INDIAN RAILWAY
RESEARCH DESIGN & STANDARD ORGANISATION
MANAK NAGAR, LUCKNOW-226011

Notice for Expression of Interest for
Developing specification for Development proposal/ Tender for Indigenous Development of Instrumented Measuring Wheel (IMW)

Instructions/ Guidelines for the firms expressing their interest against Expression of Interest (EOI)

1. **Disclaimer:** Indian Railways reserves the right not to proceed with the processor at a later stage to change the process as per the requirements of Indian Railways. It also reserves the right to decline to discuss the process further with any party expressing interest. This EOI shall not be considered in any way a proposal for procurement of Instrumented Measuring Wheels (IMW) for EN-14363 based homologation trials of Indian Railway rolling stock. The intending participants will furnish offer/details at their own cost and no claims, what so ever, in this reference will be entertained by the Railways.
2. The purpose of this EOI is to develop specifications for Development proposal/ Tender for Indigenous Development of Instrumented Measuring Wheel (IMW) for developing indigenous capability for manufacture (i.e., Designing, instrumentation, calibration, validation, data acquisition and post processing of acquired data) of Instrumented Measuring Wheels (IMW) for EN-14363 based homologation trials of Indian Railway rolling stock.
3. In case the offered proposal/technology is claimed to be patented one, the firm will submit the patent registration details and documents in support of the same.
4. In case the offered proposal/technology is claimed to be non-patented or free from IPR, the firm will submit undertaking (notarized affidavit) that the same has been developed by them and not copied from an existing product/offer/drawing, it does not violate any valid/live patent and the same is not patented/developed by any other firm(s).
5. The firm will also be required to indemnify as per proforma given in Appendix-1 against any possible dispute/litigation in future pertaining to IPR infringement of any product / technology / offer. RDSO reserves all the rights under this exercise. In case of any doubt/dispute, the decision of RDSO shall be final.
6. Interested firms must furnish the application form and details in duplicate as per the “FORMAT FOR LETTER OF RESPONSE” enclosed as Appendix-2.
7. Interested firms should submit technical information/details of their technology in the format enclosed as Appendix-3, **within 30 days w. e. f date of publishing of EOI.**
8. For any assistance may please contact on any working day at mail amitkumar.sisodia@gov.in / amitkumarsisodia@gmail.com
9. RDSO reserves all the right of this exercise. In case of any doubt/dispute, decision of RDSO shall be final.

Executive Director/Testing
Email Id: edrdsotesting@gmail.com
Mobile No. 9794863268
Website: www.rdso.indianrailways.gov.in

APPENDIX-1

(To be given on non-judicial stamp paper of appropriate value, duly notarized)

UNDERTAKING FOR INDEMNITY AGAINST INFRINGEMENT OF IPR/PATENT/REGISTERED DESIGN/TRADEMARK

I…….son of……..aged about……..resident of……..the deponent do hereby solemnly affirm and undertake as under:

1. The deponent is the authorized signatory of the (…….name of firm/company…..) as per the documents enclosed.

2. The deponent declares on behalf of the firm/company that it has developed the……. (product description) herein after referred to as "the product" and approached the Indian Railway /RDSO for field trial and use of these products on Indian Railways.

3. The deponent declares that the aforesaid product including technology and consumables, is a patented product and the deponent has complete legal authority to use it. It is also declared that the offered product does not infringe IPR of any other firm / body etc. and has not been developed by some other firm.

OR

The deponent declares that the aforesaid product including technology and consumables developed by them is not a patented product and not protected under any copyright, brand, IPR etc. and currently there are no pending legal or any other disputes pertaining to the product. It is also declared that the offered product does not infringe IPR of any other firm / body etc. and has not been developed by some other firm.

4. On behalf of the firm/company, the deponent here by indemnifies RDSO/IR and its authorized agents/vendors (which interalia includes the Zonal Railways, Public Sector Undertakings under Ministry of Railways and Vendors developed by RDSO/Indian Railways) fully at all times from any possible litigation, claims, its cost and expenses/financial liability arising out of any violation/infringement of IPR/patent/registered design/trademark of any product/item of any other firm/company/vendor/organization located both in India and abroad for the duration of use of the said product on the Indian Railways/its units.

Deponent

VERIFICATION

I declare that the contents of aforesaid Para 1 to 4 are true to my knowledge and belief, and nothing has been concealed. I understand that furnishing of any false information in above undertaking or concealing information will lead to legal and administrative action against the firm/company.

Deponent

APPENDIX-2

PERFORMA FOR LETTER OF RESPONSE

Respondents Ref No:
Date:

Executive Director/Testing
Air Brake Lab, Room No. 02
Research Designs & Standards Organization
Ministry of Railways
Manak Nagar
Lucknow,
INDIA 226011

Dear Sir,

Subject: RESPONSE TO - EOI FOR PARTICIPATION ----------

1. We, the undersigned, offer the following information in response to the Expression of Interest sought by you vide your Notification No…….. dated ……

2. We are duly authorized to represent and act on behalf of ----------(hereinafter the "respondent")

3. We have examined and have no reservations to the EOI Document including Addenda No(s)----------

4. We are attaching with this letter, the copies of original documents defining: -

   a) The Respondent's legal status;

   b) Its principal place of business;

   c) Its place of incorporation (if respondents are corporations); or its place of registration (if respondents are cooperative institutions, partnerships or individually owned firms);

   d) Self-certified financial statements of Last three years, clearly indicating the financial turn over and net worth.

   e) Copies of any market research, business studies, feasibility reports and the like sponsored by the respondent, relevant to the project under consideration.

5. We shall assist MoR and/or its authorized representatives to obtain further clarification from us, if needed.

   a) RDSO and/or its authorized representatives may contact the following nodal persons for further information on any aspects of the Response:

S. No.	Contact Name	Address	Telephone	E-mail

6. This application is made in the full understanding that:

a) Information furnished in response to EOI shall be used confidentially by RDSO for the purpose of development of the project.

b) RDSO reserves the right to reject or accept any or all applications, cancel the EOI and subsequent bidding process without any obligation to inform the respondent about the grounds of same

c) We confirm that we are interested in participating in development of the project.

7. We certify that our turnover and net worth in the last three years is as under:

Financial Year	Turn Over	Net Worth

8. In response to the EOI we hereby submit the following additional details annexed to this application.

8.1. Details of various items being manufactured/consultancy undertaken.

8.2. Details of customer(s) and supplies made in the field of item under EOI.

8.3. Experience and expertise for the items proposed in EOI.

8.4. Details of man-power with their qualification and experience.

8.5. Detailed proposal for items proposed in EOI including alternative proposal, if any.

8.6. Details of Intellectual Property Rights (IPR) held, patent filed/held and MoU/agreement signed.

8.7. Details of ISO certification

8.8 undertakings as per Annexure – A

9. The undersigned declare that the statements made and the information provided in the duly completed application are complete, true, and correct in every detail. We also understand that in the event of any information furnished by us being found later on to be incorrect or any material information having been suppressed, RDSO may delete our name from the list of qualified Respondents. We further understand that RDSO will give first preference to the applicants considered relevant for the purpose. Our response is valid till (date in figures and words): ----------

10. Our response is valid till (date in figures and words):

Yours sincerely,

(Sign)
NAME
In the capacity of
Duly authorized to sign the response for and on behalf of
Date:

ANNEXURE-A

(To be taken on non-judicial stamp paper of appropriate value as applicable in the respective state and dully notarised & witnessed)

UNDERTAKING

I, son of …….aged about..... Years resident of..... do hereby solemnly affirm as under:

1. That the deponent is the Authorised signatory of *(Name of the Sole Proprietorship Concern Partnership Firm/ Registered Company/ Joint Venture).*
2. That the deponent declares on behalf of *(Name of the Sole Proprietorship Concern Partnership Firm/ Registered Company/ Joint Venture)* that:

a) In regard to matters relating to the security and integrity of the country, no charge sheet has been filed by an agency of the Government / conviction by a Court of Law for an offence committed by the…… (name of the entity) or by any sister concern of the……name of the entity) would result in disqualification.

b) In regard to matters other than the security and integrity of the country---------- (name of the entity) has not been convicted by a Court of Law or indicted / passed any adverse order by a regulatory authority against it or it's any sister concern which relates to a grave offence, or would constitute disqualification. Grave offence is defined to be of such a nature that it outrages the moral sense of the community.

DEPONENT

VERIFICATION

I declare that the contents of para 1 to 2 above are true as per my knowledge and nothing has been hidden.

DEPONENT

APPENDIX-3

GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

RESEARCH DESIGNS &STANDARDS ORGANISATION

A) Objective

1. Brief Background: -

Testing Directorate of RDSO carries out on-track tests of new and modified designs of rolling stock from the point of view of assessment of ride behaviour and dynamic forces to assess the dynamic Stability. This often involves measurement of track forces at rail-wheel level necessitating use of Instrumented Measuring Wheels (IMWs) also referred as Instrumented Wheel Sets (IWS). Instrumented Measuring Wheel is type of sensor for real time sensing, acquisition, processing and storage of lateral and vertical forces data at rail-wheel interaction point along with other information such as time and speed during movement of the rolling stock on-track. RDSO presently has 6 sets (2 nos IMW comprise a set) of IMW's for different types of Rolling Stock (RS). The technical capability/ major components of the IMW are detailed (for reference) in Annexure B.

2. Objective of EOI: -

Developing specification for Development proposal/ Tender for Indigenous Development of Instrumented Measuring Wheel (IMW) (i.e., Designing, instrumentation, calibration, validation, data acquisition and post processing of acquired data of Instrumented Measuring Wheels (IMW) for EN-14363 based homologation trials of Indian Railway rolling stock) at RDSO, Lucknow.

3.Details of pertinent (to IMW) Infrastructure and facilities available at RDSO: -

1. Test rig details
    a. Instrumented wheelset calibration rig
    b. Data acquisition system (Dew soft R2DB, SIRIUS, HD STG and STG-M)
    c. Lateral verification Tool -
2. IMW system, presently available with RDSO comprises of Instrumented wheelset, Inductive telemetry system, Data processing module & Data acquisition.
    a. 06 sets of IMW of various rolling stocks.
    b. Concomitant accessories , Sensors , Analysis Software (Track + Dynamic)
    c. Preferably ensure Compatibility with available equipment and sensors and better utilisation of resources to manufacture IMW
3. Other Rigs
    a. Strain gauge installation Rig.
4. Facilities
    a. RWD (Rail Wheel Dynamics) Lab- Housing, servicing facility for IMWs.
    b. Jib Crane, Forklift for material handling
    c. For 3D Modelling Software – UNIGRAPHICS,SOLID WORKS
    d. FEM Software (HYPERMESH, NASTRAN and ANSYS)
    e. Analysis software for EN 14363 (Track + Dynamic Behaviour)
    f. Trained Personnel and Manpower
5. Past experience of RDSO:

Testing Team / RDSO has conducted the trial of different RS based on EN14363 norms with help of Instrumented Measuring Wheels over IR revenue track.

Data acquisition and analysis of data with the help of available Dynamic behaviour assessment software also done by RDSO.

B) Details/ information to be submitted in response to EOI:

1. Name and address of the firm.
2. Confirmation that the development work of IMW meeting/ exceeding technical capability as detailed in Annexure-B can be undertaken in collaboration with RDSO.
3. Details of any additional equipment/ facility (other than that listed in Para A.(3) of above that is expected to be necessarily needed for undertaking the development of IMWs.
4. Minimum order quantity, if any, of IMW's to be included in the development proposal.
5. Details of past projects undertaken by the firm, particularly similar to the subject work involving instrumentation, remote data collection, software-driven data post-processing, data analysis.
6. Details of the lab facilities/ equipment/ software, pertinent to the above development of IMW's, available with the firm.
7. Recommended minimum qualifying criterion (in terms of past/ proven successful projects and/ or financial capability) that is recommended by the firm to be stipulated so that non-serious bidders in the development proposal are deterred.
8. Firm's assessment of the following be included in the details to be forwarded, in response to the EoI:
    a. Expected number of manpower to be deployed in the course of the development. (Estimated man days).
    b. Expected Time- frame for development of IMW (Assume development of one set IMW).
    c. Expected development cost for one set of IMW.
    d. Stage-wise break-up of the Development project with respective delivery mile-stones.
    e. Stage-wise payment schedule with respective delivery mile-stones.
9. Recommended mode of IPR sharing (post successful development of IMW & of individual stages/ components) in the collaborative development project.
10. Apart from the facilities mentioned in para-A (3) of above, any other requirements/ inputs (logistics/ infra-support/ equipment/ software or any other) needed from RDSO.

I/We have read the above carefully & abide with the stipulations and further declare that the information furnished by me/us in this form is correct.

Encl:-

Signature with date of firm's authorized person

Name/s in capital with designation and sea

ANNEXURE-B

Technical Details of IMW (Instrumented Measuring Wheel)

A) Instrumented Measuring Wheels (IMW)

IMW measures the forces (Vertical + Lateral) at the rail-wheel contact point and the collected data is analysed further to evaluate stability behaviour of Rolling Stocks (RS) under dynamic condition. As a result of the above analysis, the optimal safe speed of newly or modified designed RS can be validated.

Instrumented Measuring wheel sets are equipped with strain-gauges, that are pasted on both side of the wheel web. The identification of gauge location on wheel web, is selected/ chosen in such a way that, it should satisfy the condition i.e. "*There should be no cross talk between the vertical and lateral forces of respective measurement gauge channels*. The location of strain gauges (radial + angular position on web) is determined by mechanical simulation tool viz FEM analysis. The measured values by these Strain Gauges, is further extrapolated to estimate the wheel Vertical (Q) and Lateral (Y) forces at the actual wheel/rail contact point.

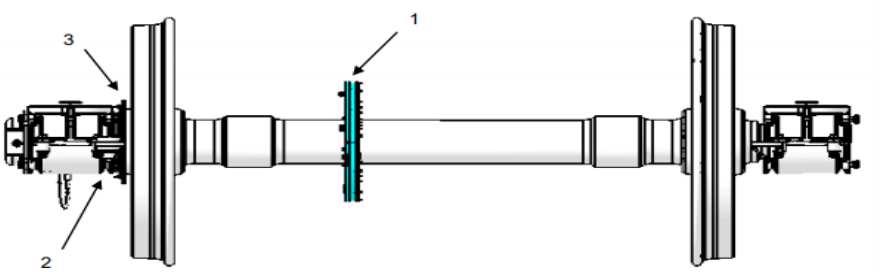
Apart from ensuring that the strain gauges are located so as to ensure NO/ minimal cross-talk between lateral & vertical forces, in order to reinforce the above, the strain gauges are connected in a suitable Wheatstone bridge formation so that the cross effect of lateral load on the vertical bridge signals, is cancelled/ minimalized and vice versa for the lateral force assessing strain gauges.

Collected data from IMW's Wheatstone bridges (formed across the strain gauges) are processed in real time and the forces (Vertical + Lateral) are monitored continuously. The signal from the rotating Instrumented wheel set is digitized at the source through the Telemetry Module mounted on the Axle of the Wheel and this signal is transmitted wirelessly through a transmitter antenna (which is placed between the axle box and wheel web) to the receiver placed on the non rotating area and finally Signals coming from IWS are transferred to the Data processing Modules (DPM) .

DPM has algorithms which process the input signals, received from Strain gauges & convert the same into proportional values of force (vertical & Lateral), which is given as a voltage output signal.

The DPM output, is finally fed into the user data acquisition (DAQ) system via relevant connectors, to obtain the output signals for vertical & lateral forces.

An illustrative figure of IMW with relevant parts is shown under



1. Telemetry Ring Assembly

2. Inductive Head Assembly

3. Coil Ring Assembly

Each IMW consist of following sub items:

i. Telemetry Ring
ii. Inductive power Supply and pick up head
iii. Data Processing Module (DPM)
iv. DAQ System
v. Track and Dynamic analysis software

1. Telemetry Ring

Each wheel sets has its corresponding telemetry ring(s). These rings are used for powering, signal conditioning, and emission of all Wheatstone bridges signals. Inside each telemetry ring, the following modules are used.

a) MTP-NT-STG acquisition modules for two Wheatstone bridges.
b) MTP-IND-TX module for inductive data transmission.
c) MTP-IND-PWR module for inductive power supply.
d) MTP-Control module.

2. Inductive power Supply and pick up head:

Inductive power head and pick up head are attached with the bracket supports to corresponding axle box fitted with Inductive Coil (Power Supply and Signal Transmission) by fasteners and Washers. Inductive power head and pick up head are connected to the telemetry power supply system and the telemetry decoder. Each decoder is connected to its corresponding DPM. Details of the connection of Inductive power Supply and pick up head are as shown under:

Telemetry configuration wiring Truck Side and car body side

Connections of IWS/ IMW system for Data Transmission

3. Data Processing Module (DPM):

Data processing Modules (DPM) is a data processing device used in the instrumented Measuring wheel sets (IMW). The DPM, processes the data captured from strain gauge bridges & converts them using Rolling-stock specific calibration matrix, into proportional voltage signals. The output of the DPM (voltage signals), after-processing, is proportional to the Lateral & vertical forces at the Rail-wheel level.

The algorithm/ correction matrix, in the DPM is the key knowledge-resource, to enable accurate functionality of the IMW.

The Final output from DPM is an analog output in terms of voltage, proportional to the following wheel-rail contact forces:

- Lateral force (Y) WHEEL 01
- Vertical force (Q) WHEEL 01
- Lateral force (Y) WHEEL 02
- Vertical force (Q) WHEEL 02

4. DAQ System (Dewsoft Model no. R2DB SIRIUS)

Data acquisition system consists of industrial computerized system installed with A/D modules. The existing Data Acquisition system has 32 channels, voltage signal conditioning module for capturing data form Instrumented Measuring Wheel sets through DPM and other additional sensors viz accelerometers (±2g, ±10g, ±30g etc) , Gyroscope, Servo Accelerometers, GPS & Laser Speed sensors as required for dynamic assessment test of RS based on EN14363 .

5. General Information (Not specific to IMW but mentioned for kind reference):

Using the collected data (of Vertical & Lateral forces), to ensure/ check conformance to requirements as detailed in EN-14363, RDSO utilises, the following two Analysis softwares:

5.1. Track analysis software:

Track Analysis Software is used to plan an on-track test campaign to assess the dynamic behaviour of a test unit, so as to know beforehand where trials/tests could be conducted to check conformance to EN 14363. This software allows user to analyse any track line for a respective type of rail-vehicle, whose dynamic behaviour assessment is to be carried out using any of the EN-14363 specified analysis methods (one-dimensional, two-dimensional or multi-dimensional).

5.2. Dynamic analysis software:

After the execution of an on-track test campaign, the Dynamic analysis software is used to analyse the gathered data to assess the dynamic behaviour of the tested vehicle. This software allows to analyse the whole test campaign by means of Test data file (recorded during the test execution), Track data files (which contains the geometric and track quality parameters recorded by a track geometry measurement system). The software can analyse the recorded data using different analysis methods (one-dimensional, two-dimensional or multi-dimensional).

Apart from the IMW, the dynamic behaviour assessment in conformance with EN-14363 also utilises several other sensors, for recording different aspects. A brief about the same is covered below:

6. Additional existing Sensors compatible with existing DAQ (Model no. R2DB SIRIUS **Dewesoft) used in EN-14363 based dynamic behaviour assessment:**

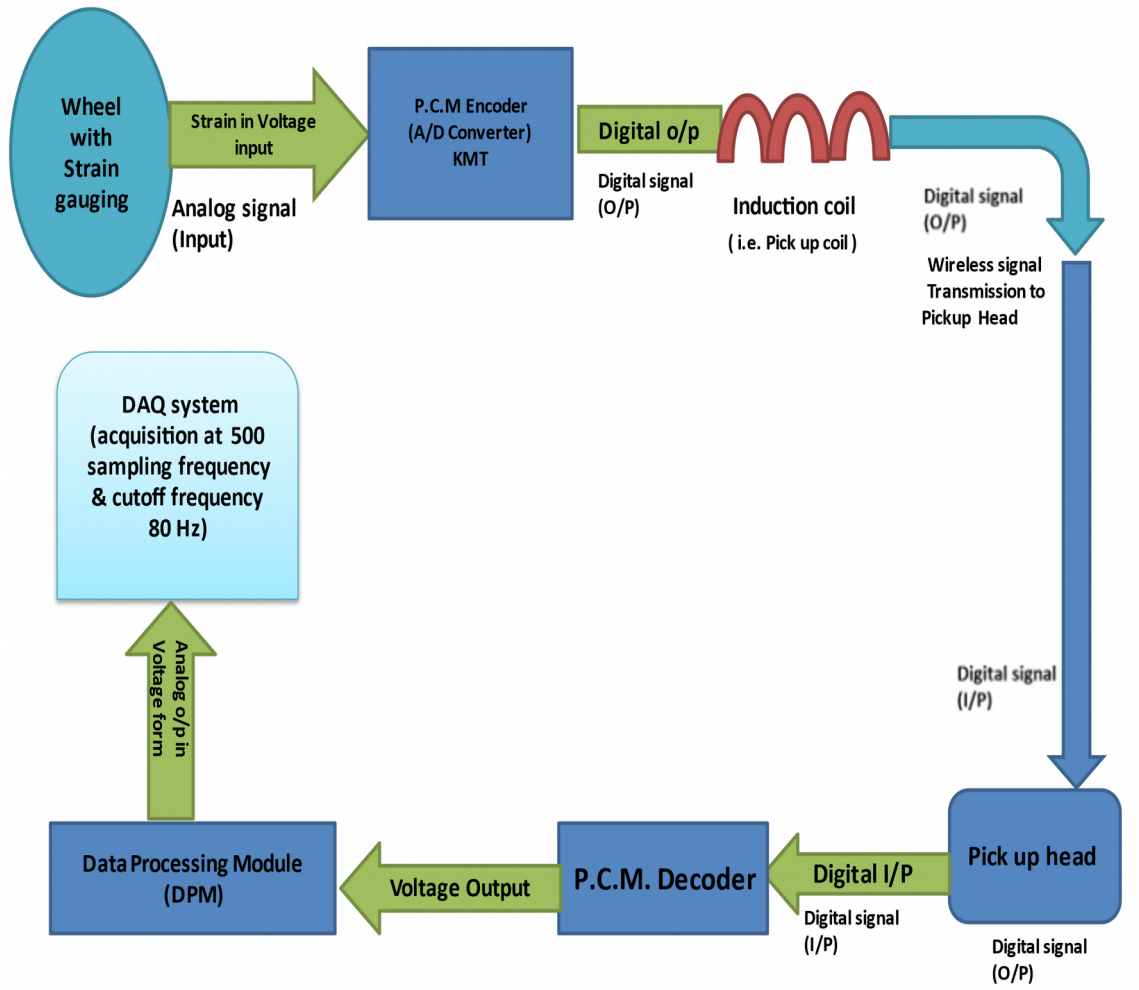
6.1. Accelerometers (Model 4610 & Endevco Model 770)
It is MEMS accelerometer for dynamic applications and placed on bogie frames as well as car body. Values measured through accelerometers are used to analysis based on EN14363 to evaluate assessment parameters.

6.2. Gyroscope (Make Micro-Sensor, Model no. CORISENS 24V12**)**
It is used for curve detection by analysing the angular rate.

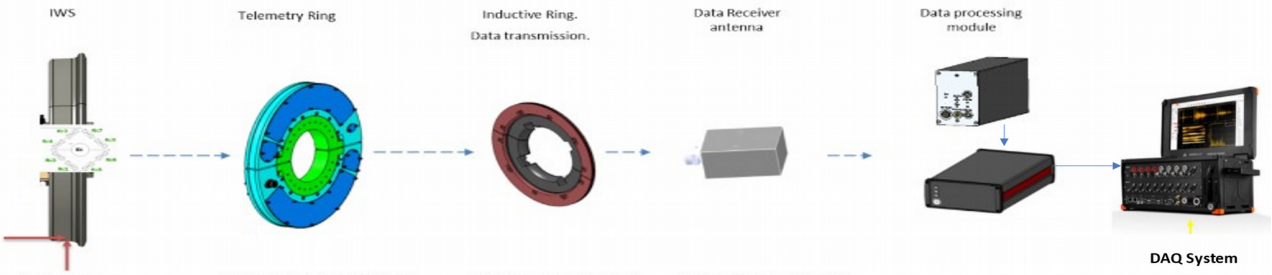
6.3. **Laser Speed sensors** (Make Data Logic, Model no. S8-PH-5-B51-PP)
It is used to determine the linear speed of Test vehicle during dynamic performance test. . Speed is important parameter to evaluate the assessment quantities based on EN14363.

6.4. Servo Accelerometers (Make Sherborne sensors; model A323-001):
It is used to determine for dynamic applications the accelerometer is placed at axle box level of wheelset to measure unbalanced lateral accelerations / Cant Deficiency. It is very important parameter to evaluate the assessment quantities over curves based on EN14363.

Block / Flow Diagram for working principle of MEASURING WHEEL



From IMW to Car Body



From Car Body to IMW