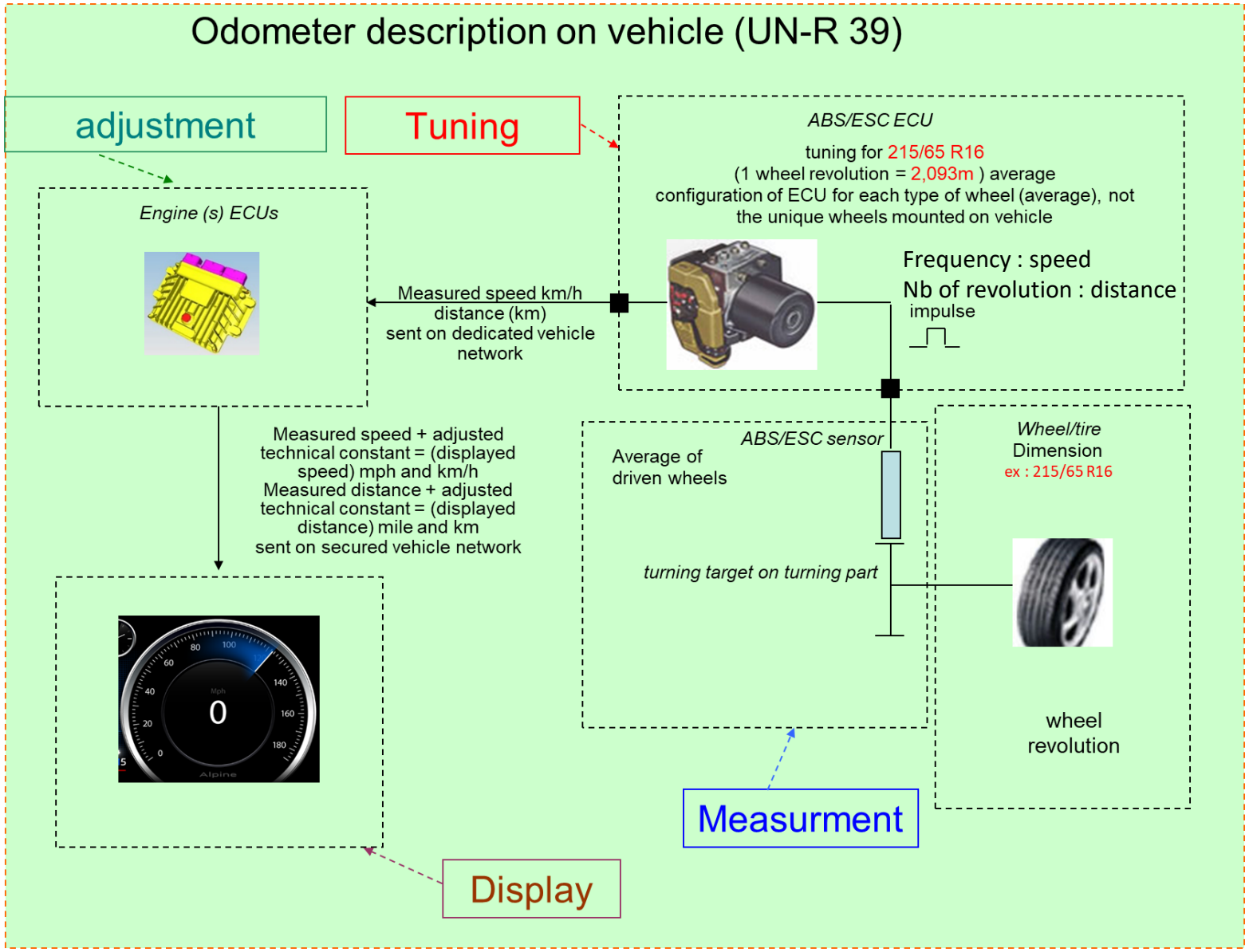
UN-R39 Odometer accuracy + anti tampering

Accuracy

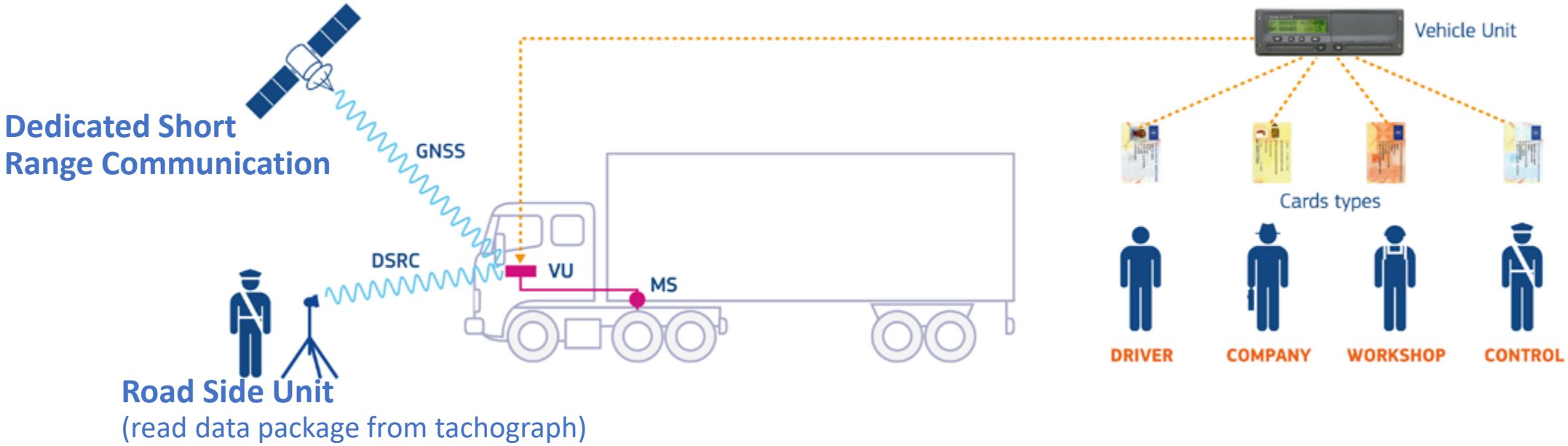
Vehicles M1, N1, M2, N2



Vehicles M3, N3 with tachograph embedded - accuracy

Tachograph system helicopter view

Global Navigation Satellite System
(for recording of position)

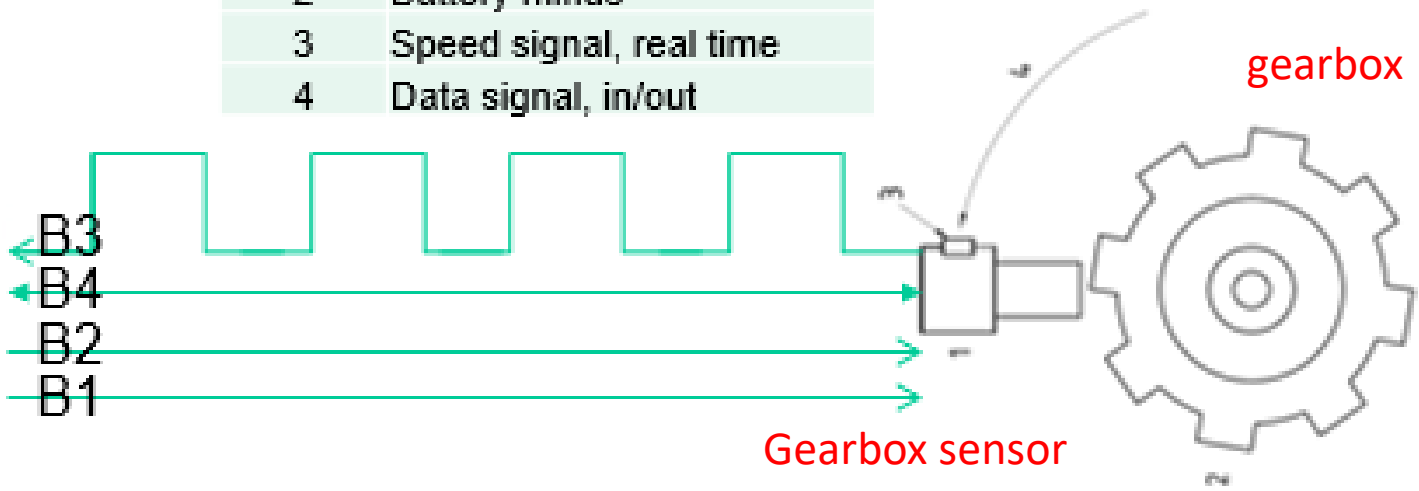


Road Side Unit
(read data package from tachograph)

Vehicles M3, N3 with tachograph embedded - accuracy
Speed and distance measurement

Frequency : speed
Nb of impulses : distance

Pin No.	Function
1	Positive supply
2	Battery minus
3	Speed signal, real time
4	Data signal, in/out



In order to calculate speed and distance based on pulse data, additional information is needed.

- size of the wheels
- k-factor (k-factor connects the number of pulses generated for a one kilometer drive of the vehicle).
- These parameters are set in the tachograph during calibration in workshop. Only trusted and controlled workshops in possession of a tachograph workshop card have access to change those parameters.

Vehicles M3, N3 with tachograph embedded - accuracy

Legislation EU 2016/799 amended by EU 2021/1228

Speed, position and distance measurement

(21) The motion sensor (possibly embedded in the adaptor) is the main source for speed and distance measurement.

(22) This function shall continuously measure and be able to provide the odometer value corresponding to the total distance travelled by the vehicle using the pulses provided by the motion sensor.

(23) This function shall continuously measure and be able to provide the speed of the vehicle using the pulses provided by the motion sensor.

(24) The speed measurement function shall also provide the information whether the vehicle is moving or stopped. The vehicle shall be considered as moving as soon as the function detects more than 1 imp/sec for at least 5 seconds from the motion sensor, otherwise the vehicle shall be considered as stopped.

(25) Devices displaying speed (speedometer) and total distance travelled (odometer) installed in any vehicle fitted with a recording equipment complying with the provisions of this Regulation, shall comply with the requirements relating to maximum tolerances (see 3.2.1 and 3.2.2) laid down in this Annex.

(26) To detect manipulation of motion data, information from the motion sensor shall be corroborated by vehicle motion information derived from the GNSS receiver and optionally by other source(s) independent from the motion sensor.

(27) This function shall measure the position of the vehicle in order to allow for the automatic recording of:

— positions where the driver and/or the co-driver begins his daily work period;

— positions where the continuous driving time of the driver reaches a multiple of three hours;

— positions where the driver and/or the co-driver ends his daily work period.

Measurement of distance travelled

(28) The distance travelled may be measured either:

— so as to cumulate both forward and reverse movements, or

— so as to include only forward movement.

(29) The recording equipment shall measure distance from 0 to 9 999 999,9 km.

(30) Distance measured shall be within the following tolerances (distances of at least 1 000 m.):

— ± 1 % before installation,

— ± 2 % on installation and periodic inspection,

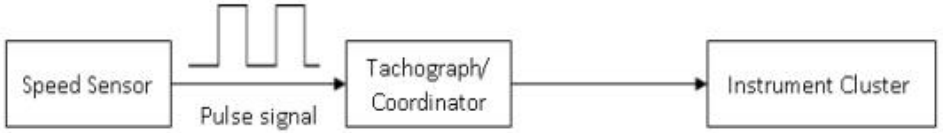
— ± 4 % in use.

(31) Distance measured shall have a resolution better than or equal to 0,1 km.

Vehicles M3, N3 with tachograph embedded - accuracy

Example of certified implementation of UN-R39 today

Odometer: The speed sensor send a signal to the tachograph.
The tachograph calculates the signal to a value and send the value (in a CAN-message) to the instrument cluster
The instrument cluster shows the odometer value.
The signal from the speed sensor is a pulse signal.
The Tachograph uses the K-value when calculates the signal to a value.
The K-value is put into the Tachograph at the calibration.
The value in the CAN-message can be 0 - 20 000 000 km with the resolution of 0,1 km.
If no Tachograph is present the Coordinator handle the same task as the tachograph.



The locally high resolution vehicle distance is calculated according to below:

$$\Delta HighResolutionVehicleDistance = \frac{PropellerShaftNrOfPulses}{K - value/1000}$$

$$HighResolutionVehicleDistance = HighResolutionVehicleDistance_{t-1} + \Delta HighResolutionVehicleDistance \quad [m]$$

PropellerShaftNrOfPulses = number of pulses since previous update
K-value = The K-value is put into the Tachograph at the calibration.
The vehicle distance is protected with check sum and saved in persistent memory for protection at system crash. If the distance has been changed, it is saved at ignition off and every 40 Km at ignition on.

RDW

Status

1 - CURRENT TYPE APPROVAL REQUIREMENT without tachograph

Speedometer UN-R39-> only the speed measurement is regulated, the accuracy of the odometer is not defined in Para 5.5 in UN-R39. Tyres dispersion, all the measurement dispersion are also the elements of consideration.

2 - CURRENT TYPE APPROVAL REQUIREMENT with tachograph or similar equipment

- A. In Europe a. tachograph is only applicable for vehicle categories N2, N3, M2, M3 above 3.5 Tonnes. Smart Tacho V2 is applicable onwards Aug 2023 (new vehicles), further Aug 2024 (V1-> V2), Aug 2025 (All). Further exception applies in the scope (less than 100 Km radius) and not to be disregarded.
- B. In Europe Further, N1 vehicles above 2.5 Tonnes are mandated under Tacho V2 only from 2026, provided usage applicable for international transport.

Anti tampering

Vehicles M1, N1, M2, N2 (LDV)

Anti tampering – current Euro 6

- **EU 2017/1151:**
-
- *Article 5*
- ***Application for EC type-approval of a vehicle with regard to***
- ***emissions and access to vehicle repair and maintenance information***
- 3. In addition, the manufacturer shall submit the following information:
- *…*
- *(f) a description of the provisions taken to prevent tampering with and*
- *modification of the emission control computer, odometer including*
- *the recording of mileage values for the purposes of the requirements*
- *of Annexes XI and XVI;*
- *…*
- *7. For the purposes of point (f) of paragraph 3, the provisions taken*
- *to prevent tampering with and modification of the emission control*
- *computer shall include the facility for updating using a manufacturer approved*
- *programme or calibration.*
-

- **EU 2017/1151:**
-
- **2.3. Provisions for electronic system security**
- 2.3.1. The requirements for electronic system security of paragraph 6.1.7. of UN Regulation 154 shall be complied with. The effective application of these strategies in protecting the emission control systems may be tested during type approval and/or market surveillance.
- 2.3.2 Manufacturers shall effectively deter reprogramming of the odometer readings, in the board network, in any powertrain controller as well as in the transmitting unit for remote data exchange if applicable. Manufacturers shall include systematic tamper-protection strategies and write-protect features to protect the integrity of the odometer reading. Methods giving an adequate level of tamper protection shall be approved by the approval authority. The effective application of these strategies in protecting the odometer may be tested during type approval and/or market surveillance.

UN-R154.03.S1 6.1.7

- 6.1.7. Provisions for electronic system security
- 6.1.7.1. Any vehicle with an emission control computer, including an evaporative emission control computer, including when integrated in an exhaust emissions control computer, shall include features to deter modification, except as authorised by the manufacturer. The manufacturer shall authorise modifications if those modifications are necessary for the diagnosis, servicing, inspection, retrofitting or repair of the vehicle. Any reprogrammable computer codes or operating parameters shall be resistant to tampering and afford a level of protection at least as good as the provisions in **ISO 15031-7: 2013.** Any removable calibration memory chips shall be potted, encased in a sealed container or protected by electronic algorithms and shall not be changeable without the use of specialized tools and procedures. 6.1.7.1.1. Only features directly associated with emissions calibration or prevention of vehicle theft may be protected in accordance with paragraph 6.1.7.1.
- 6.1.7.2. Computer-coded engine operating parameters shall not be changeable without the use of specialized tools and procedures (e.g. soldered or potted computer components or sealed (or soldered) enclosures).
- 6.1.7.3. Manufacturers may seek approval from the responsible authority for an exemption to one of these requirements for those vehicles that are unlikely to require protection. The criteria that the responsible authority shall evaluate in considering an exemption shall include, but are not limited to, the current availability of performance chips, the high-performance capability of the vehicle and the projected sales volume of the vehicle.
- 6.1.7.4. Manufacturers using programmable computer code systems shall deter unauthorised reprogramming. Manufacturers shall include enhanced tamper protection strategies and write-protect features requiring electronic access to an off-site computer maintained by the manufacturer. Methods giving an adequate level of tamper protection shall be approved by the responsible authority

Vehicles M2, M3, N2, N3 (HDV)

Anti tampering – current Euro VI

- **EU 595/2009:**
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- **Article 7 Obligations concerning systems using a consumable reagent**
- 1. Manufacturers, repairers and operators of the vehicles shall not tamper with systems which use a consumable reagent. 2. Operators of the vehicles shall ensure that vehicles are not being driven without a consumable reagent.
- **Article 11 Penalties**
- 1. Member States shall lay down the provisions on penalties applicable for infringement of the provisions of this Regulation and its implementing measures and shall take all measures necessary to ensure that they are implemented. The penalties provided for must be effective, proportionate and dissuasive. Member States shall notify those provisions to the Commission by 7 February 2011 and shall notify it without delay of any subsequent amendment affecting them.
- 2. The types of infringements by manufacturers which are subject to a penalty shall include:
- (a) making false declarations during the approval procedures or procedures leading to a recall;
- (b) falsifying test results for type-approval or in-service conformity;
- (c) withholding data or technical specifications which could lead to recall or withdrawal of type-approval;
- (d) use of defeat strategies;
- (e) refusal to provide access to information.
- The types of infringements by manufacturers, repairers and operators of the vehicles which are subject to a penalty shall include tampering with systems which control NOx emissions. This shall include, for example, tampering with systems which use a consumable reagent.
- The types of infringements committed by operators of the vehicles which are subject to a penalty shall include driving a vehicle without a consumable reagent.

- **EU 582/2011:**
- 9. MONITORING FAILURES THAT MAY BE ATTRIBUTED TO TAMPERING
- 9.1. In addition to the level of reagent in the reagent tank, the reagent quality, and the reagent consumption, the following failures shall be monitored by the anti-tampering system because they may be attributed to tampering: (a) Impeding of the EGR valve operation; (b) failures of the anti-tampering monitoring system, as described in Section 9.2.1
- 9.2. Monitoring requirements
- 9.2.1. The anti-tampering monitoring system shall be monitored for electrical failures and for removal or deactivation of any sensor that prevents it from diagnosing any other failures mentioned in Sections 6 to 8 (component monitoring). A non-exhaustive list of sensors that affect the diagnostic capability are those directly measuring NOx concentration, urea quality sensors, ambient sensors, and sensors used for monitoring reagent dosing activity, reagent level, or reagent consumption.

Vehicles M2, M3, N2, N3 with tachograph embedded – anti tampering

Legislation EU 2016/799 amended by EU 2021/1228

(9) point 3.2 is amended as follows:

(a) paragraphs (26) and (27) are replaced by the following:

'(26) To detect manipulation of motion data, information from the motion sensor shall be corroborated by vehicle motion information derived from the GNSS receiver and by other source(s) independent from the motion sensor. At least another independent vehicle motion source shall be inside the VU without the need of an external interface.

(27) This function shall measure the position of the vehicle in order to allow for the recording of:

— positions where the driver and/or the co-driver begins his daily work period;

— positions where the accumulated driving time reaches a multiple of three hours;

— positions where the vehicle has crossed the border of a country;

— positions where operations of load/unload have been carried out;

— positions where the driver and/or the co-driver ends his daily work period.';

(b) in point 3.2.1, the following sentence is added in paragraph (30):

'The tolerances shall not be used to intentionally alter the distance measured.';

```
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 workshopName                        Name,
 workshopAddress                     Address,
 workshopCardNumber                  FullCardNumber,
 workshopCardExpiryDate              TimeReal,
 vehicleIdentificationNumber         VehicleIdentificationNumber,
 vehicleRegistrationIdentification   VehicleRegistrationIdentification,
 wVehicleCharacteristicConstant      W-VehicleCharacteristicConstant,
 kConstantOfRecordingEquipment       K-ConstantOfRecordingEquipment,
 lTyreCircumference                  L-TyreCircumference,
 tyreSize                            TyreSize,
 authorisedSpeed                     SpeedAuthorised,
 oldOdometerValue                    OdometerShort,
 newOdometerValue                    OdometerShort,
 oldTimeValue                        TimeReal,
 newTimeValue                        TimeReal,
 nextCalibrationDate                 TimeReal,
 sensorSerialNumber                  SensorSerialNumber,
 sensorGNSSSerialNumber              SensorGNSSSerialNumber,
 rcmSerialNumber                     RemoteCommunicationModuleSerialNumber,
 sealDataVu                          SealDataVu,
 byDefaultLoadType                   LoadType,
 calibrationCountry                  NationNumeric,
 calibrationCountryTimestamp         TimeReal
}
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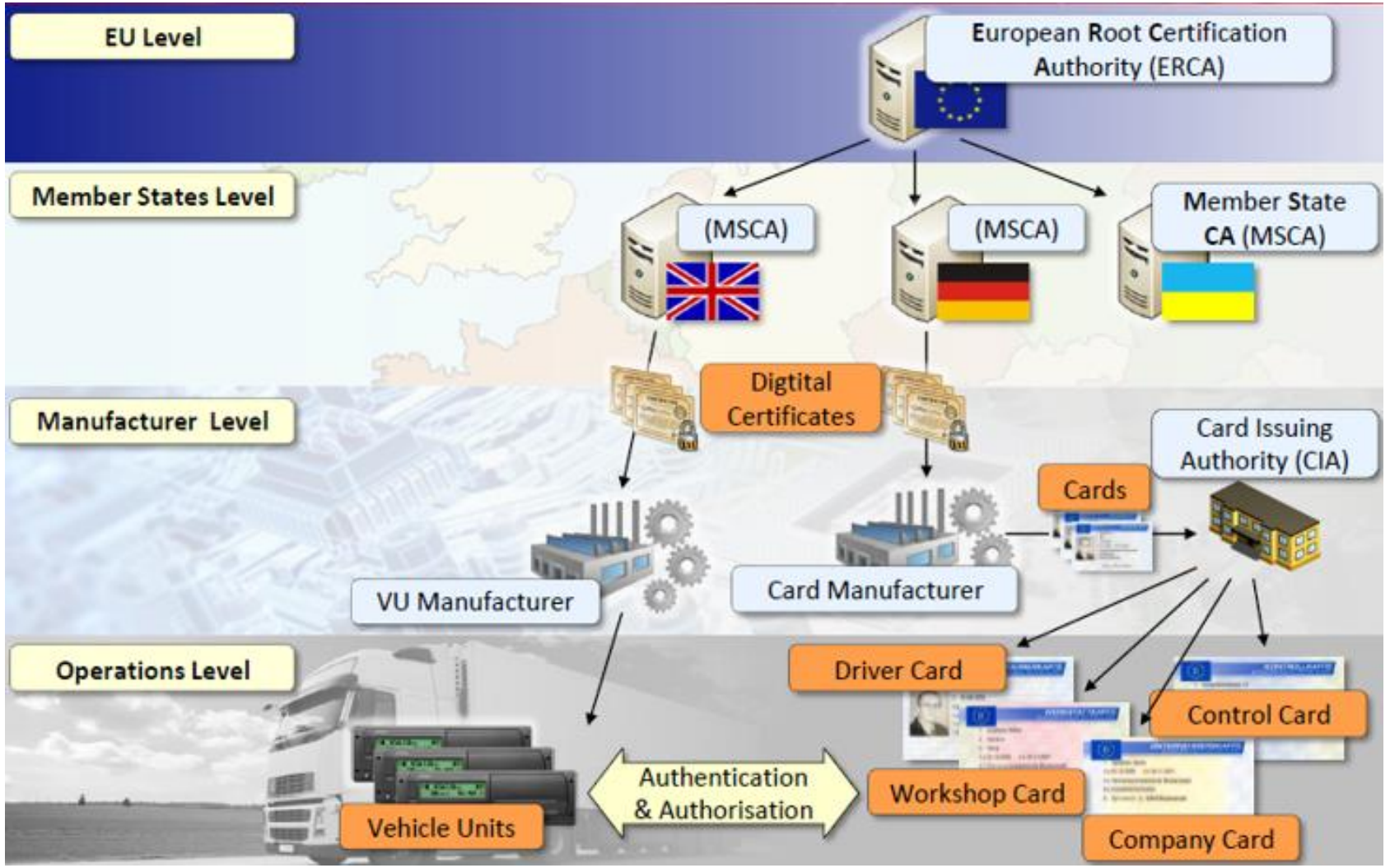
Vehicles M2, M3, N2, N3 with tachograph – Anti tampering

Tachograph PKI (public key infrastructure)



Status on UN-R39

- Odometer accuracy not regulated
- Odometer accuracy cannot be better than speedometer accuracy
  - Reminder speedometer accuracy: **Vdisp ≤ Vreal + (Vrealx0,1+4)**
    - Ex Vreal 100 km/h : Vdisp ≤ 114 km/h
    - Reminder for COP M N Vdisp ≤ Vreal + (Vrealx0,1+**6**)
- 2 differents cases
  - Vehicles without tachograph : UN-R39 certification based on **ABS signal and theorical wheel revolution** (in europe TRTO not worldwide)
  - Vehicles with tachograph : UN-R39 certifcation based on **tachograph speed sensor and measured wheel revolution**
- Odometer anti tampering regulated in EU
  - Vehicles without tachograph : current from emission requirements EU 1151/2017 with provision of standard ISO 15031-7:2013
  - Vehicles with tachograph : current from tachograph requirements EU 2016/799 amended by EU 2021/1228
- There is no added value for HDV to double specify Odometer (accuracy, anti tampering), therefore HDV with tachograph or similar should be excluded from accuracy and anti tampering requirements in this regulation.

End of presentation