SIG PERMEA3

User manual

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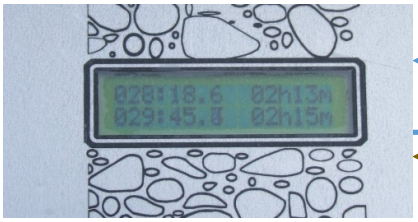
Table

INTRODUCTION

- The PERMEA3 represents the new generation of permeameters or infiltrometers. It is designed to measure the ability of a medium (like the soil) to transmit a liquid flow, called permeability or hydraulic conductivity. The test is performed by temporarily saturating the soil at the bottom of a borehole, above the water table. The test is also called Porchet method.

The PERMEA3 is composed of :

- One or several reservoirs or drums for the supply of water,

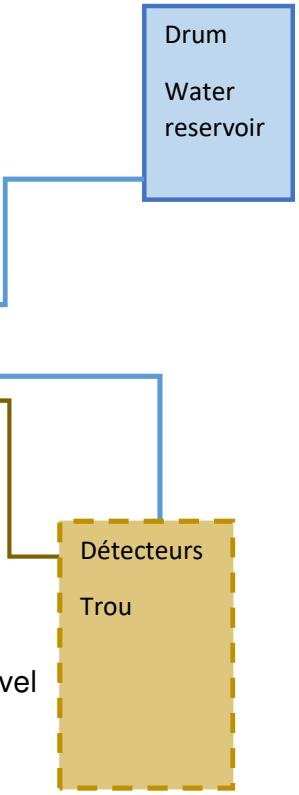


- The PERMEA3

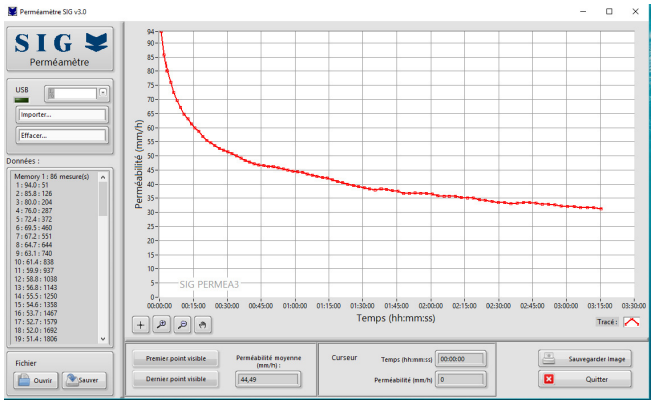
  which regulates the water input and output,

  and calculates the K coefficient,

- The probe is a screened infiltration tube, with water-level detectors,



- A software application to transfer the data.



THE PORCHET TEST PROCEDURE

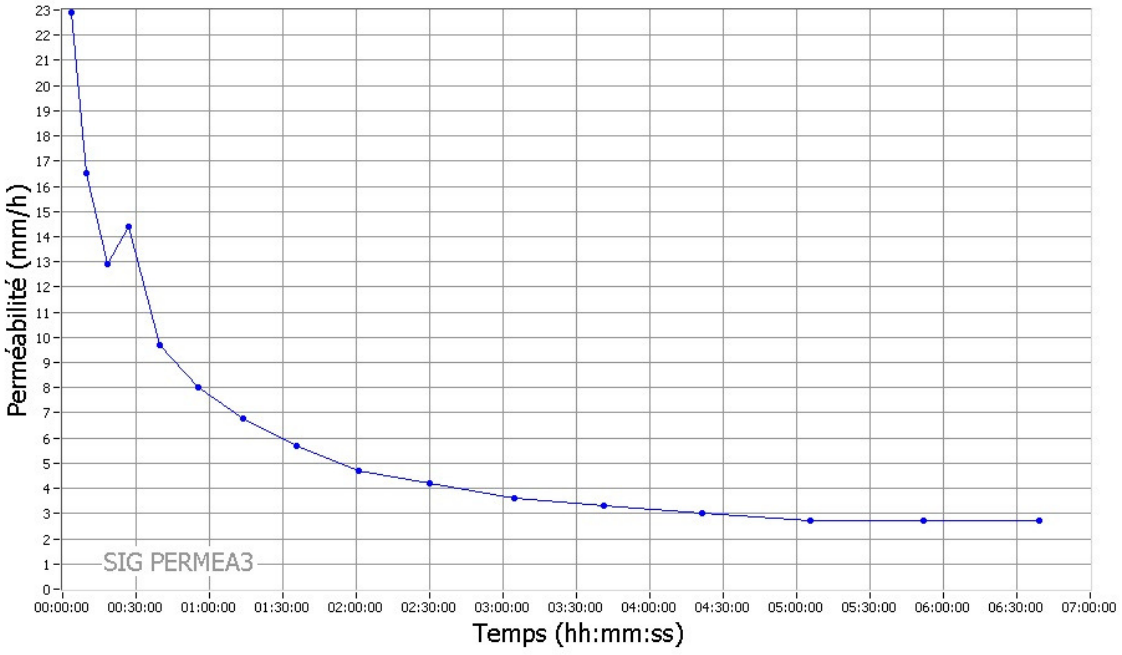
The Porchet test procedure is a measure of the hydraulic conductivity at a constant-level or constant-head in a borehole.

The test is performed in a non-saturated soil, or above the water table.

The hole must be done with an auger tool, and at the depth of interest for the study. Then the hole is filled up with water in order to determine the absorption flow rate. The volume of water must be measured, and the time to maintain the water-level constant in the hole.

K (mm/h) = Volume of water input / (Infiltration area x test duration)

A saturation phase is always necessary. Depending on the soil porosity this first phase may last from a few minutes to several hours.
When the saturation is reached the flow becomes permanent, and the value of K becomes constant.



THE PERMEA3

The PERMEA3 measures the flow rate of a constant volume of water (about 0.1 litre), records the data, and repeats automatically these infiltration cycles.

The electro-valve is electronically controlled. The water level between two closely spaced detectors located in the middle of the infiltration tube, is regulated by the permeameter. The time of an infiltration cycle is computed to output the resulting permeability coefficient K (in mm/h).

The PERMEA3 can measure K values between 0 and 700 mm/h. The use in very high hydraulic conductivities conditions (like over 1000 mm/h) over a long period of time may damage the electro-valve.

The device is autonomous with a rechargeable battery of 12 V. The container is IP64 water proof, and perfectly suited for outside use.

The data are stored in 4 memories of 250 points each, and which can be added to each other to have 2 memories of 500 points. It is then possible to store 4 infiltration tests before clearing the memories.

The data are transferred to the computer via USB serial link.

THE INFILTRATION TUBE

The infiltration tube has two functions:

- Supply water to the hole, and allow the infiltration through the slots
- Detect the water level.

The blue screened tube can be manually unscrewed from the yellow top, to access the detectors for an easy cleaning. The yellow bottom is fixed, and should not be removed.

The 3 metallic detectors should be kept cleaned to insure a good electrical contact. Oxidation should be removed with scratch paper.

OPERATION IN THE FIELD

- Auger a hole to the required depth. The hole diameter is internally fixed to be computed in the K coefficient. So the hole must be calibrated. **Standard diameter is 100 mm** (or 150 mm for the PERMEA3.15 version)
- Scarify the sides with a sharp object, or wire brush, to avoid the effects of smearing.
- Insert the infiltration screened tube into the hole.
- Plug the water hose from the tube into the hydraulic output of the PERMEA3. Les hydraulic plugs have pull-up rings to secure the connection.
- Plug the electrical connection.
- Install the drum or water reservoir a little above the hole. This will ease the water flow by gravity. Only use clear tap water. (rain water may not
- be mineralized enough). And, do not close the drum tightly, to let water in while flowing !.
- Connect the water drum to hydraulic input of the PERMEA3. To disconnect pull on the connectors ring.
- Turn the PERMEA3 on. The battery state is displayed on the screen.
- Use the arrows up and down to scroll on the memories. 
- Choose the memory : 
- Start the test : 

- The water starts to flow into the hole.

- During the test, access and exit to the display mode vith the button 

  .The data in the memories can be scrolled wih the button  .

The time and the K values (mm/h) are displayed in real time. The operator can see immediately if the values are coherent with his knowledge the soil, and of the test's conditions. In case of any doubt, it can be necessary to dig another hole, and restart the test.

On the field you can start, stop and empty the memories, and re-associate MEM1+2 or MEM3+4, if you realize that the 250 points will be achieved rapidly.

A PROBLEM ?

The PERMEA3 will stop by itself, if :

- The selected memory is full (250 data points or 500 data points with the addition).
- The water reservoir is empty.
- The battery is too weak.
-

The PERMEA3 cannot start the test :

If the permeability is very high, for example in embankment materials, the water in flowing out too fast, and the water level cannot reach the upper detector. After 30 seconds, the "flow stop" message is displayed.

The PERMEA3 displays xxx, and nothing happens :

In case of very low permeability, it can take quite a long time for the water level to release the detector which starts the counting for the test. Nothing seems to happen during this slow infiltration. It is a normal state.

You can lift the infiltration probe to check that the test will eventually start.

BATTERY RECHARGE AND STORAGE

The PERMEA3 has a great autonomy with a 12V 4.5Ah integrated NiMH battery.
The state of the battery is displayed when the device is turned on.

Only use the battery charger with timer provided with the PERMEA3.
The battery can only be charged when the PERMEA3 is turned off.
In any case, plugging the charger will turn it off.

Attention ! ONLY USE THE PROVIDED CHARGER ! Do not plug any type of charger onto the USB plug, this will damage the PERMEA3 !

Charge duration : 6 h30

To insure a longer life time to the battery, a complete charge is necessary at least every 6 months.

Storage temperature : 0 à +35°C

Inside the PERMEA3, humidity is absorbed by a canister of silica gel. When the orange silica gel, visible in the inspection window of the canister, becomes clear, reactivate it by placing it in a vented oven at 150°C for at least 3 hours (or until the silica gel turns orange again). Can be reactivated indefinitely.

DAILY MAINTENANCE

Back from the field, **it is necessary to systematically clean the equipment**.

- rinse the screened tube,
- open the tube,
- clean the detection rings, and wipe them,
- scratch them with sand paper when they become oxidized.

The good functioning of the electro-valve can easily be checked by simulating a test in a bucket of water.

SOFTWARE INSTALLATION

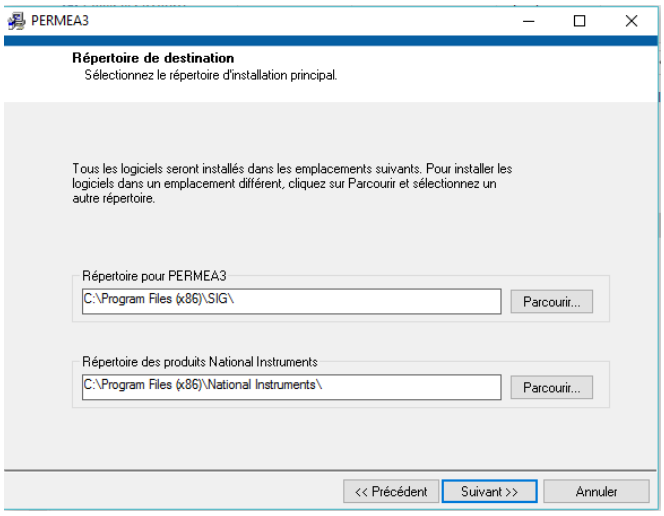
Minimal configuration required :

- Microsoft Windows XP Service pack 3 minimum

Installation :

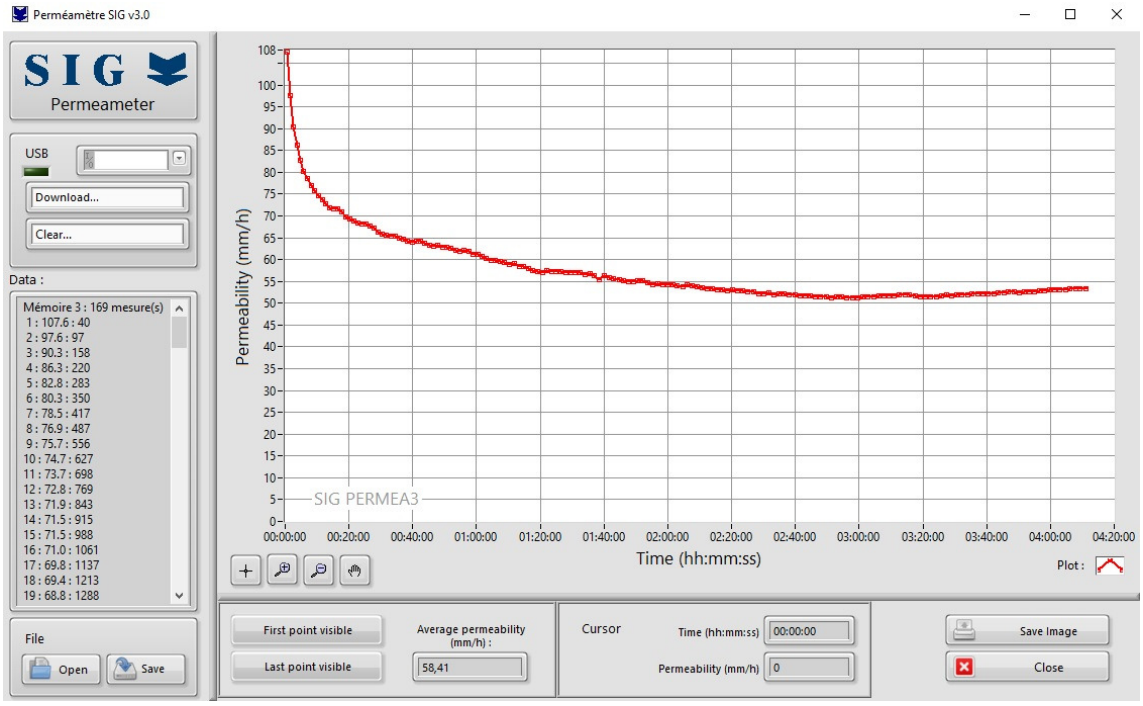
The computer will automatically search for the driver on internet. If this is not possible, disconnect the PERMEA3 and install the provided driver CDM21224_Setup.exe. Plug the PERMEA3 in again, and start the installation procedure of the driver.

- Launch the set up.exe



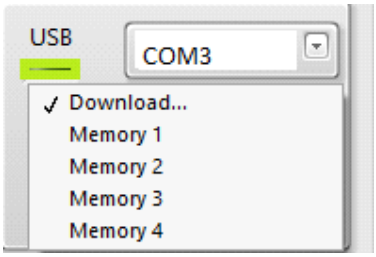
PERMEA3 SOFTWARE APPLICATION

Back from the field, plug the PERMEA3 to your computer, and turn it on. All the functions and commands are available from the software application.

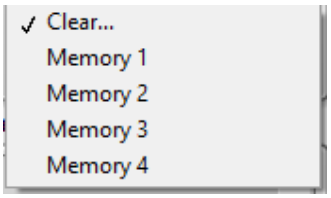


The objective of this software application is to provide a table a measures, and draw the corresponding graph. This graph in .bmp can then be inserted into any report.

Once the PERMEA3 connected to the computer and on, define the port com which should be used.



The USB green lights up once the port com is active.
Import the data from either one of the memories.
The data appear and the corresponding graph is drawn.

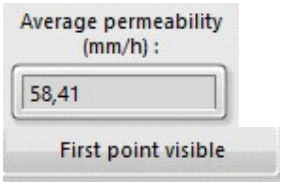


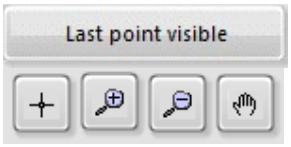
The application can clear the memories of the PERMEA3.

The .txt files can be saved.

The software application can open any .txt and draw the corresponding graph.

Several tools are available to edit the graph :

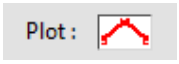




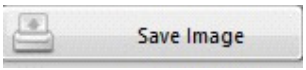
The permeability mean corresponds to the mean value of the points displayed on the graph.
The mean is also calculated on a zoom.

First point visible suppresses the first point which may be a disturbed one.
Same fast suppression of the last point.

Pointer, zoom and hand tools.
These buttons are useful to analyse segments of the graph.



The tool draw opens a dialog window to edit the styles and colors of the graph, and export the data to Excel.



Once the graph interpreted and edited, axis modified, the image can be saved in .bmp.

TROUBLESHOOTING

Pressing ON does not start the device.		
Has it been charged up?	Yes	Unscrew the top panel to access to the inside of the box. Change the fuse on the board.
	Yes	Charging plug dirty. Clean it. You may have to clean it at the back, below the top panel. Dry the inside of the box if humidity.
	No	Recharge.
« charge battery »		
Has is been charged up ?	Yes	Go into the main menu and check the state of the battery charge in it. Clean the ON/OFF button.
The flow does not stop, and the drum is emptyied, and water may overflow out the hole.		
Have you scratched the detectors ?	No	The metal detectors must be scratch with sand paper before each test, to make sure the electrical contact is good.
Do you hear the sound of the solinoid valve when you press the ON button ?	No	The sound of the commutation should be heard twice in 2 seconds. If the solinoid valve is blocked in OPEN position, the flow is constant. You may have the formation of alguae in the drums which will obsturate the valve.
Are you using tap water ?	No	The use of rain water, or tap waters in certain regions are not enough mineralized to the detectors. Add salt into the hole. Do not add salt in your drum, as the salty water would in the end corrode the solinoid valve.
	Yes	The solinoid valve is blocked : 1. Plug the hydraulic connector of the probe onto the PERMEA3. 2. Turn the PERMEA3 ON, and START the test 3. Blow air into the hydraulic plug (use a little air compressor)
The time of flowing before the beginning of counts, is abnormally long.		
Do you have algae, or dirts in the drums or hoses ?	Yes	Dirts and algae may form in the drums. They could prevent the water from flowing normally. And this could block the solinoid valve. Clean

		your reserves/drums and hoses with disinfectant liquid from time to time.
The PERMEA3 has not recorded any point.		
Are the detectors well scratched ?	Yes	Check the drums and hoses for algae and dirts.
Have you used tap water ?	No	The use of rain water, or tap waters in certain regions are not enough mineralized to the detectors. Add salt into the hole. Do not add salt in your drum, as the salty water would in the end corrode the solinoid valve.
Display screen very weak, hardly visible.		
Are you in a humid environment ?	Yes	Unscrew the top panel, open the device, and dry the inside. You can also reactivate the canister of silica gel.
« XXX » on display.		
Are you in clay soils ?	Yes	In very low K values of clay-rich soils, the time of infiltration can seem long. Check that the system is functionning normally simply by lifting the probe. If the counting starts it is OK.
	No	Mother board problem.
«flow stop »		
Does the error message appear after the choice of the memory ?	Oui	Bug on the mother board. Reprogrammation necessary or change of the mother board necessary.
Do you hear the solinoid valve when ON pressed ?	No	The noise of the commutation of the solinoid valve can be heard at 2 seconds, and twice. If the valve is blocked in closed position, the flow becomes impossible. Open the device and check the connectics on both side of the mother board.
Is the drum open ?	No	When the drum is closed, the water cannot flow out.
In the hole in a gravelous environment , or highly permeable ?	Yes	The water is infiltrating too fast. The water level does not have the time to reach the upper detector. The counting cannot start.
Is the water flowing out of the hole ?	Yes	The detectors do not detect. Scratch the detectors with sand paper.

Black band or wizzy characters on display.		
Are you in a humide environment ?	Yes	Unscrew the top panel, and open the device to dry the inside. Reactivate the canister of silica gel by heating it in an oven.
	No	Problem of mother board. Change the board.
Abnormal results/curves		
Are the detectors well scratcheds ?	No	To avoid the problems of bad contacts, it is advised to scratch the detectors before each test.
	Yes	If the detectors are well scratches, there could be a problem of foam formation in the hole. The foam will form around the detectors resulting in bad contact.
Is the device functionning normally, and the detectors like new ?	Yes	In this case it could be a bug in the program. A return to SIG will be necessary to reprogram or change the board.
USB transfer impossible		
Have you used the UBS cord provided with the PERMEA3 ?	No	Use the USB cord provided.
	Yes	The connection between the USB and the mother board may be declippsed. Or change the mother board.
Unknown peripherical		
Are you in a humid environment ?	Yes	Unscrew the top panel, and open the device to dry the inside. Reactivate the canister of silica gel by heating it in an oven.
	No	Install again USB driver (CDM21224-setup.exe)

MODIFICATION OF STANDARD PARAMETERS – infiltration area

The use of a longer screened infiltration tube, or a larger hole does modify the infiltration area, which is a parameter of the K formula.

K (mm/h) = Volume of water input / (infiltration area x test duration)

The data contained in the .txt file must be manually corrected 

K corrected = K recorded x coefficient

Length of the screened infiltration tube	**Correction coefficient**
1 m	x 0.214
0.15 m	X 1.74
Diameter of the hole	
150 mm	X 1.78 *for PERMEA3 prog in 100 mm*

SPECIFICATIONS

PERMEA3 SPECIFICATIONS			
Physical		**Screen display**	
Logging unit :	waterproof IP64	State of the battery	
Dimensions :	27 x 22 x 18 cm	MEM 1 to 4	250 points by memory
Weight :	3,2 kg	MEM 1+2 ou MEM 3+4	500 points by addition
Operating temperature :	between 0 and 60°C		
Storage temperature :	between 0 et 35 °C		
Electrical			
Integrated battery :	12V 4,5Ah	**Autonomy :**	
Charger :	0,8 A avec timer	K < 100 mm/h	4000 points
Time of recharge	6h 30	500 mm/h	1600 points
Hydraulical		**Accuracy :**	1%
Max flow rate :	18 ml/s	**Resolution :**	0,1 mm/h
Hydraulic coupling :	automatic, metal coupler		
Screens			
Dimensions :		diameter 76 mm	
Spacing between detectors		15 mm	
Min depth of use :		0.2m	

WARRANTY

SIG offers a warranty against defects in materials and workmanship, for a period of one year from the date of delivery. No returns will be accepted unless prior authorization has been received from the seller, and a SIG RMA number has been assigned.
The transport return back to SIG will be taken in charge by the customer. SIG will take in charge the transport to the customers' after the repair or remedy under warranty.
Remedy under the warranty during the applicable warranty period is that SIG will undertake to correct within a reasonable period of time any reported failure.
The warranty does not cover repairs due to an accident, or an abnormal use, or a non-observance of the manual procedures and maintenance instructions.
The warranty will not apply if the device has been opened, or dismounted.
In no event will SIG be liable to the owner of the equipment for a consequential, indirect, or similar damage, or accident arising during the use of, or inability of the use of the equipment, even if SIG has been advised of the possibility of such a damage or accident. In no case will SIG's aggregate liability exceed the purchase price of the equipment.