
Road vehicles — Crosstalk determination for multi-axis load cell

*Véhicules routiers — Détermination de l'effet transverse sur capteur
de force multi axial*

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Contents

| | Page |
|---|-----------|
| Foreword | iv |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms and definitions | 1 |
| 4 Field of application | 1 |
| 5 Crosstalk determination | 1 |
| 5.1 Test setup requirements and general preconditions | 1 |
| 5.2 Additional test information | 2 |
| 5.3 Crosstalk determination | 2 |
| 5.4 Data record | 3 |
| Annex A (informative) Workflow diagram crosstalk determination | 5 |
| Bibliography | 6 |

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 36, *Safety and impact testing*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Road vehicles — Crosstalk determination for multi-axis load cell

1 Scope

This document establishes an adequate procedure to determine crosstalk values in order to improve comparability of measurement results between testing laboratories and to enable a load cell performance rating in accordance to the crosstalk specification for transducers in vehicle crash testing given in ISO 6487, SAE-J211-1 and SAE J2570.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

crosstalk

undesired measured output of a transverse channel under defined load on the calibrated axis

Note 1 to entry: Crosstalk is alternatively known as transverse or cross sensitivity.

4 Field of application

The described measurement procedure refers to any multi-axis load cell.

The crosstalk value helps to check the transducer's performance and to identify sources of error during the calibration process. Therefore, it is recommended to determine the load cell's crosstalk value during the calibration. It could be an indicator for a wrong test setup (loading point, fixtures, channel allocation, overloading, etc.).

5 Crosstalk determination

5.1 Test setup requirements and general preconditions

Prior to determination of crosstalk values, the conditions as follows need to be maintained.

- The load cell calibration test setup follows the common standards for vehicle crash transducers for forces and moments.
- The crosstalk value is only considered for the traceable calibration range, which is defined in the calibration standard by a minimum and a maximum.
- Manufacturer's calibration fixtures or calibration fixtures which have been validated in regard to the manufacturer's fixture characteristics are utilised. While using a fixture for moment loading,

consider the force range limits specified by the load cell manufacturer for the neutral axis in which the eccentric force is applied. Avoid applying forces exceeding the manufacturer's limits, for example in order to reach the desired moment with a shorter moment arm. Inappropriate calibration fixtures or insufficiently defined calibration ranges can cause extrapolation errors.

- The data acquisition (DAQ) and filter settings of all recorded channels follow the common calibration standards.
- All force and moment channels are measured during the calibration process of each axis. All channels are to be offset corrected in unloaded condition prior to the calibration test.
- For force loading the force is applied within the neutral axes of the load cell.
- Considering material settling for better comparability it is necessary to apply the loading process sequence given by the manufacturer of the calibration fixture.

In order to keep accuracy and to prevent misalignment it should be avoided to exert torque within the mounting plane between load cell and fixture. This load case should be last in the sequence. It can cause rotation of the load cell within the fixture. Thus subsequently exerted loads can be shifted from the intended load axis.

5.2 Additional test information

Identify the calibration range for each axis (if different from the nominal range of the load cell).

Identify the order of the loading sequence, e.g. $F_x \rightarrow M_y \rightarrow M_z \rightarrow F_y \rightarrow F_z \rightarrow M_x$.

Identify the loading force direction at the moment of calibration for the correct polarity of the crosstalk value.

Identify the typical sensitivity for each axis in order to select the appropriate gain settings for the measurement. If the sensitivity is known (e.g. value from a former calibration existing in the data base), the known value can be used for the test setup.

5.3 Crosstalk determination

For a loading in discrete steps or a continuous loading procedure, the output voltages in [mV/V] of all transverse channels need to be recorded.

After the calibration of all axes, the current sensitivities of these channels are known and can be used for the calculation of the crosstalk as percentage of the transducer axis' calibration range.

For the force and moment channels, the transverse channels' output voltage recorded in [mV/V] (see NOTE 1) shall be converted to the physical dimension force or moment by applying the current sensitivity determined from the calibration test before.

NOTE 1 For digital sensors signal conditioning and A/D conversion moved into the sensor. The transducer itself is strain gage based and delivers an mV/V output. Digital sensors are covered if the transition from [mV/V] to [LSB] is validated.

The crosstalk of the transverse axes as percentage of the calibration range can be calculated following [Formula \(1\)](#):

$$X_T = \frac{V_{\text{trans}} \times S_{\text{trans}}}{R_{\text{cal,trans}}} \times 100 \quad (1)$$

where