matelex
connected refrigeration

Installation and Configuration Manual

DNI | Smart Level Detector

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Important: Follow the assembly instructions in the correct order

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GENERAL INFORMATION:

For the DNI to work correctly, it is essential to follow this manual.

- A DNI provided by MATELEX is made up of:

1 x strain gauge

1 x converter board

3 x PT100 temperature sensors with 3 m cable

3 x 100 Ω resistors

1 x pressure sensor 4-20 mA / 0-30 bar

Note: The standard pressure sensors provided must not be used with CO_2 or NH3 .

- **Additional supplies needed for assembly (**List not exhaustive)

Liquid column: (Supplied by the installer in order to fit the size of the liquid receiver)

- 1 x 2m length 1-5/8" copper tube (will be cut to the right length depending on the receiver's height)
- 2 x end caps 1 5/8 in diameter
- 1 x collar 1 5/8 in diameter
- 2 x solder connections on the column to connect to the receiver with hoses
- 2 x hoses ¼'' or 3/8'' in diameter (50 cm minimum length, depending on installation)
- Various fittings for connection to the receiver's hoses
- Eye bolt(Standers or similar) 10x40 for fastening the cable to the strain gauge
- 1.5 mm stainless steel cable

Electrical:

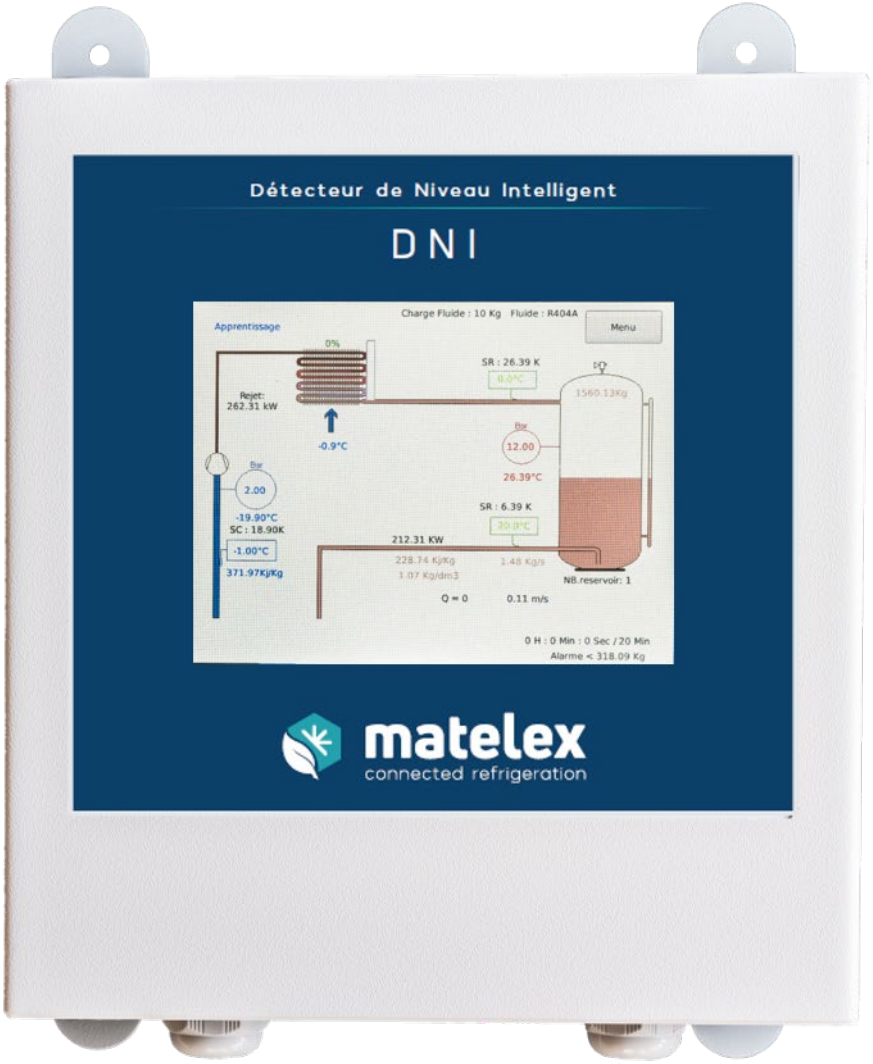
- 220/240V electric power cable (and alarm contact return); preferably shielded if broadband is to be carried via the power lines.
- cable for digital input signalling when at least 1 compressor is running (closed contact)
- cable for extending PT100 probes (≥ 1.5mm2 if possible)
- circuit breaker protection

Miscellaneous: collars – distribution box – insulating tape (for insulating the temperature probes)

Regulations applicable to the DNI and its installation:

Regulatory obligation 500 t CO2 eq.

In accordance with F-Gas EU 517/2014 (Article 5(1)): Operators of equipment listed in Article 4(2)(a) to (d) and containing fluorinated greenhouse gases in quantities equal to or greater than 500 tonnes CO2 equivalent shall ensure that such equipment is fitted with a leak detection system to alert the operator or a company providing maintenance in the



event of a leak.

Leak detection Regulatory In accordance with the F-Gas EU 517/2014 regulation (Article 4, paragraph 3)

Leakage checks in accordance with paragraph 1 are carried out at the following frequency:

(a) for equipment containing fluorinated greenhouse gases in quantities equal to or greater than 5 tonnes CO2equivalent but less than 50 tonnes CO2equivalent: at least every 12 months or, where a leakage detection system is installed, at least every 24 months ;

(b) for equipment containing fluorinated greenhouse gases in quantities of 50 tonnes CO2equivalent or more but less than 500 tonnes CO2equivalent: at least every six months or, where a leakage detection system is installed, at least every 12 months ;

(c) for equipment containing fluorinated greenhouse gases in quantities equal to or greater than 500 tonnes CO2 equivalent: at least every three months or, where a leakage detection system is installed, at least every six months.

Electrical work

The personnel involved must have the electrical clearance of the level corresponding to their activities.

The DNI housing must not be opened under voltage. It is imperative that the main power supply is switched off via the main circuit breaker when maintenance/installation operations require it to be opened.

In the case of specific applications such as deployment of updates via USB (using a key that cannot be used to close the case), the port of the adapted PPE is imperative to avoid any electrical risk.

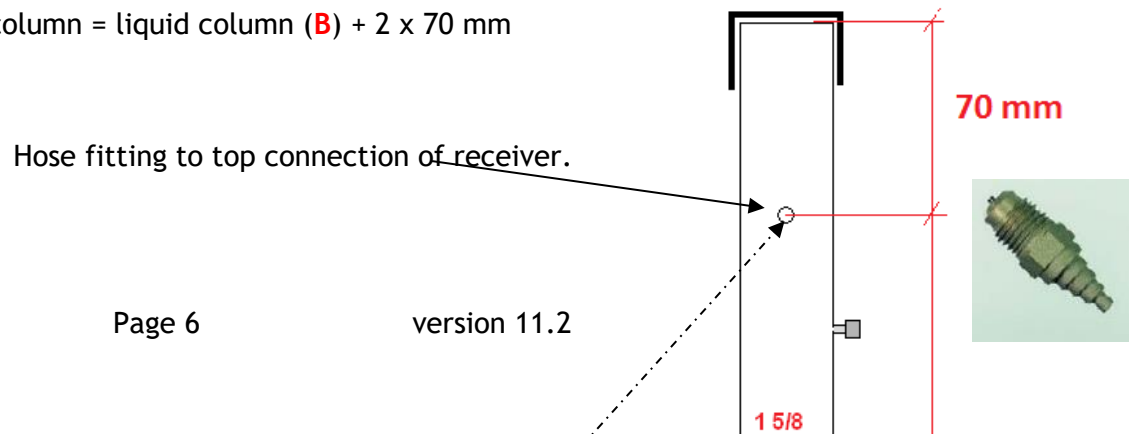
Handling of refrigerants

It must be ensured that personnel who handle refrigerants hold the certificate of competence appropriate to their activities.

DIMENSION OF THE COLUMN FOR VERTICAL RECEIVER:

The taps must be 70 mm from each end of the column

Total length of the column = liquid column (**B**) + 2 x 70 mm



Schrader

Distance between the two connections on the receiver = **B**

(Never use liquid intake or outlet valves for the taps)

The column must be made of copper 1 5/8 in diameter

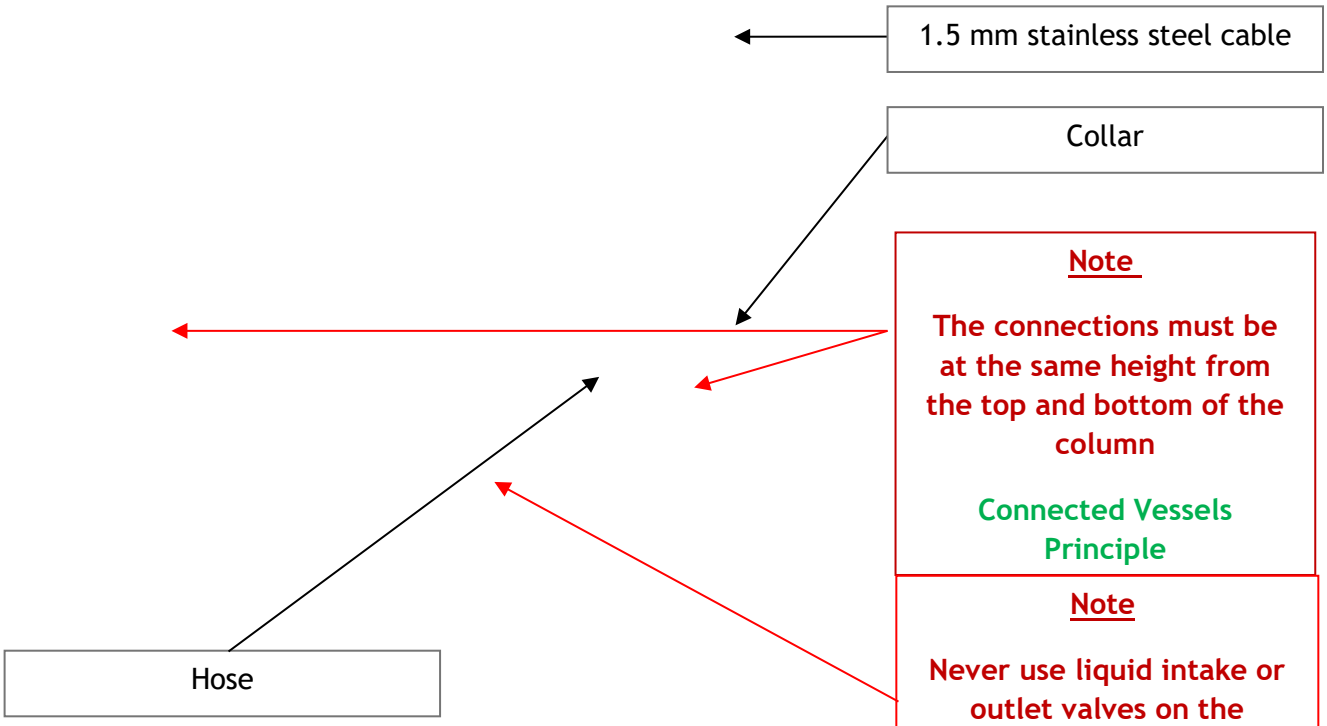
or stainless steel 40x2

Hose fitting to bottom connection of receiver

For a horizontal receiver, see page 10 to calculate the length of the column.

INSTALLING THE LIQUID COLUMN

Support for the 1st model column



1) The strain gauge must be fastened to a mount with no vibration!
2) The hoses must be long enough, but not be taut (at least 50 cm)

ANACONDA hoses are suitable.

Column mounting:

Suspend the column from the strain gauge which should be fixed to a bracket (similar to the one shown below), the measurement circuit board cab be mounted at the top of the bracket. The DNI can be fixed to the vertical channel of the bracket if desired.

Example of wall mounting

Strain gauge

Measurement circuit board housing

The gauge may be mounted in either direction

Fasten the strain gauge to a mount with no vibration!

Important:

- The strain gauge can be mounted in either direction.
- It is important to use a steel cable to attach the lower part of the strain gauge and the liquid column, as this connection needs to be flexible.

- The upper part of the strain gauge may be either a secured (bolted) or flexible (cable) fastening.

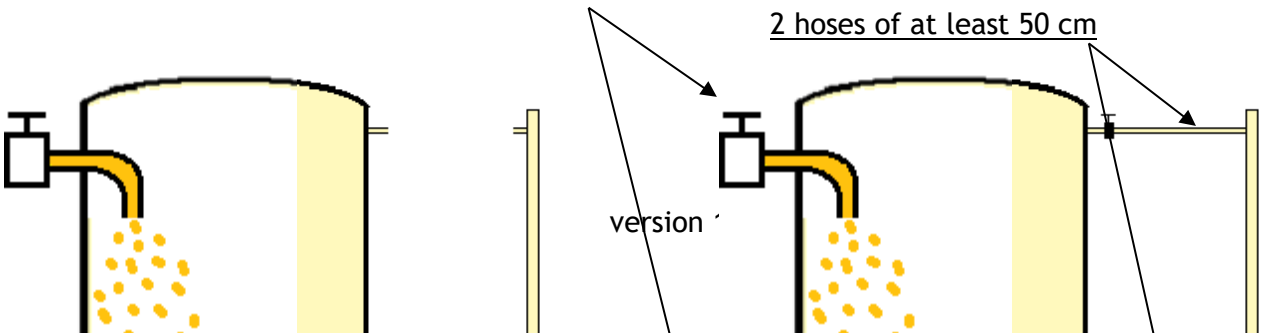
System is adjusted with the DNI.

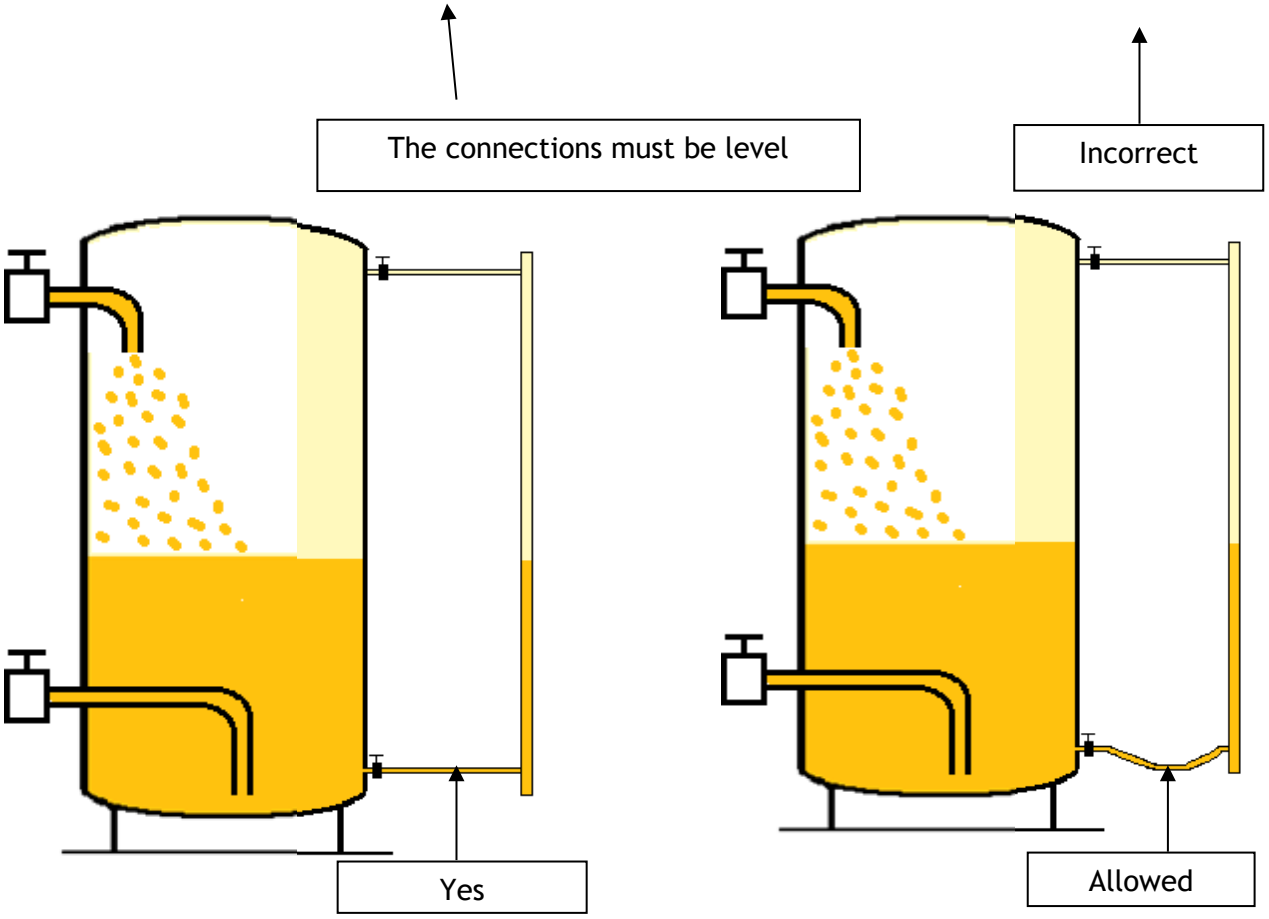
Pull on the cable to raise the column.

Push to release the cable and lower the column.

Solder a 1/4 tube onto the cap of the column and slide the suspension cable inside the 1/4 tube. Silver-solder the cable into the 1/4 tube.

1) Leave the valves closed so that the liquid column is not filled right away.
2) The receiver's liquid intake and outlet valves must never be used to connect the column with the hoses.

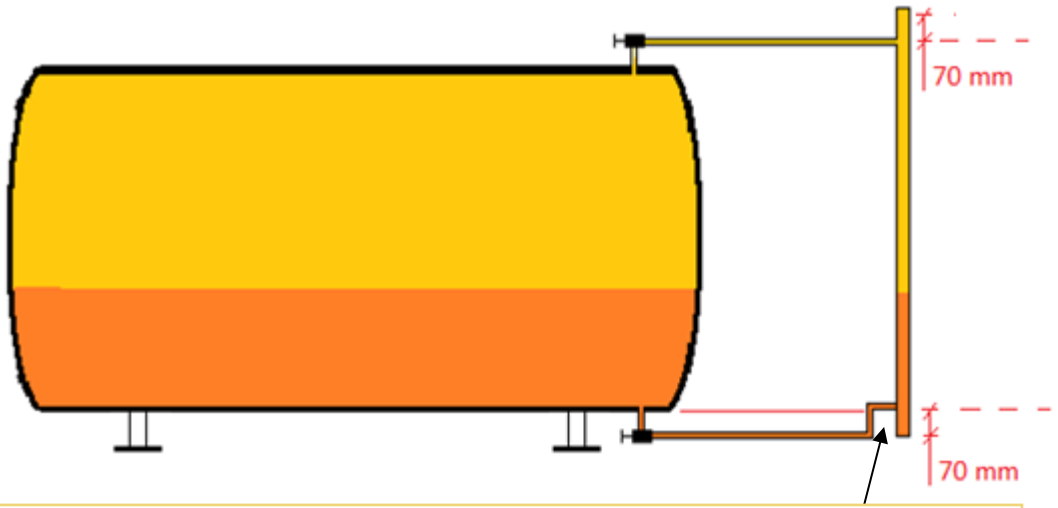




Note, when tightening the hoses do not twist the liquid column too far and place too much strain on it.

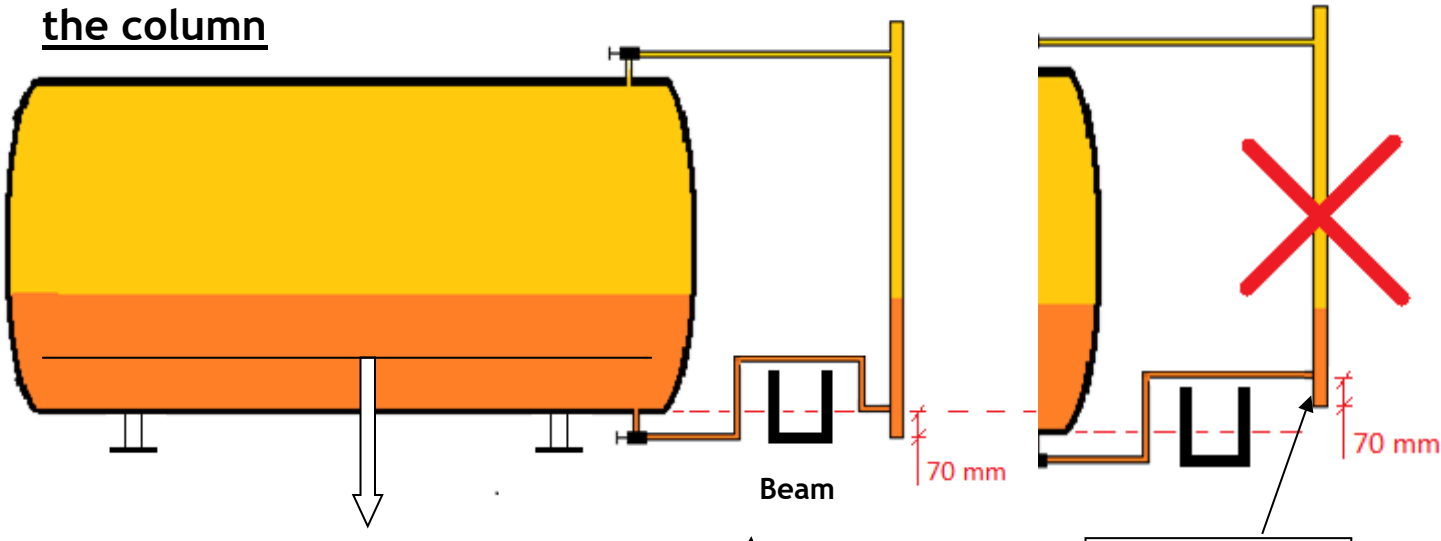
Untilted horizontal receiver

For a horizontal receiver, the concept is the same.



Make sure that the column's lower tap is at the same level as the **interior bottom** of the receiver. A length of 70 mm must be present between the connections and each end of the column

Untilted horizontal receiver but with an obstacle to sighting the column



Below this height, the DNI cannot measure levels correctly!

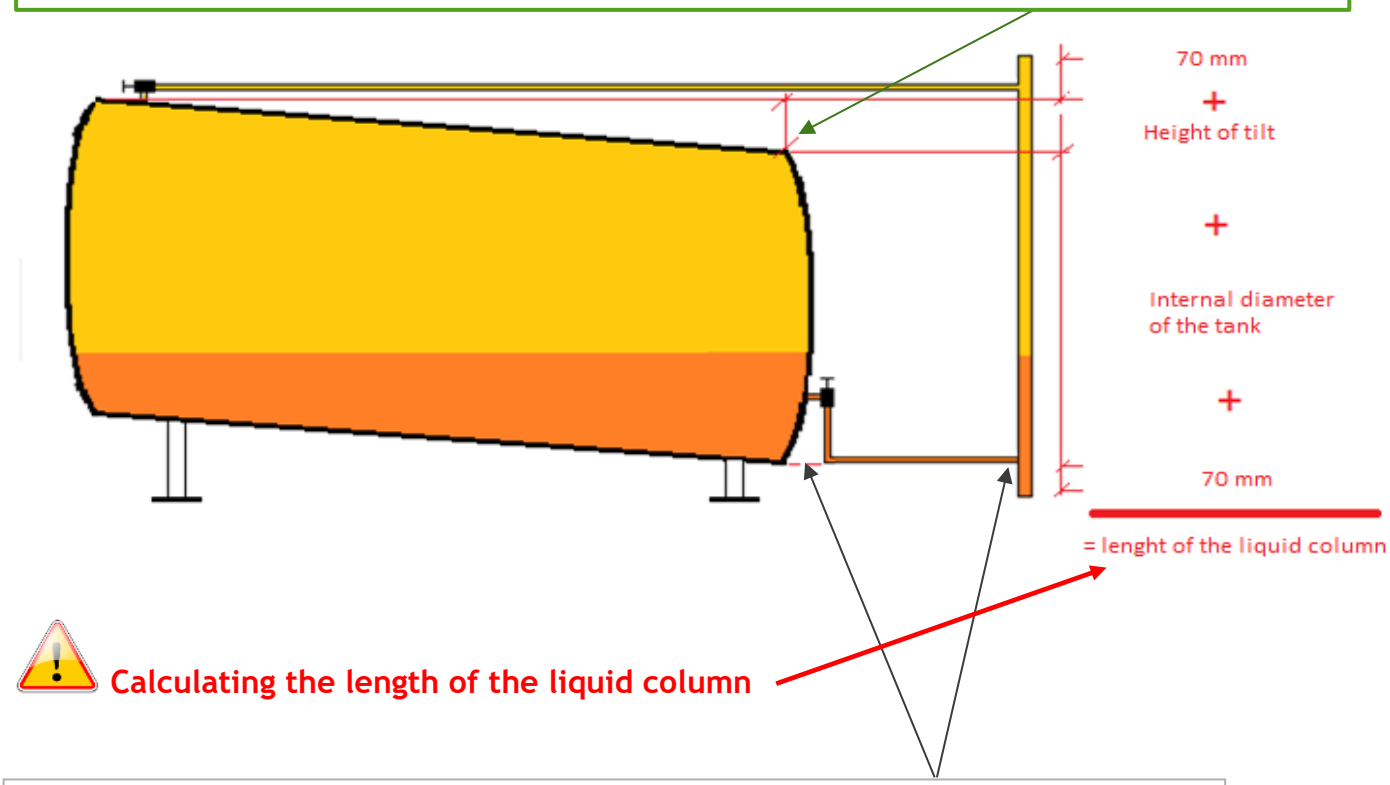
Not Allowed

Installations with a raised height are allowed. Note, in this case, it is necessary to adjust the alarm settings to take into account the volume that can't be read in the bottom of the receiver

Ensure that there is a sufficient refrigerant volume to always be above the unmeasurable level.

The DNI makes it possible to calculate the liquid volume in a tilted horizontal receiver.

The height of the slope (in mm) relative to the horizontal must be entered in the configuration menu.



As with the horizontal receivers, the bottom level of the column must be aligned with the bottom of the receiver on the lower side. Adjust the alarm level to take into account the non-readable liquid volume in the bottom of the receiver.

Level measurement accuracy

In order to be as accurate as possible the measurement circuit board is calibrated with its strain gauge. It is not recommended to install a strain gauge to different measurement board. This is why the strain gauge is supplied connected to the circuit board.

The measurement accuracy is ≈ ± 3 mm

CO2 Issues

The DNI is not in contact with the cooling installation and is therefore not subject to the installation's pressure.

Nonetheless, precautions must be taken to install the column, which must meet the requirements of the PED (Pressure Equipment Directive).

a) The 1 5/8 in tube and the connectors must be K65 quality.
b) The hoses must be suitable for the pressure.
c) A valve must be installed between the receiver's top connection and the hose in order to protect the assembly if the column is cut off.
d) If the liquid temperature is less than 0°C, insulation must be provided on the column.
e) The standard pressure sensor supplied with the DNI (0-30 bar) is not suitable for CO2. A two-wire 4-20 mA sensor must be installed at the top of the column. That sensor's pressure range needs to be configured with the DNI.

Specified Central Booster

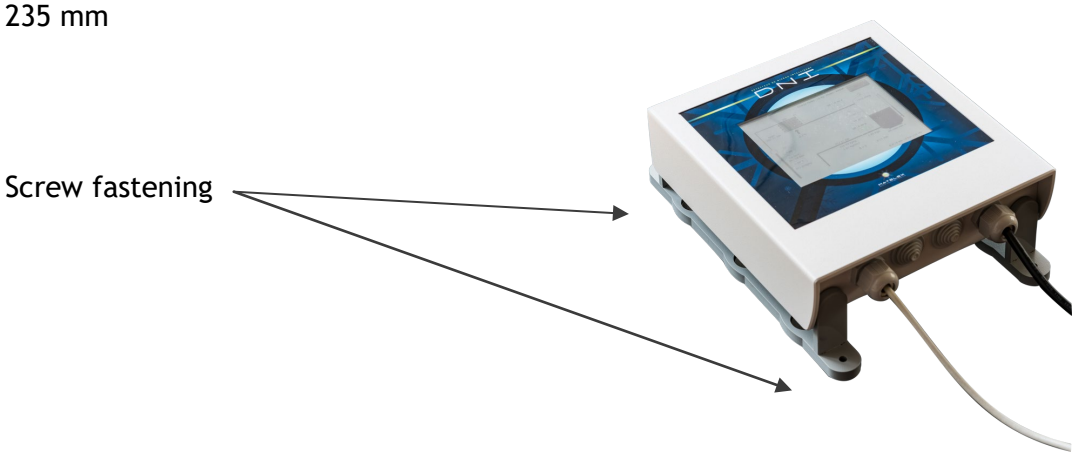
The DNI can be installed on a Booster type installation. For this, a single DNI must be installed on the medium pressure part of the installation.

Fastening the measurement circuit board housing

The measurement circuit board housing must be within 1m from the strain gauge.
The 1m cable of the strain gauge must not be extended.

Fastening the DNI housing

External dimensions of the DNI: Height 250 mm x Width 210 mm
Centre-to-centre distance of the housing fastener screws: Horizontal 168 mm and Vertical 235 mm

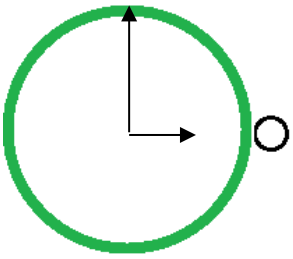


Important: The DNI also has magnetic fastener pads which can be fitted on a metal surface such as the side of an electrical box, it is not necessary to drill into it to fasten the DNI. This may save time during the installation.

Installing an adhesive duct can allow the cables to run toward the top or bottom of the electrical box. That duct can go behind the DNI, between its mounting pads.

It is also possible to fix the DNI pad directly to vertical receivers.

Installing two PT100 probes on liquid lines at the intake and outlet of the receiver



1) Install the PT100 probe on a horizontal pipe
2) Strip the paint from the pipe
3) Position the PT100 probe at 3 o'clock
4) Preferably add thermal paste between the probe and the pipe
5) Secure with a suitable strap
6) Insulate the probe

Installing the exterior PT100 probe

The probe must be shaded, away from sources of heat and from the condenser's suction.

Installing the HP 4-20 mA sensor

The sensor must be installed on the liquid side of the HP, never on the gas discharge line.

Note: It is recommended to attach a fitting to install the HP pressure sensor at the top of the liquid column. This location will make it possible to facilitate the electrical connection to the measurement housing near the HP sensor.

The tare weight will include the weight of the sensor and its power cable.

Important: Do not use the standard sensor for NH_3 or CO_2

Element grounding

If the DNI measuring elements are in contact with other metallic elements (like strain gauge on frame, temperature probe, ...), make sure that these metallic elements are earthed. An induced current can lead to measurement drifts.

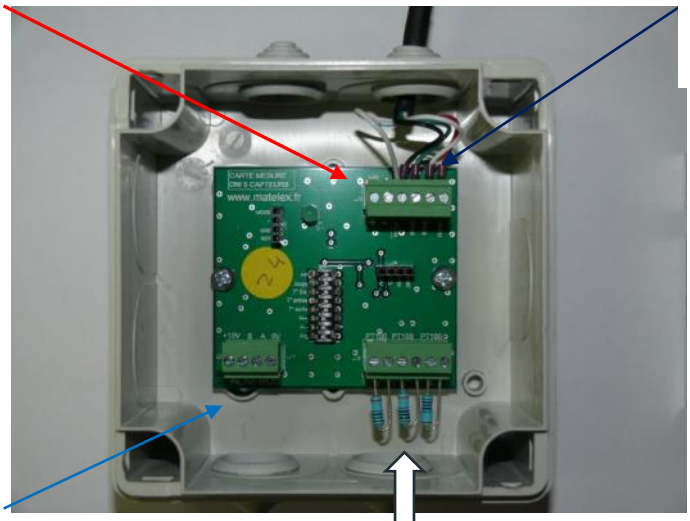
Electrical connection

The measurement circuit board:

A 1.5 mm^2 flexible cable for each of the temperature probes from the circuit board is needed.

HP sensor 4-20 mA 0-30 bar / 10 VDC / 2-wire

Gauge connection
Do not unplug



Flat screwdriver

Size N°2.5

RS485 bus connection

To configure the DNI, connect the three 100 Ω resistors in place of the PT100 probes
Reconnect the PT100 probes in place of the 100 Ω resistors once the DNI is configured

Note: The terminal boards can be disconnected to facilitate connection

Connecting the RS485 bus to the DNI:

Use a 4 core 0.34 mm^2 flexible shielded cable.

Connect as follows:

+15V from the measurement board to the DNI's +15V terminal
0 V from the measurement board to the DNI's +0V terminal
A from the measurement board to the DNI's A terminal
B from the measurement board to the DNI's B terminal

Connecting the PT100 probes:

The destination of the probes is indicated on the terminal board.

Receiver Outlet: Probe to be placed on the liquid pipe exiting the receiver
Receiver Inlet: Probe to be placed on the liquid pipe entering the receiver
Outside temp: Place the probe outside and in a shaded area.
The PT100 probe must not be located in the air flow area of a condenser.

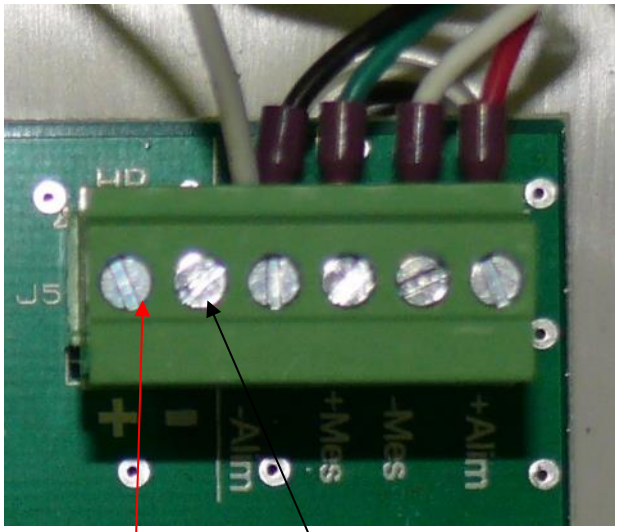
Connecting the HP sensor:

HFC or HFO installations: Connect the provided 4-20 mA 0-30 bar 2-wire VDC HP sensor
CO_2 and NH3: Connect the appropriate sensor for these applications.

The connection terminals are to the left of the strain gauge's terminals.

Flat screwdriver

Size N°2.5

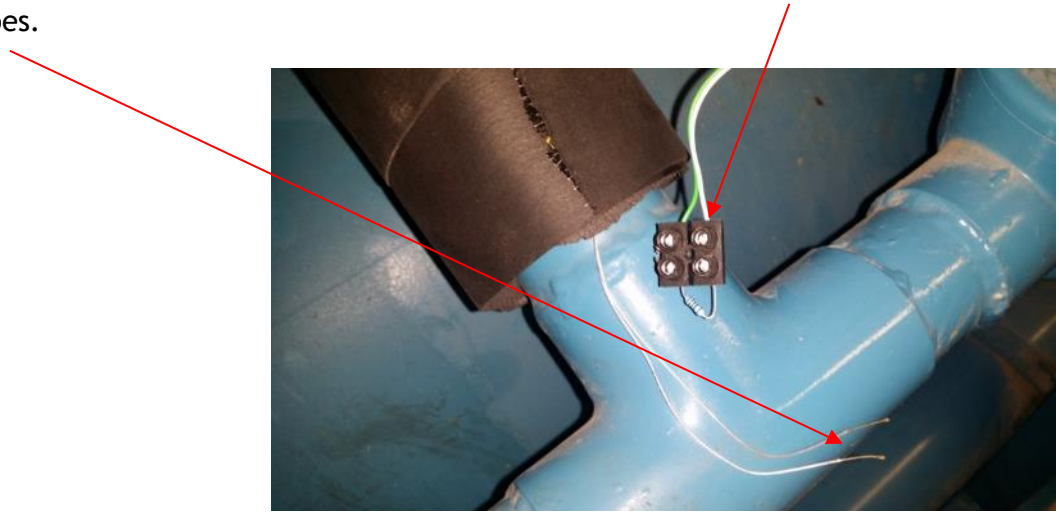


The + wire of the sensor on the + terminal of the measurement board
The - wire of the sensor on the - terminal of the measurement board

The pressure sensor may be installed on the liquid intake valve of the receiver or at the top of the column.

Connecting the PT100 probes

In order to configure the DNI, the 100 Ω resistors must be connected instead of the PT100 probes.

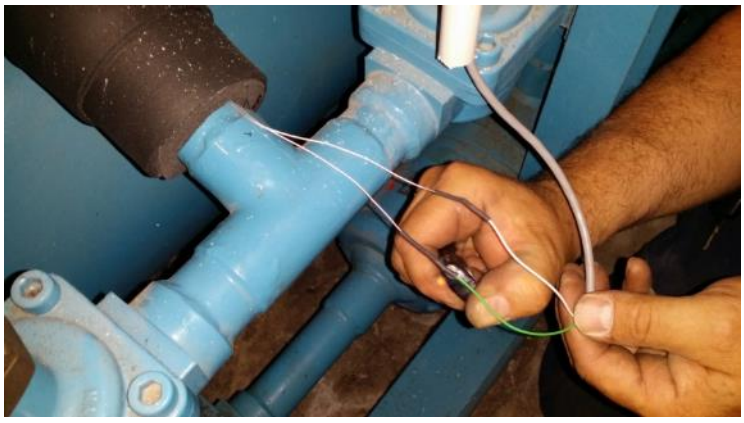


Once the calibration of the probes is complete, replace the resistors with the PT100 probes.

TIP: Solder the wires of the probes and insulate with heat-shrink cladding.

Note: For software versions above 9.67.04, it is possible to manually adjust calibration (see p.31)

No need for distribution boxes



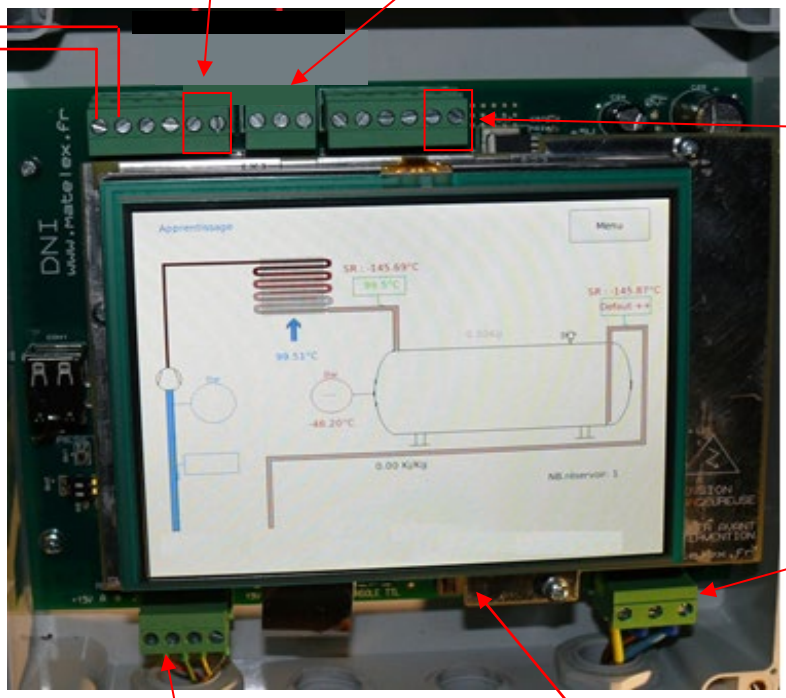
The DNI:

Alarm option on open or closed contact

Contact always closed
DNI powered on

The alarm relay
NC | Common | NO

When there is a fault, the relay is activated and the contact closes between Common and NO



Digital input
Closed dry contact indicating that at least one compressor is running

220 V power

Earth | Neutral | Live

The RS485 bus

+15V | A | B | 0V

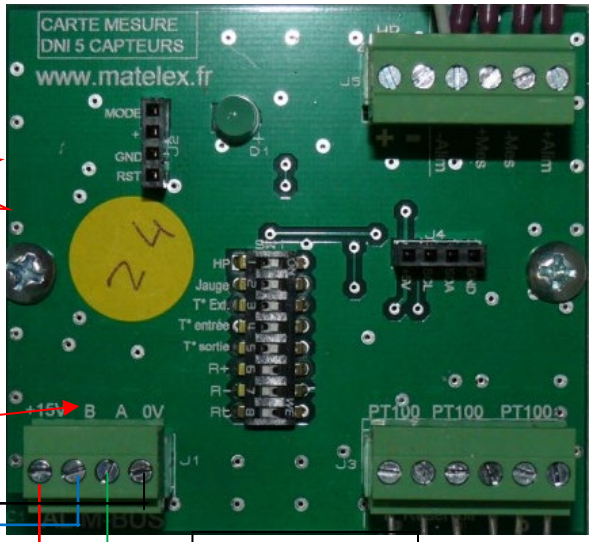
RJ45 outlet for communication with the Matelex server

A B top

Note

Have the measurement board's power go through the DNI's digital relay

B A



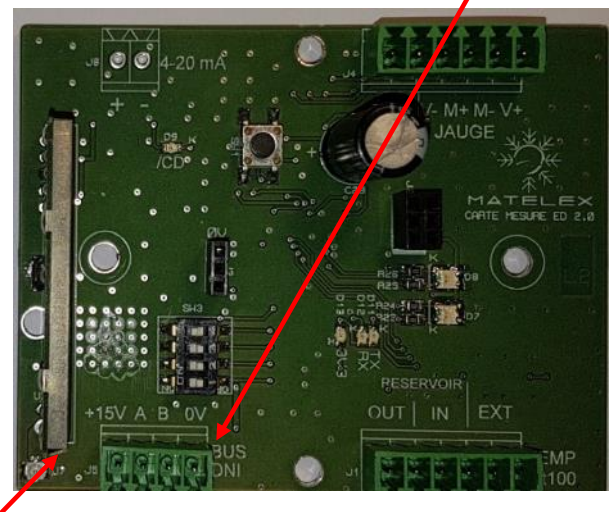
Measurement circuit board

220/240V power

The DNI's power is less than 1A
Provide separate protection (fuses) if there are multiple DNIs in the same machine room.

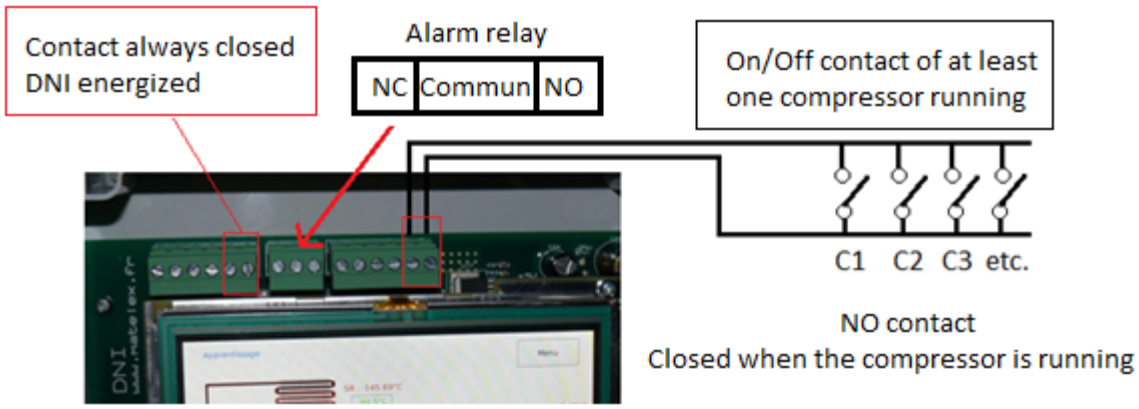
Measurement circuit board V2

If your DNI was delivered with the V2 measurement board, **be careful** to set the RS485 bus connectors in the right order, as they are different than on the V1 board. Go by the same principle as for DNI connection +15V A B 0V



The V2 board is easily recognizable by the RADIOMETRIX 433.92 MHz radio module.

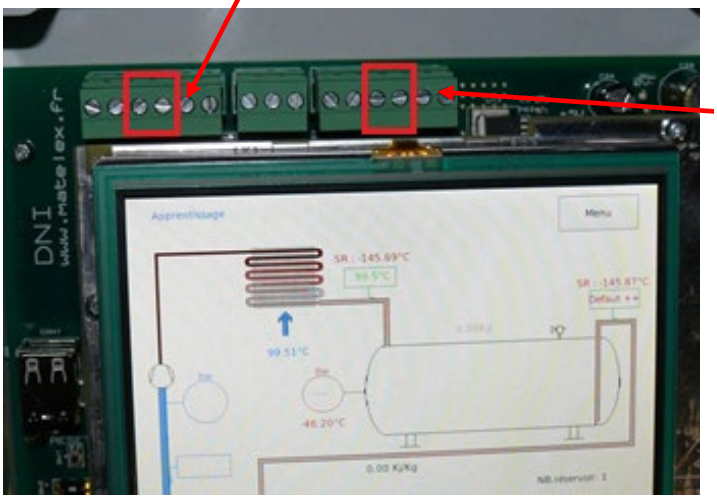
Operating information of at least one central unit compressor:



Other connections possible

Starting with version 9.67

Alarm contact only for the low-level alarm.



Installation stop input

When the contact is closed, the DNI no longer generates an alarm. The installation is meant to be off when stopped. Nonetheless, the DNI continues to save information, levels, temperatures, etc.

II - DNI Configuration

Powering on the DNI for the first time

Before powering on the DNI for the first time, you must make sure that all of the steps described above have been completed.

- Electrical connections
  - RS485
  - The HP sensor
  - The 3-probe cables with 100 Ω resistors in place of the PT100 probes
- Assembling the column by 1 5/8 in or 40x2 with the column empty (valves closed)

You must also ensure that you have all the information that the configuration requires:

- Is the fluid on the DNI's list (120 refrigerants including CO_2 and NH3)?
  - If the fluid is not on the list you can create it before configuring directly from the DNI (refrigerants up to 6 components)
- The receiver's internal diameter (the receiver's reference number often gives the external diameter)
- The outer length of the receiver between the curved ends
- The range of the HP 4-20 mA 0 sensor at x bar
- The central unit's LP setpoint (in °C)
- If the LP is adaptive

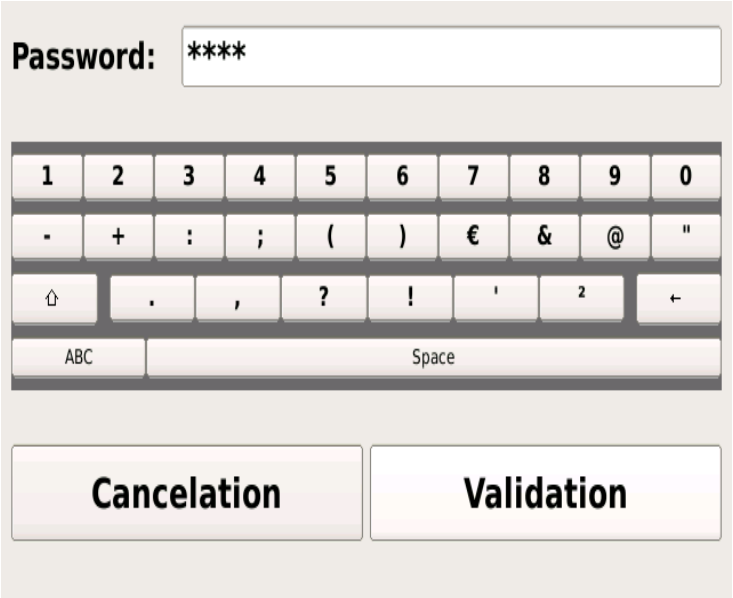
- The central unit's HP setpoint (in °C)
- If the HP is floating
- The internal volume of the central unit's condensers (in dm^3)
- Quantity of refrigerant in the installation (kg)
- The receiver's internal volume (manufacturer data)
  If you have two receivers installed in parallel, use only the volume of one of the receivers
  Both receivers must be identical (same volume and shape)
- Is there a liquid sub-cooler at one or both of the receiver outlets?
- If there are energy modules: Condenser power

Note: Incorrect information may substantially affect the detection performance.

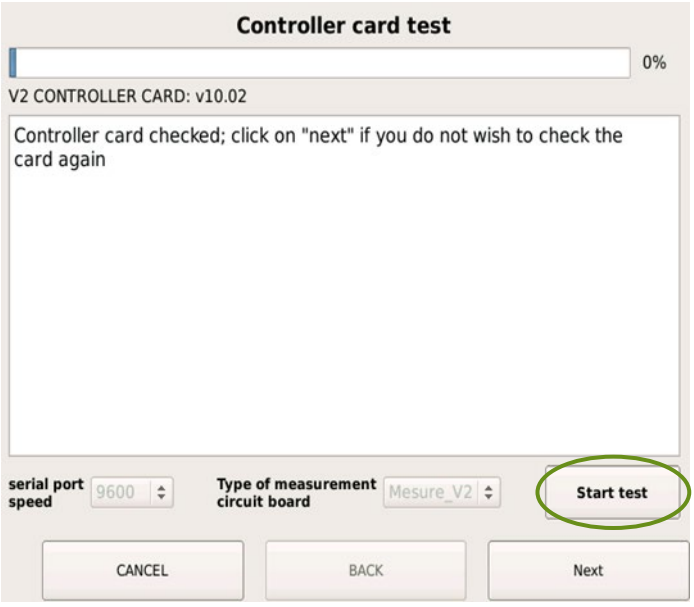
When powered on for the first time, the DNI's language menu is displayed directly on the screen.

If the language is changed, the DNI will automatically restart in that language.

Enter the password **0610**



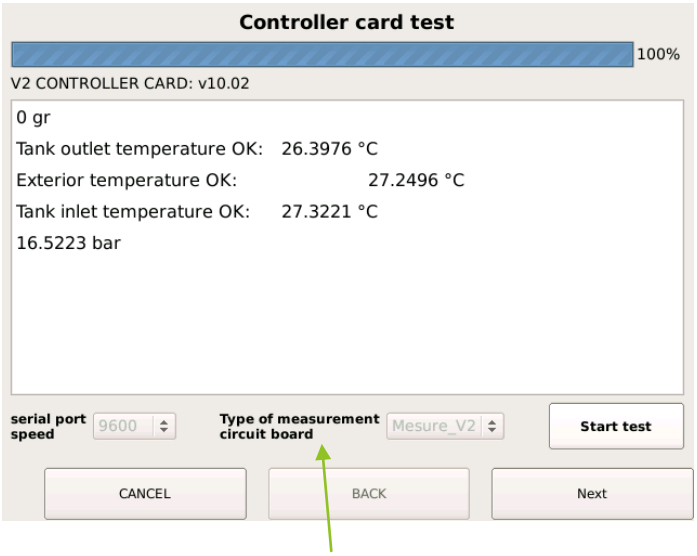
Testing the measurement board



A test that the DNI is connected to the measurement circuit board must be run before moving on to the next screen

If the test fails, the DNI will display: No response from the board. **Check the measurement circuit board's connections**

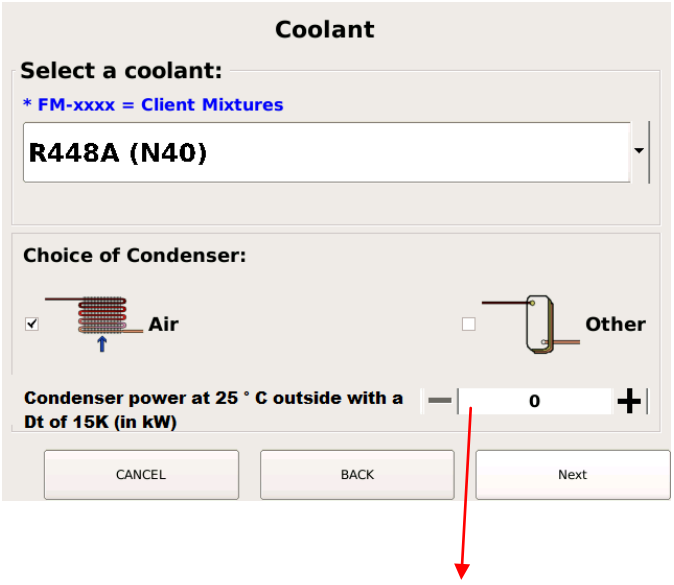
You can only move on to the next screen if the connections are correctly made



If all of the connections are OK → the DNI will display logical values

Information on the version of the measurement circuit board connected to the DNI by the RS485 bus.

Choice of refrigerant



120 refrigerants are available and updates are possible. There is also an option to input a refrigerant that is not in the library, if the components and percentage volumes are known.

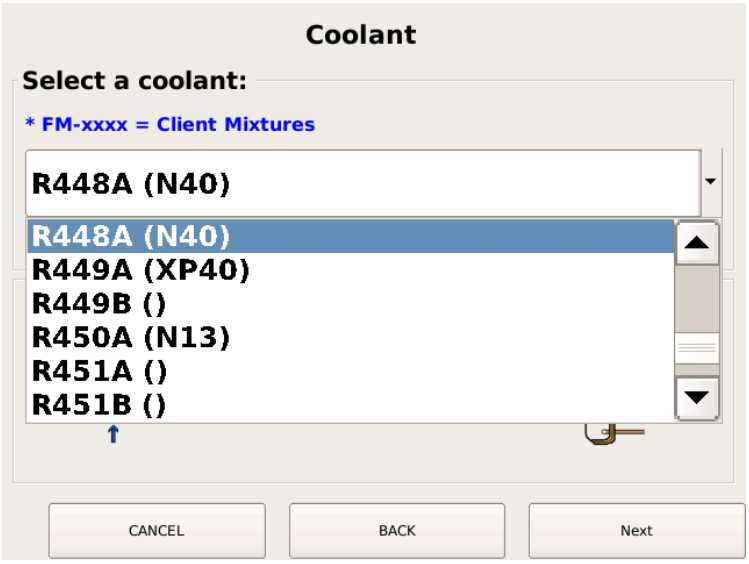
If an air condenser and an energy module are present, you must enter the power of the condenser(s).

The energy modules make it possible to display information about the power of the condenser(s). It is essential to correctly connect the DNI with the power under the stated conditions:

Power by outside +25°C and with a Dt of 15k

The DNI will recalculate the condenser's power and the rejected power in real time. On the main page of the DNI, you'll see the indication of the percentage of capacity used by the condenser, with the rejected power

More than 120 fluids available

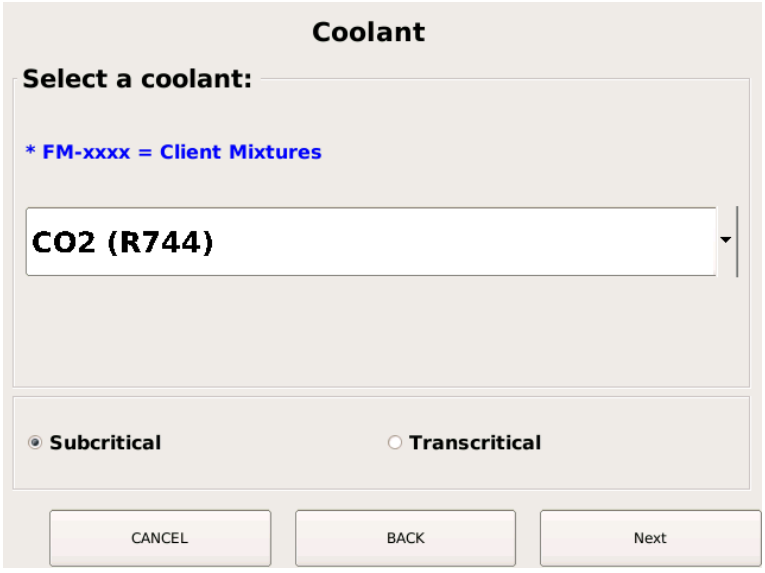


HFC, HFO, CO_2 and NH3

The powers are calculated by the DNI based on the data from the enthalpy chart

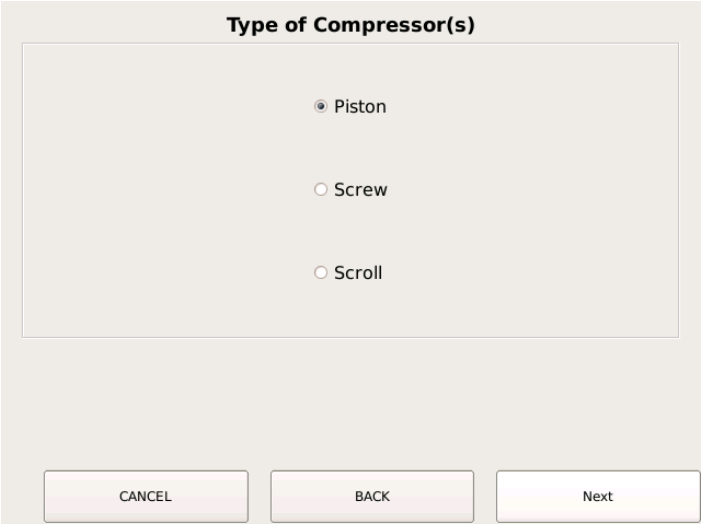
The refrigerants that you have manually added will appear in this list

Choice of fluid



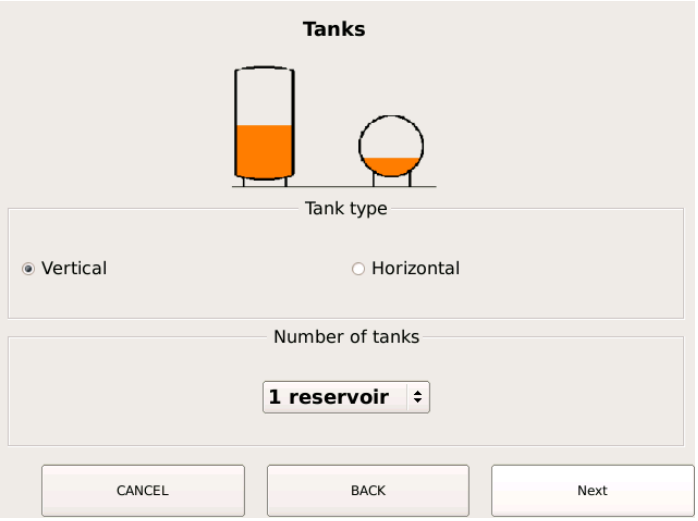
For CO_2, you must check Subcritical or Transcritical

Choice of compressor type(s)



Check the type of compressors that the central unit uses

Choice of receiver



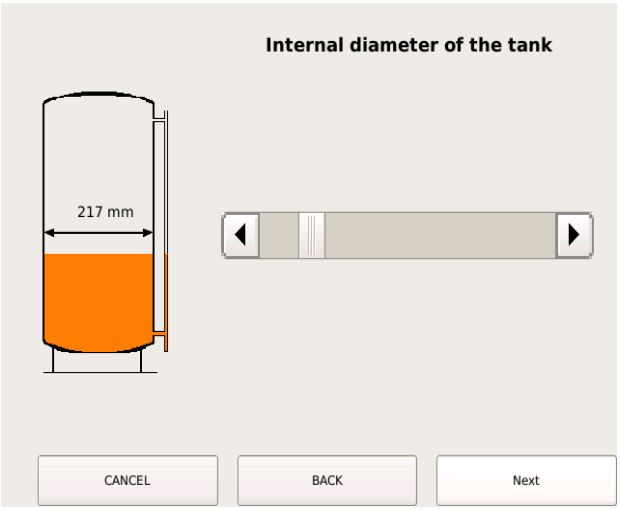
Select the receiver type

- Vertical or horizontal

Select the number of receivers

- Up to four identical receivers mounted in parallel

For a vertical receiver



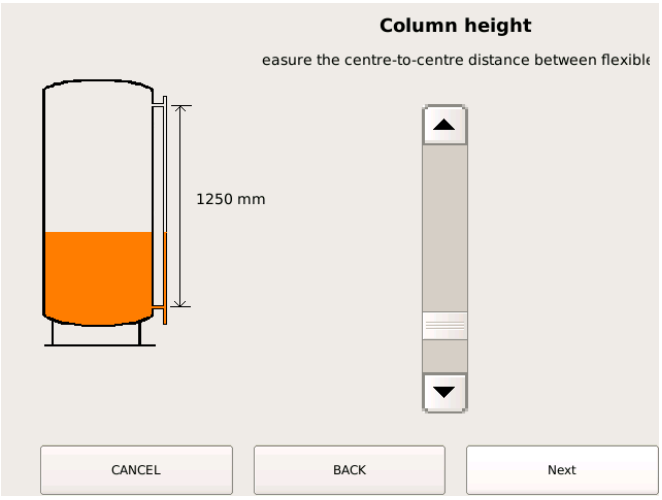
Internal diameter of the receiver

Enter the internal diameter of the receiver

Or the inner diameter **of one** of the receivers

You can calculate it: Inner diameter = circumference of the receiver divided by pi (3.14) - wall thickness: inner diameter = (circumference / π) - (2 x 6mm)

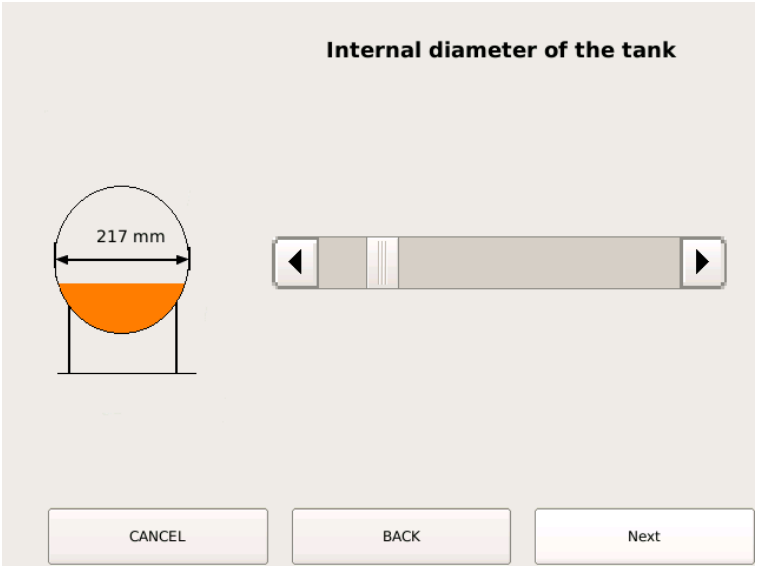
Column height



Enter the height between the two connections See explanation page 5: "Dimension of the column" = side B

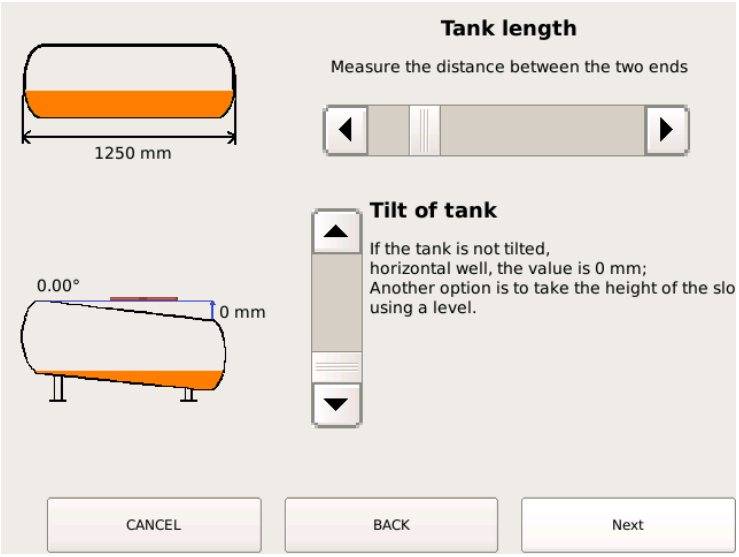
For a horizontal receiver

Internal diameter of the receiver



Enter the internal diameter of the receiver or the internal diameter of one of the two receivers if you have two identical receivers you can calculate it: Internal diameter = circumference of the receiver divided by pi (3.14) - wall thickness: inner diameter = (circumference / π) - (2 x 6mm)

Receiver length

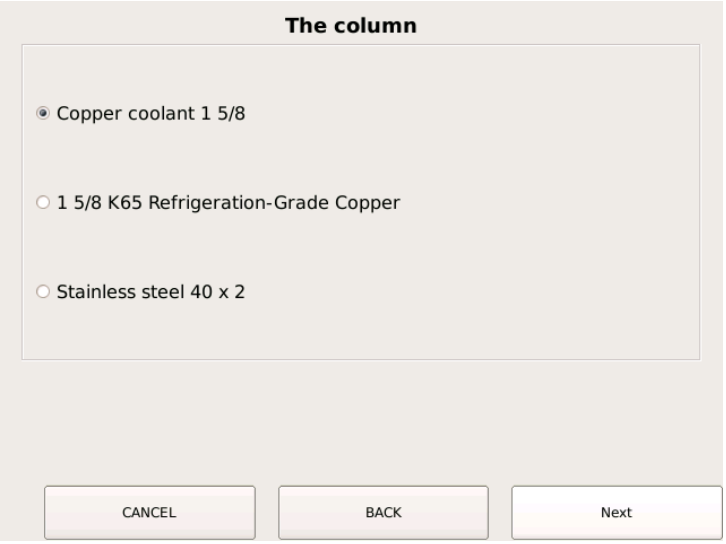


Tilt You need to enter the receiver's tilt. Put a level on a ruler placed on the receiver, and measure the difference in height between the bottom end and top end of the receiver. The DNI will calculate the angle.

Important: Protect the column from wind if the receiver is outside

Enter the outer length of the receiver curved ends included

Choice of column type



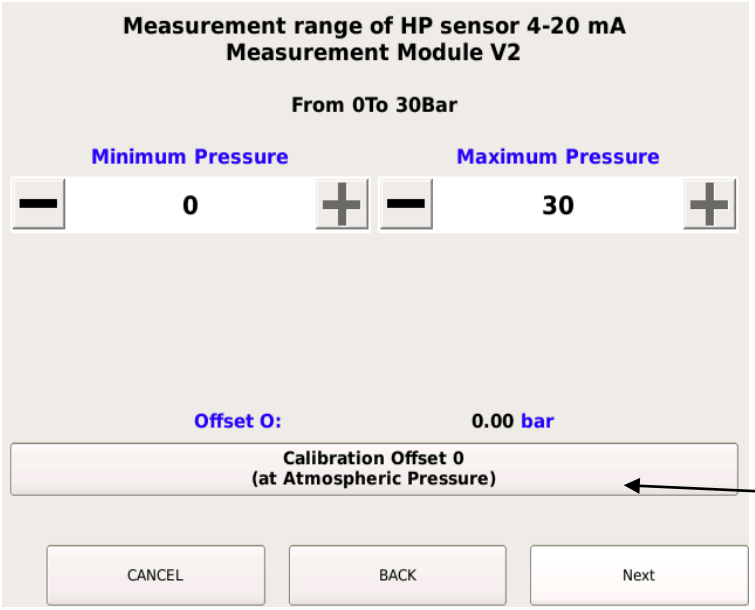
Choice of column type based on the fluid: For the HFCs and HFOs: 1 5/8in refrigeration copper tube

For CO_2: 1 5/8in K65 tube

For NH3: stainless steel tube

Measurement range of the HP sensor

The HP sensor must be placed on the liquid HP (receiver side)



Sensor provides 0-30 bar (by default) for HFC/HFO

4-20 mA sensor to be provided by installer for CO2 and NH3

Calibration of the 0 bar point by setting the sensor to atmospheric pressure and clicking on Calibration

Column tare measurement

The tare weight must be measured at least once per year during the annual check required in France for leak detectors by indirect measurement methods, and in the European community where F-gas regulations apply.

This very important step makes it possible to calculate the level of refrigerant in the receiver.

Ensure that:

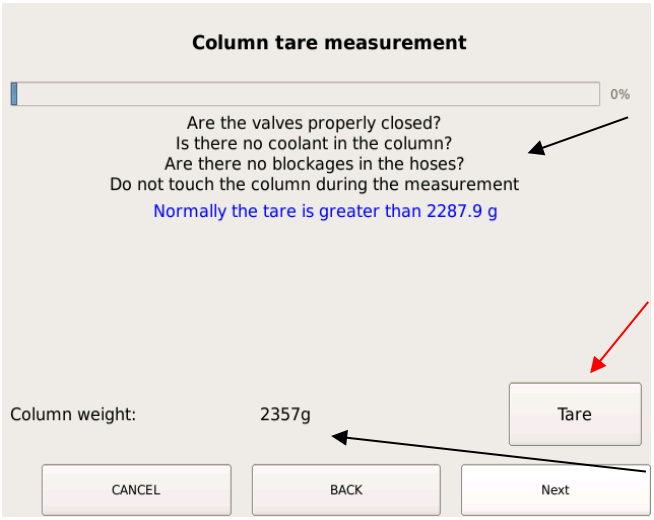
1) the receiver's valves where the column's hoses are connected are indeed closed.

2) the column contains no refrigerant.

3) the hoses are properly tightened.

4) nobody is touching the column.

5) the column is installed in accordance with the earlier instructions.



The DNI gives an indication of the minimum
weight of the column based on the earlier information (column type and length, etc.)

This is an estimate, so data may vary.

If everything is OK, launch the tare weight measurement

Tare weight information (empty column)

Any actions after the tare weight measurement has been taken that could alter the weight strains of the hoses on the column (moving or retightening the hose fittings) must be avoided. Otherwise, a new tare weight measurement after insulating and draining the column must be carried out.

Annual test procedure: Contact us

Measured tare weight

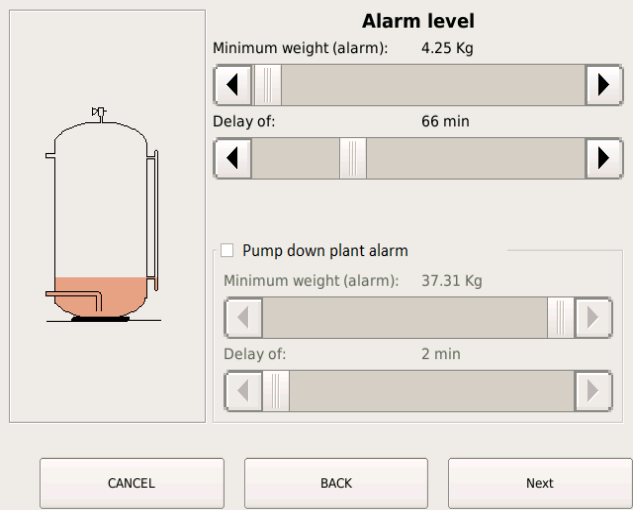
As indicated on the DNI's screen, you can open the valves of the liquid column.

Important: Wait for configuration to end before opening the valves.

Standard low-level alarm

The DNI has a low-level alarm that is operational once the DNI is placed in service. This alarm is an improved version of the optical alarm.

It differs from the specific alarms of the DNI called statistical alarms that are automatically configured after learning and statistical analysis.



Adjusting the alarm level

Adjusting the time delay before the alarm

the alarm

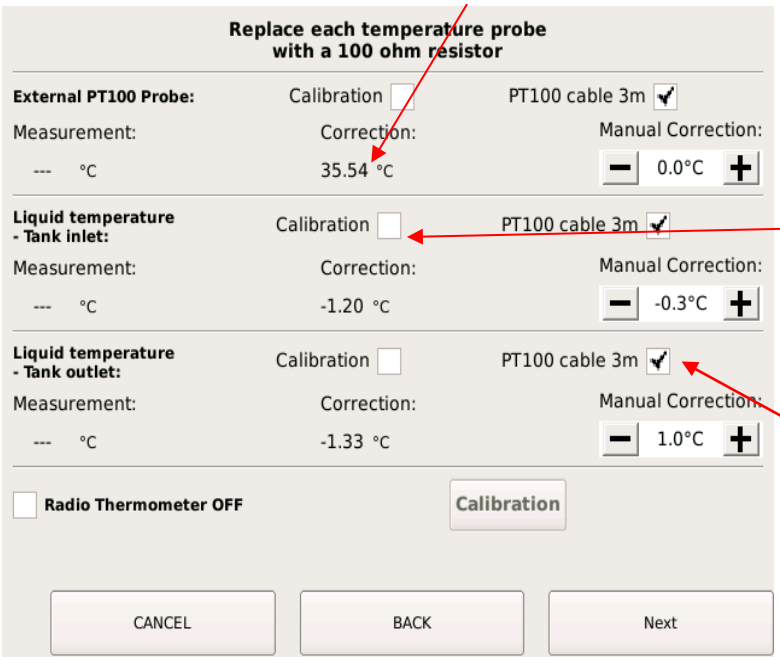
Note: This alarm triggers the changeover relay (as do static alarms) and also a special alarm contact.

Calibrating the PT100 temperature probes

The PT100 probes are class A (accuracy of ± 0.15 °C at 0°C). To provide the greatest possible accuracy for analysis, the resistance of the cables between the measurement circuit board and probes must be included. To do so, you must launch calibration once the 100 Ω resistors are connected instead of the PT100 probes.

If calibration has already been done, move on to the next screen.

Calibration has already been done if the correction column indicates a value



Probe-by-probe calibration possible.

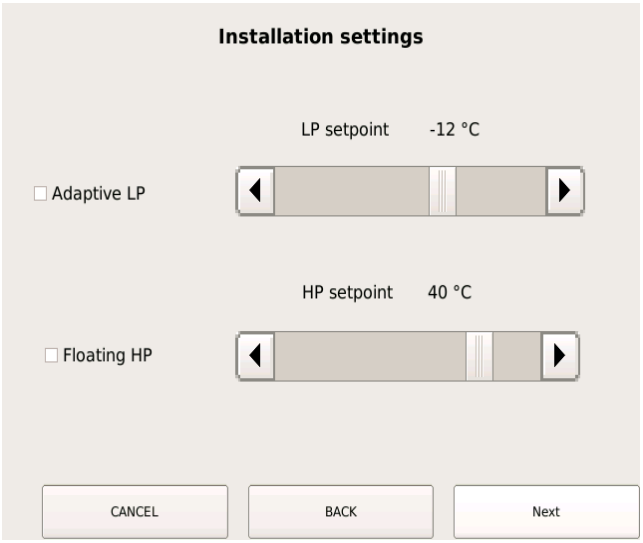
With the new PT100 probes equipped with a 3m cable, you must check PT100 3m cable and uncheck, if necessary for the old PT100s with a 20 cm cable.

Manual correction

It is possible to calibrate the PT100 probes with a reference thermometer. If this is done, enter the difference between the temperature displayed on the main page and the thermometer.

Important: The PT 100 probes will replace 100 Ω resistors only when configuration is complete.

Overview of the installation

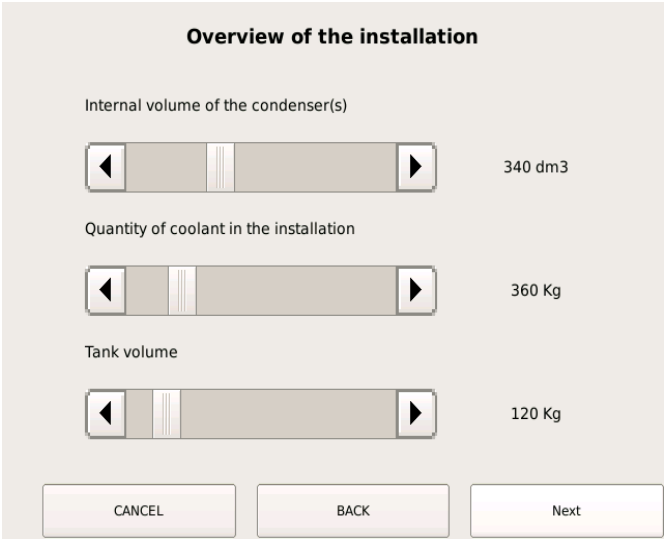


Indicate the LP and HP (summer) setpoints of the installation.

Check the floating HP box if the installation has them

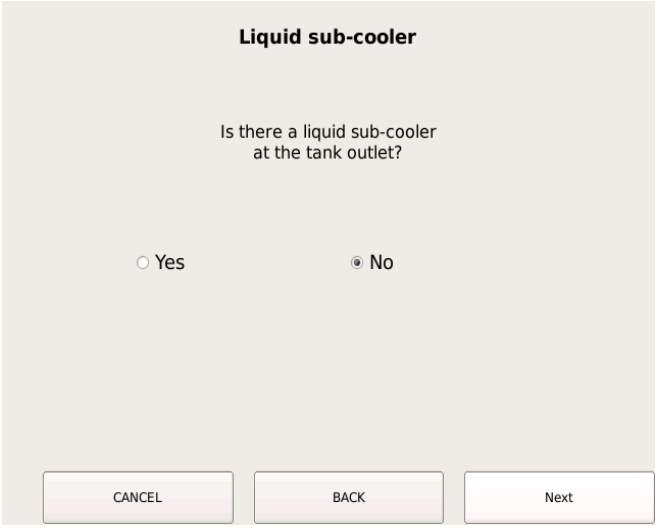
Check the adaptive LP box if there is a controller on the LP

Overview of the installation

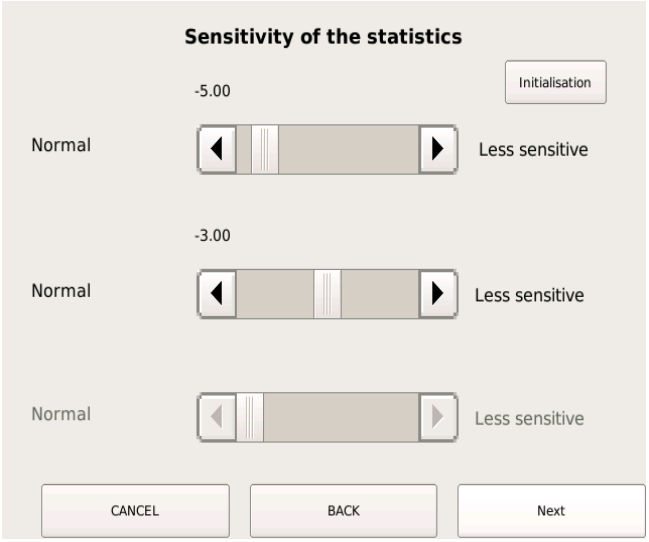


Indicate the internal volume (in dm^3) of all condensers connected to the refrigeration installation.
That information is noted in the manufacturer's documentation.
Indicate the quantity of coolant in the installation.

Indicate the volume of the receiver or one of the two. If there are two receivers, their volume must be the same. This information is available on the manufacturer’s nameplate.



Adjusting the sensitivity of the analysis



INIT to apply standard settings based on the LP setpoint (**mandatory on first configuration**)

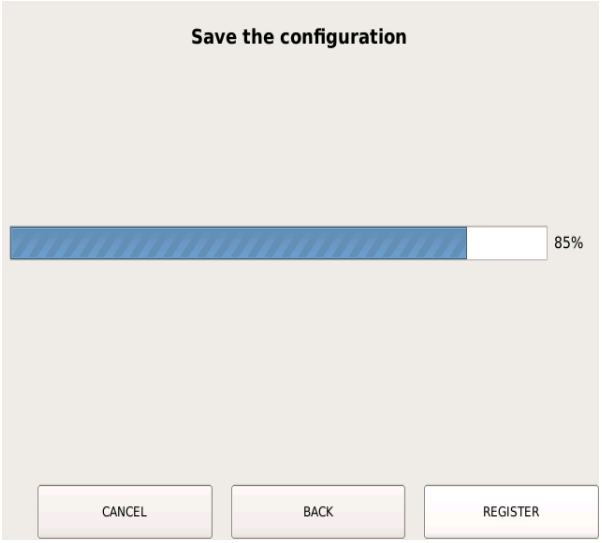
It is important to set the correct information when initially setting up, as any errors may generate unwanted alarms for example: HP set incorrectly with too large a differential.

Warning: Do not edit without accurate information.

Standard sensitivity values: For positive central units: **-5;** for negative central units **-3**

Note: The event log records all actions and settings. It is impossible to erase them.

Saving data



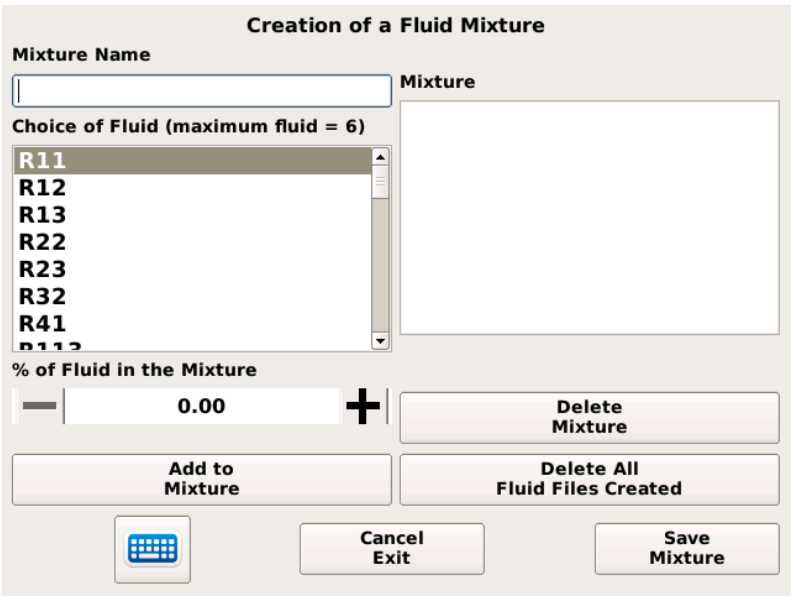
The DNI saves the data at the end of configuration.

If data was modified after an initial configuration, the DNI records the changes in the event log. All entries in the event log are timestamped.

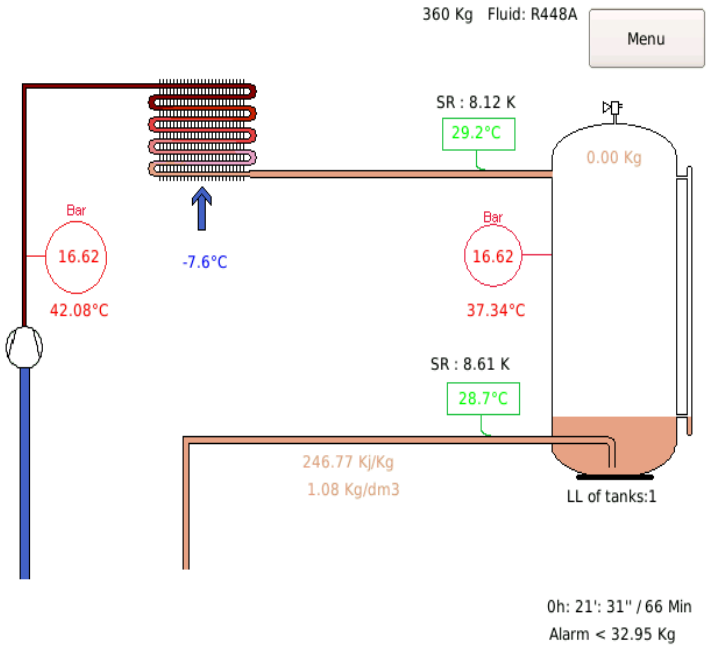
Refrigerant not listed?

If the refrigerant is not listed, you may select components from the list, indicating the percentage that component makes up, and the name the fluid that will then be added to the library.

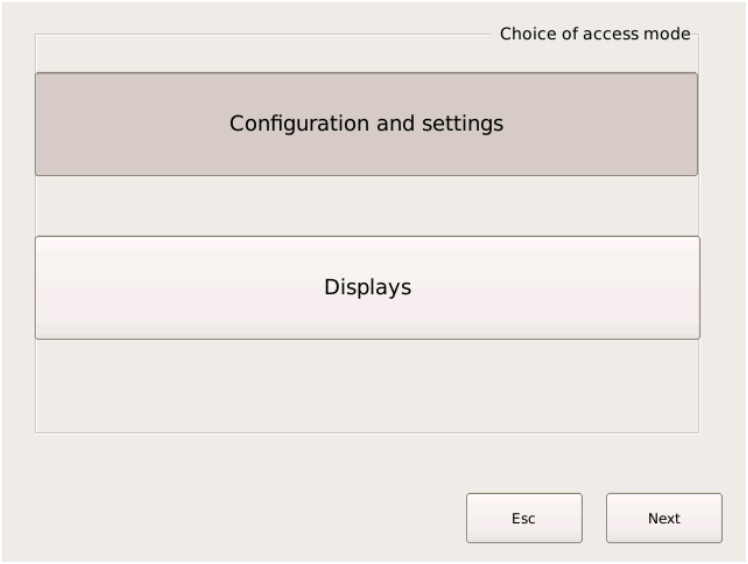
Once the refrigerant has been created, the DNI will perform the same calculations as for the others already in the library. Temperature-pressure relationship in gas or liquid phase – enthalpies – entropies – density etc.



Menu



Access to the menu from the main screen



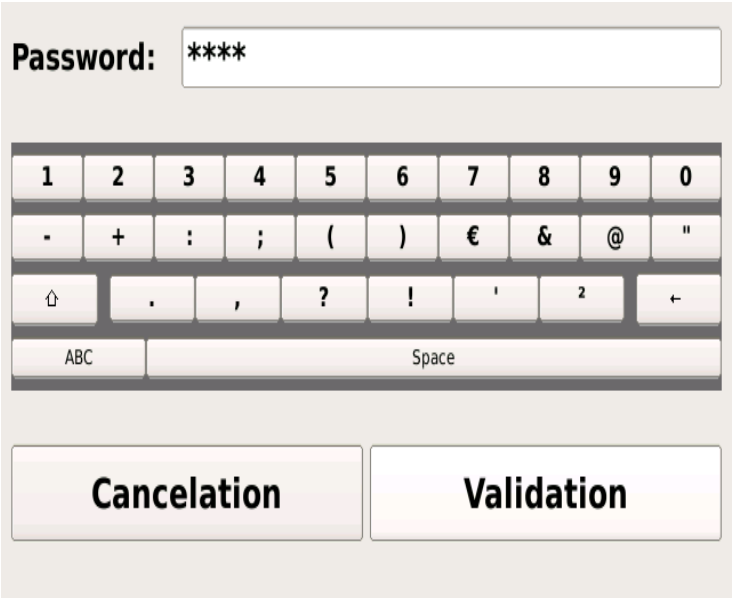
Configuration and settings

Access requires a password.

Displays

This section is password free and is only to view information. Select either of the two options and click on **next**

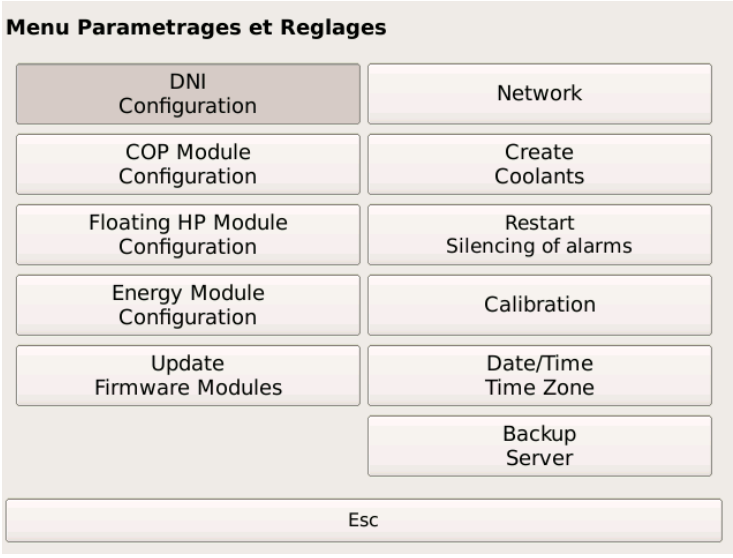
Configuration and settings



Enter the code 0610 and confirm

The code protects the settings and configurations from unauthorised people

Main menu with code

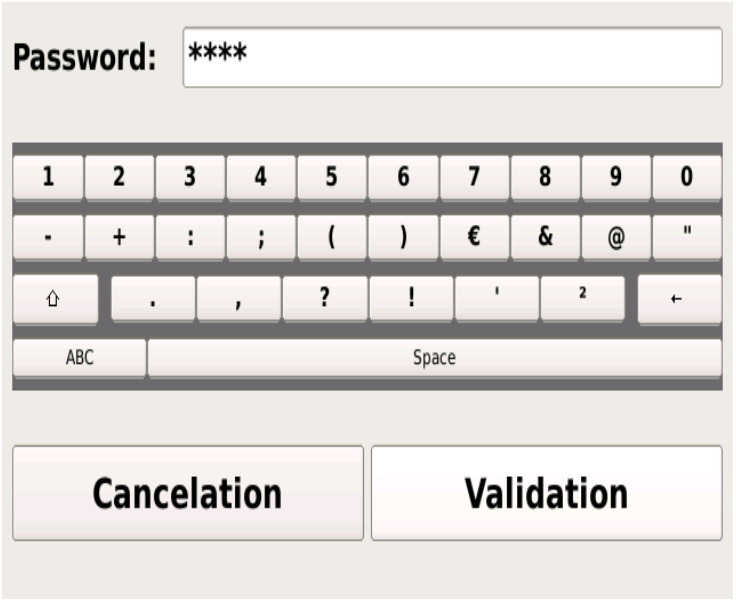


This menu provides access to configure the DNI, floating HP, and energy module. The Network is used to configure communication with Sentinelle and enter IP addresses. It is also possible to access to create new refrigerants from this screen.

The firmware update (USB key) makes it possible to update the programs of the Floating HP, energy and flowmeter modules. If the DNI is connected to Sentinelle, these updates are automatic.

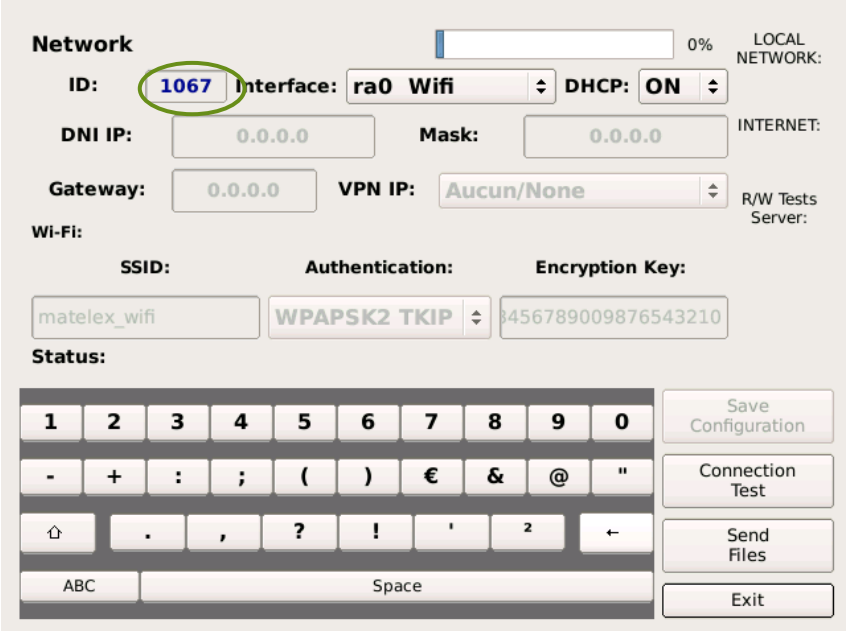
Network

To configure the Network, enter the code: **2251**



You must open **port 22**.

An ID number will be assigned the first time you connect the DNI to the Server. The ID is unique for each DNI.



Two communication modes are possible:

- Wired, with the RJ45 Ethernet connection

- Radio, with WiFi

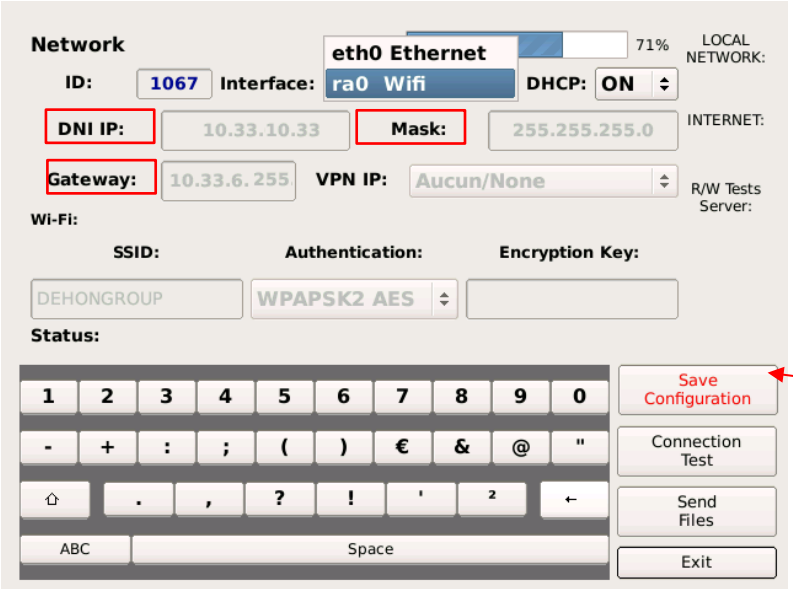
The communication mode is chosen by editing the interface

On a WiFi or Ethernet connection, you can set the DHCP to ON or OFF

In the event that the site's router enables DHCP at ON, then it will not be necessary to enter the DNI – Mask and Gateway IPs that will be filled out automatically by exchanges between the DNI and router.

DHCP set to OFF

You must enter the IP addresses assigned to the DNI on the router into the interface.
To enter the DNI's IP address, you must click on the DNI IP address to activate the change.

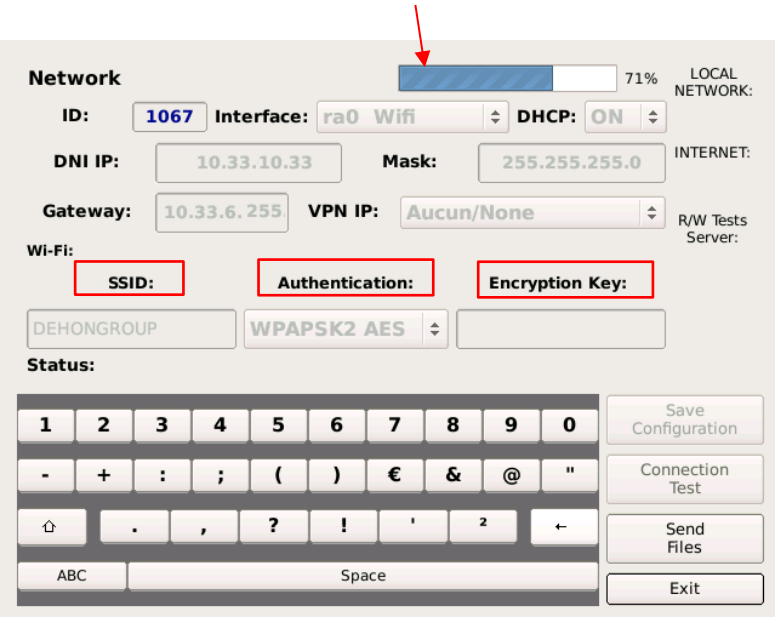


Save the configuration before testing the connection

The same is true for entering the Mask and Gateway.

WiFI connection

The network's quality is displayed when the DNI communicates with the router over WiFi



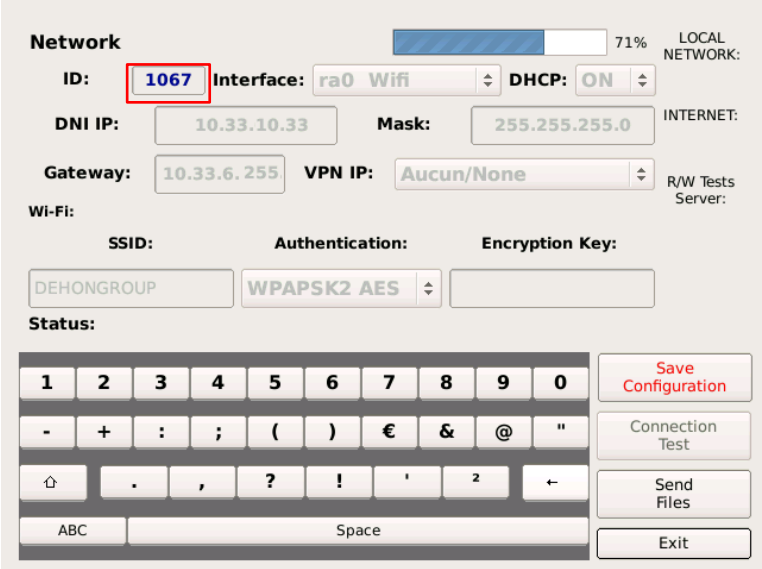
Configure the WiFi network the same way as for the IP addresses. The SSID is the network's name. Click on SSID to enter the name.

The same holds true for choosing authentication and the encryption key.

Information to be provided to us for configuring Sentinelle

The DNI is identified by Sentinelle upon the first login, a unique number is assigned for each DNI.

If the ID = 0 this means there is no connection with Sentinelle



FORM

Installation

ID:
Name of the installation:

Site address

Name of site:
Street:

Post code: Town/City:
Country:

Contact person: Telephone:
Email address:

Does the end client want email alerts? □ Yes □ No

Engineer

Name of company:
Street:

Post code: Town/City:
Country:

Contact person: Telephone:
Email address:
Does the engineer want email alerts? □ Yes □ No

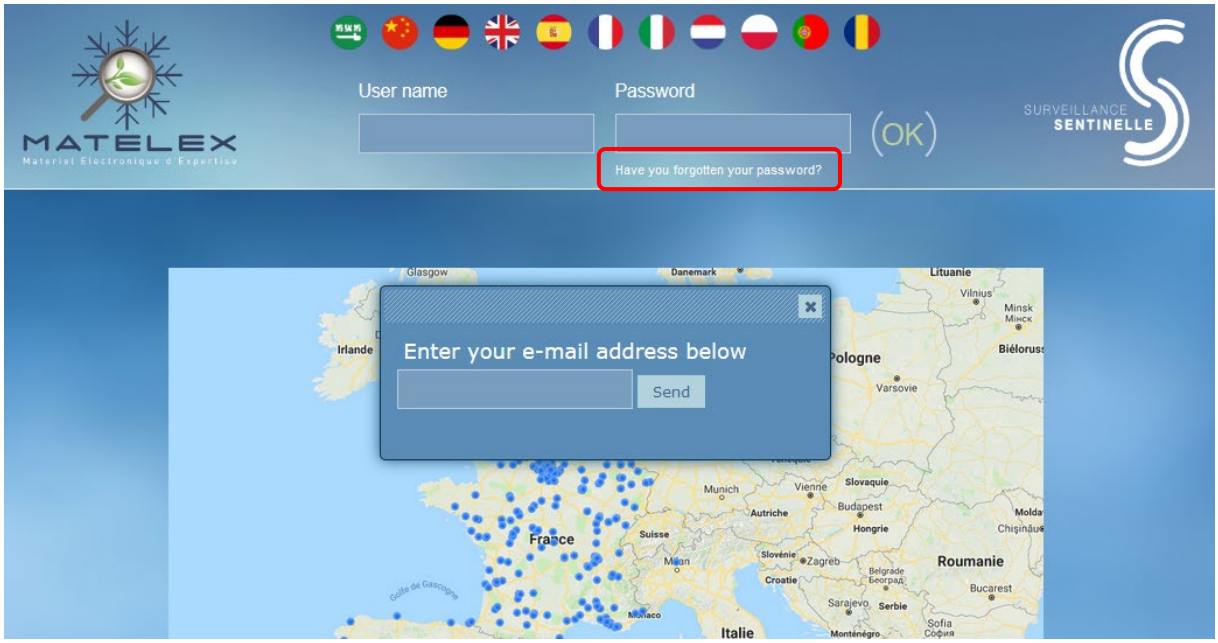
The email address is used as a login to the site and is mandatory
This information should be sent to: info@matelex.dehon.com

Access to the Sentinelle website

Link: https://sentinelle.matelex.fr

Upon the first login, you should click on "forgot password"

Enter the email address that you sent us



Sentinelle will send you a temporary password for entering the site.

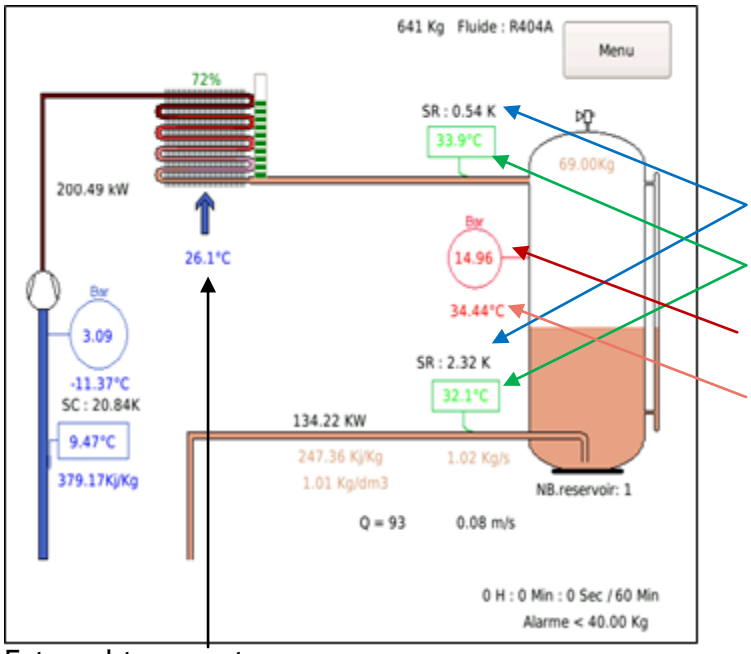
Note: It's possible that the email may end up in your spam folder so please check there if you don't receive the email and add the sender to your safe list.

Changing the password

Click on your name above the logout X.

Enter your new password in the new window

Information on the main page



SR = liquid subcooling

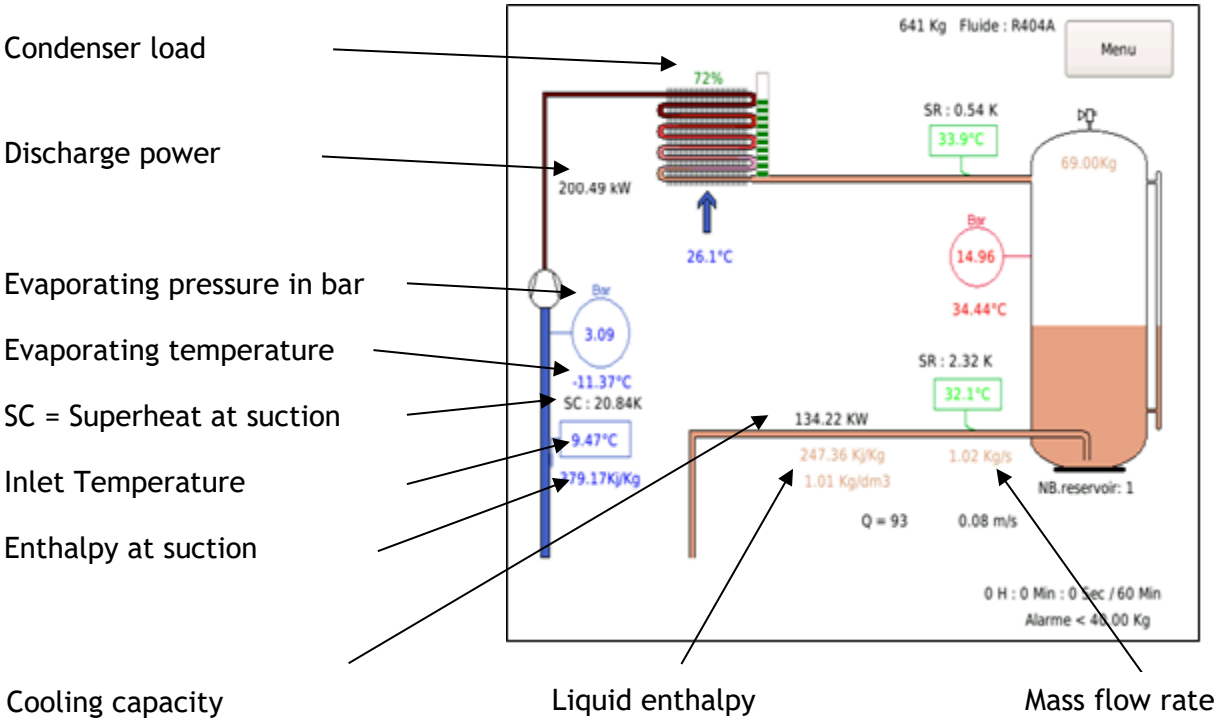
Liquid temp. measured by PT100 probes

HP pressure in the receiver (bar)

Condensing temp. (bubble curve)

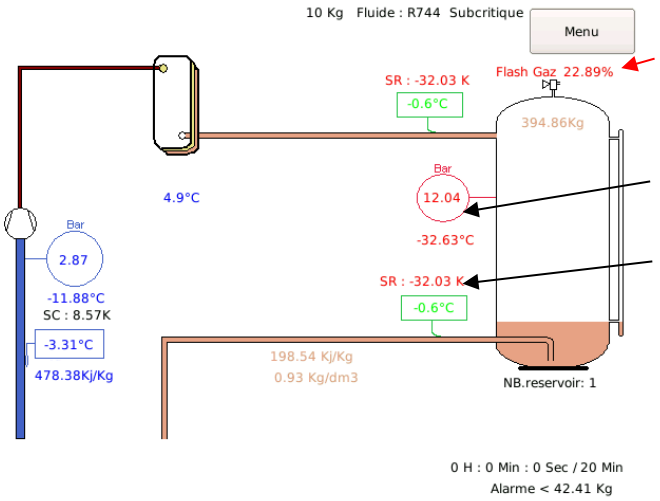
External temperature

DNI equipped with an energy module



INTERPRETING INFORMATION ON THE DNI

Receiver flash gas



Flash gas with the % of gas in the liquid

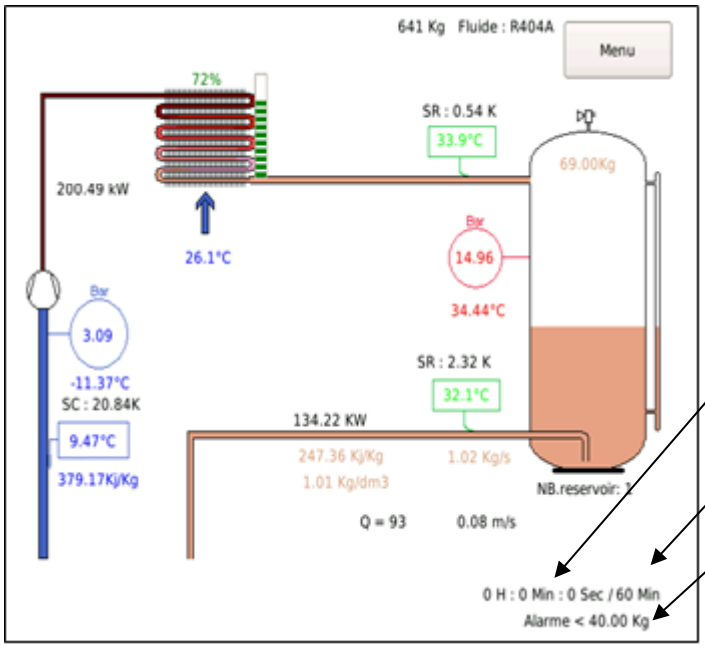
Pressure drop

Negative SubCooling = Flash Gas

A rapid drop in HP may create a flash gas in the receiver. It is essential to adjust the HP in order to eliminate major fluctuations.

A regulator supplied with liquid with a high concentration of gas will not work correctly, and causes the installation to consume too much power.

Traditional low-level alarm

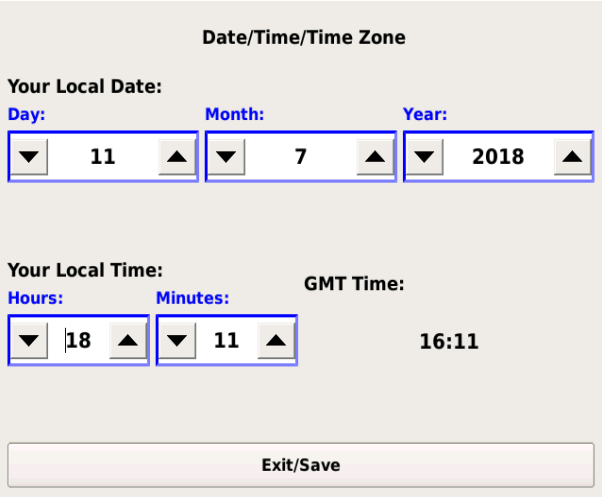


The meter is incremented once the alarm falls below the alarm setting.
The meter turns RED and generates an alarm once the configured time delay is exceeded.

Reminder of the time delay before the alarm

Reminder of the min level

Time Zone



The DNI works with two time settings. DNI connected to Sentinelle: GMT for syncing the DNI's time with Sentinelle's clock.

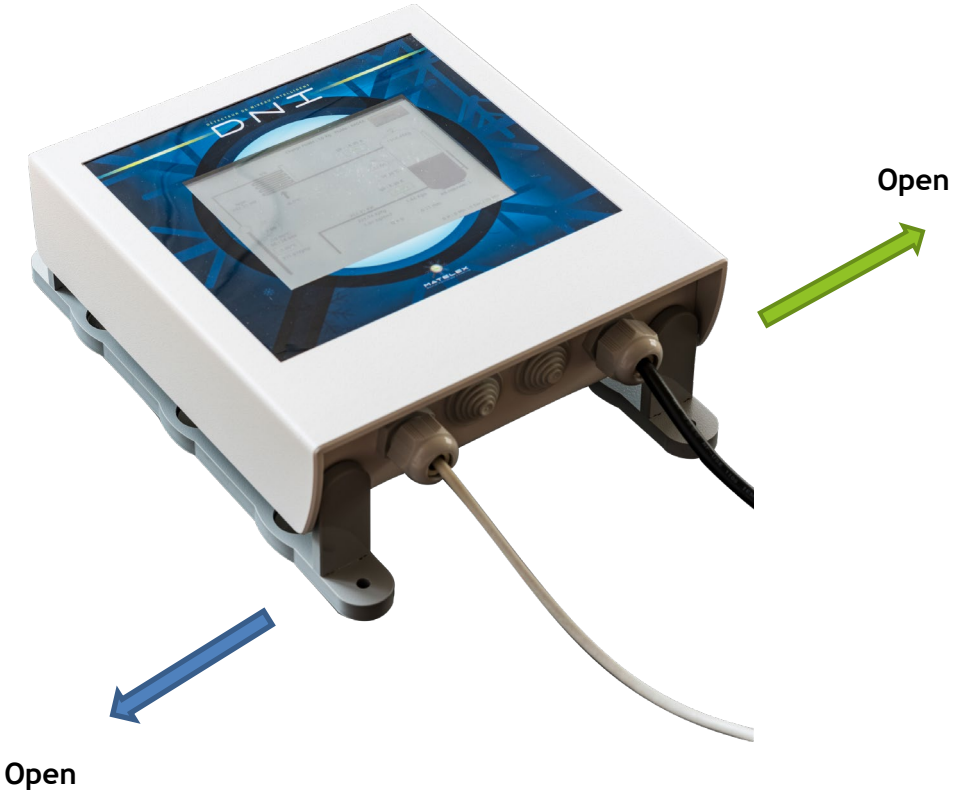
Local time is calculated with respect to GMT. It is not possible to change the DNI's date and time.

Only the daily update of GMT date and time is possible from Sentinelle.

Additional information

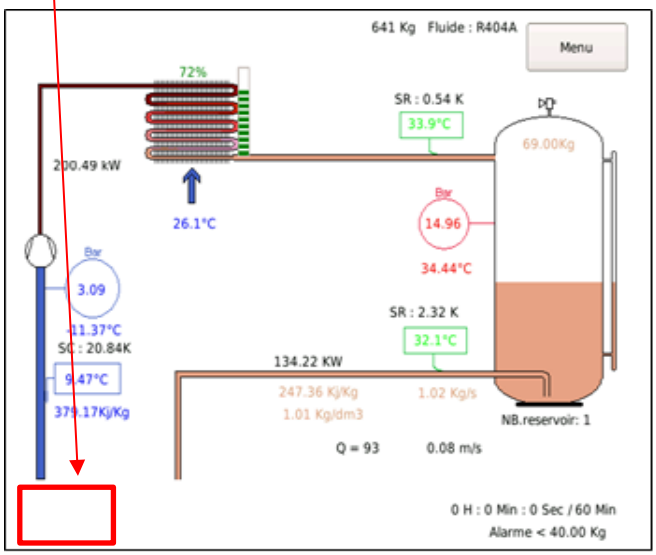
The DNI's housing

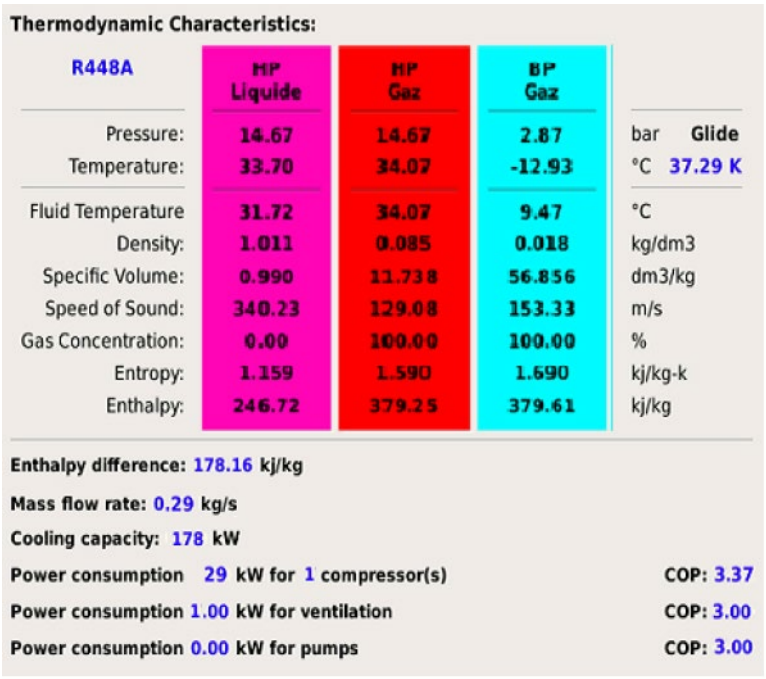
This housing includes articulated magnetic fastening that makes it possible to directly install it on a receiver with a diameter ≥300 mm or on the surface of an electrical box. This fastening saves time during assembly. Opening the housing does not require any tools, simply slide the bottom of the housing to open it or to close it.



Thermodynamic characteristics

From the main page of the DNI, click in this area of the screen to access the thermodynamic table





Access to the HP refrigerant characteristics in the liquid or vapour phase

At LP, if the DNI is connected to an **energy module**, pressure and superheat are measured. In the event that the DNI is not connected to an energy module, the pressure will be the one that was configured (see page 32).

Concentration of gas in liquid or liquid in gas

Without an energy module, the DNI calculates a Carnot COP. With the energy module, it measures the power actually consumed by the compressor(s) and the condenser fan(s) (also pumps)

COP of compressor(s)

COP of compressor(s) + condenser

The DNI therefore calculates 3 COPs.

All of the data for calculating cooling capacity is indicated in this table

All of this information is visible in real time, and also saved and transmitted to Sentinelle each day. The records are saved every 4 to 5 seconds.

The following curves may be tracked and viewed from Sentinelle: Temperature - Enthalpy - Mass flow rate - Power of compressors - Power of condenser fans - Pump(s) - Cooling capacity - COP calculated

Installation and configuration of Energy Modules

The energy module makes it possible to calculate the cooling cycle from all of the necessary measured data. Compared to the DNI alone, the Energy Module measures the LP pressure, the suction superheat, and discharge temperature.

The Energy Module measures the power consumed by the compressor(s), the condenser fan(s), and the circulation pumps if the installation has them.

A DNI equipped with the Energy Module has all of the data needed to calculate the cooling capacity at a given moment, and cumulative by hour. The DNI will calculate the COP of the compressor(s) along with the COP of the compressor(s) + condenser fan(s), and the COP of the compressor(s) + condenser fan(s) + pump(s)

All of this information will be visible directly on the DNI's screen and also in Sentinelle. From Sentinelle, curves may be tracked and viewed, and will make it possible to conduct deep analyses of power consumptions and discrepancies.

How many energy modules:

- At least 2
- At most 3

1 energy module includes 3 CT (current transformer) inputs to measure the consumption of three motors. 3 energy modules can measure up to 9 motors.

Example:

1 Central unit with **6** compressors
\+ **1** condenser (with just one CT for all of the ventilation stages)
\+ **2** circulation pumps

Total of **9** motors

Safety information

The Energy Modules are connected to high voltage in order to measure it. This connection must go through a disconnecting device.

Do not insert objects into the housing.

The connections must be carried out by a qualified electrician.

The CTs (current transformers) must be connected to the terminals of the energy module before being connected to the power cables.
Note: There is high voltage in the wires once the CT has been connected to the cable.

Our pressure sensors provided with the DNIs can only be used for HFCs or HFOs. For any other fluid such as CO_2 or NH3, you must provide your own sensors.

Caution: The Energy Modules must be installed inside the control cabinets.

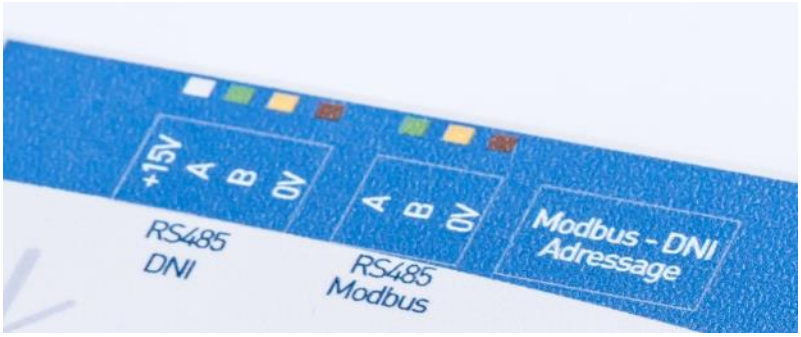
Electrical connection

Communication bus

The Energy Module must be connected to the DNI's communication bus. 2 connection options: To the DNI, or to the measurement circuit board.

Note: Connecting the power supply of the Energy Modules must use the DNI relay (See page 18 of the DNI manual)

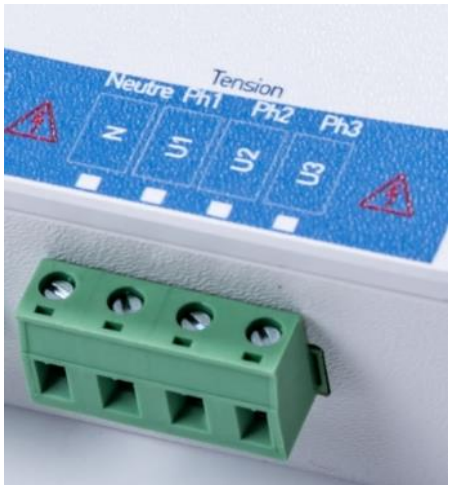
The +15V-A-B-0V terminals must be connected to the same power supply as the measurement circuit board (after going through the DNI relay)
It is recommended to use shielded cables 0.34 or 0.5 in diameter, in pairs if possible, to the colour standard DIN 47100.



*The RS485 Modbus is not yet in service.

If you have multiple Energy Modules, you must connect them to one another on the DNI RS485 terminals.

Network voltage



A residual current device must be used for the phases and neutral

If you have multiple energy modules, you must make bridges between the terminals N -U1-U2-U3.

Note: Always follow the correct electrical phase order.

CTs (Current Transformers)

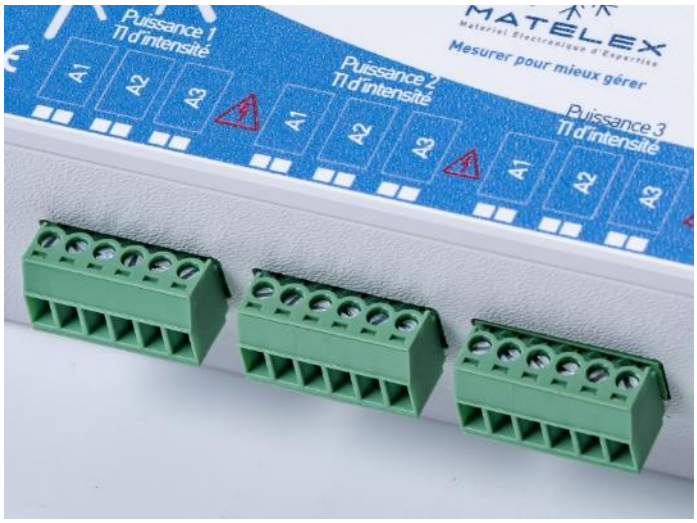
Note: One CT per motor is delivered with the order (i.e. 3 CTs per energy module)

The phases are considered balanced. You must specify the power of the CT based on your compressors and condenser ventilation.

Available CTs: 50A - 100 A -150 A and 300 A

The CTs are open and delivered with 2m of cable to make installation easier.

Beware of high voltage in the wires.
You must connect the wires to the Energy Module before connecting the transformer to the power cable



If you're installing a single CT per motor, you **must** connect it to terminal **A1**.

A1 must be connected to phase U1

If you opt for 3 CTs per motor. A2 must be connected to phase U2

A3 must be connected to phase U3

The LP pressure sensor and PT100 probe

The Energy Modules are delivered in kits of 1 to 3

Delivered with each Energy Module kit:

One LP pressure transmitter -1 to 7 bar, 4-20 mA
Note: The sensor's red wire is +

One PT100 class A probe with 3m of cable

Important: The pressure sensor must be installed at the central unit's suction. The PT100 probes must be installed on the compressor discharge and suction.

The PT100 probes must be correctly fastened to the suction and discharge pipes, properly tightened, and insulated (see p.14).

Connection to Energy Module

To the first Energy Module

Address 

You must connect the LP sensor and the PT100 probe to the central unit's suction pipe (suction superheat)

To the second Energy Module

Address 

The compressor discharge temperature PT100 probe will be connected to this second module.

The location of the second 4-20 mA input is reserved for the HP sensor (gas end of compressor discharge). This sensor is intended for transcritical CO_2 equipment. (Contact us for CO2)

Addressing the Energy Modules:

Configure the basics before installing the Energy Modules.

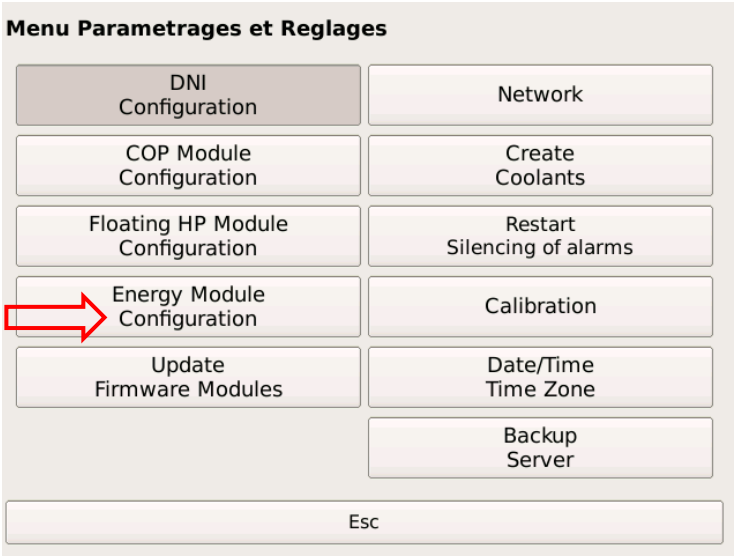
The addressing information in the configuration part of the Energy Module.

1 = On 0=Off

Module 1	000110 654321	Default setting	
Module 2	000111 654321		
Module 3	001000 654321		

Configuration

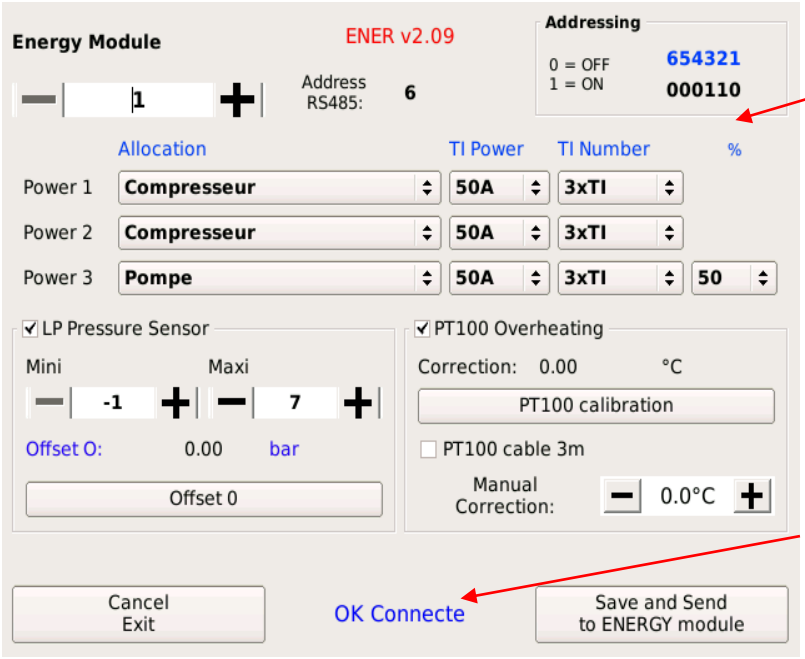
Information: The energy modules' configuration is saved in the DNI and in the Energy Modules. Each time it is restarted, the DNI checks the configuration. If an Energy Module has been replaced, there will not be any reconfiguration to carry out, because the DNI when it restarts will send the configuration to the new Energy Module.



The GUI is made as simple as possible. The DNI recognizes the Energy Modules when it boots.

Once the wiring of the DNI is complete and the addresses have been configured, restart the DNI, which will then recognize the energy modules.

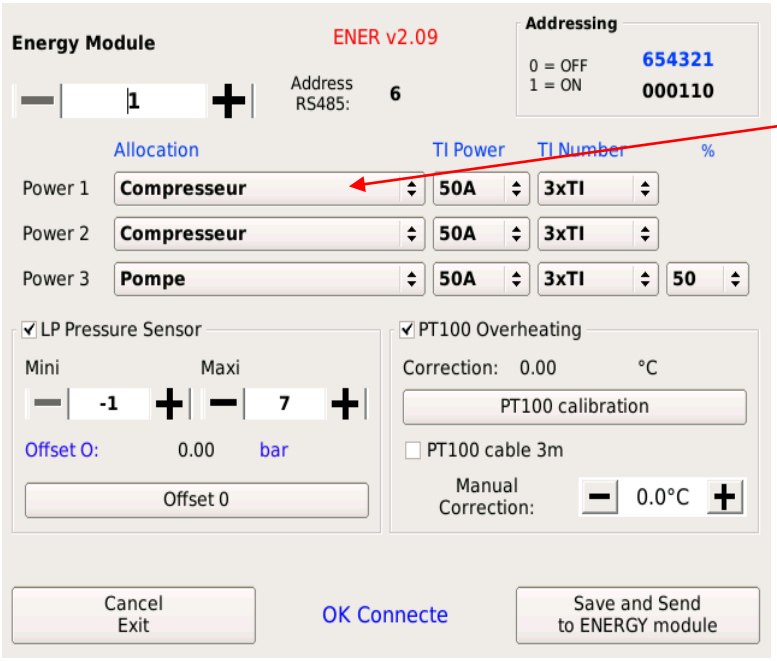
You can verify it by switching from one module to another with the + and - buttons



Reminder of the Energy Module's address

Confirming in blue that the module has been recognised

Assigning inputs



You must enter each of the inputs (motor) in the DNI. In particular, indicate whether it is:

1 compressor - 1 fan - 1 pump or other stations grouped as a family
Showcases - Cold Rooms or Lab, etc.

It is possible for economic reasons to have multiple compressors on one CT. In such a case, choose the input ***Compressors***. The DNI will then assume that there are multiple compressors on input 1 of Module 1, for example.

Important: Inspection from Sentinelle will be more accurate and complete if each of the compressors has its own power measurement.

Although the order of the inputs is not important to the DNI's operation, in order to make selection simpler, it is recommended to follow the order of the dropdown menu, i.e. starting with the compressors, then the fans of the condensers and pumps.

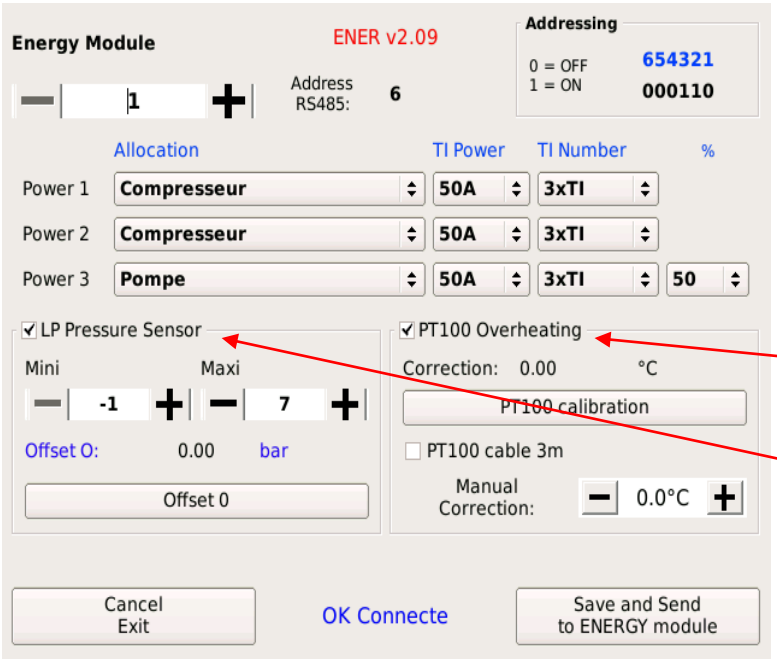
Tip: It is easier and less expensive to have a single CT for all of the condensers' ventilation stages. The DNI will calculate the COP with the ventilation stages. If there are pumps, the DNi will group together the power levels in order to integrate them into the calculation of the COPs with pump(s).

The DNI calculates 3 COPs

- COP of compressor(s)
- COP of compressor(s) + condenser fans
- COP of compressor(s) + condenser fans + pump(s)

With Sentinelle, it will be possible to compare the COPs of different installations with similar equipment.

CTs (Current Transformers)



For each power measurement, you can adapt the CT's power to the motor's rated current.

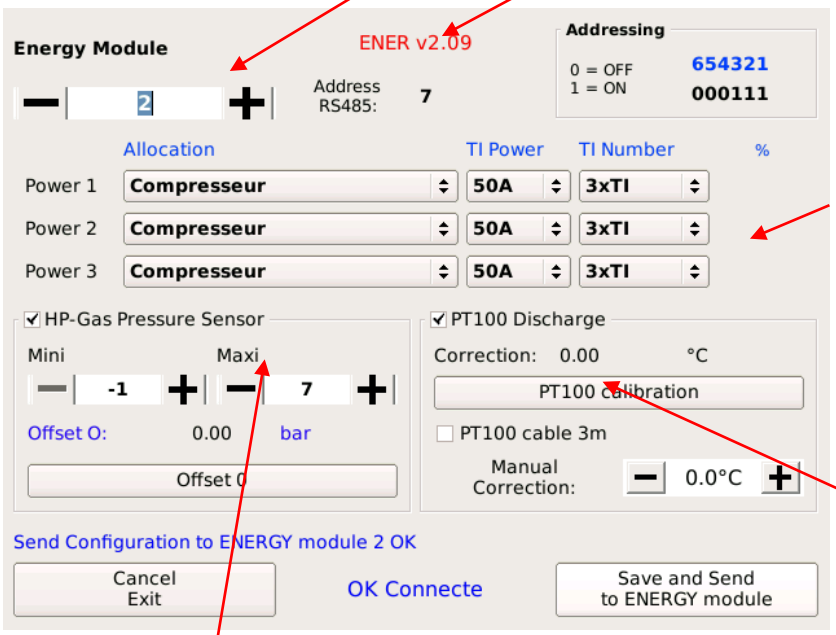
Available CTs:

50 A / 100 A / 150 A / 300 A

Suction temperature into Module 1

LP pressure sensor on module 1

Identification of the Energy Module: Module no. 2 - In red: Module's software version number



For fans or pumps you can assign a percentage of the central unit's power A pump may therefore be shared between two independent installations

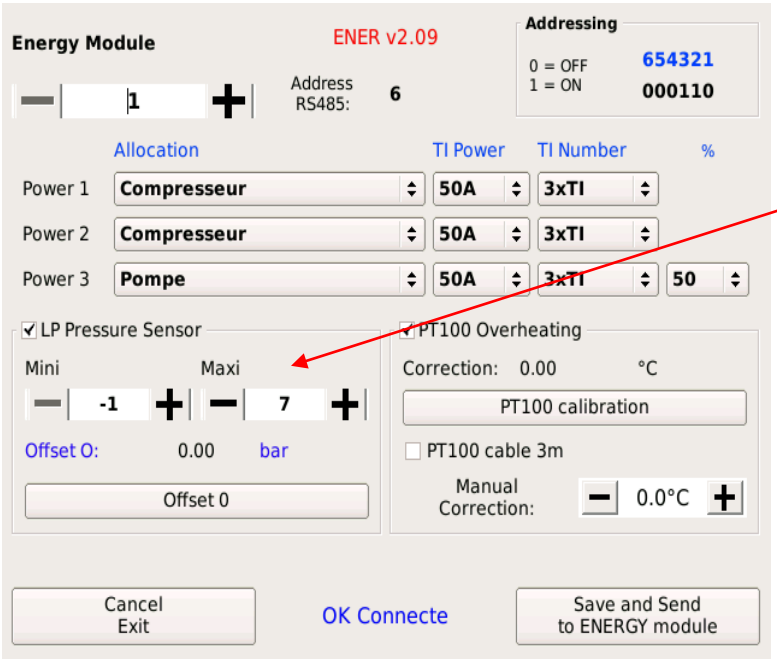
You can define the number of CTs: 1 or 3 CTs per motor

Discharge temperature at Module 2

HP gas pressure sensor on Module 2 **To be installed only on transcritical CO2 central units** (contact us).

Automatically updating the DNI and the software Modules if necessary when the DNI is connected to Sentinelle.

Pressure sensors



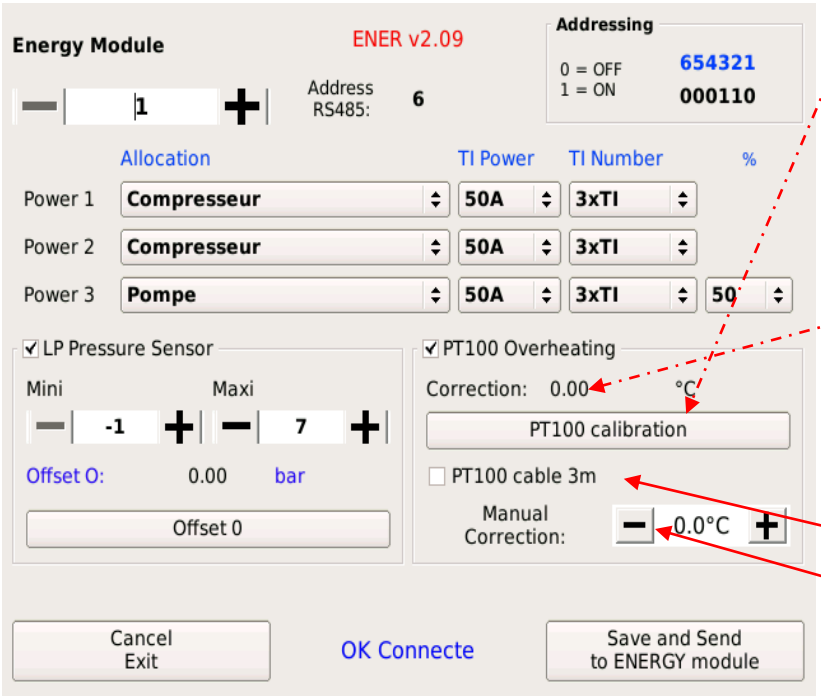
Changing the LP sensor measurement range is possible by ticking the pressure sensor

The sensor provides a range of -1 to 7 bar 4-20 mA

The sensor provided is only good for HFCs and HFOs

Note: The measurement range for CO_2 may be modified and adapted to your sensor for CO_2

PT100 temperature probes



Calibrating the PT100 probe must be done when it enters service, by placing a 100 Ω resistor (included) at the end of the electrical cable in place of the PT100 probe

The correction value will appear. After calibration, refit the PT100 probe.

Check this box for PT100s delivered with a 3m cable. Manual correction in increments of 0.1°C is permitted.

Save the configuration

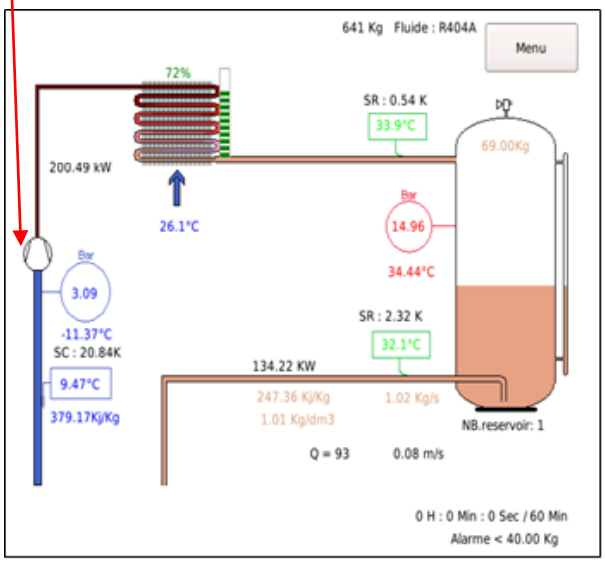
Important: The configuration of **each** of the Energy Modules must be performed.

Confirm that the saved values are OK

Note: Don't forget to save the configuration for each Module

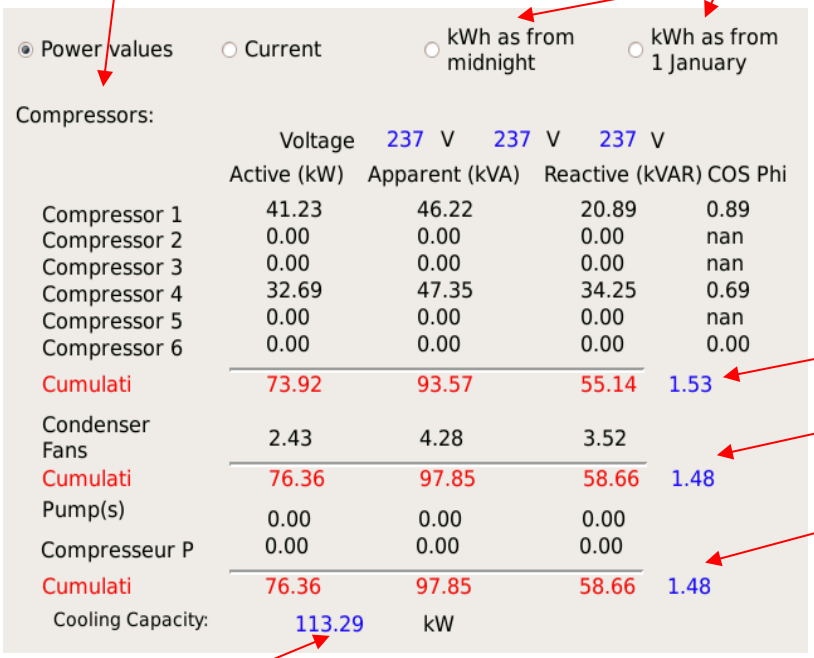
Checking absorbed power levels

Click on the compressor to access the absorbed power page



Tick power levels

Not yet accessible



COP compressors alone

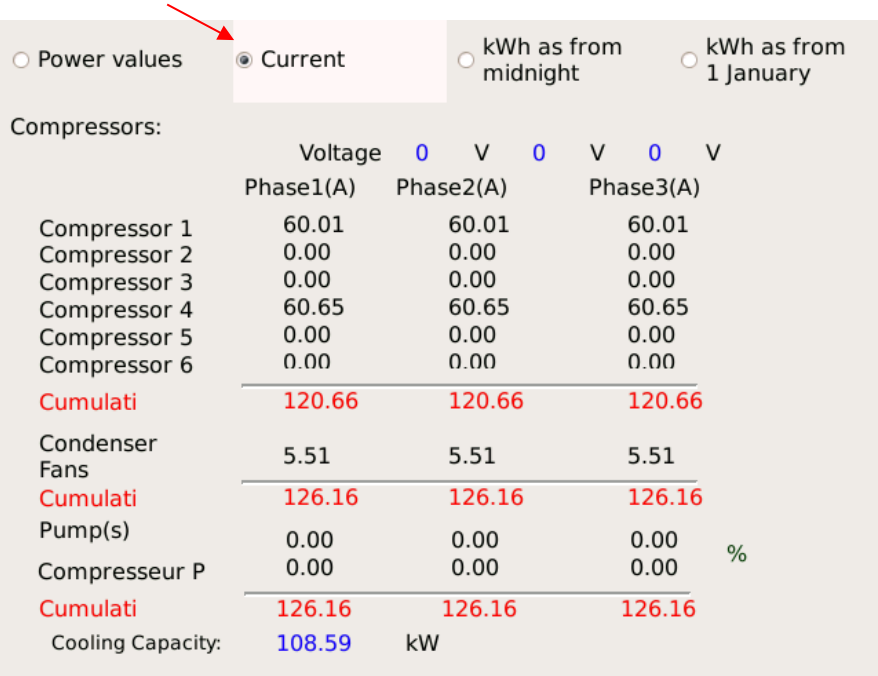
COP compressors with condenser fan

COP compressors + condenser fan + pump(s)

Cooling capacity

Checking absorbed current levels

Tick current levels



Ability to set 1 or 3 CTs on each power input

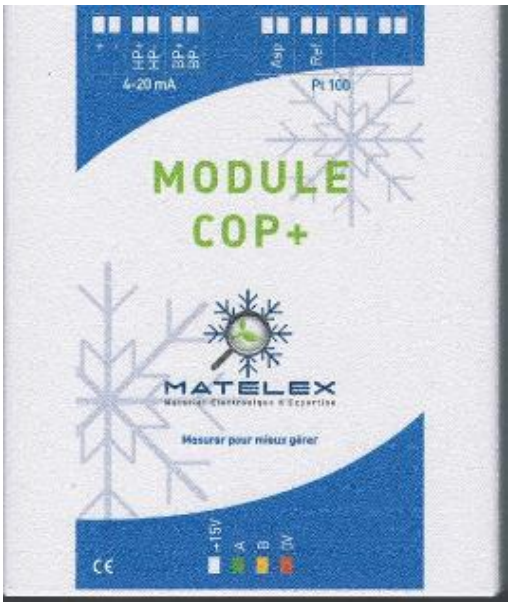
Available CTs:

50 A / 100 A / 150 A / 300 A

COP module

The COP module must be installed near the condensing unit. It makes it possible to measure LP pressure – the suction temperature (superheat) and compressor discharge
A 4-20mA input for an HP gas sensor is provided for transcritical CO_2 units.

The COP Module makes it possible, using the measured, collected, and analysed information, to calculate a more accurate COP.

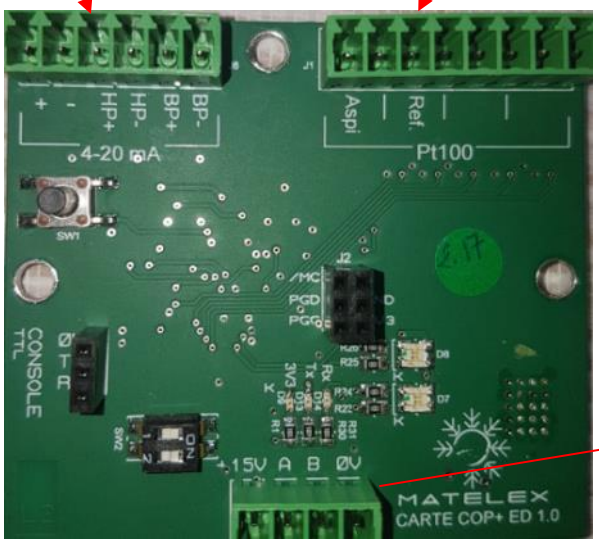


Connections of the COP Module

Once all of the components are connected, the DNI recognizes the board at startup

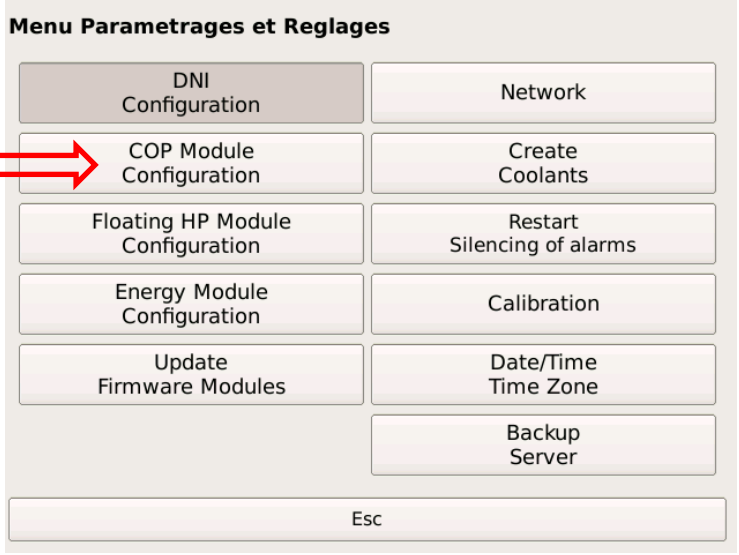
4-20mA pressure sensors

PT100 temperature probes – Prior calibration with 100 Ω resistors.



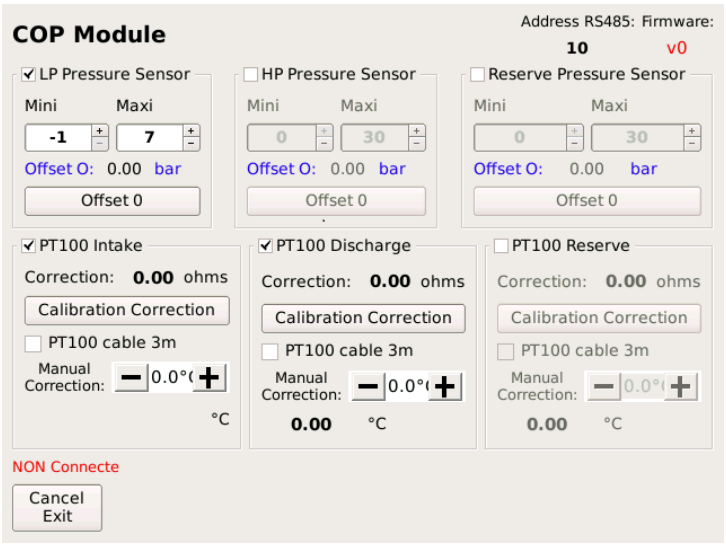
RS485 bus to be connected in parallel, either to the DNI or to the measurement circuit board.

COP module configuration menu



Configuration is done on the same principle for Energy Modules (see page 54)

Calibration of PT100 probes with a 100 Ω resistor. Pressure range for 4-20 mA pressure sensors



The COP module alone with a DNI makes it possible to accurately calculate the COP but does not make it possible to calculate cooling capacity and power discharged on the condenser. They can only be calculated with the energy modules.

Discharged power: No

Discharge temperature: Yes

LP and superheat: YES

Calculating Enthalpies: Yes