

Technical Specification for Automatic Weather Station (AWS)

General Technical Requirements

1. **Uncertainty, according to the stated requirement for the particular variable**
 - Calibration requirement and frequency for each sensor defined;
 - Required in-house and mobile calibration equipment identified and priced;
2. **Reliability and stability**
 - Sensors working life time specified;
 - Recommendation letter from WMO, ICAO, ISO or equivalent is preferred;
3. **Convenience of operation, calibration and maintenance**
 - Recommended and mandatory spares should be listed with a detailed price list;
 - Manual for the installation, maintenance and calibration should be provided in a print and multimedia format;
 - Required factory level and onsite training should be listed and priced.
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4. **Simplicity of design which is consistent with requirements**
 - All sensors interchangeable and shall be independently operated by the electronics and data processing unit so that a possible failure of any of the sensors shall not affect the performance of the remaining sensors;
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5. **Durability**
 - Sensor must be coated to protect against dust and chemicals.
 - Air temperature and humidity sensors must be protected in a naturally ventilated radiation shield.
6. **Acceptable cost of instrument, consumables and spare parts**

Rain gauge

The rain gauge shall be fabricated of corrosion resistant, rugged material or made of anodized aluminum.

The bucket should have leveling arrangement for horizontal mounting

Reed switch: full encapsulated

Protective filter in funnel

Wind speed (using ultrasonic or mechanical technology)

Gust survival: 80m/s (min. 30 minutes)

Cups must easily be field replaceable

Wind direction (using ultrasonic or mechanical technology)

Gust survival: 80m/s (min. 30 minutes)

Wind vane must easily be field replaceable

Solar Radiation

Solar radiation must be measured using an ISO-9060 certified Secondary standard pyranometer.

Detailed Specifications

1-Sensors

	Parameter Measured	Specification
1.	Wind Speed (Anemometer) using ultrasonic or mechanical technology	<ul style="list-style-type: none"> • Measuring range: 0.0 to 75m/s • Starting Threshold: <0.01m/s • Resolution: < 0.01 m/s • Accuracy: ± 0.3 m/s (with 0.4 to 60m/s) • Operating Temp: -10 to +60°C • Relative Humidity: 5 – 100%
2.	Wind Direction (Wind Vane) using ultrasonic or mechanical technology	<ul style="list-style-type: none"> • Measuring range: 0 to 360 Deg. • Starting threshold: < 1.0 m/s • Operating temperature: -10 to +60°C • Resolution: 1° • Accuracy: ± 2 Deg.
3.	Air Temperature	<ul style="list-style-type: none"> • Measurement range: -20 to +60 °C • Resolution: 0.1 °C • Accuracy: ± 0.1°C.
4.	Relative Humidity	<ul style="list-style-type: none"> • Range: 0 – 100% • Accuracy: + 1% RH from 3 to 95%. • Excellent linearity and sensitivity with fast response and long-term stability. • Operating Temp. range: - 40 to +60°C
5	Solar Radiation	<ul style="list-style-type: none"> • Spectral range (50% points): 310 to 2800 nm • Sensitivity: 7 to 14μV/Wm² • Response Time: 5 Sec • Maximum irradiance: 4000 W/m² • Non-Linearity (0 to 1000W/m): $\pm 0.2\%$ • Non-Stability (change/year): $\pm 0.5\%$ • Temperature dependency of sensitivity (-20°C to 50°C): $\pm 0.5\%$ • Operating temperature: -40°C to +80°C • Expected daily accuracy/uncertainty: $\pm 2\%$ • Tilt error (at 1000W/m²): $\pm 0.2\%$ • Impedance: 10 to 100 Ω

6	Rain, Precipitation (Intensity and Accumulation)	<ul style="list-style-type: none"> • Diameter of aperture: 225mm • Orifice: 400cm² • Resolution/Sensitivity: 0.2mm • Rainfall capacity: Unlimited • Capacity per Minute: Max. 30 tips (3 resp. 6mm) • Accuracy: ± 1% (at 25 mm/hr) • Signal output: Pulse signal • Measuring Principle: Tipping bucket - double spoon • Switch closer time: <10 millisecond
7	Pressure	<ul style="list-style-type: none"> • Range: 500-1100hPa • Operating temperature range -40- +60°C • Resolution: 0.10hPa • Calibration uncertainty: ±0.15hPa • Total accuracy: ± 0.25hPa • Long term stability: ±0.10hPa • Sensor type: solid state • Response time: 10 seconds or better
8	Soil surface temperature	<ul style="list-style-type: none"> • Measurement range: -20 to +60 °C • Resolution: 0.1 °C • Accuracy: ± 0.1
9	Sub soil temperature	<ul style="list-style-type: none"> • Measurement range: -20 to +60 °C • Resolution: 0.1 °C • Accuracy: ± 0.1
10	Visibility	<ul style="list-style-type: none"> ● Measurement range (MOR): 5 m ...75,000 m; ● Accuracy: ± 10 % range 5 m ... 10,000 m ± 20 % range 10,000 m ... 75,000 m ● Scatter measurement accuracy: ± 3 %
11	Ceilometer for Cloud Height Detection	<ul style="list-style-type: none"> ● Measurement range: 0 ... 25,000 ft. (7.5 km) ● Reporting resolution: 5 m/10 ft., units selectable ● Reporting cycle programmable: 2 ... 120 s ● Temperature range: -40 ... +60 °C (-40 ... +140 °F) ● Humidity: 0 ... 100 % RH ● Wind: 55 m/s ● Tilt positions: Vertical or 12° tilted

*The system should include at least maximum and minimum air temperature, relative humidity, wind speed and direction, rain gauge, pressure, visibility, cloud height and solar radiation. The remote stations should support at additional sensors for future potential expansion.

2-Data logging

- A multipurpose Meteorological Data Measurement Logger to receive data from various meteorological sensors and store the values within it at minimum of one year back up on

disconnection of the network and should be able to send all pending data when the network is active.

- The stored data should be retrieved by direct connection to the logger with laptop computer. It also transmits to the central data receiving system via Ethernet, GPRS, and GSM;
- The logger should be able to handle various types of sensors. In order to expand the system.
- The logger must be housed in a rugged; water and dust proof sealed enclosure with pad locks that can withstand direct exposure to harsh environment.
- The data logger must support WMO compliant measuring methods, especially for wind gust monitoring (4 samples per second) and wind vector monitoring.
- The data logger must support time-based and event-based data transmission back to base (i.e. either based on a predefined schedule or based on a preprogrammed event such as a temperature threshold). The data transmitted at user defined interval, every 15 minutes or less.

3-Power Supply

- The power supply should include back up battery, charging regulator and solar panel. The remote stations use a battery with a regular charge from the solar panel when the sun shines. The system should include rechargeable, sealed and maintenance free backup batteries sufficient for keeping the station running at least for three months without recharging. The backup batteries must have a charge regulator with protection against battery overcharge or deep discharge. The charger must have an indication of the battery condition and charging state. Working time on a full charge and the total working time of the battery should be specified.

4-Communication

- A PC-Based Central Receiving Station can be installed at NMA Head Office.
- A telemetry system, data from each AWS can be transmitted automatically from AWS to a Central Receiving Unit using GPRS communication. It has to function also with GSM, for the backup connection and connection checking.
- The system must have a serial-pass-through-mode which allows direct communication via maintenance line with any smart sensor connected to the system via serial interface.
- The system must have a connection port to which a PC can be connected in order to perform system initialization, device software update, and configurations, download stored data and monitor the unit operation.

5-Central Data Processor and gateway

The central data processor should have the following features.

- Central Station should have a Database Management Software System
- Data collection, processing, displaying, archive (back up)

- The software should have capabilities to real time data as well as “Archived” historical data at a pre-defined interval programmed in the base station software automatically without user intervention.
- The data management software should process raw data in 15 minutes to hourly, daily, monthly, etc.
- The central telemetry gateway should control a good number of station networks for future expansions (up to a minimum of 200 AWS station units).
- The telemetry gateway should have different connection ports to the LAN and the central data server (Ethernet, serial ports).
- The central system should operate in operate with a well known operating system like MS-Windows, Linux, with the latest versions.

6-Accessories

- All sensors should be supplied with cables that are UV proof to ensure good performance for years.
- All support arms holding sensors should be manufactured from anodized aluminum or galvanized steel and fitted to the tower-scaffold by means of stainless steel and/or hot galvanized clamps and stock of screws.
- Spare parts will be available for a period of 10 years. In the event that a part is no longer available, a substitute identical in function should be identified in time.
- The sensors provided should come calibrated from the factory with Certificates of Calibration.
- Users and technical service manuals be included.
- Tools for installation and maintenance must be included.
- Sensor tester; pole mast; arm for rain gauge installation; battery charger.

7-Equipment Enclosure

All parts of the electronic and data processing unit must be enclosed in a sealed robust enclosure with easy access to all components with mounting options at least to a mast or a wall. The enclosure shall have the following

- All connections must be through waterproof connectors, one connector for each sensor or device.
- All connectors must be clearly labeled as to their function.
- The connectors shall be installed at the bottom side of enclosure to reduce the risks of water or humidity penetration.
- The enclosure shall be properly vented with a device, which will not allow humidity to enter in the enclosure.

8-Capacity building

Factory level training necessary for hardware, software and data processing personnel on the calibration, installation, maintenance and data processing be clearly included with a clear price per person.

9-Data Presentation and data exchange

Data output formats should include the most common file formats in order to enable easy uploading of data to a common spreadsheet, GIS, or database software for further refinement and storage.

10-Data Security

Data security should be ensured by the system both at the remote station and in transition.

11-Sensors exposure / Polar Mast

The polar mast and all support shall support to fit the WMO standard for meteorological instrument exposure, with wind speed measurements at 2m and wind speed and direction measurement at 10 m heights.