

# easySPT100

User Manual



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## 1 PREMISE

New volumetric sampler for pollen, spores and other airborne particles between 1 and 100 µm in size. It is of the "HIRST" type, complies with the EN16868:2019 standard and is certified in capture efficiency. Battery powered, equipped with an internal flowmeter, it is easy to transport and handle. It can be supplied with an interchangeable daily or weekly sampling head. It houses up to 4 groups of batteries ensuring continuous operation, without external power supply, from 1 to 5 days. The pump speed and flow rate are electronically controlled and for the flow the regulation accuracy is 0.4l/m. The instrument is completed by a control panel for setting the system operating parameters and a Bluetooth module for connection to external.

## 2 TECHNICAL SPECIFICATIONS

#### 2.1 Mechanical characteristics

Size	L: P 370mm: 220mm H: 140mm
Weight (empty)	5kg
Weight (Full)	7kg
Height Tripod short legs	H: 300mm - Ø500mm
Height Tripod long legs	H: 1000mm -Ø1000mm
Materials	Alluminum and Polyethylene
Suction nozzle	2x14 mm
Flow regulation	4 up to 15l/m
Sampling surface	Transparent strip (easyStrip for example)
Sam. surface transaltion	$2\pm0,02$ mm/h
Safety standard	CEE 73/23 and 89/336/EE

#### 2.2 Electronic Characteristics

External DC IN	Min: 13.8V, Max: 21V
Battery operating voltage	Low: 9V, Max: 13V
Pump informations	Brush motor 80mAh / 6000h
Batteries	Max 12 cylindrical elements mod.18650 2200mAh 3.6V
	rechargeable lithium batteries.
Battery protection.	• Minimum level 9.5V with automatic detachment.
	Temperature
	Maximum charge level.
	Auto power off in standby.
Battery Duration	5 days with batteries full charged
Charging time:	MPPT (Maximum power point tracking) charging system with
	a maximum current of 1500mAh. With all batteries inserted
	the average time to full charge is about 8 hours.
Solar Panel	2x20W 21V open circuit.

## 2.3 Flow Sensor Characteristics

Flow measurement	From 5 l/m up to 20 l/m $\pm$ 0.5 l/m
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## 3 Check-list of the three configurations









## **Light Version**

- 1) easySPT100 LIGHT.
- 2) Allen key.
- 3) Power supply adaptor.
- 4) Power supply.

### **Base Version**

- 1) easySPT100.
- 2) Rain shield.
- 3) Wind vane.
- 4) Power Supply.
- 5) Power supply adaptor.
- 6) Mains cord for supply.
- 7) Allen keys and Knobs.
- 8) 10M extension cord.
- 9) Short legs fixing base.
- 10) Short legs.
- 11) Rotating contact.

## **Full Version**

- 1) easySPT100.
- 2) Rain shield.
- 3) Wind vane.
- 4) Power Supply.
- 5) Power supply adaptor.
- 6) Mains cord for supply.
- 7) Allen keys and Knobs.
- 8) 10M extension cord.
- 9) Short legs fixing base.
- 10) Short legs.
- 11) Rotating contact.
- 12) Double solar panels adaptor.
- 13) Tripod (divided in two parts)
- 14) Solar panels.



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## 4 First time assembly (Skip this chapter for "Light" version).

The instrument and it's components have been designed to minimize the overall dimension and weight during transport. Also some components are disassembled to protect them during transport. For these reasons one time received the box is necessary to assemble these parts and complete the instrument.

#### 4.1 Assembly rain shield.

The screw are installed on the cover so unscrew it with the correct Allen key. After that put the shield with circular shape, figure 4.1.1, on the front of the cover and screws it. Fix the other shield on the rear of the cover and screws it (figure 4.1.2).



Figure 4.1.1

## 4.2 Assembly wind vane.

The screw are installed in the handle, so unscrew them and put the wind vane holes in correspondence of the holes in the handle. Using the Allen key tighten the two screws and fix the wind vane in the handle (figure 4.2.1). At this point easySPT100 is assembled (figure 4.2.2)



Figure 4.2.1



Figure 4.2.2

Figure 4.1.2

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#### 4.3 Tripod with solar panels.

The long legs tripod has been thought to be able to position the tool outside, secure it to the ground and allow the installation of a solar panel for charging the batteries.

It is made of aluminium, is simple to assemble and enables a robust and reliable support to the instrument. It consists of three main parts:

- Tripod.
- Rotating contact.
- Solar Panel, double 20W panel .

*It is important to find a positioning area as flat as possible because for the correct operation of the instrument, rotation in the wind direction, it is essential that the instrument will be horizontal.* 

The new version of the tripod is divided in two parts to fit inside instrument carton box and facilitate transportation. For this reason it's necessary to mount all parts before position it.

You will find 3 legs (Fig.3), with circular foot, and each of them are provided with two allen screws installed on correct side. During transport these three legs are fixed to the other part of the tripods using plastic clamp (Fig.1). Each leg is clamped to the half-leg where it must be mounted. When you receive the tripod you have to free legs by cutting these clamps. The suggestion is to free one leg at time and fix it to the corresponding half-leg where it has been clamped, before free other leg. Below from Fig2 to Fig4 the step to install legs.



#### 4.4 Opening of the tripod and install the sliding contact.

To open the tripod lift slightly from the ground, in an upright position, as in the image to the left, and extend the legs until the central guide does not reach the locking ring.





Once you open the tripod, you can use a bubble level to make it horizontal. If you do not have a bubble level it is possible to perform this operation once the sampler is fastened to it using the bubble level on the cover. Next operation is to fix the sliding contact on the tripod.





The base has 3 holes in which to insert the fixing screws of the sliding contact. Place the sliding contact with the input cable, bottom cable, in correspondence of the support bar of the solar panel.

Fixed the sliding contact at the base of the tripod is now possible to mount the solar panel.

If you check the base of the tripod, where you fixed sliding contact, you can find three bevels at 120 degree. For each bevels you can find two holes for screws. The distance between this two holes is the same of the holes in the hinge installed on the solar panels. In the next chapter we will describe how to install solar panels on the tripod.

#### 4.5 Install the double solar panel (20W)

The installation of the two solar panel is similar to the previous chapter 3.2. The main difference is that the tripod is provided with two extension, Fig.1 and Fig.2. To fix the two solar panel use the screw provided and the Allen key also provided (Fig.3)



Fix the two panels using the two extension present in the tripod base (Fig.5). After that you have to connect the two solar panels with the cable coming from the sliding contact (Fig.6). For this purpose we provide a cross cable like in Fig.4.

Use the support bars, figure Fig.7, to fix solar panel with the right inclination. As explained before is important to turn the sampler in south direction to have maximum performance of the solar panel.



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#### 4.6 Install the sampler.

The sampler is equipped, on the basis, of 4 fixing points identified by the arrows (Fig.1). These attachment points are not symmetrical but two, those from the nozzle side, are wider than the other two. The support base is similar to a "T" then the two wider fixing point will be placed on the widest part of the sliding contact. Then use the knobs provided to hold the four points as in the image (Fig.2). Connect the cable of the sliding contact to the DC connector on the rear panel (Fig.3).



4.7

To avoid problems in case of strong wind, the sampler should be fixed as firmly as possible to the ground. For this reason it is equipped with two fixing solutions:

1. Fixing with picket or plug of the 3 disks.

Tips for fixing to ground.

2. Attaches via weights or loop.

The first solution utilizes the holes present in the three disks (Fig.4). The hole in each of the three support discs allows the use of dowels, screws or pegs for fastening to the tripod soil. If you have an hard surface the screw plug is the most suitable. If the base is made of wood, or a material in which to use self-tapping screws, we recommend the use of screws directly. If, however, the instrument is placed on the ground using picket is the most indicated. In addition to these holes, the stand is equipped with a small pin inside the slide tube (Fig.5). Observing from under the tripod is visible that pin. It's possible, using an hook, to attach a strap to secure the tripod to a weight or fix it to the ground. If you are using a weight is important to size correctly, consider that solar panel acts as a "sail", so we suggest at least 30Kg of weight.

Is however suggested, especially in very windy areas, to use both systems together for a more secure fastening of the instrument.

<u>Please be careful to better fix the instrument to ground because the solar panel are a big</u> <u>surface for the wind.</u>





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## 5 First start of the sampler.

When you receive a new sampler from our factory, for transport security, batteries are disconnected from electronic. For this reason is necessary to follow some step to startup:

- 1. Open the instrument cover to enter the inside part of it.
- 2. Remove the carter protection by unscrew the four Allen-keys.
- 3. You will find a cable disconnected from connector (Fig.1). Connect it (Fig.2).
- 4. Replace the carter protection by screwing the four Allen-keys.
- 5. Close the instrument cover using the four hooks.
- 6. Switch on the instrument by pressing the ON/PWR button
- 7. Wait the complete power-up and the STAND-BY message (Fig.3)
- 8. Press and hold the OK button for at least 3 seconds (Fig.4 and 5)
- 9. At this point the pump will start and display will change as Fig.6 displaying the read flow rate.
- 10. Usually we factory set the flow rate to 10 l/m so you doesn't need to change it.
- 11. If you need use + and buttons to change flow rate Fig.7.
- 12. The instrument is ready and operative.





Remember that easySPT100 is equipped with an electronic flow meter inside. When switched on the instrument, the software will try to maintain constant the flow rate according with the set value. For this reason if you open the cover of the instrument, and also the carter, the flow rate measure will be influenced by the drop of pressure and the software will try to reach the set value increasing the speed of the pump up to le maximum limit. This isn't a problem for the instrument but our suggestion is to stop the instrument before open it.

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## 6 Control panel

#### 6.1 General description.

In the rear of the instrument is placed control panel where you can manage and view main operating parameters.



The rear panel can be divided into 4 main areas:

- 1. Display.
- 2. Buttons to view and modify operating parameters. Starting from the left the first three buttons are used to change parameters and navigate through the various menus. The MENU button instead allows you to move between the main menu and submenus.
- 3. Power button. The instrument is equipped with an automatic shutdown system and for this reason the button is only used for to start but not to stop instrument.
- 4. Voltage input for charging the batteries or, if you leave all batteries from "battery box", to supply the instrument.

Once switched on, the display will show for few seconds information about the name of the instrument, hardware / firmware versions and serial number.



After 6 seconds the main menu will appear.

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#### 6.2 Buttons description.

#### 6.2.1 Button $\leftarrow$ - (DOWN)

Decrement button. It is used to:

- Decrease the suction flow. If you are in the main menu and the pump is on. The button allows you to decrease the flow rate.
- Previous sub-menu.
- Scroll "up" parameters of the selected sub-menu.
- Decrease the value of a selected parameter when in editing.

#### 6.2.2 Button OK.

Confirmation button. It is used to:

• Switch on and switch off the instrument pump. This is done by holding pressed this button for 3 seconds in the main menu. The display will show a countdown and the new status at which that instrument will be set when timer expires. This operation will change from Start to Stop and viceversa.



- Enter selected sub-menu .
- Enter or exit data input. When you want to modify a parameter this button allow you to enter and exit the editing. The pression of this button to exit editing will save modifications. To avoid the saving procedure the "Menu" button can be used as an "Escape" button. By pressing "Menu" button in editing will discharge the modification.

#### 6.2.3 Button $\rightarrow$ + (UP)

Increment button. It is used to:

- Increasing the suction flow. If you are in the main menu and the pump is on the button allows you to increase the flow rate.
- Next sub-menu.
- Scroll to the "bottom" of the parameters of the selected sub-menu.
- Increase the value of a selected parameter when in editing.

### 6.2.4 Button MENU

Selection button. It is used to:

- Switching between the main menu and sub-menu.
- Exit from a sub-menu.
- Discharge of a change during the input of data value.

#### 6.2.5 UP + DOWN pressed simultaneously.

It 'a special situation that allows you to perform secondary functions depending in which menu you are. to check only one display instead of two at the opposite side.

If you are in the *Events* menu, by pressing simultaneously the two buttons you will be able to clear the event memory. A countdown message of 3 seconds will be displayed. When timer expires all event data will be deleted. If you stop the count before the expiration of 3 seconds, the deletion of events memory will not occur. When logs memory is deleted the first event sored after deletion will be a "Clear LOGS".



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## 6.3 Menu map

Below you can find all menus and the relative submenus

Logs >	< Config >	< Info >	< Batt.
Config	Logs Info	Confi9 Batt.	Info
•	•	•	•
000: <b>0</b> 6/06 11:19	>Hour : 11	>FW.Ver: 1.33	>DC IN : 18.7 V
Pump ON	Min : 20	HW.Ver: 2.02	Batt. : 12.8 V
	>Min : 20	>HW.Ver: 2.02	>Batt. : 12.9 V
	Sec : 6	FW.Bat: 1.15	Curr. : 0.96 A
004:26/06 11:18	>Sec : 6	>FW.Bat: 1.15	>Curr. : 0.97 A
Start Char9er	Day : 26	HW.Bat: 2.03	Batt 1:∣ 11.6 V
	>Day : 26 Month : 6	<pre>&gt;HW.Bat: 2.03 Exit submenu</pre>	>Batt 1:∎ 11.6 V Batt 2:∎ 12.1 V
050 <b>1/:</b>	>Month : 6		>Batt 2:∎ 12.1 V
Empty	Year : 19		Batt 3:∎ 12.2 V
+ & - Pressed	<pre>&gt;Year : 19 Lan9. :English</pre>		>Batt 3:∎ 12.2 V Batt 4: V
	>Lang. :English Id Num: 1		>Batt 4: V Temp. : 36.7 C
000:26/06 11:21	>Id Num: 1		>Temp. : 36.0 C
Clear LOGS	Auto F: 0.01m		Status:Char9e
	>Auto F: 0.01m Cycle : 24 h		>Status:Char9e Exit submenu
	>Cycle : 24 h Exit submenu		

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#### 6.4 Main menu

This menu provides the main operating information. The messages displayed in this main menu it's dependent by the status of different parameters like power supply, present or absent, pump status, on or off, and batteries status like level of charge.

The following table shows different situations that can be displayed.



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#### 6.5 Secondary menus.

Secondary menus let you view and edit the instrument configuration parameters.

To enter the secondary menu, simply press the Menu button. Once inside the sub-menu by pressing again Menu return to main menu. By pressing  $\leftarrow$  and  $\rightarrow$  buttons is possible to move between the submenus and with button OK is possible to enter the selected sub-menu



Row 1 of the display will show the selected submenu that can be entered by pressing OK.

The < (minor) symbol indicates that there are others sub-menus on the left that you can access by pressing  $\leftarrow$ . If < (minor) isn't present you have reached the first sub-menu (first picture above).

The > (major) symbol indicates that there are others sub-menus on the right that you can access by pressing  $\rightarrow$ . If > (major) isn't present you have reached the last menu available (last picture below).

In Line 2 you can view, if present, the previous (left) and the next (right) sub-menu.

Once the desired sub-menu has been selected press the OK button to enter.

Except for the Logs submenu, in all other cases you can find a list of parameters and a cursor, on the left, indicating the selected parameters.

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#### 6.5.1 Logs menu (Events).

Displays the last 125 events in chronological order. Each event will display the date and time in which it occurred, and the event name. The event 0 is the latest event while the 125 is the oldest. The Logs memory is "circular" and, when full, a new event will overwrite the last one. The managed events are:

1	Power ON	Switch on instrument
1.		
2.	Power OFF	Automatic switch off.
3.	Low Battery	Low Battery.
4.	Start Charger	Start of battery charging.
5.	Stop Charger	Stop of battery charging.
6.	Pump ON	Pump On (SAMPLING)
7.	Pump OFF	Pump Off (STAND-BY)
8.	Watchdog Reset	For test (internal use).
9.	Clear LOGS	Clearing events memory
10.	Memory Initial.	For test (internal use).
11.	Prot.Temp. Start	Reached a temperature of 75 °C of the "battery box"
12.	Prot.Temp. Stop	End of the temperature alarm
13.	I2C Comm.Problem	For test (internal use).

The event display is as from image



- A. Number of position in the event log from 0 to 125. 0 is the most recent.
- B. Name of the event.
- C. Date and time of the event

Using the buttons  $\leftarrow$  is  $\rightarrow$  it is possible to move between the different stored events. When reached the last available event the display will show an empty message:

0508-	/	
	Empty	

By pressing simultaneously the buttons  $\leftarrow$  is  $\rightarrow$  for 3 sec the events memory will be cleared. The Clear LOGS event will be stored as first event after cancellation



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#### 6.5.2 Configuration menu (Config).

In this menu you can view and change operating parameters. In particular:

- Date and time used for the proper storage of events.
- Language to be used (Italian and English).
- ID number to identify the instrument BLE connection.
- Flow value for automatic regulation.



The Id Number parameter sets a number from 1 to 250 that allows the identification of the instrument among others present in the area. The instrument is equipped with a BLE module for wireless connection. When switched on the instrument "emits" information, beacons, with operating information. By using a Bluetooth applications, sniffer, you can view this data. It's clear that, if the instrument is located in close proximity with others of the same type, it is necessary to be able to identify it. For this reason the ID number will be added at the end of the name as in the below image.



The Auto F represents the desired flow rate, typically 10 l/m, that the system tries to reach automatically. This value can be modified also from main menu when you change the flow rate using + and - button. The Cycle parameter is used only if Cyclone head is present so isn't useful for easySPT100 instrument.

#### 6.5.3 Information menu (Info)

The information menu shows the data relating to hardware and software versions installed.



Versions of Hardware and Firmware programmed on the control panel, FW.Ver HW.Ver, and the version programmed into the "battery box" (FW.Bat and HW.Bat) are reported. This information is used mainly in case of service or repair.

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#### 6.5.4 Batteries Menu (Batt.)

This menu contains information about batteries status. The control panel read these information from internal "battery box". This operation is possible only if a voltage is provided on DC IN connector, otherwise you will see everything at 0. The information read are:



The status of each pack of batteries is represented by four rows "Batt 1..4". For each battery pack the information reported are:



For each battery pack the "Battery voltage" field can report the following information:

- "-----" Battery pack not present. (Image above for Batt 4)
- "11.9V" Voltage of the battery pack. Batteries present with a voltage of 11.9V.
- "Fault" Problems with the battery pack.

The "Charging Bar" is a bar that identifies the state of charge of a battery. It is a bar made up of five lines that can identify the following states:

- Bar in movement. Battery charging.
- Static full bar (5 lines). Battery fully charged.
- Bar completely off. No battery present.

The "Status" can have the following values:

.

- Charge Battery in charge.
- Standby Battery charged.

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#### 6.5.5 Special messages.

This message is displayed when the instrument restart after a switch off for low batteries voltage. It remains on the display up to the batteries voltage reach the threshold of 12V.



When the instrument is switched off for a low batteries voltage, under 9V, it can restart for one of the following situation:

- A supply voltage is provided on the DC IN connector.
- Power button is pressed.

If the instrument is connected to a solar panel the problem could be that DC IN voltage grows and falls for low insolation. In this situation the instrument will switch off and on continuously discharging the batteries up to the death. To avoid that there is a software protection that each time the instrument restart will wait 30minutes, and however a batteries voltage major 10V, before start the pump. This situation is displayed with this message.

The other messages is the "LOW BATTERY".



This message is displayed when the battery voltage decrease under 9V. When reached the possible situations are:

- A voltage is present on the DC IN connector. The message is the same of the above image. After some seconds the voltage is displayed in the second line. The message remain on the display up to the battery voltage reaches the 12V. At this point if the pump was previously on will be switched on.
- Non voltage on the DC IN connector. The message is displayed for 5 seconds and at the end the instrument will be switched off.

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## 7 Using the flow meter easyFlux.

The flowmeter easyFlux allow to set the intake flow of the instrument in a precise and repeatable manner. It can be used in 3 ways:

- 1. Using directly the display of the flowmeter itself.
- 2. Using the easySPT100 display over the wireless connection.
- 3. Automatic calibration via the wireless connection.

#### 7.1 Set flow rate using easyFlux display.

Is the basic method of adjustment that allows the use of easyFlux also with other instrument not equipped with BLE wireless connection. Push the power button and insert the adaptor of easyFlux into the nozzle of the instrument. Use the + and - buttons to adjust the intake flow until reaching the desired value (normally 10 l/m) read from flowmeter display. Whenever the flow rate is modified using the + and - buttons the new value is stored in an internal memory and will be used every time the instrument will start.

### 7.2 Set flow rate using the easySPT100 display.

In order to facilitate the adjustment of easySPT100, since the keyboard is located on the opposite side of the nozzle, it's possible to use the wireless BLE connection. Following the procedure in section 6.4 to connect easySPT100 to easyFlux. Once connected the value of the flow rate will be shown together in the easySPT100 display. It's clear that in this situation the adjustment of flow rate will be easier because all operations, read flow rate and adjust flow with + and – button, will take place on the same side of instrument. The connection to the flowmeter will stop:

- After pressing the "Menu" button
- After 3 minutes of inactivity on the keyboard when the system enters a low power consumption.

#### 7.3 Automatic flow rate adjustment .

First you need to set the level of flow "Auto F" following the procedure in section 6.5.2. Suppose you have set 10.0 l/m. This will be the suction flow value that the instrument will attempt to reach automatically once connected to the flowmeter easyFlux. Once you set this value turn on the flow meter and start the BLE connection as described in chapter 6.4. Once connection between easyFlux and easySPT100 take place, the instrument will begin to increase or decrease the suction flow automatically up to reach the value of the set flow. This process will stop:

- Once the flow rate reach the value set in "Auto F"  $\pm$  0.2 l/m
- After pressing the "Menu" button.
- After 3 minutes of inactivity on the keyboard when the system enters a low power consumption.



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## 8 Internal description.

By removing the top cover of the instrument, and removing the metal protection (4), you can see 3 main parts.



- 1. Sampling compartment where the sampling head is hosted which can be daily or weekly. It is located on the side of the suction nozzle and there are present the necessary fixing holes used for the installations of the two heads as described in Chapters 8 and 9.
- 2. The pump / batteries compartment. This part of the instrument contain a sort of cylindrical box ( that we will call "battery box" in the manual) with inside batteries, pump and all electronics necessary to control pump and charge the batteries.
- 3. Control panel compartment with display and user interface.

The three compartments are separated by two "bulkheads" in order to avoid that water or other external agents can pass between compartments.

The electronics of the "battery box" is divided into two parts:





- Electronic for battery monitoring and charging (the cap). This electronic check battery status and decide whether or not to charge a group of batteries. This part receives power from the DC IN connector ad for this reason is active only if an external power is supplied (power supply or solar panel).
- The pump control electronics. This part of the electronic is instead powered by the batteries and control concerned the suction pump maintaining a constant flow to the variation of the battery level.

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#### 8.1 Precautions

The instrument contains inside battery and electronics. For this reason is important to avoid water or conductive substances in addition to contacts with metal parts.

As protection all the electronic, circuit has been treated with and isolation resin and with a metal cover to prevent accidental dropping of water from top cover when opened.

During long periods of inactivity it is also recommended, at least once a month, to connect the external power supply provided and charge instrument for at least 24 hours

For transport it's important to disconnect the connector CN1 in order to separate the electronics from batteries. **CAUTION** must be taken to extract the connectors, before pulling off is important to press the locking tab. If the connector is hard to extract please check if tab is correctly pressed, if no and you continue to pull the risk is to broken a wire.



If the user interface doesn't respond to button pressure, nothing happens when you press any buttons, there could be a problem in firmware. To try a recover procedure press the reset button present on the user interface circuit. Open the cover of the instrument, remove the protection and check the rear of the user interface. There is a little button that must be pressed to reset system. If a DC IN voltage is connected the instrument restart automatically otherwise press the POWER button to start. Remember that this operation is interpreted by the firmware as a "low power" situation and for this reason the system restart with a message "Return from LOW Battery" and wait at least 30 minutes before start. To avoid that when the message appear press OK button for same seconds.



Old Hardware



New Hardware



## 9 Daily Head instructions

In this chapter will be described the installation and use of the daily head. The daily head is composed of the following components:



- 1. Clock, drum and slide for fixing and support.
- 2. Microscope slide support..
- 3. Allen key.
- 4. Two screws complete with washer.
- 5. Ring with o-ring for drum fixing.
- 6. Butterfly key for clock charge.

<u>CAUTION control well that in the locking ring is present the O-ring (below figure) that acts as a "clutch" to</u> prevent damage to the drum or the clock. Then lock the ring witch sufficient force to fix drum on clock.



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#### 9.1 Install the 24-Hour head.

To install the head into easySPT100 we will provide the following parts:







Before start remember these points:

- Remove the microscope slide support from head. To do this the sliding must be in the extraction position that is the same in Fig.2. In each other positions you can't extract the slide support.
- To access screw holes the slide must be in the position of Fig.2. So rotate the drum to reach this position.



FIG. 3

Starting from empty base of the instrument is possible to identify two screw holes used to fix (white arrows in Fig.1) the 24-Hour sampling head. You can also identify a "sliding rail" designed to accommodate the slide of the head.

Insert the 24-Hour head into the rail and move it towards the nozzle until it stops (Fig.2). At this point insert the Reference into nozzle using the side with written "24-HOUR" (Fig.2). The length of this Reference is calculated to set the right distance between 24-Hour head and nozzle inlet that must be around 26.4mm. One time inserted press it inside nozzle up to reach the two overhangs that do not allow you to continue. This is the limit and now the head is right positioned (Fig3).

Using the provided Allen key tighten the two screws to fix the head to the base of the instrument (Fig 4). Position the slide in the position of Fig.4 and insert the microscope slide support in the right position. Charge the clock and start sampling.

FIG. 5

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### 9.2 Positioning slide and charging the watch.

Rotate the drum anti-clockwise to bring the slide which carries the microscope slide in the starting position, that is in the bottom. The clock in fact moves in a clockwise direction so that the movement of the slide will take place from the bottom upwards (Figure 9.2.1).



Figure 9.2.1

Pull out the sled and place the treated glass slide (Figure 9.2.1). Bring back the sled (Figure 9.2.2)



Figure 9.2.1

Figure 9.2.2

Insert charging key and rotate in anti-clockwise to charge the clock spring until it become hard to rotate. At this point the instrument is ready for sampling.

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## 10 Weekly head instructions.

In this chapter will be described the installation and use of the weekly head. The weekly head is composed of the following components:



- 1. Clock with slide for support and mounting.
- 2. Drum
- 3. Ring for drum fixing.
- 4. Butterfly charging key
- 5. Two screws complete with washer.
- 6. Allen key.

<u>CAUTION control well that in the locking ring is present the O-ring (below figure) that acts as a "clutch" to</u> prevent damage to the drum or the clock. Then lock the ring witch sufficient force to fix drum on clock.



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#### 10.4 Install the 7-Day head.

To install the head into easySPT100 we will provide the following parts:













FIG. 3

Starting from empty base of the instrument is possible to identify three screw holes used to fix the 7-Day sampling head (white arrows in Fig.1). You can also identify a "sliding rail" designed to accommodate the slide of the head (Fig.6). Remove the drum to be able to access screw holes.

Insert the 7-Day head into the rail and move it towards the nozzle until it stops (Fig.2). At this point put drum on the clock and insert the Reference into nozzle using the side with written "7-DAY" (Fig.3). The length of this Reference is calculated to set the right distance between 7-Day head and nozzle inlet that must be around 26.4mm. One time inserted press it inside nozzle up to reach the two overhangs that do not allow you to continue. This is the limit and now the head is right positioned (Fig4). Remove drum to access the screws. Using the provided Allen key tighten the three screws to fix the head to the base of the instrument (Fig 4). Install drum, charge the clock and start sampling.



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#### 10.5 Positioning of the drum and charging the watch.

Bring back the drum in the clock bush. CAUTION the drum must be inserted and rotated anti-clockwise so that the drum red mark corresponds exactly with the reference arrow (Fig.1). If you rotate clockwise the drum stops before the reference arrow to indicate an erroneous positioning (Fig.2).



Once inserted the drum properly lock the ring to fix the drum to clock and allow its rotation. CAUTION control well that in the locking ring is present the sealing O-ring which acts as a "clutch" to prevent damage to the drum or the clock. Insert charging key and rotate in anti-clockwise direction to charge the clock spring until it become hard to rotate. At this point the instrument is ready for sampling.





## 11 Preparation of the drum with easyStrip

Below is the procedure for the preparation of a weekly sampling drum using easyStrip. The procedure remains valid even for the preparation with not threated strips. For the procedure we use a drum support, the double-sided adhesive tape, a pair of tweezers and of course the sampling tape.

Install the drum in winding base as shown in Fig.1. Before installing the strip is recommended to clean the drum with alcohol or other solvent by rotating the drum and dabbing with the same solvent. Wait until the solvent has evaporated before proceeding. Once cleaned apply the adhesive as shown in Fig.2 and 3 in correspondence of the mark line by put an amount which is approximately 6mm centered as to allow the fixing of the two opposite edges of the strip.



Pull easyStrip blister from the cartoon box and find the side that has a notch. The purpose of the notch is to keep raised the tape and to facilitate the extraction. Pull using the tweezers, a few cm of this tape as shown in Fig.4. Place the edge of the tape on the mark line and press with tweezers as shown in Fig.5. Begin to wrap holding in tension the tape (Fig.6)









Wrap around all the tape present in the blister. At this point press with the tweezers to fix it as in Fig.7. At this point the procedure is finished and it is possible to extract the drum and install it on the weekly head of the instrument.

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#### 12 Power sources.

The instrument is mainly designed to be powered by batteries. The batteries act as both backups and power source. For this reason the battery holder is made to accommodate from 1up to 4 groups of batteries. If the instrument is near a mains power source it could be configured with only 1 battery group that can guarantee at least 20 hours of operation even if mains fail. Instead if instrument is far from mains it can be configured with solar panel and 4 battery groups to allow an autonomy of at least 5 days without sun. However batteries have a life cycle that depend from different external parameters:

- Number of charge cycle.
- Temperature.
- Discharge
- Etc. etc.

For this reason there could be situations where batteries are in fail (voltage too low, current too low etc. etc.) and in these situations the system doesn't start. For these problem we provided a recover method that allow the user to supply the instrument using directly mains power source and bypassing batteries.

#### 12.1 Mains supply.

As explained before the instrument can be supplied directly form mains using the provided power supply. In a normal situation at least 1 groups of batteries are present inside and in this situations the power supply charge batteries and batteries supply pump. When mains fail the instrument continue to sample without interruption. Again as explained before, in case of batteries failure is possible to bypass them.

To do that follow these steps:

- 1. Open the top of battery holder unscrewing the 4 little knobs. (Figure on right)
- 2. Extract at least 1 batteries for each groups. Check the image of ther next chapter and, starting from reference in clockwire order, remove the batteries 1,4,7 and 10. If you want you can remove also all batteries by flipping the instrument .
- 3. Close again the top of battery holder.
- 4. Insert the power supply plug in the socket and wait 6 seconds.
- 5. After 6 seconds the instrument detect the absence of batteries and bypass them starting .
- 6. On the display you can see the message "Supply" instead of "Battery"

However remember that this is an exceptional situation to avoid stop of sampling. To avoid this problem we recommend a periodic maintenance of the instrument .

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#### 12.2 Batteries.

The system uses lithium battery of type 18650 with a capacity of 2900mAh. The cylindrical battery block, which I'll call hereinafter "holder", may contain a maximum of 12 batteries divided into four groups of three batteries in series. This means that in order to charge each battery pack is necessary that the DC IN connector is supplied with a voltage starting from a minimum of 13.8V to a maximum of 21V (typical values of a solar panel). It uses a charging current of 1500mAh, using an MPPT algorithm, allowing a total recharging of batteries in about 8 hours. The organization of the 4 battery groups is represented in the image.





The "holder" presents, on top, + and - symbols to identify the direction of insertion of the batteries for each positions. The right image shows the battery images to identify the polarity (sometimes the polarity is also shown on the side of the battery). As you can see batteries are inserted following the polarity marked on the charger. Then starting from the "reference" and moving clockwise, the first three batteries are the first battery pack (identified with Batt 1 in Batt menu.), the next three group 2 (Batt 2) and so on for all batteries. Starting from the "reference" the first battery must be inserted with + upwards being reported a + on the charger. The second battery is inserted with the other hand - upwards being reported - on the charger, and so for the remaining

-" indicates the absence of a battery pack.

batteries. A reversal in the insertion of one or more batteries will not damage the system but does not allow the determination of the battery pack for which will not be displayed and loaded. A Batt level menu will display "----

There is also a gummy seal to prevent the suction flow losses, so please check it before closing the charger.

#### 12.3 Batteries maintenance and replacement.

As previously mentioned we used batteries of the type 18650. The reasons for this choice are:

- Wide spreading.
- Low hazard.
- Availability in web sellers..

This type of batteries are widely used in different application including electric traction systems. They don't have the typical problem of the prismatic cells (flammability). A key factor is the large diffusion and availability in local or WW shop. Given the difficulty of transporting batteries in the world the best choice is to use items that can be locally acquired without well know transport problem. Simply do a search on the web such as "Battery 18650" to get a number of results in the major online merchants.

Beware of the false information or promises amazing on mAh !!!

If you need to replace one or more of the batteries is important to consider replacing them in groups of three. For cell balance issues is in fact necessary to remember that you can't insert different batteries in the same group, or batteries with different levels of charging. It is crucial, in case of battery replacement, remember that:

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- You must use the same batteries for each group. It is therefore not possible for example to insert a 2900mAh battery and two 2200mAh batteries in a group. Or enter a different manufacturer in the same battery pack.
- If possible, but not required, insert batteries of the same manufacturer and the same rating. Otherwise try anyway to use batteries of good quality and reliable manufacturers.
- If possible, always check the voltage of the battery to be inserted to see if they are all on the same level. Inserting batteries with different voltage level in the same group may cause problem in short time. By default, new batteries are delivered to a level of about 3.5V and are all at the same level. For this reason you should always use new batteries. Alternatively, it is possible to use a balancer for batteries that allows to charge and carry the same voltage level in one or more batteries (typically 4.2V).

For information purposes, this is a list of manufacturers which can be used within the system:

Producer	Code	Features
Samsung	ICR18650-22P	3.6V 2200mAh
Samsung	INR18650-29E	3.6V 2900mAh
Panasonic	NCR18650PF	3.6V 2900mAh
Samsung	INR18650-25R	3.6V 2500mAh
Panasonic	NCR18650B	3.6V 3500mAh
LG	INR18650F1L	3.6V 3500mAh
Panasonic	UR18650NSX	3.6V 2500mAh
LG	18650HG2	3.6V 3000mAh
SONY	US18650VTC5	3.6V 2600mAh
SONY	US18650VTC6	3.6V 3000mAh
Samsung	INR18650-35E	3.6V 3350mAh
Panasonic	NCR18650B	3.6V 3350mAh

<u>The batteries should always be kept at a sufficient level of charge to avoid damage.</u> If the batteries drop below 2V per cell is very likely to break. This can happen even when not in use for a long time due to self-discharge of the batteries. To avoid such problems it is advisable to:

- Before turning off the instrument make sure the batteries are full charged. Otherwise put in charge the instrument with the appropriate power supply.
- If you do not plan to use the instrument for a long time, you should unplug the "activation" cable by unplugging the connector from the cover of "charger."
- At least once a month remember to recharge the batteries using the supplied adapter. Then plug the "activation" cable if disconnected, and supply for at least one day the instrument with the appropriate power supply.

When you run the charge check the status of different battery groups present. As previously mentioned information about the state of the batteries, Batt menu chapter 6.5.4, you must provide a power to the DC IN socket and wait for about ten seconds while the system acquires the battery status. In the Batt menu you can check the presence of battery group and the charge status. If a battery groups is present a voltage will appears on the corresponding measure Batt 1,2,3,4. If not the "-----" will appear. If a battery group is in fault, for example a very low voltage, the display will show the word "Fault" indicating a problem.

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## 13 Internal pump substitution.

The lifetime of the pump used in the instrument is around 6000 hours and depend by environmental conditions. If suction flow is reduced compared to the initial setting, or pump become very noisy, or the pump non longer work, it's probably that the pump is broken. Before replace it please read the chapter 17 (Problems and solutions) to make some tests. If you are pretty sure that pump is the problem read the following instruction to replace it:

- 1. Stop the pump by pressing the OK button for three seconds.
- 2. Open instrument cover and unscrew the protection.
- 3. Extract the three connector (B). ATTENTION press the connector tab before lift it up. The extraction of the connector should be easy so if it's hard to be extracted check if you are pressing the tab correctly.
- 4. Open the batteries holder by removing the four little knobs(A).
- 5. Lift up the pump from the hole so you can see the connector blow the pump.
- 6. Press the little tab of the connector (C) and extract it. if it's hard to be extracted check if you are pressing the tab correctly
- 7. Replace with new pump by inserting the connector in the plug and inserting the pump in its place. The four aluminum spacer are used to support the pump.
- 8. Close battery holder cover. Before completely tighten the four knobs center the pump in the cover hole. Use your finger to move it.
- 9. Close carter and cover.
- 10. Now the instrument is ready.

Please make attention when extract the little connectors because the risk is to rip off cables that are much thin. Remember to press little tab and only after lift it up.



## 14 Cleaning and Maintenance

To maintain efficient the instrument some precaution must be taken:

- a) Every time a new sample period is started check the nozzle orifice. It' must be completely free from obstacle, dust or other particles, otherwise there could be a loss in the suction.
- b) The sampling drum must be clean before sampling. Use alcohol, or other similar diluent, to clean the drum surface before put strip on it.
- c) Check the presence of water inside the instrument and remove it if present.
- d) Check the rubber gasket on the body profile. Clean it and use some silicon grease on it. If powder or particles are present on gasket there could be a losses in the suction flow.
- e) During long period of inactivity please clean all instrument internally and externally. Remove water if present and leave the cap opened for a period to allow evaporation.
- f) During long period of inactivity is suggested to place the sampler in a dry and protected place. Leaving the instrument on the outside with pump off could generate problem to pump or clock for humidity. Indeed with pump switched on the air flow inside the instrument and avoid humidity deposition.
- g) If you notice that the drum stop before the end of 7 days there could be a problem with the clock. The instrument suck in air and dust. Dust may enter the clock and generate a rotation problem. In this case we suggest to substitute the clock. We can provide a new clock or refurbished one. If you return the broken one, and we detect that it's repairable, we can apply a discount on the new.

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## 15 Packaging

The instrument is shipped with a cartoon box that guarantees its integrity during transport. It is advisable to check the goods upon receipt as the company Cavazza Anna Sas does not guarantee transport damages if the customer accepts the package from the courier. It is also advisable to keep the same packaging so that it can be reused in case it is necessary to return the instrument to our company. The responsibility for damages deriving from inadequate packaging will be of the customer.

The instrument is provided with Lithium batteries and for this reason is subjected to some restrictions in transport (Dangerous Goods Regulations). You can empty the battery holder by extract each elements and send the sampler without battery. In this case you avoid the restrictions but it's clear that we can't test batteries for problems. Other possibility is to declare the content following the instructions of the courier. For examples DHL report the following table:

	UN3480 - PI965			UN	3481 -PI966 🚬 📩	UN3481 - PI967 🛛 💼		
Description	Lithium Cells / Batteries loose (bulk) Important: State of Charge (SoC) of the battery/ cell must not exceed 30%			Lithiu packe	m Cells/Batteries	Lithium Cells / Batteries contained		
Section	PI965 - Section II		PI965-Section IB	PI966 - Section II		PI967 - Section II		
Lithium ion cells / batteries capacity	Per cell or battery ≤ 2.7Wh	Per cell: > 2.7Wh but ≤ 20Wh	Per battery: > 2.7Wh but ≤ 100Wh	Per cell: ≤ 20Wh Per battery: ≤ 100Wh	Per ce Per bi	ell: ≤ 20Wh attery: ≤ 100Wh	Per cell: ≤ 20Wh Per battery: ≤ 100Wh	Per cell: ≤ 20Wh Per battery: ≤ 100Wh
Maximum number of cells / batteries per package and packages/consignment	N/A	8 cells	2 batteries	>2 batteries	Those necessary to power the	≤ 2 batteries or 4 cells	> 2 batteries or 4 cells and	
	Only one package per consignment and/or overpack allowed			> 8 cells	equipment and 2 spare sets (See "Note 2" for set details)		≤ 2 packages per consignment	consignments with more than 2 packages with ≤ 2 batt. or 4 cells
Maximum net weight of cells / batteries per package	2.5 kg (CAO)	N/A	N/A	10 kg (CAO)	5 kg (	PAX & CAO)	5 kg (PAX & CAO)	5 kg (PAX & CAO)
"Description of content" statement as per IATA DGR	"Lithium ion batteries in compliance with Section II of PI965" and "CAO"		"Dangerous goods as per attached Shipper's Declaration" and "CAO"	"Lithi comp PI966	um ion batteries in liance with Section II of ."	No Requirements	"Lithium ion batteries in compliance with Section II of PI967"	
Required marks and labels		N3480		100 UN3480		1000 UN3481	No Requirements	UN3481
Accepted in Time Definite International (door to door)	Yes (See "Note 1")		Yes (See "Note 1")	Yes		Yes	Yes	
Account approval required for Time Definite Int'l	Yes Separate approval for PI965 Section II			Yes	Yes		No	Yes
Requirements for Air Capacity Sales (airport to airport)	Select " <i>LB</i> " and mention " <i>CAO</i> " in the restricted commodity type			Select "DG" and mention "CAO" in the restricted commodity type	Select "Section comm	t " <b>LB</b> " and mention ion II" in the restricted nodity type	No Requirements	Select " <i>LB</i> " and mention " <i>Section</i> <i>II</i> " in the restricted commodity type
Note 1: Limited service worldwide due to CAO limitations. For additional information please contact your local DHL representative. (PAX – Passenger and Cargo Aircraft, CAO – Cargo Aircraft Only)								
Note 2: A "set" of cells or batterie	s is the number o	f individual cells	or batteries that a	re required to power each piece of	equipm	ent.		
Section	PI965 - Section IA (State of Charge (SoC) ≤ 30%) PI966 & PI967 - Section I					dh.		
Per Cell: > 20Wh Per Battery: > 100Wh	Accepted as Air Capacity Sales (See "Note 3") - CAO: ≤ 35 kg UN specification packaging required Fully regulated dangerous goods - Class 9 – Select "DG" and mention "CAO"			N.	Accepted as Air Capacity Sales (See "Note 3") - PAX: ≤ 5 KG or CAO: ≤ 35 kg UN specification packaging required (only for PI966) Fully regulated dangerous goods - Class 9 – Select "DG" and mention "PAX" or "CAO"			
Note 3: Lithium batteries packed a	according to PI96	5 Section IA and I	PI966 / PI967 Sect	ion I are not accepted in Time Defi	nite Inte	rnational when transported v	a road to/from an ADR mem	nber state.
PI965 Section IA / IB and PI960 1.4S), Division 2.1, Class 3 , Div	5,PI967 Section vision 4.1 and	<u>I</u> - Cells and ba Division 5.1. (Fo	tteries must no or PI966 and PI9	t be packed in the same outer 67 Section I is a DHL requirem	packag ent)	ing, or placed in an overpa	ack with, dangerous good	ds classified in Class 1 (except
PI965 Section II: Cells and batt	eries must not	be packed in th	he same outer p	ackaging with other dangerou	us good	ls. Cells and batteries mus	t not be placed in an ove	rpack with dangerous goods

Our instrument is under the section UN3841-PI967 and for this reason the box used for the transport must be marked with the label UN3841 (image on the right). We provided a box with all necessary label so please do not throw or broken the original packaging provided. However if want to use another courier, the main information for transport are:

- 12 batteries 2.2A/h (type 18650)
- Total power installed 95W/h.
- Total weight of the batteries: 500grams.
- Batteries are inside the instrument and protected.

In our web site is also available the Safety Datasheet of the batteries. These information could be requested by courier.

These information are provided by our company as requested by IATA regulations.



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## 16 **Problems and solutions.**

Problem	Possible cause.	Solutions
Problem to reach flow rate of 10 liters per minutes.	The cover isn't correctly closed	Check the cover of the instrument that is fixed correctly.
	Sealing gasket	Check the seal gasket along the profile of the base. It must be inserted correctly inserted in the guide and must be intact. Also check the presence of powder or particles. Use silicon grease on it to improve the seal.
	Drum distance.	The distance of the internal sampling drum from the nozzle inlet must be correct.
	Orifice obstructed	Check the front orifice and clean it.
	Broken pump	Check the pump and if it's broken change it. The main cause of this problem is usually in the bearing and for this reason is possible to ear a big noise.
System doesn't start when power button is pressed.	Battery level too low.	Connect external power sources in DC IN and, when display start, check under Batt menu the status of the batteries
	Battery disconnected.	Check that all cables are connected.
System doesn't start when you supply it from DC IN.	Broken batteries.	To check if batteries are broken you have to extract it from battery holder. In the chapter 12.1 you can find instructions on how to force batteries bypass.
System seems to be "freezed"	If the user interface doesn't respond to button pressure, nothing happens when you press any buttons, there could be a problem in firmware.	Check the chapter 8.1 where is described how to reset systems.
System isn't visible in the smartphone application	Problem with Bluetooth module.	Check the chapter 8.1 where is described how to reset systems.

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## 17 Warranty

Cavazza Anna Sas guarantees the instrument, when used according to the instructions in this manual, for a period of 24 months from the date of sale, with the exception of the pump and the batteries which are guaranteed only for the first 2 months from the date of sale.

Defective parts will be replaced free of charge once the actual defect is determined. The replacement will have to be done by our company and the return will have to take place ex our office.

The warranty does not cover failures or damages due to:

- Improper maintenance by the user.
- Unauthorized modifications to parts of the equipment.
- Use of non-original accessories.
- Neglect.

In case of return for repair or maintenance you need:

- If possible, pack the instrument using the original packaging.
- Attach to the shipment a descriptive document which contains all the information necessary for a quick diagnosis of the problem or the reasons for the return.
- Indicate the exact return address and all billing information for the invoice.
- At least one contact person for any requests and clarification. Then name, phone and email.

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## Components



#### easyFlux

Electronic flow meter, calibrated for the measurement of air flows from 0 to 100 liters per minute with precision of 1.5%. The flow sensor is equipped with pressure and temperature sensor to calibrate the measurements in every environmental conditions.



#### easyStrip

Silicone coated polyester tape, dimensions 20x349mm, thickness 0.05mm. The tape is pre-treated with silicone fluid (polydimethylsiloxane with viscosity  $100,000 \text{ cSt} \pm 10\%$ ) in cyclohexane solution. The sampling tape, supplied in blister pack, is prepared to be easily applied on the drum supplied with the instrument.



7-day Sampling Drum Sampling drum into aluminium box for transport.



#### Tape cutter

Graduated cutter to divide the sampled tape. The graduations are used as a reference and report engraves every 48 mm corresponding to 24h of sampling. Once engrave has been identified, it is possible to position the presser and cut the tape using the supplied scalpel.



Gelatine with fuchsine, 50 ml or 250 ml. Prepared according to UNI 1110800\_2004 Italian National Standards.



Gelatine without fuchsine, 50ml or 250ml Prepared according to UNI 1110800\_2004 Italian National Standards.



#### Drum support

Winding base for easyStrip silicon coated tape and tape to coat with silicon manually. It supports the 7-day drum and allows easyStrip to be easily applied to the drum for sampling or detached after sampling.



#### Kit for Tapes and Samples preparation

Box containing: gelatine with and without fuchsine 50ml, silicone fluid solution 50 ml, scalpel with 10 blades, adhesive labels, double-sided bonding tape, sampling tape not treated (50 pcs), dropper for silicone solution, stainless steel tweezers, brush for silicone solution, 26mm x 76 mm microscope slides, 24mm x 50 mm slide cover glass, gelatine heating bottle.