

# Instruction Manual

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HI 83900

Suction Lysimeter

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 **HANNA**<sup>®</sup>  
instruments  
[www.hannainst.com](http://www.hannainst.com)

Dear Customer,

Thank you for choosing a HANNA instruments® product.

Please read this instruction manual carefully before using the equipment. It will provide you with the necessary information for a correct use.

For additional technical information, do not hesitate to e-mail us at [tech@hannainst.com](mailto:tech@hannainst.com) or see the back cover for our worldwide contact list.

## PRELIMINARY EXAMINATION

Remove the equipment from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, immediately notify your dealer.

Each kit includes:

- 1 x sampler tube ending with porous ceramic tip
- 1 x capillary rubber tube with rubber cap and finger clamp
- 1 x cleaning solution starter kit (120 mL bottle)
- 1 x 30 mL syringe
- instruction manual

**Note** Save all packing materials until you are sure that the equipment functions correctly. Any damaged or defective items must be returned in their original packing materials together with the supplied accessories.

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Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

## ORDERING INFORMATION

**HI 83900-30:** Suction lysimeter, 30 cm (0.98') tube

**HI 83900-60:** Suction lysimeter, 60 cm (1.97') tube

**HI 83900-90:** Suction lysimeter, 90 cm (2.95') tube

**HI 83900-25:** Cleaning solution replacement kit, 500 mL bottle

## WARRANTY

This equipment is guaranteed for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions.

This warranty is limited to repair or replacement free of charge. Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered. If service is required, contact the dealer from whom you purchased the instrument. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred.

If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization number from the Customer Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

## GENERAL USE / OPERATING PRINCIPLES

The **HI 83900** suction lysimeter is built with a porous ceramic cap connected to a transparent tube for soil solution extraction. A rubber capillary is inserted in the tube passing through a rubber cap and reaching the ceramic tip.

The lysimeter is an ideal tool for collecting soil solution samples and then perform quantitative chemical analysis. In this way the operator can easily monitor the level of fertilization nutrients, such as ammonia, nitrate, phosphorous and potassium.

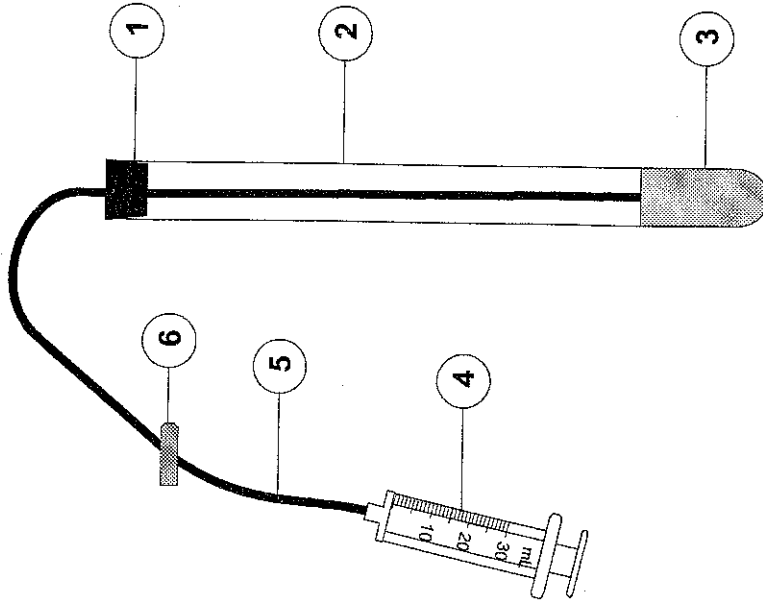
The ceramic tip of the lysimeter can be used in all types of soil, and it is made of sinterized material that does not react with nutrient elements. The soil solution, therefore, is not affected by the chemical composition of the ceramic cap, and the test results are always precise and reliable.

Use our chemical test kits or photometers for accurate analysis (see the HANNA instruments® general catalog or visit our web site at [www.hannainst.com](http://www.hannainst.com) for a complete list of equipments, reagents and accessories).

The **HI 83900** allows to extract a solution from the soil by creating a vacuum (negative pressure or suction) inside the sampler tube, that exceeds the soil water tension. This will establish an hydraulic gradient for the solution to flow through the porous ceramic cap and into the lysimeter tube. Typically, a vacuum of about -60 cb (centibar) should be drawn.

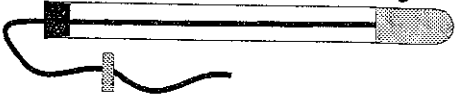
For better monitoring the soil solution composition throughout an entire growth period of crops, at least two lysimeters should be installed in the root zone of a representative plant, one at the upper part and the other in the lower part of the root zone. For better accuracy and repeatability of results, it is recommended to replicate the above described installation in at least two more locations.

## FUNCTIONAL DESCRIPTION



1. Rubber cap
2. Soil solution sampler tube
3. Porous ceramic tip
4. 30 mL syringe (pump)
5. Rubber suction capillary
6. Finger clamp

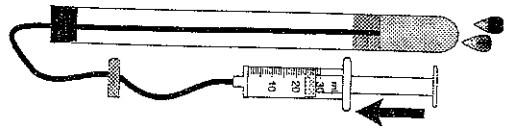
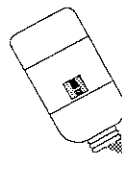
## OPERATIONAL GUIDE



Assemble the unit by inserting the rubber capillary in the sampler tube and closing with the rubber cap. Check that the rubber capillary is into the ceramic tip, then remove the plastic bag from the ceramic part and follow the activation procedure explained below.



**Important: NEVER TOUCH THE CERAMIC SENSITIVE PART WITH YOUR FINGER BEFORE AND DURING THE ACTIVATION PROCESS.**



## ACTIVATION

- Fill approximately 1/3 of the lysimeter tube with the supplied cleaning solution.
- Draw the syringe piston all the way back and attach the syringe to the rubber capillary.
- Close the tube with the rubber cap, open the finger clamp and push the syringe piston.
- Pinch the finger clamp and wait until the solution seeps through the porous ceramic tip. Draw the rest of the solution from the sampler tube and dispose of it.
- The lysimeter is now sterile, free of air bubbles and ready for insertion into the ground.
- Keep the ceramic tip moist until the lysimeter is inserted into the soil. Protect it with a plastic bag.

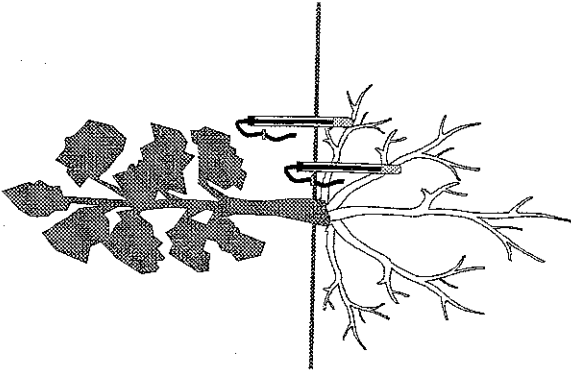
## INSTALLATION

### Location

- The selected location/plant for installing the lysimeter should be representative of the entire field.
- For better accuracy and repeatability of results, install at least 3 couples of lysimeters (see below) per each area to be monitored.

### Operation

- Place the lysimeter inside the root zone. It is suggested to install at least two lysimeters, one at the upper and the other in the lower layer of the root zone.
- The recommended distance from the drip source depends on the soil type:  
sandy soil: 5 cm; medium soil: 10 cm; heavy soil: 15 cm.
- Drill a hole in the ground at the selected location and insert the **HI 83900**, while pushing and rotating it around its axis. After the proper depth is reached, compress the surrounding soil, while paying attention that the soil is tightly in contact with the ceramic tip.



## SAMPLE EXTRACTION



**Warning!** Never operate the lysimeter in the following conditions:

- immediately after irrigation, otherwise the extracted solution will be the irrigation water and not the soil solution.
- before the irrigation water reaches the depth of the ceramic tip, because necessary tension can never be obtained if the sensitive tip is dry.

- Sample extraction needs a vacuum of approximately -60 cb (centibar) to be created inside the sampler tube. Connect the syringe to the rubber capillary, open the finger clamp and draw the syringe piston all the way back (30 ml). Pinch the finger clamp and disconnect the syringe.

To obtain a vacuum of about -60 cb (centibar), perform these operations once with the **HI 83900-30** model, twice with **HI 83900-60** and 3 times with **HI 83900-90**.

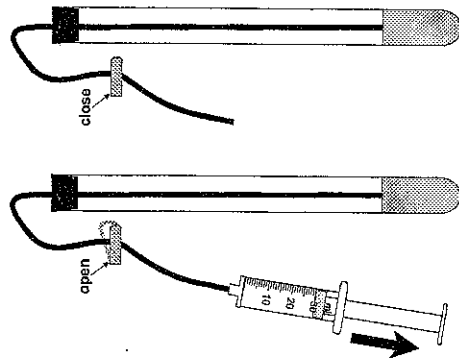
- Before drawing out the soil solution, allow a time interval which depends on the soil type.

Tuff or sandy soil: 30 minutes  
 Light soil: 1 hour  
 Medium soil: 2 to 4 hours  
 Heavy soil: 3 to 12 hours

- To collect the soil solution, connect the syringe to the rubber capillary, open the finger clamp and the rubber cap, then draw the syringe piston all the way back (30 ml).
- Hold the piston until all the solution is sucked into the syringe, then disconnect the syringe from the capillary and leave the finger clamp open.
- Transfer the soil solution into the sampling vessel and immediately perform tests.



- Never draw the syringe piston more than specified times, otherwise the soil moisture tension will be broken. In addition, when a very high vacuum is created at the soil solution, the test results will be unreliable, due to a non-aerobic process.
- After drawing out the solution, the lysimeter should not remain at vacuum conditions until the next time of operation.

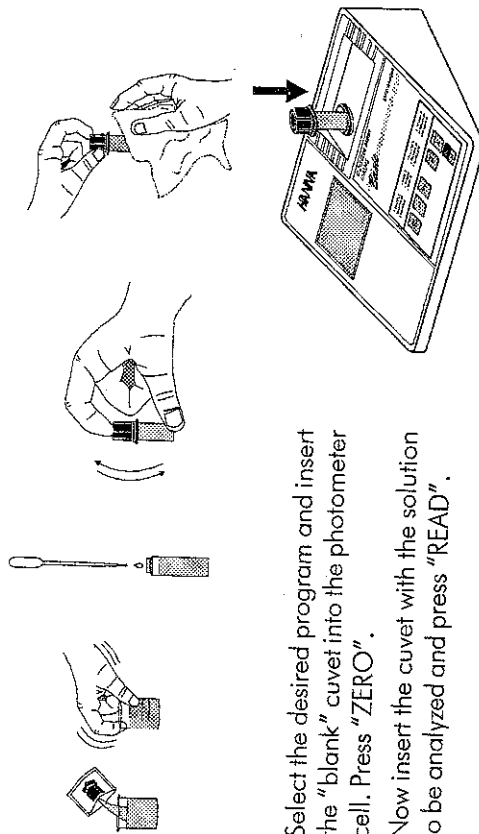


## SUGGESTIONS FOR SAMPLE ANALYSIS

HANNA instruments® offers a wide variety of instrumentation, chemical test kits and reagents (ask your dealer for details) to analyze soil solution samples.

Use the **HI 83215** (or **HI 83225**) **Grow Master** bench photometer for testing the presence and strength of **ammonia, nitrate, phosphorus and potassium** on the spot (**low, medium and high ranges**). This advanced instrument is very simple to operate even for non-technical users, and provides lab results.

1. Add the proper reagent (see photometer instruction manual) to the sample solution and shake gently.
2. Fill two measuring cuvetts, one with the solution without reagent (blank) and the other with the reacted sample. Screw the cap onto the cuvetts and shake.
3. Wipe the cuvetts with a soft tissue to remove any dirt or fingerprint.



4. Select the desired program and insert the "blank" cuvet into the photometer cell. Press "ZERO".
5. Now insert the cuvet with the solution to be analyzed and press "READ".

For **pH/EC/TDS measurements**, you can use these portable meters, housed in a water-resistant casing ideal for field applications:

**HI 9811-5** 0 to 14 pH, 6000  $\mu\text{S}/\text{cm}$ , 3000 ppm, 0 to 70°C

**HI 9813-6** 0 to 14 pH, 4.00 mS/cm, 1999 ppm, 0 to 60°C, with HANNA F.S.T. system

**HI 991300** 0 to 14 pH, 3999  $\mu\text{S}/\text{cm}$ , 2000 ppm, 0 to 60°C, with advanced features

**Chemical Test Kits for Agriculture:**

**HI 38078** kit for SAR (Sodium Absorption Ratio) test

**HI 3896** professional kit for testing traces, low, medium and high ranges of nitrogen, phosphorus and potassium, and pH from 4 to 9.

## MAINTENANCE AND STORAGE

The lysimeter should remain installed for all the crop season, and the ceramic cap must be sterilized against fungi and algae at least every two months, without removing it from the ground.

- Fill the syringe with the supplied cleaning solution (approximately 10 mL).
- With the finger clamp open, inject the solution into the lysimeter tube for about 10 seconds. Draw up the rest of the solution and dispose of it.



Do not perform soil solution tests immediately after sterilization.

In seasonal cropping and during winter, remove the lysimeter from its installation before the first frost.

- Immediately after removing the lysimeter, immerse the tip in the cleaning solution over night.
- Let the solution drain through the porous ceramic cap, gravity flow.
- Air dry the lysimeter and store it.



### Warning!

- Do not let the ceramic cap dry while dirty.
- Do not store at temperatures below freezing because some water may remain trapped inside the porous ceramic.

## TROUBLESHOOTING

If the lysimeter is unable to extract soil solution, first check that:

- The soil is tightly in contact with the porous ceramic cap.
  - >>> Compress the surrounding soil if necessary.
- The suction capillary reaches the ceramic tip.
  - >>> Otherwise push it downwards through the rubber cap.

Moreover, the following conditions can cause inability to extract soil solution:

- The water has not reached the ceramic tip. This can occur when the lysimeter is positioned at a depth of 40-50 cm.
  - >>> Delay time of operation.
- Water reaches the depth of the ceramic tip very slowly, also measured in days for very heavy or compact soils. In this case, the lysimeter should not be installed in low depths such as 50-60 cm.
  - >>> Use the lysimeter in depths of only 15-30 cm.
  - >>> Install the lysimeter in a different location, where the soil is not too compact.
- Fully developed plants can compete with the lysimeter for water, and may be not possible to extract the solution. It can also happen that the solution not collected in time will be extracted back from the lysimeter by the plant.
  - >>> Operate earlier.
- The water distribution is not uniform.
  - >>> Check the irrigation water flow.
- The soil is dry, due to an irrigation with insufficient amount of water.
  - >>> Irrigate again increasing the amount of water.