AMAZON COOPERATION TREATY ORGANIZATION – ACTO

Y

NATIONAL WATER AND SANITATION AGENCY – ANA Brazil

AMAZON PROJECT: REGIONAL ACTION IN THE AREA OF WATER RESOURCES - PHASE II

ANNEX I

TERMINS OF REFERENCE

1. IDENTIFICATION

This contract is designed to procure and deliver Automatic Telemetry Stations (Automatic Data Collection Platform - DCP) in accordance with the technical specifications outlined in Annex I. The objective is to support the implementation of the Pilot Initiative for the Hydrometeorological Monitoring Network of the Amazon Basin within the Amazon Project, which is established through a signed agreement between the National Water Agency (ANA) and the Amazon Cooperation Treaty Organization (ACTO).

2. RATIONALE

The Amazon River basin stands as the world's most extensive hydrographic network, with an approximate total area spanning 6,110,000 km². Stretching from its origins in the Peruvian Andes to its vast mouth in the Atlantic Ocean, this immense basin extends across numerous South American countries, namely Brazil, Peru, Bolivia, Colombia, Ecuador, Venezuela, Guyana, and Suriname, covering a significant 44% of South America's land surface. Remarkably, the Amazon Basin plays a vital role, contributing 20% of the total daily freshwater discharge into the oceans (PAE, ACTO. 2008).

Sharing the basin suggests the opportunity to seek international collaboration, both with institutions from other countries directly involved in the sector and with other international organizations or bodies that have information and practical experiences contributing to actions in the region. In this context, fostering technical cooperation among nations becomes crucial, acting as a fundamental instrument for continuous dialogue and the proposal of joint actions to enhance shared management, preservation, and the balanced, sustainable utilization of water resources.

The Amazon Cooperation Treaty (TCA) was signed on July 3, 1978, by the governments of Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela. Its objective is to undertake joint actions and efforts to promote the harmonious development of their respective Amazonian territories in such a way that these joint actions produce equitable and mutually beneficial results and also achieve the preservation of the environment, and the conservation and rational utilization of the natural resources of those territories.

On December 13, 2002, the Amazon Cooperation Treaty Organization (ACTO), and its Permanent Secretariat, was established in Brasilia, with international legal personality. ACTO's purpose is to enhance and strengthen the institutional process of cooperation, coordination, and joint actions among

its Member Countries to promote the sustainable development of the Amazon within the framework of ACTO. ACTO approved its Amazonian Strategic Cooperation Agenda (ASCA, 2010-2018), currently undergoing updating process, with a focus on priority topics, including water management and climate change.

The Amazon Project: Regional Action in the Area of Water Resources is an initiative led by ANA/Brazil, the Brazilian Cooperation Agency (ABC), the Department of Northern and Western South America (DAS) of the Ministry of Foreign Affairs of Brazil, and the Amazon Cooperation Treaty Organization (ACTO). The project aims to implement technical cooperation actions to strengthen the institutions responsible for water management in the ACTO member countries.

In 2016, the second phase of the Amazon Project was initiated, aiming to actively contribute to the collaborative and sustainable management of water resources in the Amazon Basin. This phase entails the establishment of shared networks for monitoring hydrology and water quality, the development of a comprehensive database covering water resources and climate change, the dissemination of knowledge regarding the realities of the Amazon region, and the provision of technical training for personnel associated with water resource management in ACTO member countries.

This second phase builds upon the activities carried out in Phase I of the Amazon Project (2012 to 2017), which contributed to strengthening coordination and technical cooperation among ACTO Member Countries.

While the Amazonian countries have implemented their national networks for monitoring water quantity and quality according to their objectives and available resources, the Amazon Project seeks to establish future actions to build and ensure a continuous strategy to support monitoring, data collection and availability, analysis, and evaluation.

One of the anticipated outcomes of this second phase is the implementation of a regional network for monitoring water quantity and quality. Designs for these networks were developed throughout 2019 and 2020 in collaboration with ACTO Member Countries, defining the network's objectives, monitoring points, and parameters to be monitored.

ACTO is responsible for monitoring the extensive Amazon Basin, where the Madeira River sub-basin stands out as a critical area facing not only seasonal floods but also increasing periods of drought. To enhance monitoring in this region and throughout the basin, it is essential to install hydrometric stations. As 80% of the Madeira River sub-basin extends into Bolivian territory, with portions also in Peru and Brazil, ACTO, through the Amazon Project, is contributing by donating 10 Data Collection Platforms (DCP), with 5 allocated to Peru and 5 to Bolivia. The goal of this initiative is to strengthen monitoring capacity, enabling more effective integrated management of the basin and consequently improving responses to extreme conditions, whether floods or droughts, in the Madeira River sub-basin.

In this context, it is proposed to engage a company to provide the equipment for the Automatic Data Collection Platform - DCP, covering expenses such as freight, taxes, and essential civil works required for its installation and operation.

3. GENERAL OBJECTIVE

The donation of the DCP aims to strengthen monitoring capacity, enabling more effective integrated management of the basin and, consequently, improving responses to extreme conditions, whether floods or droughts, in the Madeira River sub-basin.

4. LEGAL ELIGIBILITY OF THE BIDDER

Bidders must submit the following documentation attached to the technical-economic proposal:

- Deed of incorporation of the company: This document should include the company's details, such as name, purpose, share capital, address, duration, etc.; and should be duly signed by the founding members and then, notarized.
- Bylaws: This document contains the rules governing the company's operation and be duly signed by the founding members and notarized.
- Appointment of the legal representative: This document should contain details of the legal representative of the company, such as name, ID, address, etc; and duly signed by the founding members and notarized.
- Presentation Letter of the proposal with a minimum validity period of sixty (60) calendar days.
- Copy of the Tax Identification Number (NIT) of the company.
- Simple copy of FUNDAEMPRESA registration.
- Copy of the power of attorney for the company's legal representative.
- Simple copy of the Identification Card of the company's legal representative.
- Certificate of no debts from the consulting company to the Pension Fund Administrators (AFPs).
- Evidence of affiliation to a Health Insurance Fund.

5. CHRONOGRAM FOR DELIVERY OF EQUIPMENT, CIVIL WORKS, AND FACILITIES

The service's overall execution chronogram spans 90 (ninety) days, commencing from the contract signing date. The expected products are to be delivered in alignment with the execution schedule, covering the acquisition, delivery, completion of works, and installation of equipment. This chronogram should be incorporated into the proposal to be submitted.

6. PAYMENT METHOD AND APPROVAL OF SERVICES

Payment for the purchase of equipment will be made according to the following schedule and percentage:

Activity	**term**	**Percentage**	**Payment conditions**
Contract; Advance Payment.	15 days	10%	Submission of the fiscal invoice and Contract Signing
Equipment Delivery	60 days	30%	Submission of the invoice and certificate to the receiving bodies
Civil Works	90 days	30%	Submission of the invoice and certificate to the control bodies along with photographs

Installation of equipment and functionality testing	30 days	30%	Submission of the invoice and all information issued by ACTO´s team

7. SUPERVISION AND MONITORING

Consultancy monitoring will be conducted jointly by PS/ACTO and the National Water Agency - ANA-Brazil, which will appoint contract supervisors.

The products delivered by the company according to the proposed schedule will undergo a review by the supervisory entities specified in the contract, within a maximum of fifteen days from their reception. Subsequently, general and specific observations will be forwarded to the company for necessary adjustments.

The Contractor, through specially designated technicians, will monitor, supervise, and oversee the work carried out by the company.

8. DESCRIPTION AND TECHNICAL SPECIFICATIONS OF THE AUTOMATIC DATA COLLECTION PLATFORM (DCP)

ITEM 01 - TECHNICAL SPECIFICATIONS OF THE DCPs

The technical specifications for the acquisition of the Hydrometeorological Data Collector Platforms - DCP are presented below. They are "equivalent" or "similar" and "of better quality" technical specifications established as quality parameters to support the description of the object to be tendered.

The five (5) Hydrometeorological Data Collector Platforms - DCPs must include: a barometric pressure sensor, a solar-powered energy supply system, a battery charge controller, a communication system for data transmission (GOES satellite), a datalogger for processing and storing acquired data; and they must be capable of operating simultaneously with the precipitation, river level, radar, and pressure sensors specified in this document.

The batch of these 5 DCPs will be composed as presented below:

Table 1 - Description, quantity, unit, and maximum acceptable values - Item 01

ITEM	SUBITEM	DESCRIPTION	UNIT
1	1.1 to 1.9	Automatic Data Collection Platform - DCP	5
	1.10	Spare GOES Modem	2
	1.11	GOES Modem to GPS Connecting Cable	2
	1.12	GOES Modem to Yagi Antenna Connection Cable	3
	1.13	Spare Datalogger	2
	1.14	GOES Antenna	3
	1.15	GPS Antenna	2
	1,16	"U" Type Clamp	2
	1,17	Surge Protection Device (SPD)	5
	1.18	Charge Controller	2

	1.19	Fuse terminal	5
	1.20	4-Pin Female Military Connector	3
	1.21	3-Pin Female Military Connector	3
	1.22	N Connector for RGC-213 Type Cables	4
	1.23	N Connector for RGC-58 Type Cables	3
2	2.1	Electromagnetic Radar Type Water Level Sensor	7
3	3.1	Rain Sensor (Digital Rain Gauge)	7
4	4.1	SDI12 Type Keypad for DCP	7

The 5 DCPs are located according to the following geographic coordinates in the table.

No	Station	Río	Installation	Latitude	Longitude
1	Porvenir	Tahuamanu	without bridge	-11.271121	-68.736771
2	Peña Amarilla	Beni	without bridge	-11.546368	-66.676173
3	Camiaco	Mamoré		-15.335756	-64.867223
4	Abapó	Grande	without bridge	-18.909662	-63.401094
5	Sena	Madre de Dios	without bridge	-11.4669797	-67.239160

1.1 DCP PROTECTIVE CASING

Each DPC housing should include 1 datalogger, 1 sealed charge controller, 1 barometric sensor, 1 sensor to detect the opening of the front door, 1 support for a 26Ah battery, 1 GOES modem, and 1 fuse connection bar (fused terminals for a 35 mm DIN rail) for the integrated connection of all power cables from sensors and other DPC components requiring electrical power.

The casing should be in a rectangular format, feature a front door, and include a system with 2 (two) sets of keys/locks, along with a minimum of 2 (two) hinges for securing the access door, thereby ensuring the security of internal components.

Locks for all PCD casings should include keys with the identical pattern as those in the existing DCP casings within the NETWORK. Additionally, they should have an external cover for protection against rain and adverse weather conditions. The ACTO will furnish the successful bidder with the current key to reproduce the pattern.

The DCP casing should have the following features: robust; constructed of stainless steel; with highly durable UV protection; sealed from the environment; rain and water flow-resistant; excess moisture-resistant; dust and insect invasion-resistant, with white powder electrostatic paint.

It should allow easy access to DCP components, including the datalogger, charge regulator, battery(s), sensor interface, and modems. It should enable battery removal without the need to remove other DCP components. The GOES modem, Datalogger, Charge Controller, and Surge Protection Devices - SPD,

should be easily removable with common tools (screwdrivers/phillips/allen) for subsequent replacement.

The housing should have a "gutter" type system along the entire front to prevent rainwater from entering the PCD's interior. Also, the door should have an injected and reinforced rubber seal inside.

It should feature a side system facilitating opening and closing to accommodate a notebook-type microcomputer for on-site configuration and data download from the DCP. Crafted from stainless steel, it should demonstrate resilience to sun and weather, complemented by a white electrostatic powder coating.

The PCD housing must be protected from direct sunlight by a stainless steel sunlight and weather-resistant shield with a white electrostatic powder coating.

The casing's shield should encompass both sides, the back, and the top, enabling airflow between the casing surface and the shield. To accomplish this, there should be a minimum gap of 2 centimeters between the shield and the lateral and upper sections of the casing, and approximately 1 centimeter at the back. The shield should extend at least 8 centimeters from the front upper part of the casing.

A retractable system should be installed on the side of the shield to support the notebook during the operation and maintenance of the DCP.

At least two hydrophobic valves of the GORE-TEX® membrane type should be installed on the bottom of the casing to allow for the equalization of internal-external pressure without allowing water in the bottom of the box.

To prevent the SCP housing from deformation during fixation to the support, this point must be reinforced.

The connections to be installed on the casing's exterior are:

a) 1 (one) 3-pin male military-type connector for rain sensor;

b) 1 (one) 4-pin male military-type connector for water level sensor (pressure) (RS-485 communication protocol);

c) 1 (one) 4-pin male military-type connector for water level sensor (radar) (RS-485 communication protocol);

d) 1 (one) 4-pin male military-type connector to communicate the water quality probe or bubble water level sensor (SDI-12 communication protocol);

e) 1 (one) 3-pin male military-type connector for the solar panel;

f) 1 (one) N-type connector for the GPS antenna;

g) 1 (one) N-type connector for the GOES transmission antenna; and

h) 1 (one) 4-pin male datalogger-computer communication connector;

The connections identified above must be compulsorily installed at the lower part of the casing, utilizing metallic military connectors (Type "MS", Class "E", "F" or "R"). These connectors should be referenced as MS3106E14S, MS3106F14S, or MS3106R14S, with the exception of the GOES and GPS antennas that must use N-type connectors.

Each type of connection (except for the N type) should have dedicated connectors, clearly labeled on the casing to avoid any incorrect connection of DCP components.

All external connectors should include a screwable nylon or stainless steel protective cover to safeguard unused connections at the beginning.

The 4 (four) connections of the hydrological sensors (rain sensor, water level sensor (pressure), RS-485, water level sensor (radar) RS-485, and SDI-12 bubble water level sensor) must be protected against potential currents induced by electrical discharges in Surge Protection Devices (SPD), "clamper or similar" type, for DIN35mm rails, individual (1 SPD for each hydrological sensor).

For protection of GPS and GOES antennas, the chosen method should involve a coupling spark gap, varistors, diodes, or similar devices.

The conditions envisaged for the operation of the equipment inside the DCP boxes must meet the following requirements:

a) An operational **temperature range** of -10 ºC to +55 ºC, measured internally within the casing; and

b) Relative air humidity for operation ranging from 0 to 95%, assessed within the casing.

c) All internal components of the DCP box must **endure, without damage**, the specified environmental conditions:

- Temperature: -10 ºC to +60 ºC; and
- Relative Humidity: 0% to 100%.

All internal wiring connections should feature insulated terminals compatible with the connection type (e.g., needle/pin, eyelet, fork, etc.) and must be clearly labeled with laminated adhesive tape indicating the connection type (e.g., VDC+5, VDC+12, RS485-A, SDI12+, etc.), allowing visualization in the power and connection diagram linking the datalogger and connectors.

The power and electrical connection diagram between the datalogger and connectors should be supplied in one (1) unit in the form of a laminated paper. This diagram, housed in an acrylic "document holder," should be easily accessible or replaceable within the access door of the casing.

1.1.1 CONNECTION DIAGRAMS OF THE CASING

Below is the standardization of military connectors by communication protocol type:

Solar Panel – 3 Pins

A	(+)
B	(-)
C	

Rain Gauge (Pulse) - 3 pins

A	1
B	2
C	

SDI-12 – 4 Pins

A	Datos
B	(+)
C	(-)
D	nc

RS-485 – 4 Pins

A	A
B	(+)
C	(-)
D	B

1.1.2 DATALOGGER

The datalogger should be low-power, have non-volatile internal memory, and at least the following communication channels:

a) 1 standard SDI-12 serial channel (native);

b) 1 standard RS-485 serial channel (native);

c) 1 standard RS-232 serial channel (native);

d) 1 communication channel with a computer formatted with the Windows 10 operating system or higher.

The standard SDI-12, RS-485, and RS-232 serial interfaces of the datalogger described above must be provided through a dedicated connection integrated into the datalogger, not through external converters. Solutions allowing the multiplication of the native serial interfaces of the SDI-12, RS-485, and RS-232 datalogger will be accepted, provided they are integrated into the datalogger and not through external converters.

The communication port between the computer and the datalogger should allow the execution of external commands for: firmware update; programming routines for data collection, storage, and transmission of data and relevant information (e.g., hydrometeorological data, DCP and sensor configuration parameters in operation); sensor configuration (e.g., offset or multiplier); download and upload of DCP configuration parameters, and download of stored data and information.

The essential set of connections for the datalogger includes:

a) 1 (one) input for the rain sensor;

b) 1 (one) RS-485 input for water level sensor (pressure or radar);

c) 1 (one) input for bubble water level sensor or multiparametric water quality probe (SDI-12);

d) 1 (one) input for the barometric pressure sensor;

e) 1 (one) input for the door opening sensor;

f) 1 (one) channel for 12Vdc power supply;

g) 1 (one) input for the GOES data transmitter; and

h) 1 (one) input for the datalogger-computer communication.

If analog inputs are utilized in the datalogger, they must undergo conversion into digital format with a minimum resolution of 16 bits. Electric signals received from the sensors will be

automatically transformed into their corresponding engineering units.

The datalogger must meet the minimum requirements for data acquisition speed, digital encoding, and storage, considering the sensors specified in this document.

The operational program and data loaded into the datalogger will be stored in a non-volatile internal flash memory, ensuring that data and the program remain unchanged in case of power failure. The memory should possess adequate capacity to store data collected by all sensors for a minimum duration of one (1) year, with a data acquisition frequency of 5 minutes, in addition to recording rain events every 10 seconds, reaching a minimum limit of 3500 mm during that period.

In the event of a power failure, the internal clock of the datalogger should continue to operate, displaying a maximum variation of 60 seconds per month, enabling updates through the GPS antenna of the GOES modem.

The datalogger should efficiently manage internal memory, ensuring that, when reaching full capacity, new records replace the oldest ones, thereby preserving data integrity.

Should there be a power interruption or during the replacement of the battery(ies), the datalogger ought to be capable of resuming all functions upon power restoration, without losing data or prior configurations.

The datalogger must be capable of monitoring, storing, and transmitting data related to: water level information, rainfall information, internal temperature of the DCP, minimum battery voltage, sensor displacement, barometric pressure value, latitude, longitude obtained through the GPS antenna of the GOES modem, datalogger serial number, and identification of the installed software. The datalogger's serial number will be obtained automatically for subsequent transmission by reading this information from the device itself, without human intervention. The identification of the operating program can be manually entered at the time of programming, with a minimum of 4 (four) numeric characters, for subsequent transmission.

1.1.3 CHARGE CONTROLER

The charge controller, as an integral part of the power system, must be of the sealed type (providing 100% protection against non-condensing relative humidity) and adhere strictly to the maximum safe charging rate permitted for the utilized battery(ies). This consideration should factor in the battery's maximum voltage level to prevent any damage, gas explosion risk, or battery overload.

The charge controller must have a minimum current of 5 amperes and a minimum power of 60 watts.

The charge controller will feature an external bracket or adaptation for mounting on a DIN35mm rail inside the housing.

Within the DCP casing, an internal space of at least 17cm x 9cm should be reserved for the charge controller. The DIN35mm rail should be 17cm in length and longitudinally fixed, centered 4.5cm

within the specified space.

All necessary brackets, connectors, cables, and adapters for the proper installation of the charge controller inside the DCP box must be provided.

1.1.4 BAROMETRIC SENSOR

The barometer used for compensating atmospheric pressure when determining water level through an absolute pressure transducer must meet the following minimum requirements:

a) Measurement Range: 600 to 1100 hPa.

b) Operating Temperature Range: -10 °C to +55 °C.

c) Resolution: ± 0.2 hPa.

d) Uncertainty between 0 °C and +40 °C: ± 1 hPa.

e) Uncertainty between -10 °C and +50 °C: ± 2 hPa.

f) Uncertainty at +20 °C: ± 0.5 hPa.

g) Long-term Stability: ± 0.5 hPa/year.

h) Allow on-site calibration (via software or directly on the sensor).

The barometric sensor should withstand, without damage, the following ranges of environmental conditions:

a) Temperature: -10 °C to +60 °C;

b) Relative Humidity: 0% to 100%.

For proper installation and operation of the barometric sensor, other necessary components and accessories must be provided, including a calibration certificate for each barometer.

1.1.5 GOES COMMUNICATION MODEM

The data stored in the datalogger must be transmitted through the Geostationary Operational Environment Satellite (GOES) communication modem, with the following communication requirements:

a) Satellite communication should be fully compliant with the communication standards of the GOES satellite data transmission system, meeting the required power levels and signal quality. The datalogger needs to be programmable and capable of functioning on each bit constituting the transmission word.

b) It must adhere to NESDIS HDR V2.0 definition or (version 2), ensuring compatibility with GOES 16.

c) It should allow the user to select the transmission channel, support data transmission at speeds of 300 and 1200 bps and operate in both "Auto-timed" and "Random" independent modes.

d) It should have an internal GPS receiver for clock adjustment.

e) It should support external data input through the RS-232 serial interface, using ASCII characters.

f) Non-volatile memory for storing configuration.

g) Should perform self-diagnosis and generate fault reports.

h) Certification of the model offered by the National Environmental Satellite, Data, and Information Service (NESDIS) should be obtained, accessible at http://www.nesdis.noaa.gov/.

i) Certification from the National Telecommunications Agency - ANATEL.

j) Modem programming manual and interface.

k) With the GOES modem, the following parameters can be retrieved and transmitted: battery voltage at the time of transmission, latitude/longitude, transmitted signal power, and reflected signal power.

1.1.6 FRONT DOOR OPENING SENSOR

Sensor positioned to detect the opening of the front door of the casing and transmit the signal to the datalogger.

1.1.7 CONNECTOR AND SURGE SUPPRESSOR BAR

The casing must have a connection bar properly identified with labels according to the type of connection and fixed on a 35mm DIN rail.

The power lines (positive pole) of the sensor battery utilizing RS-485 and SDI-12 protocols, should be equipped with a replaceable fuse of compatible amperage with the system, offering supplementary safeguarding for both the sensors and the data logger.

These fuses should be systematically arranged and conveniently accessible inside the DCP enclosure for routine inspection and replacement.

The connections from the pressure transducer, bubbler, and radar sensor to the datalogger must be shielded against electrical surges through the application of SPD devices.

These devices are required to feature electrical connections facilitated by screw terminals, enclosed within a flame-retardant injected plastic casing. The SPD must have the following minimum technical specifications: Response time on the order of nanoseconds with a maximum peak current of 10kA.

a) High current drainage capacity.

b) Able to operate repeatedly without requiring replacement or reconnection.

c) Quickly attachable to rails for easy replacement.

d) Equipped with a flame-retardant casing.

e) Approximately sized: 79 x 63.5 x 12mm (L x W x H), with an approximate weight of 42g.

f) Connected through screw terminals and easily secured on 35mm DIN rails.

g) Models with at least two stages of cascade protection - Gas Discharge Tube (GDT) and Silicon Avalanche Diode (SAD), coordinated through series impedance, providing effective and extremely fast protection.

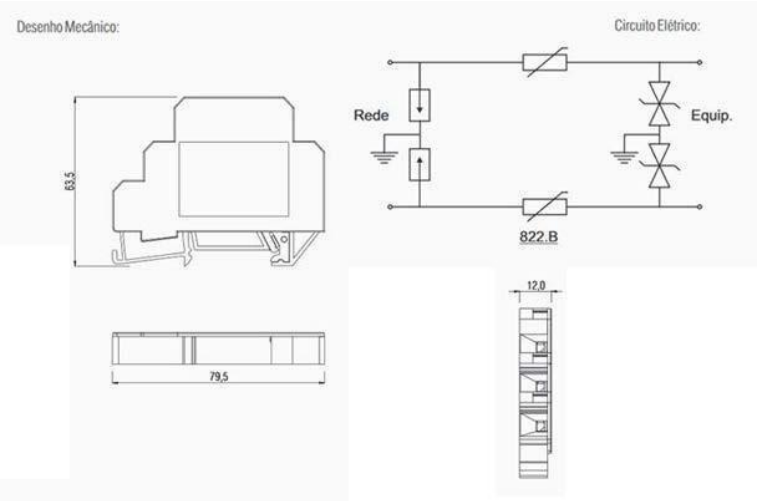
h) Provides protection in common and differential modes.

i) Class III SPD device installed near the equipment to be protected.

j) IP20 protection rating.

k) Flame-retardant plastic casing.

l) Capable of functioning multiple times without the need for replacement or reconnection.



Illustrative figure: Reference model: Clamper 822.B or a similar model available in the market.

1.1.8 BATERIA

Batteries must be rechargeable, sealed, maintenance-free, with a gas vent, and capable of supplying power to the DCP for at least 5 (five) days without any recharge, ensuring uninterrupted operation in locations or periods with low insolation.

Additionally, the system must have a single battery with a capacity of at least 26Ah at 12 VDC. Two or more batteries in parallel will not be accepted.

Batteries must have a manufacturing date after 2022, except for the sample battery.

All supports, connectors, cables, and adapters necessary for the correct installation of the battery inside the DCP box must be provided.

1.1.9 26AH BATTERY HOLDER

The battery holder will be positioned inside the DCP, facilitating the easy replacement of the battery without requiring disassembly of the internal components.

1.1.10 DCP FIXATION SYSTEM

The system for securing the DCP to the support bar should comprise two (2) U-shaped stainless steel reinforcement bar clamps with a 3/8" thread, provided with the DCP containment box. Each clamp must include two 3/8" stainless steel nuts and two washers of the same material, enabling attachment to rods with an external diameter of 6.2 cm.

1.1.11 ACCESORIES FOR DCP BOXES

To safeguard the military connectors from corrosion, moisture, and poor connections, a supply of 50g

of dielectric silicone grease per DCP box is required. Furthermore, this grease will serve to protect the rubber seal on the DCP door, preventing it from drying out.

Additionally, a kit containing 5 extra fuses should be provided for each connection.

1.2 SOLAR PANEL

The solar panel must be capable of recharging the battery(s) and simultaneously providing the required energy for the continuous operation of the DCP. This includes accounting for the consumption of the datalogger and charge controller for sensor operation, rain and water level measurements, and remote data transmission, considering 60-minute intervals for the GOES system.

The solar panels must meet the following minimum requirements:

a) Individual solar panel module of at least 30 watts.

b) b) The solar panel connection cable should include an external protective cover made of Polyamide, Polypropylene, Polyurethane, Polyolefin, Polyethylene, or Nylon, with high durability protection against ultraviolet rays, molded or similar, and robust.

c) The cable should come equipped with the installed 3-pin female military connector (Type "MS," Class "E," "F," or "R," Reference MS3106E14S, MS3106F14S, or MS3106R14S), featuring heat-shrink material at the ends for the connection between the Solar Panel and the DCP, with a length of 3 (three) meters.;

d) The solar panel must be protected against reverse currents using protection diodes or an equivalent system.

e) The solar panel should incorporate an inclination adjustment system.

All the necessary supports, connectors, cables, and adapters for the proper installation of the solar panel inside the DCP box must be provided.

The solar panel fixation system on the DCP bar should comprise two (2) stainless steel reinforcement bar clamps of the "U" type, featuring a 3/8" thread. Each clamp should include two 3/8" stainless steel nuts with two washers of the same material, allowing for fixation on rods with an outer diameter of 6.2 cm.

The solar panel connection diagram is illustrated below:

<table>
<tr><td>A</td><td>(+)</td></tr>
<tr><td>B</td><td rowspan="2">(-)</td></tr>
<tr><td>C</td></tr>
</table>

1.3 GOES ANTENNA

The antennas used for data transmission through the GOES system must meet the following minimum specifications:

a) The Yagi-type antenna for the GOES modem must be compatible with the specifications described in the document "GOES Data Collection Platform Radio Set (DCPRS) CERTIFICATION STANDARDS at 300 bps and 1200 bps," available at : https://www.noaasis.noaa.gov/docs/DCPR_CS2_final_June09.pdf

b) The GOES antenna will be Yagi-type, weather-resistant, with a gain between 10 and 11 db.

c) Connection of the GOES antenna cable to the DCP is made with an N-type connector reinforced with heat-shrink tubing or similar to prevent detachment and interference or transmission interruption issues.

d) The antenna connection cable should be RG-213 type, 50 ohms, robust, shielded, protected against UV radiation, and at least 3 (three) meters long with the N-type connector installed.

e) The antenna base should include a physical marker (high or low relief) indicating the elevation angle from 0 to 90 degrees, with marks at least every 5 degrees and digits every 10 degrees.

f) Each antenna should come with a functional test certificate indicating the antenna's serial number and transmission gain.

The antennas must exhibit a transmitted signal strength exceeding 40. This criterion will undergo verification within the SIGNAL field, accessible at https://dcs1.noaa.gov/Account/FieldTest, by accessing the configured GOES ID on the DCP. Antennas registering a transmitted signal strength below 40 will face rejection.

The fixation system for the GOES Antenna to the DCP bar should include a minimum of one (1) "U"-shaped stainless steel clamp with a 3/8" thread. Each clamp must be equipped with two 3/8" stainless steel nuts along with two washers of identical material, enabling secure attachment to rods with an external diameter of 6.2 cm.

Each GOES antenna must include two (2) N-type connectors (spare for RG-213 cables).

1.4 GPS ANTENNA

The antennas used for GPS data reception for time and date adjustment of the GOES modem must meet the following minimum specifications:

a) The GPS antenna should be exterior-type, weather-resistant, with a robust cover and a female N-type connector on the bottom base.

b) Minimum gain: 27db.

c) Output impedance: 50Ω.

d) Minimum protection rating: IP66.

e) Operating temperature range: -10 ºC to 80 ºC.

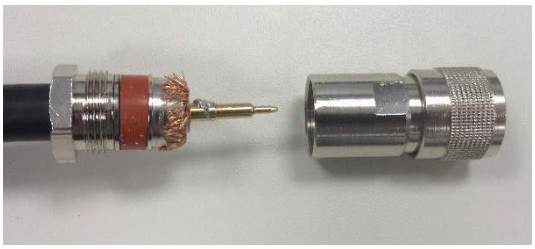
f) Each antenna should include a robust RG-58 type cable, protected against UV radiation, 3 meters long, with an N-Male connector at both ends.

g) The cable connections of the GPS antenna with an N-type connector should be reinforced with heat-shrink tubing or similar to prevent connectors from detaching and causing interference or communication interruption.

The GPS Antenna fixation system to the DCP bar should consist of at least one (1) stainless steel "U"-type clamp with a 3/8" thread. Each clamp should have two 3/8" stainless steel nuts with two washers of the same material, allowing fixation on rods with an outer diameter of 6.2 cm.

N-TYPE CONNECTOR TECHNICAL SPECIFICATIONS FOR GOES AND GPS ANTENNAS

The male N-type connectors of GOES and GPS antennas must have a locking system with a nut according to the following figures, ensuring they remain securely fastened to their respective communication cables.



Parts of N-type connectors

All N-type connectors must include a centrally soldered pin and reinforcement at the junction with their respective connection cables using "rubber sleeves" and "heat-shrink tubing" for increased strength and durability of these connections.

ANA will subsequently send the connector connection diagram.

1.5 COMMUNICATION CABLES

Two (2) communication cables must be provided for each DCP: one (1) for communication between the DCP and the laptop, and another (1) for communication between the GOES modem and the laptop.

The communication cable between the DCP and the laptop should have a minimum length of 3 (three) meters and feature a female connector of the military type with 4 pins at one of its ends, following the previously provided pattern (metallic military connectors Type "MS," Class "E," "F," or "R," reference models: MS3106E14S, MS3106F14S, or MS3106R14S). The other end can be USB or Serial-RS232 female, provided it is accompanied by an additional converter cable Serial-RS232 male - USB.

The communication cable between the GOES modem and the laptop should have a minimum length of 2 (two) meters and include a connector for the GOES modem at one of its ends. The other end can be USB or Serial-RS232 female. This cable should enable the firmware update for the GOES modem.

In both cases, the PDA must communicate with the portable devices through the USB communication port, under the Windows 10 operating system.

Additional data communication solutions between the PDA and the laptop (e.g., Bluetooth, WiFi, etc.) will be evaluated by the technical department of the ANA agency.

1.6 DCP SUPPORT BAR, SOLAR PANEL, AND ANTENNAS

For the DCP support, a 3-meter long galvanized steel tube with a nominal outer diameter of 2 inches and a minimum wall thickness of 3.2 mm should be provided.

This support should allow the joint installation of the casing, the solar panel, and the GOES and GPS data transmission antennas with a lateral arrangement on the galvanized tube. It should be resistant enough to ensure the equipment's safety in adverse temperature, humidity, and wind conditions.

Components of the DCP installed on the upper base of the galvanized tube will not be accepted.

It should include a threaded or galvanized steel cap on the upper end or welded to prevent rainwater from accumulating inside the support rod.

A locking system at the bottom of the support bar will be provided for additional fixation to the ground.

All clamps, washers, and nuts required to secure the DCP, solar panel, and GOES and GPS antennas should be identical to each other and made of stainless steel.

1.7 GROUNDING SYSTEM

A grounding system should be provided to discharge static charges accumulated in the DCP structure and provide a stable voltage reference for the equipment, following the standards NBRs 13.571/96, 5426/85, 5456/87, 6006/80, ASTM E 478, UL-467, or other standards ensuring equal or superior quality.

The grounding system planned should have the following minimum characteristics:

a) Solid copper cable, 3.0 meters in length, and nominal section of 35 mm2 (total of 1 unit per DCP);

b) Grounding rod composed of a carbon steel core, ABNT 1010 to 1020, coated with at least 0.25 mm of electrolytic copper layer with at least 95% purity, no traces of zinc, 2.4 meters in length by 1/2" in diameter, with a beveled tip (total of 1 unit per DCP);

c) The rod should not present cracks or displacement of the copper layer when bent at an angle of 30°.

d) Devices to connect the copper cable to the DCP box and the rod.

e) Connectors between the grounding rod and the copper cables should be of the "U" type, with an area of 1/2" for the grounding rod, as shown in the image below:

Photo of connectors

The grounding rod should be delivered tied inside the 3-meter galvanized tube used as the support rod for the DCP.

1.8 COMMUNICATION SOFTWARES

The software designed for datalogger programming and sensor/data transmitter configuration should exhibit compatibility with the Microsoft operating system, specifically Windows 10 and newer versions. It is expected to facilitate essential functionalities such as firmware updates, the creation of programming routines for seamless data collection, storage, and transmission, as well

as the configuration and calibration of sensors. Moreover, it should allow users to effortlessly download and upload data from the datalogger's internal memory. The comprehensive package, encompassing all required elements such as software, programs, licenses, etc., should empower users to access stored data and information effectively. Additionally, the software should seamlessly integrate programming routines for critical tasks like data collection, storage, and transmission.

In addition to the Windows software version, if the manufacturer offers a software version for the Windows Mobile operating system or applications compatible with Android or iOS, a license for each DCP for this operating software must be included. The software specifications are outlined below.

In addition to the Windows software version, a licensing provision for each DCP is mandatory if the manufacturer provides a software version compatible with the Windows Mobile operating system or applications tailored for Android or iOS. The specific software requirements are detailed below.

The communication software designed for the DCP should streamline tasks such as firmware updates, DCP identification (including name and code), and adjustments to date (day, month, and year) and time (hour, minute, and second). The specific functionalities of the programming, configuration, and data download software are outlined below.

1.8.1 PROGRAMMING DATA COLLECTION AND STORAGE ROUTINES

a) Adjust the frequency and duration of data collection (sampling) independently for each sensor or sensor set.

b) Enable users to define collection rules, such as recording the occurrence of each "tilt" of the rain sensor, adjusting the collection interval for water level data based on observed variations, and recording data from one sensor in correlation with data read by a second sensor.

c) Allow users to adjust water level data from a pressure transducer-type sensor by referencing the water level reading in the rule section (conventional limnimeter station). Additionally, provide the capability to compensate for the influence of atmospheric pressure measured by the barometric sensor.

d) Allow adjustment of water level data from radar and bubble-type sensors with the water level read in the rule section (conventional limnimeter station).

e) Activate or deactivate sensors for data collection.

f) Activate or deactivate sensors for storing collected data.

g) Program the scale and calibration (e.g., offset and gain) of sensors.

h) Allow definition of data storage and transmission format.

i) Allow configuration/programming of the standard SDI-12 and RS-485 serial interface.

j) Facilitate DCP programming by enabling the loading of a file (configuration program) that contains pre-recorded general data, including information on sensors, collection and transmission frequency, data format, and more.

1.8.2 PROGRAMMING OF DATA TRANSMISSION AND STORAGE ROUTINES

a) Facilitate the configuration of transmission parameters for both the GOES modem and GSB modem through the communication software with the DCP, eliminating the necessity of a direct connection to the GOES modem by employing an alternative form of communication.

b) Allow the selection of data to be transmitted (e.g., water level from the pressure transducer, bubble and radar sensors, accumulated rainfall, barometric pressure, etc.).

c) Allow the definition of the transmission word format.

d) Define parameters of the operational status of the DCP to be transmitted (e.g., battery charge and internal temperature).

e) Define the transmission interval (e.g., every 15 minutes, hourly, daily, etc.).

f) Define parameters and verify the transmission status.

g) Enable the transmission of alarms in case predefined events occur.

1.8.3 DOWNLOAD DE LOS DATOS E INFORMACIÓN ALMAZENADA EN LA MEMORIA INTERNA

a) Enable the download of hydrometeorological data and information, providing the option to refine the downloaded dataset based on the acquisition date.

b) Allow the download of rainfall event data, accumulated at intervals of 10 seconds or less.

c) Allow the download and upload of DCP and sensor configuration parameters

d) Allow data and information stored in the internal memory to be deleted

e) The download of data spanning 6 months, considering an acquisition frequency of 15 minutes, should not exceed 15 minutes.

1.9 DOCUMENTATION

All blueprints, catalogs, and handbooks must be provided in digital format, in Spanish, encompassing every element of the DCP: datalogger, power system, sensors, and grounding system, whether sourced domestically or internationally, obtained from external parties, or crafted by the bidding company.

The technical handbooks the bidding company should provide will comprehensively address all essential details for the accurate programming, calibration, installation, maintenance, and operation of all components, spanning the following subjects:

1.9.1 DCP MAINTENANCE HANDBOOK

This handbook is required to, at the very least, incorporate an in-depth technical overview of every PDA component: datalogger, sensors, and power system. It is expected to elucidate the configuration of components and testing points, furnish interconnection diagrams, delineate cable connections linking the datalogger and sensors, and present a step-by-step troubleshooting guide for identifying and addressing faults.

1.9.2 DCP OPERATION HANDBOOK

Sub item	**Description**	**Specifications (identical objects to those provided through sub-items 1.1 to 1.9)**	**Quantity**
1.10	GOES Modem	Spare GOES modems with data communication cable between the modem and the datalogger	2
1.11	Connection cable for GOES-GPS modem	Data communication cable between the modem and the GPS antenna of the DCP casing with installed connectors (N type for GPS antenna and connector for GOES modem)	2
1.12	Connection cable for GOES-Yagi Antenna	Data communication cable between the modem and the Yagi antenna of the DCP casing with installed connectors (N type for Yagi antenna and connector for GOES modem)	3
1,13	Datalogger	Spare dataloggers which include all terminals for connecting the wiring to all possible ports	2

1.14	GOES Antenna	Yagi-type GOES antenna with support for fixation to the DCP support bar and a 12 to 15 m cable	3

This handbook should encompass, at the very least, a comprehensive overview of the DCP, startup sequences, operational guidelines, procedures for configuring the datalogger and GOES modem, a description of potential faults detectable through visual inspection by operators, and other critical details essential for the effective operation and maintenance of the DCP.

1.9.3 PROGRAM HANDBOOK FOR DCP

This handbook is required to provide, at the very least, a comprehensive overview of the DCP's programming environment (software, programs, etc.) and the fundamental programming/configuration procedures detailed in the section pertaining to the software.

Additionally, the aforementioned technical handbooks can be consolidated into a single document, organized into chapters for ease of reference.

ADDITIONAL ITEMS (1.10 TO 1.24)

In pursuit of conducting sustained maintenance over the medium and long term for the DCP, the provision of the following supplementary spare items is required:

Sub item	**Description**	**Specifications (identical objects to those provided through sub-items 1.1 to 1.9)**	**Quantity**
		Communication with the installed "N" type connector	
1.15	GPS Antenna	Outdoor-type GPS antenna designed with a support system for secure attachment to the DCP support bar, featuring a communication cable equipped with the installed "N" type connector	2
1.16	“U” type clamp	Stainless steel "U" type clamps with a 3/8" thread supplied with two 3/8" stainless steel nuts and two washers made from the same durable material.	2
1.17	SPD	SPD - Surge Protection Devices	5
1.18	Charge Controller	Sealed-type charge controller with external support or adaptation for DIN rail mounting (35mm).	2
1.19	Fuse Terminal	Fuse terminal for 35mm DIN rail for connection bar.	5

1.20	4 pins Military Female Connector	4 pins Military Female Connector, type "MS," Class "E," "F," or "R," reference models: MS3106E14S, MS3106F14S, or MS3106R14S	3
1.21	3 pins Military Female Connector	4 pins Military Female Connector, type "MS," Class "E," "F," or "R," reference models: MS3106E14S, MS3106F14S, or MS3106R14S	3
1.22	N Connector	GOES Antenna N-Type Connector for RG-213 type cables	4
1.23	N Connector	GPS Antenna N-Type Connector for RGC58 type cables	3
1.24	Hydrophobic Membrane	Hydrophobic Membrane, Goretex type, provided with support for installation in the protection/conditioning box (DCP) ASK	3

WARRANTIES

The equipment's operational and technical support warranty extends for a period of 2 (two) years, commencing from the date of acceptance.

The provided technical support should encompass the following activities:

a) In the event of hardware or software defects during the warranty period, the DCP or any accessory may be replaced, subject to proper notice. This replacement is contingent upon the usage of the equipment aligning with the guidelines specified in the operation and maintenance manuals that will be supplied.

b) Structuring and implementation of the operation program in the DCPs' datalogger, defining monitored variables, collection intervals, data processing, and other technical details of interest.

c) Resolution of various operational issues with the DCPs, such as firmware installation or reinstallation, installation or reinstallation of the operating program, download operations, sensor configuration, etc., which may jeopardize the proper functioning of the automatic station.

The Contractor reserves the right to connect the acquired equipment with equipment or products from other manufacturers, provided that such initiative does not result in physical damage to the equipment, and the successful bidder cannot use this as a reason to exempt themselves from the performance warranty stipulated in the contract.

OVERALL CONSIDERATIONS

All requisite certificates validating compliance with the specifications will be systematically presented alongside the commercial proposal. The certificates to be furnished encompass:

a) NESDIS Certificate for the supplied model of the GOES modem.

b) ANATEL Certificate for the supplied model of the GOES modem.

c) Calibration Certificate for the supplied model of the barometric sensor.

d) Certificate of conformity for the functional test of the GOES antenna model, demonstrating transmission gain.

e) Certificate of conformity for the operational test of each supplied barometric sensor.

It is important to note that the subject of the tender (Data Collection Platform - DCP) corresponds to a technological solution composed of the integration of different components. Therefore, the offered price corresponds to the total value of the proposed solution, not to each component separately.

Technical specifications are deemed "equivalent," "similar," or "of better quality," established as quality parameters to support the description of the subject being tendered.

The supplier must provide detailed calculations of the DCP's power consumption (during full operation) in their technical proposal to clearly demonstrate that the supplied power system meets the requirements and conditions in this tender.

Data transmission systems must be complete, including all equipment required for communication with the datalogger and radiofrequency output, antennas, cables, connections, manuals, and the necessary software for system installation, maintenance, operation, and integration with the station.

All supports, connectors, cables, and adapters necessary for the proper installation of all DCP components and sensors in the field must be supplied.

TRANSPORT PACKAGING

Each DCP must be delivered in a single main volume, which should include:

DCP Box; Battery; Solar Panel; GOES and GPS Antennas; Copper cord with connector for grounding rod; and Communication cable.

The packaging of the volume must comply with NBR 5985, meaning double-wall corrugated cardboard (BC) with inner and outer brown layers (640 g/m² - outer Kraft cover), minimum thickness of 6.0 mm ± 0.5 mm.

The box closure should have 4 flaps at the top and 4 flaps at the bottom with overlapping.

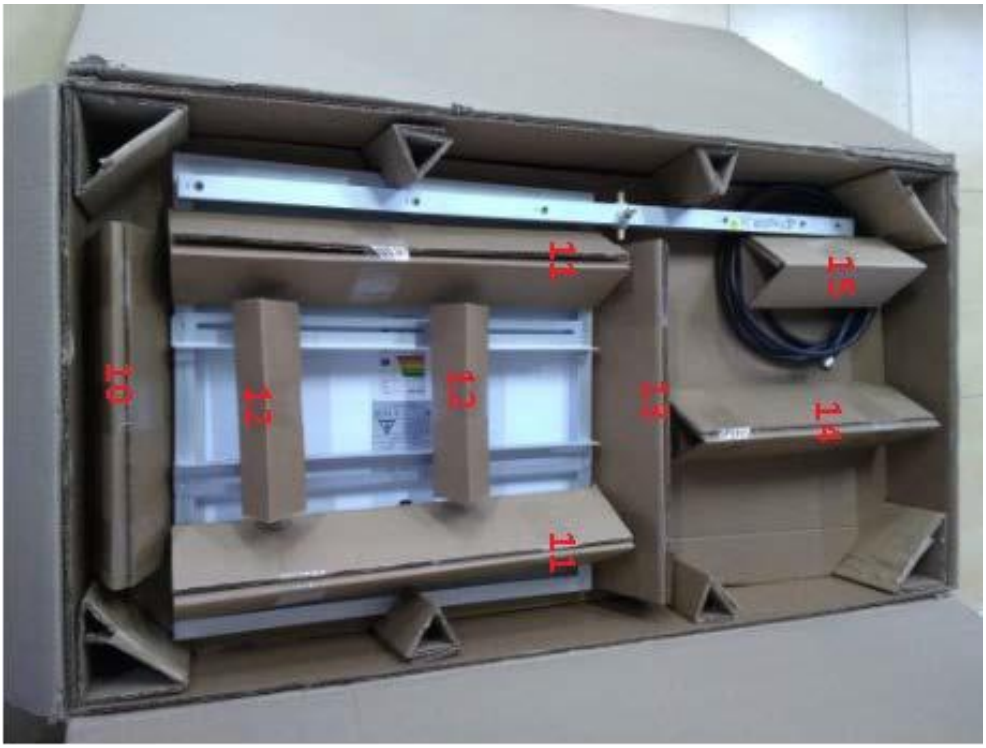
Inside the package should be strategically placed a minimum of 8 triangular columns made from the same material as the previously described box. The sides of these columns should measure

approximately 10 cm and a height sufficient to guarantee separation between the packaging box and the solar panel, as well as other accessories, in order to provide effective protection for the solar panel. Additionally, a minimum of 8 more triangular columns, matching the material and dimensions of the box, should be installed internally. This dual set of triangular columns reinforces the overall structural integrity of the external packaging. Included below are images illustrating the internal structure of the cardboard box with all 16 columns in place.

The side joints of the main packaging must be strongly glued and stapled for protection during transportation. Below is a photograph of the box for the solar panel space.

The photo below illustrates the final closure system, positioned over the solar panel and other

accessories, aiming to keep the physical structure of the cardboard box robust and ready for transportation from ACTO to other monitoring entities associated with the Organization.



Products delivered with packaging of quality and resistance inferior to the one described above will not be accepted.

Sub-items 1.1 to 1.5 will be delivered packaged together (as a unit) in the main package.

Sub-items 1.6 and 1.7: support rods and grounding rods will be delivered separately.

Spare parts described in sub-item 1.10 will be delivered packaged together in separate packaging from the other items.

ITEM 02 - TECHNICAL SPECIFICATIONS OF ELECTROMAGNETIC RADAR WATER LEVEL SENSORS FOR PDS

The water level sensor must be of the "Radar" type and meet the following minimum requirements:

a) Programmable for reading frequency between every 30 seconds and once per day.

b) Minimum measuring range: 1 to 35m.

c) Uncertainty: ± 10mm over the entire measuring range.

d) Resolution: 5mm.

e) Maximum Total Opening Angle: 12°.

f) Operating temperature range: -10 °C to +50 °C.

g) Operating relative humidity range: 0 to 100%.

h) Output signal through the standard RS-485 data communication interface (using the Modbus transfer protocol) or SDI-12.

i) Power range: 10 to 16 Vdc.

j) Electrical connection: The provision of cable for the connection between the Radar and the DCP is not part of the bidding.

k) Casing material of stainless steel and weather-resistant.

l) The bottom of the antenna must be sealed to prevent insect entry.

m) IP66 or higher protection rating.

n) Maximum Weight: 3.5 kg.

o) The radar sensor must withstand, without damage, the following ranges of environmental conditions:

- Temperature: -10 ºC to +60 ºC;
- Relative Humidity: 0% to 100%.

p) A display or software compatible with the Windows 10 operating system or higher, capable of:

- Communicating with the radar and changing the RS485 or SDI12 address;
- Checking the firmware version of the sensor and the serial number; and
- Checking the radar level and allowing changes to the unit of measurement and other calibration parameters.

q) A metallic support must be provided to fix the Radar, allowing for level adjustment.

r) The radar sensor must operate with the NetDL1000 data loggers from OTT, CR8000 from Campbell, and QML201C from Vaisala without requiring additional resistors or any additional electrical devices inside the military connector. These data loggers will be available to bidders at the ANA headquarters in Brasília/DF for communication validation.

s) All components (meter, cables, accessories) must be fully protected against moisture and be waterproof.

t) The offered Radar must comply with the technical requirements of ANATEL and the regulations established in:

- Comply with the technical conformity requirements defined in Act No. 14448, dated December 4, 2017, available at: https://www.anatel.gov.br/legislacao/es/atos-de-requisitos-tecnicos-de-certificacao/2017/1139-ato-14448.

- Comply with the Restricted Radiation Equipment Regulation defined in Resolution No. 680, dated June 27, 2017, available at: https://www.anatel.gov.br/legislacao/resolucoes/2017/936-resolucao-680, amended by Resolution No. 705, dated December 21, 2018, available at: https://www.anatel.gov.br/legislacao/resolucoes/2018/1220-resolucao-705.

u) The bidding company must submit a declaration regarding compliance with the technical requirements regulated by ANATEL in the qualification documents.

v) If the radar frequency is subject to certification by ANATEL, the bidder must provide the ANATEL homologation certificate for the offered radar sensor along with the qualification documents, following the regulations below:

- Comply with the Certification and Homologation Regulation defined by Resolution No. 242, dated November 30, 2000, available at: https://www.anatel.gov.br/legislacao/resolucoes/15-2000/129-resolucao-242

- Comply with the product certification standard established by Resolution No. 323, dated November 7, 2002, available at: https://www.anatel.gov.br/legislacao/resolucoes/2002/155-resolucao-323#item1

w) If the Radar frequency is not subject to certification by ANATEL, the bidder must submit a declaration that the offered Radar is not subject to certification by ANATEL, along with the qualification documents.

x) Other components and accessories required for the correct installation and operation of the equipment in the field, such as software, display (if necessary), cables, converters, etc., must be provided.

y) A 4-pin female metallic military connector (MS3106E14S, MS3106F14S, or MS3106R14S type, complete with its respective pigtail) must be provided for each supplied radar sensor, for the connection between the radar and the DCP.

z) All folders and technical handbooks to validate the requirements of the electromagnetic radar water level sensor must be systematically included with the commercial proposal. Should the sensor operate on the Modbus protocol, essential data such as Slave Address, communication rate, parity, Start Bit, Stop Bit, Function Code, Check Code, and other details related to Modbus-type sensor question/answer strings should also be furnished.

aa) The electromagnetic radar water level sensors must be delivered in Bolivia to the following address: Oficinas del SENAMHI Trinidad: Avenida Panamericana N°1 Edificio COE

Departamental (Telephone +591 34635204 Cell phones +591 67348172 +591 67198643), packaged separately, so that the organization can transport them to the entities responsible for hydrometeorological surveillance.

Following the recommendation of ACTO, it is advised to dispatch one unit to Brazil for testing and evaluation by the relevant department at ANA. The expenses associated with this shipment should be included in the proposer's budget. The designated address for this shipment is:

ANA - Agência Nacional de Águas e Saneamento Básico. Centro de Instrumentação e Logística. Setor Policial, Área 5, Quadra 3, Bloco "U", Brasília-DF. CEP 70.610-200.

The main packaging must adhere to NBR 5985 standards, utilizing double-walled corrugated cardboard with BC-type waves and a minimum thickness of 5mm. Products with packaging quality and resistance below the specified standards will not be accepted.

RS-485 – 4 Pins	
A	A
B	(+)
C	(-)

SDI-12 – 4 Pins	
A	Data
B	(+)
C	(-)

a) The connection diagram of the radar sensor on the 4-pin military connector should be:

or

D	B

D	nc

These are technical specifications of "equivalent" or "similar" nature and "or better quality," established as quality parameters to aid in describing the item to be tendered.

ITEM 03 - ESPECIFICACIONES TÉCNICAS DE LOS SENSORES DE BURBUJEO PLUVIALES PARA LAS PDS

a) Type: Tipping-Bucket Rain Gauge (TBRG) comprising a set with a base and a removable collector, both labeled with the brand, model, and the same serial number.

b) The cabinet (collector) should be positioned/mounted adjacent to the base only in a specific orientation. This requires the use of mechanical devices or markings on both the base and collector preventing the wrong assembly of the set.

c) The collector cabinet must be designed with internal dimensions and angles that minimize possibilities of rain splashing beyond the collection container.

d) The cabinet should be equipped with screws or a similar system (made of stainless steel) to level the rain gauge.

e) Sensor with adjustment devices to balance scale volumes, and the scales should come properly balanced from the factory.

f) Resolution: 0,20 mm.

g) Measurement range: 0 a 150 mm/hour.

h) Operating temperature range: 0 °C a + 50 °C.

i) Uncertainty: 3% for intensities up to 50 mm/hour.

j) Uncertainty: 5% for intensities exceeding 50 mm/hour.

k) Water capture orifice area of the sensor from 300 to 500 cm2; (with a tolerance of less than +/- 1 mm in nominal diameter measurements).

l) The angles (both internal and external) of the rain gauge's (collector) edge should be precisely tuned to minimize the impact of wind turbulence.

m) Includes a reed-switch interrupter.

n) Constructed entirely with corrosion-resistant materials.

o) Use of material (or paint/treatment) with a low coefficient of friction coating to prevent the retention of rain samples.

p) The sensor must include a fixed screen in the collection area, shaped like a tower, which can be removed for cleaning. It is designed to safeguard the entry point of rainwater against the infiltration of insects and other debris.

q) The rain sensor must include conduits or other devices at the bottom for the integral drainage of rainwater, allowing for verification and/or calibration. The sensor should not retain water inside.

r) The rain sensor must have mesh(es) at the discharge hole(s) of the captured water (rain exit point), suitable for preventing the entry of insects.

s) It must be equipped with an additional internal funnel, and it must mandatorily have a siphon, constructed from stainless steel.

t) The sensor must consist of a "tilting" mechanism entirely made of stainless steel and supported on stainless steel bearings.

u) The sensor must have an internal bubble leveling mechanism.

v) The cable is externally coated with materials such as polyamide, polypropylene, polyurethane, polyolefin, polyethylene, or nylon. It is electrically shielded and provides high-durability protection against ultraviolet rays. The cable is molded or similarly manufactured, featuring 3-pin female military connectors (Type "MS," Class "E," "F," or "R," with references MS3106E14S, MS3106F14S, or MS3106R14S) installed and accompanied by its corresponding rubber sleeve. Additionally, each rain sensor and the DCP follow the specified diagram, and the cable is further protected with heat-shrink tubing.

w) It should be used for the connection between the rain sensor and the DCP, with a length of 05 (five) meters.

x) The sensor must endure the specified environmental conditions without incurring any damage:

- Temperature: -10 ºC a +60 ºC; and
- Relative Humidity: 0% a 100%.

y) An independent and dedicated support rod for the rain sensor will be provided, crafted from galvanized pipe measuring 1.7 m with a nominal diameter of 1 and 1/2 inches. The pipe features a minimum wall thickness of 3.2 mm and is equipped with a locking system at the base.

z) The rain sensor will be strategically installed, ensuring that the rain capture plane is positioned at least 1.5 m above the ground. Its support will be securely anchored to the ground, free from any interference with other DCP equipment.

aa) All connectors of the rain sensors must be reinforced at the junction with their respective connection cables using "rubber sleeves" or "heat-shrink tubing" to enhance the strength and durability of these connections. The connection diagram for these connectors will be provided by ANA at a later date.

aa) For the correct installation and operation of field equipment, all components and accessories

required must be supplied, including a calibration certificate for each rain gauge.

bb) For each rain sensor, the selected supplier must provide a graduated device to verify the calibration of the rain gauge in the field (calibration kit).

cc) The graduated container will feature a volume of approximately 1 liter, equipped with interchangeable holes for adjusting the precipitation rate (included). Additionally, it will be provided with a base or alternative accessory to simplify the attachment to the rain gauge.

dd) The calibration kit requires a mechanism (siphon or equivalent) to maintain a constant water flow during the calibration process..

ee) For each calibration kit, 1 digital pulse counter will be provided (battery-operated or using batteries available in the national market), with a pair of 1m-long cables attached to a pair of approximately 3 cm male electrical terminals for the verification of rain gauge calibration, according to the images shown below..

ff) Except for the support rod of the rain sensor, it is required that all sensors be delivered separately, and packaged for transportation by ANA to the entities responsible for hydrometeorological surveillance.

gg) The main packaging must comply with NBR 5985, using corrugated cardboard with BC-type waves, double-walled, with a thickness not less than 5mm, and high density.

hh) The connection diagram for the Rain Sensor on the 3-pin military connector should be:

Rain Gauge (Pulse) - 3 pins

A	1
B	

C	2

These are technical specifications of "equivalent" or "similar" nature and "or of better quality," established as quality parameters to facilitate the description of the object being tendered.

ITEM 03 - TECHNICAL SPECIFICATIONS FOR DISPLAY-TYPE KEYBOARDS FOR PDS

Minimum General Requirements:

a) Device composed of a keyboard, a display, a protective case, and processing capability allowing manual data input and communication with a data logger using the SDI-12 serial communication protocol.

b) The device must use the SDI-12 communication protocol, a standard for all ANA DCPs, enabling hydrological observers (and trained personnel) to input hydrological data through the attached keyboard.

c) The main applications of the collected information will be:

- Replace the use of automatic sensors in locations where installation is impractical.

- Employ manually input data from observers for comparison with information transmitted by automatic sensors at crucial hydrological control stations.

Minimum requirements for the shielding of the SDI-12 keyboard casing

a) The SDI-12 Keyboard casing must be protected from direct sunlight by a stainless steel shield, resistant to sunlight and weather, with a white electrostatic powder coating. The shield must cover the sides, back, and top of the case, allowing air to pass between the box surface and the shield so there must be a minimum distance of 1 (one) centimeter between the shield and the side and top parts of the box. The shield must protrude at least 2 (two) centimeters from the front top of the case.

b) All accessories for fixing the shield (clips, clamps, nuts, screws, etc.) must be provided.

c) The set consisting of the shield and the SDI-12 Keyboard case must have a stainless steel fixing bracket allowing attachment to rods with an outer diameter of 6.2 cm. For each SDI-12 Keyboard, two (2) stainless steel "U" clamps with 1/4" thread, nuts, and stainless steel washers must be supplied.

d) The shield's external dimensions require approximately (H x W x D): 23 cm x 23 cm x 10 cm.

Minimum Requirements for the SDI-12 Keyboard Case

a) The device must be securely installed within the casing and protective cover, exhibiting the following features: robust construction, built with stainless steel, possessing high durability against ultraviolet rays, environmentally sealed, resistant to rain and water, humidity, dust, and insect intrusion, and finished with a white electrostatic powder coating.

b) The SDI-12 Keyboard case is required to incorporate a front door, a set of keys/locks, and two hinges for securing the access door, ensuring the safeguarding of internal components.

c) The SDI-12 Keyboard case requires a vented Gore-Tex® or a similar membrane mechanism, effectively minimizing pressure and temperature differentials between the case's interior and exterior while maintaining its sealing properties.

d) All locks on SDI-12 Keyboard cases require keys with identical codes as the ANA SDI-12 Keyboard cases, along with an external cover for protection from rain and adverse weather conditions. The current code will be provided by ANA for duplication.

e) Each SDI-12 Keyboard must be supplied with two keys sharing the same code.

f) The orifice for the keyboard cable passage through the case should be situated at the box's bottom, equipped with a sealing mechanism (cable gland or similar) to ensure compliance with the case's sealing requirements.

g) The external dimensions of the SDI-12 Keyboard Case must be approximately (H x W x D): 16 cm x 16 cm x 8 cm.

Minimum Requirements for the SDI-12 Keyboard

a) Use the SDI-12 serial communication protocol, version 1.3 or higher, for communication with ANA dataloggers.

b) Be compatible with dataloggers: Vaisala QML-201C, OTT NetDL100, and Campbell CR300.

c) Possess a non-volatile internal memory for storing configurations.

d) Possess a standard RS232 or USB communication port located inside the cover to allow configuration.

e) Consume less than 10 mA in standby mode and less than 100mA in operation.

f) Exhibit a 12-volt DC input voltage sourced from the SDI-12 interface, bearing voltages within the range of 10 to 16 volts DC without causing any harm to the keyboard.

g) Be made of stainless steel.

h) Adhere to the impedance and transient limits outlined in the SDI-12 communication standard, ensuring that communication with other equipment linked to the same SDI-12 port is not impeded or obstructed.

i) Possess the following operating environmental conditions:

- Temperature: -5 a +55°C;

- Relative Humidity: 0% a 100% (non-condensing).

j) Possess the following storage environmental conditions:

- Temperature: -20 a +70°C;
- Relative Humidity: 0% a 100% (non-condensing).

k) Possess the following maximum external dimensions (H x W x D): 16 cm x 16 cm x 8 cm.

l) Possess e sealing with IP65 protection standard.

m) Possess a 16-key membrane manufactured according to NBR 13173 recommendations from August 2012.

n) Possess keys: "0 to 9", "●", "+/-", "turn off", "abort", "enter", "function".

o) Possess minimum key dimensions: 10mm x 10mm.

p) Possess a minimum distance between key centers: 15mm.

q) Possess a maximum contact time of 5 ms.

r) Possess a minimum durability of 500,000 cycles per key.

s) The external dimensions of the SDI-12 Keypad should be approximately (H x W x D): 13 cm x 13 cm x 2 cm.

Minimum Requirements for the SDI-12 Keypad Display

a) Alphanumeric LCD display with 02 lines, each comprising at least 12 digits and 16 segments or 35 points.
b) Minimum character dimensions of 03 mm width and 6 mm height.
c) Backlight for enhanced visibility in outdoor environments.

Minimum Requirements for the Cables and Connectors of the SDI-12 Keypad

a) Attached to the casing, with a sealing mechanism (cable gland or similar) ensuring compliance with the sealing requirements of the IP65 protection standard.
b) Standard 4-pin female military connector, Class "E" or "F" (reference models: MS3106E14S or MS3106F14S).

Minimum Requirements for the Communication and Configuration Software of the SDI-12 Keypad

a) The device must be configurable from an external application compatible with the Windows 10

operating system or higher.

b) This application must be provided to ANA with a perpetual license, without restrictions.

c) The source code of the Windows application and the firmware controlling the device must be provided to ANA, allowing for modifications and updates.

Minimum Functional Requirements of the SDI-12 Keypad

a) Allow the entry of at least 10 different variables, selectable from the "function" key.

b) Each selected variable must have an alphanumeric label displayed on the top line of the screen.

c) Allow the input of decimal numbers.

d) Allow the input of negative numbers with a selectable sign using a "+/-" key.

e) The entered value and the "+/-" sign should appear on the bottom line of the screen.

f) Store the values entered via the keypad, allowing their subsequent reading by the datalogger, at predefined time intervals in the datalogger. Once this operation is completed, the keypad will return to standby mode.

g) To conserve energy, the display screen will automatically power off, and the device will transition to standby mode after a preconfigured period of inactivity on the keypad. It will reactivate upon pressing any key.

h) Configurations will be stored in a non-volatile internal memory, ensuring they remain unchanged in case of a power outage.

i) Stored values should be deleted:

- Stored values must be erased: either after the datalogger has read the values stored in the keypad, or
- after the pre-established time on the keypad has elapsed.

j) It should be configurable through an external application compatible with the Windows 10 operating system.

k) Configuration from a laptop requires the device to include not only the SDI-12 interface for communication with the Datalogger but also a standard RS232 or USB communication port.

l) Minimum configuration functions:

- SDI-12 address selection from 0 to 9.
- Allowing the input of up to 10 parameters (variables).
- Allowing the input of up to 10 parameters (variables) in the main flow and up to 8 control parameters (0 or 1) in the alternate flow.
- Allowing the selection of the order of parameters.
- Allowing the insertion of an alias (name) for each parameter for display on the first line of the screen.
- Possessing the function to reset the factory settings (via the application).
- Configuring the serial communication pattern (communication speed, number of bits, parity, stop bit, and flow control).
- Configuring the screen turn-off time.

m) Configuring the time after which the device will erase the entered keyboard data.
Minimum Standard Programming Requirements for SDI-12 Keypad

a) The following functions must be assigned to special keys (Abort, Delete, and Function):

- "Abort" key: Discards the data of the entered variables (before the end of the standard flow), and the standard flow must restart.
- "Delete" key: Deletes one character at a time, from left to right on the line.
- "Function" key followed by a number: Cancels the ongoing operation and directs to the variable corresponding to the selected number. In the example of the previous standard flow, pressing the "Function" key and the number 1 directs the keypad to the elevation variable.

b) Here is the **primary sequence** for defining parameter 02. Elevation corresponds to variable 01, and precipitation corresponds to variable 02. This default sequence should be set as the factory default.

- 1- Press any key to exit standby mode and enter operation mode, illuminating the screen.
- 2- The screen shows the message "Elevation-cm" on the top line of the screen and the empty bottom line.
- 3- The user enters the elevation value (e.g., 4587) and presses the "Enter" key.
- 4- The screen shows the message "Rain-mm" on the top line of the screen and the empty bottom line.
- 5- The user enters the cumulative precipitation value (e.g., 15.7) and presses the "Enter" key.
- 6- The screen shows the message "END" and stores the data in memory.
- 7- The screen will enter standby mode after 30 seconds.
- 8- Entered data should remain in the device's memory for a fixed time (configurable) or for later input. Values will be automatically erased after this configurable interval.

c) **Alternate flow** programming should involve the technician inserting up to 8 control parameters during the device's maintenance visit. The following provides a background description of the alternate flow with 3 parameters that should be preconfigured as factory defaults: maintenance,

elevation adjustment, and rain gauge calibration.

- 1- Pressing the <Function> key followed by the number 000 and the <Function> key will display the message "Maintenance?" centered on the top line and "1-YES 2-NO" centered on the bottom line. The user should press the <1> key to confirm that the station maintenance has been performed or <2> to cancel the operation and return to the beginning of the main flow cycle.
- 2- If the answer is YES, the screen will display the message "Elevation adjustment?" centered on the top line and "1-YES 2-NO" centered on the bottom line. The user should press the <1> key to report that the elevation adjustment was performed or <2> to report that the elevation was not adjusted.
- 3- The screen will display the message "Rain gauge calibration?" centered on the top line and "1-YES 2-NO" centered on the bottom line. The user should press the <1> key to report that the rain gauge was calibrated or <2> to report that the rain gauge calibration was not performed.
- 4- Binary values 0 and 1 should be associated with the responses NO and YES, respectively. The numbers corresponding to the responses should be grouped to form an 8-digit binary variable, ordered from right to left, filling empty positions with 0.

Illustrative figures and photographs of the SDI-12 keyboard, packaging, and shield.

a) The following images show the SDI-12 keyboard, the casing, and the protective shield.

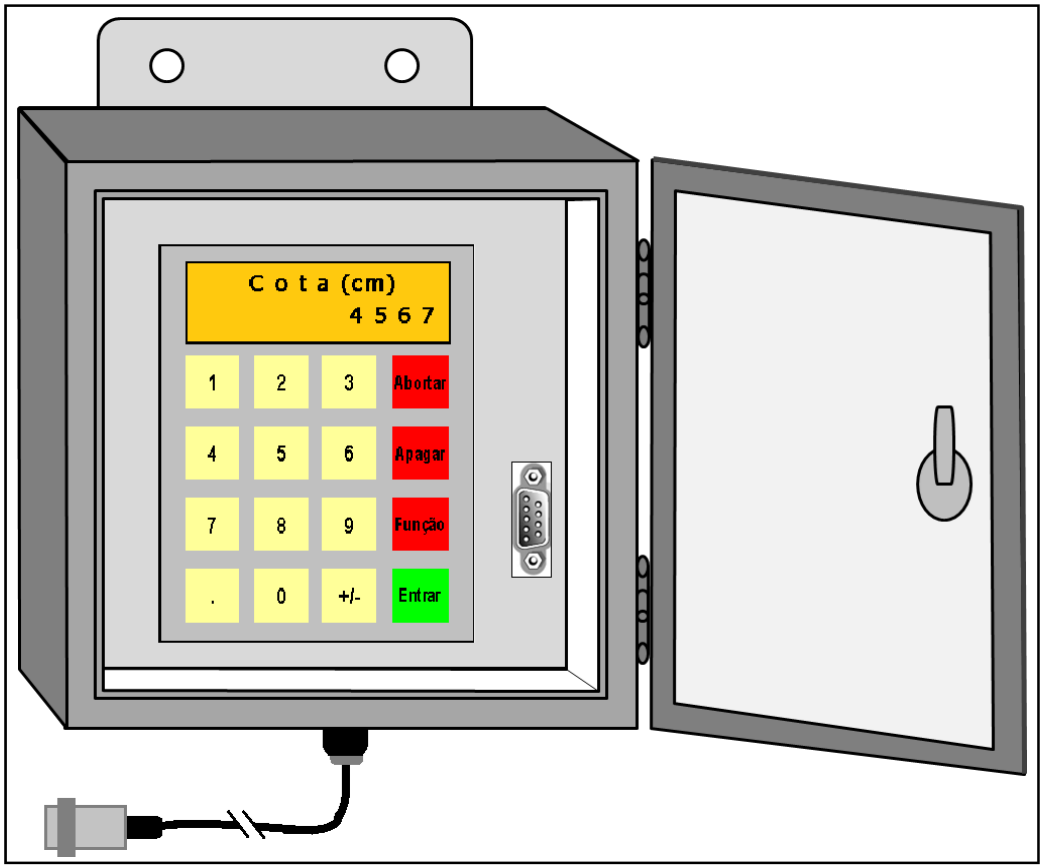


Figure 1 – *Layout* of SDI-12 keyboard

Figure 2 – Image of the front part opened

Figure 3 –Image of the bottom part

Figure 4 –Image of the front part closed

Figure 5 – Internal image of the casing door

ADDITTIONAL TERMS

Guarantee of permanent customer technical support

The supplier must maintain a Technical Support Department accredited by the manufacturer, ensuring continuous availability to provide on-site technical assistance for the maintenance, repair, and configuration of the client's stations, without additional charges, throughout the equipment warranty period. If issues arise with the configuration or operation of the station(s) in the field during the equipment warranty period, the technical support team must promptly assist field personnel in resolving the problem. In case of complex issues, the

support should furnish the required information for an immediate preliminary assessment, followed by a final evaluation or solution within a maximum period of 15 days.

Training

The supplying company must train the technical staff in the configuration, operation, and maintenance of the offered equipment, including its calibration.

Supply of Spare Parts

The company must guarantee the supply of spare parts and maintenance for at least two years and/or in a manner similar to the operational warranty.

Supply of Parts or Equipment

The supplier must ensure the supply of the necessary parts or equipment for the proper functioning of the station during the aforementioned technical warranty period.

Repair of Equipment and Service Location

Technical assistance services for the maintenance and operation of the equipment must be carried out at the company's facilities or at locations expressly authorized by the company, free of charge during the warranty period.

Inspection and Operational Control

The supplier will verify the functionality of the equipment before installation and acceptance. Tests will be conducted collaboratively with the supplier, and reconditioned equipment will not be accepted.

Upon completion of the installation and configuration of the hydrometric stations, on-site inspections of the station installations, accompanied by relevant operational tests, will be conducted with the technical and administrative personnel.