



**RESEARCH DESIGNS AND STANDARDS ORGANISATION**  
**Manak Nagar, Lucknow-226011**  
**Track Machines & Monitoring Directorate**

**Specification for Portable Track Geometry Measurement System**  
**Specification No.- TM/SM/456 dated 02.08.2022**

## 1.0 Scope:

This specification covers the functional and technical requirements with testing details of Portable track geometry measurement system should be able to measure track geometry parameters on Indian railways track. It should be able to measure and record the Track Parameters of all track structures (BG) with 52 Kg / 60 Kg rails under floating conditions on Indian Railways like (a) Gauge (b) Cross Level (c) Twist (d) Unevenness (e) Curvature/Alignment (f) Track Distance/ Chainage

## 2.0 References :

Following codes/specifications have been referred to in this specification. Updated copy of latest version with correction slip/amendments of these codes/specifications shall be followed and available at the Works of the firm.

1.	IS: 9000 (Part II/ sec 1 to 4) – 1977(Re-affirmed 2004)	Basic Environmental testing Procedures for Electronic and Electrical Items. Part-II/Sec. 3 Cold Test.
2.	IS: 9000 (Part III/Sec.1 to5) – 1977(Re-affirmed 2004)	Basic Environmental testing Procedures for Electronic and Electrical Items. Part-III/Sec.-3 Dry Heat Test.
3.	IRPWM	Indian Railways Permanent Way Manual (Latest version)

## 3.0 Materials, Processing and Workmanship:

3.1. Portable Track Geometry Measurement System shall be a compact, light weight and easy to carry trolley like device.

Note: Gauge should be reported as variation from nominal gauge of 1676 mm with excess from nominal gauge being shown as ‘+’ and shortage from nominal gauge as ‘-’

3.2. PTGMS should be supplied with a display unit (min. 12 inch screen) having in-built software which is able to record following items mentioned in table of para3.3 & 3.4 and compare it with permissible value for concerned items as per IRPWM (latest version). It should be able to display the value in red color which is beyond permissible limits. The software/system should have the provision for feeding the permissible values for Indian condition for various parameters to be measured by PTGMS. System should have the facility to enter the station code, Turn-out No., Curve No., Level crossing No. and Hectometer Post. System should have provision to record name and designation of the inspecting official.

3.3. Inspection on Straight track: System shall be able to record following parameters in straight track. Alignment and Unevenness shall be recorded on user selectable chord in the range 2m to 20 m. The initial measurement shall be based on inertial principle.

SN	Station No.	Gauge (mm)	Cross-level (mm)	Unevenness (mm)	Alignment (mm)	Twist (mm)
1.						
2.						
3.						

4.						
....						

3.4.Inspection on Curve Track: System shall be able to measure three stations before starting of curve and three stations after end of the curve. System shall be able to record following parameters in curve track. Versine shall be measured on user selectable chord length/base in the range of 2m to 20 m. System shall be able to measure succession on curves of Left and Right hands and different degree in a continuous way without interruption/ rotating the trolley.

SN	Station No.	Gauge (mm)	Cross-level (mm)	Unevenness (mm)	Versine (mm)	Twist (mm)
A						
B						
0						
1.						
2.						
.....						

3.5. There should be provision to record/report the Twist on user selectable base from 2 m to 20 m at sampling interval.

3.6.The System shall have the facility of recording, storing and transferring Data. The on-board system shall have a capacity (Nonvolatile memory) to record and store track parameters for at least 400 km.

3.7.The device shall also be capable of recording and storing the locations of parameter peaks . An odometer shall be used to record distance.

3.8.System Data shall be stored in CSV/ASCII format which is compatible for use in Track Management System (TMS) software being used in Indian Railways.

3.9.System should be mounted on a light weight framed structure which can be split in main parts and assemble easily within 15 minutes so as to be handled by max two persons and kept off track during any approaching train. Total weight of the system(including battery/s) shall be not more than 36 Kg max.

3.10. It should be insulated to work without interfering signaling equipment and also work in electrified sections. The track recording system and its accuracy of measurement shall not be affected in any manner due to the induction effect of the electric traction and signaling systems.

3.11. Rechargeable battery/hot swappable batteries shall be used as power source for operation of the system. The battery shall have sufficient capacity for continuous working of at least 10 hrs.

3.12. The system shall be compact and robust and capable of working continuously during the severe Indian atmospheric and climatic conditions. It shall also be water resistant and dust proof for functioning in harsh environment of dust, vibration, shock, rain, wind and fog, which are normally encountered on Indian Railways. The complete system shall be at least IP 67.

- 3.13. The system shall be capable of recording as set into motion upto 05 km/h
- 3.14. Sampling distance/ measurement interval of the system should be user selectable of 0.25m or multiple of 0.25m and reporting/exporting interval can be decided by user. However, the sampling interval shall not be changed during measurement.
- 3.15. Facility to suspend/ pause the recording at marked location and again restarting from same location shall be available so that system trolley can be removed from track on arrival of train on the same path. The system should also have the flexibility for intermittent recording i.e. for closing the work at a particular location /time and re-starting from the same location at different time.
- 3.16. The system should have the facility for recording and storage of various track features and track defects along with their locations through keyboard entry by operator during recording. The track features to be recorded along with track geometry parameters are at least: Kilometer post (KM), Points & Crossing (P&C), Missing rail fittings (RF), Rail fracture, Missing ERC, Rubber pad, Fish plate, Loose bolts, Broken Rail, Broken Sleeper. Other required features are tabulated below: (Please see Annexure 3.16)
- 3.17. The system must have the provisions to transfer the measurement data from Portable Track Geometry Measurement System (PTGMS) to PC. The measurement data files should be password protected.
- 3.18. The system must have the provisions to generate off-line report & output on different user-selectable chord lengths from 2 to 20m in step of even multiple of sampling interval.`
- 3.19. System shall have the facility for calibration of odometer and sensor along with facility of continuous monitoring of odometer and sensor signals to ensure reliable recording of parameters.
- 3.20. Display of the data on the screen should be clearly visible with naked eyes in direct sunlight.
- 3.21. System must have software module to generate all types of reports from the recorded track geometry as per annexures attached.
- (a) Track parameters (i.e. Gauge, Cross-level, Un evenness, Alignment) peaks with magnitude above user input threshold value along with its location. (as per Annex 3.21 A). The location accuracy shall be  $\pm 1$  meter in a kilometer.
- (b) Evaluation and printing of standard deviation of unevenness and alignment for 200 meters block in a kilometer, the distance of last block in the kilometer may be more or less than 200 m. If the distance in last block is less or equal to 50 m it should be combined with previous block otherwise it shall be dealt as separate block i.e. the maximum and minimum length of last block may be 250 m and 51m respectively. Format for evaluation of the results and printing of a kilometer report is attached as Annex 3.21 B.
- 3.22. Height of the display above rail- head shall be adjustable within the range between 1.0 m to 1.5 m.

#### 4.0 Technical Features:

Range and accuracy of the system shall be as under:

SN	Parameter	Chord	Range	Accuracy
i.	Unevenness	User selectable	$\pm 50$ mm	$\pm 1.0$ mm/ 10m chord
ii.	Alignment (measured 14 mm below rail table)	User selectable	$\pm 200$ mm	$\pm 1.0$ mm /10m chord (for straight section)
	Versine			$\pm 1.0$ mm /20m chord (for curved track)
iii.	Twist	User selectable	_____	_____
iv.	Gauge (measured 14 mm below rail table)	_____	-25 to + 50 mm	$\pm 1.0$ mm
v.	Cross level	_____	$\pm 250$ mm	$\pm 1.0$ mm

#### 5.0 Tests:

Following tests shall be carried out in sequence.

##### 5.1 Visual & Dimensional check:

The machine shall be checked visually and dimensionally. The machine shall be free from all visual defects in material, construction and fabrication. The weight of system device including battery shall also be taken and recorded by the Inspecting officer.

##### 5.2 System Functionality Test:

The data should meet the accuracy requirements and other parameters as given in para 4.0 for technical features. More than 95% measured parameters should fall within the accuracy levels given in the para 4.0. The system shall be checked for its performance in the following manner:

- Straight Track: At least one km of straight track shall be measured. The measured data shall be compared with the data recorded manually separately viz. Gauge and cross-level shall be measured by Gauge cum Level; Unevenness and Alignment shall be measured at the 10m chord length.
- Curve Track: At least two curves of length exceeding 500m and 0.5 degree shall be measured with the system. The measured data shall be compared with the data recorded manually. Gauge and cross level shall be measured by Gauge cum Level. Alignment and unevenness shall be measured on standard chord length of 20.0 meter using string.

**5.3 Test for compatibility of recorded data:** It should be compatible with Track Management System (TMS).The system shall have the facility to upload the recorded data for straight track, curves etc. directly on TMS. The TMS data format is CSV/ASCII.

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**5.4 Environmental Tests:** The firm shall submit the test certificates from NABL accredited laboratory/certificate or an equivalent for foreign firms/ OEM's for such tests to be conducted in-house by manufacturer for following:

- a) Dry heat test
- b) Cold test

**a) Dry heat test:** This test is intended to determine suitability of the device to withstand high temperature severities prevailing in hot days of summer. This test shall be conducted as specified in IS: 9000 (Part III/Section 3) at the following severity:

Temperature (Ambient):  $+40^{\circ}\text{to}\pm 2^{\circ}\text{C}$   
Duration : 4 hrs.

**b) Cold test:** This test is intended to determine the suitability of the device at the specified low temperature likely to be encountered in coldest days of winter. The test shall be conducted as specified in IS: 9000 (Part-II/ sec 3) at the following severity:

Temperature:  $+5^{\circ}\pm 3^{\circ}\text{C}$   
Duration: 4 hrs.

## 6.0 Acceptance test:

Inspecting authority shall carry out acceptance test on all the equipment /sub-units. The following shall comprise the acceptance test:

6.1 Maker's test certificate for the outsourced items:

- a) Test certificate for odometer.
- b) License of windows operating system
- c) License of Antivirus software of reputed supplier with 24 months subscription.

## 6.2 Visual Inspection (As per clause 5.1):

i) General Workmanship: ii) Portability, compactness, Lightweight of system iii) Indications and displays iv) Mounting, fitment and clamping of connectors v) Painting, labeling and marking

## 6.3 System level Functionality Test:

It shall be carried out as per clause 5.2 .

## 7.0 Inspection:

**7.1** The inspection of machine during procurement as per Para 6.0 shall be carried out by RDSO. This inspection will be conducted in the presence of firm's authorized representative. Minimum level of inspecting official shall be SSE/SSRE.

**7.2** Each machine shall be inspected for its acceptance as mentioned in clause no. 6.0. If the machines satisfy all the tests prescribed as per acceptance criteria, the machine is acceptable.

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**7.3** After the machines have been supplied at consignee's end, the supply shall be considered as complete only after conducting training on operation etc. within four week of supply provided by the manufacturer /supplier as per clause 8.0.

## **8.0 Training and Commissioning:**

Supplier should provide training to Railway officials for three days at consignee's end in calibration, operation, repair and maintenance of the system on site. It shall include both hardware and software training which is required for the smooth operation and maintenance of the system. A video presentation regarding (a) basic features (b) operation of system (c) trouble-shooting (d) precaution during handling and operation should be supplied in English language with sub-title language in Hindi/English.

## **9.0 Documentation:**

9.1 Operation, maintenance, trouble shooting and training manuals shall be prepared in sufficient detail to the satisfaction of purchaser and supplied in three copies each. However, calibration will be carried out by the supplier after 1 year of commissioning by deploying specially trained staff and whenever demanded by the consignee within warranty period.

9.2 Installable version of Software shall be given on magnetic media such as CD or zip disk or pen drive.

## **10.0 Service Facility:**

10.1 Spare Parts: One spare of Data Transfer Module unit (Pen Drive /Data Transfer cable etc.) and battery shall be supplied with the system so that even during warranty period in case of malfunction of these parts; system can be made functional immediately. An additional battery should also be provided at the time of supply.

10.2 Tools: All tools including measuring equipment required for normal maintenance should be supplied as complete kit in one set. The list of such tools and equipment proposed to be supplied with system shall be furnished as part of technical details of offer.

## **11.0 Warranty :**

11.1 The contractor shall ensure that the system supplied including all parts , components ,etc. used is free from defects and faults in design, material, workmanship and shall be of highest quality and in conformity with the contract specifications.

11.2 The warranty shall expire 24 (twenty four) months from the date of acceptance i.e. from the date of issue of commissioning certificate by the purchaser/consignee for the system except in respect of complaints , which are lodged before the expiry of the 24 months.

11.3 The supplier shall be required to supply and install free of cost all the equipment, components, PCB cards, ICs , cables transducers, connectors, spares which may fail, malfunction, become defective or required for uninterrupted working of system during the

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currency of Warranty period except external battery(s) in display unit and / or system, stationary, ink cartridges. However, manufacturer's warranty will be applicable for external batteries.

11.4 The supplier shall also keep adequate stock of such components, spares and modules, which are critical and may require repairs/ replacement from time to time for ensuring uninterrupted working of the system during the warranty period.

## 12.0 Marking:

Each machine shall be legibly and indelibly marked with the following details:

- Name and trade mark of the manufacturer.
- Year and month of manufacturing.
- Contact details of Manufacturer/ Supplier
- Date of supply- The warranty period should be calculated from the date of supply/commissioning of the machine whichever is later.
- Warranty period of such machine should be at least 02 years.
- Alphanumeric code and of machine exhibiting important features/Specification should be engraved or marked on a plate bolted on.

## 13.0 Packaging:

System shall be enclosed in a wooden carton / suitable box and care shall be taken during transportation so that no moisture can percolate into the wooden/card board boxes and the functioning do not get hamper due to mishandling.

**14.0** All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-8.1-11(Document Title: Vendor-Changes in approved status), subsequent versions/amendments thereof shall be binding, and applicable on the successful manufacturers/suppliers in the contracts floated by Railways to maintain quality of products supplied to Railways. The updated document is available on RDSO Website i.e. <https://rdso.indianrailways.gov.in>.

**15.0 Preference to Make in India:** The Government of India policy on 'Make in India' shall be applicable.

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Annexure 3.21(A)

Peak values above threshold for different parameters

Parameter	Threshold	Recorded Value	Location	
			Kilometer	Meter
Gauge	9.0	11.0	134	567
AL-9.0	7.0	9.0	137	413
TW-3.0	6.0	8.0	141	723
UN-9.0	12.0	15.0	141	611

- Specimen copy

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## Annexure 3.21(B)

Kilometer	Block	UN-9.0	AI-9.0
123	1	2.1	3.1
	2	2.2	2.9
	3	2.5	2.5
	4	2.2	2.7
	5	2.4	2.1
124	1	2.3	2.5
	2	2.4	2.3
	3	2.1	2.0
	4	2.0	2.1
125	1	2.5	2.9
	2	2.2	2.8
	3	2.0	2.5
	4	2.3	2.3
	5	2.4	2.5

- Specimen copy

Annexure(3.16)

Bridge (Start)-	Level Crossing (LC) In	Joggle Fish Plate
Bridge (End)	Level Crossing (LC) Out	Missing fastening
Broken Sleeper	Points & Crossing (P&C)	OHE Mast (OHEM) Location
Curve-IN	Switch Expansion Joint (SEJ)	Dipped Welds
Curve out	Broken Rail	