INDICATIVE LIST OF EQUIPMENT

Sr. No.	Name of Hydro-Meteorological Instrument
1)	Automatic rain gauges
2)	Rain and snow gauges
3)	Snow depth sensor
4)	Shaft encoder
5)	Radar
6)	Ultrasonic sensor
7)	Bubbler
8)	Pressure transducer
9)	Automatic weather stations
10)	Groundwater level sensor with vent tube
11)	Groundwater level sensor without vent tube
12)	Acoustic Doppler Current Profiler
13)	GSM / GPRS modem
14)	INSAT radio
15)	VSAT trans-receiver
16)	Data collection platform (data-logger)
17)	Multi electrode resistivity imaging system
18)	Time domain electromagnetic (tem) equipment
19)	Resistivity meter (signal averaging system)
20)	Multi-parameter digital geophysical logger (500 m)
21)	Multi-parameter digital geophysical logger (1000 m)
22)	Resistivity meter (indigenous or equivalent)
23)	Snow water equivalent
24)	Electromagnetic Flow Meter
25)	Water Quality Sonde

Hydrological and Hydraulic Modelling Software	Suitable model as per mountainous terrain and LULC with flash flood component.
GIS and Remote Sensing Software	ArcMap 10.6 (ESRI Product)
GPS Instruments	Garmin for incident location mapping

ITEM 1: AUTOMATIC RAIN GAUGE STATIONS

FUNCTIONAL REQUIREMENT:

i. Rainfall shall be measured using the tipping bucket method and shall be able to record cumulative rainfall.
ii. A spout filter shall prevent ingress of insects and debris.
iii. WMO certification is required.

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	Value
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5 to 100 %
Altitude	0 to 2500 meter
Sensor	
Sensor Type	Tipping Bucket type with Reed Switch
Capacity	250 mm/hour or better
Resolution	0.5 mm or better
Accuracy (Intensity)	2 % or better, ±2 mm
General Features	
Output Interface	SDI12/ RS 485 / / 4-20 mA / Compatible with Data logger
Power Supply	12 V DC or switch rated for 12 VDC
Material	Corrosion Resistance Metal (Stainless steel or Aluminum)
Enclosure	NEMA 4
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Accessories	Sensor Mounting support, cables and other accessories as required

ITEM 2: RAIN AND SNOW GAUGE STATIONS

FUNCTIONAL REQUIREMENT: To measure the hourly rainfall and snowfall

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	**Value**
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5 to 100 %
Altitude	2000 to 5000 meter
Sensor	
Sensor Type	Storage Gauge with Anti-freeze system without heating
Capacity	1000 mm minimum
Resolution	0.5 mm or better
Accuracy (Intensity)	2 % or better, ±2 mm
General Features	
Output Interface	SDI12/ RS 485 / / 4-20 mA / Compatible with Data logger
Power Supply	12 V DC or switch rated for 12 VDC
Material	Corrosion Resistance Metal (Stainless steel or Aluminum)
Enclosure	NEMA 4
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Accessories	Sensor Mounting support, cables and other accessories as required

ITEM 3: SNOW DEPTH SENSOR

FUNCTIONAL REQUIREMENT: To measure the depth of snow

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	**Units**
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5 to 100 %
Altitude	2000 to 5000 meter
Sensor	
Sensor Type	Ultrasonic sensor
Range	0-10 meter
Resolution	1 mm or better
Accuracy	0.25 % of measuring distance
General Features	
Output Interface	SDI12/ RS 485 / / 4-20 mA / Compatible with Data logger
Power Supply	9-18 V DC
Material	Corrosion Resistance Metal (Stainless steel/ Aluminum or PVC)
Enclosure	NEMA 4
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Accessories	Sensor Mounting support, cables and other accessories as required

ITEM 4 :SHAFT ENCODER

FUNCTIONAL REQUIREMENT: To measure the water level

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	Value
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5 to 100 %
Altitude	0 to 2500 meter
Sensor	
Sensor Type	Shaft Encoder based rotary position sensor with Digital Display
Range	1-100 meter
Resolution	3 mm or better
Accuracy	0.025 % FSO
Output Interface	SDI-12 / RS 485 / 4-20 mA / compatible with data logger
Power Supply	12 V DC or Switch rated for 12 V DC
General Features	
Material	Corrosion Resistance Metal (Stainless steel or Aluminum)
Enclosure	Lockable (key) box provided by the supplier to be mounted in Stilling well or Gauge hut, with IP65 or NEMA 4 protection
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Graduated Tape	The tape should be of high quality to withstand harsh and humid environment, should not get twisted or wrinkeled while operation.
Accessories	Sensor Mounting support, Floats, graduated tapes (metric), wheel, counterweight, and cabling

ITEM 5 : RADAR

FUNCTIONAL REQUIREMENT: To measure the water level

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	**Value**
Site Conditions	
Ambient Temperature	-20°C to +60°C
Humidity	0 to 100 %
Altitude	0 to 2500 meter
Sensor	
Sensor Type	Microwave non-contact sensor
Range	15M / 20M/35M/75M
Resolution	3 mm or better
Accuracy	0.02 % FSO
Beam Angle:	≤ 16 °
Output Interface	SDI-12 / RS 485 / 4-20 mA / compatible with data logger
Power Supply	10-15 V DC
General Features	
Material	Corrosion Resistance Metal (Stainless steel / Aluminum or PVC)
Enclosure	The Sensor shall be easy to dismount and replace in the event of malfunction.
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Accessories	Sensor Mounting support, cables and other accessories as required
Protection	NEMA 4 or IP65
Horizontal Mounting /Installation Arrangements	Above FRL, Below a bridge girder wherever available otherwise horizontal cantilever arrangement from a mast/wall/pedastal
Radar Sensor should have display feature for diagnostic purpose	

ITEM 6 : ULTRASONIC SENSOR

FUNCTIONAL REQUIREMENT: To measure the water level

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	Value
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5 to 100 %
Altitude	0 to 2500 meter
Sensor	
Sensor Type	Ultrasonic non-contact sensor
Range	Upto 10 meter
Resolution	3 mm or better
Accuracy	0.02 % FSO
Output Interface	SDI-12 / RS 485 / 4-20 mA / compatible with data logger
Power Supply	10-15 V DC
General Features	
Material	Corrosion Resistance Metal (Stainless steel / Aluminum or PVC)
Enclosure	The Sensor shall be easy to dismount and replace in the event of malfunction.
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Accessories	Sensor Mounting support, cables and other accessories as required
Protection	NEMA 4 or IP65

ITEM 7 : BUBBLER

FUNCTIONAL REQUIREMENT: To measure the water level

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	**Value**
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5 to 100 %
Altitude	0 to 2500 meter
Sensor	
Sensor Type	Continuous bubbling system and non-submersible transducer
Range	15/30 PSI
Resolution	0.0001 psi or better
Accuracy	0.1 % FSO
Output Interface	SDI-12 / 4-20 mA / RS485, compatible with Data logger
Power Supply	11 to 15 V DC
Average current Draw	<15mA based on 1 bubble per second
Purge	Manual line purge
Bubble Rate	Programmable 30–120 bubbles per minute
Desiccators	The bubbling mechanism and the non-submersible transducer must be equipped with a desiccating system to keep system from malfunction for a period not less than one year.
General Features	
Tools	Complete tool kit for installation and routine maintenance
Manuals	Full documentation and maintenance instructions in English
Accessories	Sensor Mounting support, cables and other accessories as required
(*) Enclosure	NEMA4 or IP65

ITEM 8 : PRESSURE TRANSDUCER

FUNCTIONAL REQUIREMENT: To measure the water level

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	Value
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5 to 100 %
Altitude	0 to 2500 meter
Sensor	
Sensor Type	Pressure Sensor
Range	Upto 30 meter of water column
Resolution	3 mm or better
Accuracy	0.02 % FSO
Output Interface	SDI-12 / RS 485 / 4-20 mA / compatible with data logger
Power Supply	10-15 V DC
General Features	
Material	Corrosion Resistance Metal (Stainless steel / Aluminum or PVC)
Enclosure	The Sensor shall be easy to dismount and replace in the event of malfunction.
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Accessories	Sensor Mounting support, cables and other accessories as required
Protection	NEMA 4 or IP65

ITEM 9 : AUTOMATIC WEATHER STATIONS

FUNCTIONAL REQUIREMENT: To measure the weather parameter

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	Value
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5 to 100 %
Altitude	0 to 2500 meter
Air Temperature Sensor	
Sensor Type	Platinum resistance or better or equivalent
Range	-20 Degree Celsius to + 60 Degree Celsius
Resolution	± 0.1°C
Accuracy	Within ± 0.1^{o} Celsius in the entire working range
Response time	10 Secs or lesser
Self-aspirated	To ensure continuous supply of air.Free from turbulence, water droplets and Radiation
Power Supply	12 V DC or switch rated for 12 VDC
Accessories	All accessories for mounting the instrument e.g. special cross arm clamps or flag, if any, shall be provided.
Relative humidity Sensor	
Sensor Type	Capacitive/ Solid State Humidity Sensor
Range	0 to 100 %
Resolution	1%
Accuracy	±3% or better
Power Supply	12 V DC or switch rated for 12 VDC
Response time	10 Secs or lesser
Wind Speed and Direction Sensor	
Sensor Type	Ultrasonic sensor (No moving Parts)
Range	0-60 m/s for speed & 0-360 degrees for direction or better
Resolution	0.1 m/s for Speed; ±5 degree for direction
Accuracy	Better than 1% full scale
Response time	Less than 1 second lag in operating range
Mounting	All accessories for mounting the instrument e.g. special cross arm clamps or flag if any shall be provided.
Air Pressure Sensor	
Sensor Type	Temperature Compensated
Range	800 - 1200 hPa
Resolution	± 0.01 hPa

Accuracy	± 0.5 hPa
Power Supply	12 V DC or switch rated for 12 VDC
Solar Radiation Sensor	
Sensor Type	ISO Class 1 Pyranometer (CMP 11 or better)
Threshold	120 W/m^2 of direct solar irradiance
Methodology	Alternate shading of sensor to account for sky radiation
Spectral Range	400nm to 1100 nm
Range	0-2000 W/Square meter
Resolution	1 W/Square meter
Accuracy (Including Temperature Compensation)	3% or better
General Features	
Material	Corrosion Resistance Metal (Stainless steel/ Aluminum or PVC)
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Accessories	Sensor Mounting support, cables and other accessories as required
Output Interface	SDI 12/RS 485/ 4-20 mA/ Compatible with Data logger
Evaporation- Pan Specification	
Operating temperature	-5 to 60 degree Celsius.
Diameter of the pan	1.2 m or more
Accuracy	+/- 1%
Accessories	As required for complete installation of the sensors and Equipment
Material	Clean cast seamless acrylic plastic tubing or brass sheet
Platform	Rot resistant timber treated with creosote or other effective Wood preservative.
Graduation	in millimeter

ITEM 10 : GROUNDWATER LEVEL RECORDER (DWLR) WITHOUT VENT TUBE

FUNCTIONAL REQUIREMENT: To measure and transmit the ground water level

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	Value
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5-100 %
Altitude	0-2500 meter
Sensor	
Sensor Type	Submersible pressure transducer having vent tube, with atmospheric pressure and temperature compensation
Range	30 psi The full scale water fluctuation measuring range will be specified by the implementing agency depending on the requirement 0-5/10/20/30/50 m of water column
Installation Depth	The installation depth will be specified by the implementing Agency depending upon their requirements 0-10/20/50/100/150/200/300m
Accuracy	0.1% FSO
Temperature Coefficient	<0.01% Full scale/degree centigrade for water temperatures between 10˚C and 40˚C
Resolution	3 mm
Reproducibility	0.1% full scale or better
Long Term Stability	0.1% Full scale and should ensure long term stability without any field calibration requirements except barometric compensation
Temperature Measuring Range	0 to 50˚C
Accuracy	Better than 0.1˚C
Burst Pressure	>=3 Time Full scale
Overload Pressure	2 Time full scale without effect on calibration
Over voltage protection on supply & sensor wires	Over voltage protection should be provided on power supply lines
Non-Vented Cable	Includes barometric sensor for post-processing
Output	SDI-12, RS-485 or compatible with data logger included
Datalogger	
Atmospheric Pressure correction	Should be applied automatically
Resolution of Measurement	1mm or better
Measuring interval and measuring modes	Should be programmed to store data from 1 minute one reading to 24 hours one reading with future start option.
Settling up Time	<30 minutes after submersion
Recording Capacity	Non-Volatile flash data storage of more than 1,00,000 data points (at least)
Memory Type	Non-Volatile memory

Power Supply	Should be equipped with lithium or alkaline battery pack, giving at least 5 years operation (with one transmission and four recordings per day). Battery must be replaceable in the field or in local offices of the implementing Agency or supplier. Replacement batteries must be readily available in Dushanbe or Central Asia.
Battery Voltage Monitoring	Monitoring and transmission of Battery Voltage level
Datalogger Location	If Data logger and transmitter are integral parts of sensor, it should be located on top (near ground surface) instead of bottom
Built in clock	Accurate to ±1 minute per year
Displayed Time Resolution	1 second
Over-voltage Protection	Should include lightening, over-voltage and surge protection
Enclosure	
Enclosure for Pressure sensor and Data Logger	Data Logger should be concealed into a single tubular enclosure which is waterproof and corrosion proof.
Dimension	Outer diameter of sensor unit: <=50mm, (for sensor & logger only)
Material	Titanium, stainless Steel or other corrosion resistant material
Installation	The system should be provided with a suspension bracket or Well Cap allowing secure installation within the Piezometers' headwork, including appropriate cable mounting to allow the sensor to be adjusted to the required depth
Direct Read Cable	The cable shall have following features: Diameter of cable should be less than 30mm Strength members for good longitudinal stability of cable The cable and contacts should be fixed or quick connect
Protection	IP67 with Impact Resistant
Communication Interface	
Computer Interface	The Logger must be capable of connection to a computer via USB 2.0/USB 3.0 and supply should include the necessary interface cables.
Wireless Communication	Option for Bluetooth/IR/Wi-Fi interface (atleast any one of the three options specified) should be available.
File Format	The format of the data downloaded by communication interface shall be in standard ASCII/CSV/XML format.
GSM / GPRS Transmitter	
Transmission System	GPRS/edge based data transmission system
Performance	Data Reception availability of 95% or better
Communication Direction	Utilize GPRS network for two-way TCP/IP (INTERNET) connection
VPN protocol	Radio to utilize VPN protocol
Transmission trigger	Data collection to be triggered by interrogation from Data Center, or by event based transmission triggered by remote site
Power Saving	Ability to disable interrogation system in order to save power at remote site
Communication Protocol	Data transmission to execute HTTP Post or FTPS to transmit data to the Data Center
Accessories	All associated equipment, including Antenna all cables and mounting

	hardware
Software	
Operating System	Windows software for system configuration, transfer and analysis of data to computer
Version	English language version
License	All required licenses included
General Features	
Battery	The battery should be easy to replace, and easily available in the market
Tools	Complete tool kit for installation and routine maintenance
Manuals	Full documentation and maintenance instructions in English

ITEM 11 : GROUNDWATER LEVEL RECORDER (DWLR) WITH VENT TUBE

FUNCTIONAL REQUIREMENT: To measure and transmit the ground water level

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	Value
Site Conditions	
Ambient Temperature	From -20 to +60
Humidity	5-100 %
Altitude	0-2500 meter
Sensor	
Sensor Type	Submersible pressure transducer without vent tube, having atmospheric pressure compensation sensor on each individual equipment
Range	30 psi The full scale water fluctuation measuring range will be specified by the implementing agency depending on the requirement 0-5/10/20/30/50 m of water column
Installation Depth	The installation depth will be specified by the implementing Agency depending upon their requirements 0-10/20/50/100/150/200/300m as specified
Accuracy	0.1% FSO
Temperature Coefficient	<0.01% Full scale/degree centigrade for water temperatures between 10˚C and 40˚C
Resolution	3 mm
Reproducibility	0.1% full scale or better
Long Term Stability	0.1% Full scale and should ensure long term stability without any field calibration requirements except barometric compensation
Temperature Measuring Range	0 to 50˚C
Accuracy	Better than 0.1˚C
Burst Pressure	>=3 Time Full scale
Overload Pressure	2 Time full scale without effect on calibration
Over voltage protection on supply & sensor wires	Over voltage protection should be provided on power supply lines
Non-Vented Cable	Includes barometric sensor for post-processing
Output	SDI-12, RS-485
Datalogger	
Atmospheric Pressure correction	Should be applied automatically
Resolution of Measurement	1mm or better
Measuring interval and measuring modes	Should be programmed to store data from 1 minute one reading to 24 hours one reading with future start option.

Settling up Time	<30 minutes after submersion
Recording Capacity	Non-Volatile flash data storage of more than 1,00,000 data points (at least)
Memory Type	Non-Volatile memory
Power Supply	Should be equipped with lithium or alkaline battery pack, giving at least 5 years operation (with one transmission and four recordings per day). Battery must be replaceable in the field or in local offices of the implementing Agency or supplier. Replacement batteries must be readily available in Dushanbe or Central Asia.
Battery Voltage Monitoring	Monitoring and transmission of Battery Voltage level
Datalogger Location	If Data logger and transmitter are integral parts of sensor, it should be located on top (near ground surface) instead of bottom
Built in clock	Accurate to ±1 minute per year
Displayed Time Resolution	1 second
Over-voltage Protection	Should include lightening, over-voltage and surge protection
Enclosure	
Enclosure for Pressure sensor and Data Logger	Data Logger should be concealed into a single tubular enclosure which is waterproof and corrosion proof.
Dimension	Outer diameter of sensor unit: <=50mm, (for sensor & logger only)
Material	Titanium, stainless Steel or other corrosion resistant material
Installation	The system should be provided with a suspension bracket or Well Cap allowing secure installation within the Piezometers' headwork, including appropriate cable mounting to allow the sensor to be adjusted to the required depth
Direct Read Cable	The cable shall have following features: Diameter of cable should be less than 30mm Strength members for good longitudinal stability of cable The cable and contacts should be fixed or quick connect
Protection	IP67 with Impact Resistant
Communication Interface	
Computer Interface	The Logger must be capable of connection to a computer via USB 2.0/USB 3.0 and supply should include the necessary interface cables.
Wireless Communication	Option for Bluetooth/IR/Wi-Fi interface (atleast any one of the three options specified) should be available.
File Format	The format of the data downloaded by communication interface shall be in standard ASCII/CSV/XML format.
GSM / GPRS Transmitter	
Transmission System	GPRS/edge based data transmission system
Performance	Data Reception availability of 95% or better
Communication Direction	Utilize GPRS network for two-way TCP/IP (INTERNET) connection
VPN protocol	Radio to utilize VPN protocol

Transmission trigger	Data collection to be triggered by interrogation from Data Center, or by event based transmission triggered by remote site
Power Saving	Ability to disable interrogation system in order to save power at remote site
Communication Protocol	Data transmission to execute HTTP Post or FTPS to transmit data to the Data Center
Accessories	All associated equipment, including Antenna all cables and mounting hardware
Software	
Operating System	Windows software for system configuration, transfer and analysis of data to computer
Version	English language version
License	All required licenses included
General Features	
Battery	The battery should be easy to replace, and easily available in the market
Tools	Complete tool kit for installation and routine maintenance
Manuals	Full documentation and maintenance instructions in English

ITEM 12: ADCP

FUNCTIONAL REQUIREMENT: To measure the discharge

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	Value
Site Conditions	
Ambient Temperature	-5 to 45 Degree C
Humidity	5-100 %
Altitude	0-2500 meter
mode of operation	real time from a sailing boat/Bridge/cableway
Sensor	
ADCP Type	Down looking ADCP for measurement of discharge in open channel environment
Velocity Profiling Range	0.1 to 5 meter / 0.4–25 meter / 0.4 to 40 meter (Actual requirement would be specified by implementing agency based on site conditions)
Profiling Velocity	+/-20 m/s
Velocity Accuracy	0.25% of measured velocity
Velocity Resolution	0.001m/s
Depth Range	0.3-80 m
Depth Accuracy	1%.
Depth Resolution	0.001 m
Positioning	Optional capability to acquire position by bottom tracking or DGPS.
Computations	All performed internally or on Windows-based software (also to be supplied)
Accessories	
Platform	Floating platform/ Trimaran for ADCP deployment (optional as per requirement of Intender)
Positioning	DGPS for positioning in case of moving bed
Tethers	All necessary tethers and taglines
Software	Windows-based software for display of velocity, discharge, depth, and width information in real-time.
General Features	
Tools	Complete tool kit for installation and routine maintenance
Manuals	Full documentation and maintenance instructions in English

ITEM 13 : GSM / GPRS MODEM

FUNCTIONAL REQUIREMENT: To transmit data

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	Value
Ambient Site Conditions	
Operating Temperature	From -20 to +60
Performance	Data Reception availability of 95% or better
Form factor	The Transmitter should either be integral part of data logger specified above, or it should be supplied as independent unit compatible with supplied data logger
Specific Features	
Communication Direction	Utilize GPRS network for two-way TCP/IP (INTERNET) connection
VPN protocol	Radio to utilize VPN protocol
Transmission trigger	Data collection to be triggered by interrogation from Data Center, or by event based transmission triggered by remote site
Power Saving	Ability to disable interrogation system in order to save power at remote site
Communication Protocol	Data transmission to execute HTTP Post or FTPS to transmit data to the Data Center
Accessories	All associated equipment, including Antenna all cables and mounting hardware
Antenna features	
Frequency range	900 MHz: 824-960 MHz/1800MHz:1710-1880 MHz
Impedance	50 ohms
VSWR	≤ 2.0
Radiation	Omni-directional
Operating temperature	-10 to + 60 degrees Celsius
Connector	SMA adaptable to GSM/GPRS modem
Cable length	As required

ITEM 14 : INSAT RADIO

FUNCTIONAL REQUIREMENT: To transmit data

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	**Value**
Operating Temperature	From -20 to +60
Environment Relative Humidity	0 to 100 %
Career Frequency	402 - 403 MHz
Carrier Stability	In steps of 100 Hz from 402.0 MHz to 403.0 MHz
Modulator	PCM/BPSK
Data coding	NRZ(L)
Output Power	3-10 W, user settable
Data Bit Rate	4.8 kbps
Frequency Stability	
a) Long term	Transmit frequency inaccuracy including aging of oscillator should not exceed ± 400 Hz per year. Oscillator/synthesizer should have provision to adjust for the long term drift
b) for temperature	± 1 ppm or better (-40 to +55^{o}C)
Signal Bandwidth	6.0 KHz maximum or better
Output Power	3-10 W (settable)
Power Stability	±1 dB
Spurious	-60 dB or better
Harmonics	-40 dB or better
Antenna cable	LMR 400 grade or better
Performance	Data Reception availability of 99% or better
Form factor	The Transmitter should either be integral part of data logger specified above, or it should be supplied as independent unit compatible with supplied data logger
Operating power	Switched 12V D.C controlled by data logger.
Yagi Antenna	
Polarization	LHCP or RHCP, switchable in field
Gain	Minimum 11 dbi or better
Center Frequency	402-403 MHz
Mounting	Proper mounting and Pointing arrangement for 360 degree azimuth and elevation adjustment
Operating Wind speed	250 kmph
Wind Survival	300 kmph
Material	Rust-proof and Oxidation-proof
Specific Features	
Satellite System	INSAT Radio System to be Used on the INSAT Satellite

	operated by ISRO
Certification	Certificate of acceptance required by Met Agency as part of the bid package
Demonstration in Dushanbe or Central Asia	Demonstrated use of the satellite radio with at least 200 radios in current operation in Dushanbe or Central Asia using INSAT
Accessories	All associated equipment, including GPS, GPS Antenna, INSAT Antenna, all cables and mounting hardware

ITEM 15 : VSAT TRANS-RECEIVER

FUNCTIONAL REQUIREMENT: To transmit and receive data

DESIGN REQUIREMENTS: The equipment offered should conform to the following technical Specifications:

Feature	**Value**
Operating Temperature	From -20 to +60
Antenna cable	LMR 400 grade or better
Performance	Data Reception availability of 99% or better
Specific Features	
Communication Direction	VSAT Radio system to allow two-way communication system between Data Center and remote station
Single Hop or double hop	Provision to use either single hop (leased lines between user and service provider hub) or double hop (via vsat) for receiving data at user end
Frequency Band	C Band or Extended C band (Ku or Ka band would be acceptable)
Bandwidth Sharing	VSAT bandwidth will be able to be shared among all stations using TDMA mode
Alarm Conditions	VSAT remote stations shall be able to transmit based on alarm conditions at the remote site such as critical water level or exceptional precipitation events
Accessories	All associated equipment, including Antenna all cables and mounting hardware

ITEM 16 : DATA COLLECTION PLATFORM

FUNCTIONAL REQUIREMENT:

1. The DCP shall also continuously monitor the status of the instruments, power supply and communications. In the event of failure of an instrument or disruption of any of the power sources, an alarm shall be sent back to the ERS/modeling center.
2. The sensor's signal conditioning unit should be an integral part of the system.
3. The system shall have provision to easily include and change the following information in field as mandatory requirements:
    - Unique station identification code.
    - Time of observation.
    - Sensor identification.
4. The system shall have an integrated microprocessor based data acquisition and storage system having adequate hardware configuration and software support to serve as an interface between sensors and the communication link to perform tasks as stated below.
5. Providing necessary electrical power to the sensors and conversion of electrical output signals from the sensors into engineering values based on calibration equations stored in the memory. Full compatibility with all types of sensors provided in the packages shall be mandatory.
6. The system should be stand-alone and all programming functions/ set-ups to be carried out through system keypad and display independent of a PC/ Laptop.
7. The system should be capable of continuous updating of the values of sensed parameters and post processing the instantaneous values into average values over a specified period of time for transmission to the DCP with earth receiving station.
8. The system shall have in-built sensor simulation system options to conduct tests on the system for field installation, two-point calibration/ re-calibration and maintenance of the sensors.
9. The system shall support the following functions:
    - Easy programming set up.
    - Multi tasking capability
    - User friendly software programming.
    - The system shall have self-diagnostic facility and be capable of displaying Station ID/ Sensor ID codes and messages on the display panel for general identification of the fault. It should have facility to monitor these codes and other health status through an external lap top/ PC.
    - Setup shall be organized in a tree of menus and sub-menus. Protection of setup parameters and data through password should be supported by the system. In addition, the DCP shall support the manual entry of data through keypad and its display.
    - Data including the setup and program files shall be transferable from the system via a serial port to PC and SD card or other suitable memory device and vice versa.
10. The data logger shall be programmable locally in field via laptop/ PC.
11. The surge suppression in form of fuse or other appropriate device shall be provided for all interfaces to protect the data logger from surges emanating from the sensors.

16A. Specification of Data Logger for 1-2 Sensors

Feature	Value
Site Conditions	
Ambient Temperature	From -20 to +50 Degree C
Humidity	5 to 100 %
Altitude	0 to 5000 meter
Sensor Interface	
Analogue Inputs	1 Analogue Input Channels
Analog inputs	4 to 20 mA ; 100% over-range withstand
SDI Port	One SDI-12 Interface port
Digital Inputs	1 Digital Channels, bidirectional
Pulse Input	1 Input for Rain Gauge impulse
Input - Output Interfaces	
Data Transfer	USB stick option for Data transfer
Port for Configuration	One Serial Port (RS232) for communication with Laptop for programming
[1]Port for Telemetry	2 Ports for Communication with Telemetry (GSM / VSAT / INSAT) Device (See Note 1 Below)
[2]Display Port	Optional port for connecting external display screen for Data in running text (See Note 2 Below)
Computer Software	
Operating System	Windows software for system configuration / communication
Version	English language version
Licenses	All required licenses included
Analog to digital converter	
Resolution	16 bit or better
Conversion Accuracy	± 1 LSB
Sample Intervals	1 sec. to 24 hr. in 1 second increments (user selectable)
General Features	
Flash memory	Non-volatile Flash memory that can one store one year of data and expandable to a minimum of 1GB.
Resolution	A/D resolution ≥16 bit
Recording Interval	Individual recording intervals for each sensor/parameter
Firmware Operating System	Multi-tasking operating system - must log data and transmit at same time
Display	Inbuilt Digital Display for viewing current data and setting values
Power Supply	Power supply 12V DC, low current drain (quiescent ≤10.0mA)
Battery Voltage	Monitoring of battery voltage level

Internal battery	Internal battery backup for clock, Lithium Battery, storage: 2 years
Charge controller	Internal or External
User Permissions	Different user levels, system of user rights / passwords, access restricted to authorized personnel
Internal clock	Internal clock with drift less than 2 seconds per year or using GPS
Keypad	Keypad for displaying or transferring data to memory stick, configuration of data-logger and sensors
Real-Time Clock	GPS synchronized
System integrity	System integrity check procedures
Enclosure	for wall-mounting in a shelter / enclosure with IP65 (NEMA 4) protection or better
Accessories	Serial cable + adaptor (if required) for notebook connection. All accessories (fixing units, etc.) as required
Tools	complete tool kit for installation and routine maintenance giving full detail(number of pieces and type)
Manuals	full documentation and maintenance instructions in English (1 copy per station).

Note 1: The data logger should have at least 2 ports for data transmission via telemetry devices (GSM / VSAT / INSAT). Both telemetry systems should work simultaneously for redundancy. The type of port required for telemetry device may be different (Serial, RS 485, RS 232, RJ-45 etc) and proposer may offer multiple models having different combination of ports.
Note 2: The port for attaching external display device to show data as running text is optional. The proposer may offer two different models, with or without port for display device.

16B. Specification of Data Logger for more than 2 Sensors

Feature	Value
Site Conditions	
Ambient Temperature	From -20 to +50 Degree C
Humidity	5 to 100 %
Altitude	0 to 5000 meter
Sensor Interface	
Analogue Inputs	8 Analogue Input Channels
Analog inputs	4 to 20 mA ; 100% over-range withstand
SDI Port	One SDI-12 Interface port
Digital Inputs	6 Digital Channels, bidirectional
Pulse Input	2 Input for Rain Gauge impulse
Input - Output Interfaces	
Data Transfer	USB stick option for Data transfer
Port for Configuration	One Serial Port (RS232) for communication with Laptop for programming
[1]Port for Telemetry	2 Ports for Communication with Telemetry (GSM / VSAT / INSAT) Device (See Note 1 Below)
[2]Display Port	Optional port for connecting external display screen for Data in running text (See Note 2 Below)
Computer Software	
Operating System	Windows software for system configuration / communication
Version	English language version
Licenses	All required licenses included
Analog to digital converter	
Resolution	16 bit or better
Conversion Accuracy	± 1 LSB
Sample Intervals	1 sec. to 24 hr. in 1 second increments (user selectable)
General Features	
Flash memory	Non-volatile Flash memory that can one store one year of data and expandable to a minimum of 1GB.
Resolution	A/D resolution ≥16 bit
Recording Interval	Individual recording intervals for each sensor/parameter
Firmware Operating System	Multi-tasking operating system - must log data and transmit at same time
Display	Inbuilt Digital Display for viewing current data and setting values
Power Supply	Power supply 12V DC, low current drain (quiescent ≤10.0mA)
Battery Voltage	Monitoring of battery voltage level
Internal battery	Internal battery backup for clock, Lithium Battery, storage: 2 years

Charge controller	Internal or External
User Permissions	Different user levels, system of user rights / passwords, access restricted to authorized personnel
Internal clock	Internal clock with drift less than 2 seconds per year or using GPS
Keypad	Keypad for displaying or transferring data to memory stick, configuration of data-logger and sensors
Real-Time Clock	GPS synchronized
System integrity	System integrity check procedures
Enclosure	for wall-mounting in a shelter / enclosure with IP65 (NEMA 4) protection or better
Accessories	Serial cable + adaptor (if required) for notebook connection. All accessories (fixing units, etc.) as required
Tools	complete tool kit for installation and routine maintenance giving full detail(number of pieces and type)
Manuals	full documentation and maintenance instructions in English (1 copy per station).

Note 1: The data logger should have at least 2 ports for data transmission via telemetry devices (GSM / VSAT / INSAT). Both telemetry systems should work simultaneously for redundancy. The type of port required for telemetry device may be different (Serial, RS 485, RS 232, RJ-45 etc) and proposer may offer multiple models having different combination of ports.
Note 2: The port for attaching external display device to show data as running text is optional. The proposer may offer two different models, with or without port for display device.

16C. Power Supply for DCP

The equipment offered should conform to the following technical Specifications:

Feature	Units
Battery	
Voltage	From -20 to +60
Type	Sealed Maintenance free
Capacity	Based on site conditions and Telemetry method, to provide 21 days of backup
Solar Panels	
Size	Based on Site conditions and Telemetry method used for 21 days of backup
Mounts	The mounts should be sturdy in design; the solar panel should not move or rotate with wind. It should have provision to adjust direction and elevation during installation for optimal solar power generation
Charger	Smart solar charger with protection
General	
The supplier should determine optimal size of solar panels and batteries, such that system should be operational for at least 21 days in the absence of charging	

ITEM 17: MULTI ELECTRODE RESISTIVITY IMAGING SYSTEM

Multi- electrode Resistivity imaging with SP and IP system fully automatic, capable of recording, storing Resistivity and induced polarization data for arbitrary electrodes configuration. Software fully automatic and data acquisition, processing and interpretation is required with the facility of 2/3 – Dimensional Resistivity imaging. The equipment should be complete with all accessories: electrodes, Multi core cable, Charger for internal batteries transportation case and other required accessories for field survey. All the equipments and accessories should be fitted in a suitable AC vehicle so that data acquisition and processing of field data can be done at the site itself. It will also provide the safety of equipments which contains various electronic circuits.

Feature	**Specification**
General Features	
General	The unit should be compact and light with display, main processing unit; internal memory and multi-electrode system are integrated in the same housing. No separate electronics other than cables.
Environmental	Weather proof, Shock proof
Operating Temp	From -5 Degree C to +50 Degree C
Interface	Equipment can be interfaced with PC or laptop for upload and load of sequence file and data file.
Power source	Internal and external rechargeable battery source for imaging, data acquisition and data transfer to external PC or Laptop.
Specific Features	
Injection Current	Automatic injection current ranging and stacking and averaging.
Resistivity Measurement	Direct measurement of Resistivity, SP and IP.
Cable	120 takes out in 10m spacing
No. of Channels	10 channels or more.
Automatic Ranging	Microprocessor controlled.
Current measurement precession	0.2 percent.
Voltage measurement precision/ resolution	0.2 percent typical/ 1 micro volt or better
Noise Reduction	Continuous stacking selectable manually or automatic.
SP compensation	Through automatic line at drift correction.
Resistivity accuracy	0.2 percent typical or better.
Induced Polarization	Arbitrary windows flexibility, configured to power line frequencies
Output	
Output Voltage	400 V or more. (Peak to Peak 800 V or more)
Output current	2 A or more
Output Power	200W or more
Input	

Input Impedance	100 Mega Ohm
Input Voltage protection	up to 1000V
External Transmitter	
Transmitter	Not less than 250 watt with external power Booster or Not less than 250 with external 5 KW
Current Output option	2.5 Amps or more
Interface	
LCD Display	Color & day light visible
Interface I/O port	USB and through LAN
Memory Capacity	Greater than or equal to 20,000 readings

ITEM 18: TIME DOMAIN ELECTROMAGNETIC (TEM) EQUIPMENT

Feature	Specification
General Features	
Operating temperature	-20° C + 65° C
Specific Features	
Time gates	48 geometrically spaced
Time range	Up to 16000 us or more
Transmitter's current	Max. 10 A or more
Transmitter Loop size	1600-2500 m^2
Sounding Depth Range	Up to 300m or more in favorable condition
Sensitivity	≈ 0.1μV
Stacking	Up to 65000 stack in single loop
Display	Note book or Hand held PC
Weight(kg)	Compact and light weight
Transmitter Protection	Electronic and electromechanical protection.
Casing	The unit should be compact and light with generating and measuring block with the internal battery housed in a water proof case.
Accessories:	
	Cable for connection of the computer with port RS 232.
	Cable for measurements with the single receiving –generating antenna.
	Cable for measurements with the receiving and generating antenna (4 wires).
	Cables for connection of the external battery.
	Test –coil.
	Charging device with a cable.
	Antenna 50m X 50m (100m cable R=< 2 Ohm and 2X50 = 100 m, R= < 4 Ohm).
	Additional sockets for antennas.
	Dedicated Software.

ITEM 19 RESISTIVITY METER (SIGNAL AVERAGING SYSTEM)

Feature	Specification
General Features	
Power input	12/24 V rechargeable batteries
Display	Alphanumeric LCD
Specific Features	
Power Out	100 watts or more
Current	up to 2 Amp
Frequency	Less than or equal to 0.8 Hz
Noise rejection	95 db or more
Potential measuring	10 micro volts
Range Resolution Range selection	Automatic
Resistance range	10 micro ohms to 10 Kilo ohms
SP Cancellation	Automatic
Dynamic range	Better than 15 bits
Data averaging	up to 64 cycles
Input Impedance	10 M ohms or more
Accuracy	1%
Interface	
	User friendly menu operation with feather touch key pad
	Provision for data transfer to any window based PC
	Provision to display error signals in case of poor electrode contacts or discontinuity

ITEM 20 : MULTI-PARAMETER DIGITAL GEOPHYSICAL LOGGER (500 M):

Feature	Specification
General module and Acquisition Console	
Power supply	230 Volt ± 5% by Generator driven at 50 hertz AC frequency, suitable horse power Generator which enable to take load of 500m cable in viscous mud fluid for measuring during down and upward below 500m borehole. Generator may bear all weather temperature of Dushanbe or Central Asian tropical climate condition during running condition.
Communication Interface	RS 232 or Latest for communication with latest Laptop
Software	Acquisition and interpretation Software's with editing and presentation facility.. Instantly plot the recorded graph during measurement and facility to store in external drive like Pen-drive or better storage facility. Data collected by the down hole & Up-hole probes are digitally stored during acquisition in a Laptop PC, Low resolution field printouts are produced while the data is being acquitted allowing the operator to review the data for completeness Later, appropriate scale are chosen and filters may be applied and high resolution printouts are made. Presentation quality logs from several probes are merged on the final printouts.
Front Panel	Voltmeter, current meter, torque, Speedo meter and Depth indicator etc. will be fitted in front panel along with operating of which drive system. Or suitable device may be given for above monitoring.
	Operating system of modules, which drive and borehole location should be aligned after mounting the Logger. So that operator may observe up to borehole during operation of GP Logging.
Operating Temperature	All weather Dushanbe or Central Asian tropical condition including natural borehole temperature up to 500m (Hot water borehole to icing condition) or better.
Storage Temperature	-5 to 60˚C or better (All should be fitted in suitable vehicle with capacity of sitting of operators at least three persons in comfort, all equipments with all probes, tool box and Generator etc).
Winch Assembly	
Motor	Suitable capacity, SCR type, motor can take load up to 500m in borehole filled with viscous mud fluid during logging operation.
Controller	SCR controller, with 10 amp current limit or better
Speed	0 to 30 m/min
Maximum cable capacity	500m
Emergency Brake	Winch assembly should be provided with emergency brake & provision to drive manually in case failure of Generator
Caliper tool	

Number of Arms	Three or four (Two set short and long arms)
Diameter	≤ 60mm
Length	≤150cm
Measurement range	Up to 31cm approx. OR more by short arms and long arms up to 50.4cm approx. OR more
Probes and Tools	
Fluid Resistivity measuring range	0-100 ohm meter
Temperature measuring range	All borehole natural temperature from hot to icy condition.
Fluid Resistivity Resolution	≤0.05%.
Temperature Resolution	≤0.1˚C
Accuracy	≤1%
Probe Diameter	60 mm or lower
Gamma tool:	Provision for various time constants desirable
Electric tool:	
Low range normal Resistivity range	0-250 ohm-meter
High range normal Resistivity range	0-10000 ohm-meter
Resistivity accuracy	≤1%
Resistivity Resolution	≤0.02%
Self Potential range	≤ -1.5to 1.5 VDC
Self Potential accuracy	≤1%
Self Potential resolution	≤0.02%
Calibration Box	Calibration box of above measurement parameters
Mud Resistivity Meter	Portable, measured range 0 to 250 ohm meter
Water Analysis Tool	Portable Water analysis Tool
Tool Kit	Complete geophysical tool kit for field operations including tripod and digital Multi-meter
Spares	Acquisition system spares including complete cable head spares, probe parts, winch parts, O-rings and consumables

ITEM 21 : MULTI-PARAMETER DIGITAL GEOPHYSICAL LOGGER (1000 M)

Feature	Specification
General module and Acquisition Console	
Power supply	230 Volt ± 5% by Generator driven at 50 hertz AC frequency, suitable horse power Generator which enable to take load of 1000m cable in viscous mud fluid for measuring during down and upward below 1000m borehole. Generator may bear all weather temperature of Dushanbe or Central Asian tropical climate condition during running condition.
Communication Interface	RS 232 or Latest for communication with latest Laptop
Software	Acquisition and interpretation Software's with editing and presentation facility . Instantly plot the recorded graph during measurement and facility to store in external drive like Pen-drive or better storage facility. Data collected by the down hole & Up-hole probes are digitally stored during acquisition in a Laptop PC, Low resolution field printouts are produced while the data is being acquitted allowing the operator to review the data for completeness Later, appropriate scale are chosen and filters may be applied and high resolution printouts are made. Presentation quality logs from several probes are merged on the final printouts.
Front Panel	Voltmeter, current meter, torque, Speedo meter and Depth indicator etc. will be fitted in front panel along with operating of which drive system. Or suitable device may be given for above monitoring.
	Operating system of modules, which drive and borehole location should be aligned after mounting the Logger. So that operator may observe up to borehole during operation of GP Logging.
Operating Temperature	All weather Dushanbe or Central Asian tropical condition including natural borehole temperature up to 1000m (Hot water borehole to icing condition) or better.
Storage Temperature	-5 to 60˚C or better (All should be fitted in suitable vehicle with capacity of sitting of operators at least three persons in comfort, all equipments with all probes, tool box and Generator etc).
Winch Assembly	
Motor	Suitable capacity, SCR type, motor can take load up to 1000m in borehole filled with viscous mud fluid during logging operation.
Controller	SCR controller, with 10 amp current limit or better
Speed	0 to 30 m/min
Maximum cable capacity	1000m
Emergency Brake	Winch assembly should be provided with emergency brake & provision to drive manually in case failure of Generator
Caliper tool	

Number of Arms	Three or four (Two set short and long arms)
Diameter	≤ 60mm
Length	≤150cm
Measurement range	Up to 31cm approx. OR more by short arms and long arms up to 50.4cm approx. OR more
Probes and Tools	
Fluid Resistivity measuring range	0-100 ohm meter
Temperature measuring range	All borehole natural temperature from hot to icy condition.
Fluid Resistivity Resolution	≤0.05%.
Temperature Resolution	≤0.1˚C
Accuracy	≤1%
Probe Diameter	60 mm or lower
Gamma tool:	Provision for various time constants desirable
Electric tool:	
Low range normal Resistivity range	0-250 ohm-meter
High range normal Resistivity range	0-10000 ohm-meter
Resistivity accuracy	≤1%
Resistivity Resolution	≤0.02%
Self Potential range	≤ -1.5to 1.5 VDC
Self Potential accuracy	≤1%
Self Potential resolution	≤0.02%
Calibration Box	Calibration box of above measurement parameters
Mud Resistivity Meter	Portable, measured range 0 to 250 ohm meter
Water Analysis Tool	Portable Water analysis Tool
Heavy duty tripod assembly	Can take load of 1000 m armored cable up to depth 1000 m in viscous mud filled fluid
Tool Kit	Complete geophysical tool kit for field operations including tripod and digital multi-meter
Spares	Acquisition system spares including complete cable head spares, probe parts, winch parts, O-rings and consumables

ITEM 22 : RESISTIVITY METER (INDIGENOUS OR EQUIVALENT)

Feature	Specification
General Features	
Input Power Source	12/24V rechargeable batteries
Display with the System	Alphanumeric Liquid Crystal Display.
Specific Features	
Power Output	40 Watts or more
Noise Rejection	95 db or more
Potential Measuring range	10 micro volts.
Range selection	Manual/Automatic
Resistance Measuring Range	10^{-3} to 10^{4} ohms.
Self potential cancellation	Automatic
Data Averaging	Up to 16 cycles or more
Input Impedance	1 Mega Ohm or more
Accuracy	$\pm$ 1%
Output	Resistance
Protection	Protected against circuit overloads.
Weight and Dimension	Light weight and small

ITEM 23: SNOW WATER EQUIVALENT (SWE)-SNOW PILLOW

Feature	Specification
Site Conditions	
Ambient Temperature	From -40 to +60
Humidity	5 to 100 %
Altitude	2000 to 5500 meter
Snow Pillow	• For measurement of snow water equivalent • Consisting of liquid-filled pillow and pressure transducer (or, alternatively, a system consisting of a standpipe, float and shaft encoder) • Four snow pillow per station plumbed together • Total area min 7 m2 (80 sq ft) • Tanks made from stainless steel by manufacture experienced with fabricating snow pillow tanks. • Antifreeze solution for filling snow pillow • Pipes and valve as required
Range	1000 mm water equivalent
Pressure measuring Accuracy	1% full scale (10mm)
General Features	
Output Interface	SDI12/ RS 485 / / 4-20 mA / Compatible with Data logger
Power Supply	12 V DC or switch rated for 12 VDC
Material	Corrosion Resistance Metal (Stainless steel or Aluminum)
Enclosure	NEMA 4
Tools	Complete tool kit for operation and routine maintenance
Manuals	Full Documentation and maintenance manual in English
Accessories	Sensor Mounting support, cables and other accessories as required

Item 24: Electromagnetic Flow Meter

Feature	Specification
Accuracy	+- 1 % of reading plus zero stability
Max Water Velocity	10 m/s
Tube Material	316 Stainless Steel
Electrode Material	AISI 316L (Standard) / Hastelloy/ Titanium
Liner Material	PTFE
O-Ring Seal Material	Viton and Buna N
Flow range	0.75 to 63 L/s
Temperature Range	0 Degree C to 80 Degree C
Max Pressure	16 bar
max cable Length	100 m
Min Conductivity	5 micros/cm
Rating	IP 68
CE Declaration	EN 61326:1997 to EN 61326/A3:2003
Power	12/24 V DC ; 90-264 VAC / Battery
Datalogger	Built in
Graphic Display	With totalizer, indication above 8 mm
Power Management	Total management with automatic sleep function
Communication	MODBUS RTU on RS 485
Password	Multi level
Line Size	2 Inch to 6 Inch, to be specified later by Implementing Agencies

Item 25: Water Quality Sondes

Feature	Value
Site Conditions	
Ambient Temperature	-5 to 45 Degree C
Humidity	5-100 Percentage
Altitude	0-5000 meter
Multi parameter Sonde	
Ports	2 optical, 1 conductivity/temperature, 1 pH
Response Time	<90 s
Output	SDI-12, RS-232 or compatible with handheld device
Tools	Complete tool kit for installation and routine maintenance
Manuals	Full documentation and maintenance instructions in English

Depth Sensor

Accuracy	0.003 m
Resolution	0.001 m
Range	0 to 60m

Conductivity

Accuracy	+/- 3% FS or 5µS/cm
Resolution	1µS/cm
Range	0 - 100 µS/cm

Dissolved oxygen

Sensor Type	Optical
Accuracy	+/- 5% reading or +/- 0.2 mg/L
Resolution	0.01 mg/L
Range	0 to 50 mg/L
Sensor Cleaning	Automated sensor cleaning mechanism

Temperature

Accuracy	+/- 0.2^{o}C
Resolution	0.2^{o}C
Range	-5 to 45^{o} C

Turbidity

Accuracy	+/- 5% reading or 2 NTU
Resolution	1 NTU
Range	0 to 1000 NTU
Sensor Cleaning	Automated sensor cleaning mechanism

pH

Accuracy	+/- 0.2 pH units; +/- 1.0 mV
Resolution	0.01 pH unit; 0.1 mV
Range	2 - 12 pH units (minimum) ; 0-14 pH units (Preferred)