SAE Update for
UN EVE GTR 22 Activities

J1979DA Ballot

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Version 3

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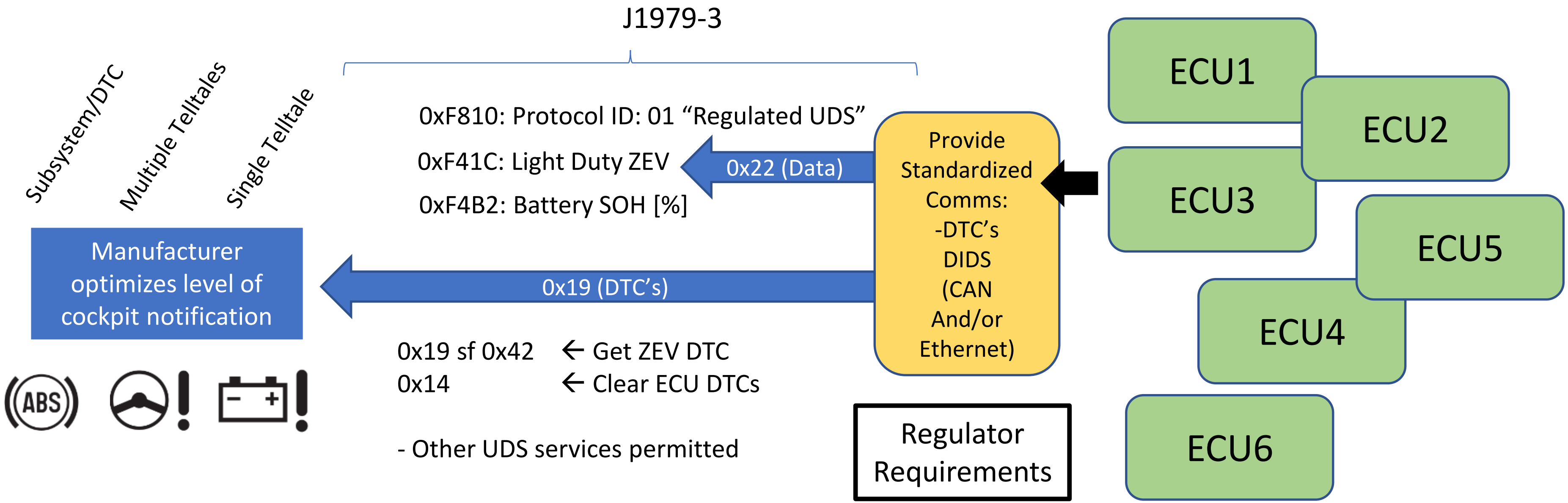
Overview of ZEV Diagnostic and Repair Standardization - ZEVDRS (J1979-3)

- Focus is on Independent Data Support and Repair (ISO 14229 Reserved DID Range)
- Standardized DTC's (J2012)
- Standardized Connector (J1962 – Already allows for CAN and Ethernet)
- Standardized Protocol (elements of ISO 14229 (UDS)) to allow low-cost customer and vehicle communications (ensure no difference in communication method between propulsion and other vehicle ECU's for service)
- J1979-3 (provides a minimum number of required diag services)
    - Propulsion system functional response requirements
    - ZEV protocol discovery using traditional Service 0x22 – 0xF810 → 0xF41C (HD ZEV, etc.)
        - Aligns nicely with existing conventional vehicle scan tool validation framework
        - However! The vehicle may only respond to 0xF810 over Ethernet OR CAN.
            - It can still support diagnostics over both buses, but per ACC2 must only acknowledge "regulated ZEV" from 0xF810 over one bus or the other.

Minimize disturbance to mature off the shelf UDS control system = Fastest time to market, robustness, lowest cost for customers



As internal combustion vehicles phase out, also phase out referencing emissions requirements and focus investment on ISO-14229 / ISO 13400 (CAN and Ethernet). J1979-3 Provides Elaboration on the minimum quantity of services and the standardized data is expected (J1979DA and J2012)

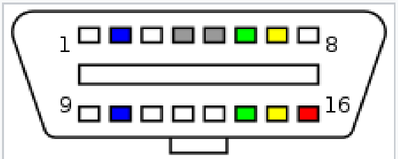
J1962 Connector : How to connect to a vehicle in MY26+

J1979-3 transitions manufacturers to support 3 possible already validated configurations for supporting ZEV Standardization.

- J2534-2

w/ Direct Connect
Ethernet Option

A. CAN (pins 6,14)
B. Ethernet Option 1 (pins 3,11,12,13) +8
C. Ethernet Option 2 (pins 1, 9, 12, 13)+8



Female OBD-II connector pinout - front view

Managing the Standardized Data:

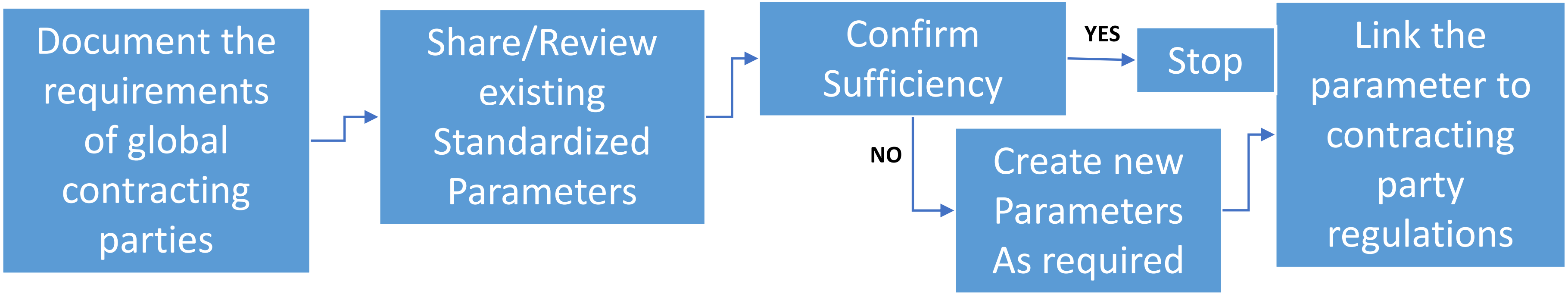
J1979 Committee assists in providing a column to highlight the source of the requirements for these new DIDs (in addition to ZEVDRS voluntary supported DIDs):

ISO 27145-2/J1979-2 ITID	Description	Scaling/bit	External test equipment SI (Metric) / English display	Comment	Reset w/Serv - $04/$14	LD CARB ZEV: ACC2 1962.5	J. T E
0xF894	Minimum and Maximum Pack Temperature (Lifetime)						
0xF894	Maximum Pack Temperature (Lifetime)	1 Byte 1 °C with -40 °C offset Min Value: -40 C Max Value: 215 C	MAX_BATTEMP-L: XXX C	The maximum measured temperature in the energy storage system over its lifetime. See Note B for reset conditions, see Note C for freeze conditions.			
0xF894	Minimum Pack Temperature (Lifetime)	1 Byte 1 °C with -40 °C offset Min Value: -40 C Max Value: 215 C	MIN_BATTEMP-L: XXX C	The minimum measured temperature in the energy storage system over its lifetime. See Note B for reset conditions, see Note C for freeze conditions.			
0xF895	Average Battery Pack Temperature (Lifetime)	1 Byte					
0xF895	Average Battery Pack Temperature (Lifetime)	1 Byte 1 °C with -40 °C offset Min Value: -40 C Max Value: 215 C	AVG_BATTEMP-L: XXX C	The average measured temperature in the energy storage system over its lifetime. The lifetime average shall be calculated as a running average of each individual propulsion system active cycles and charging cycles. See Note B for reset conditions, see Note C for freeze conditions.			

For example:

1. Advanced Clean Cars 2 Markets
2. UN-EVE GTR 22 Cert Markets, etc.
3. EU Certification Requirements

The philosophy driving SAE J1979DA Parameter creation:



- The digital annex has a long history of providing:
  - Single source for regulated calculation requirements
  - Allows for consistency of public-facing parameters (scaling, identification, etc.)
  - Allows for cross-industry validation tools (J1699, etc.)
  - Allows efficient and lower cost repair via generic scan tools and troubleshooting across manufacturers
  - Seeks to avoid confusion and duplication of effort resulting from decentralized requirements (lowering complexity and cost)
  - Avoids scaling errors in data as it is transferred from vehicle to cloud for analysis

SAE J1979DA GTR 22 Implementation Status Report DIDS (0xF4xx) and ITIDS (0xF8xx) Spring 2023

In the following slides, the draft DID assignments, scaling and calculation requirements, are provided for review.

They are subject to change pending feedback from industry / government during the ballot period April 15->May 1st

Annex 2

Values to be read from vehicles:

1. On board SOCE value	NEW DID CREATED
2. On board SOCR value	NEW DID CREATED
3. Odometer (in km)	EXISTING DID PROPOSED
4. Date of manufacture of the vehicle	NEW DID CREATED
5. Total distance (sum of the distance driven and the virtual distance) [km], if applicable	PLANNED FOR NEXT RELEASE
6. Percentage of virtual distance [in per cent], if applicable	NEW DID CREATED
7. Worst case certified energy consumption of PART B family [Wh/km], if applicable	NEW DID CREATED
8. Total discharge energy in V2X [Wh], if applicable	EXISTING DID PROPOSED
9. Elapsed time since last charged by more than 50 per cent SOC swing [Days]	NEW DID CREATED
10. Maximum, minimum, average battery pack temperature the battery experienced [lifetime]	NEW DID CREATED
11. Energy throughput	EXISTING DID PROPOSED
12. Capacity throughput	EXISTING DID PROPOSED
13. Total time of use of the battery	DISCUSSION REQUESTED

The levels of requirement details in J1979DA can vary:

- When a metric should be calculated the same way in all markets, the parameter calculation requirements are specific and unambiguous:
  - Example: Vehicle Odometer <0xF4A6>

- Sometimes, the market requires a standardized parameter and scaling, however the calculation itself may have regional requirements. In those cases, the requirements in J1979DA are sometimes more general and the implementation requirements are directed to regional requirements:
  - Example: Certified Energy Consumption Wh/km <0xF8A6>
    - Some markets may choose worst case (GTR) , some may use nominal, etc.

1. SOCE / 2. SOCR (0xF4B2)

State of Certified Energy (Byte B) and Range (Byte C) are provided in the same DID and can be individually enabled by the calibration bits at the start of the parameter* (Byte A).

0xF4D2	High Voltage Battery State of Certified Energy/Range				
0xF4D2	Support of SoC Data	A			Bit Mapped
0xF4D2	State of certified energy supported	A,bit 0	0	1	1 = State of certified energy supported
0xF4D2	State of certified range supported	A,bit 1	0	1	1 = State of certified range supported
0xF4D2	Reserved	Bit 2-7	0	1	Reserved (bits shall be reported as '0')
0xF4D2	**State of certified energy**	**B**	**0%**	**100.0%**	**100/255 % per bit**
0xF4D2	**State of certified range**	**C**	**0%**	**100.0%**	**100/255 % per bit**

SOCE/SOCR Requirements Provided in J1979 ‘comments field’

"State of certified energy" (SOCE) is the on-board estimated UBE performance at a specific point in its lifetime, expressed as a percentage of the certified usable battery energy.

State of certified range" (SOCR) represents the on-board estimated electric range at a specific point in its lifetime, expressed as a percentage of the certified electric range.

To the extent feasible, this calculation reflects the control systems best characterization of the degradation of the plurality of propulsion components that contribute to the range of the vehicle. (Energy storage system, motors and power electronics (traction, on board chargers, and 12 V conversion, etc.). The numerator of the SOCR shall amalgamate the recent onboard characterization of all of these components. This characterization is limited to the on-board propulsion components and shall not include the mechanical deterioration of tires, wheel bearings, or half shafts.

For systems where on-board characterization of powertrain components is not feasible, this calculation shall at least include the energy storage systems contribution to range degradation.

The denominator of the ratio shall represent the as-certified range of a nominal energy storage system for the particular certification region.

3. Odometer (0xF4A6) [DID ALREADY EXISTS]

A regulated odometer calculation is already standardized and provided in production today by emissions-related products.

0xF4A6	Vehicle Odometer Reading	A,B,C,D	0 km	429,496,729.5 km	0.1 km per bit

4. Date of Manufacture of the Vehicle (F8A2) [NEW ITID CREATED FOR GTR 22]

Date of Manufacture of the Vehicle is provided in YYYY:MM:DD format

0xF8A2	Date of Manufacture of Vehicle	8 bytes ASCII data	Manf_Date: YYYY:MM:DD	The date of manufacture of the vehicle. Each digit in the year month and day is represented by the ASCII numerical value of the character.

5. Total Distance (Vehicle Odometer + Battery Distance <V2X>)
[NEW ITID PLANNED FOR NEXT RELEASE, Vehicle Odo and Battery Virtual Odo Already Created]

Vehicle Odometer provided using 0xF4A6
Virtual Distance provided using 0XF8A3

0xF8A3	Energy Storage Distance Travelled During V2X (Virtual Distance)	4 bytes 0.1 km per bit Min: 0 km Max: 429,496,729.5 km	ES_DT: xxxxxxxxx.x km	The virtual milage is provided as a measure of the non-propulsion based usage of an energy storage system and related componentry. It is calculated by utilizing the measured AC Charging Energy at certification, the UBE measured at certification [DID 0xF8A8], the lifetime Energy in V2X [DID 0xF8A4], and the Certified Energy Consumption [0xF8A6] . See Note B for reset conditions, see Note C for freeze conditions.

Total Distance = 0xF4A6 + 0xF8A3

New ITID Next Release = Vehicle Odometer + Battery Odometer

* It is anticipated that this new DID will be used by manufacturers for the measurement of the warranty period once it is completed.

** Typically, it isn't preferred to create DIDS for simple calculations that can be done with the off-board device (simple sum), however this value is so useful to customer (ie., potentially linked to warranty) – the separate DID requested as requested by the GTR seems to be a convenient onboard value---implementation planned in Summer 2023.

6. Percentage of Virtual Distance [NEW ITID CREATED FOR GTR 22]

V2X Ratio is the ratio of V2X Distance to Propulsion Distance

0xF8A5	V2X Ratio	2 bytes 0.01 % per bit Min Value: 0 % Max Value: 100.00 %	V2X_RAT: xxx.xx %	The ratio of lifetime virtual distance (0xF8A3) to total lifetime distance travelled (0xF88D). When Lifetime Distance Travelled = 0, in order to avoid divide by zero, this value shall report 100%.

7. Worst Case Energy Usage (Wh/km) [NEW ITID CREATED FOR GTR 22]

- An ITID is provided for usage in represent the function of providing the energy deployment efficiency of a given propulsion system.

(in Wh/km)

0xF8A6	Certified Energy Consumption	2 bytes 0.1 Wh per bit Min Value: 0 Wh Max Value: 6553.5 Wh / km	CEC_WC: xxxx.x Wh / km

Implementation language is planned to reflect flexibility to meet the needs of each cert market. (Worst case, nominal, etc.)

This value is critical for the V2X virtual mileage calculation.

8. Total Discharge Energy in V2X (Lifetime)
[ITID REUSED 0xF88B, and NEW ITID PLANNED FOR NEXT RELEASE]

An existing ITID is provided that provides an accumulation of energy provided to V2X usage (Non-PSA). Additions are also coming to calculate the usage during PSA.

0xF88B	Total battery energy supplied to an off-board usage during propulsion system non-active operation (Lifetime)	4 bytes 0.1 kWh per bit Min value: 0 kWh Max value:429,496,729.5 kWh	RESS_V2X_EN_NONPSA-L: XXXXXXXXXX kWh

0x____	Total battery energy supplied to an off-board usage during propulsion system active operation (Lifetime)	4 bytes 0.1 kWh per bit Min value: 0 kWh Max value:429,496,729.5 kWh	RESS_V2X_EN_NONPSA-L: XXXXXXXXXX kWh

** See additional SAE presentation regarding complete V2X calculation*

9. Elapsed Time Since Charge More than 50% Swing [NEW ITID CREATED FOR GTR22]

A value is provided that provides an insight into when a higher accuracy measurement of battery energy is expected to be completed. (resulting in more accurate SOCE/SOH%)

0xF8A7	Elapsed Time since Last Charged by more than 50% swing (Days)	2 bytes 1 day per bit Min value: 0 days Max value: 65535 days	SOC_T_50PCT_SWG: xxxxx days

10. Maximum, minimum, average battery pack temperature the battery experienced [NEW ITIDS Created for GTR 22]

Parameters to exactly match the GTR requirements for battery temperature have been generated and are included in the next ballot of J1979DA:

0xF894	Minimum and Maximum Pack Temperature (Lifetime)		
0xF894	Maximum Pack Temperature (Lifetime)	1 Byte 1 °C with -40 °C offset Min Value: -40 C Max Value: 215 C	MAX_BATTEMP-L: XXX C
0xF894	Minimum Pack Temperature (Lifetime)	1 Byte 1 °C with -40 °C offset Min Value: -40 C Max Value: 215 C	MIN_BATTEMP-L: XXX C
0xF895	Average Battery Pack Temperature (Lifetime)	1 Byte	
0xF895	Average Battery Pack Temperature (Lifetime)	1 Byte 1 °C with -40 °C offset Min Value: -40 C Max Value: 215 C	AVG_BATTEMP-L: XXX C

11. Energy Throughput [Using Existing ITID]

- Various options are provided within J1979DA, however the most simple is to assess the lifetime energy stored into the RESS:

0xF888	Total grid energy into the battery during off-board charging (Recent)	4 bytes 0.1 kWh per bit Min value: 0 kWh Max value:429,496,729.5 kWh	TGE_OVC-R: XXXXXXXXXX kWh
0xF888	Total grid energy into the battery during off-board charging (Lifetime)	4 bytes 0.1 kWh per bit Min value: 0 kWh Max value:429,496,729.5 kWh	TGE_OVC-L: XXXXXXXXXX kWh

- An alternative is to measure lifetime discharge energy:

0xF88B	Total battery energy supplied to an off-board usage during propulsion system non-active operation (Lifetime)

+

0xF886	Total net energy consumed in propulsion system active operation (Lifetime)

12. Capacity Throughput [Using Existing ITID]

- It assumed that this requirement desires to tracker for purely current-based flow through the RESS:

0xF885	Total net battery current in propulsion system active operation (Recent)	4 bytes 0.001 Ahr per bit Min value: -2,147,483.648 Ahr Max value: 2,147,483.647 Ahr
0xF885	Total net battery current in propulsion system active operation (Lifetime)	4 bytes 0.001 Ahr per bit Min value: -2,147,483.648 Ahr Max value: 2,147,483.647 Ahr

13. Total Time of Use of Battery – Further Discussion Needed.

- This ITID is in backlog and is under consideration for next release.
- Question 1: Are any other metrics that can be used in lieu of "Time of Use"?
- Question 2: Further requirements are required to define this DID:
  - How is "use" defined?
    - Pack Assembly?
    - Vehicle Integration?
    - First time charged in a vehicle?
    - Should the timer pause accumulation when the contactor is opened and hence battery isn't in "use"?
  - Shall the calculation be designed to comprehend servicing of modules and or subpacks?
    - Should the value be designed to represent the newest section of a pack or the oldest?

Important Considerations for Discussion in 2023:

1. CARB SOH % [0xF4B2] vs GTR 22 SOCE [0xF4D2 ByteB]:

Potential for confusion is on the horizon w/ these two possible customer facing battery health metrics.

CARB SOH appears to have similar functional requirements to SOCE, with the additional requirement that CARB SOH% being required to communicate reserve capacity degradation (if equipped).

Seemingly, manufacturers could provide the CARB required higher stringency SOH% in order to comply with the needs of GTR22 requirement for the presence of an SOCE monitor.

SOCE (F4D2 ByteB) would continued to be supported in J1979DA in case the requirements of SOCE and SOH% diverge in a noteworthy way in the future.

2. Manufacturers would continue investigation of the levels of feasibility of the SOCR monitor and those efforts would be visible via DID 0xF4D2-ByteC.

J1979-3 Edition 2 Publishing Targeted Spring 2023
J1979DA 2023 Edition Publishing targeted Spring 2023.
To access the documents referenced in this presentation:

Visit:

https://www.iso.org/store.html/

https://www.sae.org/standards

Contact Info

Thank you!

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