

TENDER FOR PURCHASE OF 3D LASER SCANNING AND IMAGING SYSTEM

TECHNICAL SPECIFICATIONS

1. OVERVIEW

- 1.1. These specifications identify the minimum requirements for the 3D Laser Scanning and Imaging System intended to be procured.
- 1.2. Other components, not identified or specified, which are necessary for the system to meet required functionality are understood to be proposed and provided by vendor.
- 1.3. The vendor has to state clearly those aspects of the products that are not compliant to specifications listed hereunder.
- 1.4. In the financial bid, costs of all the components have to be provided separately.
- 1.5. Only bids from vendors who have provided systems comparable in terms of the working principles, capacity and scope, and have well-established maintenance and repair services will be considered.
- 1.6. The technical proposal should contain the following and should be placed in a separate envelope, and should not contain any financial information:
 - 1.6.1. Background of the company and the service offered in India for installation, maintenance and repair.
 - 1.6.2. Duly-filled checklist for the technical specifications.
 - 1.6.3. Details of comparable equipment supplied by the vendor in India, with contact details for possible verification and inspection.
 - 1.6.4. Details of the spare parts and AMCs.

2. SYSTEM FUNCTIONALITY:

- 2.1. System must provide automatic 3D Scanning with a 360^o (horizontal) by 270^o (vertical) field- of-view.
- 2.2. System must feature 3D single point accuracy of 6mm at 50m range, 4 mm at 0.1m range; modelled accuracy of 2mm.
- 2.3. System must be able to scan at high-resolution at long range.
- 2.4. System must capture objects at a minimum range of 0.1 m to a maximum range of 300m (based on 90% reflectivity) from axis of scanner.
- 2.5. System must feature survey-grade dual-axis tilt compensation (1.5 seconds accuracy in real-time) and support built-in survey workflows, namely traversing and resection and provide quality assurance on collected data from movements or disturbance to reduce field time and guarantee measurement accuracy.
- 2.6. System must feature low minimum scan distance (not more than 10 cm) to capture objects close to scanner.
- 2.7. System must feature a fully enclosed and protected scan mirror to be clear from impacts from dust, moisture or general environmental impacts.

- 2.8. System must be robust and be operable under all weather conditions and feature at least IP54 rating for dust and water protection.
- 2.9. System must support on-board scanning and imaging control, target acquisition, point cloud and real-time video viewing as well station setup capability without the use of external device, cables or accessories.
- 2.10. System must include on-board video to define scan resolution at specified range and scan window for high-resolution windows scans.
- 2.11. System must provide real-time viewing and navigation of scan data in 3D during the scan process.
- 2.12. System must include integrated (parallax-free) digital high-resolution still/video camera.
- 2.13. System must include built-in laser plummet for easy setup and relocation of the system.
- 2.14. System must operate on portable, simultaneous use, hot swappable batteries for up to 12-hour operation.
- 2.15. System must be able to operate on portable, simultaneous use, hot swappable batteries.
- 2.16. System hardware must feature onboard solid-state drive for data storage or scan into USB drive.
- 2.17. System must provide upgrade option to interface on the same axis with dual-Frequency RTK GPS system.
- 2.18. System must provide scan data manipulation, visualization and modelling capabilities, such as the creation of drawings (plan/cross-sections/elevation) and creation of CAD objects (e.g. cylindrical components, steel shapes, box, patch, cylinder, torus, cone, torus and similar generic CAD objects).
- 2.19. System must support data registration, computation, analysis and modelling under one single software environment and in one single database up to the web publication phase, animation and 3D modelling phase.
- 2.20. System must allow publication of point cloud into web-based format for on-line Collaboration, supporting hyperlink, measurement, and mark-up inside Microsoft Internet Explorer. Published data should be deployable also on a CD and viewed through a free viewer. This system should be simple to use and install and does not require server installations.

Hardware Specifications:

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|--------------------------------|--|
| 1. Measuring range: | 300m @ 90% reflectivity, 134m@18% reflectivity |
| 2. Minimum range: | 0.1 m |
| 3. Spatial accuracy: | 6mm position, 4mm range (a single point from the entire point cloud) |
| 4. Point spacing: | 1mm from 0.1m to 300m range |
| 5. Modelled surface precision: | 2mm (one standard deviation, subject to modelling methodology) |
| 6. Target Acquisition: | 2mm (one standard deviation) |

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|---------------------------|--|
| 7. Laser spot size: | 1-50m: 4.5mm 1-50m (FWHH)/7mm
(Gaussian) |
| 8. Data acquisition rate: | Min 50,000 points per second |
| 9. Field-of-View: | 360° (horizontal) by 270° (vertical) |
| 10. Digital camera: | Integrated high-resolution digital camera |
| 11. Tilt Compensator: | Dual-Axis, (1.5 second resolution, dynamic range +/- 5') |

Environmental Specifications:

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|-----------------------------------|--|
| 1. Optimal Operation Temperature: | 0°C to +40°C |
| 2. Storage Temperature: | -25°C to +65°C |
| 3. Dust/Humidity | IP54 |
| 4. Lighting: | Fully operational between bright light and complete darkness |
| 5. Humidity: | Non-condensing |

3. SOFTWARE SPECIFICATIONS:

- 3.1. System must include free web-based view, measurement, mark up and collaboration tool for free deployment and utilization of scans, CAD model and imagery.
- 3.2. Software system must be able to handle unlimited size of point cloud database.
- 3.3. Software system must be client server-based to allow a single storage of and dissemination of point cloud data.
- 3.4. System must provide a single storage of all point cloud, imagery, CAD, survey information, 3D model and other data inside a single database server and database file for better security, storage and management of scanning related data.
- 3.5. System must provide 2D and 3D viewing capability in synchronized views.
- 3.6. System must provide concurrent use and editing of the same database to up to 10 users in real-time.
- 3.7. System must provide four registration methods and algorithms that can be used independently or in conjunction, namely
 - 3.7.1. Survey-based traversing workflow;
 - 3.7.2. Cloud-to-cloud matching;
 - 3.7.3. Resection to known targets; and
 - 3.7.4. Registration to CAD models.
- 3.8. System must provide integrated 2D drawing and 3D modelling tools through least squares based best-fitting work process or manual line drawing workflow.
- 3.9. System must provide surface modelling, volumetric computation and surface cleaning tools.
- 3.10. System must provide tools to generate profiles/sections through point cloud data.
- 3.11. System must provide the ability to register and superimpose internal images.

3.12. Automatically and external images (3D Cubic Map and single camera image) on scanned data for photo-realistic presentation.

3.13. Must provide 2D and 3D viewing capability in synchronized views.

Basic Module Specifications

1. Level of Detail: Dynamic level of detail management, displaying different levels of scanned data & 3D model for fast visualization.
2. Limit Box: Define limit box for efficient viewing and user interaction of captured scanned data
3. Registration: Automatic best-fit registration of multiple scans for geo-referencing. Support registration through point-cloud to point-cloud data fit. Support registration via traversing and resection workflows. Support registration to CAD models.
4. Conceptual design tools: Integrated 2D drawing and 3D modelling tools.
5. Fitting of geometric object: Derive geometric models from scanned data and provide quality of fit check against industry standard specifications.
6. Mesh tools: Create basic, complex and TIN mesh. Enable intelligent data filtering. Provide break line support. Delete and add faces. Surface deviation analysis.
7. Profiles and sections: Create profiles, plans and sections automatically.
8. Measurement: Take measurement on scanned data, 3D models; slope distances; volumes and surface areas.
9. 2D Drawing: Extract 2D drawings from 3D models and scanned data
10. Laser intensity mapping: Ability to colour scanned images by the intensity of the laser return
11. Photo draping: Ability to register and superimpose internal images automatically and external images (3D Cubic Map and single camera image) on scanned data for photo-realists presentation
12. Contours: Create contours from meshed scanned data with user-defined intervals
13. CAD Interface: Provide CAD (Microstation and AutoCAD) interface that allows quick display and manipulation of scanned data
14. Direct Import Format: Support direct import of .FLS, .300, ASCII point data (XYZ, SVY, PTS, PTX, TXT), Land XML, ZFS, ZFC, DBX format and support .imp format
15. Direct Export Format: ASCII point data (XYZ, SVY, PTS, PTX, TXT), DXF, Land XML, DBX format

Modelling Module Specifications

1. Must provide 3D animation capabilities through point cloud data sets
2. Must provide 3D limit box to reduce point density
3. Must provide automatic and manual point density control

4. Must provide 2D and 3D synchronized viewers of point cloud database
5. Must provide 3D modelling of various CAD primitive types; include piping, steel, box, patch (circular and planar), surface and structural elements.
6. Provide surface modelling, reduction and computation capabilities.

Registration Module Specifications

1. Must provide user control functionalities for registration network including target weighting.
2. Must provide auto-target matching of fixed targets and actual scene objects from different scanning positions to create a system of constraints for scan alignment.
3. Must provide a complete traverse computation, management capability for managing, editing, and computing field collected traverse data.
4. Must create registration statistics include the error for each target constraint and the Root Mean Square (RMS) error and error histogram for each cloud constraints
5. Must provide cloud to cloud registration capabilities through the ICP algorithm

CAD Extension Module Specifications

1. Must provide a plug-in to AutoCAD or Rivet and open point cloud databases without conversion, through a single database client/server environment.
2. Must provide CAD modelling tools inside AutoCAD using point cloud database (e.g. patch modelling, etc).
3. Must provide 2D and 3D views of point cloud synchronized to the same view point.
4. Must provide clash detection to highlight data that is outside of defined area and tolerance for investigative purpose.

Web Publishing Module Specifications

1. Installation: Web-publishing module must be simple to install and requires installation only of free client viewers (i.e. server installation not required).
2. Viewer: Viewer must be free and deployable on all computer assets of the user or its affiliates.
3. Functionality: Viewer should support hyper-linking, measurement and collaboration through the sharing of views and information across the Internet/Intranet and allow publishing of imagery, scan and CAD solids and objects.

CHECKLIST FOR TECHNICAL SPECIFICATIONS

1. SYSTEM FUNCTIONALITY

Hardware Specifications:

Parameter	Description	Availability	
		Yes	No
1. Measuring range:	300m @ 90% reflectivity, 134m@18% reflectivity		
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8. Data acquisition rate:	Min 50,000 points per second		
9. Field-of-View:	360° (horizontal) by 270° (vertical)		
10. Digital camera:	Integrated high-resolution digital camera		
11. Tilt Compensator:	Dual-Axis, (1.5 second resolution, dynamic range +/- 5 minutes)		

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2. SOFTWARE REQUIREMENTS

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7. Profiles & sections:	Create profiles, plans and sections automatically.		
8. Measurement:	Take measurement on scanned data, 3D models; slope distances; volumes and surface areas.		
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