Draft ePTO Signalling specification 0.1.0

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1 Document History

Date	Changes/Additions	Version
2022-07-04	Creation of document	0.0.1
2023-05-20	Review of the document	0.0.2
2023-07-31	Review of the document	0.0.3
2023-10-10	Final draft	0.1.0

2 Introduction

2.1 Abbreviations

Abbreviation	Description
ePTO	Electric Power Take-Off
OEM	Original Equipment Manufacturer
EPBC	EquiPotential Bonding Conductor
ECU	Electronic Control Unit
AC	Alternating Current
DC	Direct Current
VIN	Vehicle Identification Number

2.2 Definitions

Abbreviation	Term	Description
M	Mandatory	It is a must
O	Optional	It is up to each OEM to decide if they want to implement this information or not

2.3 References

Document name
SAE J1939DA
ISO 3779
ISO 11992-3
Draft ePTO Connection Specification V.0.1.0
Draft Technical Supplement V 0.1.0

3 General remarks

ePTO gives the opportunity for external body builders to power their equipment from the energy storage of an electrified vehicle propulsion system.

The HV power is delivered on a separate connector and described in the ePTO Connection specification ("draft ePTO Specification Connection V 0.1.0.pdf").
The signal/communication connector is described physically as well in the ePTO Connection specification ("draft ePTO Specification Connection V 0.1.0.pdf")

This ePTO Signalling specification defines the signal interface (bidirectional communication) between vehicle and trailer/body ECUs.

This specification covers signals as well based on safety requirements.

The ePTO Signalling Specification defines the logical interface requirements that provide interoperability and cross compatibility for systems and equipment.
The communication is based on SAE J1939 and ISO 11992.

Out of scope is the support of more than one ePTO and AC-ePTO from vehicle side.

4 1Communication Signals

The signal definition covers both directions (from vehicle -> Body/trailer and Body/trailer -> vehicle) including safety relevant signals.

4.1 General system overview

See draft technical supplement ("draft technical supplement V 0.1.0.pdf").

4.2 Communication signals

This specification covers the support of DC systems only.

4.2.1 Direction Body to Vehicle

Function	Type	Description	Purpose / application	Resolution / Range	Repetition rate
Trailer ID	Status	Trailer identification number (maybe no standard existing)	Signal sent by the trailer to inform the vehicle of the trailer identification. Used to help track usage of ePTO's per trailer/customer	17 Characters 8 Bit / character (similar to the VIN)	10 000 ms
ePTO Activation	Status	Request activation /deactivation of the ePTO outlet	Signal sent from the body equipment to the vehicle to request activation or deactivation of the ePTO outlet for power delivery	00: not requested 01: requested 10: Error 11: Not available	50 ms
ePTO emergency deactivation request	Status	Request for emergency deactivation of the ePTO outlet When requested, emergency deactivation gets higher priority than ePTO request.	Signal sent from the body equipment to the vehicle to request an emergency deactivation of the ePTO outlet	00: not requested 01: requested 10: Error 11: Not available	10 ms
ePTO Error Status	Status	Status signal of ePTO	Signal sent from the body equipment to the vehicle to report an error related to the ePTO	00: No error 01: Error 10: Reserved 11: Not available	100 ms

Function	Type	Description	Purpose / application	Resolution / Range	Repetition rate
ePTO actual power (body)	Measured	Power currently measured on the body equipment Negative value range is meant for recuperation	Signal sent from the body equipment to the vehicle to report the current power used by the body equipment (from the ePTO outlet)	0-64255: -1600 … +1612.75kW (0.05 kW/bit) 64256-65023: Reserved 65024-65279: Error 65280-65535: Not available	100 ms
ePTO actual voltage (body)	Measured	Voltage currently measured on the body equipment	Signal sent from the body equipment to the vehicle to report the current voltage measured on the body equipment	0-240: 0…1200V (5V/bit) 241-253: Reserved 254: Error 255: Not available	100 ms
ePTO actual current (body)	Measured	Current currently measured on the body equipment. Negative value range is meant for recuperation.	Signal sent from the body equipment to the vehicle to report the current currently drawn by the body equipment on the ePTO outlet	0-250: -250 … +250A (2A/bit) 251-253: Reserved 254: Error 255: Not available	100 ms
Body equipment acceptable voltage (min)	Status	Body equipment minimum acceptable voltage		0-240: 0…1200V (5V/bit) 241-253: Reserved 254: Error 255: Not available	1000 ms
Body equipment acceptable voltage (max)	Status	Body equipment maximum acceptable voltage		0-240: 0…1200V (5V/bit) 241-253: Reserved 254: Error 255: Not available	1000 ms
Body equipment current class	Status	Body equipment required current class	Provides information on the current requirement	0: Class A (<50A) 1: Class B (<150A) 2: Class C (<250A) 3: not available	1000 ms

Table 1: Signal direction Body to Vehicle

4.2.2 Direction Vehicle to Body

Function	Type	Description	Purpose / application	Resolution / Range	Repetition rate
ePTO Control Status	Status	Current status of the ePTO.	This data informs body systems about the current status of ePTO in electrical vehicles.	0000 = Not ready e.g., Checking system, activation not allowed and no request can be accepted yet 0001 = Ready waiting for activation 0010 = On/Initiating Activation received, preparing power supply 0011 = On/Active System running, power available 0100 = Deactivating About to shut down 0101 = System Failure Deactivated, no request can be accepted, reset conditions OEM specific 0110..1101 = Reserved 1110 = Error 1111 = Signal not available	50 ms
Vehicle Identification (VIN)	Status	Unique identification based on ISO 3779 Standard		17 Characters 8 Bit / character	10000 ms

Function	Type	Description	Purpose / application	Resolution/Range	Repetition rate
ePTO Energy Status	Measured		Information for body about the energy level of the ePTO.	0000 = Level 0/no energy left for ePTO 0001 = Level 1 (Minimum – prepare for deactivation) 0010 = Level 2 0011 = Level 3 (Maximum) 0100..1101 = Reserved 1110 = Error 1111 = Signal not available	1000 ms
ePTO Connector Locking Status	Status	ePTO safe to disconnect state.	This data informs body systems about the current state regarding safety to disconnection of the ePTO.	00 = Connector unlocked 01 = Connector locked 10 = Error 11 = Signal not available	Remark: it is up to the OEM to use it cycle time is OEM specific
ePTO Available Power	Measured	Current value of the available ePTO power.	This data informs body systems about the current value of the available power of the ePTO.	0..64255 = 0 .. +3212.75 kW (0.05 kW/bit) 64256..65023 = Reserved 65024..65279 = Error indicator 65280..65535 = Not available	100 ms
ePTO Recuperation Power Allowed	Measured			0..250 = 0..+1250 kW (5 kW/bit) 0 = recuperation not allowed 1 – 250 = 5kW … +1250kW 251..253 = Reserved 254 = Error 255 = Signal not available	100 ms
ePTO actual current (vehicle)	Measured	Current value of the ePTO current.	This data informs body systems about the current value of the current measured at ePTO system.	0..250 = -250..+250 A (2 A/bit) 251..253 = Reserved 254 = Error indicator 255 = Signal not available	100 ms

Function	Type	Description	Purpose / application	Resolution / Range	Repetition rate
ePTO actual voltage (vehicle)	Measured	Current value of the ePTO voltage.	This data informs body systems which is the current value of the voltage applied in the ePTO system.	0..240 = 0..1200 V (5 V/bit) 241..253 = Reserved 254 = Error indicator 255 = Not available	100 ms
ePTO actual power (vehicle)	Measured	Power currently measured on the vehicle Negative value range is meant for recuperation	Signal sent from the vehicle to the body equipment	0-64255: -1600 … +1612.75kW (0.05 kW/bit) 64256-65023: Reserved 65024-65279: Error 65280-65535: Not available	100 ms
ePTO lifetime Consumed Energy	Measured	Lifetime energy consumption of the connected body or trailer	Accumulated value over lifetime Can be used for accounting	4 bytes long 0….4294967290 (1kWh per bit) 4294967291-4294967294 = reserved 4294967295= Error indicator 4294967296= not available	1000 ms
ePTO interlock status	Measured	Status indication of the HV interlock		2 bit 00 = open 01 – closed 10 – error indication 11 – not available	100 ms
ePTO Error Status	Status	Error status Can be extended by OEM specific error cases	If more than one error is detected the 1110 error value shall be sent	4 bit 0000 = No error 0001 = Connection error 0010 = Vehicle system error 0011 = Body system error 0100 = Galvanic separation error 0101 = Crash 0110 = Interlock error 0111 – 1101 reserved 1110 = error 1111 = not available	100 ms

Table 2: Signal direction Vehicle to Body