PIV2

Technical Manual

Portable viscometer
for field use

SOFRASER
ZI, 15 rue Nobel
45700 Villemandeur - France
info@sofraser.com - www.sofraser.com
+33 (0) 238 85 77 12 - Fax +33 (0) 238 85 99 65

REF.: 247/4

IMPORTANT

THE OFFSET ADJUSTMENT IN THE AIR **MUST** BE THE FIRST TASK COMPLETED.

The offset adjustment in the air should be done each time you take the PIV2 in your hand.

The zero adjustment in the air procedure is described in the § 2.2.

Follow these instructions:

- clean and dry the vibrating rod of the viscometer in order to make it neat and dry;
- seize the sensor by its handle and maintain a constant pressure on it;
- on the main view, press “H” to enter the menu;
- “Offset” is the first feature in the menu. The current offset is displayed. Press “OK” and the system will ask the user to do the offset acquisition “Acq. Offset”;
- press “OK” and the new zero adjustment in the air is done. Press “H” and the system goes back to the previous menu;
- when the zero adjustment in the air is done, press “OK” again to return to the main view.

Legend:


: Home button: “H”

: OK button: “OK”

/!\ IMPORTANT /!

- Never use the PIV2 viscometer while the batteries are being charged;
- Never use the batteries charger when the batteries are removed.

TABLE OF CONTENT

1. GENERAL PRESENTATION 3
1.1. WORKING PRINCIPLE 3
1.2. CHECKING THE EQUIPMENT AFTER RECEIPT 3
1.3. CHECKING THE EQUIPMENT WHEN ON FIELD USE 3
1.4. PERIODIC CHECKING 3
1.4.1. Offset adjustment in air 4
1.4.2. Modification of the previous calibration 4
1.5. TECHNICAL CHARACTERISTICS OF THE SENSOR 4
1.6. THE ELECTRONIC DEVICE 4
1.6.1. Technical characteristics 4
1.6.2. Power supply 4
2. THE PIV2 OPERATING FUNCTIONS 5
2.1. START AND MENUS 5
2.2. OFFSET 6
2.3. RAW VALUES 6
2.4. UNITS 7
2.5. STORED DATA 7
2.5.1. Read data 7
2.5.2. Erase data 7
2.5.3. Synoptic scheme 7
2.6. MEASUREMENT PROCEDURE 8
2.7. ADVICE FOR GOOD MEASUREMENTS 9
2.8. MEASUREMENT INFORMATION 9
3. SOFRASER INTERFACE SOFTWARE 10
3.1. THE MAIN FEATURES 10
3.2. THE USER-FRIENDLY INTERFACE 10

1. General presentation

1.1. Working principle

The measuring chain is composed of two inseparable elements: the sensor and the electronic device that controls it. The sensor cannot be used with another electronic device because they are matched together as one vibrating system, and vice versa.

The provided viscosity information is relative. In the same fluid and under the same environmental conditions, the information is the same. For two fluids with a different rheological behaviour, the response can be different. Since it is perfectly repeatable, it just needs a different correlation.

The active part of the sensor is composed of a vibrating rod held in oscillation at resonance frequency by driving magnets. When the rod is immersed into a viscous material, the amplitude of the vibration is dampened. The vibration amplitude varies according to the product viscosity where the rod is immersed.

The sensor receiving coil detects the response and the signal is converted to a viscosity value through the electronic device. The factory calibration is performed with standard oils.

The electronic device acquires the coils' amplitudes and generates various signals. These signals represent the properties being measured. It is also in charge of powering the whole system.

It gives viscosity information through two kinds of output:

- LCD screen display;
- Serial communication through mini-USB port.

1.2. Checking the equipment after receipt

- First and foremost, check the conformity with the ordered equipment, that is to say mainly check if the needed parts for mounting the equipment are delivered. The parts that are destined to be mounted on the process shall be given to the concerned department, for the installation preparation.
- Place the sensor on a soft foam plate, connect it to the processor (see §3.3) and switch it on. The rod shall start vibrating and the viscosity indication is close to zero. When touching the rod, the value has to increase.

In case of a subnormal operation occurs, check as follows:

- power supply, connections, cables;
- the good conditions of the vibrating rod (no bending, no damages,…).

1.3. Checking the equipment when on field use

Before starting to use the equipment, check that the viscosity information is stable (vibrating rod in the air) If not, check the zero adjustment in the air (§ 2.2).

1.4. Periodic checking

Conformity to regulations relative to Quality Insurance implicates a periodic control of the measuring equipment used in the manufacturing operations, taking in consideration (or correcting) their drift in time.

It is proved that this equipment drift is negligible. However, it is good to check their aspect and their response once a year, at the same time as the other process equipments.

A quick control is possible from time to time, if the sensor active part is in air, or immersed in a cleaning or rinsing solution. As long as these values stay similar, we can say that the sensor operation is right among its whole range (if no intermediate re-programming occurred).

1.4.1. Offset adjustment in air

The clean and dry rod is vibrating in air when the offset adjustment is carried out.

The amplitude, corrected with an offset, is shifted so that the viscosity value is 0 cP.

The zero adjustment in the air procedure is described in § 2.2.

1.4.2. Modification of the previous calibration

The device has been programmed in order to perfectly answer to the customer's needs. These features are noted in the factory specification pages at the end of this document.

At first, be sure that the modification is necessary, and not consecutive of a non-coherent comparative information (different measuring conditions, bad standards, inaccurate or wrong laboratory measurements,…).

The calibration parameters are protected and can only be modified at SOFRASER.

For any modification of the calibration, contact the distributor.

1.5. Technical characteristics of the sensor

Weight: 2.5 kg

Material:

- body in stainless steel 316L;
- handle in aluminium AU4G

Watertighness: IP67

Operating conditions: up to 50 °C

1.6. The electronic device

1.6.1. Technical characteristics

Weight: 0.4 kg

Material: ABS

Operating conditions: up to 40 °C

1.6.2. Power supply

PIV2 sensors are delivered with 4 rechargeable batteries.

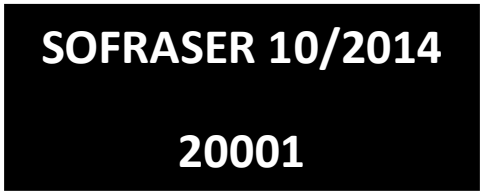
Autonomy of the sensor: about 8 hours.

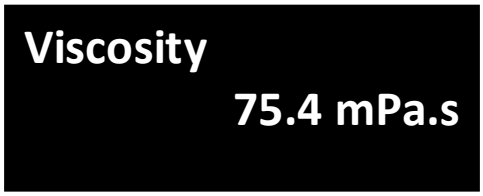
The batteries should be loaded with the battery charger delivered by Sofraser and this one only.

2.The PIV2 operating functions

2.1. Start and menus

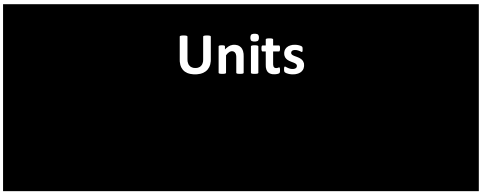
After turning on the device, the LCD screen switches on and the following window appears for a few seconds. The first line indicates the month and year of the sensor's manufacturing. The second line is the sensor's serial number. Then, the being measured viscosity value is displayed.





This is the main display of the device, the one the user is most interested in.

By pushing the "H" button (see the legend in the age 3 of this manual), we get access to the six different menus proposed by the processor. We can browse from one to the other with the help of "H". To enter into a menu, one must press "OK".



2.2. Offset

In this menu, we set the zero in the air. This is a very important step in the procedure for installing the equipment and it must be done each time the sensor is being used.

Before proceeding to the zero setting, the rod must be clean and dry. Be sure the process is empty and that the rod is vibrating in the air. The sensor must be fixed on its final position and will have to remain so. If not, the offset calibration will have to be done again.

Press "OK" to enter the menu. The window with the current adjustment value (here 7) appears. If "OK" is pressed, the new adjustment value (here 17) is displayed. The user can set the zero in the air again by pressing "OK" or he can get out of the menu by pressing "H". The new value is displayed.

The viscosity signal delivered to the outputs of the electronic device is calculated by using the corrected amplitude of the rod. If the offset is done in a wrong way or has been forgotten, the viscosity value will be false.

It is the essential setting of the installation and has to be performed with the most extended attention in order to set the MIVI in its best conditions for optimal measurements.

Note: *The user should wait at least one minute between two zero adjustments, in order to get accurate signals and calculations.*

2.3. Raw values

This menu allows the user to read the raw values of the main measured signals and the firmware number. There are four of them: amplitude, coil value, frequency and program version.

The amplitude value is the one directly given by the oscillating rod with no correction and no calculation.

The coil value is an image of the inner temperature.

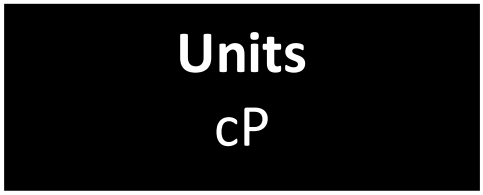
The frequency here is the frequency of the sensor and is used as a debug value.

Then, it is the program version in order to let the service after-sale know what device you have.

Mainly, these data are a good use to make a first diagnosis on the system if something wrong happens with the sensor.

2.4. Units

It is possible to select the viscosity unit for the main display on the LCD screen.
The choices are cP, P, mPa.s and Pa.s.



2.5. Stored data

The PIV2 device can save up to 16 measurements on field. While being on the main window and performing a measurement, the user can record the displayed value by pressing “OK”.

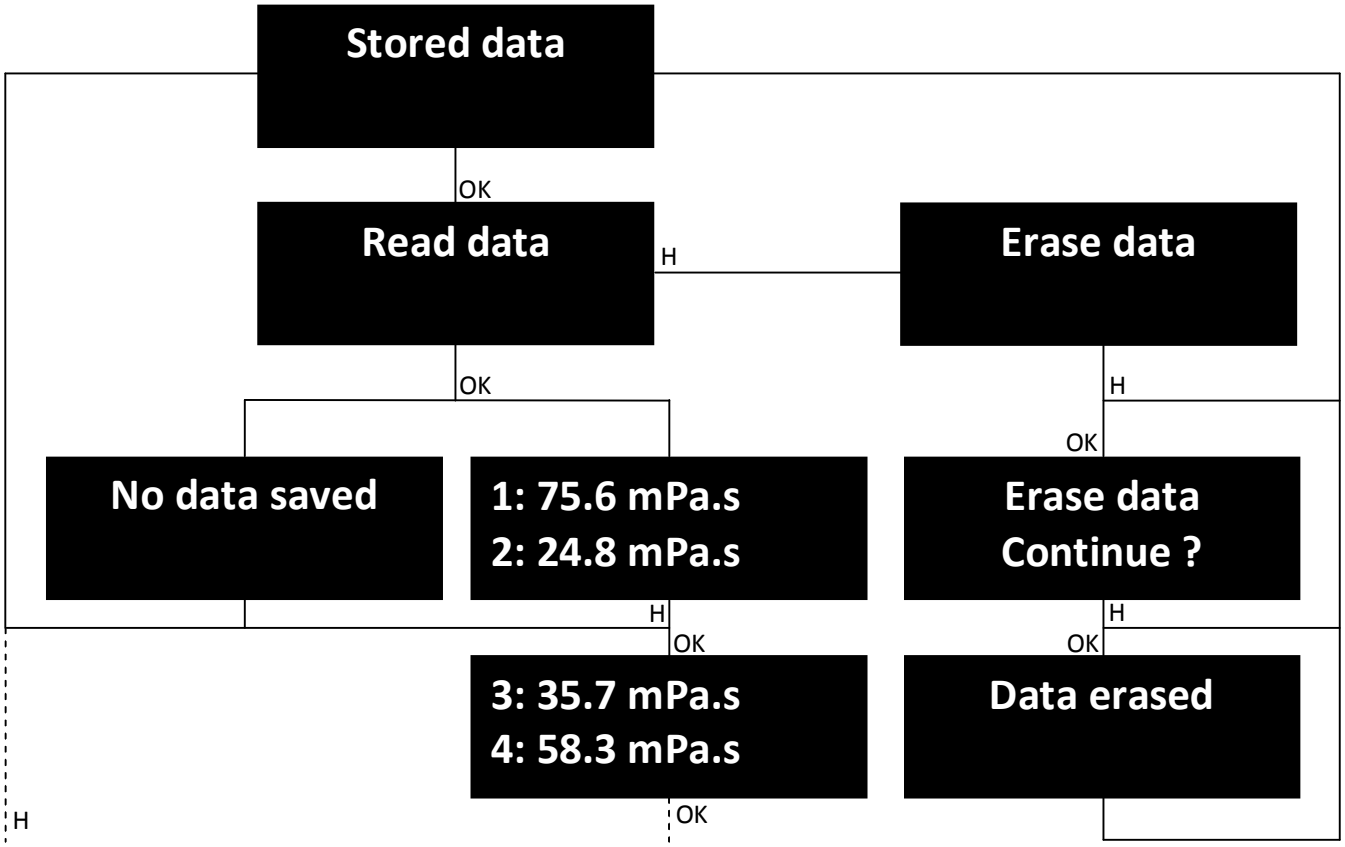
2.5.1. Read data

In the menu “Stored data”, by pressing “OK”, the user can access to the reading function of the recorded values. By pressing “OK” again and browsing in the menu with “OK”, the viscosity saved values will scroll one after another.

2.5.2. Erase data

In the menu “Stored data”, by pressing “H”, the user can delete all the recorded points he took from the field. A warning message needs to be validated because this action is irreversible.

2.5.3. Synoptic scheme



2.6. Measurement procedure

In order to get measurements under the best conditions of operation, it is highly recommended to use the sensor according to the following procedure.

- *step 1*

Bring out the PIV2 of its suitcase of transport and connect the viscometer to its electronic case.

- *step 2*

Make the zero adjustment in the air as explained in the paragraph 2.2 of this manual.

- *step 3*

Immerse the active part of the sensor (vibrating rod in its protector tube) in the fluid to measure until the displayed viscosity value is stable.

Be careful to hold sharply the handle and stay still while measuring the sample.

- *step 4*

Read the viscosity value on the PIV2 display and record it if necessary (see § 2.5).

- *step 5*

Clean the sensor's rod with the brush and then wipe the protector tube with a clean damp. This step is very important to avoid polluting the next sample to measure. The zero adjustment in the air should have to be made again after the measurement is done.

2.7. Advice for good measurements

- The sensor's rod must be clean and dry before measuring the sample's viscosity.
- The offset adjustment in the air must be done each time you take the PIV2 in your hand.
- Check that the viscosity indication in the air is zero. If not, see § 2.2.
- The sensor's rod must be completely immersed in the fluid.

Differences between the PIV2 measurements and some lab measurements can come from these reasons:

- gap in the zero adjustment in the air: see §2.2.
- damage to the sensor's rod: if the rod is bent, the PIV2 sensor with its electronic device must be sent back to your distributor for replacement or repair.
- constant use of the fluid around the sensor's rod: in the case of high viscosity fluids, and if the fluid is static, the rod's motion can create a hole in the sample, giving a viscosity indication lower than the actual value.
- the fluid's rheological behaviour: In case of a non-Newtonian fluid, viscosity depends on shear rate induced by the viscometer. Generally, lab viscometers induce small shear rates whereas the PIV2 shear rate is higher. In the case of a pseudo-plastic behaviour (viscosity decreases when shear rate increases), lab viscometers will give a higher viscosity value than the PIV2 sensor.

2.8. Measurement information

The PIV2 sensor gives viscosity information:

In standard (factory calibration), the viscosity unit is either "mPa.s" or "Pa.s" (calibrated in accordance to the customer's request).

- Repeatability: $\pm$ 1 % of the measurement;
- Viscosity ranges: from 0-100 mPa.s to 0-1000 mPa.s.

3. Sofraser Interface Software

The Sofraser Interface Software (SIS) has been designed for working with the PIV2 electronic device. It allows the communication between the electronic board of the PIV2 and the computer in order to make some data logging or to set some parameters.

This software has been designed to work on Windows XP, Windows Vista and Windows 7 systems. The communication is established through the RS485 port, MODBUS (code RTU) protocol.

This is optional and not delivered with the PIV2 device.

3.1. The main features

The main features of the SIS are as following:

- displaying and refreshing the dynamic values from the sensor: viscosity, temperature (if there is a Pt100 probe), amplitude, coil signal, frequency;
- making the zero adjustment in the air;
- displaying graphs of the different dynamic measurements;
- download the field recordings in an Excel file;
- adjusting some correlations for the viscosity

3.2. The user-friendly interface

When connecting the PIV2 to a computer, the SIS will automatically detect the board and display the serial number of the device. By clicking “OK”, the user is ready to start working with the equipment.

Each equipment is protected with a registration. At first use, the SIS will ask for the key code to activate the software. From then on, the SIS will always be able to communicate with the PIV2.

Different levels of security have been set up in the SIS, so that different users can have different possibilities on the equipment.

A tutorial is available directly in the tabs, for more efficient support when needed.