

9700

User Manual



9710 multi-sensors processor

To manage up to 4 MIVI sensors with their 9000 transducers

9720 multi-products processor

To manage up to 256 sets of parameters

Original version

REF.: 396/5

IMPORTANT

When using a 9700 device to control one to
four MIVI+9000 viscometers,

**THE OFFSET ADJUSTMENT IN THE AIR
MUST BE THE FIRST TASK
COMPLETED on each sensor**

[MENU\Setting\Offset] and follow the instructions on the screen.

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 30 MINUTES.
5. ENTER THE "SETTING" MENU IN THE 9700 PROCESSOR, CHOOSE THE "OFFSET" FUNCTION THEN "DO OFFSET" IN ORDER TO COMPLETE THE ZERO ADJUSTMENT IN THE AIR;
6. THEN 'VALIDATE'.

The offset adjustment procedure is detailed in § 3.5.1 – *Setting|Offset*.

Before installing and using the 9700 processor, pay good attention to the MIVI and 9000 technical manuals references 379 and 381 in order to ensure a proper installation of the sensor and its transmitter.

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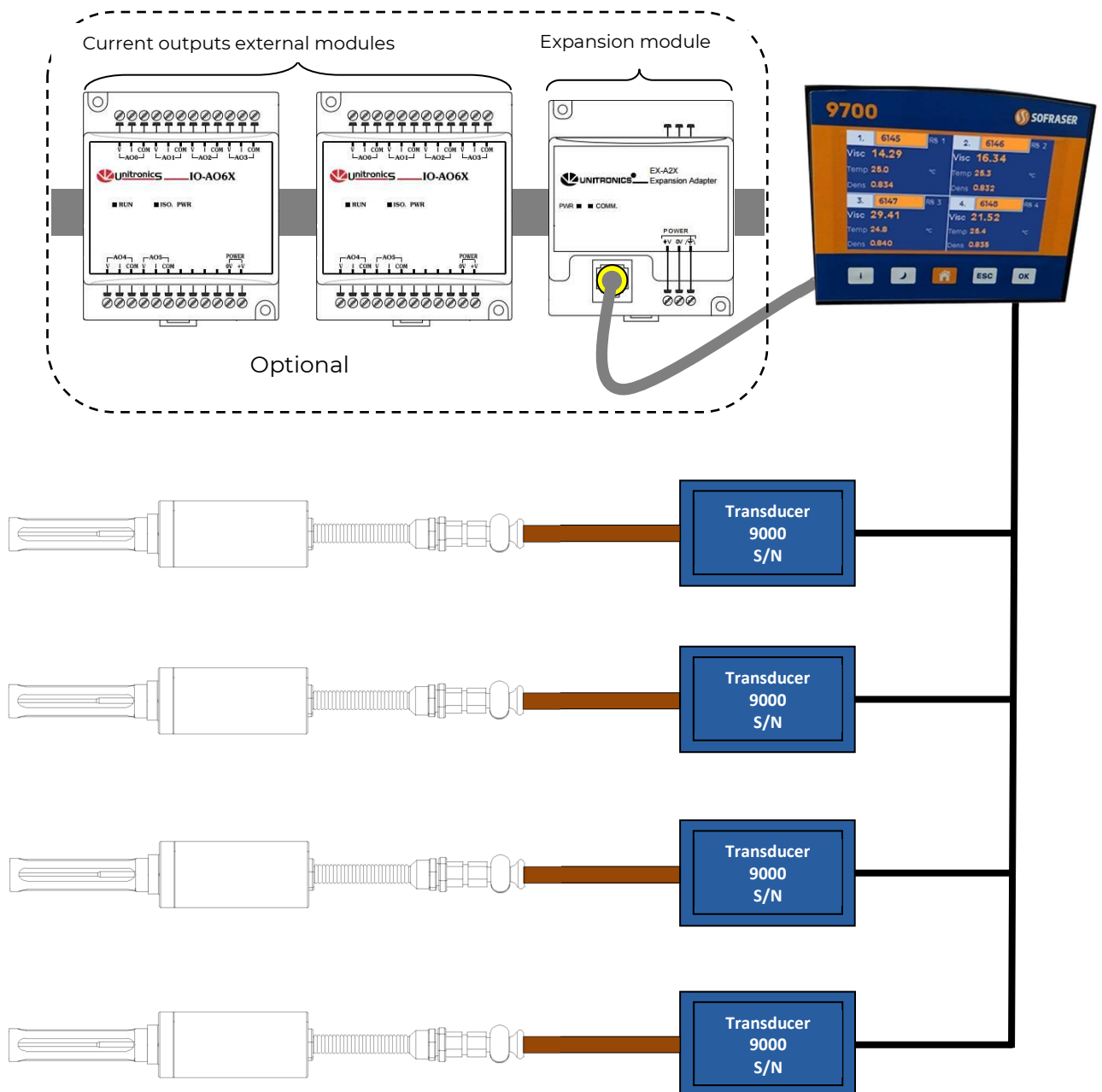
1. General presentation

The 9700 processor is an accessory controller that is to be connected to the transducer(s) of the MIVI sensor(s) in order to add numerous functions to the whole system. The purpose of this accessory module is to offer a large amount of displaying items and controlling relays, but also to provide the user with up to 14 current outputs (2 by default) that can be allocated according to his needs. This manual describes the two models:

The 9710 multi-sensors model that manages up to 4 MIVI 9000 viscosity and temperature sensor(s).

The 9720 multi-products model that manages one MIVI 9000 viscosity and temperature sensor to be used with up to 256 sets of products parameters.

When 9700 is combined with one MIVI 9000 viscosity, temperature and density sensor, please refer to the relevant additional document.



2. 9700 technical characteristics

The 9700 processor and its viscometer(s) should be considered as one PLC with one to four external module(s).



PLC
 Panel Programmable Logic Controller

2.1 Mechanical characteristics

Dimensions behind the collar:	122 x 91 x 61.3 mm
Collar dimensions:	136 x 107 (105.1 on the side) x 7.3 mm
Cut-out for assembly on panel:	122.5 x 91.5 mm. Thickness ≤ 5mm
Weight:	about 0.40 kg
Mountings (Tightness):	Panel mounted (IP66/IP65/NEMA4X)
To meet the UL508 standard, panel-mount the device on the flat surface of a Type 1 enclosure	
Operational temperature:	0 °C to 50 °C (32 to 122°F)

2.2 Display and keyboard

Screen:	4.3" Color Touchscreen (16:9)
Display type:	LCD type TFT
Display resolution:	480 x 272 pixels
Colors:	65,536 (16-bit)
Illumination backlight:	white LED
Keys:	Virtual keyboard + 5 function keys

2.3 Power supply and battery

The processor requires a 24 VDC (± 3.4 V), 1 A stabilized and filtered power supply. Preferably, use the same power supply than the transducers 9000's one.

To maximize performance, avoid electromagnetic interference by:

- ① Mounting the controller on a metal panel
- ① Connect each common and ground connection directly to the earth ground of your system
- ① For ground wiring uses the shortest and thickest possible wire

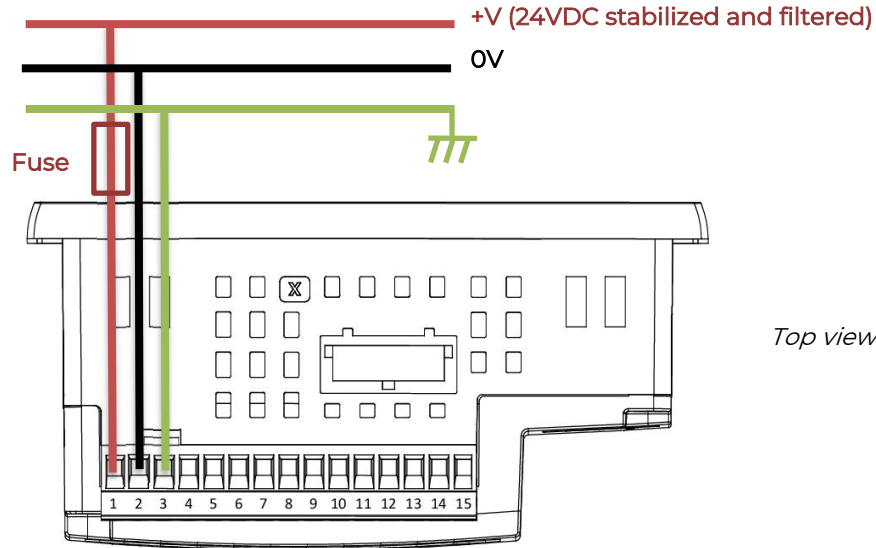
The parameters backup battery lifespan is 7 years typical at 25 °C (for RTC and system data, including variable data).



2.4 9700 connection blocks

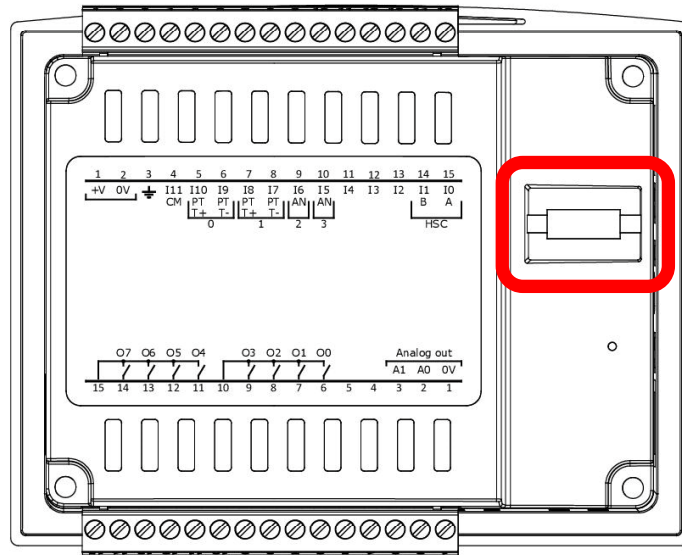
This version proposes current, relay and RS-485 serial communication outputs.

The colors codes used and the name of these connection blocks are taken again for each connection diagram.



Top view of the 9700

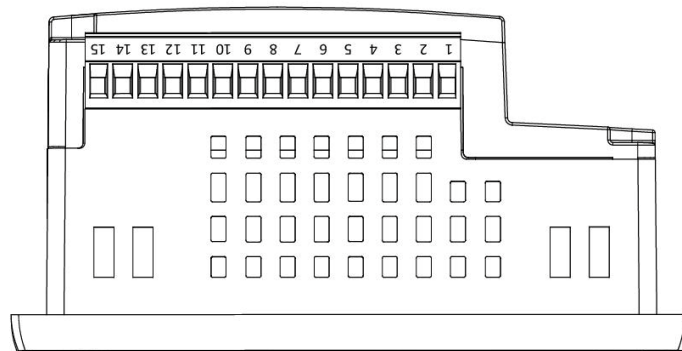
Top connector



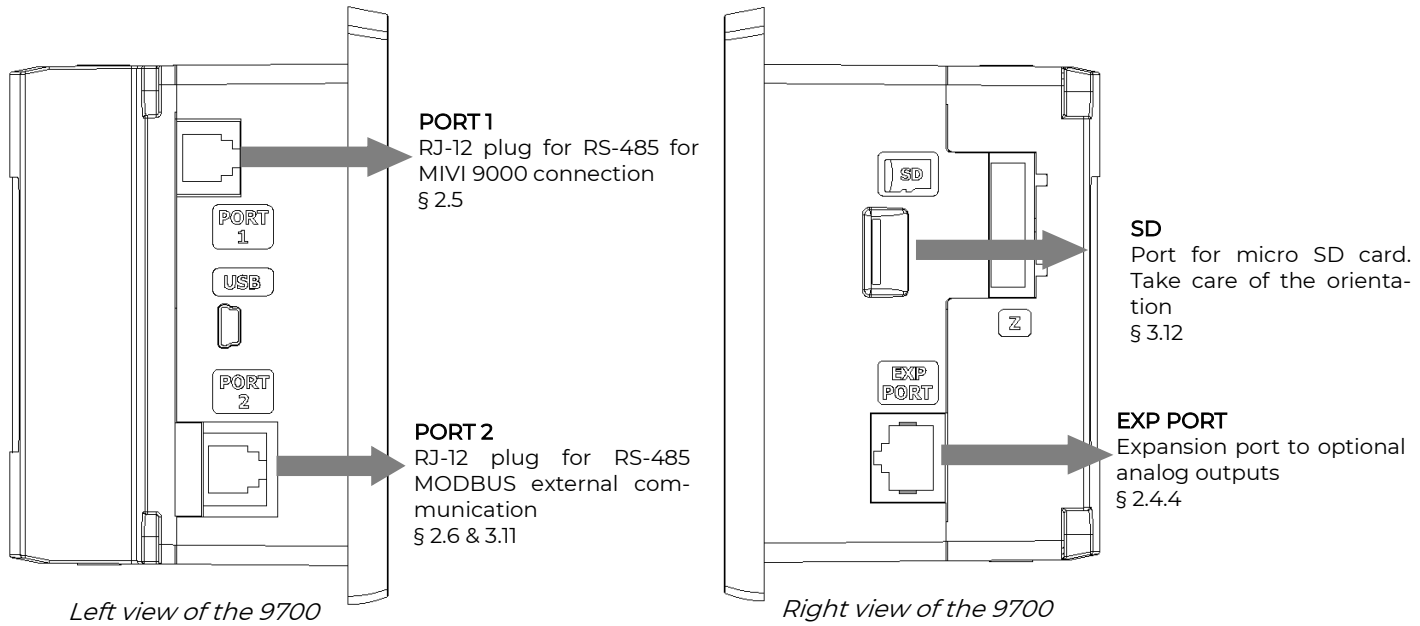
Factory hardware settings for communication. Do not modify!

Back view of the 9700

Bottom connector



Bottom view of the 9700



2.4.1 Analog & Digital inputs

These inputs are not used on the 9700 device.

2.4.2 Output relays

8 Normally Opened (NO) output relays (in 2 groups) are available on bottom connector (§ 2.4 – O0 to O3 and O4 to O7). Except for the relays O0 (watchdog), they can be allocated according to the user's specifications (§ 3.5).

- 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:

Output current:	3 A maximum per relay
(Resistive load)	8 A maximum per Common
Rated voltage:	250VAC or 30VDC

- Minimal charge: 1mA for 5VDC


- Relays lifespan: 100 000 operations at the maximum charge

- Response time: 10 ms (typical)

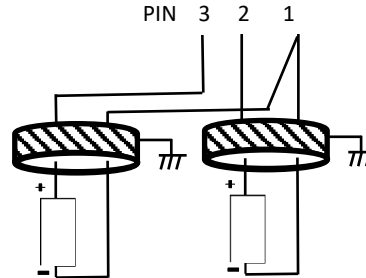
If these relays are used to commute some inductive charge, we advise you to add some RC networks to the charge terminals (preferably) or to the contacts terminals. They will then lessen the electromagnetical phenomena.

Relay O0 is used as a watchdog. It opens as soon as any of the alarms is active (RS failure, Out of range Viscosity or Temperature, Battery low, RAM failure (see § 3.5.2).

2.4.3 Analog outputs

2 current outputs are available by default on the PLC bottom connector (§ 2.4 – Analog out). Current outputs are Active type and should never be connected to an external power supply. Failure to comply with this instruction will damage the outputs. 

Resolution: 12 bits
Outputs: 4-20 mA
Load impedance: 500Ω maximum



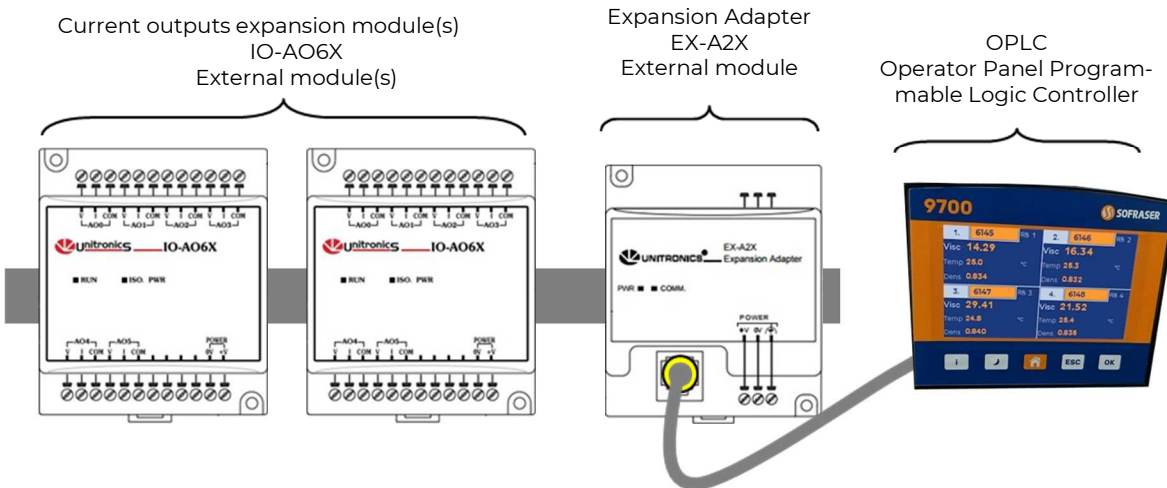
As for the relays, the analog outputs can be allocated to the user's specifications (§ 3.5).

Optional (to be ordered with 9710 processor):

- ④ Possibility of 0-10 V outputs instead of 4-20 mA outputs
- ④ 6 or 12 additional current outputs (§ 2.4.4)

2.4.4 Optional analog outputs expansion

The 9710 processor should be considered as one PLC with its two or three external modules numbered from #1 to #2 or #3.



The PLC is connected from its EXP PORT located on the right side (§ 2.4) to the Expansion adapter with the hereunder grey communication cable with connectors housed with yellow insulation. This proprietary cable is provided by Sofraser. The hereunder orientation of the cable must be followed for proper operation of the device. Noticed the “To Adapter” tag that indicates the side to connect on the “Expansion Adapter”.



Then all the modules should be connected one behind the other with the module-to-module connector. Note that there is a protective cap provided with the adapter. This cap covers the port of the final I/O module in the system (already mounted when delivered).

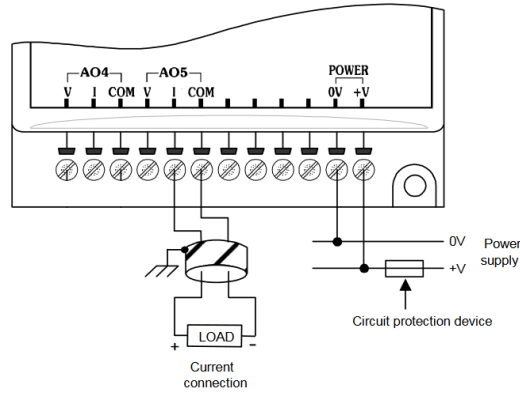
EX-A2X: Expansion adapter


IO-AO6X: Current outputs expansion module(s)



It is **absolutely essential** that the modules are linked in the order of their ID number: the Expansion Adapter first, then the two current outputs expansion modules. The system will not be able to work at all if some connections are made in the wrong order. As shown on the above picture, use the same power supply on each module, as well as on the PLC. These modules are best suited for a DIN-rail mounting.

When this option has been ordered, 6 or 12 additional analog outputs are available. Their characteristics are identical to the embedded ones (§ 2.4.3) and wiring must be done as per hereunder wiring diagram (between I and COM).



Current outputs are Active type and should never be connected to an external power supply. Failure to comply with this instruction will damage the outputs. 

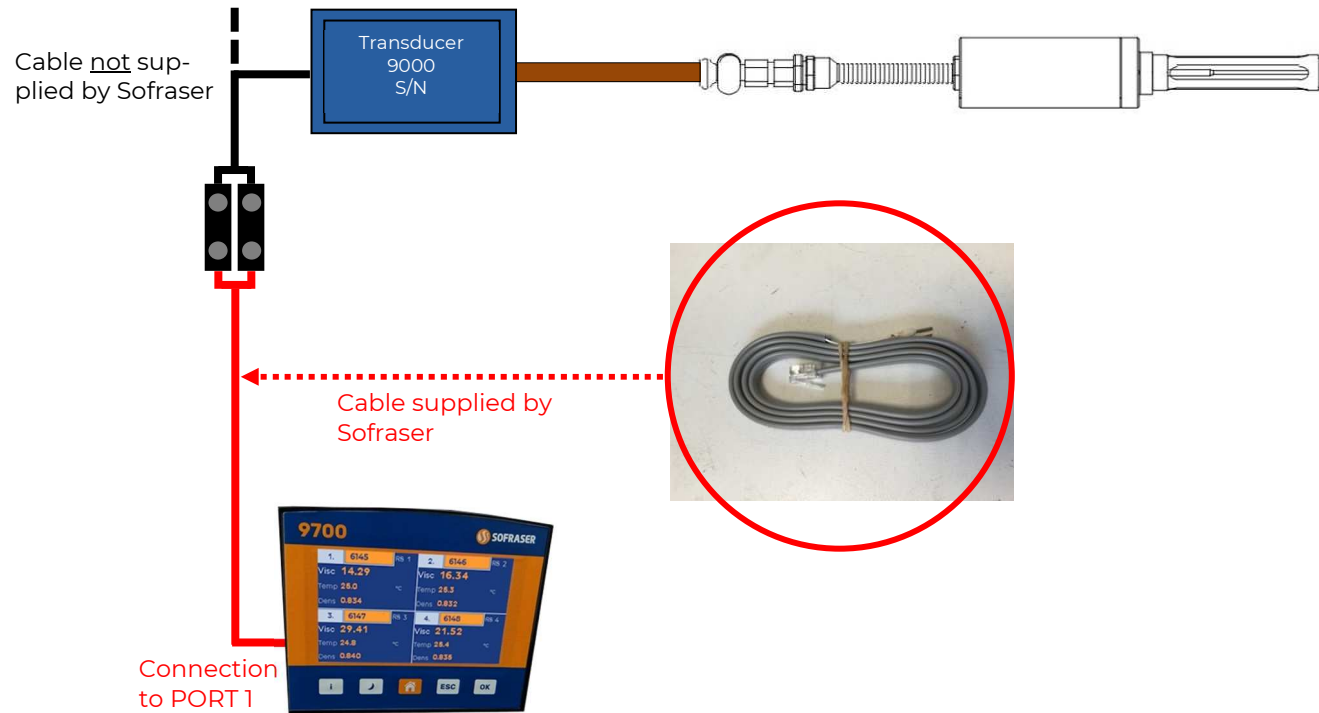
The analog outputs can be allocated to the user's specifications. The same 4 values can be controlled this way: viscosity, compensated viscosity, temperature, density. Moreover, each analog output can be assigned to a different sensor (§3.5).

2.5 Connections to be done by the user

When the 9710 processor is ready for action, the user only has to plug the serial RS-485 communication cable on the different sensors of the equipment delivered.

An industrial shielded and twisted pair RS-485 cable needs to be used to link the items. This cable is not provided by Sofraser. Only a 1-meter RS-485 cable is in the scope of supply in order to make the link between the 9710 device and the industrial cable.

Wiring between PLC and transducers must respect a Bus topology and do not forget to plug a termination resistance on the last Transducer 9000 of the line. 



See detailed wiring diagram reference C-2166.

2.6 Serial communication

2.6.1 Wirings

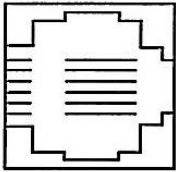
9710 PLC can be connected to an external device (laptop, PLC, DCSO) thank to the RS-485 Port 2 that is available on the side of the 9710 PLC (§ 2.4). The type of the port is RJ-12.

Baud rates	<i>PORT 1</i>	<i>PORT 2</i>	<i>Voltage limits</i>
	Reserved to transducer 9000 connection	9600 bps	-7V to +12VDC

Parameters of COM2 can be modified by user (3.11)

- Ⓢ 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 1200m.
- Ⓢ Do not cross A and B signals: positive terminals must be wired to +, and negative terminals to -.



Pin #1 →	<i>Pin number</i>	<i>Function</i>
		1
	2	-
	3	-
	4	-
	5	-
	6	B signal -

- Ⓢ The RS-485 serial port is not isolated. If the controller is used with a non-isolated external device, avoid potential voltage that exceeds $\pm 10V$. 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.



2.6.2 Modbus-RTU communication protocol

The goal is to read viscosity, temperature compensated viscosity (TCV), density and Pt100 values of various sensors using RS-485 communication on the PORT 2 of the 9710.

The Modbus slave address of the 9710 can be set up by pressing "Menu" button, then COM Ports (§ 3.11). There click on the current address value and a keyboard will appear. Modify the address value and press ENTER to validate.

The connection needs to be done with a cable with an RJ-12 connector (not supplied by Sofraser) which has to be plugged in the PORT 2 of the 9710.

COM port characteristics:

Speed: 57600 bauds Number of bits: 8 Parity: none Stop bit: 1

Address, Timeout, and Retries can be modified by LEVEL 2 access in the “COM Ports” menu.

S: send from the console to the PLC

R: response from the board to the console

Viscosity: end user viscosity

Density: end user density

Pt100: end user probe temperature

Note: all data sent or received is in Hexadecimal.

Generic frame format:

S = SN 03 XX XX YY YY <CRC-16>

R = SN 03 AA {DATA} <CRC-16>

SN: slave number of the 9710 PLC

03: reading function

XX XX: starting point for the addresses to be read

YY YY: number of words to be read

AA: number of bytes read

DATA: content of the asked address

<CRC-16>: checksum Modbus RTU on 16 bits

List of addresses:

Data	Address in Hexadecimal				Number of words
	Channel 1	Channel 2	Channel 3	Channel 4	
Viscosityx1000	712C	7131	7136	713B	2 words (4 bytes)
Temperaturex1000	712D	7132	7137	713C	2 words (4 bytes)
Densityx1000	712E	7133	7138	713D	2 words (4 bytes)
TCVx1000	712F	7134	7139	713E	2 words (4 bytes)
TCDx1000	7130	7135	713A	713F	2 words (4 bytes)

Example 1: to read the viscosity of sensor 1 connected to a 9710 PLC which has a slave address of 17 (11 in Hexadecimal), which displays a viscosity of 72,583 mPa.s

S = 11 03 71 2C 00 02 1C 6E

R = 11 03 04 04 53 87 20 78 FB

11: slave number

03: reading function

71 2C: viscosity address of sensor 1

00 02: number of words

04: number of bytes read

04 53 87 20: Viscosity x1000 in Hexadecimal

1C 6E: checksum (can be calculated automatically depending on the PLC/software used)

78 FB: checksum of response frame

Example 2: to read the temperature of sensor 3 connected to a 9710 PLC which has a slave address of 5 (05 in Hexadecimal) which displays a temperature of 21.3 °C

S = 05 03 **71 37** 00 02 6F 7D
R = 05 03 **04 00** 00 53 34 70 D2

05: slave number
71 37: temperature address of sensor 3
04: number of bytes read
6F 7D: checksum (can be calculated automatically depending on the PLC/software used)
70 D2: checksum of response frame
03: reading function
00 02: number of words
00 00 53 34: Temperature x1000 in Hexadecimal

Example 3: to read all data of sensor 2 connected to a 9710 PLC which has a slave address of 10 (0A in Hexadecimal)

S = 0A 03 **71 31** 00 0A 8E 45
R = 0A 03 **04** <Visc-32> <Temp-32> <Dens-32> <TCV-32> <TCD-32> <CRC-16>

0A: slave number
71 31: First data address of sensor 2
04: number of bytes read
6F 7D: checksum (can be calculated automatically depending on the PLC/software used)
<CRC-16>: checksum of response frame
03: reading function
00 0A: number of words
<Data-32>: Data x1000 in Hexadecimal

2.6.3 Specific to 9720

Control station can change the activated product ID by writing the figure in the buffer address 00 56 (Hexadecimal). Take care, writing data elsewhere then address 0056 will prevent the processor from working properly.



Example 5: to select the product ID=225 (00 E1 in hexadecimal) and write the information in the 9720 which has a slave address of 1

S = 01 06 **00 56** 00 E1 A9 92

01: slave number
00 56: register address
A9 92: checksum (can be calculated automatically depending on the PLC/software used)
06: writing in register function
00 E1: Product ID in hexadecimal (225 in decimal)

Hereunder instruction is used to read the ID of the product that is currently activated on 9720. The ID of the product that is activated is saved in address 00 55 (hexadecimal). Do not write in address 00 55.

Example 4: to read the ID of the activated product (ID=15, 00 0F in hexadecimal) on a 9720 processor which has slave address of 1

S = 01 03 **00 55** 00 01 94 1A
R = 01 03 **02 00** 0F F8 40

01: slave number
00 55: First data address
02: number of bytes read
94 1A: checksum (can be calculated automatically depending on the PLC/software used)
F8 40: checksum (can be calculated automatically depending on the PLC/software used)
03: reading function
00 01: number of words
00 0F: Product ID in hexadecimal (15 in decimal)

2.7 Standards and Class

List of the device generic standards:

Low Voltage Directive	EN 61131-2	Power supply 24 VDC-not submitted
EMC Immunity	EN 61000-6-2	Electro-static discharges Radio-frequency Burst quick transients
EMC Emission	EN 61000-6-3 EN 61000-6-4	Radio-frequency
Process variable	CEI 751	Pt100
Protection	CEI 529	IP 66 on front panel mounted
Size	CEI 473	Front panel: 96 * 96 mm Cut-out: 92 * 92 mm
Climatic conditions	Storage	-20 to 60°C (-4 to 140°F) 5 to 95% HR non-condensing
	Work	0 to 50°C (32 to 122°F) 5 to 95% HR non-condensing
Shock	IEC 60068-2-27	15G, 11ms duration
Vibration	IEC 60068-2-6	5 to 8.4Hz, 3.5mm constant amplitude 8.4 to 150 Hz, 1G acceleration

2.8 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 return this equipment to our factory with a signed letter confirming that it is an equipment that has to be destroyed/recycled.

2.9 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 regulated 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 earth-grounding the power supply.








3. 9710 operating functions

3.1 Navigation and Function keys


The navigation in the different menus of the 9710 processor can be done with the touchscreen. Use best a stylus for touchscreen.

There are also 5 function keys under the screen (from left to right):

Key	Action
	Displays the system information for each viscometer [available on the mono sensor main screen(s)]
	Energy saver: Turns off the screen (press again to turn it on)
	Go to the main menu (from any screen, except multi sensor main screen)
	Back to the previous screen (also present on the touchscreen)
	Confirm / Select

When necessary, touch the screen on the field you want to write, a virtual keyboard appears on the touchscreen.

While displaying the virtual keyboard, only

the  function key can be used and it validates the setting.



On a given screen, the buttons highlighted in orange color can be selected/activated by user. The buttons highlighted in grey color cannot be selected/activated. The status of the buttons and the number of selectable features is determined by the user's access level (§ 3.3.1 and 3.6.5).

3.2 Main screens

3.2.1 Multi sensor main screen (only for 9710)

When the 9710 is powered on, it displays the multi sensor main screen. It is divided in four Positions (numbered from 1. to 4.). The multi sensor main screen can managed up to 4 viscometers

One position is dedicated to one viscometer and its screen shows the serial number (E.g. 6145).

The active status of the communication between 9710 and viscometer is confirmed when RS is displayed, it is followed by its slave address (E.g. RS 1).

The other information are viscosity (Visc), the temperature (Temp) and the density (Dens) measurements.

1.	6145	RS 1	2.	6146	RS 2
Visc	14.29		Visc	16.34	
Temp	25.0	°C	Temp	25.3	°C
Dens	0.834		Dens	0.832	
3.	6147	RS 3	4.	6148	RS 4
Visc	29.41		Visc	21.52	
Temp	24.8	°C	Temp	25.4	°C
Dens	0.840		Dens	0.835	



In case of communication break between the 9710 and a viscometer, after half a minute, the serial number is highlighted in red and measurement figures are replaced by ***.

By touching the serial number of the sensor, the mono sensor main screen is displayed (press ESC to go back to multi sensor main screen).



The Multi sensor main screen is not available on 9720 model that manages only one viscometer.

3.2.2 Mono sensor main screen

Hereunder picture is showing the screen for 9710 model.

	6145	ESC		
Viscosity	14.35	cP	@	25.0 °C
Temperature	25.0	°C		
Density	0.860	g/ml		
TCD	0.835	g/ml	@	50.0 °C
TCV	7.710	cP	@	50.0 °C
V D T	11 : 42	23 September 2021	RS	1

From top to bottom, and from left to right

- ④ The “HOME” icon is used to reach the MENU (§ 3.3)
- ④ The serial number of the sensor (E.g., 6145 HCE) is displayed in the top of the window.
- ④ The “ESC” icon is used to go back to the multi sensor main screen (§ 3.2.1)
- ④ The  icon is used to reach the Information screen that gives basic information about the viscometer and 9710 program (§ 3.2.3).
- ④ The alarm icon  helps to reach the System Alarms screen. The icon is highlighted in red and is blinking when a failure or alarm is detected by the 9710 (§ 3.2.3)
- ④ On the left are the three bar-graphs for viscosity (V), density (D) and temperature (T).
- ④ the middle of the screen is dedicated to the measured values. Above picture shows the full version when TCD and TCV advanced features are activated (§ 3.6). The Screen displays the viscosity (at process temperature), the process temperature (optional), the density (at process temperature), the Temperature Compensated Density (optional – at reference temperature) and the Temperature Compensated Viscosity (optional – at reference temperature) are displayed.
- ④ On the bottom are the time, the date and the slave address of the sensor. If RS and slave address are missing it means that communication between 9710 and viscometer is lost. In this case the “alarm” icon is highlighted in red and is blinking.

Hereunder picture is showing the screen for 9720 model. The specific features are the display of the ID and Designation of the product that is activated on 9720, and the selection of the product.



Display of the ID and Designation

- a) Designation of the product currently activated on 9720
- b) ID of the product currently activated

The corresponding set of parameters is used by 9720 to process the signals (§ 3.5.5). If the settings are modified thank to the 9700 menus, the value of the new parameters will be saved (except the 4-20mA settings).

Selecting the product

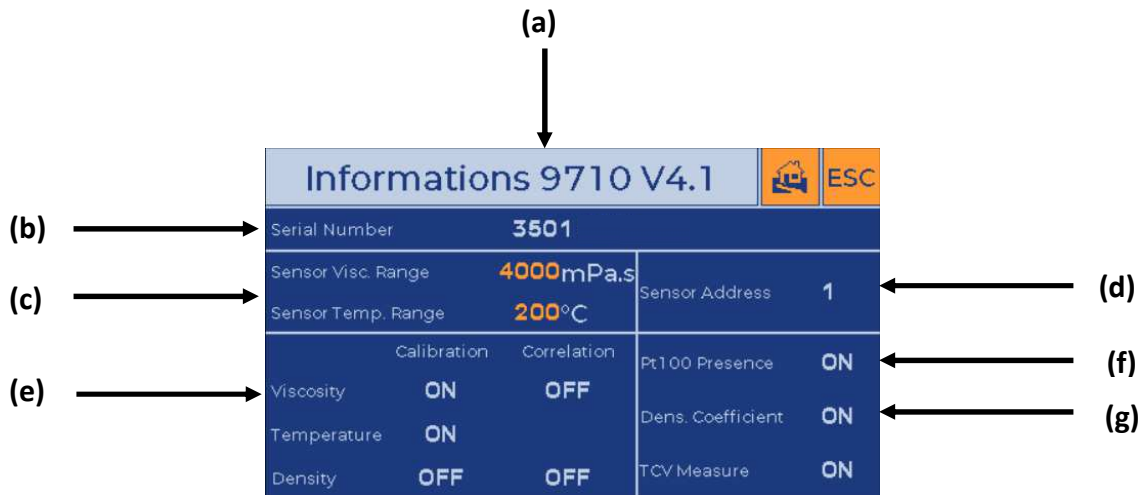
The selection of the active product ID can be done either by an operator thanks to the 9720 touchscreen, either by the control station (§ 3.6.6).

The button c) - Select ID is available and highlighted in orange when choice is set to Operator. Pressing the c) - Select ID button will display the virtual keyboard asking for Level 3 password and activates the b) button.

Pressing the b) button will display the virtual keyboard asking for the new product ID number (from 0 to 255).

After making the product selection, press on ESC icon to leave the menu.


3.2.3 Information screen





Informations 9710 V4.1				ESC
(b)	Serial Number	3501		
(c)	Sensor Visc. Range	4000 mPa.s	Sensor Address	(d) 1
	Sensor Temp. Range	200°C		
(e)	Viscosity	Calibration: ON	Correlation: OFF	Pt100 Presence: (f) ON
	Temperature	ON		Dens. Coefficient: (g) ON
	Density	OFF	OFF	TCV Measure: ON

2

From top to bottom, and from left to right

- (a) Model (9710 or 9720) and version of the program (E.g. V4.1)
- (b) Serial number of the viscometer (E.g. 3501)
- (c) Sensor's Viscosity and temperature full scale ranges. Viscosity range of the viscometer is set at Sofraser according to the specifications of each customer and application. Viscosity overshoot doesn't damage the instrument, nevertheless best is to avoid this situation. Temperature range is set according to, either customized specification, either limit of use in hazardous area regarding to the ATEX temperature marking, either to the design limits of the viscosity sensor. By default, never exceed the sensor temperature range otherwise it will be damaged.
- (d) Sensor slave address (E.g. 1) 
- (e) Status of the Calibration (§ 3.7) and Correlation features (§ 3.8) for Viscosity, Temperature (if sensor presence) and Density (if viscometer has been delivered with optional density measure). OFF means that the feature is disabled. ON means that the feature has been enabled.
- (f) Presence or absence of optional Pt100 temperature probe on MIVI sensor (or external temperature probe). If setting is OFF, the 9710 PLC does not display the temperature on multi sensor main screen and mono sensor main screens (§ 3.9).
- (g) Dens. Coefficient ON indicates that 9710 processor uses the constant density setting (§ 3.6.4). The setting is displayed on multi and mono sensor screen(s) and used for raw signals processing and calculation of kinematic viscosity. Dens. Coefficient OFF indicates that the density measured by MIVI sensor is used (§ 1). Status of the temperature compensated viscosity (TCV). The TCV feature can be set and activated in § 3.6.

3.2.4 System Alarms screen


On the Mono sensor main screen, the alarm icon  is blinking in red  if an alarm is activated.

Touch this icon to see the alarm status.

If an alarm is activated the line will appear in red.


Empty line means that the option hasn't been ordered or the feature is disabled.



- (a) When message “Battery Low” is displayed send the 9710 to Sofraser after-sales service for battery replacement. When battery will be empty PLC will lose saved data and program. Meanwhile keep the 9710 connected to its power supply.
- (b) If message “COM 1 Break” is displayed, check the communication between 9710 and viscometer(s). see § 2.5.
- (c) If message “Viscosity Out of Range” is displayed, check that viscosity of your liquid in the process conditions are within the Full-Scale range of the viscometer (§ 3.2.3) and take measures to reduce the viscosity.
- (d) Information dedicated to density is hidden when MIVI does not measure the density. If message “Density Out of Range” is displayed, check that density of your liquid is within the Full-Scale Range of the viscometer and that process conditions are compliant with the density measure feature.
- (e) Information dedicated to Temperature is hidden if MIVI sensor isn't equipped with its incorporated temperature probe, or if the probe has been disabled (§ 3.9). If message « temperature Out Range » is displayed, check that temperature of your liquid is within the temperature range of the viscometer (§ 3.2.3). Take measures to reduce the temperature in your process, viscosity sensor can be damaged. 
- (f) Message “Assigned Sensor Not Found On Com” indicates that the S/N of the viscometer that is currently connected to the 9710 on a given position is not the S/N that has been assigned during the sensor scan procedure (§ 3.10). This may happen if the original viscometer has been disconnected and replaced by a another one that has the same RS slave number. Use the right viscometer or proceed to a new “Sensor scanning” in order to assign the new viscometer.
- (g) If the message “Pt100 Break” is displayed, check the presence of the Pt100 temperature probe, in case of presence check its wiring (see MIVI and 9000 technical manuals).

3.3 Menus and Access Levels

From mono sensor main screen (§ 3.2.2),

touching the  icon will display the Level 4 Menu screen. No access code is required and only Display submenu is available.

From any sub menu screen, touching the



icon will display the Menu screen.

Menu			ESC	ⓘ
Display	Settings	Parameters		
Calibrations	Correlations	Pt100		
Sensor Scan	COM Ports	SD Card		
Clock	Factory	Bargraphs		
Security	LEVEL 1	LEVEL 2	LEVEL 3	

The submenus highlighted in orange (E.g. Display on above screen) can be opened, those in grey (E.g. from Settings to Bargraphs) require a security level code. The security codes limit the access to some functions of the processor in order to protect data and parameters.

Level 1 : Distributor access – Security code reserved to Sofraser after sales team

Level 2 : Manager access – Security code 1111 by default (can be changed - § 3.6)

Level 3 : Technician access - Security code 1111 by default (can be changed - § 3.6)

Level 4 : Operator access – no security code required

Above codes are set by default by Sofraser. They are also indicated in the specific notes and manufacturing parameters of each unit.

To enter an access code touch “Level 2” or “Level 3” and then enter the security code.

When a given level is activated then it is highlighted in Yellow and the accessible sub menus are highlighted in orange.

I.e for Level 3

Menu			ESC	ⓘ
Display	Settings	Parameters		
Calibrations	Correlations	Pt100		
Sensor Scan	COM Ports	SD Card		
Clock	Factory	Bargraphs		
Security	LEVEL 1	LEVEL 2	LEVEL 3	


I.e for level 2

Menu			ESC	ⓘ
Display	Settings	Parameters		
Calibrations	Correlations	Pt100		
Sensor Scan	COM Ports	SD Card		
Clock	Factory	Bargraphs		
Security	LEVEL 1	LEVEL 2	LEVEL 3	

3.4 Display

3.4.1 Block "Display" Menu


This menu's purpose is to make some changes on the values or items mainly displayed on the main page. These adjustments can only be enabled or disabled from this menu.

Display		 ESC
Measurement units		
Data		
Current Outputs Status		
Relay Outputs Status		
Security	LEVEL 3	

3.4.2 Measurement Units

To reach this menu Level 3 code is required. The active units are highlighted in Yellow (E.g cP, °C and g/ml). The user has the choice among:

- 5 dynamic viscosity units cP, Po (Poise), mPa.s, Pa.s, no unit.
- 4 kinematic viscosity units. cSt, St, mm²/s, no unit.
- 2 temperature units °C, °F.
- 3 density units No unit, g/cc, g/ml

Measurement Units			 ESC
Dynamic Viscosity in cP		Temperature in °C	
cP	cSt	°C	
Po	St	°F	
mPa.s	mm ² /s	Density in g/ml	
Pa.s		no unit	
		g/cc	
no unit	no unit	g/ml	


To choose a unit, just select it on the screen. The cell is highlighted in Yellow and the setting will be active after leaving the screen. When a unit is changed, remember to change the thresholds as appropriate (For Alarms – Outputs - see §3.5 SETTINGS).

3.4.3 Data

The Data screen displays:

- the raw measures (Amp, Coil, Freq, ...) in real time
- the factory settings (Y0, A, 1/B, ...).

These data can be recorded on the SD card for after sales service by touching "SD Save Data" button. The micro-SD card must be installed (§ 3.12). Data are saved in file named SOF_DATA.CSV (see Annexes).


Data		 ESC	
Measures	Sensor Data		SD Save Data
Amp 1542	Y0 1000.00000	OffA -47.10583	OffF -1.10419
Coil 1365	A 1100.00000	AOff 0.00000	ATf 0.00000
Freq 276.124	1/B 3.30000	BOff 10.00000	BTf -0.04500
Temp 25.0	C 0.00000	COff 1000.00000	CTf 276.00000
EtaRho 12.340	D 0.00000	Tc 24.3	K 1.00000
Rho 0,000	E4 0.00000	ATc 0.02000	1/L 1.00000
		BTc -3.00000	M 0.00000
			N 1.00000

3.4.4 4-20 mA current outputs status

On this screen the real time current values delivered by the analog outputs of 9710 are displayed.

A0 and A1 are available by default on 9710 PLC. The cells are highlighted in blue and values in orange (§ 2.4 & 2.4.3). The cells for optional Current outputs expansion modules are highlighted in grey when not available (§ 2.4.4).

See § 3.5 for association and settings of the current outputs.


4 - 20 mA Status				ESC
9700	Module 1	Module 2		
A0 4.0 mA	0.0 mA	0.0 mA		
A1 4.0 mA	0.0 mA	0.0 mA		
A2	0.0 mA	0.0 mA		
A3	0.0 mA	0.0 mA		
A4	0.0 mA	0.0 mA		
A5	0.0 mA	0.0 mA		



3.4.5 Relay outputs status

Instant state of the relays is displayed on this screen.

See § 2.4 & 2.4.2 for location and § 3.5.2 for association and settings.


Relay Outputs Status					ESC
Relays are closed when affiliated measure is between 2 set instructions					
Relays are open when affiliated measure is out of set instructions					
Relay 0 Watchdog	Closed	Relay 4	Closed		
Relay 1	Closed	Relay 5	Closed		
Relay 2	Closed	Relay 6	Closed		
Relay 3	Closed	Relay 7	Closed		

3.5 Settings

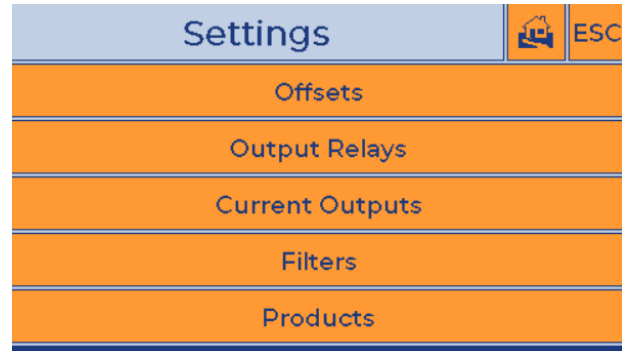
This menu's purpose is to set the parameters for the sensor measurement and the outputs. Level 2 code is required.

Some settings – such as the Offsets (adjustment of the raw signals to reference values in the air) – have a direct and essential influence on the measurements.

These settings must be done by taking great care of the modifications that will hence be enabled for the measurements.

Settings		ESC
Offsets		
Output Relays		
Current Outputs		
Filters		
Products		

The Products menu is available only on 9720.



3.5.7 Offset

Viscosity and density (optional) are calculated starting from the amplitude and frequency corrected with offset. So, if the offsets are not adjusted correctly, the viscosity and density values will be false.

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

The offset adjustment must be done:

- At each new installation of the sensor on the process
- At each observation of the signal drift in the air.

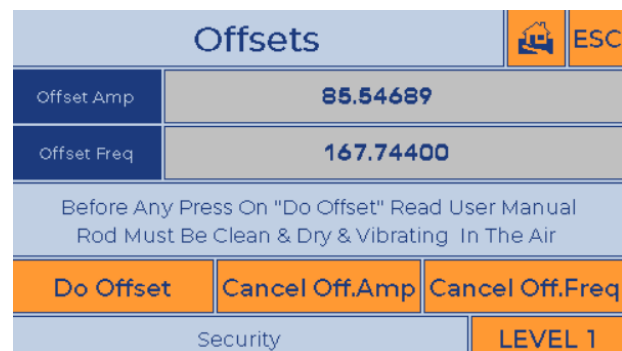
STEP 1: Clean the sensor rod and make sure that it is neat and dry.

STEP 2: Make sure that the process is empty so that the sensor is vibrating in the air during the adjustment.

STEP 3: Install the sensor using the fastening screws.

STEP 4: Switch on the viscometer(s) and 9710 PLC and wait 30 minutes. Sensor(s) and its mounting accessories must be thermally stable.

STEP 5: When all conditions are met, enter the “Offsets” screen. If not ready, you can leave the screen with ESC icon and check steps 1 to 4. See “Cancel Off. Amp” and “Cancel Off. Freq” buttons.



When ready, touch the “Do offset” button in order to update the Offset(s) values and save them. The new offset values are displayed. Repeat several times “Do Offset”, at least 1 minute apart, to check that you have a stable offset value.

At this stage, if you leave the screen thanks to ESC, the offset(s) will be saved definitively.

If required, the “Cancel Off. Amp” and “Cancel Off. Freq.” buttons can be used to cancel the Offset(s) values that have just been adjusted. They will be replaced by the previous settings that were active before entering the “Offsets” screen. Then live the Offsets screen with ESC.

The offset(s) can be manually modified with level 1 access.

3.5.2 Relay Outputs

On the first screen, the real time status of each relay is displayed (§ 2.4.2 & 2.4).

By touching the “Closed” or “Opened” button, you can check the proper functioning of the relays.

This procedure is best used during starting up and/or periodic checking because it will change the status of the relay.

To assign alarms and set levels touch the “Programmation” button.

Relay Outputs				ESC
Programmation Menu bellow allows you to configure Relays Output from 1 to 7				
Programmation				
00	Closed	04	Closed	
01	Closed	05	Closed	
02	Closed	06	Closed	
03	Closed	07	Closed	

For each relay O1 to O7 it is possible to assign:

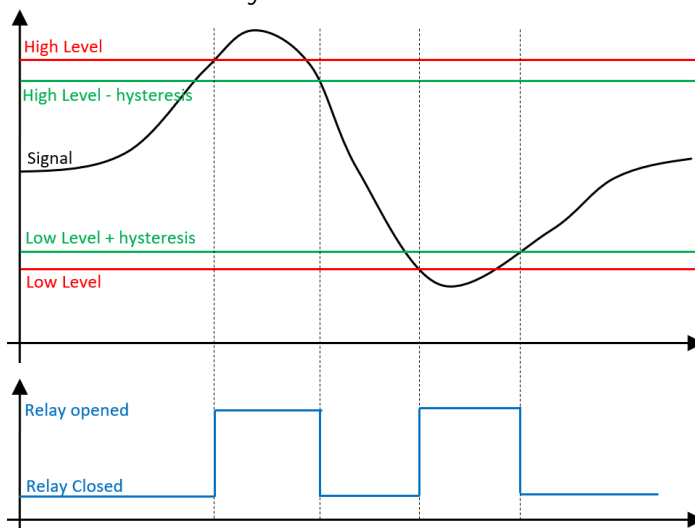
- one viscometer by setting its position number (1 to 4 – see § 3.2.1)
- one measure (Viscosity, TCV, Density, Temperature, and TCD – see § 3.2.2).
- the low and high level (see § 3.4.2 for physical units)
- an hysteresis value (see § 3.4.2 for physical units)

Viscometer # is changed by touching the cell on the screen and scrolling the choices.

1	Programmation				ESC
O1	1	Viscosity	0.000 min	1000.000 max	0 [hyst]
O2	1	Temperature	0.000 min	200.000 max	0 [hyst]
O3	1	Density	0.000 min	2.000 max	0 [hyst]
O4	1	TCV	0.000 min	1000.000 max	0 [hyst]
O5	1	TCD	0.000 min	2.000 max	0 [hyst]
O6	1	None	0.000 min	0.000 max	0 [hyst]
O7	1	None	0.000 min	0.000 max	0 [hyst]

Values are changed thanks to the virtual keyboard (§ 3.1).

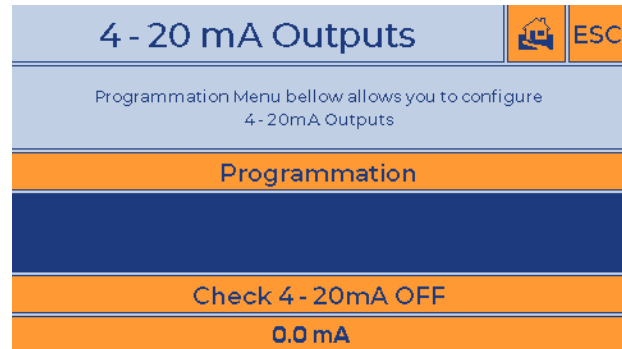
Low and high level and hysteresis are changed by touching the cell, the virtual keyboard will appear, set the desired value confirm with ENTER (↵) button. It will immediately take the modified value into consideration and will make it possible to skip to the following threshold. The hereunder figure shows how the thresholds and hysteresis are working and the impact on state of the relay.



3.5.3 4 – 20 mA current Outputs

This screen allows to set the available current outputs and check them.

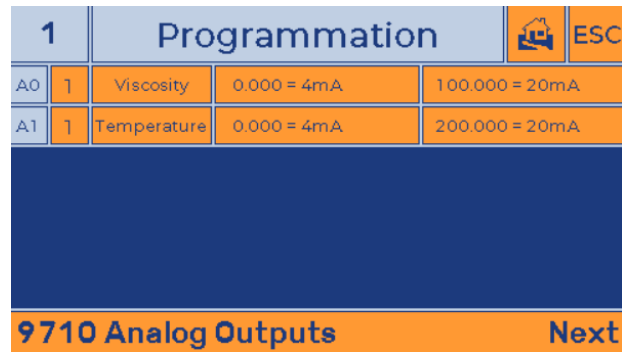
To assign 4-20mA outputs and define levels touch the “Programmation” button.



First programmation screen is dedicated to analog outputs A0 and A1 installed on 9710 PLC (§ 2.4 & 2.4.3)

For each current output it is possible to assign

- one sensor (position 1 to 4 - § 3.2.1)
- one measure (Viscosity, Density, Temperature, TCV and TCD - § 3.2.2).
- the low and high level in physical units (§ 3.4.1)



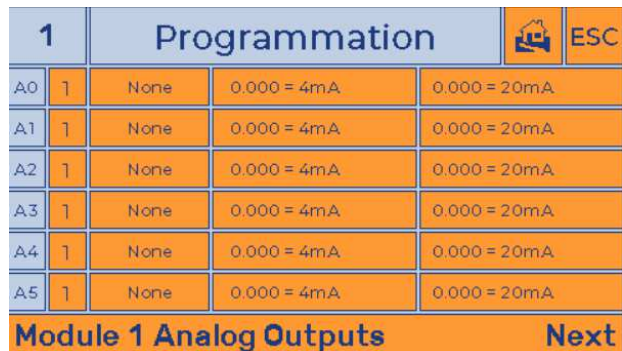
Viscometer and measure are changed by touching the cell on the screen and scrolling the choices.

Low and high levels are changed by touching the cell, the virtual keyboard will appear, set the desired value confirm with ENTER (↵) button. It will immediately take the modified value into consideration.

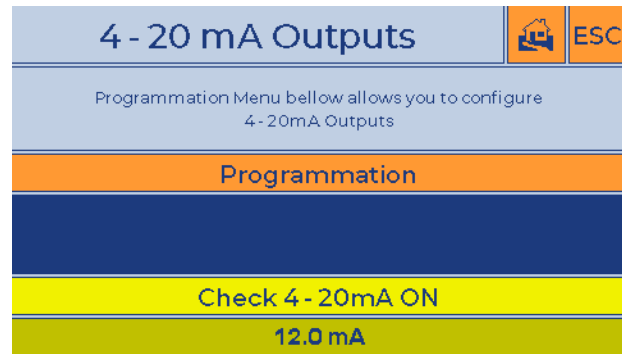
To program the optional Current outputs expansion module(s), touch “Next”.

When the optional additional current outputs are available, the settings can be done by using the same rules.

If installed, the “Next” button gives access to the settings for the second “Current outputs expansion module”.



It is possible to test the proper operating of all available 4-20mA outputs by touching the "Check 4-20mA OFF" button and then enter the desired current value in the below cell thanks to the virtual keyboard. This value will be sent to all current outputs and real value can be checked on each current output (§ 2.4.3 & 2.4.4). Switch off the "check 4-20mA" feature after use.



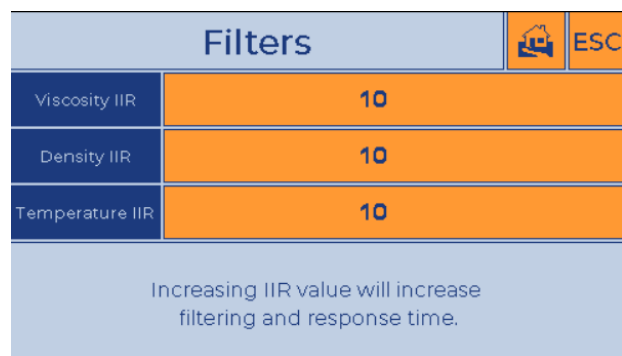
3.5.4 Filters

This screen is used to change the settings of filters of the three measured values.

Touch the value to modify it thanks to the virtual keyboard.

The filter is a first order IIR (infinite impulse response) type.

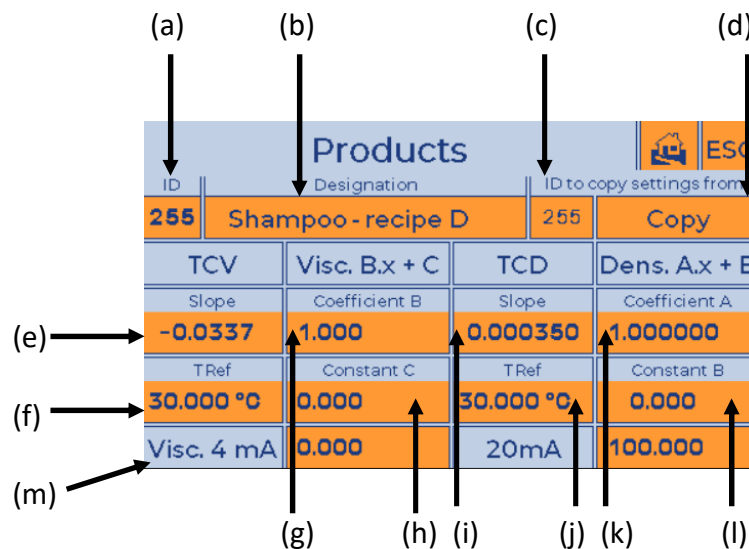
The higher the value is, the more effect the filter will have. 100 is the standard setting.



3.5.5 Products

This screen is available only on 9720 model.

It is used to set the parameters for the different products. For the product that is activated on Mono sensor main screen (§ 3.2.2) these parameters can also be modified thanks to the different Menu.



(a) Select your product ID (from 0 to 255) and ...

(b) Enter your product Designation (16 numbers or letters).

(c) Select the ID of another product for copying its settings on this screen ...

- (d) Press the “Copy” button to copy (optional feature).
- (e) Set the selected product’s TCV Slope (temperature compensated viscosity) and ...
- (f) the TCV reference temperature TRef in °C (§ 3.6.2).

- (g) Set the B linear correlation coefficient and ...
- (h) the C linear correlation constant.
 Formula for Viscosity being $A.X^2+B.X+C$, the A coefficient is set by default at 0 (§ 3.8.3).

- (i) Set the selected product’s TCD Slope (temperature compensated density) and ...
- (j) the TCD reference temperature TRef in °C (§ 3.6.3).

- (k) Set the A linear correlation coefficient, and ...
- (l) the B linear correlation constant.
 Formula for Density being $A.X+B+C/X$, the C coefficient is set by default at 0 (§ 3.8.5).

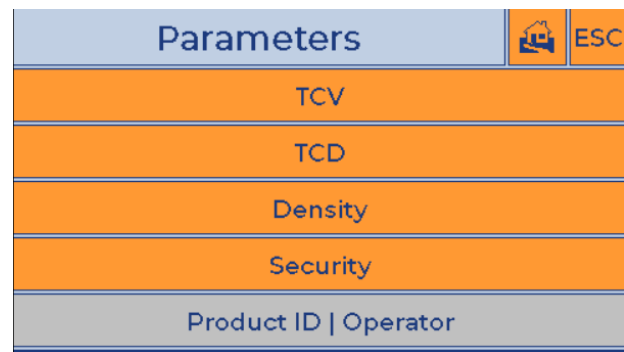
- (m) Enter the minimum and maximum viscosity values you want for the selected product on your Temperature Compensated Viscosity (TCV) programmed 4-20mA current output (§ 3.5.3). This setting cannot be modified thanks to the MENUs.

3.6 Parameters

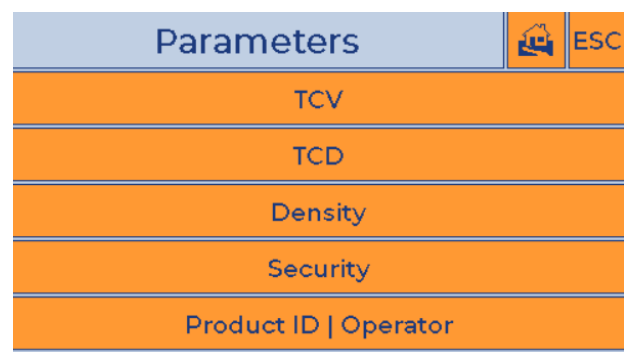
To reach this menu Level 2 code is required (§ 3.3)

3.6.1 Parameters

This menu is used to configure the different measurement option such as Temperature compensated Viscosity, Density and Temperature Compensated Density



The product ID submenu is available only on 9720 model. It is used to select who is authorized to select the active product ID. Either the operator thanks to 9720 touch screen, either the control station thanks to RS485 signal (§ 3.6.6)



3.6.2 TCV - Temperature Compensated Viscosity - Viscosity @TRef

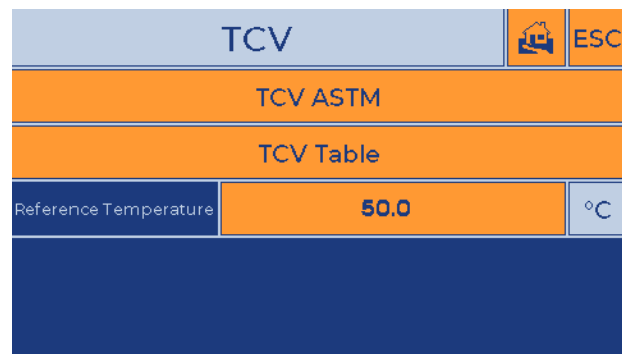
Thanks to the measured viscosity at process temperature, the process temperature and the viscosity versus temperature data for a reference product that has a behavior as close as possible to the process liquid, 9710 processor can calculate a theoretical viscosity at another temperature, named the Reference temperature, that is different from process temperature. The result of this calculation is the Temperature Compensated Viscosity TCV. This remains a theoretical value, whose reliability is function of several parameters and that by default doesn't reach the reliability of a measure really performed at the reference Temperature. The TCV feature requires the temperature measure.

From this screen you can reach:

the TCV by equation feature (optional)

the TCV by table feature

Set the Reference Temperature



Touch the "TCV ASTM" button (optional) or "TCV Table" button to configure and activate it.

3.6.2.1 TCV ASTM

This optional feature may not be available.

The calculation of the TCV is done thanks to the simplified equation described in the ASTM D341 Standard.

In given conditions and for given liquids, the viscosity (in log scale) versus temperature (in log scale) curve is described by a linear equation with -B slope value. Refer to ASTM D-341 Standard for detailed equation in log scales.



According to the ASTM standard, viscosity unit should be the cSt or mm²/s kinematic viscosity (§ 3.4.2). Nevertheless, the calculation works if a dynamic viscosity unit is set.

Above screen is used to set the value on the slope -B and activate the feature. The content of the field indicates the status of the feature. In above example "Formula ON" indicates that the feature is activated. Touching it will disable the feature and display the information "Formula OFF".


3.6.2.2 TCV Table

This is the standard feature implemented in 9710 processor and uses a simplified equation that is limited to a temperature difference of 15°C between process temperature and reference temperature. Moreover, the viscosity versus temperature curve of the reference product used to set the table should be as close as possible to the process liquid.

The TCV Table screen is used to set the table.

“Temperature X” column must be filled with increasing temperatures. The temperature range must include the reference temperature and the minimum/maximum process temperatures. Use the same temperature unit set in § 3.4.2.

“Viscosity Y” column must be filled with corresponding viscosity values. Use the same viscosity unit set in § 3.4.2.

TCV Table				ESC
Temperature X	Viscosity Y	L	"Measured X" column must be entered in crescent order. "Save Table" Before Scrolling.	
0,000	1,000	0		
999,999	1,000	1	▲	
999,999	1,000	2	Table ON	
999,999	1,000	3	RESET	
999,999	1,000	4	SAVE	
999,999	1,000	5	▼	

Press “SAVE” button to save the content of the table.

Press “RESET” button to erase to table and go back to the by default content (Y = 1.000).

“Table ON” content button indicates the status of the feature that is activated in above screen. Pressing the button will inverse the status, deactivate the feature and display the “Table OFF” message.

3.6.3 TCD - Temperature Compensated Density - Density @TRef

This feature can be used if MIVI viscometer that is managed by the 9710 is set in order to measure the viscosity (§ 1).


In this screen you set:

the alpha coefficient (Thermal expansion coefficient – see equation at the bottom of the screen)

the reference temperature

Activate or disable the feature. The content of the button indicates the status of the feature. In the example the feature is activated. Pressing on the button will disable the feature and display the message “Formula OFF”.



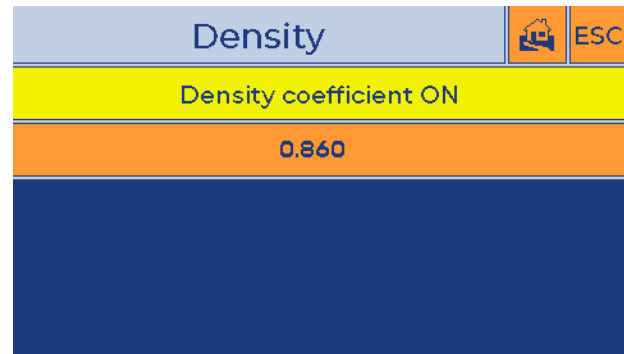
TCD			ESC
Alpha	0.000350		
Reference Temperature	30.0	°C	
Formula ON			
$TCD = \rho + \alpha * (T_{process} - T_{REF})$			

3.6.4 Density

When MIVI isn't set with the optional density measure feature it is possible to set a constant density value. This setting corresponding to the process liquid will be used by the linearization model and to calculate the kinematic viscosity (§1).

When MIVI is set with the optional density measure feature, the first button can be used to activate or not the use of the density coefficient. The button indicates the status of the feature. When Density coefficient OFF is active, the 9710 PLC is using the measured density value.

Below cell is used to adjust the constant density setting. Use same unit as set in § 3.4.2. The default value is 1.000 g/cc



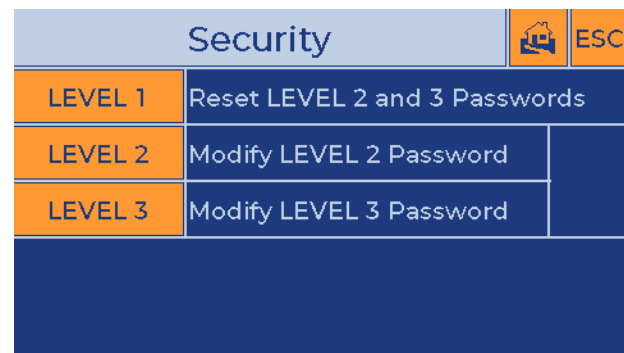
3.6.5 Security

To change Security codes 2 et 3, touch “Level 2” or “Level 3” button enter the current code and then touch the code to enter the new one.

Code 3 = 1111 – Editable.

Code 2 = 1111 – Editable.

Note the new codes on a copy of the specific notes. Only Sofraser servicing people will be able to restore the default codes thanks to “Level 1” code.

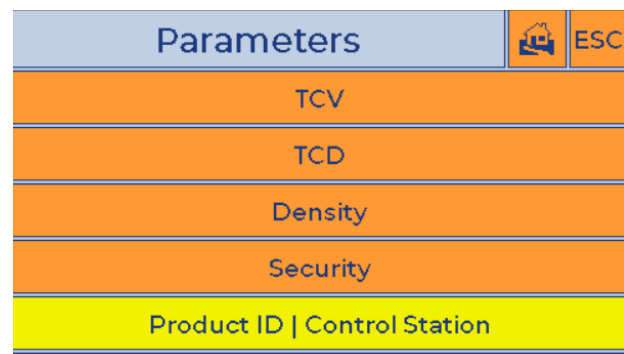


3.6.6 Product ID

This menu is available only on 9720 model.

The selection of the active product ID can be done in two ways.

“Product ID | Operator” choice gives access to modifications of the used by PLC product by a Technician through the screen thanks to the “Select ID” button asking for a password (§ 3.2.2).



“Product ID | Control Station” cancels the access to modifications by operator through the touchscreen. Only RS485 is allowed to modify the in used product ID. Passing from “Operator” to “Control Station” takes back automatically to last Control Station selected product (by default 255 if the feature has never been used). See § 2.6 and 2.6.3 for the description of the RS485 frame to be sent to 9720 thanks to PORT 2 (§ 2.4).

3.7 Calibration

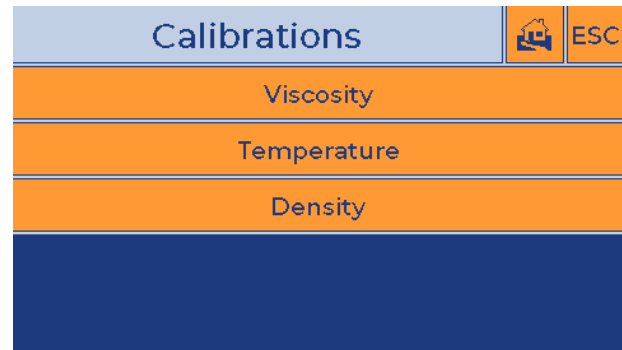
3.7.1 Calibrations

It is possible to enable or disable a calibration with all the measured values of viscosity, density and temperature (when these options are active).

The viscosity and the density calibrations are 10-point tables.

The temperature calibration is a second-order formula.

The status of each calibration (activated or deactivated) is displayed on the information screen (§ 3.2.3 - press 'I' when on the main screen).



3.7.2 Viscosity calibration

To calibrate the viscosity, there are two possibilities:

- Fill directly the 10-point calibration table with the "Viscosity Table" button
- or use the wizard to help you to create the calibration table with "Viscosity Wizard" button.



3.7.3 Viscosity table

See §3.7.4 for procedure to use for proceeding to the calibration and get the calibration data. The unit of the viscosity figures in the table must be cP.

Enter the measured viscosity values in the "Measured X" column, in ascending order.

Enter the corresponding expected viscosity values in the "Expected Y" column.

Touch "SAVE" before scrolling to lines 6 to 9 and finally to validate the complete table.

"Table ON" indicates that table is activated. Touch the button to disable the table and display "Table OFF".

Viscosity Calibration in cP			ESC
Measured X	Expected Y	L	
0,000	0,000	0	"Measured X" column must be entered in crescent order. "Save Table" Before Scrolling.
1,000	1,000	1	▲
999999.999	999999.999	2	Table ON
999999.999	999999.999	3	RESET
999999.999	999999.999	4	SAVE
999999.999	999999.999	5	▼

Touch "RESET" to delete the calibration table content and fill it with the by default content (Expected Y = Measured X).

3.7.4 Calibration "wizard"

This wizard assists the user to proceed to his on-site calibration when needed. Follow the instructions. It is possible to use up to 9 standard oils but it is usually sufficient to use only 2.

Before starting the calibration steps, the MIVI sensor has to be installed on its SOFRASER lab stand at ambient temperature and the 9710 processor has to be powered for at least 30min. Reset the viscosity calibration table (§3.7.3). Then follow the instruction from the wizard.

Screen "1. Introduction"

The introduction screen reminds the range of the viscometer and displays:

- the instantaneous viscosity,
- the current offset value,
- the ID of the viscosity standard (at least 1 sample of viscosity standards must be used)

Press on "Next" button.

Calibration Wizard		ESC
Next	1. Introduction	
Range	100 cP	Welcome to Calibration Wizard Refer to your Technical Manual For more Information Click on "Next" to proceed
Measure	0 cP	
Offset Value	2.17969	
Sample	1	
OFFSET	1 Sample(s)	Validate
0.000 cP	0.900	See Table

Screen "2. Sensor installation on lab stand"

The purpose is to adjust the offset in the air (see § 3.5.1 for information).

Be sure that the rod is clean and dry and is vibrating in the air.

Touch the "OFFSET" button one first time, touch it again a few minutes later, the offset value should be the same (+/- 5 points). If the value is the same touch "Next", if not verify that the sensor is stable (mechanically and thermally), wait a few minutes and restart the offset procedure.

Calibration Wizard		ESC
Next	2. Sensor installation on lab stand	
Range	100 cP	Sensor rod must be in the air - Cleaned - Dried - Vibrating Click on "OFFSET" then Click on "Next" to proceed
Measure	0 cP	
Offset Value	0.52747	
Sample	1	
OFFSET	1 Sample(s)	Validate
0.000 cP	0.900	See Table

Screen "3. Select a number of Viscosity Standards"

Press on "1 Sample(s) button and thanks to the virtual key board set the number of the viscosity standards you want to use to calibrate the sensor (from 1 to 9). After validation the button will indicate your choice. Then touch the "Next" button.

Calibration Wizard		ESC
Next	3. Select a number of Viscosity Standards	
Range	100 cP	Click on "# Sample(s)" to select a number of standards from 1 to 9 Click on "Next" to proceed
Measure	0 cP	
Offset Value	0.52747	
Sample	1	
OFFSET	1 Sample(s)	Validate
0.000 cP	0.900	See Table

Screen “4. Standards Measurements”

The window highlighted in Blue displays the measured viscosity and the ID of the sample (e.g Sample #1).

Immerse the vibrating rod in the lowest viscosity value standard (without moving the sensor). Window highlighted in Blue displays the measured viscosity.

Calibration Wizard				ESC
Next	4. Standards Measurements			
Range	100 cP	During manipulation - Never move the sensor - Make sure the rod is fully immersed Click on "Next" to proceed		
Measure	74.5 cP			
Offset Value	0.52747			
Sample	1			
OFFSET	1 Sample(s)	Validate		
75.600 cP	0.900	See Table		

Set the expected viscosity value and the density of the viscosity standard in the bottom of the screen (e.g 75.600 cP and 0.900 g/cc). For calibration the units to be used are cP and g/cc. When the measured value is stable, touch “Validate”, the relevant line of the calibration table will be filled and screen for next sample will be displayed.

Repeat for each viscosity standard, and then touch “Next”.

Screen “5. Access to Viscosity Table”


Touch “See Table” to check the viscosity calibration table you just have created.

Calibration Wizard				ESC
Next	5. Access to Viscosity Table			
Range	100 cP	Click on "See Table" to - Check your modifications - Save them - Use them		
Measure	0 cP			
Offset Value	0.52747			
Sample	1			
OFFSET	1 Sample(s)	Validate		
0.000 cP	0.900	See Table		

Screen “Viscosity Calibration in cP”

Check the consistency of the content of the table and touch “SAVE” to validate the table.

Take care, use it only if necessary ! “RESET” button erases the content of the table and fills it with the by default content (Expected Y = Measured X).

Viscosity Calibration in cP				ESC
Measured X	Expected Y	L	"Measured X" column must be entered in crescent order.	
0.000	0.000	0		
74,500	75.600	1	▲	
999999.999	999999.999	2	Table OFF	
999999.999	999999.999	3	RESET	
999999.999	999999.999	4	SAVE	
999999.999	999999.999	5	▼	

“Table OFF” indicates that calibration table is disabled. Press the button in order to activate it and display “Table ON”.


3.7.5 Temperature calibration

If the temperature option is active (§ 3.2.3), you can also proceed to on-site calibration of the temperature.

The temperature calibration is a second order polynomial. Update parameters A, B and C.

Touch one value to modify it thanks to the virtual keyboard.

The screen shows the status of the feature; Touch "Formula OFF" to activate the calibration and "Formula ON" to deactivate it.

Temperature Calibration			ESC
$Y = A.X^2 + B.X + C$			
A	0.000000		
B	1.000		
C	0.0		
X	25.0	°C	
Y	25.0		
ON/OFF	Formula OFF		

3.7.6 Density Calibration


This feature is available when MIVI sensor has the optional density measurement.

Enter the density values measured in the first column Measured X and expected in the second one Expected Y in ascending order.

Touch "SAVE" to validate the table.

Touch "Table OFF" to activate the calibration and "Table ON" to deactivate it.

Touch "RESET" to delete the calibration table

Density Calibration				ESC
Measured X	Expected Y	L	"Measured X" column must be entered in crescent order.	
0,000	0,000	0		
1,000	1,000	1	▲	
999999.999	999999.999	2	Table OFF	
999999.999	999999.999	3	RESET	
999999.999	999999.999	4	SAVE	
999999.999	999999.999	5	▼	

3.8 Correlations

The "Correlations" features can be used to correlate the viscosity delivered by the viscometer to another physical parameter such as, concentration, dry extract, viscosity at another shear rate ...

3.8.1 Correlations

It is possible to enable a correlation for the viscosity and density measurements. The viscosity and density correlations can be of 2 types: a 9-point table (By Table) or a second-order formula (By Formula).

Only one correlation can be enabled AT A TIME for each measurement. If you activate a new correlation, it will automatically disable the previous one.

The status of each correlation (activated or deactivated) is displayed on the information screen (press 'i' when on the main screen).

Correlations			ESC
Viscosity Table			
Viscosity Formula			
Density Table			
Density Formula			

3.8.2 Viscosity correlation - by table

On this screen, it is possible to read and modify the correlation table (up to 9 points). Update the content of Measured X and Expected Y column. Best it to start the table at X = 0.0 (for the unit see § 3.4.2) and cover the full-scale range of the viscometer (see 9000 transducer specific notes or § 3.2.3).


Touch "SAVE" to validate the table.

Touch "RESET" to erase the table.

The screen shows the status of the feature.

Touch "Table OFF" to activate the correlation

Touch "Table ON" to deactivate the correlation

Viscosity Correlation					ESC
Measured X	Expected Y	L	"Measured X" column must be entered in crescent order.		
0,000	0,000	0			
1,000	1,000	1	▲	▼	
999999,999	999999,999	2	Table OFF		
999999,999	999999,999	3	RESET		
999999,999	999999,999	4	SAVE		
999999,999	999999,999	5	no unit		

The correlated viscosity will be displayed instead of the viscosity in the main screen. If a TCV is activated, the correlation will apply to the TCV value.

3.8.3 Viscosity correlation - by formula


On this screen, it is possible to read and modify the correlation formula. Update the parameters A, B and C.

The screen shows the status of the feature.

Touch "Formula OFF" to activate the correlation.

Touch "Formula ON" to deactivate the correlation.

The correlated viscosity will be displayed instead the viscosity in the main screen. If a TCV is activated, the correlation will apply to the TCV value.

Viscosity Correlation					ESC
Y = A.X ² + B.X + C					
A	0.000000				
B	1.000				
C	0.000				
X	14,349	cP			
Y	14.349				
ON/OFF	Formula OFF				

On 9720 model the A parameter is forced to 0.

3.8.4 Density correlation – by table

On this screen, it is possible to read and modify the correlation table (up to 9 points). Update the content of Measured X and Expected Y column. Best it to start the table at X = 0.00 g/cc and cover the area up to 2.00 g/cc.

Touch “SAVE” to validate the table.

Touch “RESET” to erase the table.

The screen indicates the status of the feature. If “Table OFF”, touch the button to activate the correlation. If “=“Table ON” touch the button to deactivate the correlation

The correlated density will be displayed instead the density in the main screen. If a TCD is activated, the correlation will apply to the TCD value.

Density Correlation			ESC
Measured X	Expected Y	L	"Measured X" column must be entered in crescent order.
0,000	0,000	0	
1,000	1,000	1	▲ ▼
999999,999	999999,999	2	Table OFF
999999,999	999999,999	3	RESET
999999,999	999999,999	4	SAVE
999999,999	999999,999	5	no unit

3.8.5 Density correlation - by formula

On this screen, it is possible to read and modify the correlation by formula.

Update the settings of the A, B and C parameters.

Cell on the bottom of the screen shows the current status of the correlation feature (E.g., disabled in the example). Touching the cell will invert the setting.

The correlated density will be displayed instead the density in the main screen. If a TCD is activated, the correlation will apply to the TCD value

Density Correlation			ESC
Y = A.X + B + C/X			
A	1,000000		
B	0,000		
C	0,000000		
X	0.835	g/ml	
Y	0.835		
ON / OFF	Formula OFF		

On 9720 model the C parameter is forced to 0.

3.9 Pt100 Activation

Thanks to this screen, it is possible to enable or disable the display of the temperature. This is the standard setting when MIVI sensor is without its optional incorporated temperature probe.

The screen indicates the current setting (E.g., ON – enabled on this example).

Touching the button will invert the setting.

Pt100 Activation		ESC
Sensor's Pt100 ON		

3.10 Sensors Scanning

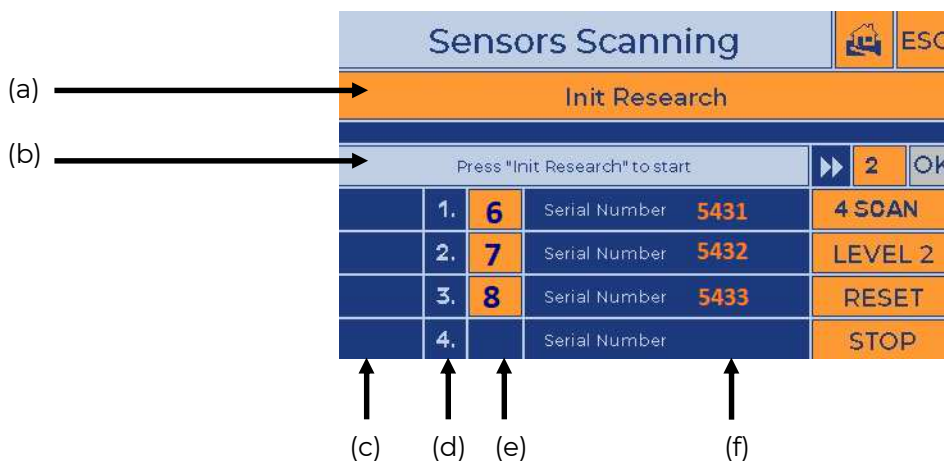
3.10.1 Sensor Scanning Introduction

In this menu, it is possible to identify the new viscometers connected to the 9700, to assign them to one of the 4 positions, to reset a position and cancel the assignation of its viscometer and if required to modify the slave addresses of the sensors.

Note that 9700 remembers the sensor settings and parameters from one time to another except if the position is reset.

9700 processor can manage up to 4 MIVI 9000 viscometers. To communicate with several viscometers, these sensors must have different slave addresses. If several sensors are delivered at the same time, Sofraser will set them accordingly (see 9000 specific notes). Each sensor is associated to its position (§ 3.2.1).

The hereunder picture shows the Sensors Scanning screen when 3 viscometers have been assigned to the 9710 processor.



(a) « Init Research » button

This button is used for detecting the viscometer(s) connected on the RS485 loop (§ 3.10.2)

(b) Information cell

This cell displays information messages and next step of sensor scanning procedure

(c) Cells in this column display a selection button in the “assignment” step (§ 3.10.5).

(d) Cells in this column display the “Position”, from 1 to 4

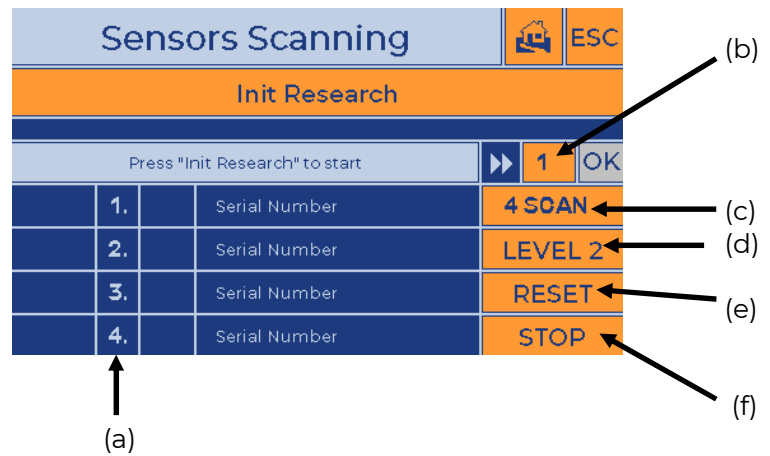
(e) Cells in this column display the slave addresses of the viscometers

(f) Cells in this column display the serial numbers of the viscometers

If a new viscometer, or more, is connected for the first time to the 9710, end-user must proceed to the Sensor Scanning and Initiate a research (§ 3.10.2). If all 4 positions are already assigned to a viscometer, end-user will have to reset one of them and erase the settings of the viscometer.

3.10.2 Init Research

When more than one viscometer will be connected to the 9710, they must have different slave addresses. If there is a doubt on the slave addresses values then in a first step check each viscometer alone. Connect the first viscometer to the RS485 loop (§ 2.5). Start the sensor scanning and press “Init Research” and check its slave address. Disconnect the first viscometer and connect the second viscometer. If the slave address is the same then change it (§ 3.10.5). Repeat for the other viscometers until each of them has its own slave address.



Firstly, the sensors have to be connected to the 9710 processor (See 2.5). Then, the scanning has to be performed. From Main Menu screen, select Level 3, then “Sensor Scan”.

- (a) Cells in this column indicate the viscometers “Positions”
- (b) First address to be scanned.
Value can be modified thanks to the virtual keyboard, between 1 and 99.
- (c) Last address to be scanned.
Can be modified thanks to virtual keyboard, between 1 and 99, must be greater or equal to first address.
- (d) Button to set security code for level 2. Gives access to the RESET feature.
- (e) Button to reset a position (Level 2 access needed)
- (f) Button to stop the sensors scanning process.


After setting the first and last address to scan, touch “Init Research” button to start the scanning. If no sensor is detected in the set area, 9710 will continue the scanning process from address 1 to “Last address”. When connected sensor is already assigned and doesn’t have the “new sensor” status, use “STOP” button to stop the scanning.

3.10.3 Sensor detected

When a sensor is detected, the 9710 will beep and the scanning process will stop: "Sensor detected" message is displayed.

Touch "OK" to continue.


If sensor is already assigned, the information will be displayed on next screen. User can either leave the Menu or RESET the position.

Sensors Scanning					ESC
Init Research					
Sensor detected Press "OK" to continue					
				▶▶	1 OK
1.		Serial Number		4 SCAN	
2.		Serial Number		LEVEL 2	
3.		Serial Number		RESET	
4.		Serial Number		STOP	

3.10.4 New sensor detected


This is the screen when a new sensor is detected.

Touch "OK" to continue and proceed to assignment.

Sensors Scanning					ESC
Init Research					
New sensor's detected Press "OK" to continue					
				▶▶	1 OK
1.		Serial Number		4 SCAN	
2.		Serial Number		LEVEL 2	
3.		Serial Number		RESET	
4.		Serial Number		STOP	

3.10.5 Select Position and change slave address


The user can choose in which Position the sensor has to be installed by touching the ">>" button (cells highlighted in orange, in the left column of the screen) facing the chosen Position number

Sensors Scanning					ESC
Init Research					
Press ">>" to select new sensor's assignment					
				▶▶	1 OK
▶▶	1.		Serial Number	4 SCAN	
▶▶	2.		Serial Number	LEVEL 2	
▶▶	3.		Serial Number	RESET	
▶▶	4.		Serial Number	STOP	

In this example, Viscometer S/N 1234 has been detected, assigned to Position 1, and its slave address is 1.

It is possible to change the sensor's address by touching the button next to the Position. This step must be performed if at least two viscometers have the same slave address (see the 9000 specific notes)

To install the eventual other viscometers, touch again the "Init Research" button. The scanning will continue.

Sensors Scanning					ESC
Init Research					
Press "Init Research" to start					<input type="button" value="2"/> <input type="button" value="OK"/>
1.	<input type="button" value="1"/>	Serial Number	1234	<input type="button" value="4 SCAN"/>	
2.		Serial Number		<input type="button" value="LEVEL 2"/>	
3.		Serial Number		<input type="button" value="RESET"/>	
4.		Serial Number		<input type="button" value="STOP"/>	

3.10.6 Sensors Scan Error

The "Sensors Scan Error" screen is displayed if a detected viscometer has the same RS slave address than another viscometer already registered by 9710.

If this situation occurs you can change the RS address of the new viscometer that has been detected, or delete the parameters of the old viscometer, or cancel the Sensor Scanning.

Sensors Scan Error	
An existing Sensor already uses this address You may use one of the options below.	
Change New Sensor Address	<input type="button" value="44"/>
Delete Old Sensor Parameters	<input type="button" value="Reset"/>
Cancel Current Research	<input type="button" value="Cancel"/>


When viscometers with unknown slave addresses need to be connected to the 9710, it is advised to check them one by one before proceeding to the global sensor scan.

3.11 COM PORTS

This screen shows the MODBUS RTU characteristics.

COM1 is used to communicate with viscometers via PORT 1 (§ 2.4 & § 2.5).

COM2 is used for external communication via PORT 2 (§ 2.4 § 2.6). It is possible to modify the parameters of COM2.


COM Ports					ESC
COM 1		COM 2			
Address	<input type="text" value="01"/>	Address	<input type="text" value="01"/>		
Timeout	<input type="text" value="100 * 10ms"/>	Timeout	<input type="text" value="25 * 10ms"/>		
Retries	<input type="text" value="3"/>	Retries	<input type="text" value="1"/>		
Baudrate	<input type="text" value="9600"/>	Baudrate	<input type="text" value="57600"/>		
Stop bits	<input type="text" value="1"/>	Stop bits	<input type="text" value="1"/>		
Parity	<input type="text" value="None"/>	Parity	<input type="text" value="None"/>		

3.12 SD Card

While the 9700 device is processing some data measured by the sensor immersed in the fluid, it is possible to record several values from these measurements on a micro-SD card.

The micro-SD card must be located in the appropriate slot on the right side of the 9700 processor (§ 2.4). Micro-SD card must be FAT32 formatted and it is necessary to create a directory named “EXCEL” on the card.

Thanks to the virtual keyboard, the user must set the file name, the point period that must be greater than or equal to 4 seconds per point, the end date of the acquisition and select which sensors have to be recorded.

SD Card							ESC	
File Name	FILENAME							
Point Period	5 s/pt							
All Data ON/OFF	ALL DATA OFF							
End Date	01	January	2021	12	00	00		
Sensor 1	Sensor 2	Sensor 3	Sensor 4	Start				

By default, select “ALL DATA OFF” in order to save the measures. “ALL DATA ON” is for after sales service and saves in addition the raw datas. The cell displays the current status of the setting.


Touch “Start” button to start the data acquisition and leave the screen. Go back to the SD CARD screen and touch “Stop” button if you want to stop the data acquisition before the “End Date”.

The “Start/Stop” button isn’t available when the SD card isn’t inserted in the 9700 SD port.

Starting a data acquisition on an already existing file name will add the new data at the end of the already saved data.

Only for 9720 model.

SD Card screen forces the selection of Sensor 1 and ignores other selections because multiproduct model only manages one viscometer, on channel 1.

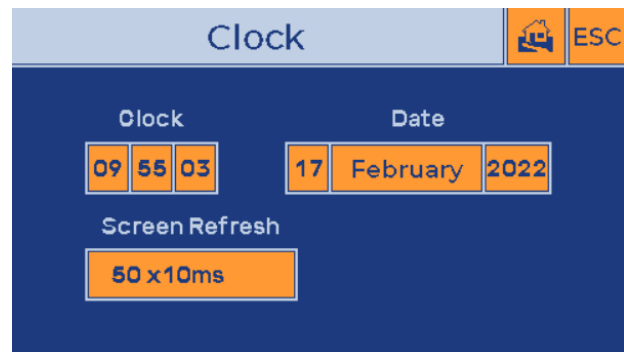
SD Card							ESC	
File Name	SHAMPOOD							
Point Period	5 s/pt							
All Data ON/OFF	ALL DATA ON							
End Date	18	February	2022	00	00	00		
Sensor 1	Sensor 2	Sensor 3	Sensor 4	Start				

Hereunder a file example with product ID set at 164, point period set à 4 seconds per point and ALL DATA OFF choice.

Product ID	164					
Product Name	PRODUCT.....164					
Starting Time and Date	10/03/2022 11:47:26					
Period	4 s/Pts					
All Data OFF						
Date and Time	Product	Viscosity 1	Temperature 1	Density 1	TCV 1	TCD 1
10/03/2022 11:47:34	PRODUCT.....164	117.461330	21.201890	1.111	180.468570	1.111
10/03/2022 11:47:38	PRODUCT.....164	117.325350	21.185160	1.111	180.181410	1.111
10/03/2022 11:47:42	PRODUCT.....164	117.182400	21.201890	1.111	180.067960	1.111
10/03/2022 11:47:46	PRODUCT.....164	117.500440	21.201890	1.111	180.524640	1.111
10/03/2022 11:47:50	PRODUCT.....164	117.618870	21.201890	1.111	180.694580	1.111
10/03/2022 11:47:54	PRODUCT.....164	117.353050	21.201890	1.111	180.313070	1.111
10/03/2022 11:47:58	PRODUCT.....164	117.616990	21.201890	1.111	180.691830	1.111
10/03/2022 11:48:02	PRODUCT.....164	117.209720	21.201890	1.111	180.107320	1.111
10/03/2022 11:48:06	PRODUCT.....164	117.500130	21.201890	1.111	180.524250	1.111
10/03/2022 11:48:10	PRODUCT.....164	117.318530	21.201890	1.111	180.263570	1.111
10/03/2022 11:48:14	PRODUCT.....164	117.247310	21.185480	1.111	180.071170	1.111
10/03/2022 11:48:18	PRODUCT.....164	117.055320	21.201890	1.111	179.885610	1.111

3.13 Clock

Touch the screen on the hours, minutes, seconds, day, month and year cells to set the values.



3.14 Factory

Locked: for Sofraser service only.

3.15 Bargraphs

This screen is used to check and set the bargraphs scales.

By default the scales are the sensor's ranges.

It is possible to change these scales by touching "Manual Range OFF" and then entering the desired ranges.

Bargraphs		
	Minimum	Maximum
Viscosity	0	100
Temperature	0	100
Density	0,000	2,000
Manual Range OFF		

4. Starting up procedure

Refer to MIVI sensor manual (reference 379) and 9000 transducer manual (reference 381) for global installation of the viscometer(s) and the 9700 user manual for the processor and the optional analog outputs expansion modules (§ 1 and §2).

After connections have been performed (§ 2.5) the first step is to check or proceed to the viscometer(s) scanning (§ 3.10).

If all viscometer(s) have been delivered together with the 9710, the “Sensors scanning” has been performed at Sofraser. The viscometer(s) will be detected when the system is powered.

If at least one new viscometer is connected to the system and/or the viscometer(s) position(s) on the “multi-sensors screen” is required, proceed to a complete “Sensor Scanning” (§ 3.10.1 to 3.10.5). If more than one viscometer will be connected to the 9710 check that each viscometer has its own RS slave address (§ 3.10.1 and 3.10.5).

When the viscometers have been assigned to the suitable positions (§ 3.2) according to your requirements, set the measurement units for all measurements and viscometers (§ 3.4.2).

If required customize the Security codes (§ 3.6.5).

Set alarms and relays (§ 3.5.2 & § 3.4.5)

Set 4-20mA current outputs (§ 3.5.3 & § 3.4.4).

Adjust the offset(s) of the raw signals in the air (§ 3.5.1).

When offset(s) have been adjusted you can fill your process with the fluid/liquid.

If required viscosity fluctuations can be dampened thanks to the filter feature (§ 3.5.4).

If you are planning to use these features, set Temperature Compensated Viscosity (§ 3.6.2) and/or Correlation (§ 3.8) feature(s). If both features are set and activated, the correlation applies on the Temperature Compensated Viscosity.

Specific to 9720

Fill the products sets of parameters (§ 3.5 and § 3.5.5).

Select who is authorized to activate the products (§ 3.6.1 and § 3.6.6)

Activate one of them (§ 3.2.2).

Update the specific notes delivered with the 9700 in order to take into account your customized settings and/or save the configuration on the SD Card (§ 3.4.3).

Recording the measure and raw data on the Micro SD card can be an option for some end-users (§ 3.12).

Sofraser viscometers have almost no drift in time in normal operating conditions when operated on homogeneous and stable liquids. Nevertheless, it may happen that expected and measured viscosities are different. This situation can be handled thanks to the Correlation feature if not already used, or thanks to the Calibration feature (§ 3.7).

5. Troubleshooting

The hereunder table lists all the reasonable malfunctioning and some advices in order to analyze them and to fix them:

Observed malfunctioning	Checking advice
The screen does not light on when we turn on the power supply.	Check the wiring connections and the power supply of the equipment. Disable energy saver (§ 3.1).
The sensors are not vibrating but the screen lights on.	Check that the transducer are connected to a 24 VDC stabilized and filtered power supply; Double-check all connections.
The sensors are vibrating but the PLC does not process any data.	Check the RS-485 cable all over the line, the "Diagnosis" window on the PLC should help to locate the breaking point.
The analog outputs and/or the relay outputs do not provide any information.	Check the wiring connections, the power supply of the equipment and the outputs allocation. Use "Check 4-20mA feature" in order to test the outputs (§3.5.3)
The status and the settings for the 4/20 mA current outputs for Module 1 and /or module 2 are not available.	Module 1 and Module 2 are optional items and features. Check if they have been ordered (§ 3.4.4)
Analog outputs Module 1 and Module 2 are installed and set in the 9700 configuration, but no signals on the outputs.	Check the wiring of the modules (§ 2.4.4). Check power supply, communication cable (check the direction) and module to module connection. Normal status of the LEDs: - on Expansion Adapter EX-A2X PWR (green and continuous) COMM (green and continuous) - on Expansion modules IO-A06X RUN (green and continuous) ISO. PWR (green and continuous) Check that the current output is assigned to a viscometer, to a physical value and that settings are consistent (§ 3.2.3). Check the good working of the outputs thanks to the "Check 4-20 feature (§3.5.3).

<p>LEDs on Expansion Adapter EX-A2X</p>	<p>Normal status of the LEDs:</p> <ul style="list-style-type: none"> - PWR (green and continuous) - COMM (green and continuous) <p>If PWR (OFF), check 24VDC power supply</p> <p>If COMM (OFF), check the communication cable with 9700 and the connection to IO-A06X</p>
<p>LEDs on Expansion Module(s) IO-A</p>	<p>Normal status of the LEDs</p> <ul style="list-style-type: none"> - RUN (green and continuous) - ISO. PWR (green and continuous) <p>If PWR (green and blinking), check communication cable between EX-A2X and 9700.</p> <p>If PWR (OFF) check 24VDC on all modules and check connection between EX-A2X and IO-A06X</p> <p>If ISO.PWR (OFF), check 24VDC and all modules, check connection between EX-A2X and IO-A06X</p>
<p>9700 shows an error screen with message STOP reasons = expansion error</p>	<p>This screen is displayed in case of break of communication cable between 9700 and Ex-A2X and /or break of connection between Ex-A2X and IO-A06X.</p> <p>Fix the connections and re-start the 9700</p>
<p>Temperature measure is abnormal</p>	<p>MIVI sensor configuration is without the incorporated temperature probe (§ 3.2.3 and § 3.9), or probe is not wired (see 9000 transducer manual).</p>
<p>Displayed viscosity has not the expected value</p>	<p>Check that offset has been set according to the instructions (page 2 and §3.5.1). Check viscosity unit (§ 3.4.2) Check density coefficient setting (§ 3.6.4). Use correlation feature (§ 3.8.1 to 3.8.3) in order to adjust process viscosity to expected viscosity. Check viscometer calibration thanks to one or several viscosity standards and using a Sofraser lab stand for MIVI sensor. If applicable either send the viscometer back to Sofraser for re-calibration, either do an on site calibration (§ 3.7.1 to 3.7.4).</p>

<p>A screen named "Info Mode", not described in the manual, is displayed.</p>	<p>This screen appears when screen is pressed continuously during several seconds. This screen is dedicated to Sofraser after-sales service team. Leave it thanks to ESC icon.</p> <p>Entering in the submenus can modify factory and program settings and damage definitively the processor.</p>
<p>On multi-sensors screen, the measures are missing and replaced by *** and viscometers serial numbers are highlighted in red.</p>	<p>This status appears after 30 seconds of communication break between 9710 and 9000 transducer(s). Check the connections (§ 2.5).</p>
<p>It is not possible to read the measures on PORT2</p>	<p>See § 3.11. Your master device must send its inquiries to the 9700 slave address (§ 3.11).</p>
<p>Only for 9720 model. Control room is not able to change the ID of the product that must be active on 9720.</p>	<p>The choice is set as Operator and the changes must be done thanks to the 9720 touch screen. Or change the setting of the Product ID choice to control room (§ 3.6.6)</p>
<p>Only for 9720 model The ID of the activated product on mono sensors display is not the expected one.</p>	<p>This happens when the setting is out of the 0 to 255 range.</p>
<p>Only for 9720 model Why is product ID changing when I skip from Operator to Control Station choice</p>	<p>When choice is set to Control station, the product ID is automatically set at the last used</p>
<p>It is not possible to assign more than 1 viscometer on 9700 processor.</p>	<p>Check the model of your processor. 9720 model manages only one viscometer (§ 3.2.3).</p>
<p>What is the model of the 9700 and the version of the program?</p>	<p>The information is available on the Info screen (§ 3.2)</p>
<p>On multi-sensors screen the serial numbers are missing.</p>	<p>Do a sensor scan (§ 3.10)</p>

