

# UDS Unified Diagnostic Services - ISO 14229

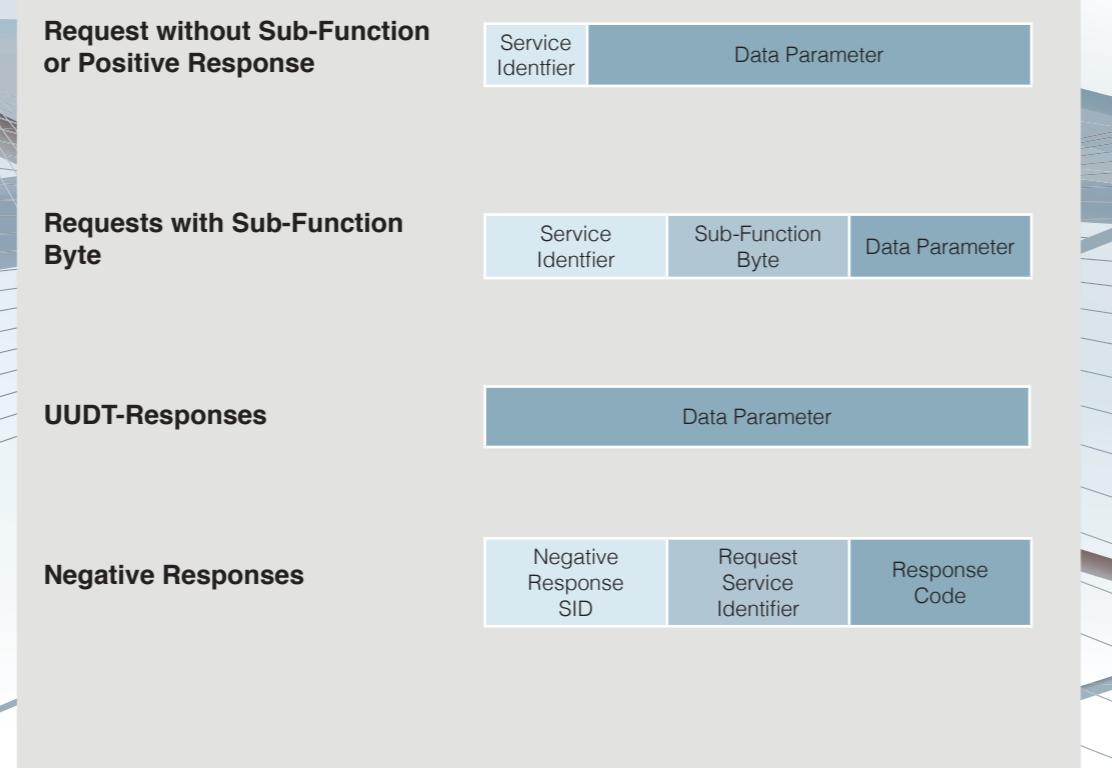
## UDS and OBD Positioning in the ISO/OSI Layer Model

International Standard Organization's Open System Interconnect 7 Layer Communication Model

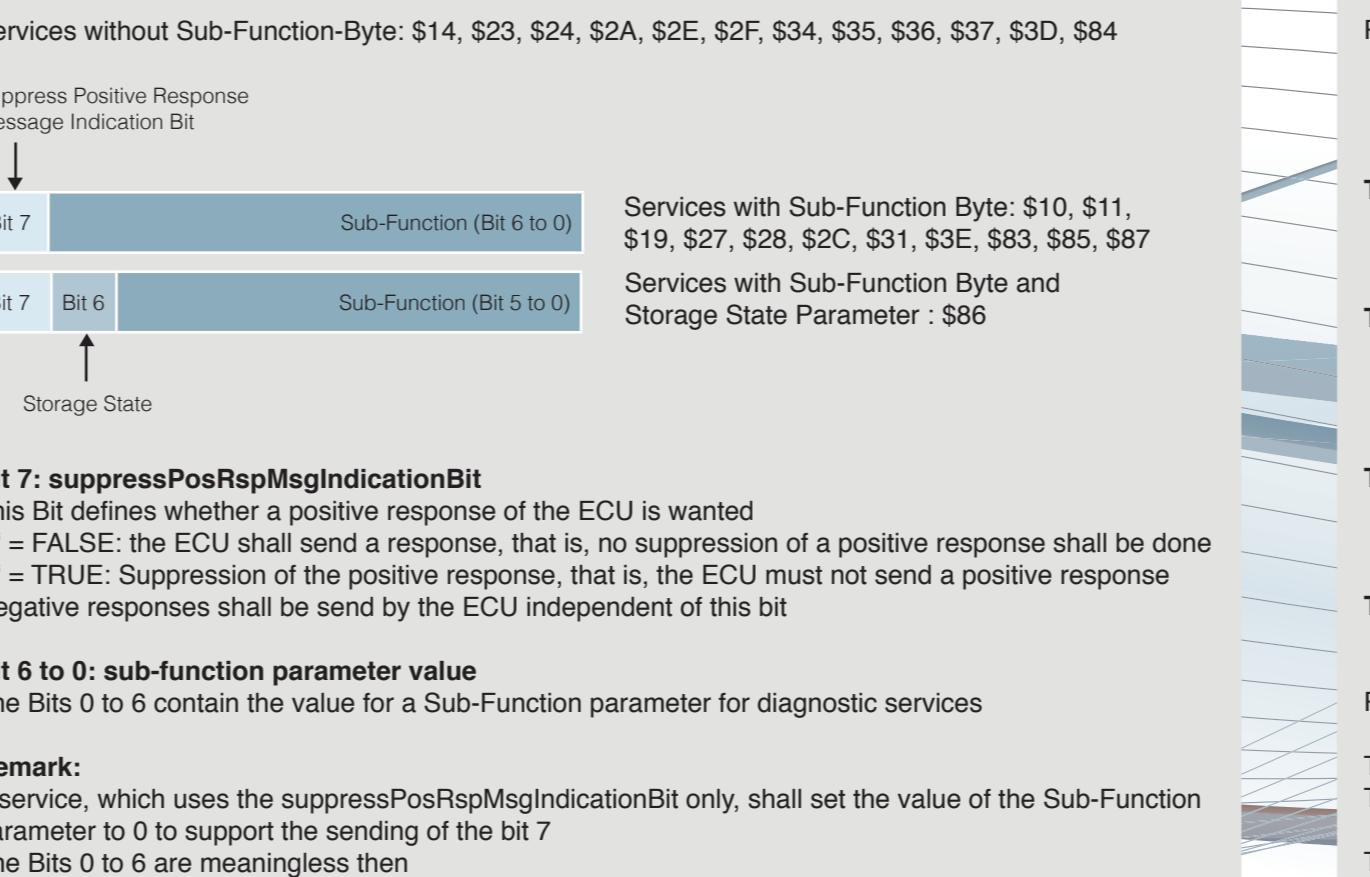
| Layer | Description            | Standards for UDS          | Standards for OBD |
|-------|------------------------|----------------------------|-------------------|
| "8"   | Diagnostic Application | User                       | ISO 15031-5       |
| 7     | Application Layer      | ISO 14229-1<br>ISO 15765-3 | ISO 15031-5       |
| 6     | Presentation Layer     | Not applicable             | Not applicable    |
| 5     | Session Layer          | ISO 15765-3                | Not applicable    |
| 4     | Transport layer        | ISO 15765-2                | Not applicable    |
| 3     | Network Layer          | ISO 15765-2                | ISO 15765-4       |
| 2     | Data Link Layer        | ISO 11898-1                | ISO 15765-4       |
| 1     | Physical Layer         | ISO 11898-2<br>ISO 11898-3 | ISO 15765-4       |

\*) The bus physics used is to be selected by the user  
Therefore, several standards for different physical layer for e.g. High-Speed- (ISO 11898-2) or Fault-Tolerant-CAN (ISO 11898-3) can be used

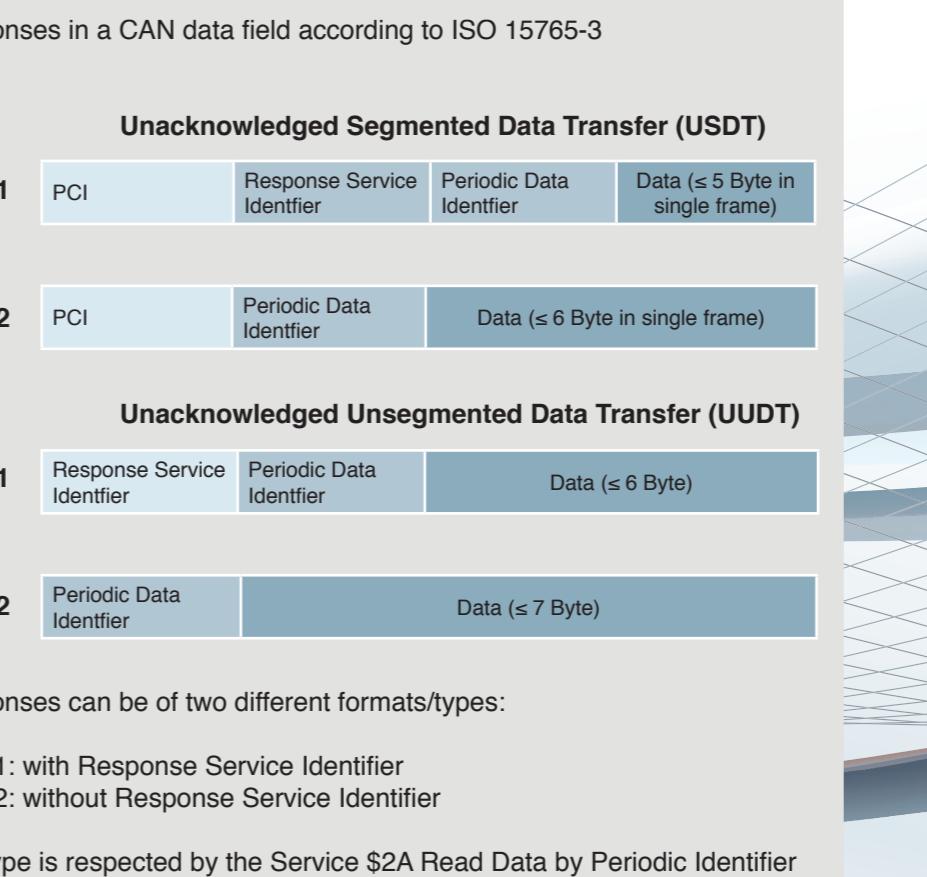
## Diagnostic Messages - Structures and Types



## The Sub-Function Byte of UDS



## Periodic Message Types of UDS



## Service Overview

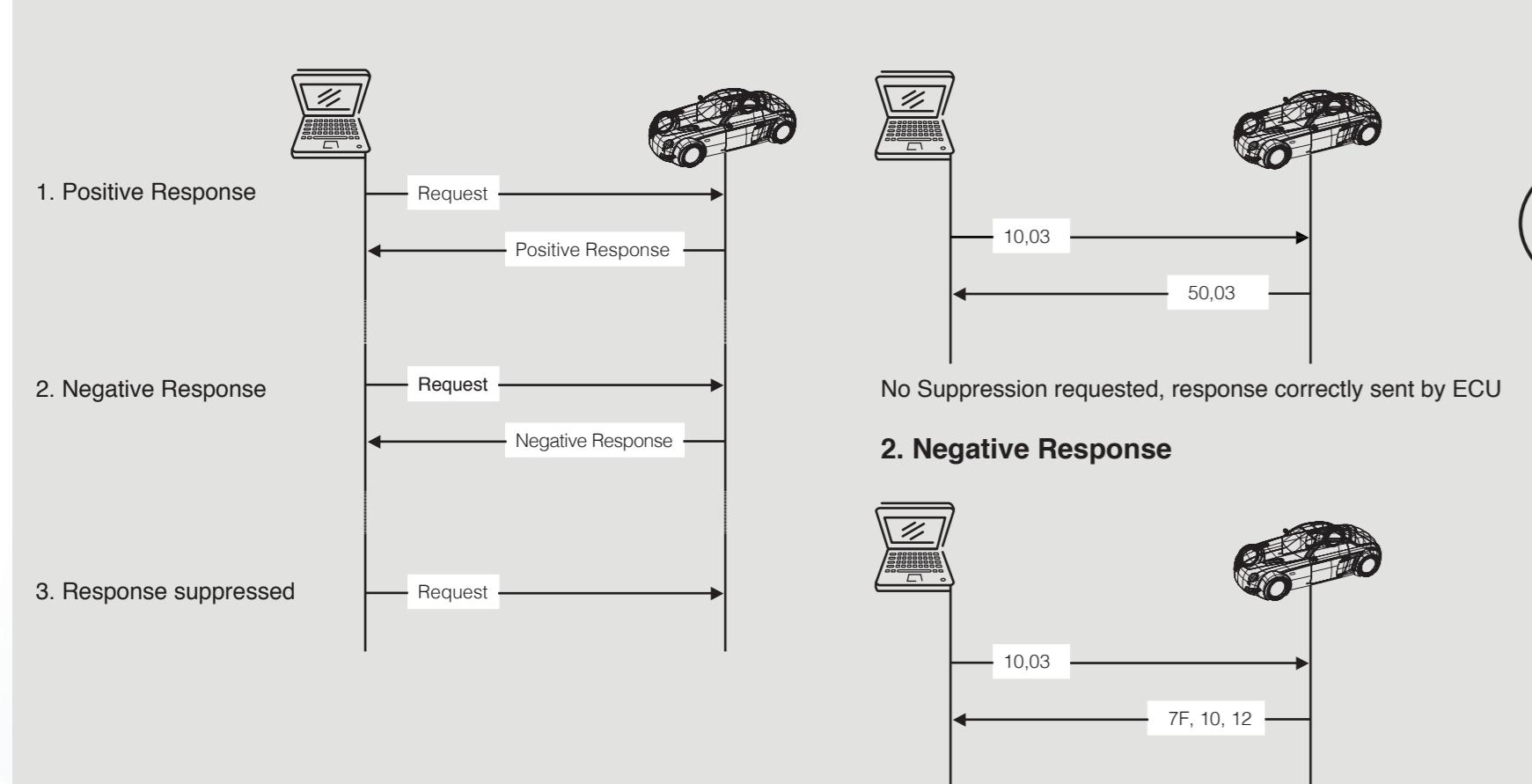
| Functional Unit                         | SID  | Available in Default Session | Available for RoE | Has Sub-Function | Service Name                       | Mnemonic |
|---|------|------------------------------|-------------------|------------------|------------------------------------|----------|
| Diagnostic and Communication Management | \$10 | ✓                            |                   | ✓                | Diagnostic Session Control         | DSC      |
|   | \$11 | ✓                            |                   | ✓                | ECU Reset                          | ER       |
|   | \$27 |                              |                   |                  | Security Access                    | SA       |
|   | \$28 |                              |                   |                  | Communication Control              | CC       |
|   | \$3E | ✓                            |                   | ✓                | Tester Present                     | TP       |
|   | \$83 |                              |                   |                  | Access Timing Parameter            | ATP      |
|   | \$84 |                              |                   |                  | Secured Data Transmission          | SDT      |
|   | \$85 |                              |                   |                  | Control DTC Setting                | CDTCS    |
| Data Transmission                       | \$86 | ✓                            |                   | ✓                | Response On Event                  | ROE      |
|   | \$87 |                              |                   |                  | Link Control                       | LC       |
|   | \$22 | ✓                            |                   |                  | Read Data By Identifier            | RDBI     |
|   | \$23 | ✓                            |                   |                  | Read Memory By Address             | RMBA     |
|   | \$24 | ✓                            |                   |                  | Read Scaling Data By Identifier    | RSDBI    |
|   | \$2A |                              |                   |                  | Read Data By Periodic Identifier   | RDBPI    |
|   | \$2C | ✓                            |                   |                  | Dynamically Define Data Identifier | DDDI     |
|   | \$2E | ✓                            |                   |                  | Write Data By Identifier           | WDBI     |
| Stored Data Transmission                | \$3D | ✓                            |                   |                  | Write Memory By Address            | WMBA     |
|   | \$14 | ✓                            |                   |                  | Clear Diagnostic Information       | CDTCI    |
|   | \$19 | ✓                            | ✓                 | ✓                | Read DTC Information               | RDTCI    |
|   | \$2F |                              | ✓                 |                  | Input Output Control By Identifier | IOCBI    |
|   | \$31 | ✓                            |                   | ✓                | Routine Control                    | RC       |
|   | \$34 |                              |                   |                  | Request Download                   | RD       |
|   | \$35 |                              |                   |                  | Request Upload                     | RU       |
|   | \$36 |                              |                   |                  | Transfer Data                      | TD       |
| Upload Download                         | \$37 |                              |                   |                  | Request Transfer Exit              | RTE      |

## Simple/Polling Diagnostic Services

These services consist of one request and one response (max.) for physical addressing, or a group of responses for functional addressing

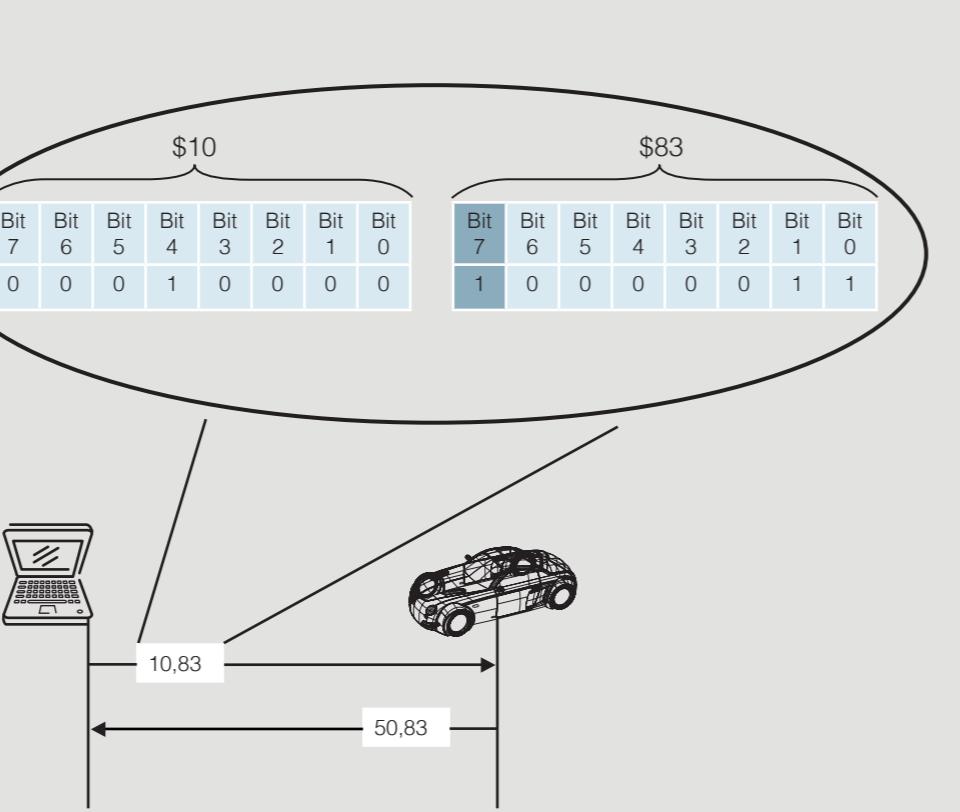
### Three Potential Polling Communication Flows when using the Sub-Function Byte

#### 1. Positive Response



### Erroneous Communication with Sub-Function Byte

Suppression requested (Bit 7 of Byte 2 is set to "1", but response is sent by the ECU)



## Common Response Codes

| Hex   | Mnemonic | Description   |
|-------|----------|---|
| 10    | GR       | General reject                                      |
| 11    | SNS      | Service not supported                               |
| 12    | SFNS     | Sub-Function not supported                          |
| 13    | IMLOIF   | Incorrect message length or invalid format          |
| 14    | RTL      | Response too long                                   |
| 21    | BRR      | Busy repeat request                                 |
| 22    | CNC      | Conditions not correct                              |
| 24    | RSE      | Request sequence error                              |
| 25    | NRFSC    | No response from sub-net component                  |
| 26    | FPEORA   | Failure prevents execution of requested action      |
| 31    | ROOR     | Request out of range                                |
| 33    | SAD      | Security access denied                              |
| 35    | IK       | Invalid key   |
| 36    | ENOA     | Exceeded number of attempts                         |
| 37    | RTDNE    | Required time delay not expired                     |
| 38-4F | RBEDLSD  | Reserved by Extended Data Link Security Document    |
| 70    | UDNA     | Upload/Download not accepted                        |
| 71    | TDS      | Transfer data suspended                             |
| 72    | GPF      | General programming failure                         |
| 73    | WBSC     | Wrong Block Sequence Counter                        |
| 78    | RCRRP    | Request correctly received, but response is pending |
| 7E    | SFNISAS  | Sub-Function not supported in active session        |
| 7F    | SNSIAS   | Service not supported in active session             |

All values not described are reserved for future definition

## Specific conditions driven Response Codes

| Hex | Mnemonic | Description                       |
|-----|----------|-----------------------------------|
| 81  | RPMTH    | rpm too high                      |
| 82  | RPMTL    | rpm too low                       |
| 83  | EIR      | Engine is running                 |
| 84  | EINR     | Engine is not running             |
| 85  | ERTL     | Engine run-time too low           |
| 86  | TEMPTH   | Temperature too high              |
| 87  | TEMPL    | Temperature too low               |
| 88  | VSTH     | Vehicle speed too high            |
| 89  | VSTL     | Vehicle speed too low             |
| 8A  | PTPH     | Throttle/Pedal too high           |
| 8B  | PTPL     | Throttle/Pedal too low            |
| 8C  | TRNIN    | Transmission range not in neutral |
| 8D  | TRNIG    | Transmission range not in gear    |
| 8F  | BSNC     | Brake switch(es) not closed       |
| 90  | SLNIP    | Shifter lever not in park         |
| 91  | TCCL     | Torque converter clutch locked    |
| 92  | VTH      | Voltage too high                  |
| 93  | VTL      | Voltage too low                   |

All values not described are reserved for future definition

## Error Memory Functions

### 1) Erase Error Memory (\$14 Clear Diagnostic Information)

Parameter 1: Service ID = \$14  
Parameter 2: Diagnostic Trouble Code (DTC) with three byte length

### 2) Sub-Functions for Service \$19 Read DTC Information

| Hex | Description   |
|-----|---|
| 01  | Report number of DTC by Status Mask                         |
| 02  | Report DTC by Status Mask                                   |
| 03  | Report DTC Snapshot Identification                          |
| 04  | Report DTC Snapshot Record by DTC number                    |
| 05  | Report DTC Snapshot Record by Record number                 |
| 06  | Report DTC Extended Data Record by DTC number               |
| 07  | Report number of DTC by Severity Mask Record                |
| 08  | Report DTC by Severity Mask Record                          |
| 09  | Report Severity Information of DTC                          |
| 0A  | Report Supported DTC  |
| 0B  | Report First Test Failed DTC                                |
| 0C  | Report First Confirmed DTC                                  |
| 0D  | Report Most Recent Test Failed DTC                          |
| 0E  | Report Most Recent Confirmed DTC                            |
| 0F  | Report Mirror Memory DTC by Status Mask                     |
| 10  | Report Mirror Memory DTC Extended Data Record by DTC number |
| 11  | Report number of Mirror Memory DTC by Status Mask           |
| 12  | Report number of Emissions Related OBD DTC by Status Mask   |
| 13  | Report Emissions Related OBD DTC by Status Mask             |
| 14  | Report DTC with Permanent Status                            |
| 15  | Report DTC with Permanent Status                            |

## Periodic Service Execution (Service \$2A)

For one Request follows one initial Response. After that, periodically more responses will follow. The sending can be stopped by using a simple diagnostic service

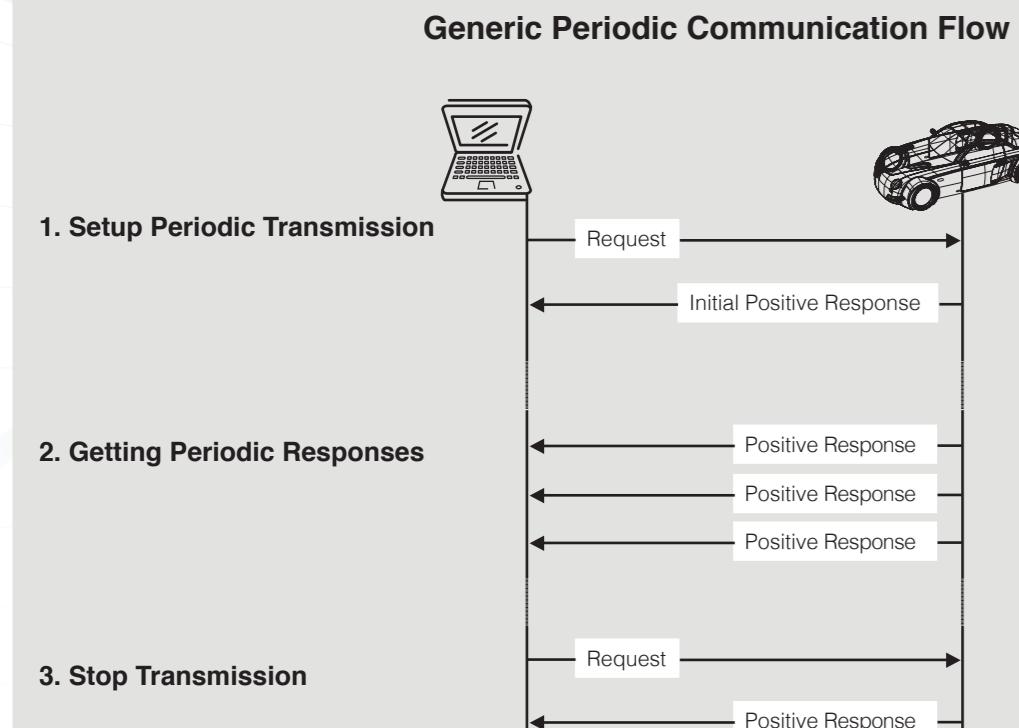
Service parameter "Transmission Mode"

The frequency of the data transmission can be configured using the the Transmission Mode. The UDS-Standard defines abstract values as:

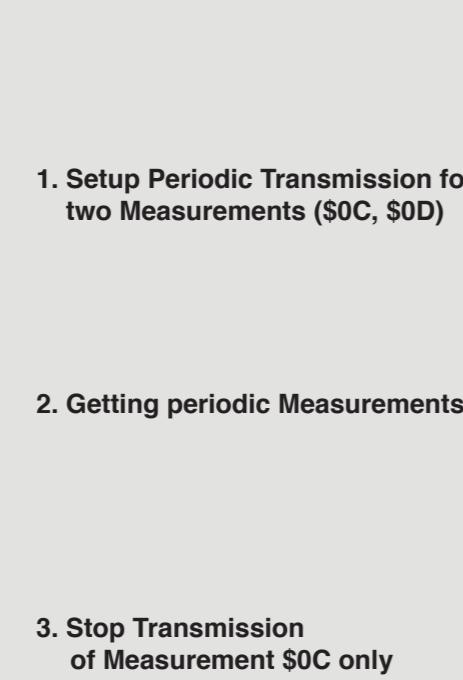
Slow = \$01  
Medium = \$02  
Fast = \$03  
Stop sending = \$04

The real values in Hertz for each frequency need to be defined between OEM and ECU supplier

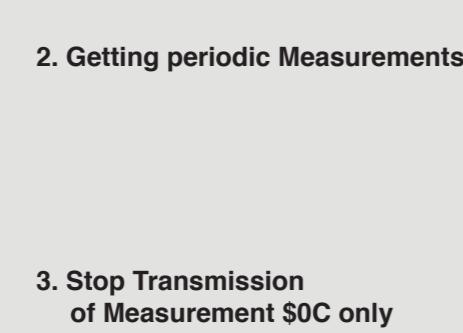
### Generic Periodic Communication Flow



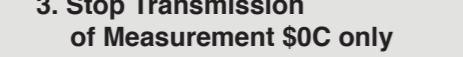
#### 1. Setup Periodic Transmission for two Measurements (\$0C, \$0D)



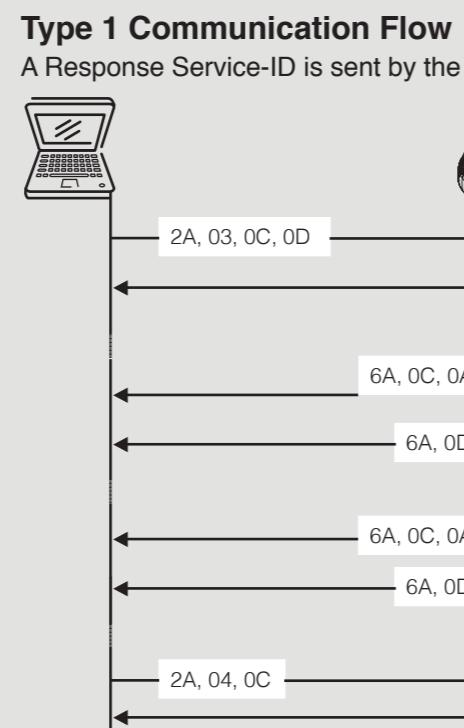
#### 2. Getting periodic Measurements



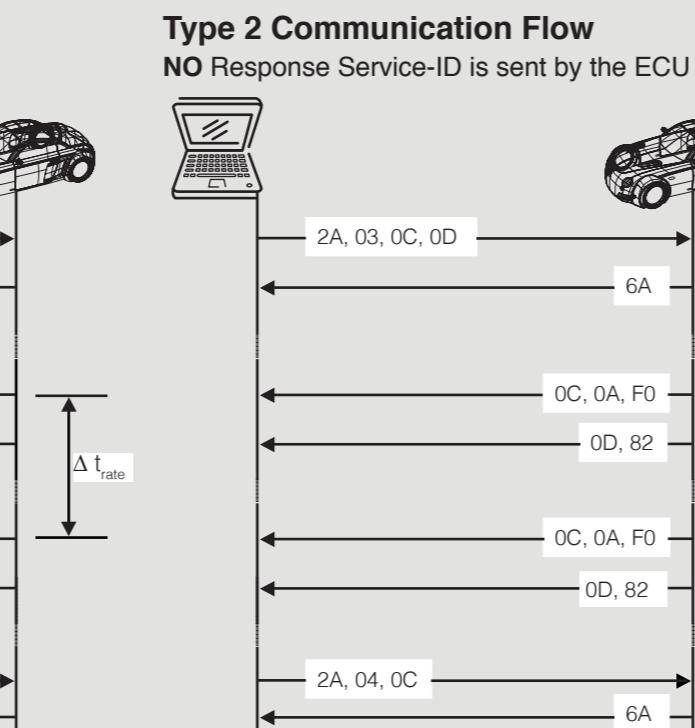
#### 3. Stop Transmission of Measurement \$0C only



### Type 1 Communication Flow



### Type 2 Communication Flow NO Response Service-ID is sent by the ECU



## Response on Event – RoE (Service \$86)

For one or two setup and start Requests one or two initial Responses are given, followed by 0 to n event-driven Responses depending on the number of occurrences of tracked events. The distance between several events is non-deterministic.

- The RoE mechanism can be activated in any Session, including the Default-Session
- If does not Tester Present messages to stay active

### Generic Event-Driven Communication Flow

