

**LISTE DES COUPLEMETRES EMBARQUES HOMOLOGUES* PAR LA
FIA
LIST OF ON BOARD TORQUEMETERS HOMOLOGATED*
BY THE FIA**

LISTE TECHNIQUE N° 89 / TECHNICAL LIST N° 89

Numéro d'Homologation <i>Homologation Number</i>	Fabricant <i>Manufacturer</i>	Modèle <i>Model</i>
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***CONDITIONS DE DELIVRANCE D'UNE HOMOLOGATION**

La délivrance d'une homologation par la FIA atteste que le couplemètre homologué est conforme aux Spécifications techniques de la FIA. La FIA n'exerce aucun contrôle sur le processus de fabrication du couplemètre. La responsabilité de la FIA se limite à la seule délivrance de l'homologation au titre des Spécifications techniques de la FIA et ne pourra jamais être engagée en relation avec le couplemètre et/ ou ses conditions de fabrication et/ ou le respect de toute exigence de sécurité applicable.

*** CONDITIONS OF ISSUE OF THE HOMOLOGATION**

The grant of a homologation by the FIA attests that the homologated torque meter meets the Technical Specifications of the FIA. The FIA does not have any control over the manufacturing process of the torque meter. The FIA's liability is limited solely to issuing the homologation as per the FIA Technical Specifications, and cannot be engaged in relation with the torque meter and/or its manufacturing conditions and /or compliance with any applicable safety requirement.

SPECIFICATIONS REQUISES POUR LE COUPLEMETRE EMBARQUE REQUIRED SPECIFICATIONS FOR THE ON BOARD TORQUEMETER

1 <u>Introduction</u>
1.1 Scope
This specification defines the requirements for the torque meter to be homologated.
2 <u>System Overview</u>
2.1 Measurement Description
The sensor measures torque.
The sensor must have on-board diagnostics to check for out-of-bounds operational conditions.
The sensor must measure the total time under load since the last recalibration.
2.2 Environment Description
The sensor operates either on the front or on the rear driveshafts.
2.3 Atmospheric Environment
The sensor may operate on either closed or open wheel cars.
2.4 External End-user Instruments
The sensor will typically be one of several instruments on the CAN bus. The output data from the sensor will be recorded by the FIA data logger over the CAN bus.
At the discretion of the regulatory body, the teams will also have access to the sensor's CAN bus data.
The data acquisition system will be the FIA data logger.
The sensor shall have the ability to transmit its measurement data via CAN.
2.5 Power Source
System power for the sensor will be low voltage DC, typically provided from the data logger or power distribution module. Alternatively, a battery pack could be used.
3 <u>General Design Requirements</u>
3.1 Reliability and Service Life
3.1.1 Operation Time
The sensor shall run up to 30 hours continuous without the need for power cycling.
3.1.2 Lifetime between reconditioning
The sensor system shall achieve a minimum of 30 hours of running and still meet performance specifications, as long as the calibration torque limits of the sensor system are never exceeded under any transient or steady-state conditions.
3.1.3 Lifetime
The sensor shall run 8,000 km of service before reconditioning.
3.2 Safety Requirements
The sensor shall not detach from its location during use.

4 Physical Requirements
4.1 General
The sensor must be able to be fitted to an LMH car (See LMH Technical regulations for details).
4.2 Identification
The following identifications shall be visible as a minimum:
Sensor Manufacturer Logo
Unit Serial Number
Sensor Part Number
Sensor Homologation Number
The sensor must offer a suitable place for an FIA sticker (25x25mm with 1mm corner radius)
4.3 Tamper Proofing
The sensor shall be protected by anti-tampering measures.
4.4 External Connections
The sensor shall use a Deutsch ASDD006-09PN-HE connector.
5 Functional Requirements
5.1 Measurement
5.1.1 General Performance
The sensor shall measure a range of ± 5000 Nm
The sensor shall have an accuracy of no less than $\pm 0.5\%$ for post-filtered instantaneous torque measurement.
The sensor shall have a 200Hz minimum measurement rate.
The device measurement shall be repeatable to $\pm 0.25\%$.
The sensor shall be able to power up and begin full functionality throughout its operating temperature range and regardless of the torque condition in under 5 seconds. This time must be consistent sensor to sensor.
The sensor shall be able to self-diagnose when operational boundary conditions have been exceeded or when there are internal hardware or software faults.
5.1.2 Temperature Measurement
The device shall produce a PCB temperature data output between 10°C and +110°C without factory calibration.
5.2 Homologation requirements
In order for a device to be homologated, it must be approved on a torque test bench through a 5-lap simulation. The 5-lap simulation comprises a one-lap simulation repeated five times. The one-lap simulation profile will be available from the FIA by request (<i>FIA_Torque_Profile_V3</i>).
Each shaft-sensor system is subjected to the loads defined by the 5-lap simulation at each of the following shaft temperature set points:
i. T = 30°C
ii. T = 60°C
iii. T = 90°C
iv. T = 110°C
Further details about the acceptance criteria are available from the FIA by request.
5.3 Calibration
The only calibration allowed is the factory calibration.
5.4 CAN / DATA LOGGING
The sensor should communicate by CAN to the FIA control unit with the BASE IDs listed below:
0x150 – Input shaft sensor
0x15A – Front Left Driveshaft

0x15D – Front Right Driveshaft
0x153 – Rear Left Driveshaft
0x156 – Rear Right Driveshaft
Communication with the sensor from the FIA control unit should be restricted to BASE ID +1 and BASE ID + 2
CAN communications shall meet ISO 11898-2 (High Speed Applications)
5.5 Encryption
The device shall not allow unauthorised access to firmware and memory locations over CAN.
The device should create and display checksums in order to determine if the correct calibration data are programmed in the sensor.
The device should create and display checksums in order to determine if the correct firmware and hardware is present in the sensor.
5.6 Electrical Requirements
5.6.1 Power Supply
A minimum supply voltage of 9V min shall apply.
A maximum supply voltage of 16V max shall apply.
A nominal supply of 12V shall apply.
Overvoltage (non-destructive) of 16V transient clamp shall apply.
Maximum continuous reverse supply (non-destructive) of -16V shall apply.
The sensor's power supply circuitry shall be protected from reverse polarity.
The sensor's power supply circuitry shall be protected from ground and battery short circuits.
5.7 Environmental Requirements
5.7.1 Unit Operating Temperature
The sensor must operate with a maximum PCB temperature of 110°C
The sensor must operate with a minimum PCB temperature of 10°C
5.7.2 Storage Temperature
The sensor must not be adversely affected by a storage temperature minimum of -10°C
The sensor must not be adversely affected by a storage temperature maximum of 85°C
5.7.3 Sealing
The device must be sealed to a level equivalent to IP67

ENGAGEMENT DE LA PART DU FABRICANT DE CAPTEUR DE COUPLE UNDERTAKINGS FROM THE TORQUE METER MANUFACTURER

Once it is proven to FIA that the sensor meets the technical specifications stated above, the sensor manufacturer must fulfil the below requirements in order to grant and retain homologation for its sensor:

- The sensor's manufacturer must provide to FIA, free of charge, a reference sensor identical to the homologated sensor. FIA will be able to use it as needed. The sensor's manufacturer will maintain, update and replace these sensors free of charge.