



Public Pricing Tender 2023 PHYSICO-CHEMICAL SENSORS

Digital Labs

I+D+i

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1. BACKGROUND

Since 2011, Centro Ceibal has made physico-chemical sensors available to Primary Education, Secondary Education and Education Training Centers with the purpose of addressing new didactic challenges by promoting learning and the application of scientific methodology. Through the collection and analysis of experimental data, these sensors constitute important tools for innovation and development of educational projects.

2. EDUCATIONAL CONTEXT

The main objective of the devices is to enhance learning processes mainly related to the area of science, in elementary and middle school students of our Public Education System.

The target public are students and teachers of the second cycle of elementary school (4th, 5th and 6th year) and middle school students of the UTU and Secondary subsystems. The target age range is from 9 to 16 years old.

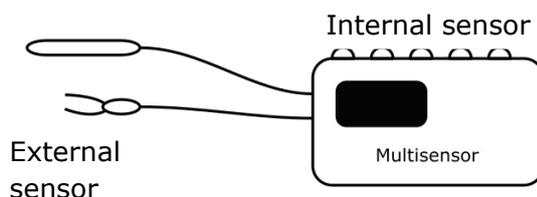
The equipment will be used in educational centers by teachers and students; therefore, the search is oriented to equipment of intuitive operation. Likewise, the equipment must be robust and resistant, guaranteeing proper operation inside and outside the educational center. In relation to the above mentioned, it is of utmost importance that the device is a multisensor and that it includes most of the sensors in the same device to avoid the loss of parts and components in the Educational Centers.

Its application and use will be for educational purposes to demonstrate theoretical concepts, so that each person can obtain their own records of practical experiences when using the sensors inside and outside the classroom. The data obtained from the physico-chemical variables obtained from the sensors allow analyzing and interpreting the results by applying critical thinking through the scientific method, appropriating the experimental design through practical experiences.

3. CALL AIM

The aim of this Bidding Document is to acquire multisensors and their corresponding data collection and analysis software compatible with Plan Ceibal equipment (ANNEX III- Device specifications).

"Multisensor" means a device with the following characteristics: it must be self-contained (portable, with its own power and storage); it must incorporate a number of sensors; it must be able to read point measurements and configure measurement logging from the device itself; and it must be able to connect or link external sensors for measurements that require contact.



*Figure 1. Illustrative schematic only, which does not refer to or condition a specific design format and size of the hardware device.

4. REQUIREMENTS

The requirements of the educational multisensor products to be purchased are detailed below.

4.1 MANDATORY REQUIREMENTS

4.1.1 Mandatory Requirements of Hardware

Table I and Table II - Annex II detail the mandatory requirements to be met by the products offered.

The measurement ranges and sample rates indicated are reference values to guide the selection of sensors to offer; Different ranges of operation will be studied during the evaluation.

The sampling rates are expressed in samples per second (sps).

TABLE I: Mandatory requirements: Type of sensors				
#	Type of sensor	Units, ranges and maximum sampling rate (for reference)	Specificities	Mandatory external accessories
1	pH	0 to 14	Pre-calibrated Allows calibration before use	Storage buffer solution in instructions
2	External temperature probe	°C and K -25 °C to 125 °C 100 sps	Pre-calibrated Waterproof	Not required
3	Voltage	± 25 V 20.000 sps	Pre-calibrated	Cables with banana connectors
4	Electricity	±1 A 20,000 sps	Pre-calibrated	Cables with banana connectors
5	Air pressure (barometric)	0 to 300 kPa 10 sps	Pre-calibrated	Plastic Tube

6	RH	0 to 100% RH 100 sps	Pre-calibrated	Not required
7	Light (light level)	0 to 55,000 Lx	Pre-calibrated	Not required
8	Sound (sound level)	10 to 100 dB[SPL] with A-weighted (required)	Pre-calibrated	Not required
9	Distance	0.4 to 10 m 10 sps	Pre-calibrated	

In addition, other mandatory hardware and software requirements detailed below in TABLE II must be met.

TABLE II: Mandatory Requirements of Hardware: Performance Specifications	
#	Characteristic
1	It must allow scheduling, storing (recording) and configuring experiments (sensors, sampling rate or frequency).
2	It must have the capacity to store data obtained autonomously. It must have a minimum internal memory with a capacity to store at least 500,000 samples (using at least 3 sensors at the same time).
3	The recorded data must be expressed in units of the International System of Units (SI).
4	It must support simultaneity of sensor use: the equipment must be able to record simultaneous measurements of any subset of at least 3 of the mandatory sensors installed.
5	Connectivity with laptops (see Annex III) to export the data obtained with the hardware (USB, Bluetooth, WIFI among others)
6	In case of USB connectivity, a USB cable must be included to transfer the data from the multisensor device to the device.
7	Power supply based on built-in internal rechargeable battery, excluding externally rechargeable batteries. Fully charged battery should support 24 hours of continuous operation (measurements).
8	The connection to the electrical network of the equipment or its chargers must comply with the following: the plug must be of type CEE 7/16, with 2 cylindrical legs with insulation; power is nominal 230V, 50Hz.
9	The equipment must comply with standards applicable to information technology equipment such as UL1950 / IEC950 / EN60950. The safety regulations must be declared in the offer.

4.1.2 Mandatory Requirements of Software – Table III Annex II

The software associated with the device is a tool for the representation and visualization of the data registered and obtained by the sensors found in the hardware. It allows to visualize and recognize the sensors that are selected in the hardware, expanding the possibilities of working in the classroom with this technology.

The software associated with the hardware allows the different behaviors of the variables to be studied with the device to be analyzed using graphs and tables.

The communication of the software with the hardware broadens the possibilities of use and application of the device in learning processes from the different subjects of the curriculum. Strengthens the interpretation of data and the correct presentation of experimental results that guides the scientific methodology.

The following functionalities are valid both for experiments communicated from the multisensor hardware, as well as for the study and visualization of previously saved experiments. The characteristics and mandatory requirements of the measurement visualization, analysis and recording software are detailed below.

TABLE III: Mandatory Requirements of Software	
#	Characteristic
1	The software must be compatible with the operating systems of the devices delivered by Ceibal (see Annex III).
2	The software must be free to download and use, without requiring extra costs or licensing procedures for the user and have a clear explanation of the download and installation procedure.
3	The software must allow working with the data obtained without the need to have the multisensor hardware connected, it must also allow downloading of the records obtained and exporting the data in CSV format.
4	User interfaces must be able to be configured in Spanish language.
5	The software must be usable without an internet connection: the usage and viewing functions listed below must not require an internet connection. This is without prejudice to the fact that other extra functionalities do require connection (for example, functions to share experiments or generate reports).

6	The recorded data must be expressed in units of the International System of Units (SI), except for temperature, which must be expressed in degrees Celsius.
7	The sensors used must be detected automatically.
8	Graphical representation of data: it must be possible to select the sensors to represent graphically.
9	Numerical representation of data: It should be possible to view the sensor records in a tabular way.

4.2 DESIRABLE REQUIREMENTS

The desirable requirements are listed in **TABLE IV**.

The desirable hardware requirements and the availability of these sensors and features will evidence the possibility of expansion and additional facilities of the multisensor base product. The desirable product packaging requirements consider the educational purpose of the product and the storage it has in the Educational Centers avoiding misplacement, damage and loss of multisensor components and additional sensors.

TABLE IV: <i>Desirable Requirements</i>	
4.2.1 <i>Desirable Requirements of Hardware</i>	
1	That the multisensor equipment has an integrated display for instantaneous visualization of selected sensors and log configuration menu.
2	Sensors integrated in the multisensor, in addition to those mentioned in the mandatory requirements, which are integrated in the same device.
4.2.2 <i>Desirable Requirements of software</i>	
3	It should allow downloading of data in additional formats besides .scv
4	Graphical representation of the data: in addition to selecting the sensors to be represented, it is possible to modify the time intervals to be displayed.
4.2.3 <i>Desirable requirement for packaging and accessories</i>	
5	The packaging of the multisensor device must contain inside (in a single package) all the components that are part of the purchased product.

6	It includes supports or complements for experimental designs with the multisensor (e.g. complements that fix the multisensor on a laboratory table to improve the correct functioning of data collection).
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4.3 OPTIONAL SENSORS

4.3.1 Optional Sensors:

TABLE V: Optional Requirements of Hardware: Type of sensors				
#	Type of Sensor	Units, Ranges, Max Rate Of sampling (as a reference)	Specificities	Mandatory external accessories
1	Carbon dioxide gas	0 to 10.000 ppm, 100 sps	Pre-calibrated	Co2 probe attached to the sensor body by rubber coated cable. Glass bottle and / or container that accompanies the design of the sensor to carry out the experiments.
2	Dissolved oxygen	0 to 15 (mg/L), 100 sps 0 to 125 %, 100 sps	Pre-calibrated	DO (Dissolved Oxygen) calibration solution and fill the DO (Dissolved Oxygen) sensor (1 M KCl) and replacement membrane.
3	Turbidity	0 to 200 NTU, 100 sps	Pre-calibrated	Cells or cuvettes for correct measurement in the sensor cell.
4	UVA radiation	0 to 65000 mW/m2 100 sps	Pre-calibrated	
5	UVB radiation	0 to 1,500 mW/m2 aprox 290 to 320 nm 100 sps	Pre-calibrated	
6	Electrical conductivity of liquids	Three types of records: µS / cm - microsiemens - per centimeter - mg / L - ppm	Pre-calibrated Carbon graphite parallel electrodes	

		Operating range: 0 to 20.00 μ S / cm 100 sps		
7	Soil moisture	0 to 100% in the temperature range 203 $^{\circ}$ K - 323 $^{\circ}$ K,	Pre-calibrated	

5. OFFER

The offer must be submitted according to the specifications detailed in this section. Centro Ceibal reserves the right to reject an offer that does not respect the mandatory specifications.

The offer must be expressed according to the Price Quote table in Annex I, and indicate compliance with the mandatory and optional requirements requested in section 3 and 4 using the tables in Annex II.

Likewise, along with the offer, the following must be submitted:

- **Sample** of the multisensors offered to carry out measurement tests and evaluate performance (1 per model) with their respective accessories. The sample submitted shall be exactly as detailed in the price table and in its original sealed presentation (in packaging and contents). Samples of both mandatory and optional sensors are required, according to section 4.1.
- Access to measurement and graphics **software**
- **Technical documentation** containing sensor specifications and detailed characteristics as mandatory and optional requirements, specified in point 4.
- **Economic offer** through the listing table of **Annex I** and Tables of compliance with mandatory and desirable requirements of **Annex II**.
- **Background Information** as in point 5.2

5.1 SAMPLE OF OFFERED SENSORS

- A sample of the complete product offered must be presented to carry out data record tests in practical experiences related to the curriculum of our public of the educational system (Primary and Middle) and evaluate the correct operation and accuracy of the values obtained by each sensor. Sensors or optional features that do not present samples will not be evaluated.

- If the sensors require calibration or storage solutions (pH, chloride, nitrate, dissolved oxygen, dissolved carbon dioxide, conductivity, etc.), a sample of these solutions and a technical specification of the composition of that solution and / or buffer must be available.
- Some tests to be carried out with the samples could result in total or partial destruction, or alter the conditions with respect to which they were delivered. Those samples that are not damaged may be returned in different conditions with respect to which they were delivered.
- The bidder will have 4 weeks from the award to collect the submitted samples. Once the previous term has expired without the total of the samples of the products offered being withdrawn, Centro Ceibal will be able to freely dispose of them, without the right to claim on the part of the bidder.
- In exceptional cases and when there are justified reasons in Ceibal's judgment, the bidder may defer delivery for a reasonable period that Ceibal will evaluate.
- Samples must be delivered to Proveeduría de Ceibal (Av Italia 6201, Predio LATU, Los Ceibos building, CP 11500). The opening hours are from Monday to Friday from 9:30 am to 4:00 pm. Samples must be delivered before the bid opening date, and Ceibal may extend the deadline for reasonable reasons at its discretion.

5.2 TECHNICAL DOCUMENTATION REQUIRED

At least the following information must be specified and included in the offer, and may also accompany brochures and manuals, physical and / or digital, with additional information.

- Hardware user manual with technical specifications and use or operation guide (in physical or digital medium)
- Specific calibration manual for those sensors that require calibration prior to use. This should include manual or instructions for the preparation of the storage buffer solution and calibration for the pH sensor, dissolved oxygen, dissolved carbon dioxide, nitrate, chloride and all those that require it.
- Examples of experiences or educational practices that can be carried out with the sensors offered are requested.

5.3 ECONOMIC OFFER

The offer shall specify the unit CIF Montevideo quotation for each product offered, according to the following volume ranges specifying terms following the **PRICE TABLE in ANNEX I.**

The quotation of the mandatory sensors must be made in the PRICE TABLE A including the mandatory sensors that are not considered in the multisensor and are external. The included multisensors (both mandatory and non-mandatory but cannot be separated from the multisensor) must be specified in the comment box.

The optional sensors must be priced in the PRICE TABLE B respecting the volume ranges. The discounts considered by a bundle of different sensors must be specified in the comments box (for example: 10 + 20 + 15 + 30).

5.4 Background Information

The bidder must also present background information as a supplier:

- Folder with specification of factory background, the factory that will produce the devices offered must be detailed.
- Folder with background of educational projects in which he has participated.

6. DELIVERY PERIODS

The bidder shall specify the delivery time of the products, to be met upon notification of award. A desirable full delivery is expected within 90 calendar days of the issuance of the purchase order.

In case of not being able to comply with the aforementioned deadlines, the bidder must specify the delivery deadlines in his offer.

Centro Ceibal may request to adjust the arrival schedule with the awarded supplier.

7. WARRANTY

The bidder must include in his proposal the conditions, procedures and deadlines for executing warranty claims. The bidder will guarantee that the products supplied under the contract are new, complete, unused and free from defects attributable to design, materials, manufacturing, storage conditions (packaging,

appropriate temperature and humidity), shipment or any other act or omission of the bidder that could manifest itself on the occasion of the normal use of the products under the prevailing conditions in the country.

The warranty period for the product must be informed by the bidder, with a minimum warranty period of 1 year. In the event that the guarantee period is not specified, Centro Ceibal will consider a guarantee period of at least one year.

8. SENSORS EVALUATION

The evaluation consists of a technical evaluation and an economic evaluation, which will be weighted according to the following technical-economic formula:

Aspects to be evaluated	Weight
Technical offer	70%
Price	30%

In the **technical evaluation**, compliance with all mandatory requirements is verified, and a minimum of 60/100 points equivalent to 60% is contemplated.

The technical evaluation will try to assess the adequacy of the sensors to the operating environment to which they will be exposed and to the work dynamics to be achieved in educational centers. They are categorized by weighting percentages defined according to their relevance to Plan Ceibal, according to the expected learning objectives. In the evaluation stage, Ceibal may also request a demonstration of the products from the bid

Therefore, in the evaluation, divide the total of 100 points as follows:

Technical Evaluation- 100 points

1. Adaptation to the educational environment - 25%
 - usability
 - adaptation to both teaching audience and students
 - activity guide or educational support materials specific to the device
2. Technical characteristics of the Hardware - 35%
 - autonomy (battery life, portability)
 - robustness (IP, resistance to dust, water etc)
 - recording capacity and sampling memory
 - precision and accuracy of the measurements recorded by the sensors
 - sensor calibration appropriate to the educational environment

- screen for measurements and configuration on the multisensor unit
- other non-mandatory sensors incorporated in the multisensor equipment

1. Software - 25%

- communication with hardware
- usability
- data analysis tools
- display of measurements in real time

2. Packaging and accessories- 15%

9. ANNEX I – PRICE TABLES

Unit prices in USD - CIF Montevideo

Quote the mandatory sensors as a single multi sensor and according to the ranges.

PRICE TABLE A (Unit prices USD- CIF MVDO.)		
MANDATORY		
<i>Physico-chemical multisensor (including mandatory sensors external to the multisensory)</i>	<i>Multisensor Model</i>	<i>Delivery period</i>
Offer Range 2: 1 to 100 Multisensors		
Offer Range 3: 101 to 200 Multisensors		
Offer Range 4: 201 to 300 Multisensors		
Offer Range 5: 301 or more Multisensors		
Comments		
<i>Sensors included in multisensor</i>		

In all cases, the delivery period must be specified for each item according to each range in case of variation.

Unit prices in USD - CIF Montevideo

Quote the desirable sensors each one separately and according to the ranges.

PRICE QUOTE TABLE A (Unit prices USD- CIF MVDO.)		
DESIRABLE		
Optional sensors	Non-mandatory Sensor/s	Delivery period
Educational complements	Practical experiences and training for use with the multisensor	
Offer Range 1 1 a 50 Multisensors	Model A . . . Model N	
Offer Range 2: 51 to 100 Multisensors		
Offer Range 3: 101 to 200 Multisensors		
Offer Range 4: 201 to 300 Multisensors		
Offer Range 5: more than 301 multisensors		
Comments		

- For optional sensors, if there is a discount for a bundle of different sensors (e.g. 10 + 20 + 15 + 30), please specify in the comments box.

10. ANNEX II – COMPLIANCE TABLES

The bidder must complete the compliance tables for all the requested requirements. For reference to the evaluation team, you must also indicate in which part of the submitted offer the information corresponding to the requirement is found in the Observations field.

The column COMPLIANCE with the mandatory requirements will be completed with the options Yes / No. In the case of the options, it can be completed with the options Yes / No / Partial. In the event of partial compliance, the information is included in the OBSERVATIONS column.

TABLE I: Mandatory requirements of Hardware: Type of sensors						
#	Type of sensors	Units, ranges and maximum sampling rate (as a reference)	Specificities	Mandatory external accessories	COMPLIANCE YES / NO	OBSERVATIONS
1	pH	0 to 14	Pre-calibrated Allows calibration before use	Storage and instructions buffer solution		
2	External temperature probe	°C and K -25 °C to 125 °C 100 sps	Pre-calibrated Waterproof	Probe		
3	Voltage	± 25 V 20.000 sps	Pre-calibrated	Cables with adequate connectors		
4	Voltage	± 25 V 20.000 sps	Pre-calibrated	Cables with adequate connectors		
5	Air pressure (barometric)	0 to 300 kPa 10 sps	Pre-calibrated	Plastic Tube		
6	RH	0 to 100% RH 100 sps	Pre-calibrated	Not required		
7	Light (light level)	0 to 55,000 Lx	Pre-calibrated	Not required		

8	Sound (sound level)	10 to 100 dB[SPL] with A-weighted (required)	Pre-calibrated	Not required		
9	Distance	0.4 to 10 m 10 sps	Pre-calibrated	Not required		

TABLE II: Mandatory Requirements of Hardware: Performance Specifications

#	Characteristic	COMPLIANCE YES / NO	OBSERVATIONS
1	It must allow scheduling, storing (recording) and configuring experiments (sensors, sampling rate or frequency).		
2	It must have the capacity to store data obtained autonomously. It must have a minimum internal memory with a capacity to store at least 500,000 samples (using at least 3 sensors at the same time).		
3	The recorded data must be expressed in units of the International System of Units (SI), and degrees Celsius for temperature.		
4	It must support simultaneity of sensor use: the equipment must be able to record simultaneous measurements of any subset of at least 3 of the mandatory sensors installed.		
5	Connectivity with laptops to export the data obtained with the hardware (USB, Bluetooth, WIFI among others)		
6	In case of USB connectivity, a USB cable must be included to transfer the data from the multisensor device to the device.		
7	Power based on built-in rechargeable battery. A full battery charge must support 24 hours of continuous operation (measurements).		
8	The connection to the electrical network of the equipment or its chargers must comply with the following: the plug must be of type CEE 7/16, with 2 cylindrical legs with insulation; power is nominal 230V, 50Hz.		
9	The equipment must comply with standards applicable to information technology equipment such as UL1950 / IEC950 / EN60950. The safety regulations must be declared in the offer.		

TABLE III: Mandatory Requirements of Software

#	Characteristic	Compliance YES / NO	Observations
1	The software must be compatible with the operating systems of the devices delivered by Ceibal (see Annex V).		
2	The software must be free to download and use, without requiring extra costs or licensing procedures for the user and have a clear explanation of the download and installation procedure.		
3	The software allows working with the obtained data without the need of having the multisensor hardware connected, and it allows downloading the obtained records and exporting the data (i.e. the set of measurements of all sensors and their corresponding timestamps) in CSV format.		
4	User interfaces must be able to be configured in Spanish language.		
5	The software must be usable without an internet connection: the usage and viewing functions listed below must not require an internet connection. This is without prejudice to the fact that other extra functionalities do require connection (for example, functions to share experiments or generate reports).		
6	The recorded data must be expressed in units of the International System of Units (SI), except for temperature, which must be expressed in degrees Celsius.		
7	The sensors used must be detected automatically.		
8	Graphical representation of data: it must be possible to select the sensors to represent graphically, as well as the time intervals to be displayed.		
9	Numerical representation of data: It should be possible to view the sensor records in a tabular way.		

TABLE IV: Desirable Requirements

4.2.1 Desirable Requirements of Hardware:			Compliance YES / NO	Observations
1	That the multisensor equipment has an integrated display for instantaneous visualization of selected sensors and log configuration menu.			
2	Sensors integrated in the multisensor, in addition to those mentioned in the mandatory requirements, which are integrated in the same device.			
4.2.2 Desirable requirements of software				
3	It allows downloading of data in additional formats besides .scv			
4	Graphical representation of the data: in addition to selecting the sensors to be represented, it is possible to modify the time intervals to be displayed.			
4.2.3 Desirable requirement for packaging and accessories				
5	The packaging of the multisensor device must contain inside (in a single package) all the components that are part of the purchased product.			
6	It includes supports or complements for experimental designs with the multisensor (e.g. complements that fix the multisensor on a laboratory table to improve the correct functioning of data collection).			

TABLE V: Optional Requirements of Hardware: Type of sensors

#	Type of Sensor	Units, Ranges, Max Rate Of sampling (as a reference)	Specificities	Mandatory external accessories	Compliance YES / NO	Observations
1	Carbon dioxide gas	0 to 10.000 ppm, 100 sps	Pre-calibrated	Co2 probe attached to the sensor body by rubber coated cable. Glass bottle and / or container that accompanies the design of the sensor to carry out the experiments.		
2	Dissolved oxygen	0 to 15 (mg/L), 100 sps 0 to 125 %, 100 sps	Pre-calibrated	DO (Dissolved Oxygen) calibration solution and fill the DO (Dissolved Oxygen) sensor (1 M KCl) and replacement membrane.		
3	Turbidity	0 to 200 NTU, 100 sps	Pre-calibrated	Cells or cuvettes for correct measurement in the sensor cell.		
4	UVA radiation	0 to 65000 mW/m2 100 sps	Pre-calibrated			
5	UVB radiation	0 to 1,500 mW/m2 aprox 290 to 320 nm 100 sps	Pre-calibrated			
6	Electrical conductivity of liquids	Three types of records: $\mu\text{S} / \text{cm}$ - microsiemens - per centimeter - mg / L - ppm Operating range: 0 to 20.00 $\mu\text{S} / \text{cm}$ 100 sps	Pre-calibrated Carbon graphite parallel electrodes			
7	Soil moisture	0 to 100% in the temperature range 203 °K - 323 °K,	Pre-calibrated			
8	OTHERS					

11. ANNEX III – DEVICE SPECIFICATIONS

DEVICE SPECIFICATIONS

See details of devices in the following link:

<https://ceibal.edu.uy/dispositivos-soporte/tablets-y-laptops/>