

MIVI 9610

9612 Version Technical Manual



IMPORTANT

BEFORE STARTING THE PROCESS, IT IS VERY IMPORTANT TO PROCEED TO THE OFFSET ADJUSTMENT IN AIR:

The procedure of the offset adjustment is detailed in the user manual § 5.1:

1. CLEAN AND DRY THE SENSOR ROD.
2. BE SURE THE PROCESS IS EMPTY. THE ROD MUST VIBRATE IN AIR.
3. INSTALL THE SENSOR ON THE PROCESS AND FIX IT WITH ITS 4 SCREWS.
4. REACH THE OFFSET ADJUSTMENT FUNCTION STARTING FROM THE BLOCK "SETTINGS" AND WITH THE SECURITY CODE 2.
5. FOLLOW THE INSTRUCTIONS DISPLAYED ON THE ELECTRONICS SCREEN.
6. PRESS ON "F3" AND "OK" TO ADJUST THE OFFSET. IT MEANS THAT V_{BRUT} WILL BE SHIFTED TO THE REFERENCE 900 mV.

PRESSING ON "OK" IS POSSIBLE ONLY IF V_{BRUT} IS WELL SHIFTED TO 900 mV.

A MESSAGE SAYING THE OPERATION WAS SUCCESSFUL APPEARS.

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1. General presentation

The measuring chain is composed of two indissociable elements : the sensor and the electronic processor.

1.1. The sensor

Each sensor is matched with its own electronics. Before switching on, be sure that serial numbers at the sensor and the electronics identification plates are corresponding.

The operation principle of the equipment makes that the provided viscosity information is relative : in the same fluid, at the same conditions the information is the same. But for 2 rheologically different fluids the response can be different (despite it is perfectly repeatable).

The sensor active part is protected by an stainless tube which must not be removed.

The sensor is fixed upon its mounting flange by means of the provided 4 long screws.

See the detailed leaflet, § 2.

1.2. The processor

Its functions:

- Powers the sensor,
- Processes the sensor's information,
- Displays and transmits the process information : viscosity, temperature, sensor's frequency, outputs and relays states....

The processor is composed of two modes :

“UTILISATION” Mode :

The “UTILISATION” Mode makes it possible to visualize in different forms viscosity and temperature values.

- Visualization with bargraphs, acquisition graph
- Access to the sensor identification data
- Access to the “ADAPTATION” Mode blocks starting from the principal menu

“ADAPTATION” Mode :

The “ADAPTATION” Mode makes it possible to adapt the displayed data, parameters, settings and configuration of the processor according to the using conditions.

- Display block : makes it possible to display outputs and relays states, rough data, to choose viscosity and temperature units and to choose the viscosity correction to active.
- Settings block : makes it possible to set current outputs, alarms, bargraphs and graph scales, to choose and set the modalities parameters of kinematic viscosity calculation, to proceed to the mounting offset adjustment, to activate and define viscosity filter and to change the Pt100 status.
- Parameters block : makes it possible to parameter viscosity corrections, to read and modify the compensation table, to modify security codes and to set the density coefficient.
- Configuration block : makes it possible to SOFRASER to configure the processor with the manufacturing data (thermal drift, calibration) and to define the viscosity adjustment data.

1.3. Checking the equipment at the receipt

- a) At first, check the supply conformity with the ordered equipment, mainly the presence of the parts necessary for the equipment mounting. Those to be used at the process will be given to the concerned department, for the installation preparation.
- b) Place the sensor on a soft foam plate, connect it to processor (see §3.10) and switch on. The vibration appears at the rod, the viscosity indication is close to zero (or close to the minimal required current value of the analog output). When touching the rod, the information has to increase.

In case of subnormal operation a) or b), check as follows :

- Power supply, connections, cables,
- The good condition of the vibrating rod (no bending or knock damages).

Consult your distributor.

1.4. Checking the equipment when placed at the process

Before filling the network check that the viscosity information is stable (vibrating rod in air). If not, check the strength of the sensor fitting, then rotate the sensor of 90° (4 possible positions). Choose the position where the information is the most stable.

Locate this position, in order to restore it when the sensor is removed – put in place.

Adjust the mounting offset, at room temperature. The rod is vibrating in air.

When possible, note the viscosity information when a cleaning or rinsing solution is flowing.

If the original calibration is convenient, one of the 2 above mentioned values can be taken as reference for periodic control of the equipment operation each time that the same conditions will occur (rod in air, or in the cleaning solution). Such an operation can be assimilated to a self-checking.

If the original calibration has been modified the reference values will be of course those obtained with the new calibration.

1.5. Periodic checking

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

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

A fast test is many times available, when the sensor active part is in air, or immersed in a cleaning or rinsing solution. As long as these values stay similar, we can say that the sensor operation is right among its whole range (if no intermediate re-programming occurred).

1.5.1. Offset adjustment in air

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

The amplitude, corrected in offset, V_{brut} , must be shifted to the reference of 900 mV.
See User Manual §5.1.

1.5.2. Modification of the previous calibration

The device has been programmed in order to answer to your needs. These features programming steps are noticed on the features specification pages at the end of this document.

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



The calibration parameters are protected and can only be modified with the security code.

For modifications of calibration, contact your distributor.

1.6. Directives and Standards

1.6.1. Certification ATEX

MIVI sensors are in agreement with 94/9/EC directive (ATEX) for equipments installed in explosive gas atmospheres or in presence of combustible dust :

 II 2G (gas) or  II 2D (dust)

Ex d IIC T1 to T6 : gas

Ex tD A21 IP67 T75°C, T90°C, T125°C, T190°C, T290°C, T300°C : dust

Be sure the sensor's certification is in accordance with the security level required on your process location : Area classification, equipments group, protection method, gas type, temperature codes...

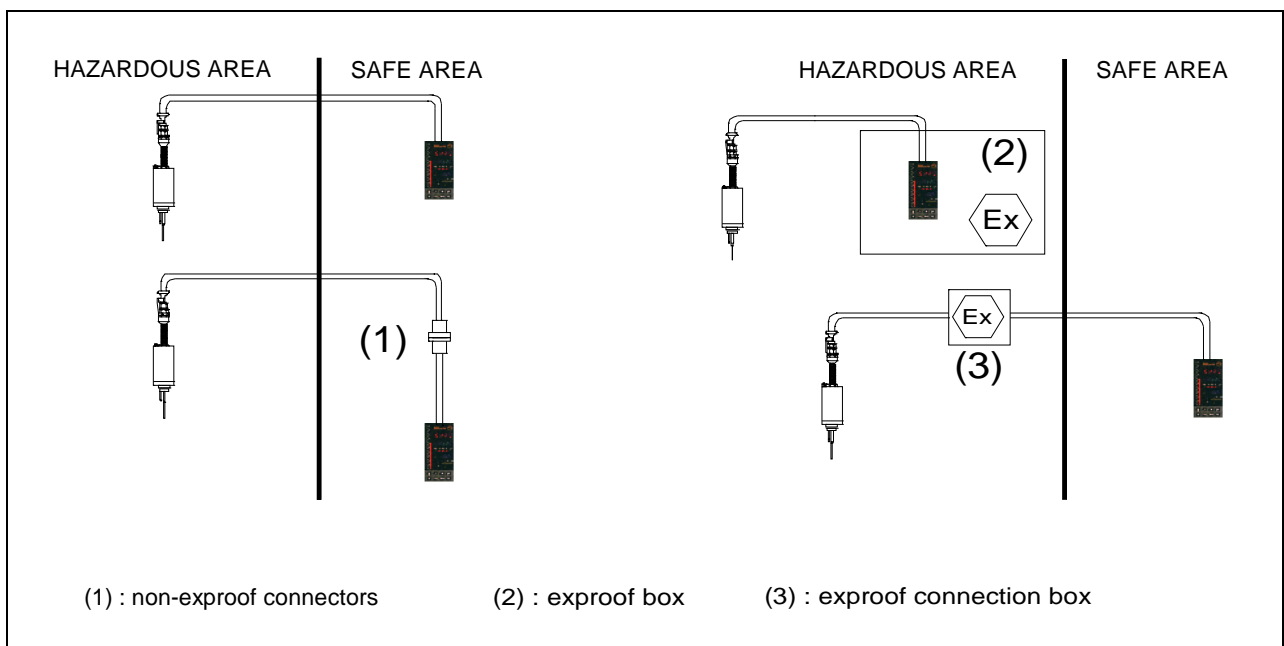
Area classification and equipments installation rules are detailed into IEC 7910 and EN 60 079 standards for gas or EN 61 241 standards for dust.

To always keep the maximum security level of the viscometer, don't open it. Furthermore, we advice to install the sensor with the cable gland orientated to the floor.

Check periodically information indicated on the sensor's identification plate are still visible.

1.6.2. Installation in hazardous area

Here are the possible ways to install MIVI 9601 sensors in hazardous area.



IMPORTANT : Always connect the sensor's body (screw on the top of the body) to the ground.

1.6.3. European Pressure Equipment Directive

Up to 60 bars, MIVI sensors are in agreement with the article 3.3 of the PED 97/23/EC. In case of higher pressure, sensors are certified one by one.

The mounting flange is an accessory to be welded on the process line. It means it can not be individually certified but with the whole process line.

1.6.4. EMC and low voltage directive

The processor 9601 is in agreement with EMC specifications detailed into 89/336/EEC (modified by 92/31/EEC and 93/68/EEC).

Processors 9601 are supplied by 24 VDC. So they are not subjected to the Directive Low tension 73/23/CEEC (modified by 93/68/CEE).

MIVI sensors have been designed and manufactured according to the electrical safety rules.

2.2.1. Elbow mounting

- The flange is welded on a right angle tee as indicated in pic.1.
- The minimal pipe diameter is of 32 mm.
- The flange and the pipe axes have to be the same.
- The flow direction is as indicated on fig.1 (unless for fibrous fluids where the flow is inverted and the rod protector removed. (See §2.2.5).
- A free area of at least 150 mm length is necessary.

Advice : choose a sensor position in order to assure a permanent fluid renewal and to avoid the existence of "dead zone".

2.2.2. Plane side mounting

- The flange is welded on a metal plate as indicated on pic.2.
- The free area around the vibrating rod has to be at least $\varnothing 40$, 150 mm length.
- In order to avoid parasitic vibrations, the plate where the flange is welded must be thicker than 5 mm.

Advice : preferably choose a sensor position with the rod to the top in order to have a total immersion of the vibrating rod and to avoid the formation of "dead zone".

2.2.3. Pot mounting, for small flow rates, or pilot plant

See picture 3.

2.2.4. Special mountings

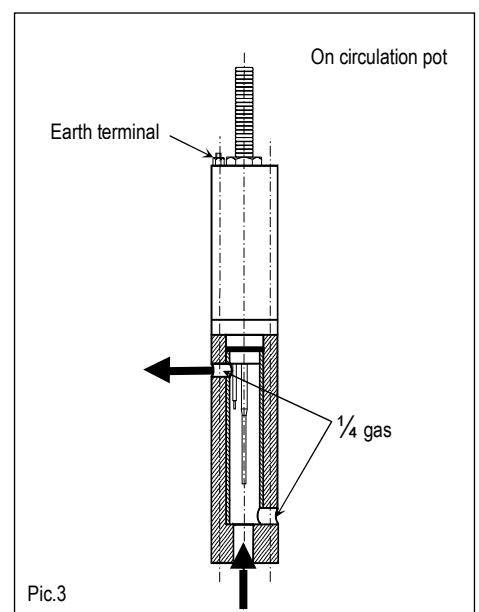
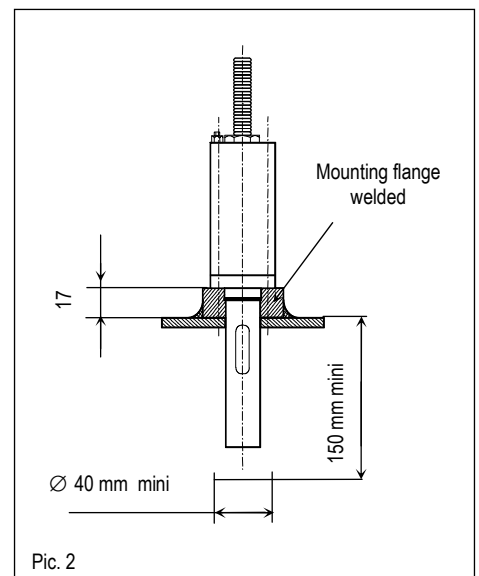
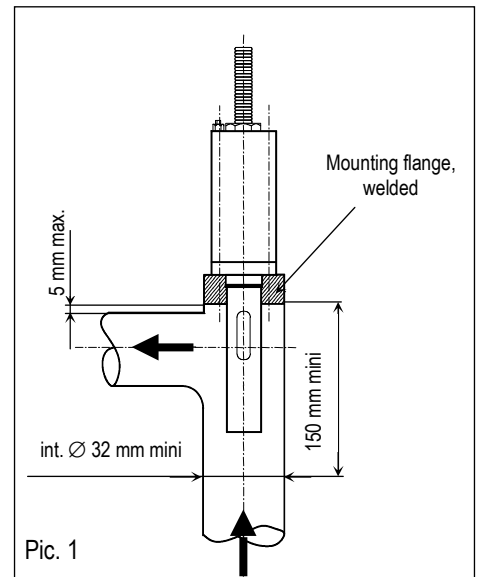
The small sensor size allows numerous personalization of its fitting according to the user's requirements. Consult your distributor.

2.2.5. Replacement cap

Each mounting flange is provided with an obturation kit :

- Cap and O-ring
- 4 fixing screws CHC M6 (or 8 fixing screws M8 for high pressure sensor)

It allows the installation working when the sensor has to be removed.



2.3. Practical advices

Torque at the mounting screws: 9 N.m \pm 1 at the M6 \times 100 screws, or 22 N.m \pm 1 at the M8 screws (for the high pressure design).

Tightness is assured by a O-ring (2 for sanitary model). Connections of ground of the sensor and electronics must be equipotential.

Warning :

Each sensor is equipped with a guard tube in order to protect the vibrating rod. This protector must be left on the sensor at the time of the assembly on the mounting flange. The fluid renewal is done through the slits of the protector. He has not to be removed unless when the sensor is used in particular conditions : on pot mounting, sanitary use, very viscous and fibrous fluids.

WARNING !

In this case, the mounting / removing of the sensor must be made with precaution, in order to avoid to bend the vibrating rod.

A ring, with the same dimensions of the protector's base must be placed on the head of the sensor in order to maintain the O-ring.

IMPORTANT :

- *As soon as the sensor is removed, screw immediately its guard tube.*
- *IP 67 tightness is only obtained when firmly screwing either the cable connectors, their replacing caps, and the cable glands.*
- *The minimal bending radius at the flexible pipe (electric outlet) is of 100 mm. Less radius can generate leakage, then failure.*

2.4. Checking

In case of subnormal operation, check the following points:

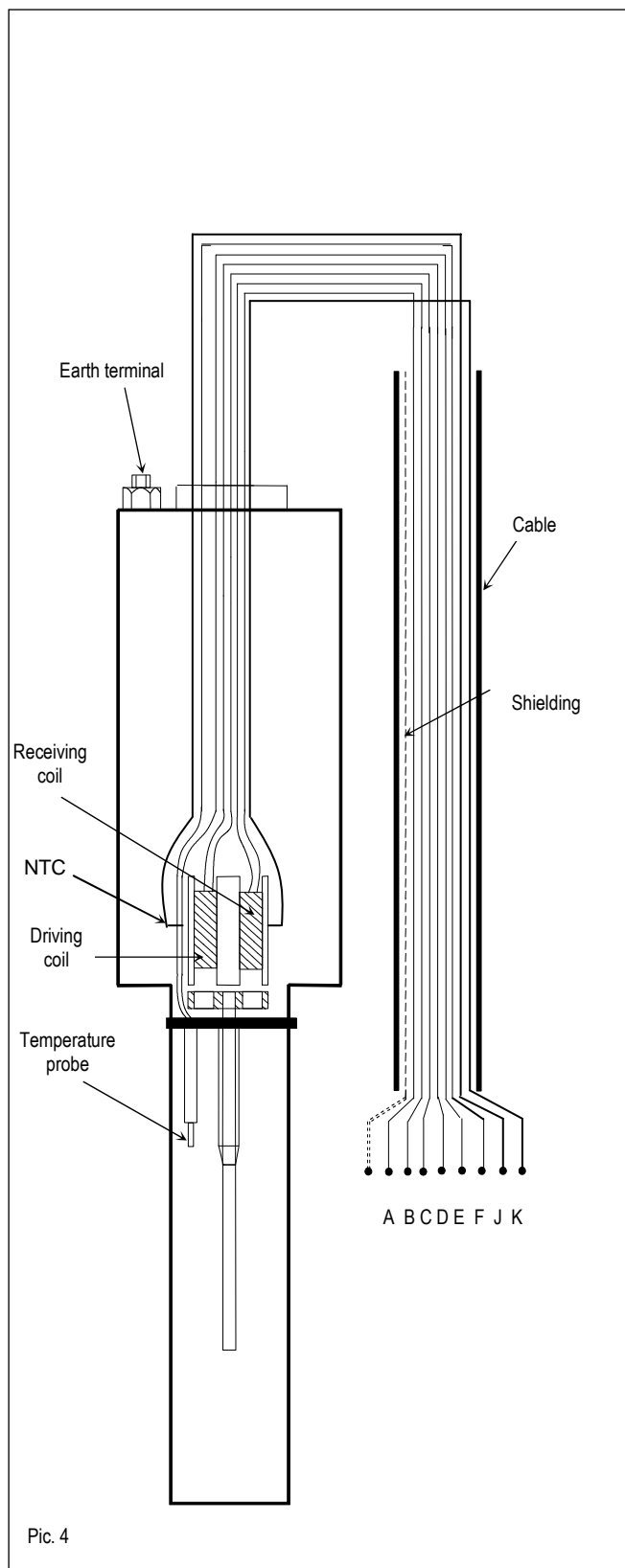
- Electrical connections (connectors, cables, power supply...)
- Remove the sensor from the process and clean it
- Check that the vibrating rod is not bent.

When powered, check with the finger that the vibration is existing at the rod end. At this moment, the viscosity information has to increase.

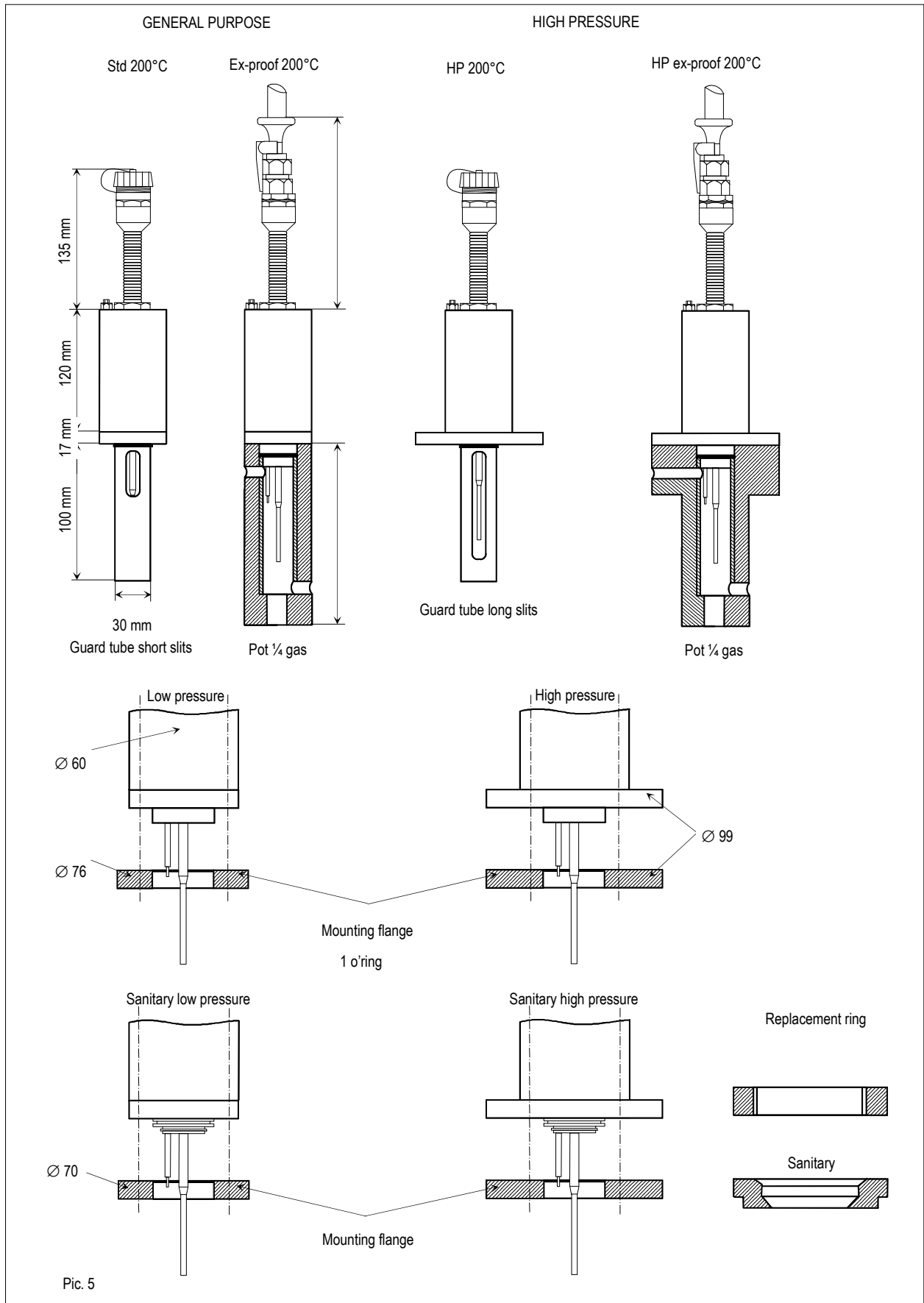
2.5. Sensor wiring

Repère câble	Correspondance	Couleur
A	Receiving coil	Blue
B		Brown
C	Driving coil	Transparent
D		Black
E	PT100	Red
F		Yellow
J	NTC	Green
K		White
/	Shielding	

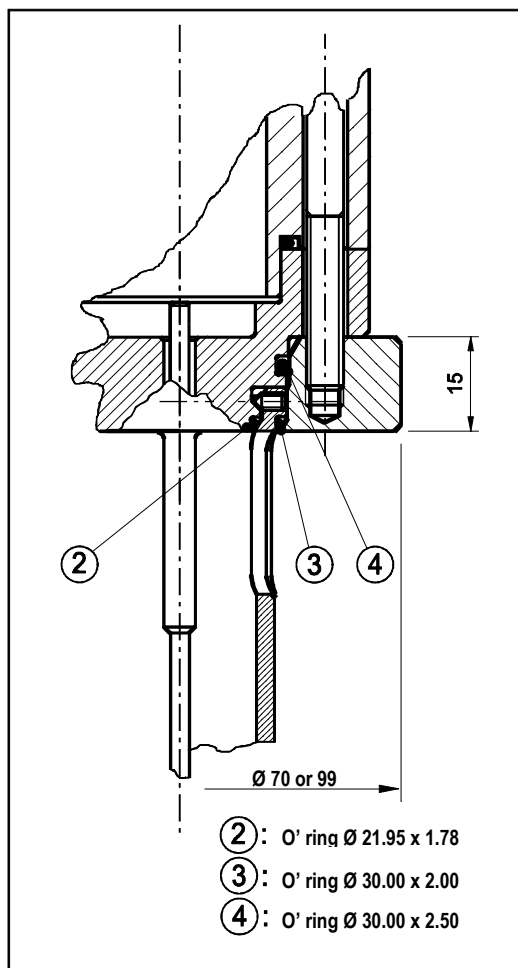
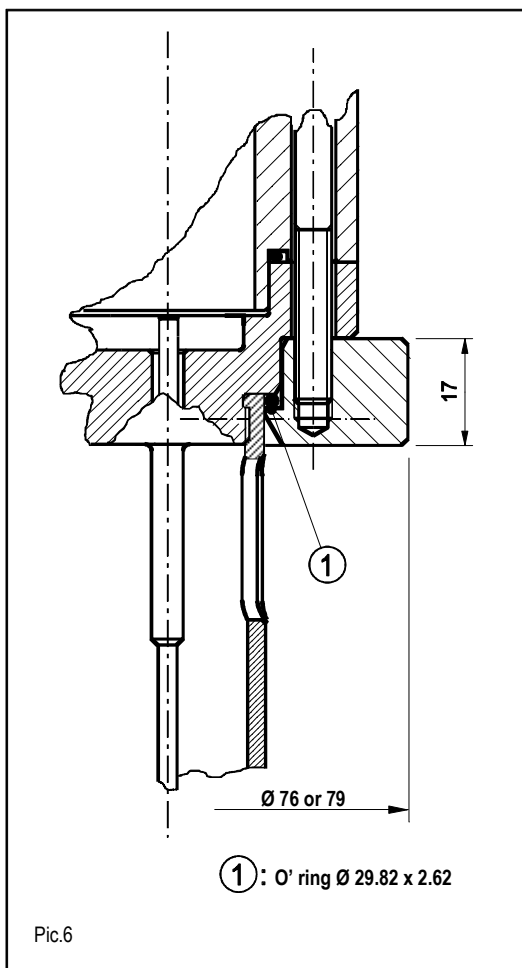
Standard and explosion proof models are both equipped with cable glands. Those ones can match the ATEX norm, depending on the MIVI version.



2.6. Models and dimensions



2.7. Tightness



3. Transducer's mechanical characteristics

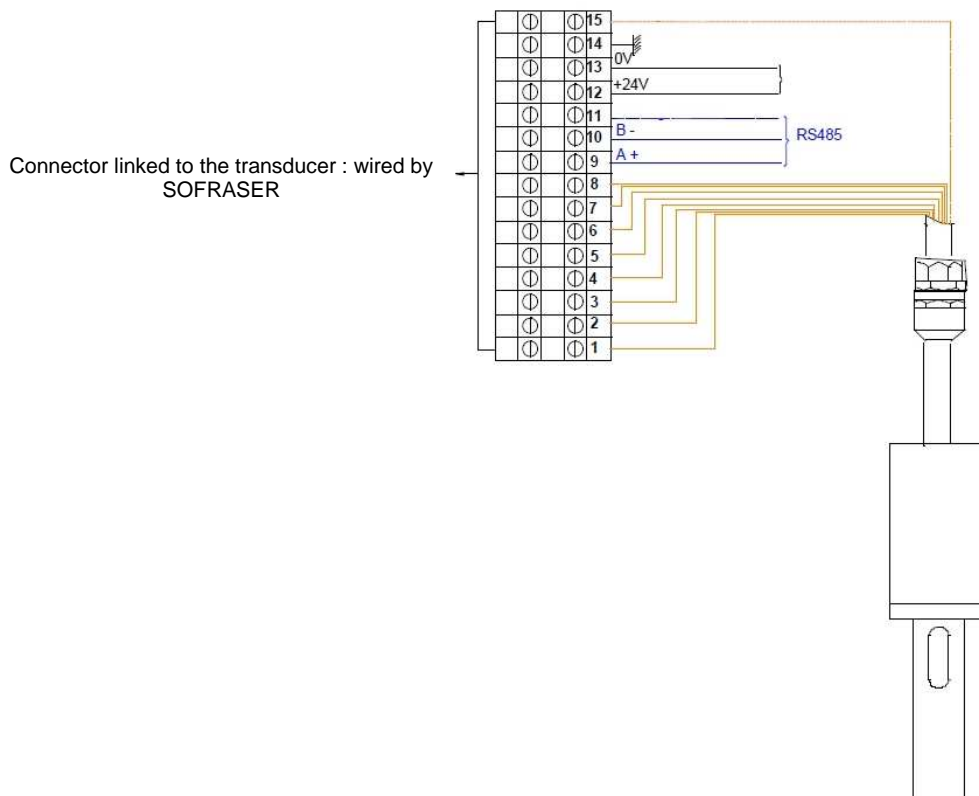
3.1. Housing's mechanical characteristics

non-ATEX version

External dimensions : (Height) 80mm * (Width) 100mm * (Length) 160mm
 Tightness : IP66
 Material : Aluminium
 Temperature : from 0°C to 45°C

3.2. Transducer's electronic board wiring

The transducer's board is wired through the connector, which is plugged in the metallic box.

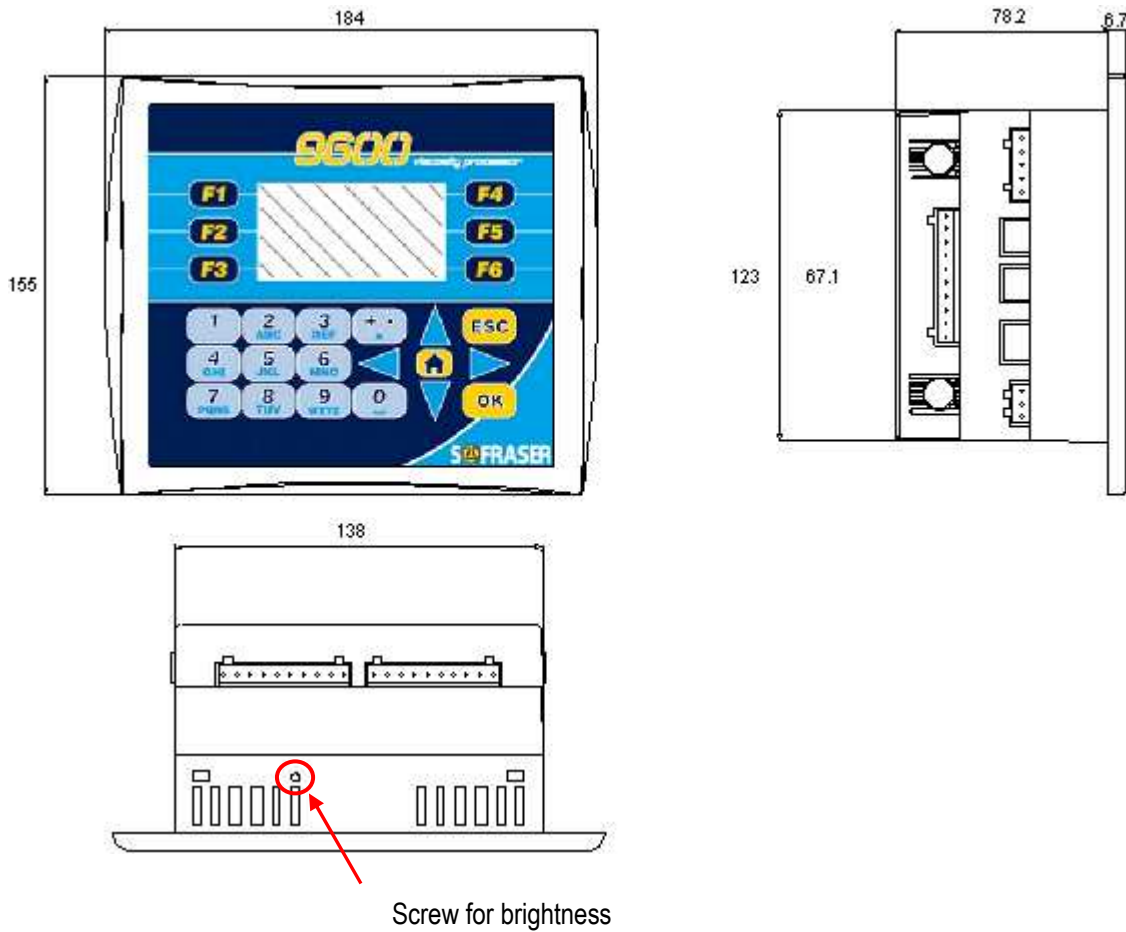


IMPORTANT : All boards must have the same power supply.

4. Processor technical characteristics

4.1. Mechanical characteristics

Dimensions behind the collar : 138 x 123 x 78.2 mm
 Collar dimensions : 184 x 155 x 6.7 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



4.2. 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.

4.3. Keyboard

24 keys : alphanumeric keys and function keys.

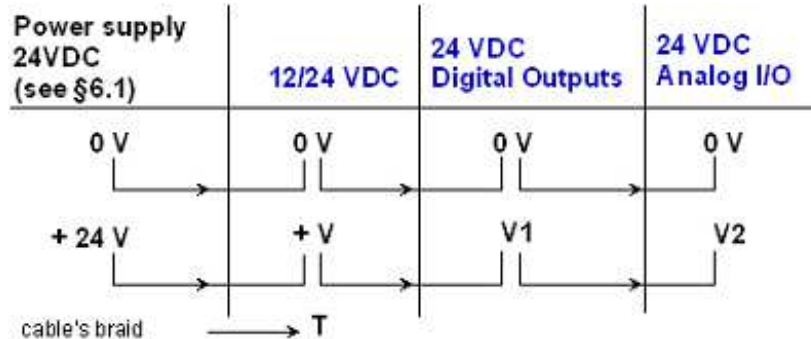
4.4. Battery

The battery lifespan is about 7 years at 25°C.

4.5. Consumption

Typical power consumption : 7,2 W maximum
 Current consumption : 300 mA maximum

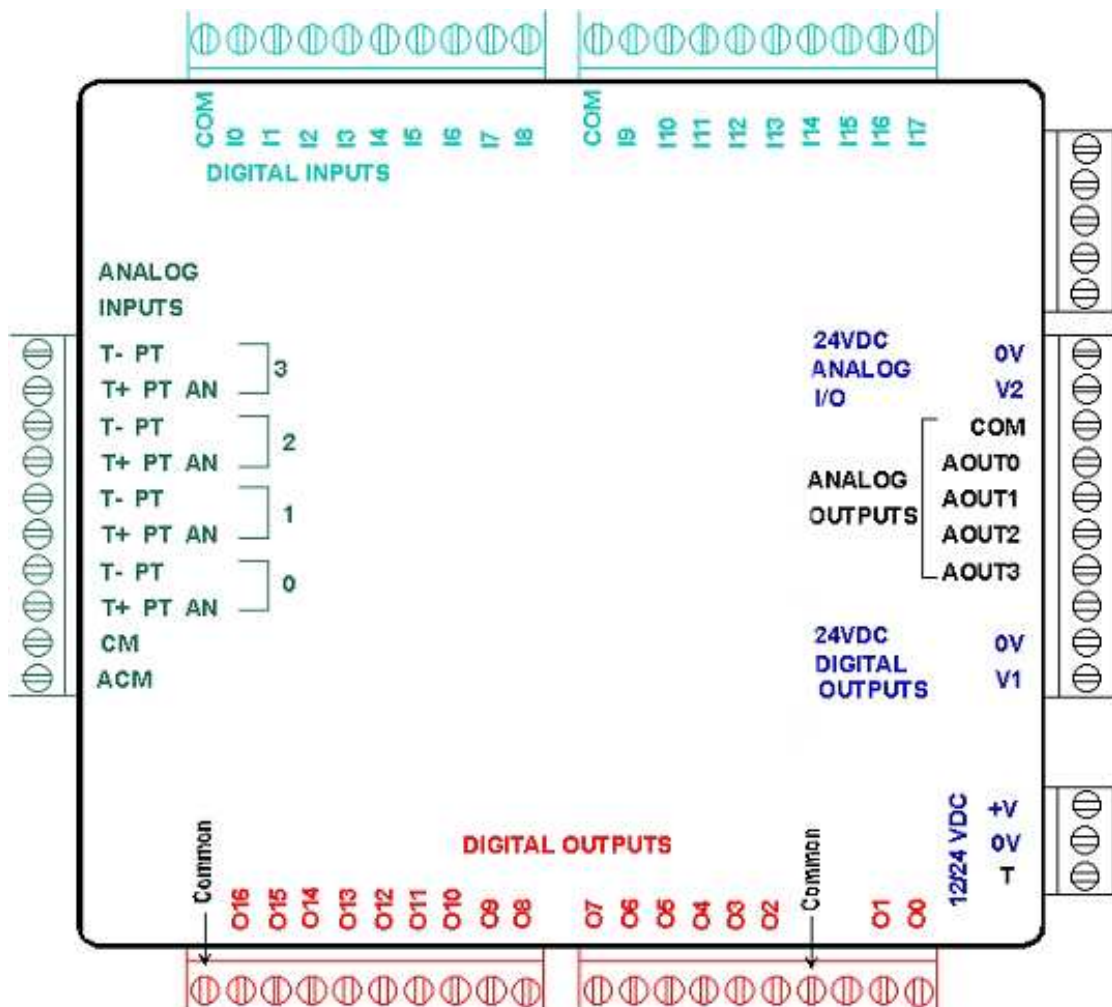
4.6. Power supply wiring



4.7. 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.



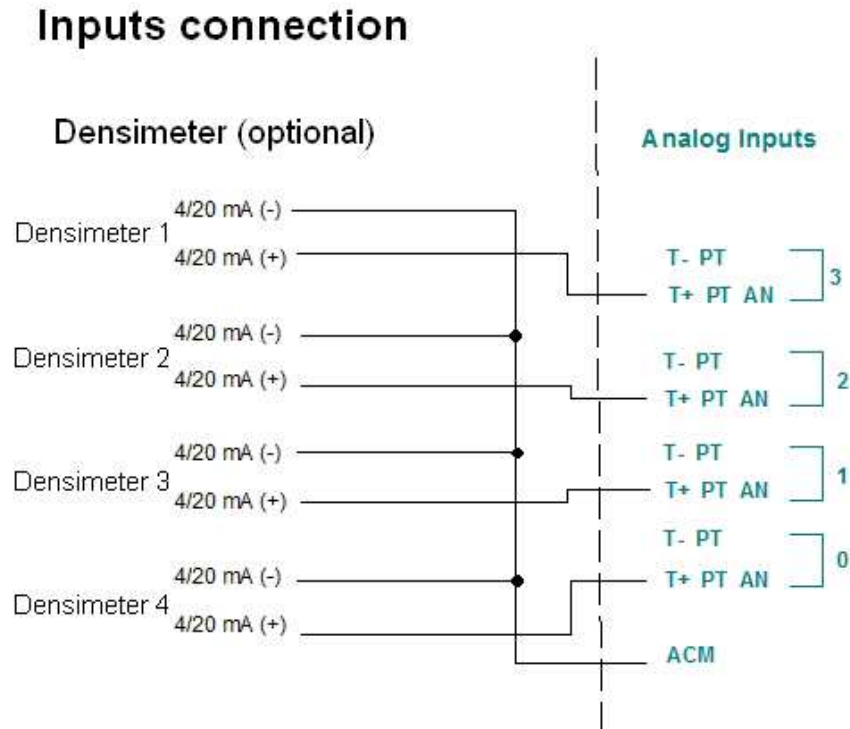
4.8. Analog Inputs

4 analog inputs are available. Resolution : 14 bits.

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

On 9612 electronics, these inputs are connected as 4-20mA and are specific to the plug of a densimeter. Four densimeters can hence be connected to the 9612 module for the first four detected sensors.

4.9. Analog inputs connection (densimeters)



4.10. Relay outputs

15 relay outputs are available on this device. Based on our configuration, 13 of them are defined, as follow :

- 12 relay outputs are attributable to the module by the user (cf User Manual § 5.2.2).
They can be used as alerts for :
 - LOW viscosity
 - HIGH viscosity
 - LOW and HIGH viscosity
 - LOW and HIGH temperature
- 1 relay output as a stand-by alert for the general working process.

How the relays operate :

- Normal behaviour :
The relays coils are supplied and contacts are closed.
- In case of a troubling parameter :
The relays coils stop being supplied and contacts are opened : measurements out of range, unsupplied processor...

Tolerance for the relays :

From 02 to 07 and from 08 to 013 : 3 A max, 250VAC or 30VDC
Common : 8 A max (common plug not written, see the connecting plan)

Minimum load :

1mA à 5VDC

Lifespan :

100 000 operations with a maximum load

Response time :

10 ms

If the relays are used in order to commute some inductive loads, we clearly advise to add some RC circuits to the load terminals or to the contacts terminals. The purpose is to decrease the impacts of electromagnetic effects.

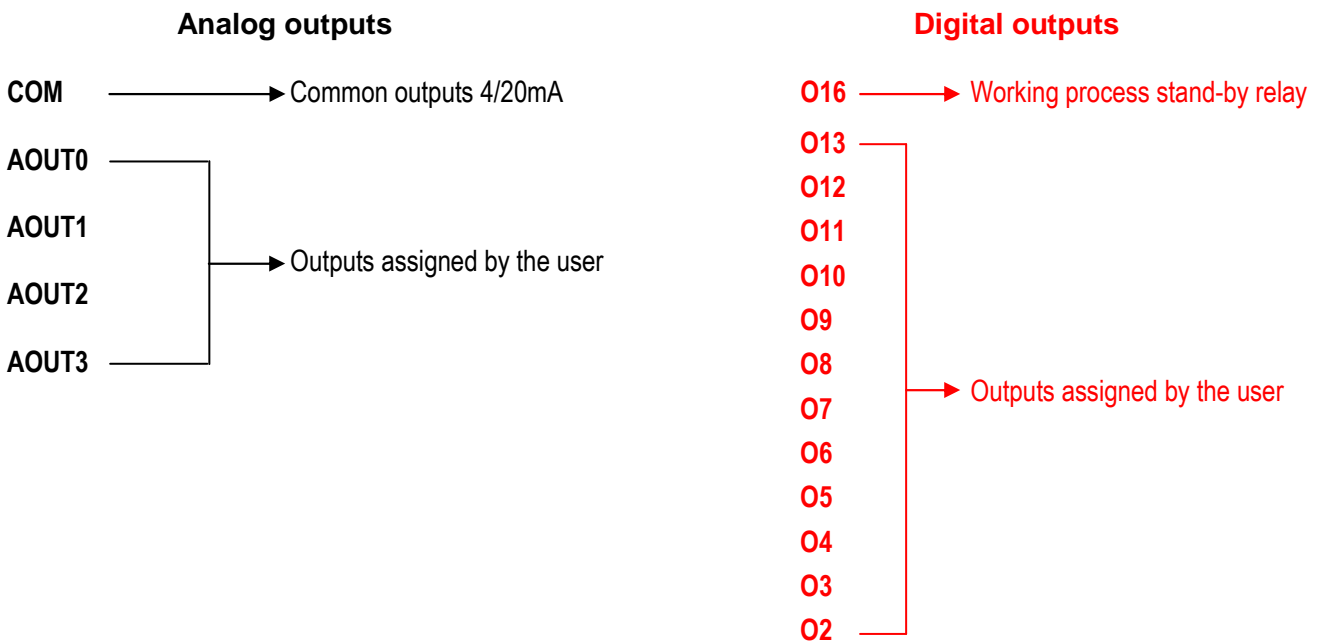
4.11. Analog outputs

Four analog outputs are available on the module. Their resolution is 12 bits.
They can be calibrated as 4-20mA current outputs or as 0-10V tension outputs.
The user is the one to choose how to configure the current outputs (see User Manual § 5.3.2).

The 9612 module can manage up to six sensors. So only the four first listed sensors will be able to be connected to current outputs.

They can be used to display the viscosity and the temperature.

4.12. Outputs wiring scheme



4.13. 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

4.14. Wastes handling

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


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

5. Mounting the processor - Installation

Piece of advise :

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

<p>Step 1</p>	<p>Make a panel cut-out as follow :</p> <p>Ø4 mm 0.15" Hole for NC6-32 screw</p>
<p>Step 2</p>	<p>Connecting the power supply to the Earth :</p> <ul style="list-style-type: none"> - Drill a Ø4 mm hole for the provided NC6-32 screw. - Scrape the panel's paint away to ensure the conductive connection. - Drive the screw into the hole and place the following items : first washer, ring cable shoe, second washer, spring, nut. <p>Note : The wire used to connect with the Earth should not be more than 8mm long. If the conditions are not suitable, do not connect the system to the Earth.</p>
<p>Step 3</p>	<p>Slide the processor into the cut-out, ensuring that the rubber seal is in place.</p>

<p>Step 4</p>	<p>Push the 4 mounting brackets into their slots on the processor sides, shown as follow.</p> 
<p>Step 5</p>	<p>Tighten the bracket screws on the panel. Firmly hold the mounting brackets on the processor while tightening the screws.</p>

6.Communication

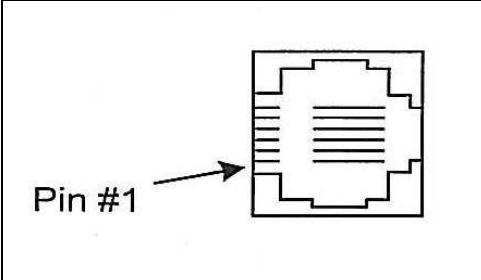
6.1. RS232 interface

2 RS232 ports are available. The RS232 ports are located on the side of the processor.
Serial ports type : RJ-11.

- Caution :
 - Turn off the power before making communication connections.
 - Do not connect the controller directly to a telephone or a telephone line.
 - The RS232 port is not isolated.
 - Signals are related to the processor 0V, this is the same 0V used by the power supply.
- Characteristics :

Speed	COM 1	COM 2
	300 à 57600 bps	300 à 115 200 bps

Voltage limits : $\pm 20V$

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

6.2. RS485 interface

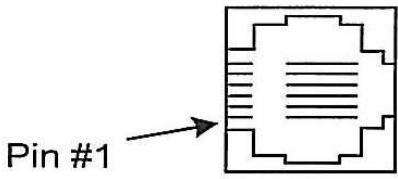
RS485 port is used to make the connection between the transmitter and the device.
Used COM port : COM 3.
Serial port type : RJ-11.

- Caution :
 - The RS485 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.
 - Turn off power before making communications 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 (positive terminals must be wired to positive, and negative terminals to negative).

- Characteristics :

Speed	from 300 to 115 200 bps
Communication capacity	up to 32 devices

Voltage limits : from -7 V to +12 V, as max differential

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

* Pins from 2 to 5 are not used for communicating with the RS485.

5.3. Protocol

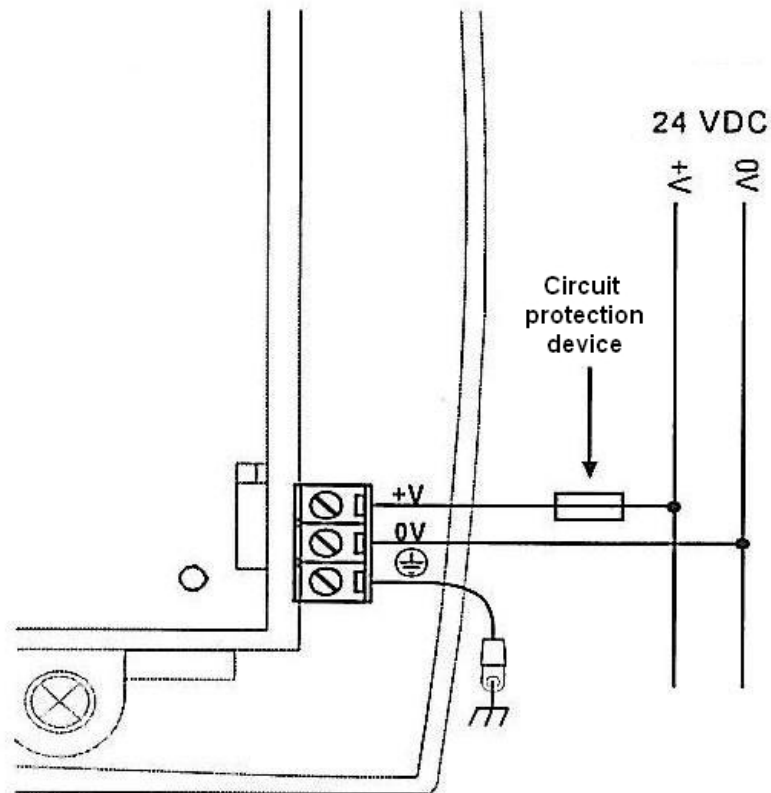
The implemented protocol is a master / slave MODBUS.

7. Power supply

7.1. Characteristics

The processor requires a 24VDC power supply.

An external circuit protection device (fuse) must be used, shown as follows :



The power supply is not provided by SOFRASER.

7.2. Safety considerations

- Do not touch live wires.
- A non-isolated power supply can be used provided that a 0V signal is connected to the frame.
- If the device is mounted on a metal panel, standard safety considerations require that the power supply must be earthed to avoid electrocution.
- Do not connect either the 110/220VAC “Neutral” or “Line” signals 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 the cabled installation before turning on the power supply.

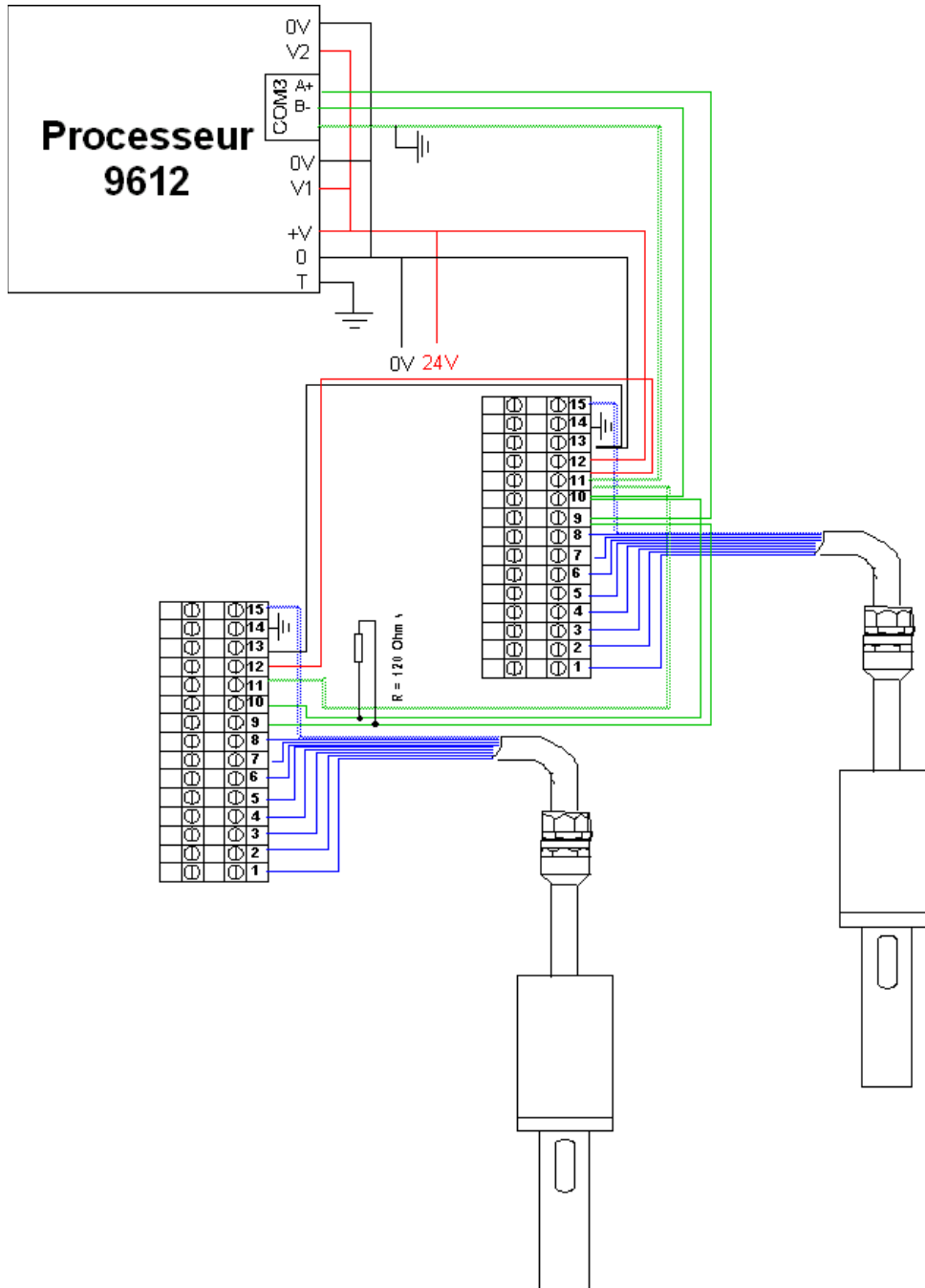
7.3. Power supply wiring

- Do not use tin, solder, or any other substance on the stripped wire that might cause the wire strand to break.
- Install at maximum distance from high-voltage cables and power equipment.
- To avoid any damage on the wire, do not exceed a maximum torque of 0,5 N.m.
- We recommend that you use crimp terminals for wiring. Use 26-14 AWG wire for all wiring purposes.
- To maximize the system's performance, electromagnetic interferences can be avoided by mounting the processor on a metal panel and by connecting power supply to the Earth.

Note : the wire used to earth the power supply must not exceed 8 cm long. If your conditions do not permit this, do not earth the power supply (cf. Step 2 § 4.1).

8. General cabling schematics

2 MIVI sensors connected to the 9612 device:



Pieces of advice :

- The transducers must all have the same power supply.
- Put a 120 Ω resistance at the end of the line (1/4 W power is enough).
- The RS485 shielding has to be connected to the Earth. This connection would be much better if it could be at the beginning of the BUS.

9. Specific notes and manufacturing parameters

9.1. Block Settings

ALARMS				
Viscosity	LOW	0.0	HIGH	999999.9
	HYST	0.0	HYST	0.0
Temperature	LOW	0.0	HIGH	999.9
	HYST	0.0	HYST	0.0
Alarms attribution				

CURRENT OUTPUTS			
		Physical value	Current output value
Viscosity	LOW	0.0	4
	HIGH	999999.9	20
	BURN		4
Temperature	LOW	0.0	4
	HIGH	999.9	20
	BURN		4
Current outputs attribution			

DENSITY CHOICE			
Densimeter	0,000	Constant	1,000

BARGRAPHS				
Viscosity	Min	0	Max	999999.9
Temperature	Min	0	Max	999.9
Density	Min	0	Max	9.999

9.2. Block Parameters

VISCOSITY CORRECTIONS				
Table C1			Formula C2	
	X	Y		
Line 0	0.0	0.0	A	0,0000
Line 1	999999.9	999999.9		
Line 2	999999.9	999999.9	B	1,0000
Line 3	999999.9	999999.9		
Line 4	999999.9	999999.9	C	0,0000
Line 5	999999.9	999999.9		
Line 6	999999.9	999999.9		
Line 7	999999.9	999999.9		
Line 8	999999.9	999999.9		
Line 9	999999.9	999999.9		

COMPENSATION TABLE		
	X	Y
Line 0	0,0	0,0
Line 1	999,9	0,0
Line 2	999,9	0,0
Line 3	999,9	0,0
Line 4	999,9	0,0
Line 5	999,9	0,0
Line 6	999,9	0,0

DENSITY COEFFICIENT	
Coefficient [g/cc]	1.000

SECURITY CODES			
CODE 2*	1111	CODE 3*	1111

* CODE 2 – CODE 3 : codes defined by defect, modifiable.

CODE 0 and CODE 1– not communicated.

If it is necessary to work in the menus where CODE 1 is needed, contact your supplier.

9.3. Block Configuration

THERMAL DRIFT		
	X	Y
Line 0	0	0
Line 1	999	0
Line 2	999	0
Line 3	999	0
Line 4	999	0
Line 5	999	0
Line 6	999	0
Line 7	999	0
Line 8	999	0
Line 9	999	0

VISCOSITY ADJUSTMENT			
A	1,000	B	0,000

CALIBRATION DATA	
SERIAL N° :	
Y0	0.0000
a	1.0000
b	1.0000
Offset	mV
Viscosity range	mPa.s
Temperature range	°C
Frequency	Hz
Tuning	
Program Version	

Date :

Visa :