9601

Technical Manual

Viscosity and temperature processor

Original version

REF: 382-0

SOFRASER
Pioneering viscometry since 1972

IMPORTANT

THE OFFSET ADJUSTMENT IN THE AIR

MUST BE THE FIRST TASK COMPLETED.

Offset adjustment procedure is detailed in § 9.1.

1. **CLEAN AND DRY THE SENSOR ROD.**
2. **BE SURE THE PROCESS IS EMPTY. THE ROD MUST BE VIBRATING IN THE AIR.**
3. **INSTALL THE SENSOR ON THE PROCESS AND FIX IT WITH ITS 4 SCREWS.**
4. **POWER ON THE DEVICE, WAIT 15 MINUTES.**
5. **REACH THE OFFSET ADJUSTMENT FUNCTION BY ENTERING INTO MENU / SETTINGS / OFFSET.**
6. **FOLLOW THE INSTRUCTIONS DISPLAYED ON THE ELECTRONICS SCREEN.**
7. **PRESS “F3” TO ADJUST THE OFFSET. IT MEANS THE RAW SIGNAL IN THE AIR IS SHIFTED TO THE VOLTAGE REFERENCE DEFINED IN THE FACTORY CALIBRATION STAGE.**

Table of contents

1. Transmitter principle

The measuring chain is composed of three inseparable elements: the sensor, its cable and the 9601 processor that controls it. The sensor cannot be used with another transmitter or another cable type or length because they are all a part of the resonant loop so they are matched together as one vibrating system.

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 processor acquires the coils' amplitudes and frequency and generates various signals. These signals represent the properties being measured. It is also in charge of powering the whole system. It gives viscosity and temperature information through analog outputs, serial communication and displays it. The processor also allows settings as the very important "zero in the air" procedure.

2. Processor technical characteristics

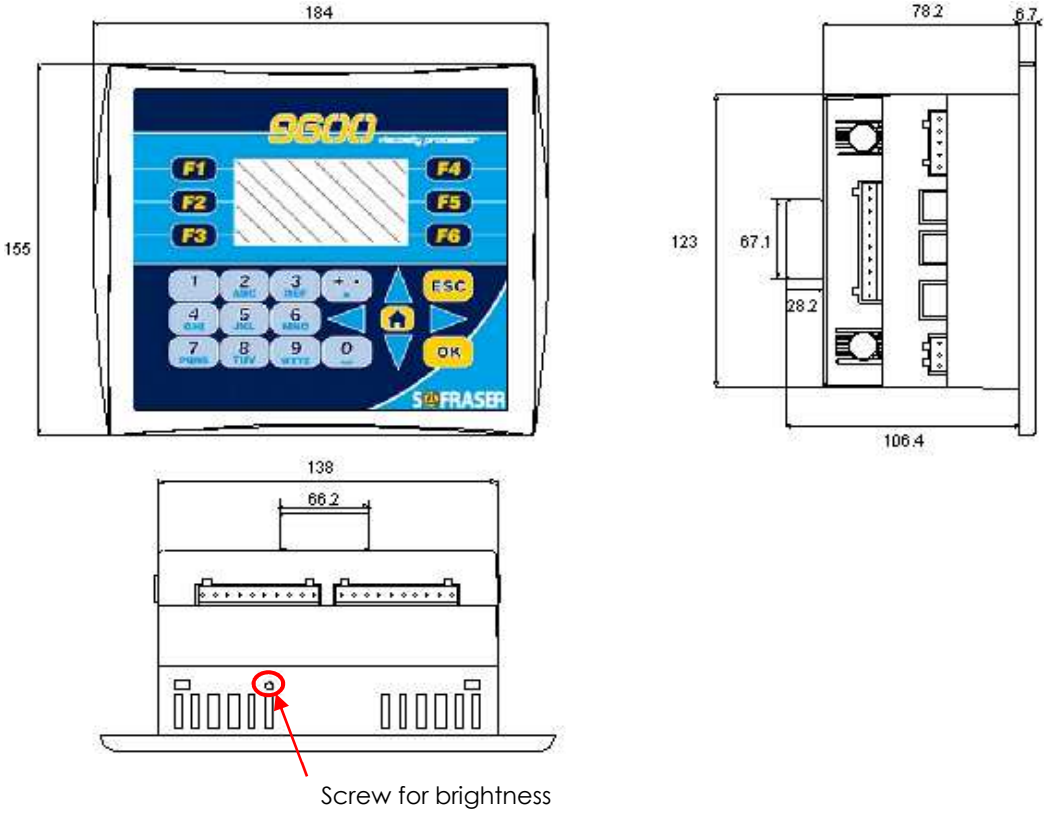
2.1 Electronic device size

The electronic box has the purpose to be fitted in a panel, close to the process line. The collar is the only visible part, composed of a face plate and a LCD screen. It is continuously displaying the viscosity value and, in the case there is a Pt100 probe, the temperature value.

The ID label is stick on the back panel with main information (see §2.6).

2.2 Mechanical characteristics

- Dimensions behind the collar: 138 x 123 x 106.4 mm
- Collar dimensions: 184 x 155 x 6.7 mm
- Case transducer dimensions : 66.2 x 67.1 x 28.2 mm
- Cut-out for assembly on panel: 141 x 126 mm. Thickness ≤ 5mm.
- Weight: about 515 g.
- Tightness: IP 65 with panel mounting and IP20 on rear panel.
- Operational temperature: 0 °C to 45 °C.



2.3 Display

- Display type: STN LCD
- Illumination backlight: LED yellow
- Display resolution: 128 x 64 pixels

The brightness can be adjusted using the screw on the top panel.

2.4 Keyboard

24 keys: alphanumeric keys and function keys.

2.5 Battery

The battery lifespan is about 7 years at 25 °C. When the battery no longer works, the operating parameters of the sensor are no longer stored in memory. It is then necessary to foresee the change of the battery after 5 years of use of the sensor.

2.6 Consumption

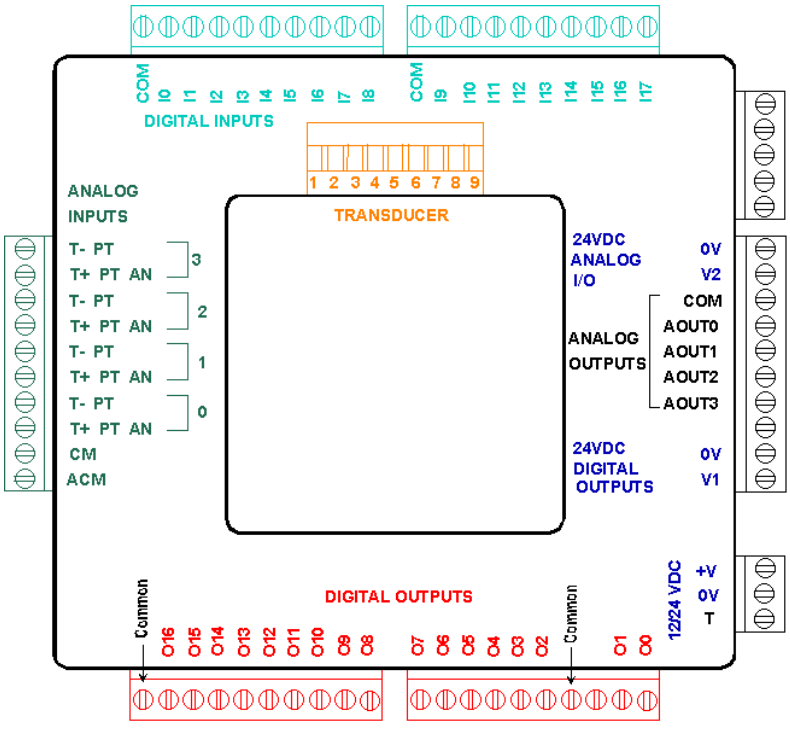
The processor requires a 24 VDC (± 2.4 V) stabilized and filtered power supply (not provided by SOFRASER).

Typical power consumption: 7.2 W maximum

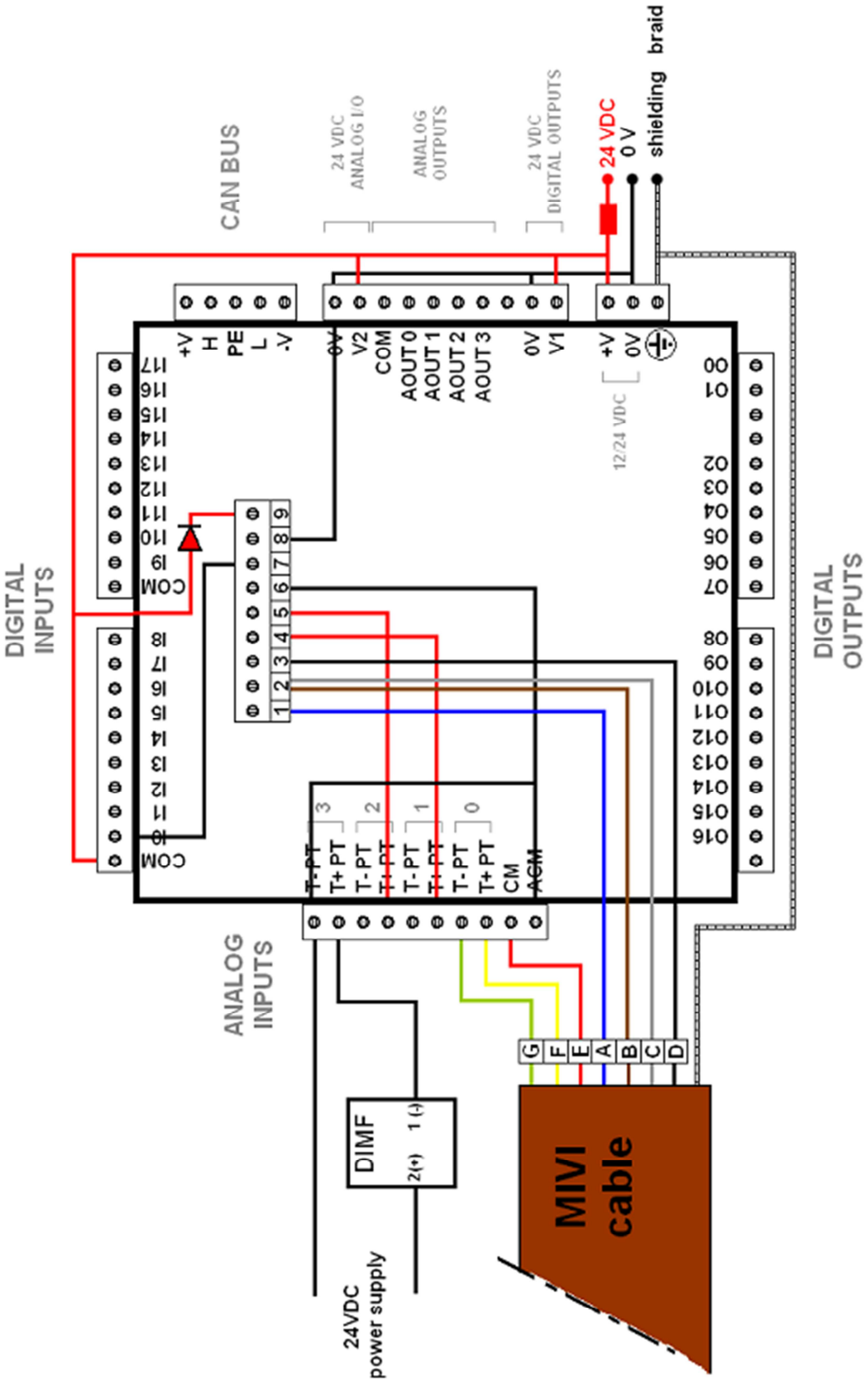
2.7 Connection blocks

On the processor back module, various categories are identified (example: DIGITAL INPUTS, ANALOG OUTPUTS...).

We will call these categories "connection blocks". The diagram below identifies the various connection blocks. The colours codes used and the name of these connection blocks are taken again for each connection diagram.

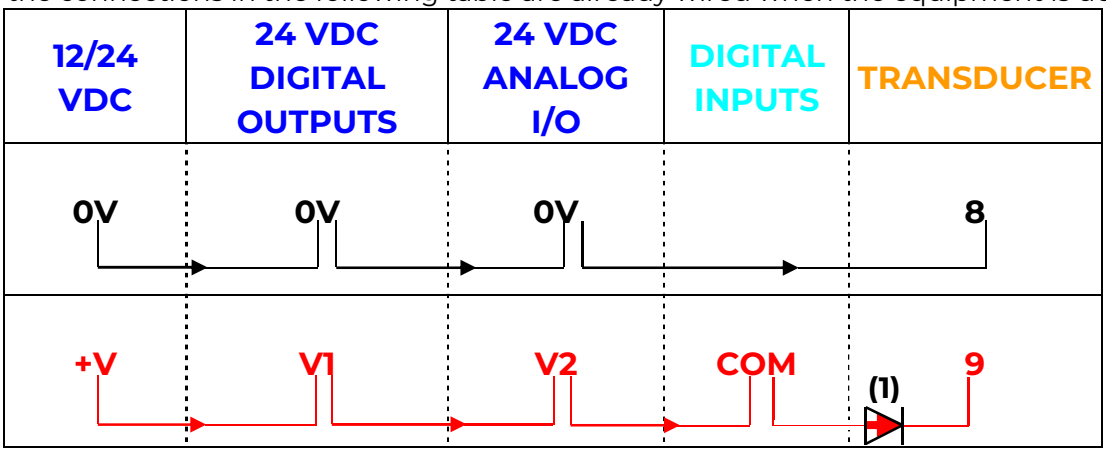


2.8 General scheme of the electronic device



2.9 Connections made by Sofraser

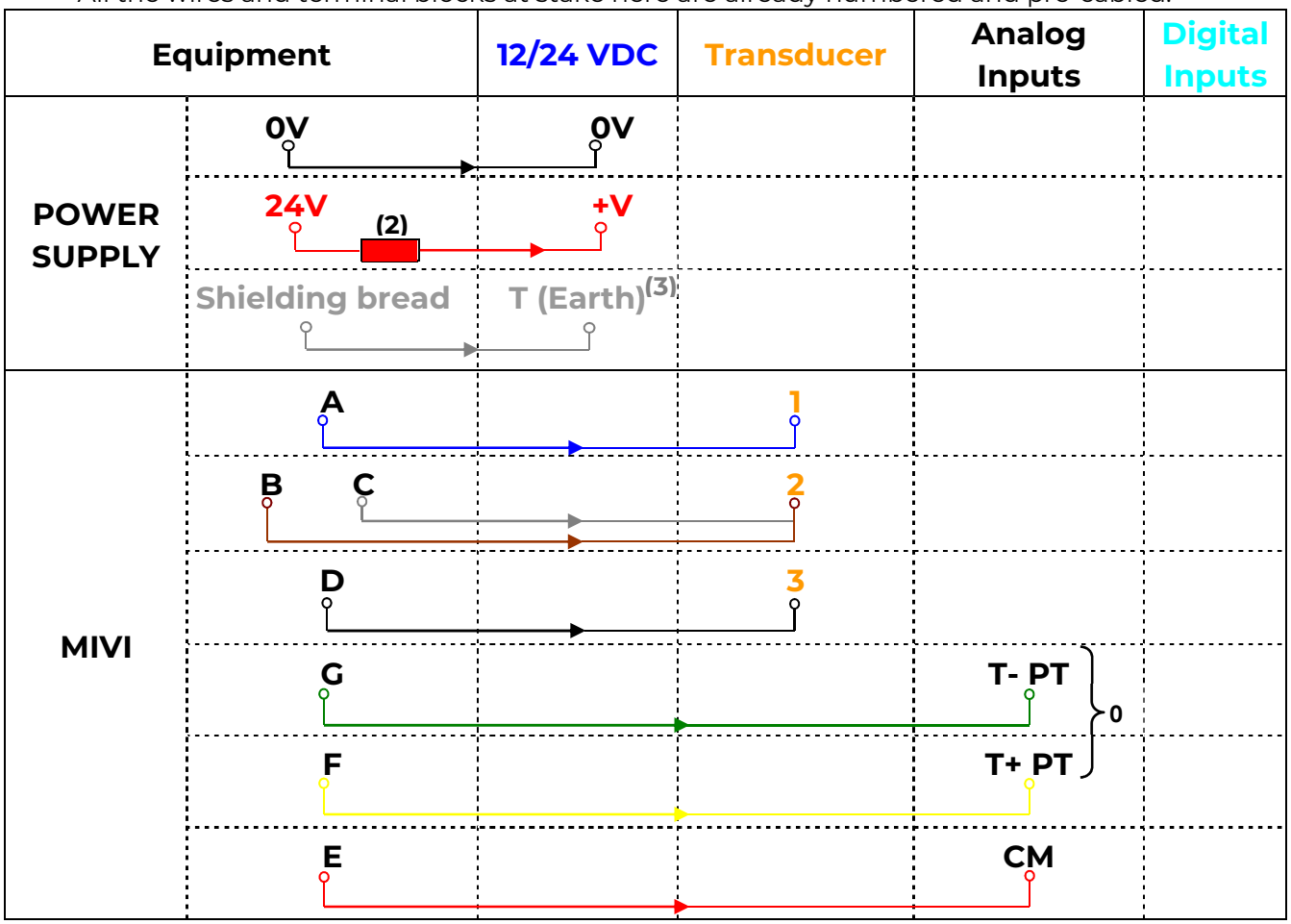
All the connections in the following table are already wired when the equipment is delivered.



A 1N4007-type diode **(1)** is cabled between the digital inputs block and the transducer in order to protect the transducer from the unexpected power supply inversion.

2.10 Connections to be done by the user

All the wires and terminal blocks at stake here are already numbered and pre-cabled.



If there is no incorporated Pt100 probe, there are no E, F and G wires to connect. In the case of a non-provided by SOFRASER external probe, be sure this is a 3-wires one.

An external circuit protection device (such as a fuse) is recommended as shown in **(2)**.

See §3 for power supply earthing **(3)**.

2.11 Digital Inputs TOR

18 TOR inputs are available including 2 inputs which can be used as high speed counter, shaft encoder or for frequency measurement.

In our configuration, we only use one input (for the frequency): I0 (see §2.8).

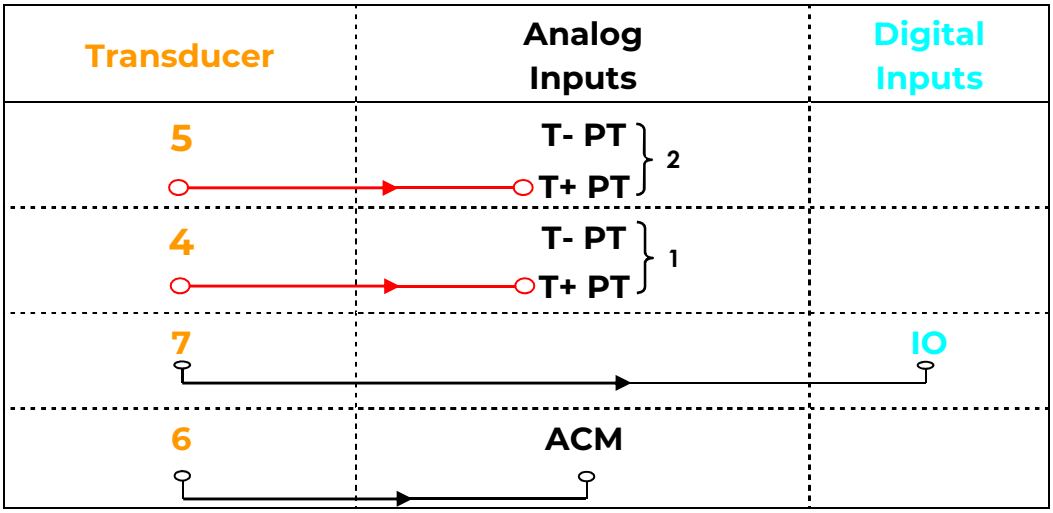
2.12 Analog Inputs

4 analog inputs are available. Their resolution is 14 bits.

Analog inputs type: voltage 0-10 V, current 0/4-20 mA. These inputs can be used with a thermocouple or a Pt100 probe.

On the 9601 processor, these inputs are used as follows:

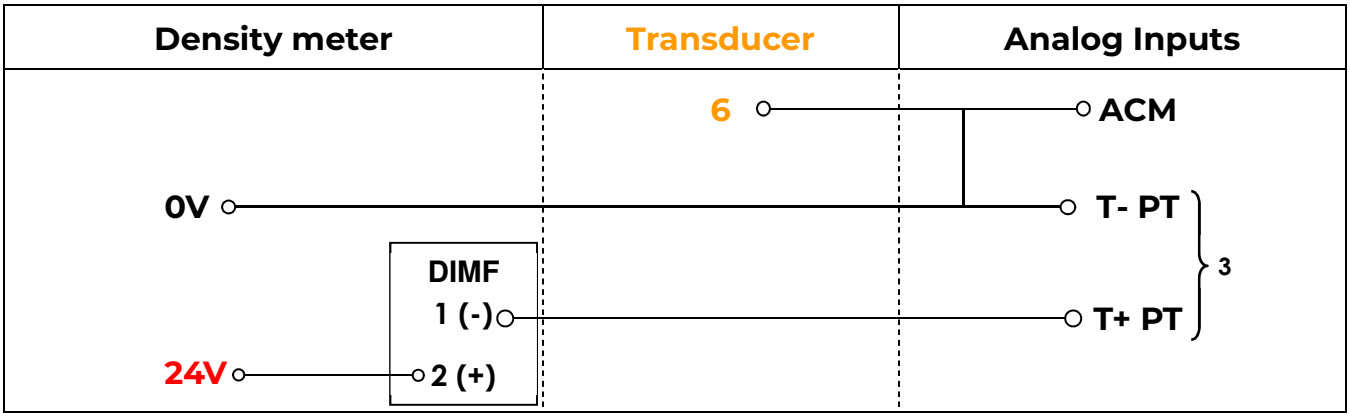
Physical value	*Input type*	*Scale*
amplitude	voltage	0-10V
coil	voltage	0-10V
temperature (optional)	Pt100 Ω – 3-wires mode	-50°C to 200°C
	PT100 external probe	-200°C to 600°C
density (optional)	current	4-20 mA



Note: These connections are also made by SOFRASER.

2.13 Density meter (optional)

In the case of SOFRASER provides its density meter, this is the way to connect it to the device.



2.14 Safety considerations

- Do not touch wires while the processor is ON.
- A non-isolated power supply can be used provided that the 0V is connected to the frame.
- In the event of mounting on a metal panel, standard safety considerations require that the power supply should be earthed to avoid electrocution.
- Do not connect either the “Neutral” or “Line” signal of the 110/220VAC to the device’s 0V pin.
- In the event of voltage fluctuations or non-conformity to voltage power supply specifications, connect the device to a filtered and stabilized power supply.
- Double-check all wiring before turning on the power supply.
- Do not use tin on the stripped wire that might cause the strand to break.
- Install at maximum distance from high-voltage cables and power equipment.
- To avoid damaging the wire, do not exceed a maximum torque of 0.5 Nm (0.05 kgf.m).
- We recommend using crimp terminals for wiring. Use 26-14 AWG wire for all wiring purposes.
- To maximize the system performances, avoid electromagnetic interferences by mounting the processor on a metal panel and earthing the power supply.

Note: The wire used to earth the power supply must not exceed 8 cm in length. If your conditions do not permit this, do not earth the power supply (cf. step 2 § 3).

2.15 Relay outputs

15 relay outputs are available.
In our configuration, 9 relay outputs are used as follows:

Physical value	*Relays*
Viscosity	1 NO relay for LOW threshold 1 NO relay for HIGH threshold
Compensated Viscosity	1 NO relay for LOW threshold 1 NO relay for HIGH threshold
Temperature	1 NO relay for LOW threshold 1 NO relay for HIGH threshold
Density	1 NO relay for LOW threshold 1 NO relay for HIGH threshold
Diagnosis - Dysfunction	1 NO relay

- *Normal functioning:* The coils of the relay are under tension and the contact is closed.
- *In case of anomaly:* The coils are not under tension and the contact is opened: measurements out of set point, processor power supply is turned off…
- *Power cut-out:*

  Relays O2 to O7 and relays O8 to O15: 3 A maximum per relay, 250VAC or 30VDC
  Common: 8 A maximum
  Common is not located, refer to the plugging chart

  Minimal charge: 1mA for 5VDC
  Relays lifespan: 100 000 operations at the maximum charge
  Response time: 10 ms

If these relays are used to commute some inductive charge, we advise you to add some RC networks to the charge terminals (preferably) or to the contacts terminals. They will then lessen the electro-magnetic phenomena.

2.16 Analog outputs

4 analog outputs are available. Their resolution is 12 bits.
Analog outputs type: current output 4-20 mA or voltage output 0-10 V.
In our configuration, analog outputs are used as follows:

Physical value	***Output type***	***Scale***
viscosity	current	4-20 mA
temperature	current	4-20 mA
compensated viscosity	current	4-20 mA
density	current	4-20 mA

2.17 Outputs wiring

Analog outputs	
COM	Common outputs 4/20mA
AOUT0	4/20mA viscosity output
AOUT1	4/20mA temperature output
AOUT2	4/20mA compensated viscosity output
AOUT3	4/20mA density output

Digital outputs	
O16	NO relay - diagnosis
O15	NO relay HIGH - density
O14	NO relay LOW - density
O13	NO relay HIGH - comp. viscosity
O12	NO relay LOW - comp. viscosity
O11	NO relay HIGH - temperature
O10	NO relay LOW - temperature
O9	NO relay HIGH - viscosity
O8	NO relay LOW – viscosity

2.18 General information

List of the device generic standards:

Low Voltage Directive	EN 61131-2	Power supply 24 VDC-not submitted
CEM Immunity	EN 61000-6-2	Electro-static discharges Radio-frequency Burst quick transients
CEM Emission	EN 61000-6-3 EN 61000-6-4	Radio-frequency
Process variable	CEI 751	Pt100
Protection	CEI 529	IP 65 on front panel and IP 20 on rear panel
Size	CEI 473	Front panel : 184 * 155 mm Cut-out : 141 * 126 mm
Climatic conditions	Storage	-20 to 60°C 5 to 90% HR non-condensing
	Work	0 to 45°C 5 to 90% HR non-condensing

2.19 Wastes handling

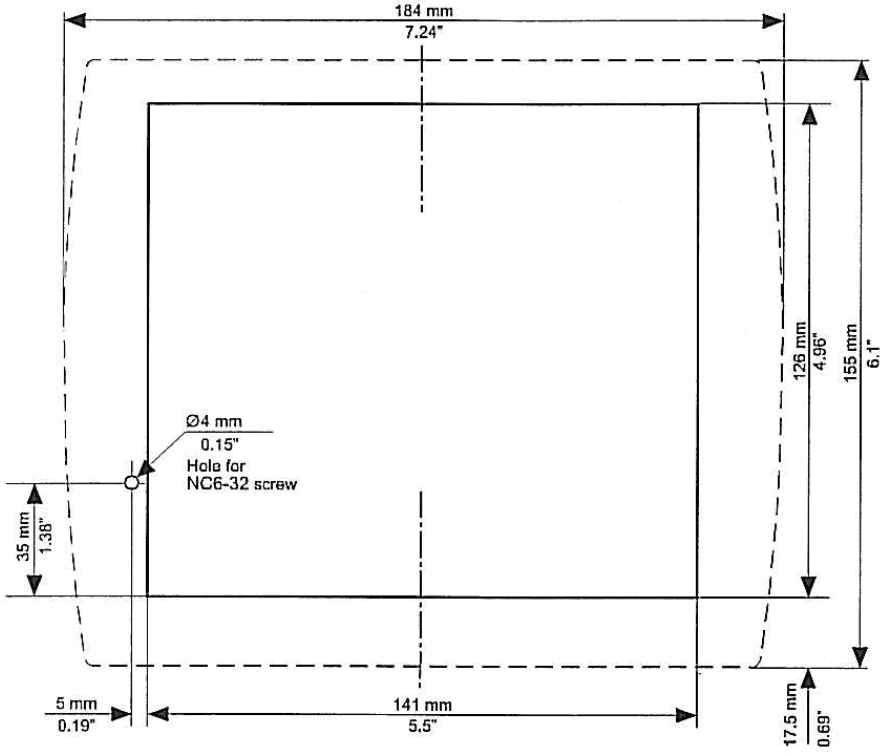
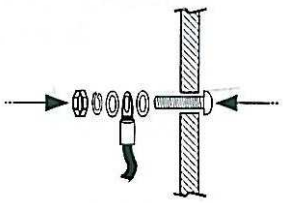
Within the framework of the directive 2002/96-CE application, commonly named directive DEEE, relating to the wastes of electric and electronic equipment, SOFRASER considers taking in charge the equipment arriving at the end of the lifetime.

Do not throw the equipment to the dustbin. If the user does not have the means to take in charge the wastes of our electronic equipment, he should returned these equipment to our factory with a signed letter confirming that it is an equipment that has to be destroyed/recycled.

3. Processor mounting-installation

Warning:

The mounting panel should not be more than 5 mm thick.

Step 1	**Make a panel cut-out as following:** 
Step 2	Earth the power supply - Bore a hole of Ø4 mm that suits the NC6-32 screw supplied. - Scrape the panel paint away from the contact area to ensure a conductive connection. - Drive the screw into the hole and place the following hardware in this order: washer, ring cable shoe, second washer, spring and nut.  Note: The wire used to earth the power supply must not exceed 8 cm in length. If your conditions do not permit this, do not earth the power supply.
Step 3	Slide the processor into the cut-out, ensuring that the rubber seal is in place.

Step 4	Push the 4 mounting brackets into their slots on the processor sides as shown as following: 
Step 5	Tighten the bracket screws against the panel. Hold the mounting brackets firmly against the processor during the screws tightening.

4. Communication

4.1 Serial interface

2 RS ports are available. One is a RS232 (PORT 1), the other one can be either a RS232 or a RS485 (PORT 2). They are located on one side of the processor.

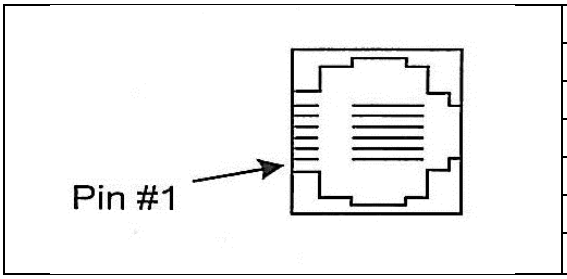
Serial ports type: RJ-11.

- Caution:

- Turn off power before making communication connections.
- Do not connect the controller directly to a telephone or a telephone line.
- Use shielded, twisted pair cables.
- Minimize the length of the connection cables. The length should not exceed 1200 m.
- Do not cross A and B signals: the positive terminals must be wired to +, and the negative terminals to -.
- The RS232 port is not isolated.
- The RS485 serial port is not isolated. If the controller is used with a non-isolated external device, avoid potential voltage that exceeds ± 10V.To avoid damaging the system, all non-isolated device ports should relate to the same ground signal.
- Signals are linked to the processor's ground, this is the same ground used by the power supply.

- RS232 characteristics

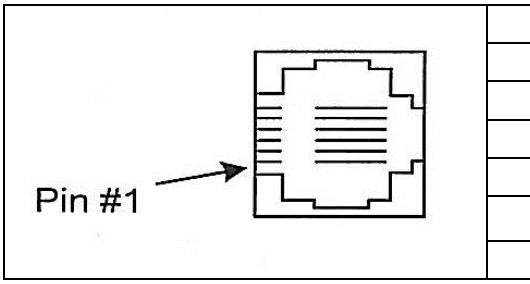
Baud rates	***PORT 1***	***PORT 2***	***Voltage limits***
	300 to 57600 bps	300 to 115 200 bps	-20V to 20V



Pin number	***Function***
1	DTR signal
2	0V reference
3	TxD signal - Transmission
4	RxD signal - Reception
5	0V reference
6	DSR signal

- RS485 characteristics

Baud rates	***Nodes***	***Voltage limits***
300 to 115 200 bps	Up to 32 processors	-7V to 12V



Pin number	***Function***
1	A signal (+)
2	*
3	*
4	*
5	*
6	B signal (-)

* pins 2 to 5 are not used for RS485 communication.

4.2 Modbus communication protocol

Goal: read amplitude, coil, viscosity and Pt100 values using RS-485 communication

S: send from the console to the board
R: response from the board to the console
Amplitude: signal read before correction, offset and without linearization
Coil: signal which is an image of the sensor inner temperature
Viscosity: viscosity calculated in cP
Pt100: value in Celsius degrees of the temperature read by the probe (if there is one)

COM port characteristics

Speed: 9600 bits/s Number of bits: 8 Parity: none Stop bit: 1

Generic frame format

S = SN 3 XX XX YY YY <CRC>
R = SN 3 AA {DATA} <CRC>

SN: slave number (hexadecimal)
XX XX: starting point for the addresses to be read
AA: read bytes number
<CRC>: checksum (automatic)

3: reading function
YY YY: number of words to be read
DATA: content of all the asked addresses

List of addresses:

Viscosity	0x143C	4 bytes
Temperature	0x0021	2 bytes
Compensated viscosity	0x144C	4 bytes
Density	0x001F	2 bytes
Frequency	0x000D	2 bytes
Amplitude	0x001C	2 bytes
Coil	0x0007	2 bytes
Offset	0x001B	2 bytes

Example:
S = 11 03 14 3C 00 02 <CRC>
R = 11 03 04 00 08 8D F3 <CRC>

11: slave number (hexadecimal)
14 3C: viscosity address
04: number of bytes read
<CRC>: checksum

03: reading function
00 02: number of words
00 08 8D F3: viscosity value (0x88DF3 = 560.627 mPa.s)

5. General information on the use of 9601

Before any use, read carefully the technical manual of the MIVI sensor in order to ensure the good installation of the unit.

5.1 Navigation

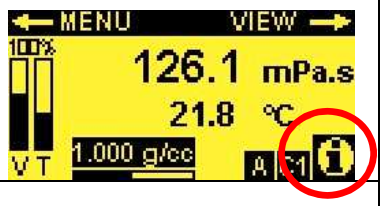
Press on this key:

ESC to return to the previous level

to return to the "Bargraphs" view (see §6.1)

5.2 Diagnosis

When an anomaly is detected by the processor, the symbol appears on the main "Bargraphs" view.



Press F6 and the details about the anomaly appear.

Out of range: Viscosity.	We consider that the sensor is out of range when viscosity exceeds 110 % of full scale range.
Out of range: Compensation table	The reference temperature, that can be set on "Compensated viscosity" view (see § 6.2) or the instantaneous temperature is out of the table.
Alarms	Message that appears at the reach of the low or high threshold for viscosity, temperature or density.
Rupture	Message that appears when there is a coil wire breakdown (viscosity or density) generally related to a connection problem.

5.3 Security codes

Refer to §12 (Specific notes and manufacturing parameters) and §10.4 (Modify security codes) of this Technical manual.

4 security codes, CODE 0 to CODE 3, are defined.

- Code 3 = 1111 – Modifiable
- Code 2 = 1111 – Modifiable
- Code 1 = Not modifiable and reserved to SOFRASER after-sales service
- Code 0 = Not communicated and not modifiable

5.4 Modes

The utilization mode enables to visualize viscosity, temperature and density values in various forms (§6).

The Adaptation mode enables to adapt parameters, settings and configuration of the processor according to the using conditions. (§7).

6. Utilization Mode

The Utilization mode enables to visualize viscosity, temperature and density values in various forms

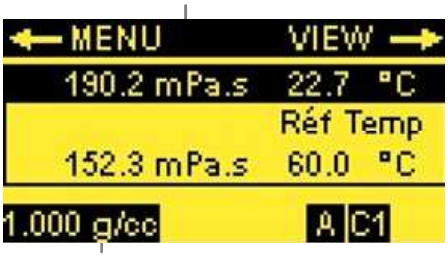
6.1 *"Bargraphs" view*

"Bargraphs" view is the principal view. The following data are displayed:

- Viscosity, temperature and density bargraphs.
- Instantaneous viscosity, temperature according to the selected unit and density (coefficient or density meter).

6.2 *"Compensated viscosity" view*

Instantaneous measurements



Compensated viscosity calculated at reference temperature

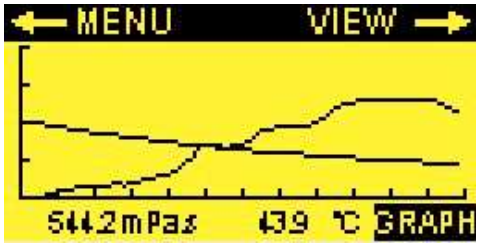
The viscosity at reference temperature calculation requires knowing the viscosity evolution in function of temperature.

Setting and saving the compensation table is done in the "Parameters" block.

The reference temperature can be modified starting from this view as following:

- Using the keyboard, enter the new value of the reference temperature.
- Press **OK**: the modification is done and the viscosity is re-calculated according to this new value of reference temperature.

6.3 *"Acquisition graph" view*



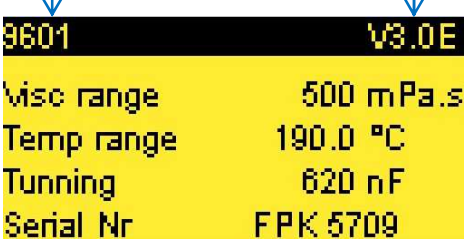
The acquisition graph represents viscosity and temperature.
One graph represents 120 values and the acquisition time can be set in the "Settings" block.
For example: For an acquisition time setting at 30s, the graph will represent an acquisition of 1 hour.

A first pressing on **F6** enables to display the viscosity graph, with the same time scale of the graph for viscosity and temperature.

A second pressing enables to display the temperature graph.

6.4 *Information – version*

Electronic version Program version

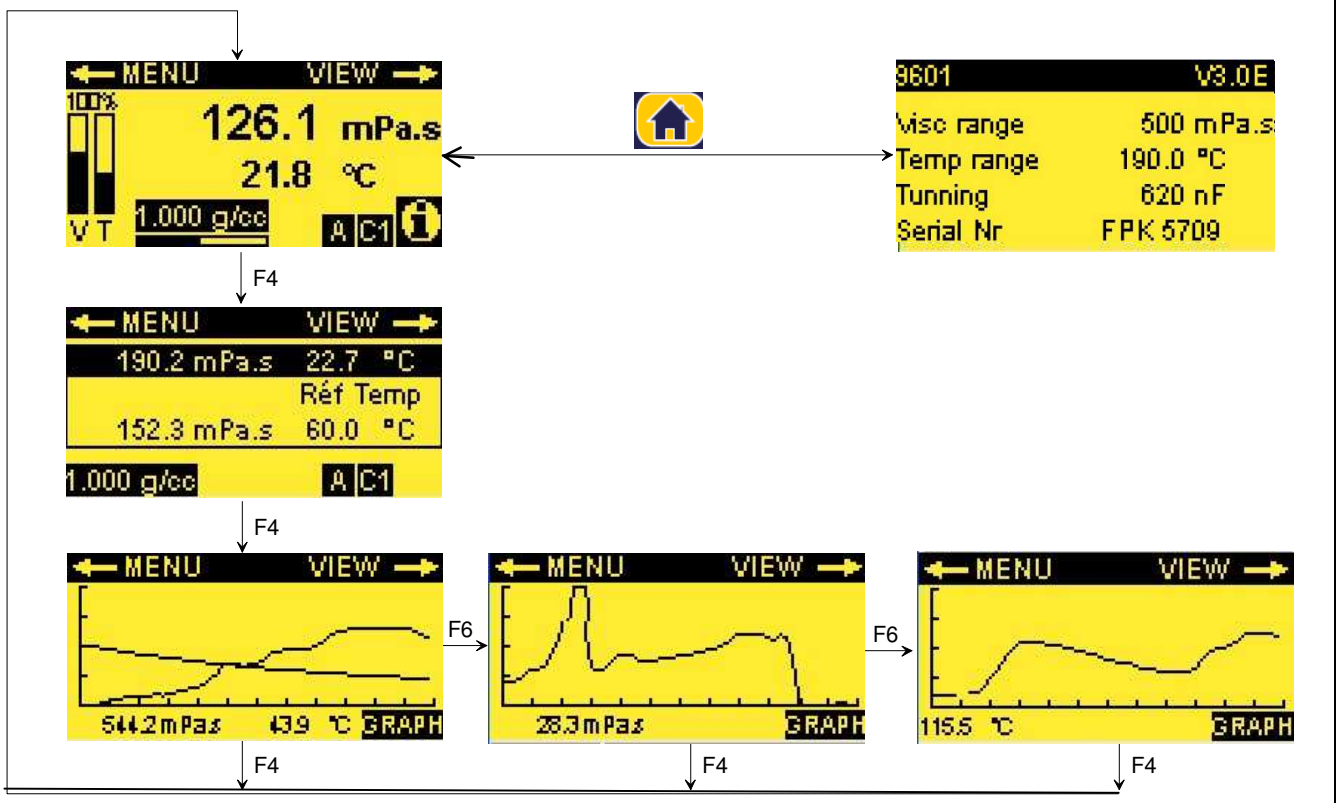


The information view is accessible starting from the main view by pressing on  .

6.5 Synoptic

Navigation between the three views “Bargraphs”, “Compensated viscosity” and “Acquisition graph” is possible by pressing on the key **F4**.

Starting from all these views, pressing on the key **F1** enables to reach to the Adaptation mode main menu.



7. Adaptation Mode

The Adaptation mode enables to adapt parameters, settings and configuration of the processor according to the using conditions.

The Menu is accessible, starting from all the Utilization Mode views, by pressing on the **F1** key.
The Menu enables to reach the various block of the Adaptation Mode.

To select the block you want to reach, use the arrows and press "**OK**".

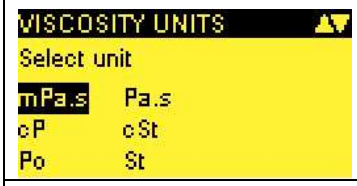
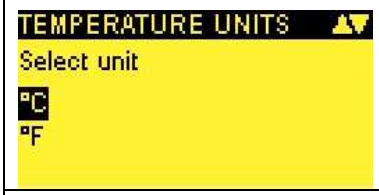
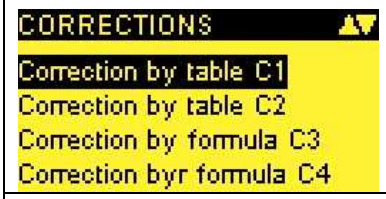
Displays: see § 8

Settings: see § 9

Parameters: see § 10

Configurations: see § 11

8. Block "Displays"

8.1 Menu of the block "Displays" 	Use the arrows to select the function you wish and press "**OK**".
8.2 Choose the Viscosity Unit 	The security code 3 is needed. To choose the new viscosity unit, it is enough to select it with the arrows and to press "**OK**". The change is automatically done.
8.3 Choose the Temperature Unit 	The security code 3 is needed to choose the new temperature unit, it is enough to select it with the arrows and to press "**OK**". The change is automatically done.
8.4 Activate viscosity correction 	The security code 3 is needed. Setting the correction is done in "Settings" block Select the correction you want to apply using the arrows, for example table C1.
 	If it is indicated "OFF": the correction is activated and if you press on **F3**, it will disable the correction. If it is indicated "ON": the correction is disabled and if you press on **F3**, it will activate the correction. Only one correction can be enabled. If you activate a new correction, it will automatically deactivate the previous one. The correction, which is activated, is displayed on the "Bargraphs" view. *For example: Correction C1 is activated.*

8.5 Status

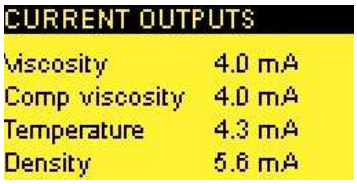
This function enables to reach:

- Status of current outputs
- Status of relays
- Raw data

The data visualized starting from this block is not modifiable.

Select the function you want to reach by using the arrows.

8.5.1 Current outputs status



It makes it possible to visualize the instantaneous values of current outputs corresponding to the viscosity, the compensated viscosity, the temperature and the density.

The setting of current outputs is made starting from the block "Settings".

8.5.2 Alarms relay outputs status

In this example:

Temperature and Density are under their Low thresholds. This is an anomaly so contacts are opened.

It makes it possible to visualize the status of the relays allocated to viscosity, compensated viscosity, temperature and density alarms.

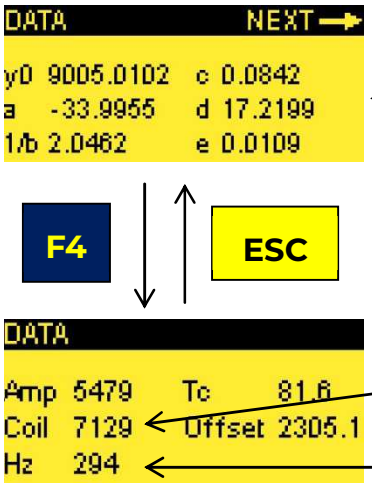
Relays are NO type.

Under normal functioning, the coils of the relay are under tension and the contact is closed.

In anomaly, the coils are not under tension and the contact is opened: measurements out of set point, processor power supply is turned off…

The setting of High and Low thresholds is made starting from the block "Settings".

8.5.3 Data status



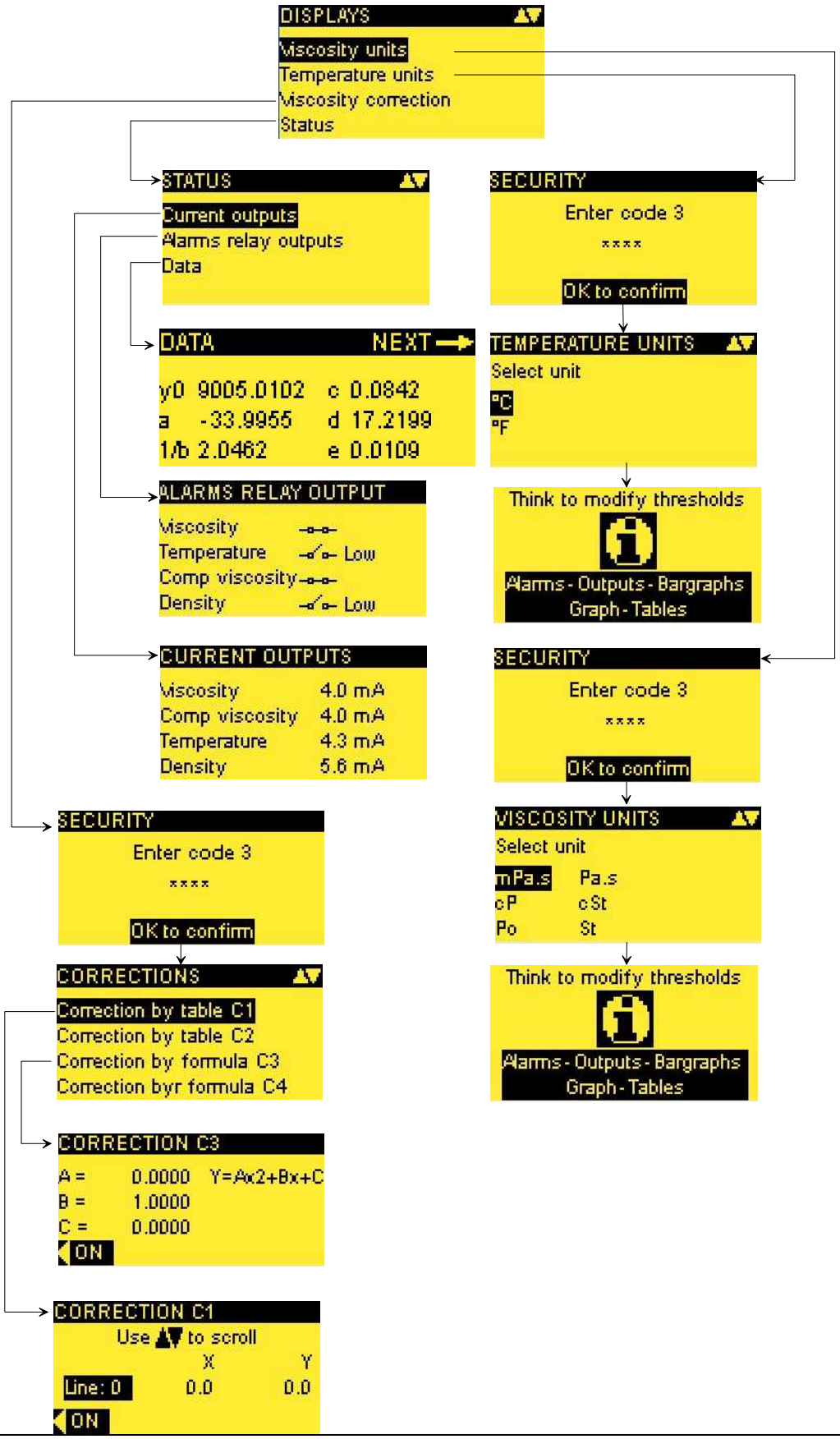
This view is intended for SOFRASER after sales service.

Calibration parameters

Coil value

Frequency

8.6 Synoptic of Block "Display"



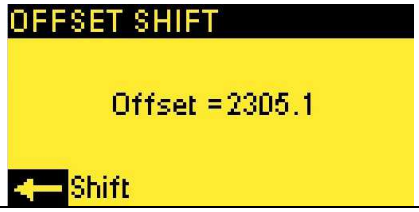
9. Block "Settings"

9.1 Set the offset

Air is used as reference fluid in order to adjust the raw signal during the installation.

The offset adjustment must be done at each new installation of the sensor on the process.

The stages to follow to proceed to the offset adjustment are describes below:

Step 1	Enter in the "Settings" block
Step 2	Enter the security CODE 2 and choose the function "Offset"
Step 3	Clean the sensor rod and make sure that it is clean and dry
Step 4	Make sure that the process is empty so that the sensor is vibrating in the air during the adjustment, i.e. that the rod is not immersed. Install the sensor using the fastening screws. Wait until stabilization of the raw signals (see raw data §8.5.3)
Step 5	When all checks have been done press OK to confirm
Step 6	Press on F3 to perform the offset adjustment 
Step 7	Repeat the offset adjustment 2 times, 1 minute apart to check stability of the offset
Step 8	*The offset adjustment is successful* Press on  and note the new offset value and the date on the specific notes form

Consequences of a failed offset adjustment:

Viscosity is calculated starting from the amplitude corrected with offset.

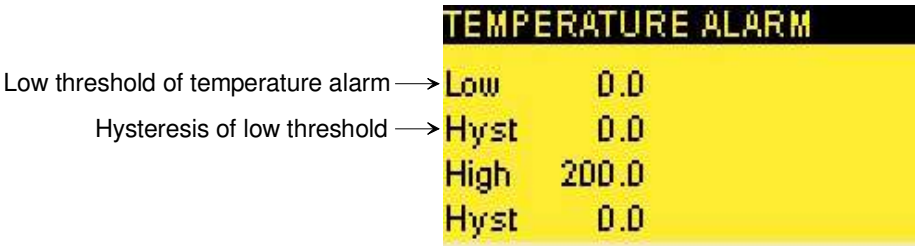
So, if the offset is not adjusted correctly, the viscosity value will be false.

9.2 Set the alarms

It makes it possible to set LOW and HIGH thresholds and hysteresis of viscosity, compensated viscosity, temperature and density alarms.

Pressing **OK** does the navigation from one threshold to another.

The modification of a value is done using the keyboard. Pressing on **OK** will immediately take the value modified into consideration and will make it possible to skip to the following threshold.



Alarm 1 = alarm corresponding to the viscosity LOW threshold
Alarm 2 = alarm corresponding to the viscosity HIGH threshold
Viscosity unit = cP

Example: *VISCOSITY ALARM*

Low threshold = 15.0

Hysteresis = 5.0

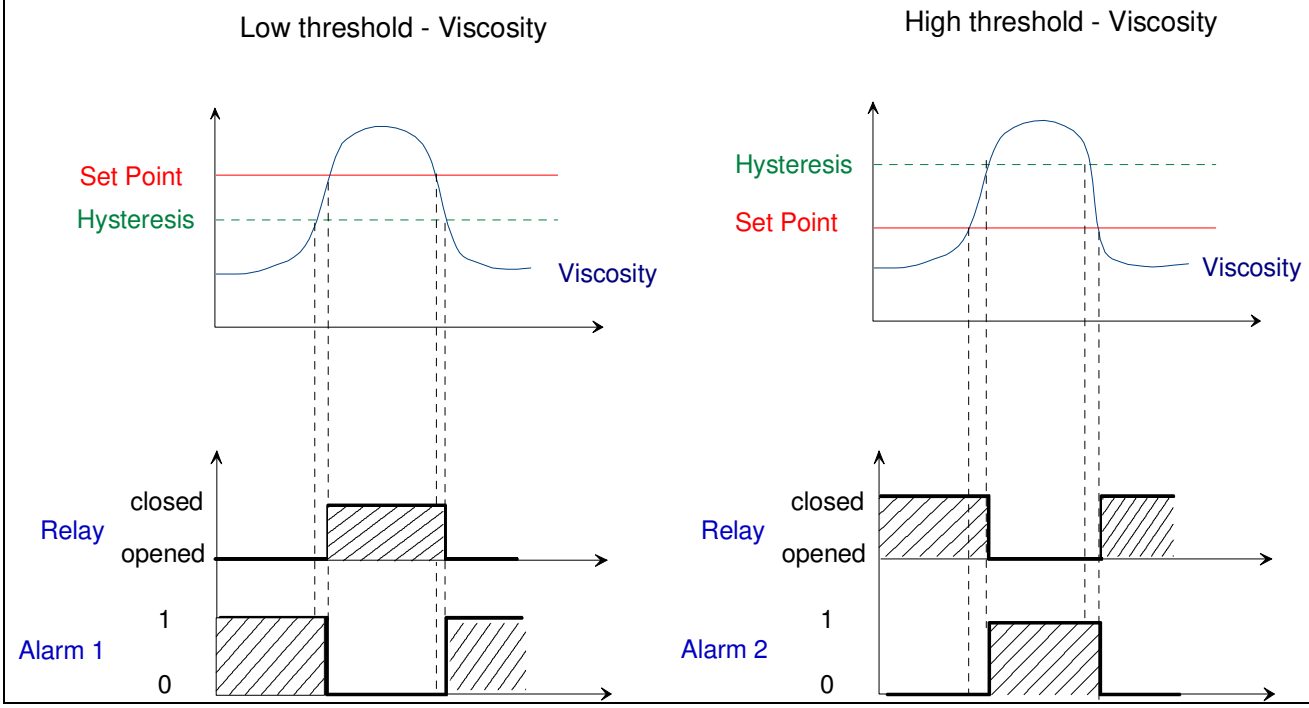
High threshold = 100.0

Hysteresis = 10.0

Alarm 1 is activated when the viscosity reaches 10 cP. It stays active as long as viscosity does not reach the set point 15 cP.

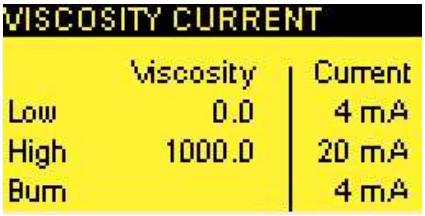
The relay associated is opened as long as Alarm 1 is activated. Alarm 2 is activated when the viscosity reaches 110 cP. It stays active as long as viscosity does not reach the set point 100 cP.

The relay associated is opened as long as Alarm 2 is activated.



9.3 Set and test the current outputs

9.3.1 Set the current outputs



It makes it possible to set viscosity, compensated viscosity, temperature and density current outputs.

Pressing on **OK** does the navigation from one value to another.

The modification of a value is done using the keyboard. Pressing on **OK** key will immediately take the value modified into consideration and will make it possible to skip to the following threshold.

Low = Minimal physical viscosity value: 0.0 cP => Value of the current output for the minimal physical value: 4mA

High = Maximum physical viscosity value: 1000.0 cP => Value of the current output for the maximum physical value: 20mA

Burn = Value of the current output (Between 4 and 20 mA) in the event of breakdown of the measurement signal.

9.3.2 Test the current outputs

Code 1 is needed to access this testing function.

This function permits to SOFRASER after-sales service to test current outputs by generating a current.

For the output you want to test, define a current on this view.

With an ammeter measure the signals (mA) on the analog outputs connector located on input/output module of the processor (on the back module). The measured signal should be equal to the defined testing current.

You have to stay on the view “current generator” to proceed to the test.

COM + AOUT 0: viscosity current output

COM + AOUT 1: temperature current output

COM + AOUT 2: compensated viscosity current output

COM + AOUT 3: density current output

9.4 Choose the method of kinematic viscosity calculation

It is possible to calculate the kinematic viscosity in 2 ways:

1) Starting from the density measured by a density meter (in option): When the 9601 processor is delivered with a density meter, the density input configuration (4/20 mA) is the following one: 4 mA → 0,4 g/cc and 20 mA → 2 g/cc
2) By considering that the density is constant settable between 0 and 9.999 g/cc (see §10.3)

The choice of the calculation method is done by selecting it with the arrows.

Caution: if the user chooses to work with kinematic viscosity values, the viscosity unit (§ 8.2) must be “cSt“ in order to activate the conversion.

9.5 Set the bargraphs

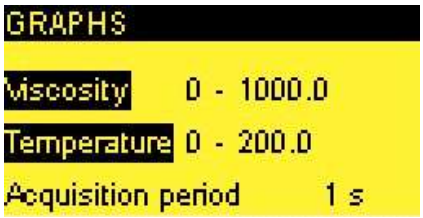
Bargraphs are displayed on the main view, which is accessible by pressing on  .

The bargraphs scales require to be modified during a change of viscosity or temperature unit in order to remain in coherence with the range of the physical units.

Only high thresholds of bargraphs can be modified.

The modification of a value is done using the keyboard. Pressing on OK key will immediately take the value modified into consideration and will make it possible to skip to the following threshold.

9.6 Set the graph scales



It makes it possible, for the user, to set the working range to visualize on the acquisition graph: minimum and maximum of the scales and acquisition frequency.

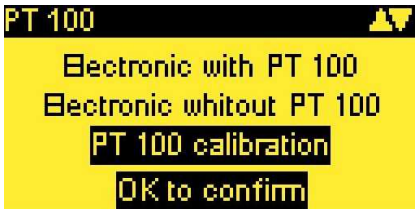
	Minimum	Maximum	By default
Scale	Always 0		The maximum of viscosity / temperature range
Acquisition	1s	120s	30s
Number of point	120 points		

The scales must be verified and adjusted following:

- Modification of the viscosity unit (§ 8.1)
- Modification of the temperature unit (§ 8.2)

Example: When acquisition period = 1 s, a point will be recorded and traced every seconds. The graph will represents 2 minutes of acquisition

9.7 Activate the Pt100



Electronic with Pt100: makes it possible to activate all displays and functions related to the temperature.
Electronic *without Pt100:* when the temperature measurement is not available or when the user prefers to work without temperature indication. It will cancel all displays (bargraphs, graphs, instantaneous measurements) and will block the access to all the functions related to the temperature (temperature unit, temperature and viscosity compensated alarms, temperature and viscosity compensated current outputs, compensation table…)
PT100 calibration: Y = A*x + B

Use the arrows to select the function you wish and press **OK** (OK to confirm)

9.8 Define the filter

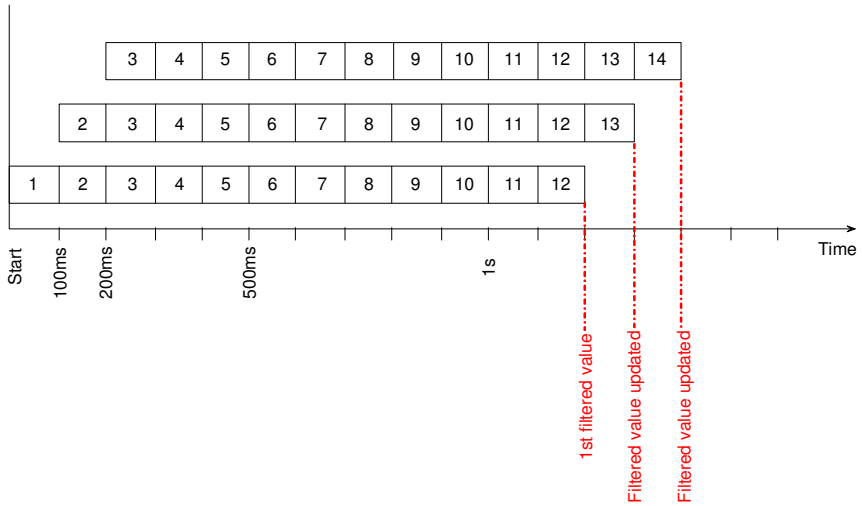
This function permits to activate and define parameters of the viscosity filter.

Two parameters need to be defined by the user:

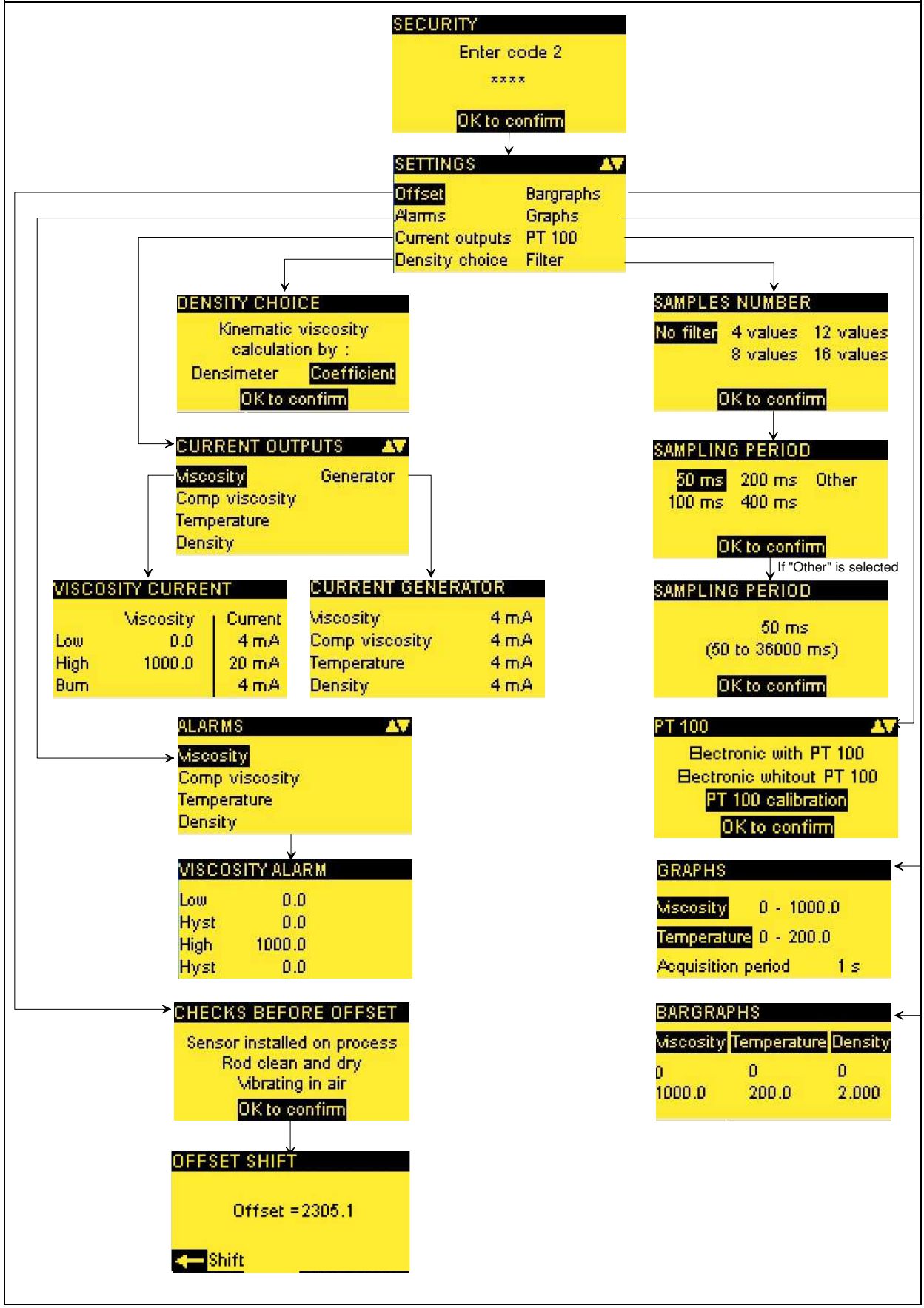
1) Samples number: number of values that are used to calculate the averaged viscosity. Four possibilities are proposed (4, 8, 12 or 16 values) and the user can deactivate the filter by choosing “no filter”.

2) Sampling period: this period corresponds to the new viscosity value acquisition period. At each period, a new value enters in the table and the oldest is getting out. The filtered viscosity is updated. Four periods are proposed (50, 100, 200, 400 ms) and the user can define another period from 50 ms to 36000 ms. The first filtered viscosity value is calculated (samples number * sampling period) after the starting of the sensor.

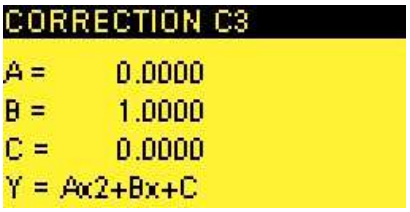
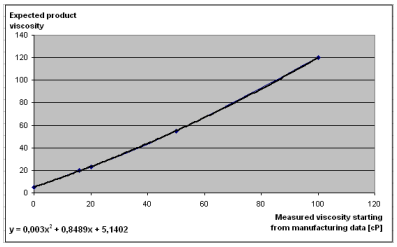
For example: Samples number = 12 – Sampling period = 100ms



9.9 Synoptic of Block "Settings"



10. Block “Parameters”

10.1 Viscosity corrections		This function can be used in two ways: 1) define a correlation 2) define new viscosity unit
	Correlation:  	4 correlations can be set: C1 and C2 are correction by table (10 rows) C3 and C4 are correction by equation The selection of a viscosity correction makes it possible to correlate the measured viscosity (in cP), starting from the manufacturing calibration data, to the expected viscosity of a product. This correlation is done by table or by equation of second order. This function enables to take into account the effects of non-Newtonian behaviour.
	 	Example for correction by an equation In our example, the user have to define parameters as follows : A = 0.003 B = 0.8489 C = 5.1402
	Viscosity unit:	The viscosity units, which are defined, are the following ones: mPa.s, cP, Po, Pa.s, cSt. It is possible to define other viscosity units using this function. The activation of the correction is made in the block “Display” (§ 8.4). NOTES: It is not possible to give a name to these corrections.

<table>
<tr><td colspan="2">10.2 Compensation table</td><td>This function enables to read and to modify the temperature compensation table.

The compensation table contains 7 couples of points (Temperature, Viscosity).

Temperature range must include both reference temperature and process temperature.

Note: take care to the coherence between the unit of the table points and the temperature and viscosity units chosen to display. Any change of viscosity or temperature unit requires the modification of the table points: conversion of the value into the selected unit.</td></tr>
<tr><td></td><td>10.2.1 Reading of the compensation table</td><td>The reading is simply made after selecting the function “Compensation table” starting from the “Parameters” block.

The direction arrows are used to skip from a table line to the next one.</td></tr>
<tr><td></td><td>10.2.2 Modification of the compensation table</td><td>To modify the table points, follow the steps below:
<table>
<tr><td>Step 1</td><td>Position using the arrows  on the table line to be modified.</td></tr>
<tr><td>Step 2</td><td>Press on OK to have access to the modification.</td></tr>
<tr><td>Step 3</td><td>Modify the X value - temperature: using the keyboard and press on OK to validate.</td></tr>
<tr><td>Step 4</td><td>Modify the Y value – viscosity: using the keyboard and press on OK to validate.</td></tr>
<tr><td>Step 5</td><td>Pressing on OK, at the time of the validation of the Y point, will close the modification window. The 2 modified points are taken into account and the reading window becomes active again.</td></tr>
</table>
Reference temperature is set in compensated viscosity view (§6.2)</td></tr>
</table>

10.3 Define the density coefficient

If the kinematic viscosity is calculated with a constant density, the user has to define this constant by this function.

The coefficient must be programmed in [g/cc] setting possible between 0 to 9.999 g/cc.

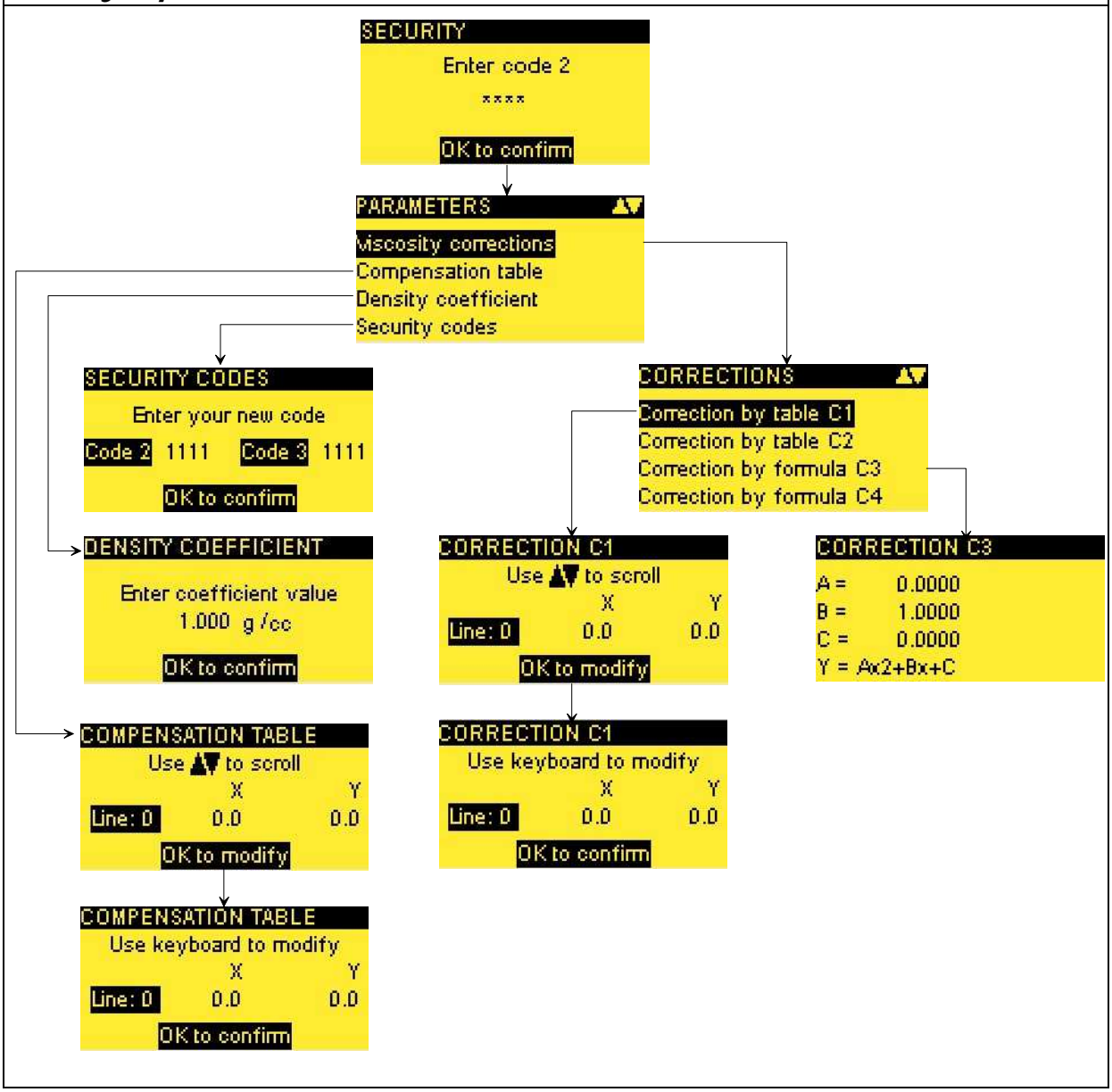
10.4 Modify the security codes

The security codes make it possible to protect data and to limit the access to some functions of the processor.

CODE	
3	Code 3 = 1111 – Modifiable. This code gives access to the functions of Viscosity and Temperature units choice and of viscosity corrections activation (§8.2, §8.3 and §8.4).
2	Code 2 = 1111 – Modifiable. This code gives access to the blocks “Settings” and “Parameters”.
1	Not modifiable and reserved to SOFRASER after-sales service.
0	Not communicated and not modifiable. This code gives access to the parameterized manufacturing data: calibration data and thermal drift table.

To modify a security code, it is enough to enter it using the keyboard and to press on OK to record it.

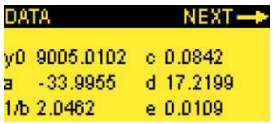
10.5 Synoptic of Block "Parameters"

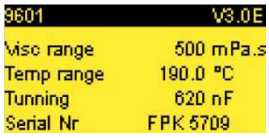


11. Block "Configuration"

These data are reserved at the SOFRASER workshop and at the after-sales service.

11.1 Define the thermal drift table and the calibration data





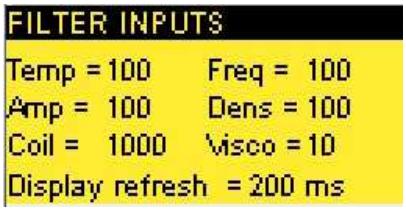
The security code 0 is required to have access to these functions.

These manufacturing data should not be modified.

Nevertheless, it is possible to visualize the calibration data starting from 2 different views:
Accessible starting from the block "Display".

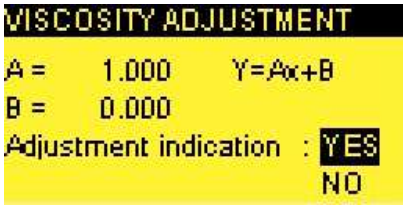
Accessible starting from the main view "Bargraphs" by pressing  .

11.2 Define the filter inputs



The filter inputs are defined by the SOFRASER workshop for the most common cases, however, it is possible for the distributor to adapt them to the process needs. To do so, after entering the security code 1, you must either modify the desired values and validate with OK, or keep and move to the next value by pressing OK.
The higher the value is, the longer the measurement response time will be.
Display refresh doesn't impact the filter.

11.3 Define the adjustment data



Y = Ax + B

x = measured viscosity

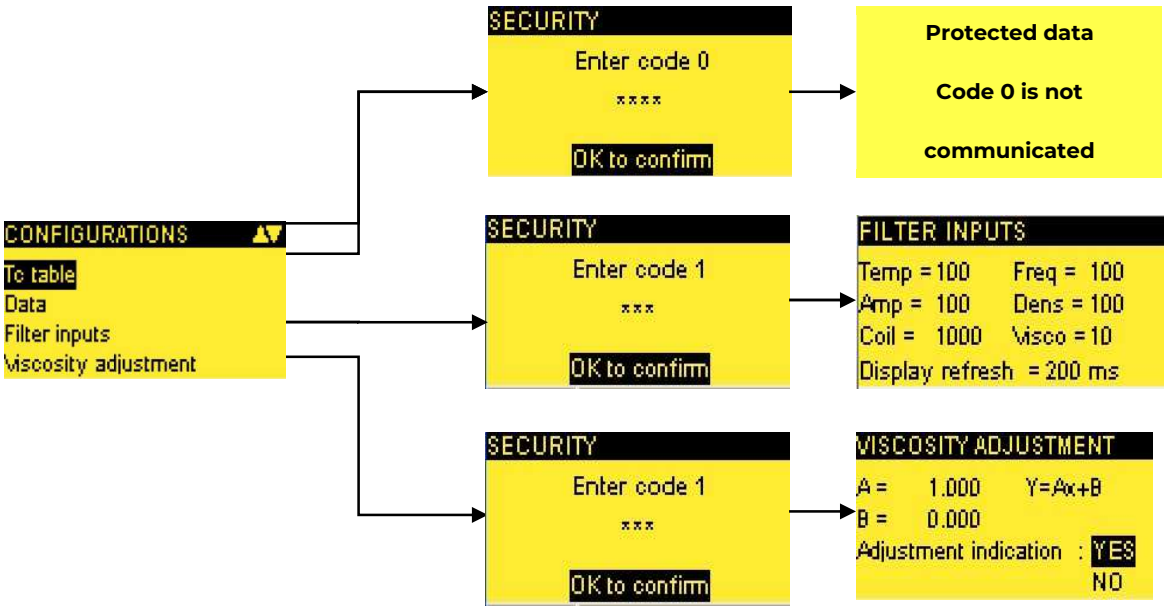
Y = adjusted viscosity

The adjustment function makes it possible for the distributor to do a re-calibration in order to make correspond the measured viscosity to the awaited viscosity.
The adjustment of the measured viscosity is done with equation as follows:
If "Adjustment indication" is selected as "YES", it means that the activation will be represented on the main view "Bargraphs" with an "A".
If "Adjustment indication" is selected as "NO", it means that the activation will not be represented on the main view "Bargraphs". The adjustment is still activated.
To deactivate the adjustment, parameters must be recorded as follows:

A = 1 B = 0

For a new calibration, the sensor must be returned to SOFRASER.

11.4 Synoptic of Block "Configuration"



12. Specific notes

Each viscometer has its own specific notes form enclosed at the end of the manual. They contain the settings, parameters and configuration set at SOFRASER during manufacturing.