

① Unit: PAHSC. Soil Moisture Sand Unit

Key features:

- ▶ **Advanced Real-Time SCADA.**
- ▶ **Open Control + Multicontrol + Real-Time Control.**
- ▶ **Specialized EDIBON Control Software based on Labview.**
- ▶ **National Instruments Data Acquisition board (250 KS/s , kilo samples per second).**
- ▶ **Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.**
- ▶ **Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.**
- ▶ **Capable of doing applied research, real industrial simulation, training courses, etc.**
- ▶ **Remote operation and control by the user and remote control for EDIBON technical support, are always included.**
- ▶ **Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).**
- ▶ **Designed and manufactured under several quality standards.**
- ▶ **Optional CAL software helps the user perform calculations and comprehend the results.**
- ▶ **This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.**

**OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL**

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 ↳ Units
 ↳ 13.-Environment

For more information about Key Features, click here:



ISO 9000: Quality Management
(for Design, Manufacturing, Commercialization and After-sales service)



European Union Certificate
(total safety)



**Certificates ISO 14000 and
ECO-Management and Audit Scheme**
(environmental management)



**Worlddidac Quality Charter
Certificate**
(Worlddidac Member)

DESCRIPTION

Unit, computer controlled, designed to study and understand the water retentivity principles, in terms of soil suction, as well as for the derivation of characteristic curves of the ground 's humidity.

Basically it is composed by:

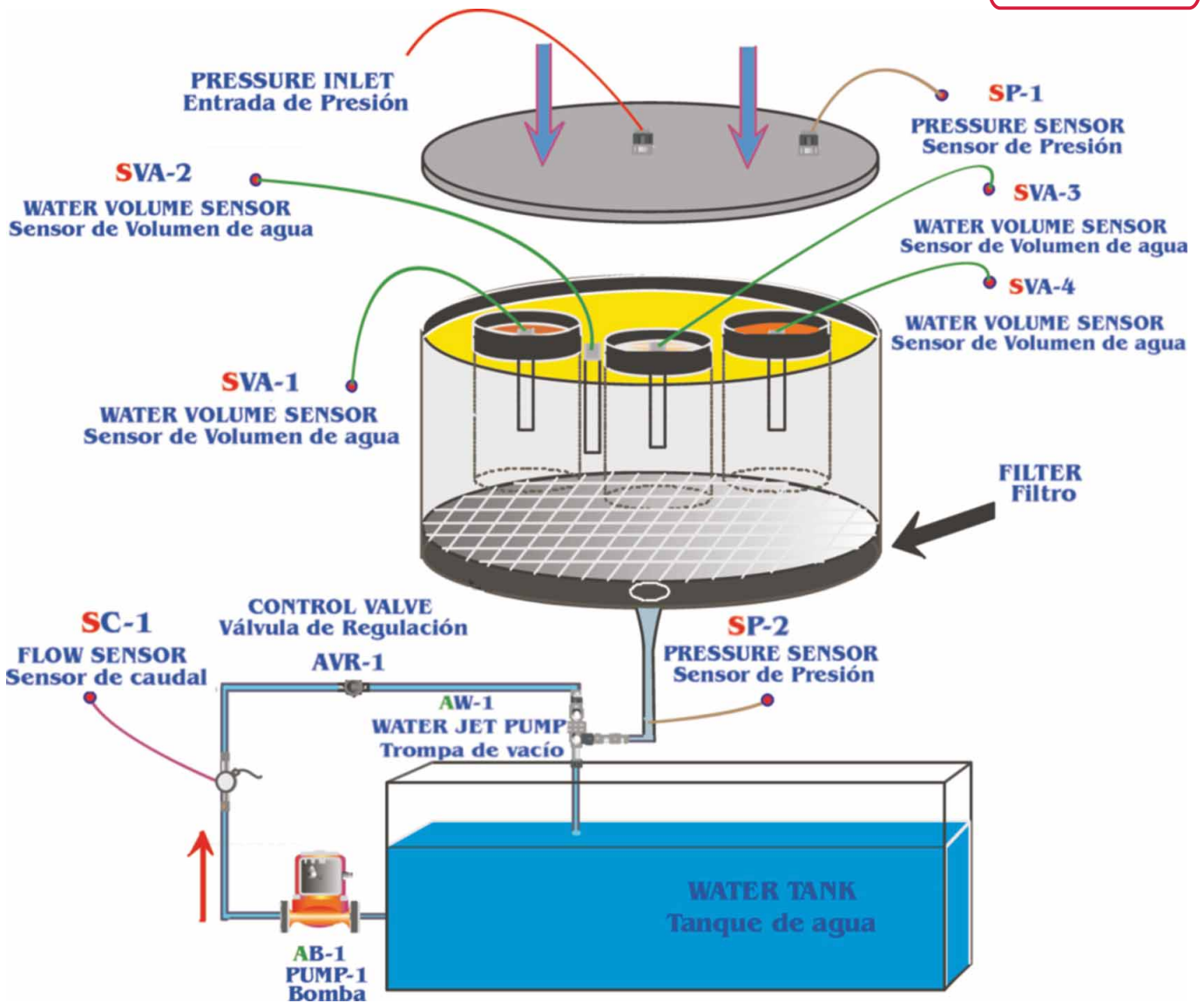
- Suction system, composed by a water circuit (including a water tank), that is impelled by a pump that makes the water flow through a water jet pump, that sucks the water of the soil container. It has a flow sensor and a pressure sensor.
- Soil container, it is composed by a cylindrical tank that contains the wet sand. Inside of the sand you must introduce the soil samples and the volume sensors. It also has a pressure sensor and an air inlet (to pressure the environment).

With this unit, computer controlled, it is provided the EDIBON Computer Control System (SCADA) that includes: Control Interface Box+Data Acquisition Board + Control Software and Data Acquisition for controlling the process and the different parameters.

PROCESS DIAGRAM AND UNIT ELEMENTS ALLOCATION

1 actuator and 7 sensors controlled from any computer, and working simultaneously

OPEN CONTROL
+
MULTICONTROL
+
REAL TIME CONTROL



Items supplied as standard

① PAHSC. Unit:

- Anodized aluminium structure.
- Panels and main metallic elements in stainless steel.
- Diagram in the front panel with similar distribution that the elements in the real unit.
- Suction system, including:
 - Water circuit.
 - Water tank, capacity: 5 l.
 - Water pump, range: 3 l./min.
 - Water jet pump.
 - Pressure sensor, range: -1 to 1 bar.
 - Flow sensor, range: 0-3 l./min.
- Soil container, including:
 - Filter.
 - Transparent circular tank for filling with sand. Capacity: 15 l.
 - 4 soil sample retaining rings. Capacity of each one : 0.3 l.
 - 4 water volume sensors (humidity), range: 0.5 l.
 - Pressure sensor, range: 0-2.5 bar.
 - Air inlet (pressure inlet).



PAHSC. Unit

② PAHSC/CIB. Control Interface Box :

- Control interface box with process diagram in the front panel and with the same distribution that the different elements located in the unit, for an easy understanding by the student.
- All sensors, with their respective signals, are properly manipulated from -10V. to +10V. computer output. Sensors connectors in the interface have different pines numbers (from 2 to 16), to avoid connection errors. Single cable between the control interface box and computer.
- The unit control elements are permanently computer controlled, without necessity of changes or connections during the whole process test procedure. Simultaneous visualization in the computer of all parameters involved in the process. Calibration of all sensors involved in the process.
- Real time curves representation about system responses. Storage of all the process data and results in a file. Graphic representation, in real time, of all the process/system responses.
- All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process. All the actuators and sensors values and their responses are displayed on only one screen in the computer.



PAHSC/CIB

Shield and filtered signals to avoid external interferences.

Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Real time computer control for pumps, compressors, resistances, control valves, etc.

Open control allowing modifications, at any moment and in real time , of parameters involved in the process simultaneously.

Three safety levels, one mechanical in the unit, other electronic in the control interface and the third one in the control software.

③ DAB. Data Acquisition Board:

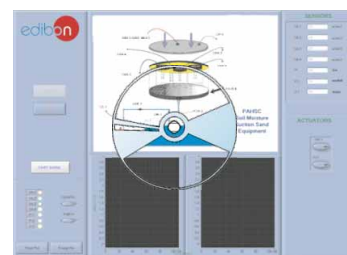
- PCI Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI.
- Analog input:
 - Number of channels= 16 single-ended or 8 differential. Resolution= 16 bits, 1 in 65536.
 - Sampling rate up to: 250 KS/s (Kilo samples per second).
 - Input range (V)= ±10V. Data transfers=DMA, interrupts, programmed I/O. Number of DMA channels=6.
- Analog output:
 - Number of channels=2. Resolution= 16 bits, 1 in 65536. Maximum output rate up to: 833 KS/s.
 - Output range(V)= ±10V. Data transfers=DMA, interrupts, programmed I/O.
- Digital Input/Output:
 - Number of channels=24 inputs/outputs. D0 or DI Sample Clock frequency: 0 to 1 MHz.
 - Timing: Counter/timers=2. Resolution: Counter/timers: 32 bits.



DAB

④ PAHSC/CCSOF. Computer Control+ Data Acquisition+ Data Management Software:

- Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. Compatible with the industry standards.
- Registration and visualization of all process variables in an automatic and simultaneous way. Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters. Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second.
- Calibration system for the sensors involved in the process.
- It allows the registration of the alarms state and the graphic representation in real time.
- Comparative analysis of the obtained data, after the process and modification of the conditions during the process.
- Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.
- This unit allows the 30 students of the classroom to visualize simultaneously all results and manipulation of the unit, during the process, by using a projector or an electronic whiteboard.



PAHSC/CCSOF

⑤ Cables and Accessories, for normal operation.

⑥ Manuals:

This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

***References 1 to 6: PASHC + PASHC/CIB + DAB + PASHC/CCSOF + Cables and Accessories + Manuals are included in the minimum supply, enabling a normal operation.**

Additional and optional items to the standard supply

PLC. Industrial Control using PLC (7 and 8):

⑦ PLC-PI. PLC Module:

Circuit diagram in the front panel.

Front panel:

Digital inputs(X) and Digital outputs (Y) block:

16 Digital inputs, activated by switches and 16 LEDs for confirmation (red).

14 Digital outputs (through SCSI connector) with 14 LEDs for message (green).

Analog inputs block:

16 Analog inputs (-10V. to + 10V.)(through SCSI connector).

Analog outputs block:

4 Analog outputs (-10V. to + 10V) (through SCSI connector).

Touch screen:

High visibility and multiple functions.

Display of a highly visible status.

Recipe function.

Bar graph function.

Flow display function.

Alarm list.

Multi language function.

True type fonts.

Back panel:

Power supply connector.

Fuse 2A.

RS-232 connector to PC.

USB 2.0 connector to PC.

Inside:

Power supply outputs: 24 Vdc, 12 Vdc, -12 Vdc, 12 Vdc variable.

Panasonic PLC:

High-speed scan of 0.32 μsec. for a basic instruction.

Program capacity of 32 Ksteps, with a sufficient comment area.

Power supply input (100 to 240 V AC).

DC input: 16 (24 V DC).

Relay output: 14.

High-speed counter.

Multi-point PID control.

Digital inputs/outputs and analog inputs/outputs Panasonic modules.

Communication RS232 wire, to computer (PC).

⑧ PAHSC/PLC-SOF. PLC Control Software:

For this particular unit, always included with PLC supply.



PLC-PI

Items available on request

⑨ PAHSC/CAL. Computer Aided Learning Software (Results Calculation and Analysis).

⑩ PAHSC/FSS. Faults Simulation System.

Software Main Screens

Main screen

The main screen features the edibon logo in the top left. In the center is a schematic diagram of the PAHSC Soil Moisture Suction Sand Equipment, showing a pressure inlet, four water volume sensors (SVA-1 to SVA-4), two pressure sensors (SP-1, SP-2), a filter, a water tank, and a pump (AB-1) with a flow sensor (SC-1). On the right, a 'SENSORS' panel displays real-time data for SVA-1 to SVA-4 (all at 0.0 m³/m³), SP-1 and SP-2 (both at 0.0 bar), and SC-1 (at 0.0 l/min). Below this is an 'ACTUATORS' panel with controls for AB-1 (Pump) and BAS. The bottom section contains two empty graphs labeled 'Graph A' and 'Graph B', each with an amplitude axis from 0 to 2.8 and a time axis from 0 to 100 seconds. On the left side, there are buttons for 'START', 'STOP', 'START SAVING...', and a status indicator for sensors (SVA-1 to SVA-4, SP-1, SP-2, SC-1) with '2 GRAPHS' and 'Graph A' options.

Note: SVA= Water Volume sensor. SP= Pressure sensor. SC= Flow sensor. AB= Pump.

Examples of Sensors Calibration screens

The calibration interface is divided into two main parts. On the left is a 'Single Sensor Calibration' window for sensor SC-1. It shows the 'Analog Input Channel' set to SC-1, 'Sensor Name' as SC-1, and 'Least Squares Fit' selected. The 'Gain' is 7.35436 and the 'Offset' is -0.5593. The 'PTA' is set to 10. The 'Volts' are 4.948 and the 'Calibrated' value is 35.83. There are 'ENTER' and 'DONE' buttons. On the right is the 'Simultaneous Calibration' screen, which displays a table of sensor data and calibration parameters.

Select	Sensors	Volts	Calibrated	AT	GAIN	OFFSET	r
<input type="checkbox"/>	ST-1	0.2753	28.8346	28.83	101.705	0.8354	0
<input checked="" type="checkbox"/>	ST-2	0.3335	29.7856	29.79	98.5001	-3.0594	0
<input checked="" type="checkbox"/>	ST-3	0.331	29.0641	29.06	102.291	-4.7913	0
<input checked="" type="checkbox"/>	ST-4	0.3254	29.5453	29.55	102.262	-3.7268	0
<input checked="" type="checkbox"/>	ST-5	0.3295	28.4276	29.43	101.438	-3.8967	0
<input checked="" type="checkbox"/>	ST-6	0.3458	34.752	34.75	91.5356	3.1025	0
<input type="checkbox"/>		-0.0037	-0.0037	0	1	0	0
<input type="checkbox"/>		-0.004	-0.01826	0.02	105.08	-7.5992	0
<input type="checkbox"/>		3.4768	3.4768	3.48	1	0	0
<input type="checkbox"/>		3.215	291.888	291.89	92.6831	-6.0846	0
<input type="checkbox"/>		3.066	3.066	3.07	1	0	0
<input type="checkbox"/>		2.6614	2.6614	2.66	1	0	0
<input type="checkbox"/>		2.4281	2.4281	2.43	1	0	0
<input type="checkbox"/>	SC-1	0.1291	0.1424	0.14	SC-1	0.764847	0.0411
<input type="checkbox"/>	SC-2	0.0104	-0.0211	0.02	SC-2	0.3193	-0.0307
<input type="checkbox"/>	AN-1	5.9886	5.9886	5.99	AN-1	1	0

The 'Simultaneous Calibration' screen also includes a 'Reference Value' field set to 0, a 'Data taken' counter at 0, and 'ENTER', 'DONE', 'EXIT', and 'SAVE & EXIT' buttons at the bottom.

EXERCISES AND PRACTICAL POSSIBILITIES

Some Practical Possibilities of the Unit:

- 1.- To understand the relationship between water retentivity and soil.
- 2.- To understand the basic principles of water retentivity in terms of soil suction.
- 3.- Derive soil moisture characteristic curves for several soils.
- 4.- Effect of the atmospheric pressure.

Other possible practices:

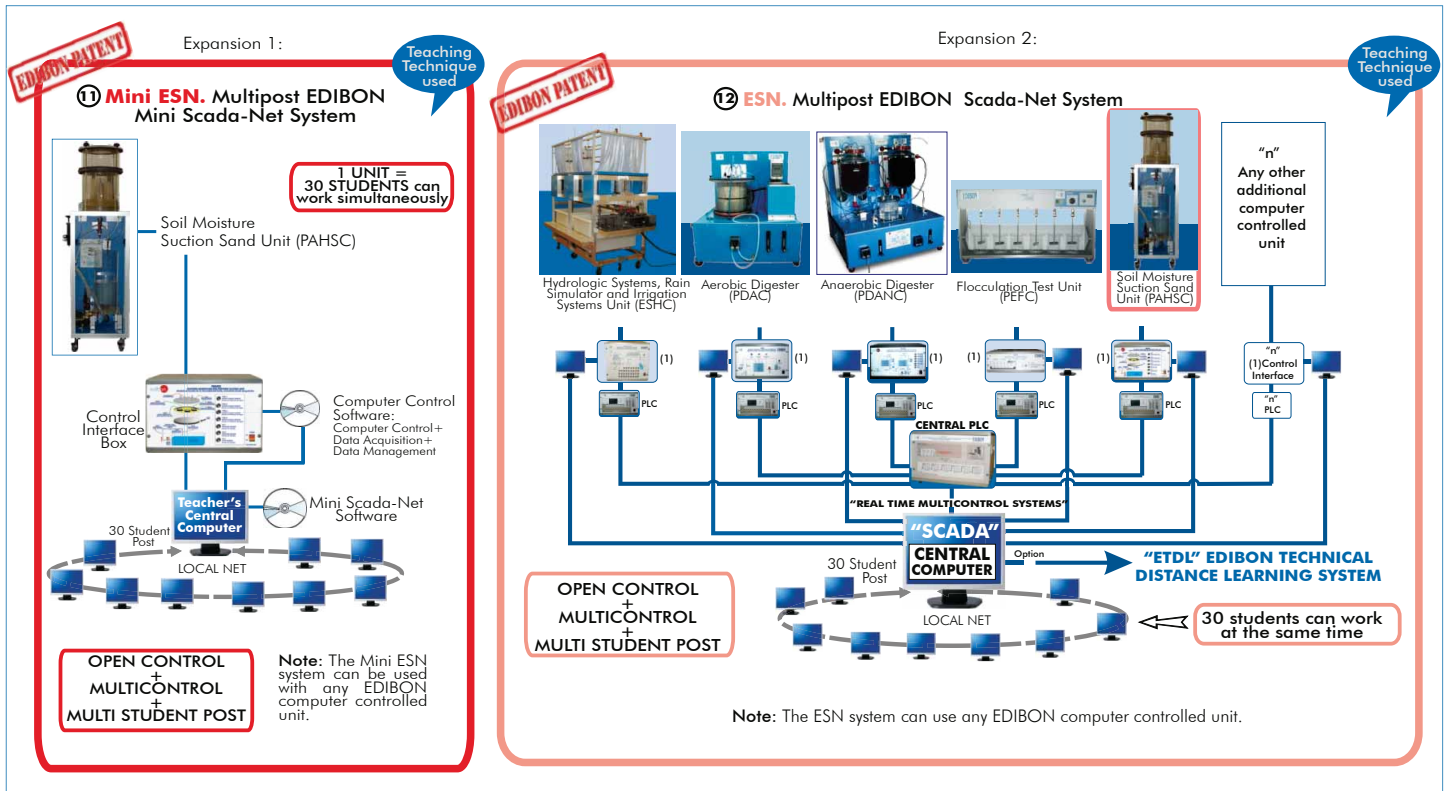
- 5.- Sensors calibration.

Practices to be done by PLC Module (PLC-PI) + PLC Control Software:

- 6.- Control of the PAHSC unit process through the control interface box without the computer.
- 7.- Visualization of all the sensors values used in the PAHSC unit process.
- 8.- Calibration of all sensors included in the PAHSC unit process.
- 9.- Hand on of all the actuators involved in the PAHSC unit process.
- 10.- Realization of different experiments, in automatic way, without having in front the unit. (This experiment can be decided previously).
- 11.- Simulation of outside actions, in the cases do not exist hardware elements. (Example: test of complementary tanks, complementary industrial environment to the process to be studied, etc).

- 12.- PLC hardware general use and manipulation.
- 13.- PLC process application for PAHSC unit.
- 14.- PLC structure.
- 15.- PLC inputs and outputs configuration.
- 16.- PLC configuration possibilities.
- 17.- PLC program languages.
- 18.- PLC different programming standard languages (literal structured, graphic, etc.).
- 19.- New configuration and development of new process.
- 20.- Hand on an established process.
- 21.- To visualize and see the results and to make comparisons with the PAHSC unit process.
- 22.- Possibility of creating new process in relation with the PAHSC unit.
- 23.- PLC Programming Exercises.
- 24.- Own PLC applications in accordance with teacher and student requirements.

POSSIBILITIES OF OTHER AVAILABLE EXPANSIONS



ORDER INFORMATION

Items supplied as standard

Minimum configuration for normal operation includes:

- ① Unit: PAHSC. Soil Moisture Suction Sand Unit.
- ② PAHSC/CIB. Control Interface Box.
- ③ DAB. Data Acquisition Board.
- ④ PAHSC/CCSOF. Computer Control + Data Acquisition + Data Management Software.
- ⑤ Cables and Accessories, for normal operation.
- ⑥ Manuals.

*** IMPORTANT: Under PAHSC we always supply all the elements for immediate running as 1, 2, 3, 4, 5 and 6.**

Additional and optional items to the standard supply

PLC. Industrial Control using PLC (7 and 8):

- ⑦ PCL-PI. PLC Module.
- ⑧ PAHSC/PLC-SOF. PLC Control Software.
- ⑨ PAHSC/CAL. Computer Aided Learning Software (Results Calculation and Analysis). (Available on request).
- ⑩ PAHSC/FSS. Faults Simulation System. (Available on request).

Expansions

- ⑪ Mini ESN. Multipost EDIBON Mini Scada-Net System.
- ⑫ ESN. Multipost EDIBON Scada-Net System.

REQUIRED SERVICES

- Electrical supply: single phase, 220V/50Hz or 110V/60 Hz.
- Computer (PC).
- Water supply.
- Drainage system.
- Sand.

DIMENSIONS & WEIGHTS

- PAHSC Unit: -Dimensions: 400 x 500 x 1200 mm. approx.
-Weight: 90 Kg. approx.
- Control Interface Box: -Dimensions: 490 x 330 x 310 mm. approx.
-Weight: 10 Kg. approx.
- PLC Module (PLC-PI): -Dimensions: 490 x 330 x 310 mm. approx.
-Weight: 30 Kg. approx.

AVAILABLE VERSIONS

Offered in this catalogue:

-PAHSC. **Computer Controlled Soil Moisture Sand Unit.**

Offered in other catalogue:

-PAHS. **Soil Moisture Sand Unit.**

*Specifications subject to change without previous notice, due to the convenience of improvements of the product.



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