g., a split-cable for CAN should follow the requirements specified in ISO 11898-2.

It is up to the device vendor of the permanently or semi-permanently connected diagnostic communication device to define when the communication to the non-external client can be restarted, a delay of at least 5 minutes is recommended.

5. REMOTE OBD (US)

Specific regulations may allow remote access to OBD information as a complement to I/M tests. This access may be through an OEM installed telematics system or through an owner installed aftermarket device. The device connects to the diagnostic communication link, reads the OBD data utilizing SAE J1979 services, and transmits the data to a server. This section specifies recommendations for the remote device.

The information should be sent direct to the approved datacenter.

The device can be used in all vehicles which support the needed diagnostic services and data but there may be some deviations of how the vehicle manufacturer has implemented the OBD services and data in early models, see SAE J1699-4.

Due to the original intent of the standards defining OBD communication, in-vehicle communication bus architectures aren't necessarily designed to allow for devices constantly polling OBD data from the respective ECUs. Such scenarios might result in a situation where the designed vehicle functionality is impaired, adversely impacting the customer experience.

The communication to the vehicle should be as robust as possible and take into account known deviations from the standards, i.e., the device manufacturer can check SAE J1699-4 and implement functionality to take care of those anomalies.

It is also important to define an IT security concept ensuring vehicle safety and data security, i.e., so an external user cannot connect/get access to the vehicle (hack the vehicle) through the remote OBD device.

The device has two-sided communication, one towards the vehicle and one towards the infrastructure.

For the vehicle side, 4.3 applies. For the infrastructure side, 5.1 applies.

5.1 Communication Recommendations (Infrastructure Communication)

The infrastructure side can utilize (but is not limited to) communication methods such as WLAN (e.g., hotspots) and cellular communication. The communication type is TCP/IP but the data carrier can be anything which can carry TCP/IP information as long as the communication is secured and the data is encrypted.

This guideline is unique to Remote I/M applications and should not be inferred to apply to other aftermarket vehicle data use cases. The Remote I/M device should be able to store at least data for one week of measurements within NV memory if there is no connection to the infrastructure for two weeks then the oldest data should be overwritten. When communication is established, the stored data should be sent to the infrastructure and the buffer should be emptied.

The data format in the Remote I/M device to be stored is defined by the Remote I/M device manufacturer; it can be either raw data or interpreted data as long as the data sent to the infrastructure always follows the same format.

If the data communication is interrupted due to an engine start then the device needs to establish communication again.

The raw data in the Remote I/M device should be protected by encryption and it should not be possible for the data to be deleted by an external device.

5.2 Service Recommendations for the Remote Device (US)

The device should as minimum use the set of SAE J1979 defined services according to Table 1. All services defined in Table 1 are not supported by all model years. Early models may not support Service 0x09 or Service 0x0A and therefore no response will be received.

TABLE 1 - SERVICES TO BE USED BY SAE J1979 BASED REMOTE DEVICES

Service	**Usage**
Service 0x01 Request Current Powertrain Diagnostic Data	Request data stream data (e.g., RPM, LOAD_PCT, ECT)
Service 0x02 Request Powertrain Freeze Frame Data	Request OBD freeze frame data
Service 0x03 Request Emission-Related Diagnostic Trouble Codes	Request Confirmed emission related DTCs
Service 0x06 Request On-Board Monitoring Test Results for Specific Monitored Systems	Request OBD test values (US only)
Service 0x07 Request Emission-Related Diagnostic Trouble Codes Detected During Current or Last Completed Driving Cycle	Request Pending emission related DTCs
Service 0x09 Request Vehicle Information	Request Vehicle information (e.g., VIN, CALID, CVN)
Service 0x0A Request Emission-Related Diagnostic Trouble Codes with Permanent Status	Request Permanent emission related DTCs (US only)

NOTE: The remote device is not permitted to send a ClearDTC Service 0x04 at any time.

5.3 Data to be Retrieved from the Vehicle

The remote device should request as minimum the data parameters defined in Table 2 and the InfoType parameters as defined in Table 3. All information is not supported by all model years. Early models may only support I/M Readiness, LOAD_PCT, and RPM parameters

TABLE 2 - PID DATA INFORMATION TO BE READ BY SAE J1979-BASED REMOTE DEVICE BY USING SERVICE 0X01

PID	Acronym	Description
0x00/0x20/… 0xE0	PID supported	The information has two purposes, the first purpose is to be used by the remote device to configure the list of information the device will request from the vehicle, the second purpose is that the information will be stored in the database and will indicate that the device is used in another vehicle, e.g., if the first vehicle support 23 PIDs and the device is installed in another vehicle which support a different number of PIDs or different set of PIDs.
0x01	I/M Readiness Data including MIL Status	The Readiness data will be used for indicating that all monitors have executed after a repair. The MIL status indicates if the MIL has been commanded to be on.
0x04	Calculated Load Value	The LOAD_PCT could be used for detecting tampering. If the same LOAD_PCT is read every time then the vehicle has been tampered with.
0x05/ 0x67	Engine Coolant Temperature	The ECT could be used for detecting tampering. If the same ECT is read every time then the vehicle has been tampered with.
0x0C	Engine RPM	The RPM could be used for detecting tampering. If the same RPM is read every time then the vehicle has been tampered with.
0x1C	OBD requirements which the ECU should support	The OBD_SUP should indicate if the ECUs in the vehicle are designed for the appropriate regulation.
0x1F	Time since engine start	The RUNTM is used for detecting tampering. If the same RUNTM is read every time then the vehicle has been tampered with.
0x21	Distance Traveled While MIL is Activated	The Distance Traveled while MIL is activated indicates the distance the vehicle has been driven with a confirmed fault which illuminates MIL.
0x4D	Engine run time while MIL activated	Engine run time while MIL is Activated is an alternative for those applications which do not use distance as an OBD relevant signal, e.g., trucks with manual gearbox.

PID	Acronym	Description
0x31	Distance traveled since DTCs cleared	Distance traveled since DTCs cleared can be used as an anti-tampering detection since the distance should be incrementing.
0x4E	Engine run time since DTCs cleared	Engine run time since DTCs can be used as an anti-tampering detection since the engine run time should be incrementing.
0x30	Number of warm-ups since DTCs cleared	Number of warm-ups since DTCs cleared.
0x41	Monitor status this driving cycle	Monitor status (Enable, Disabled) and Completed/Not completed for this driving cycle. May give information why Monitor Complete (PID 0x01) shows "Not Completed"
0x46	Ambient Air Temperature	Ambient air temp will indicate if the monitor may have been disabled due to low ambient temperature
0x33	Barometric Pressure	Barometric pressure will indicate if the monitor may have been disabled due to low barometric pressure.

TABLE 3 - INFOTYPE DATA INFORMATION TO BE READ BY SAE J1979-BASED REMOTE DEVICE USING SERVICE 0X09

InfoType	Acronym	Description
0x02	VIN	Vehicle identification number to uniquely identify the vehicle in which the device is installed.
0x04	CALID	Firmware and calibration identification to identify the firmware that is downloaded into the ECU.
0x06	CVN	Checksum to identify the validity of the firmware.
0x0A	ECUName	ECUName is an identifier to specify which ECU sends the response.
0x08/0x0B	IUMPR	The General denominator can be used to detect tampering. If it does not increment between readouts then the vehicle has been tampered with.
0x00/0x20/…0xE0	InfoType supported	The information has two purposes, the first purpose is to be used by the remote device to configure the list of information the device will request from the vehicle, the second purpose is that the information will be stored in the database and will indicate that the device is used in another vehicle, e.g., if the first vehicle supports 5 InfoTypes and the device is installed in another vehicle which supports a different number or different set of InfoTypes.

5.4 Data Information to be Sent from the Remote OBD Interface as Defined by OBD Clearinghouse.

TABLE 4 - INFORMATION SENT FROM THE REMOTE DEVICE

Parameter	**Description**
Communication protocol	This information is gathered by the remote device.
Powertrain control module Identification Address	The remote device stores the source addresses from all ECUs which respond to Service 0x01 PID 0x00 requests.
ECUName	InfoType 0x0A List of all responding ECU included.
PID count	The remote device calculates how many PIDs each ECU has implemented including the PID/InfoType Supported IDs.
CALID	InfoType 0x04 retrieved by remote device using SAE J1979 from vehicle.
CVN	InfoType 0x06 retrieved by remote device using SAE J1979 from vehicle.
OBD requirements	PID 0x1C retrieved by remote device using SAE J1979 from vehicle.
MIL status	PID 0x01 retrieved by remote device using SAE J1979 from vehicle.
Monitor complete since last Clear DTC	PID 0x01 retrieved by remote device using SAE J1979 from vehicle.
VIN	InfoType 0x02 retrieved by remote device using SAE J1979 from vehicle.
Date of Data collection	Remote device internal real time date.
Time of Data collection	Real-time from the remote device when the data was read.

Parameter	Description
Engine RPM	PID 0x0C retrieved by remote device using SAE J1979 from vehicle
Confirmed DTCs	Service 0x03 retrieved by remote device using SAE J1979 from vehicle
Pending DTCs	Service 0x07 retrieved by remote device using SAE J1979 from vehicle
Permanent DTCs	Service 0x0A retrieved by remote device using SAE J1979 from vehicle
Distance travelled while MIL is activated	PID 0x21 retrieved by remote device using SAE J1979 from vehicle
Number of Warm-Ups since DTC Cleared	PID 0x30 retrieved by remote device using SAE J1979 from vehicle
Distance since DTC Cleared	PID 0x31 retrieved by remote device using SAE J1979 from vehicle
Minutes run by the engine while MIL activated	PID 0x4D retrieved by remote device using SAE J1979 from vehicle
Time since DTC cleared	PID 0x4E retrieved by remote device using SAE J1979 from vehicle
Device Status	Remote device internal status
Device Firmware Number	Remote device firmware number
Device serial number	Remote device serial number
Device manufacturer	Remote device manufacturer
Device name	Remote device name

Parameter	Description
Monitor Complete This Driving Cycle	PID 0x41 retrieved by remote device using SAE J1979 from vehicle
Ambient temperature	PID 0x46 retrieved by remote device using SAE J1979 from vehicle
Barometer	PID 0x33 retrieved by remote device using SAE J1979 from vehicle

The Remote device should send the test data record, as described in Table 4, to the infrastructure when one of the following events has occurred:

- Change of MIL status (This means that the MIL has been turned on or off).
- Change of status of any monitor (Readiness, this means that the monitor has either executed and passed or executed and failed twice and is therefore illuminating the MIL).
- Change of fingerprint (e.g., number or set of supported PIDs, different VIN, CALID or CVN) data to indicate that the remote device has been installed into a new vehicle or the firmware in the ECUs has been updated.
- Battery power has been disconnected but is re-connected.

5.5 Tampering Recommendations

The remote device should read and store the following data in its memory:

- Service 0x09 InfoType 0x02 (VIN), which uniquely identifies the vehicle.
- Service 0x09 InfoType 0x04 (CALID), which is the firmware used in the ECUs in the vehicle.
- Service 0x09 InfoType 0x06 (CVN), which is the corresponding checksum of the firmware in the ECUs.
- Service 0x01 PIDs 0x00 0x20 0x40 0x60 0x80 0xA0 0xC0 (PIDs supported) to get a fingerprint of the functionality needed for tampering detection.
- Service 0x01 PID 0x31/0x4E (Time/Distance since code clear), which is the time and distance that have elapsed since a Clear DTC. This value should increment if DTCs are not cleared unless the counter has reached its maximum value.
- Service 0x01 PID 0x1F (Time since engine start) can be used if multiple read outs are used in a single driving cycle. Once this parameter begins to increment, each number shall be larger than the last until the limit is reached or the vehicle has been tampered with.
- Service 0x01 PID 0x0C 0x04 0x05/0x67 (Engine RPM), calculated load, engine coolant temp and time since engine start should be different at different read outs. It is highly unlikely that the load, RPM and coolant temp are the same during different readouts, but this can occur during long idle or driving at constant speed on a flat freeway, however the Time since engine start should always change

5.6 Security Recommendations

If the remote device provides a mechanism whereby it can be reprogrammed, security mechanisms must be included to reduce the threat of intrusion or tampering. The remote device should apply digital signature mechanisms using certificates uniquely identifying to the vehicle where the data originated to ensure non-repudiation.

NOTE: This requires signature validation or certificates at the communication peer entity that the data is intended for.

6. REMOTE OBD FOR EURO VI UTILIZING ISO 27145

6.1 Communication Recommendations (infrastructure communication)

See section 5.1.

6.2 Service Recommendations for the Remote Device (Euro VI)

The device should use the set of ISO 27145-3 defined services according to Table 5.

TABLE 5 - SERVICES TO BE USED BY ISO 27145-3 BASED REMOTE DEVICES

Service	**Usage**
Service 0x22 ReadDataByIdentifier	Request data stream data (e.g., RPM, LOAD_PCT, ECT) Request Vehicle information (e.g., VIN, CALID, CVN)
Service 0x19 0x42 reportWWHOBDDTCByMaskRecord	Request Confirmed emission related DTCs by severity class and by DTC state

NOTE: The remote device is not permitted to send an ISO 14229-1 Service 0x14 ClearDTC service at any time.

6.3 Data to be Retrieved from the Vehicle

The remote device should as minimum request the data parameters defined in Table 6.

TABLE 6 - INFORMATION TO BE SENT FOR EURO VI VEHICLES

Service	**Usage**
Service 0x19 0x42 ReadDTCInformation	Request Confirmed emission related DTCs confirmed and active DTCs for Class A malfunctions confirmed and active DTCs for Class B1 malfunctions
Service 0x22 ReadDataByIdentifier	Request data stream data and vehicle information
0xF404 Calculated Load Value, LOAD_PCT	The data can be used to detect tampering
0xF40C Engine RPM	The data can be used to detect tampering
0xF41F Time since engine start	The data can be used to detect tampering
0xF433 Barometric pressure	Barometric pressure is used for disabling monitors in DID 0xF441
0xF446 Ambient temperature	Ambient temperature is used for disabling monitors in DID 0xF441
0xF467 ECT	The data can be used to detect tampering
0xF490	Discriminatory/ non-discriminatory display strategy MIL status readiness of the OBD system the number of engine operating hours during which a continuous-MI was last activated (continuous-MI counter) the cumulated operating hours with a continuous-MI (cumulative continuous-MI counter)

Service	Usage
0xF493	Cumulated operating hours with a continuous-MI (cumulative continuous-MI counter)
0xF494	NOx control information (tampered exhaust after treatment)
0xF802	VIN (vehicle identification number)
0xF804	Firmware calibration identification(s)
0xF806	Calibration Verification Number(s)
0xF80A	ECUName
0xF810	GTR (and revision) number
0xF811	Protocol identification record
0xF430 0xF44E	Number of warm-up cycles and number of engine operating hours since recorded OBD information was last cleared

The actual Data information for ISO 27145-based remote OBD is the same as for SAE J1979 based remote OBD.

6.4 Data Information to be Sent from the Remote OBD Interface

TABLE 7 - INFORMATION SENT FROM THE REMOTE DEVICE

Parameter	**Description**
Communication protocol	This information is gathered by the remote device.
Powertrain control module Identification Address	The remote device stores the source addresses from all ECUs which respond to Service 0x22 DID 0xF400 requests.
ECUName	InfoType 0xF80A This is a list of all responding ECUs in the vehicle.
DID count	The remote device calculates how many DIDs each ECU has implemented including the PID/InfoType Supported IDs.
CALID	InfoType 0xF804 retrieved by remote device using ISO 27145 from vehicle. This is the software/firmware part number which can include calibration data set.
CVN	InfoType 0xF806 retrieved by remote device using ISO 27145 from vehicle. CVN is the checksum which corresponds the CALID.
OBD requirements	DID 0xF41C retrieved by remote device using ISO 27145 from vehicle. The OBD requirement is the requirement which the vehicle shall fulfill, e.g., OBD II or Euro VI.
MIL status	DID 0xF490 retrieved by remote device using ISO 27145 from vehicle. This information shows if the MIL is continuous on, is showing a short-MIL or is commanded to be off,
Monitor complete since last Clear DTC	DID 0xF401 retrieved by remote device using ISO 27145 from vehicle.
VIN	InfoType 0xF802 retrieved by remote device using ISO 27145 from vehicle.
Date of Data collection	Remote device internal real time date.

Parameter	Description
Time of Data collection	Real-time from the remote device when the data was read.
Engine RPM	DID 0xF40C retrieved by remote device using ISO 27145 from vehicle.
Confirmed DTCs	Service 0x19 0x42 retrieved by remote device using ISO 27145 from vehicle. Bit 3=1 in the status mask.
Pending DTCs	Service 0x19 0x42 retrieved by remote device using ISO 27145 from vehicle. Bit 3=1 in the status mask.
Distance travelled while MIL is activated	DID 0xF421 retrieved by remote device using ISO 27145 from vehicle.
Number of Warm-Ups since DTC Cleared	DID 0xF430 retrieved by remote device using ISO 27145 from vehicle.
Distance since DTC Cleared	DID 0xF431 retrieved by remote device using ISO 27145 from vehicle.
Minutes run by the engine while MIL activated	DID 0xF44D retrieved by remote device using ISO 27145 from vehicle.
Time since DTC cleared	DID 0xF44E retrieved by remote device using ISO 27145 from vehicle.
Device Status	Remote device internal status
Device Firmware Number	Remote device firmware number
Device serial number	Remote device serial number
Device manufacturer	Remote device manufacturer
Device name	Remote device name
Monitor Complete This Driving Cycle	DID 0xF441 retrieved by remote device using ISO 27145 from

Parameter	Description
	vehicle.
Ambient temperature	DID 0xF446 retrieved by remote device using ISO 27145 from vehicle.
Barometer	DID 0xF433 retrieved by remote device using ISO 27145 from vehicle.

The Remote device should send the test data record, as described in Table 7, to the infrastructure when one of the following events has occurred:

- Change of MIL status (This means that the MIL has been turned on or off)
- Change of status of any monitor (Readiness, this means that the monitor has either executed and passed or executed and failed twice and is therefore illuminating the MIL)
- Change of fingerprint (e.g., number or set of supported PIDs, different VIN, CALID or CVN) data to indicate that the remote device has been installed into a new vehicle or the firmware in the ECUs has been updated.
- Battery power has been disconnected but is re-connected.

6.5 Tampering Recommendations

The remote device should read and store the following data in its memory:

- Service 0x22 DID 0XF802 (VIN), which is the identity of the vehicle.
- Service 0x22 DID 0xF804 (CALID), which is the firmware used in the ECUs in the vehicle.
- Service 0x22 DID 0xF806 (CVN), which is the corresponding checksum of the firmware in the ECUs
- Service 0x22 PIDs 0xF400 0xF420 0xF440 0xF460 0xF480 0xF4A0 0xF4C0 (PIDs supported) to get a fingerprint of the functionality needed for tampering detection.
- Service 0x22 DID 0xF431/0xF44E (Time/Distance since code clear), which is the time and distance that have elapsed since a Clear DTC. This value should increment if DTCs are not cleared unless the counter has reached its maximum value.
- Service 0x22 DID 0xF804 0xF41F (Time since engine start) can be used if multiple read outs are used in a single driving cycle Once this parameter begins to increment, each number shall be larger than the last until the limit is reached or the vehicle has been tampered with.
- Service 0x01 PID 0x0C 0x04 0x05/0x67 (Engine RPM), calculated load, engine coolant temp and time since engine start should be different at different read outs. It is highly unlikely that the load, RPM and coolant temp are the same during different readouts, but this can occur during long idle or driving at constant speed on a flat freeway; however the Time since engine start should always change.