

Digital Levels

Annexure A

S. No.	Description	Requirement
1	Height Measurement Accuracy	(per Km Double run as per ISO 17123-2:2001 Full Procedure)
a	With Invar Staff	Equal to or Better than 0.3 mm/km double run
b	With Standard Staff	Equal to or Better than 1.0 mm
2	Resolution of Each Height Measurement Reading (With Invar Staff)	Equal to or Better than 0.01 mm
3	Height Measurement Range (Distance) (With Invar Staff)	Range(Distance)(With Invar Staff) Between 2.0m to 100.0 m or better
4	Distance Measurement (With Invar Staff)	
a	Accuracy	Equal to or Better than 30 mm at 30 m
b	Resolution	Equal to or Better than 1.0 mm
c	Measurement Time	Equal to or Better than 3 seconds
5	Compensator	
a	Setting Accuracy	±0.3" or Better
b	Tilt/Inclination Range	± 09' or Better
6	Sensitivity of Circular Level	8'/2mm or Better
7	Telescope Magnification	Equal to or Better than 32x
8	Levelling Methods	BF, BFFB, BFBB, BBFF, aBF, aBFFB, aFBFF
9	Internal Power Backup (Operating Time) (With Li-ion Rechargeable Battery)	Equal to or Better than 10 hrs (without external power backup)
10	Environment	
a	Operating Temperature	Should able to work in -15 ⁰ C to +50 ⁰ C
b	Dust and Water Proofing	Should confer to IP54 or better Standards
c	Humidity	Should able to work at 95%, Non-condensing
11	Data Transfer Interface	Data transfer Interface RS-232C Port/ USB/ Mini USB
12	Memory	
a	Internal	Equal to or Better than storing 10,000 measurements in any of the leveling method as mentioned above.
b	External	1GB or higher USB backup
13	Invar Staff	With two circular bubble and stave container.
a	Length	Minimum 3 m
14	Display	Graphical with minimum 192x 80pixels
15	Keypad	Alpha-Numeric or Touch
16	Weight of Digital Level (including Battery)	Equal to or Less than 4 Kg
17	Digital Level's Warranty	03 Years
18	Real time clock and temperature sensor	Yes
19	Internal Power Backup (Operating Time)	Better than 24 hrs (without external power backup)
20	External Power Supply / Backup	Yes
21	Auto Focus	Yes
	Minimum Range	Equal to or Better than 1.0 m
	Maximum Range	Equal to or Better than 60.0 m
	Time	Equal to or Better than 4 Seconds
22	Working Capacity in Night i.e. Illumination Capacities	Yes
23	Data Transfer Interface	Bluetooth / Mini USB
24	Levelling Methods	BF, BFFB, BFBB, BBFF, FBFF, aBF, aBFFB, aBFBB, aBBFF, aFBFF
25	Internal Memory	storing 30,000 measurements

1	Carry case for Digital Level	Heavy duty HDPE protective case.
2	Measuring Staff	
a	Invar Staff	02 Nos Length of minimum 3 m
b	Carry case for Invar Staff	Rugged transportation carry case
3	Battery	01 + 01 Extra
4	Battery charger	01 + 01 Extra
5	Data Transfer Cables	01 + 01 Extra
6	Tripod	01 Nos Telescopic and Non-Flexible
7	Foot plate with steel punch (iron shoe)	02 Nos
8	Bringee	02 Nos Brass Bringee
9	Software	1 Nos Perpetual License
a	For Instrument	Single line measurement, Stake out, Line Levelling with intermediate sight and stake out line adjustment, Longitudinal and transverse profile generation etc.
b	For Processing on PC	To import, process and export data transferred from Digital Level.

Geodetic Grade GNSS Reference Receivers

Annexure B

Sl. No.	Name of the Item	Required Specification
1	GNSS receiver	<p>Measuring Mode</p> <p>Static</p> <p>Fast or Rapid Static</p> <p>Real Time Kinematic (RTK)</p>
		<p>Horizontal Accuracy</p> <p>3mm + 0.1 ppm RMS Static (long)</p> <p>0.5cm ± 0.5ppm RMS (Static & Fast Static) or better</p> <p>1cm ± 1ppmRMS (Single base line Real Time Kinematic) or better</p> <p>1cm ± 0.5ppmRMS (Network Real Time Kinematic) or better</p>
		<p>Vertical Accuracy</p> <p>3.5mm + 0.4 ppm RMS Static (long)</p> <p>1.0cm±0.5ppm RMS (Static & Fast Static) or better</p> <p>2 cm±1ppm RMS (Single base line Real Time Kinematic) or better</p> <p>2cm ± 0.5ppmRMS (Network Real Time Kinematic) or better</p>
		<p>The offered receiver shall have 500+ physical channels and Static baseline process Range of 300 kms or higher</p>
		<p>Multiple frequency and supporting the following simultaneous signal tracking:</p> <ul style="list-style-type: none"> - GPS: L1 C/A; L2E/L2P; L2C; L5 - GLONASS: L1 C/A; L1P; L2 C/A; L2P; L3 - GALILEO: L1; E5A; E5B; E5 AltBoc - BEIDOU: B1; B2; B3 - IRNSS: L5 - QZSS: L1 C/A; L1C; L1; L2C; L5 - SBAS : EGNOS /MSAS /WAAS/ GAGAN
		<p>Receiver must be capable of tracking all satellites in view, even if unhealthy, to an elevation angle of 0°.</p>
		<p>The receiver shall support real time kinematic positioning using industry standard formats</p>
		<p>The receiver shall support onboard worldwide, real-time positioning via Internet Protocol (IP).</p>
		<p>The offered receiver shall offer a minimum of two power inputs supporting both AC and DC operation with a minimum input power range of 10-28VDC.</p>
		<p>The offered receiver shall contain an internal (Li-Ion) and with battery charger. The internal battery shall be capable of operating the unit standalone for up to 12 hours. The offered receiver shall contain capability to Automatic swapping between power sources without affecting data recorded.</p>
		<p>Internal battery must be capable of operating as an internal battery backup system (UPS) functionality.</p>

		<p>The receiver must automatically restart after loss of power and must power up in the same configuration when powered down (or loss of power).</p>
		<p>The receiver must have LED indication/LCD screen to view satellite tracking, Memory, Network connectivity, Bluetooth/Wifi, Battery status .</p>
		<p>Support of logging rates from 50Hz to 600 seconds</p>
		<p>Must contain internal/removable memory with 16 GB or more of logging space. The internal memory should not dislodge from its socket during high motion events such as earthquakes should be able to maintain operation and logging during said events.</p>
		<p>In addition to the internal memory, the receiver must have a port for removable media.</p>
		<p>Must support a minimum of 8 independent and concurrent logging sessions.</p>
		<p>Internally logged data shall have a file size of less than 6MB (unzipped), for a continuous 24 hour observation at interval of 15 second, to maximize storage capacity</p>
		<p>Must be capable of producing RINEX and stream BINEX file format</p>
		<p>Must be capable of pushing logged and converted data files to three separate FTP servers.</p>
		<p>Receiver must support both a configurable ring buffer style memory deletion scheme as well as session specific “pools” with similar functionality.</p>
		<p>Receiver must support the configurable input, output and logging of Met/Tilt measurements.</p>
		<p>The receiver must have an integrated RJ45 or equivalent connector (supporting both TCP/IP/upgradable to UDP), one serial ports, one USB/Mini USB, and an external frequency input. RJ45 or equivalent connector should be enabled for server feature.</p>
		<p>A minimum of 6 unique TCP/IP ports. Unique meaning one multicast TCP/IP port (allows multiple connections) only counts as 1 TCP/IP port. Each port must be fully configurable independent of the other ports and outputs.</p>
		<p>In addition to the 6 TCP/IP ports, the receiver shall support a minimum of 1 NTRIP Caster, 1 NTRIP Client, and 1 NTRIP Server ports</p>
		<p>Receiver must support IP filtering restricting IP packet access to and from the receiver for enhanced access control security based on individual IP addresses or subnets based on a user specified net mask.</p>
		<p>The receiver must support one Bluetooth/Wifi connections or greater.</p>
		<p>The receiver must support FTP downloads as well as the FTP PUSH command.</p>
		<p>The receiver must support the following streaming data types: CMR, CMR+, RTCM v2.x, RTCM v3.x, BINEX, and NMEA. Proprietary message types will be considered in addition to (not in replace of) the before mentioned formats.</p>
		<p>The receiver shall support dynamic domain name system (DDNS).</p>
		<p>Receiver must implement a secure network connection (secure means</p>

		<p>via an encrypted, authenticated session) as well as provide various access levels to the receiver controls.</p> <p>Communication interface: Receiver must be provided with cellular modem (internal/external) for accessing internet through 4G LTE or equivalent cellular technology</p> <p>Receiver must meet the following environmental specification: Operating temperature: -40° C - + 65° C with external power and -20° C - + 50° C with internal batteries, Humidity: 95%, fully sealed with IP67 certification or better, Shock: 1m drop to hard surface. Equipment must have Compliance to Vibration / Shock test of MILSTD-810 G or equivalent.</p>
2	GNSS Antenna	<p>Chock Ring Antenna tracking GPS, Glonass, Galileo, Beidou, SBAS, L-Band, With Technology that minimizes multi-path interference.</p> <p>Phase centre stability better than 2 mm and repeatability less than 1 mm</p> <p>Antenna gain 29 dB <u>or better</u></p> <p>Supply current 125 mA maximum</p> <p>Minimum tracking elevation = 0 degrees</p> <p>Absolute calibration file from IGS must be available. For antenna calibrations to be valid the GNSS antenna must be orientated to within ±5° of True North while installation at site.</p> <p>Powered by receiver (supply voltage 3.5 to 20VDC)</p> <p>Antenna shall operate in humidity, high winds, sand storm and blowing rain</p> <p>Temperature range is -40°C to +65°C</p> <p>Humidity up to 95%, fully sealed</p> <p>Shock rating 1m drop</p>
3	Antenna cable	<p>One 30 mt length cable and one 5 mt Length to be supplied. The Supplied cables and components should have a total signal loss of less than 9 dB over the entire length of the cable run.</p>
4	Accessories	<p>GNSS-Receiver must have a robust heavy-duty wooden tripod stand, tribrach, antenna adopter along with USB data cable, Power cable, Connectors, cable for connecting Car Batteries and other standard OEM accessories. Lightweight Rugged carry case for transporting equipment is to be provided.</p>
5	Firmware/Software and Security	<p>Instrument should be supplied with necessary software/firmware for Full control and configuration of receiver. Software/firmware should allow remote data retrieval, and firmware updates over HTTPS/HTTP. It should have FTP server and FTP Client (push), Email notification and SNMP support</p> <p>It should also have access management facility with following Security features</p> <ul style="list-style-type: none"> • HTTP login • HTTPS/SSL • NTRIP <p>It must have NTRIP Caster utility with support for at least 6 mount point for streaming/redirecting RTK correction from reference station to NTRIP 1.0 and/or NTRIP 2.0 compliant rover user.</p>

Geodetic Grade GNSS Receivers and Controller

Annexure C

RECEIVER POSITIONING PERFORMANCE & ACCURACY (RMS)	
Differential GPS (DGPS) Accuracy - (Horizontal)	25 cm + 1 ppm
Differential GPS (DGPS) Accuracy - (Vertical)	50 cm + 1 ppm
High Precision / Long Observation Static Accuracy - (Horizontal)	3 mm + 0.1 ppm
High Precision / Long Observation Static Accuracy - (Vertical)	3.5 mm + 0.4 ppm
Static and Fast Static Accuracy - (Horizontal)	3 mm + 0.5 ppm
Static and Fast Static Accuracy -(Vertical)	5 mm + 0.5 ppm
Real-Time Kinematic (RTK) Accuracy - (Horizontal)	8 mm + 1 ppm (Single Base RTK), 8 mm + 0.5 ppm (Network RTK)
Real-Time Kinematic (RTK) Accuracy - (Vertical)	15 mm + 1 ppm (Single Base RTK), 15 mm + 0.5 ppm (Network RTK)
Stand alone L-band Accuracy via satellite based correction (95%) - (Horizontal)	Less than 5 cm
Stand alone L-band Accuracy via satellite based correction (95%) - (Vertical)	Less than 10 cm
RECEIVER FEATURES & FUNCTIONS	
Receiver Type	Rover
Interchangeable / Configurable as Base or Rover	Yes
Base Station able to serve multiple Rovers	Yes
Provision to Indicate the Connectivity with Base Station	Yes
Mode of Processing	RTK with Network RTK Correction
RTK processing	Yes
Built-in stand alone L-band facility and satellite based correction	Yes
Receiver Antenna	Integrated
Multi-path Mitigation for Receiver Antenna	Yes
Post Processing Software with free updates up to Warranty period inclusive in the scope of supply	Yes
Compatible to Electronic Total Station (ETS) of Other Makes	Yes
All Control functions available with receiver	Yes, GNSS Rover shall be capable of surveying in Static, Differential GPS, RTK and PPK mode. The GNSS -Rover shall be able to receive different type of corrections to allow different kind of services via TCP/IP over: a. Single RTK corrections from specific stations b. Single RTK corrections from nearest station. (Requires rover's position to be sent, rover should be able communicate his position to even for different make and model Base receiver).

	c. Network RTK corrections from VRS, FKP and MAC solution through NTRIP protocol. (Requires rover's position to be sent).
RECEIVER TRACKING CAPABILITIES	
Base Line Processing Range (Static)	500 kilometer
Number of Channels	672, 555
Initialisation Time	4 second, 5second
Maximum Position Update Rate	20 Hertz
Tilt Sensor	No
Position Acquisition Method	Fix
GNSS TRACKING SIGNALS (RECEIVER)	
GPS Tracking Signals	L1,L1 C/A,L2,L2 C,L2 P,L5
GLONASS Tracking Signals	L1,L2,L2 C/A,L2 P,L3
NAVIC Tracking Signals	L5
Galileo Tracking Signals	E1,E5 a,E5 b,E5 ab,E6
BeiDou Tracking Signals	B1,B2,B3
L-band tracking Signals	Nil
SBAS Support	GAGAN,WAAS,EGNOS,MSAS,QZSS
SUBSCRIPTION LICENSE FOR SATELLITE BASED CORRECTION	
Subscription license for satellite based correction, inclusive in the scope of supply	No
If Yes, Validity of License period	0 year
COMMUNICATIONS	
Communication Ports	USB,RS 232,Bluetooth,Combined LEMO,Wi-Fi / WLAN
Communication Protocols	NMEA,RINEX,RTCM 2.0,RTCM 3.0,CMR,CMR+
Phone Modem Antenna	Internal Antenna
Radio Modem Antenna	NA
Built-in Data Links - Phone & Radio Modems	GSM,GPRS,LTE,HSDPA
External Data Links Supported	GSM,GPRS,CDMA,LTE,UMTS,HSDPA,UH F
RAM / STORAGE	
Data Storage Medium	Internal, External/Removable
Internal Storage Capacity	4 GB,6 GB
External / Removable Storage Slot	SDHC,SD, Memory Stick, NA

External / Removable Storage Card Capacity supplied with Receiver - inclusive in the scope of supply	8 gigabyte
BATTERY	
Power Source	Internal - Rechargeable Battery
Supports 12 V External Battery	Yes
Chemistry of Battery	Li-ion
Capacity of internal Battery (mAh)	-
Battery Back Up Time	6 hour
Number of Batteries required for operation	1
Number of Batteries Supplied	2
Battery Chargers for Rechargeable Batteries (inclusive in the scope of supply)	Yes
12 V Vehicle Charging Kit inclusive in the scope of supply	Yes
Hot - Swappable b/w External and Internal Power Sources without affecting Data Recording	Yes
ENVIRONMENTAL PARAMETERS	
Minimum Operating Temperature	-40 degree Celsius
Maximum Operating Temperature	65 degree Celsius
Non Condensing Humidity, Rh	95 percent or better
Ingress Protection	IP 67. IP68
Maximum operational Altitude	13000 foot
ACCESSORIES	
Tribrach with Optical Plummet and Adopter supplied with receiver - inclusive in the scope of supply	No
Tribrach with Laser Plummet and Adopter supplied with receiver - inclusive in the scope of supply	No
Tribach tester - inclusive in the scope of supply	No
Telescopic Tripod supplied - inclusive in the scope of supply	No
Tripod Material	NA
Stop and Go Pole supplied - inclusive in the scope of supply	Yes
Clamp for Controller supplied - inclusive in the scope of supply	Yes
USB Data Transfer Cable - inclusive in the scope of supply	Yes
Power Cable,Connectors and Cables for Connecting to Car Batteries - inclusive in the scope of supply	Yes
Light Weight carrycase / Roll Over Trolley for Transporting Equipment and Accessories	Yes

List of Items and Quantity of each item included in the offer	Standard Accessories
WARRANTY / TRAINING	
Warranty	3 year
Training Type	At Buyer's Premises
Training Period	3 day
TEST REPORTS	
Compliance to Dust test	MIL-STD-810 F, MILSTD-810 G
Compliance to Water Intrusion test	MIL-STD-810 F, IEC-60529 or Equivalent Specn
Compliance to Vibration / Shock test	MIL-STD-810 F, MILSTD-810 G
COMPATIBLE CONTROLLER WITH FILED SOFTWARE	
CONTROLLER SOFTWARE AND FEATURES	
Field Software with free updates upto warranty period inclusive in the scope of supply Controller	Yes
Operating System	Windows Based, Android based
OS Version	-
Allow Configurable Survey Style for Static Mode	Yes
Allow Configurable Survey Style for Post - Processed Kinematic (PPK) Mode	Yes
Allow Configurable Survey Style for Real - Time Kinematic (RTK) Mode	Yes
Allow Configurable Survey Style for Stand alone L-band Processing mode and and satellite based correction	Yes
Capable of Multi-tasking so that Multiple Operations can be Opened at a time, eg, COGO, Stakeout, Point Manager etc	Yes
Datum and Projection Support and Support Grid Coordinates	Yes
Graphical Support to Visualize Work while Working	Yes
"Support Feature Coding with Attributes for GIS Data Collection, 3D Control coding possible for automatic plot creation "	Yes
Support COGO Functionality and Able to Key in Lines, Sub Divide Lines and Creating Parallel Lines for Staking out Purpose	Yes
User Friendly and Menu Driven for Easy Field Operation	Yes
Able to Store GNSS Data Collected by the RTK System	Yes
Able to email Data Collected in the Field in case Facility is Available and Able to Import & Export User Configurable Files for Effective GIS Support	Yes

"Support Graphical Stakeout, for Points, Lines and DTM as well and Able to Perform Real Time"	Yes
Able to Accept Background Maps in CAD Format	Yes
Ability to Convert Grid to Ground and Vice Versa Conversion Onboard	Yes
	Field software to be provided with free updates upto Warranty period inclusive in the scope of supply. It should at least have following functionality a. Full GNSS receiver Configuration, setup, status monitoring and management. b. Should provide full control over selection and configuration of RTK correction sources, type of correction and type of data stream, Projection and datum coordinate system. c. Downloading of Data containing Corrected and uncorrected co-ordinates, raw file etc. d. Correction sources type of correction and type of data stream Projection and datum coordinate system. e. Collection and storage of Point line and area features on basis of rover's position feature coding and basic symbolization. f. Graphical staking of points lines arcs and alignments. g. Calculating coordinate points from surveyed bearings distances and angles and vice versa. h. Provide standard COM components to integrate into third party applications. i. COGO functions for measurements of Area Volume Distance Angle etc. j. Add Raster layer in the background of working space. k. Digitize points lines and area feature over attached raster. l. Manipulate Point Line and Area features. m. Stake-out Capability. n. Collection of Data for Post-processed kinematic GNSS survey
Additional Features, if any	
INTEGRATED PERIPHERALS/ CONNECTIVITY	
Camera	With
Camera Capacity (MP)	8.0 to 8.9
Flash	Yes
Integrated GPS	Yes
Integrated Compass	Yes, No
Integrated Accelerometer	Yes
Integrated Cellular Modem	Yes, 4G LTE
SBAS Support	Yes
Audio Jack	No
Connectivity	USB,WiFi,Bluetooth
RAM / STORAGE	

Memory - RAM	4GB, 8 GB
Internal Storage Capacity	32 GB, 64 GB SSD eMMC
External / Removable Storage Slot	SDHC, Micro SD
DISPLAY / KEYPAD	
Type of Display	LED, LCD
Colour Display	Yes
Touch Screen Display	10 point capacitive multitouch with stylus,touch, and glove mode
Sunlight-readable Display	Yes
Display Resolution	WXGA
Display Size(in inch)	7.0 to 7.4
Alphanumeric full QWERTY Hard Keypad	No
BATTERY	
Power Source	Internal - Rechargeable Battery
Controller Supports 12 V External Battery	Yes
Chemistry of Battery	Li-ion
Capacity of internal Battery (mAh)	-
Battery Back Up Time	6 hour
Number of Batteries required for operation	1
Number of Batteries Supplied	2
Battery Charger for Rechargeable Batteries inclusive in the scope of supply	Yes
12 V Vehicle Charging Kit inclusive in the scope of supply	Yes
Hot - Swappable b/w External and Internal Power Sources without affecting Data Recording	Yes
GENERIC	
Weight (including Battery)	
Size (length x width x depth) (in mm X mm X mm)	
List of Items and Quantity of each item included in the offer	With Accessories including ergonomical rotating hand strap
OPERATING CONDITIONS	
Minimum Operating Temperature	-20 centidegree Celsius
Maximum Operating Temperature	55 centidegree Celsius
Non Condensing Humidity, Rh	95 percent
Ingress Protection	IP 68
Maximum operational Altitude	13000 foot
WARRANTY / TRAINING	
Warranty	3 year
Training Type	At Buyer's Premises
Training Period	1 day

TEST REPORTS	
Compliance to Dust test	MIL-STD-810 F, MILSTD-810 G, IEC-60529 or Equivalent Specn
Compliance to Water Intrusion test	MIL-STD-810 F, MILSTD-810 G, IEC-60529 or Equivalent Specn
Compliance to Vibration / Shock test	MIL-STD-810 F, MILSTD-810 G

Relative Gravimeter

Annexure D

Sl. No.	Name of the Item	Required Specification
SL. No.	Specification	Recommended Range/Value/Requirement
1	READING RESOLUTION	1 μ Gal or better
2	Digital Display	on board/remote
3	GPS	on board/remote
4	REPEATABILITY	less than or equal to 5 μ Gal
5	CLAMPING	Must not be present
6	OPERATING RANGE	7000 mGal or more
7	RESIDUAL DRIFT	< 35 μ Gal/day (new)
		< 20 μ Gal/day (mature)
8	RANGE OF AUTOMATIC TILT COMPENSATION	\pm 200 arcseconds or more
9	AUTOMATED CORRECTIONS	For Tide, instrument tilt, temperature, noisy sample filter, seismic noise filter, drift
10	TOUCH-FREE OPERATION	With Handheld Tablet with Bluetooth
11	HOT SWAPPABLE DUAL BATTERIES	YES
12	BATTERY QUANTITY	Minimum 2 rechargeable lithium batteries
13	BATTERY LIFE DURING OPERATION	24hrs
14	OPERATING TEMPERATURE	Range: (-)15°C to (+)50°C
15	DIGITAL DATA OUTPUT	USB /Bluetooth connectivity for data transfer.
16	ACCESSORIES	Tripod/Base plate, Battery Charger, USB cable & power supply, User Manual, Transit Case, Spare Partskit, Carry Bag, spare gravimeter batteries and if required remote display unit, Tablet computer (windows/AndroidbasedOS) with preloaded software for operating & customizing gravimeter and its spare batteries.
17	GRAVITY DATA COLLECTION	Instrument must have the facility to record the number & duration of gravity data as per user requirement.
18	Warranty Period	3 (three) years
19	Instrument demonstration	Required as per GIB CI 31.5

Pressure Gauge Sensors

Annexure E

Sl. No.	Brief Description	Specification
1.	10-m Cable Length Sensor made of Marine Bronze	Pressure Range: 0 - 10mWG Output: 4 - 20mA / 2-wire Supply Voltage: 10 - 32V dc Cable Length: 10m cable Process Connection: Self flushing nose cone Housing Material: Marine Bronze (CA104) Seal Material: Viton Diaphragm Material: Aluminium Oxide Accuracy (NL&H): $\pm 0.1\%$ / Span (BFSL) Cable Sheath material: PUR Thermal Zero Shift (TZS): $< \pm 0.04\%$ / Span / °C Media Temperature: -25 to +80°C Operating Temperature: -25 to +80°C
2.	20-m Cable Length Sensor made of Marine Bronze	Pressure Range: 0 - 10mWG Output: 4 - 20mA / 2-wire Supply Voltage: 10 - 32V dc Cable Length: 20m cable Process Connection: Self flushing nose cone Housing Material: Marine Bronze (CA104) Seal Material: Viton Diaphragm Material: Aluminium Oxide Accuracy (NL&H): $\pm 0.1\%$ / Span (BFSL) Cable Sheath material: PUR Thermal Zero Shift (TZS): $< \pm 0.04\%$ / Span / °C Media Temperature: -25 to +80°C Operating Temperature: -25 to +80°C

Radar type Tide gauges

Annexure F

Application	Continuous Measurement of Sea level by non-contact radar sensor
Measuring range	upto30m
Antenna	Horn antenna or enamel or stand pipe 2"
Process temperature	-40...+80°C
Process pressure	-1...+3 bar (-100...+3000kPa)
Measuring Frequency	1 Hz or better
Beam Angle	4 Degree
Measurement Accuracy	±2mm or better
Time Accuracy	1 sec or better
Frequency	80GHz
Ingress Protection	IP66
Wireless Data Logger	
Channels	16 single ended 8 differential
On board Sensors	Barometric Pressure
Resolution	24 bit
Accuracy	±0.01% of FS
Type	Sigma - Delta
Sampling Rate	Up to 10 Hz
Simultaneous Parameters	up to 176 parameters - including sensor and calculated parameters
Data Rate	1 minute (min) to 24 hours (max)
Digital I/P	2
Digital O/P	2
Serial I/P	RS232, SDI12
Communication Network	Type Quad-Band
GSM Frequency Band	850/900/1800/1900 MHz
Data Rate	85.6 Kbps upload and 42.8Kbps download
Data Security	AES (128 bit)
Interfaces	RS232 Serial, RS485 RTU & USB as mass storage
Micro-processor	32 bit
Display	Graphic LCD Display 128 x 64 resolution
LED Indicators	Power, Network Health, Communication
Keypad	3 button Keypad
Date & Time	RTC with backup battery (replaceable) Accuracy: better than 10 ppm from -20°C to 70°C RTC with backup battery (replaceable)

Time Synchronization	GPS (configurable 2 hours to max 23 hours), Server
Internal Flash	8 MB
External Flash	8 GB Micro SD (default) (expandable to 32 GB)
Operating Temperature	-20°C to +70°C
Storage Temperature	-40°C to +80°C
Protection	IP65 Housing ABS UV Protected

Declination and inclination Magnetometer

Annexure G

Sl. No.	Name of the Item	Required Specification	
1	DECLINATION INCLINATION MAGNETOMETER	Magnetometer	
		Polarity	+ve non-inverting output when pointing North
		Measuring range	±0.2mT or less
		Scaling (analogue output)	10mV/μT or better with x1 sensitivity 100mV/μT or better with x10 sensitivity
		Scaling temperature coefficient	<10ppm/ °C
		Offset in zero field	±1nT or less
		Offset temperature coefficient	0.01nT/ °C or less
		Scaling error	≤0.1%
		Maximum resolution	0.1nT or better
		Operating temperature range	0°C to +50°C
		Relative humidity	0-90% non-condensing
		Enclosure material	High impact ABS, Dust Proof, Water Resistant
		Display: X 1 sensitivity X 10 sensitivity	Yes, LCD/LED, Backlit Displays 0 to 20μT with 1nT resolution and 20 to 200μT with 10nT resolution Displays 0 to 2μT with 0.1nT resolution and 2 to 20μT with 1nT resolution
		Battery Type	Li-ion
		Probe	
		Calibration accuracy	0.1% or better
		Collimation error	<20 seconds (collimation adjustment by joystick and clamp)
		Operating temperature range	-20°C to +50°C
		Protective enclosure	Aluminium housing, mechanically isolated from element mounting
		Connecting cable:	≥10 m
		Theodolite	

		Theodolite	Steel-free
		Scaling division	6 seconds or better
		Estimation	3 seconds or better
		Directional accuracy	3 seconds or better
		Accessories	
		Steel-free tripod	Yes
		Steep sighting prisms	Yes
		Other Accessories	Manual and standard operating procedure for each component. And all necessary accessories & carrying case for each component for the smooth and efficient observation both in observatory and field.
2	Warranty	Five years	<p>a) Comprehensive Warranty (including spares and labour)</p> <p>b) The bidders must quote Standard Comprehensive Warranty as per Conditions of Contract of the Tender document for complete equipment (Including all spares, labour and third-party items).</p> <p>c) The warranty charges shall not be quoted separately.</p> <p>d) All software updates should be provided free of cost during Comprehensive Warranty period.</p>

TOTAL FORCE MAGNETOMETER**Annexure H**

Sl. No.	Name of the Item	Required Specification	
1	TOTAL FORCE MAGNETOMETER	Display	LED colour display with adjustable backlighting
		Sensitivity	≤ 0.15 nT
		Resolution	0.01 nT or better
		Absolute Accuracy	+/-0.2 nT@ 1 Hz or better
		Dynamic Range	20,000 to 120,000 nT
		Gradient Tolerance	Over 7000 nT/m
		Samples Rate	User selectable 1,2,5,10 samples per second
		Operating Temperature	-20°C to +50°C
		Storage	32 MB or more
		Data output	Active sync(RS-232C), USB Flash Drive and SD card
		GPS	Inbuilt
		Real Time Clock	GPS time or user defined
		Power	Removable batteries with 24 hr operational backup
		User interface	Keypad with touch screen(optional)
		Operating Range	Worldwide
		Standard Components & Accessories	Console, Standard software, batteries, harness, charger, sensor with cable, RS-232 cable, USB adapter, stave, Instruction manual, shipping case, backpack etc.
2	Warranty	Five years	a) Comprehensive Warranty (including spares and labour) b) The bidders must quote Standard Comprehensive Warranty as per Conditions of Contract of the Tender document for complete equipment (Including all spares, labour and third-party items). c) The warranty charges shall not be quoted separately. d) All software updates should be provided free of cost during Comprehensive Warranty period.

TOTAL FORCE SCALAR MAGNETOMETER

Annexure I

Sl. No.	Name of the Item	Required Specification	
1	TOTAL FORCE SCALAR MAGNETOMETER	Sensitivity	$\leq 0.022 \text{ nT} / \sqrt{\text{Hz}}$
		Resolution	0.01 nT or Better
		Absolute Accuracy	+/- 0.2 nT or Better
		Dynamic Range	20,000 to 120,000 nT
		Long Term Stability	< 0.05 nT/year
		Sampling Rate	1 sample per second or Higher
		Power	12 V 200mA Max.
2	Warranty	Five years	a) Comprehensive Warranty (including spares and labour) b) The bidders must quote Standard Comprehensive Warranty as per Conditions of Contract of the Tender document for complete equipment (Including all spares, labour and third-party items). c) The warranty charges shall not be quoted separately. d) All software updates should be provided free of cost during Comprehensive Warranty period.