PROCESSOR X

Product reference: PF000187

USER MANUAL
&
INSTALLATION GUIDE

V1.2

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1 PRESENTATION

The Processor X acquires and processes data from on-board sensors. Equipped with a wide variety of communication ports (Topline, CAN, Serial, GPIO, etc.), a wide variety of sensors and keypads can be plugged into it, along with third-party computers. This product was designed to be an interface with customised functionalities, offering a wide range of achievable tasks.

This computer is equipped with highly advanced data processing capabilities. Multiple data sources can be selected to apply filters and arithmetic operators to them, as well as tables to feed the standard bus channels or create custom variables. The latter can be published in dynamic channels or simply saved for after-the-fact analysis.

It therefore makes it possible to calibrate the data required for navigation and auto pilot.

2 HARDWARE

The Processor X is delivered with the following elements:

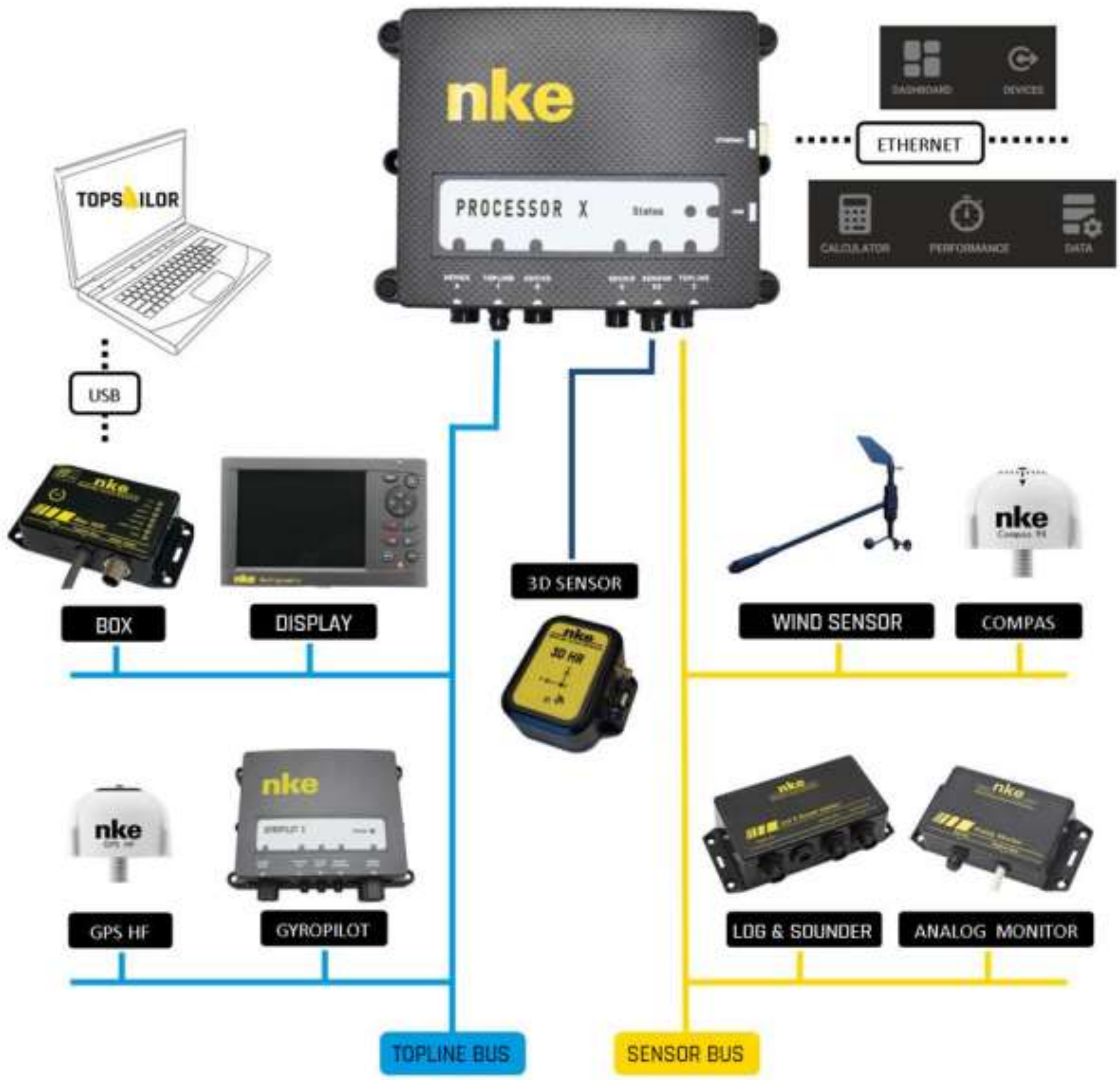
- A 3m TOPLINE bus cable: SF000531
- A 3m Sensor bus cable: PF000196

You can equip your Processor X with the following devices and accessories:

- 3D Sensor HR: PF000197
- 3D Sensor FOG: PF000270
- 3D Sensor cable for Processor X: SF000428
- 15m Topline bus cable: SF000455
- 8-Pin Device cable for Device A and B: PF000321
- 5-Pin Device cable for Device C or 3D Sensor: PF000276

3 ARCHITECTURE

The diagram below makes it possible to understand how an installation containing a Processor X is organised. The Topline main bus (in blue) is used to connect the displays, the pilot computer, a router and other instruments. The Sensor bus (in yellow) makes it possible to connect most sensors you would want to include in the installation. The Processor X makes it possible to process data from both buses.
Other sensors or peripherals (such as a 3D Sensor HR, a selector, etc.) may be connected to the Processor X via the Device ports provided.
Finally, an on-board intuitive Web page accessible from the Ethernet port makes it possible to administer the Processor X.
This innovative environment gives you access to the calculations, variables and tools enabling you to optimise your installation and navigations.



4 CONNECTION PORTS

4.1.1 Topline Bus

Use the 3m Topline cable (reference: SF000531) provided with the Processor X to connect it to a junction box of the Topline main bus.

Function	SF000531
VBUS power supply	White
Ground	Strip
Data	Black

4.1.2 Sensor Bus

Use the 3m Topline cable (reference: PF000196) provided with the Processor X to connect it to a junction box of the Sensor bus.

Function	PF000196
Grounding	Strip
Data	Black
-	Yellow
VBUS power supply	White
-	Red

4.1.3 Device A and Device B

Use an 8-pin Device cable (reference: PF000321, not provided) to connect an analog sensor, on/off outputs or an RS232 connection.

Function	PF000321
VBUS power supply	White
Ground	Strip
5V power	Orange
RS232-RX	Yellow
RS232-TX	Red
GPIO-IN/ANALOG	Black
GPIO-OUT1	Blue
GPIO-OUT2	Green

4.1.4 Device C

Use a 5-pin Device cable (reference: PF000276, not provided) to connect an analog sensor.

Function	PF000276
Ground	Strip
GPIO-IN/ANALOG	Black
CAN-L	Yellow
VBUS power supply	White
CAN-H	Red

4.1.5 3D Sensor

Use a 3D Sensor cable (reference: SF000428, not provided) to connect a 3D Sensor HR directly to the Processor X.

Use a 5-pin Device cable (reference: PF000276, not provided) to connect a Compass 9X to the 3D Sensor Port of the Processor X by using a suitable junction box.

Function	PF000276	Compass 9x
Ground	Strip	
-	Black	
RS232-RX	Yellow	Red
VBUS power supply	White	
RS232-TX	Red	

4.1.6 ETHERNET Port

Use a category 5 RJ45/UTP cable or above to connect the Processor X either to a PC or the boat computer network.

4.1.7 USB port

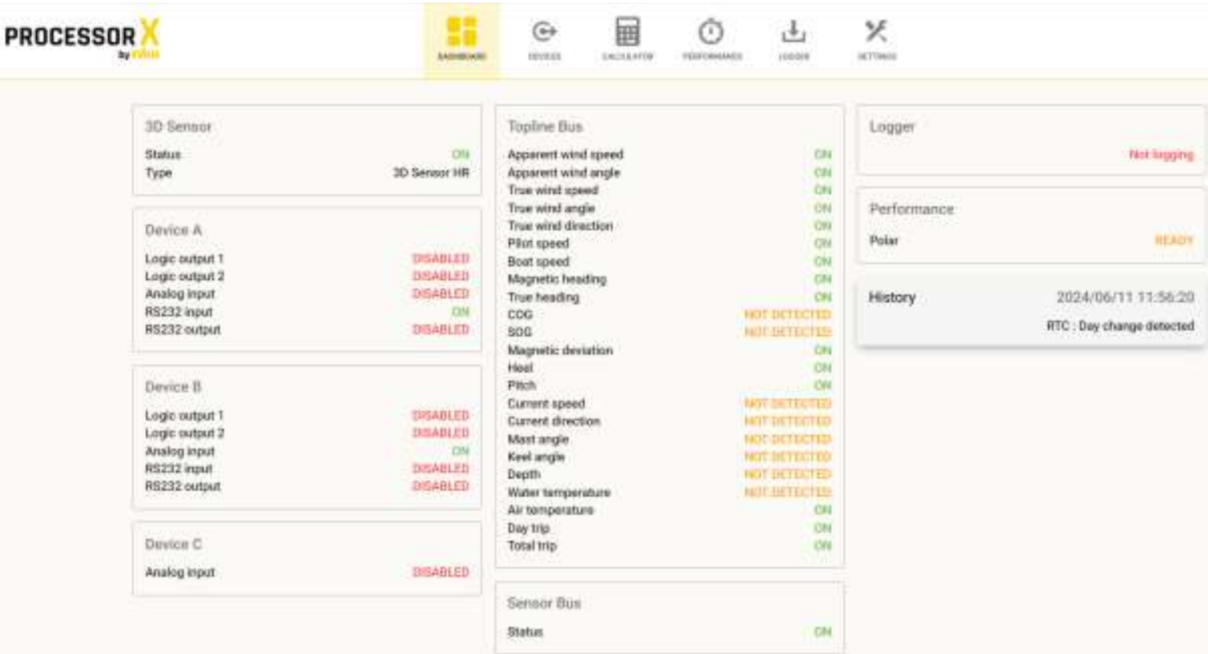
A USB A port makes it possible to connect a USB flashdrive to the Processor X.

5 CONFIGURATION AND SUPERVISION

5.1 WEB INTERFACE

The Processor X has a configuration and supervision WEB interface. This interface has 5 tabs: dashboard, peripherals, calculations, recordings, settings and system tools.

This WEB interface was optimised and validated to operate on Chrome and Firefox PC browsers. It is also available via the TopSailor software to fully integrate the nke environment tools.



5.1.1 TOPLINE Bus (main bus)

This is the main bus which mainly comprises the displays, the GyroPilot, the remote controls and some sensors. The data from these sensors does not need to be processed by the Processor X. The sensors plugged into this bus operate in the standard context, and the data they publish is not processed or calibrated by the Processor X.

This main bus is maintained via a WiFi, N2K or Ethernet Router.

The main bus displays make it possible to display the data, set and control the pilot and calibrate the sensors via the basic settings (offset, slope, etc.).

5.1.2 SENSOR Bus

The sensors to be processed via the Processor X will be connected here, along with the Analog Monitors which make it possible to acquire analog measurements.

This secondary bus is maintained via a WiFi, N2K or Ethernet Router.

There is no need to connect a display to this bus as the available data must first be processed by the Processor X.

NOTE1: Do not connect displays, remote controls or a Gyropilot to this bus.

NOTE2: The Sensor bus power supply is not insulated from the Topline main bus supply

NOTE3: the display tables (true wind calibration, magnetic heading compensation) are not published by the Processor on the Topline main bus. The tables are directly integrated into the Processor calculations.

5.1.3 3D Sensor

This sensor must provide accurate heading and attitude data. A compatible sensor needs to be connected to it (3D Sensor HR, 3D Sensor FOG, Compass 9X) in order to benefit from the automatic configuration (see 3D sensor/compass User Manuals). The Processor X makes it possible to control and calibrate the compatible nke sensors.

5.1.4 Devices A, B & C

These ports enable you to connect a peripheral to the Processor X (RS232, GPIO or analog input).
This makes it possible to connect a non-Topline sensor or system. These ports are configured via the webpage. We identified existing systems that may be connected:

- Buzzer
- Push button or selector
- 0-10V analog sensor
- NMEA sensor (weather, drift, etc.)
- Serial peripheral (Computer, Raspberry Pi, etc.)

Here are a few non-exhaustive use cases:

- Acquire an analog sensor to linearise it per table
- Acquire an RS232 sensor (Frame example: GPHDT,COM1,25<CR><LF>)
- Enable a buzzer or relay linked to a variable

5.2 THE INDICATOR LIGHTS

The LEDs indicate a status per peripheral.

In addition, the dashboard and events log make it possible to complete the diagnostic.

LEDs	Status	USB	3D Sensor	Bus Topline	Bus Sensor	Device A	Device B	Device C
Off	No power	No USB	No 3D	No power	Not used	Not used	Not used	Not used
Fixed green	No error	USB detected	3D detected			Active	Active	Active
Fixed red	Calculation failure	USB failure	Failure	Failure	Failure	Failure	Failure	Failure
Flashing green	SDCARD log	USB log active	Flow	Flow	Flow	Flow	Flow	
Flashing red	SD CARD Full	USB Full	CHK err	Collision	Collision			
Orange								
Flashing orange		Configuration	No calibration					

6 INSTALLATION

This chapter concerns the installation and initialisation of the Processor X in a Topline bus with all its elements.

> **CAUTION**
> Switch off the electronic installation before any intervention on the Topline and Sensor buses.

The Processor X installation is conducted in several steps:

1- Confirm your installation is operational without a Processor.
2- Add the Processor X as slave at address 0.
3- Configure the IP network.
4- Access the Processor X webpage.
5- Reinitialise the master display address.
6- Switch the Processor X to Topline master from the webpage.
7- Install the Sensor bus.

6.1 CONFIRM YOUR INSTALLATION

The first phase consists in establishing an operational installation of all the Topline bus elements without the Processor X. To do so, you must refer to the user manuals for the different elements (displays, sensors, etc.).
This installation must include at least one display (Multigraphic or Multidisplay) with address 1 (master) in order to check that the set of elements is consistent and operational.

6.2 INTEGRATING THE PROCESSOR X

It is important to switch off your installation while installing the Processor X.
Add the Processor X to the installation which will be at address 0. Thus, you will need to use your "Topline bus" cable. Connect the Topline 1 port of your Processor X to the cable connector. You can then connect the ground (strip), the power supply (white wire) and the data wire to your junction box which interconnects the Topline bus instruments.

6.3 CONFIGURING THE IP NETWORK

Start by connecting your Processor X to your network with the Ethernet cable.
To connect to the Processor X webpage, you must first configure your IP network.
Configure the PC's network cad IP as static IP at a free address on the same network (e.g.: 192.168.56.200).
The maintenance interface of the Processor X (webpage) is accessible via a web browser from a computer connected to the Processor X via Ethernet.

6.3.1 Factory IP configuration

The Processor X is delivered with the following IP configuration:

- Single factory-set MAC address
- IP mode: AUTO IP
- Static IP address: 192.168.56.30
- Static IP mask: 255.255.255.0
- Static IP Gateway: 192.168.56.30

6.3.2 Without a DHCP server on the network

The Processor X tests the presence of a DHCP server during 15s at start-up. In the absence of a DHCP server, the Auto IP mode assigns the address 192.168.56.30/24 to the Processor X (/!\ Caution! Make sure this address does not conflict with an existing address on the network).
Your computer's IP address then needs to be configured in order for it to be able to connect to the same range with a different address. The connection can be established either with a crossover or straight-through cable, except for some older computers.
To configure your computer's IP address, refer to your operating system references.

6.3.3 With a DHCP server

The Processor X can be a DHCP client. It may be important to fixer the Processor X's IP address on the DHCP server in order to not need to search for its address if its lease should change. The TopSailor software enables you to know the IP address of your Processor X and go to its maintenance page.
In the case of a network with DHCP server, your computer will also receive a lease with an IP address on the same range as the Processor X. Once again, it may be advisable to fix the computer's IP address rather than let the server manage it blindly.
For anything pertaining to building the on-board IP network, refer to the user manuals for your servers and other active elements on your network.

6.4 ACCESSING THE PROCESSOR X WEB INTERFACE

As we have seen previously, there are three ways to access the Processor X maintenance interface.

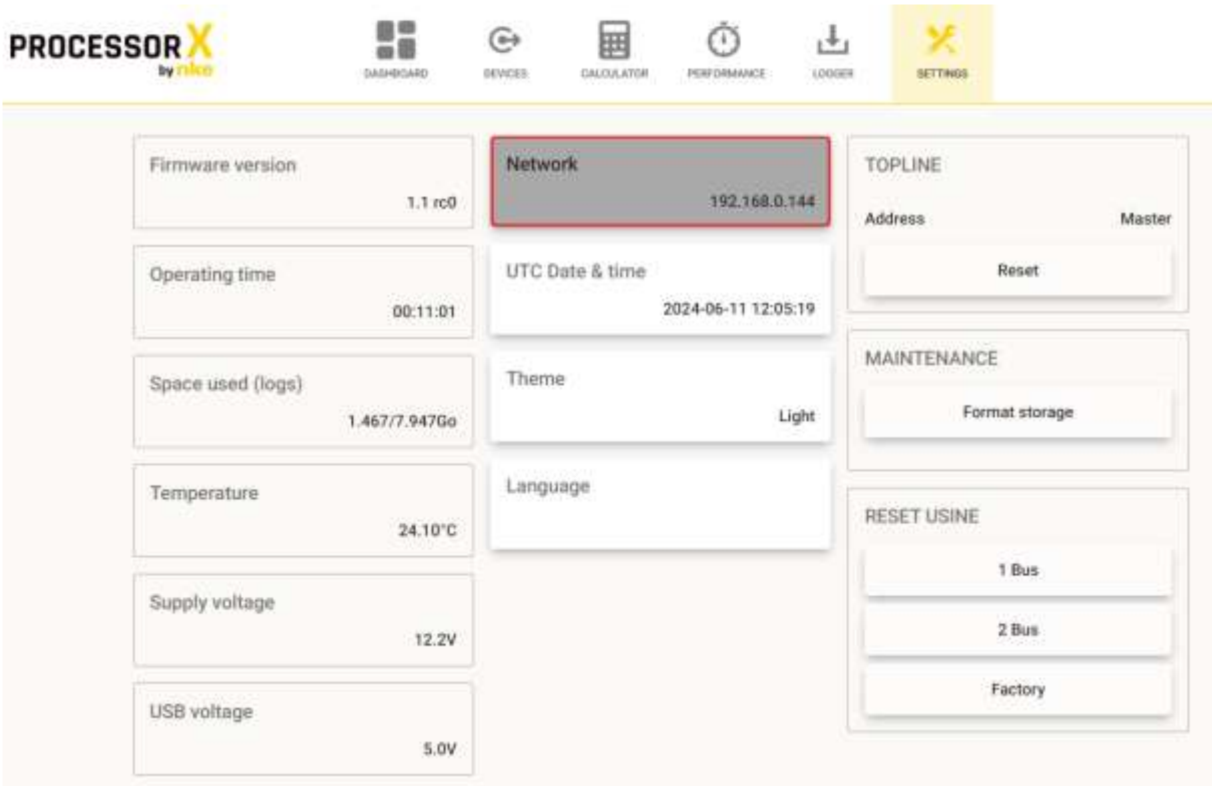
6.4.1 With the IP address

In this case, you will need to know the IP address for your Processor X, which you will need to enter in your web browser.
Example with a Processor X with static IP (factory setting) 192.168.56.30/24.

6.4.2 Without knowing the IP address

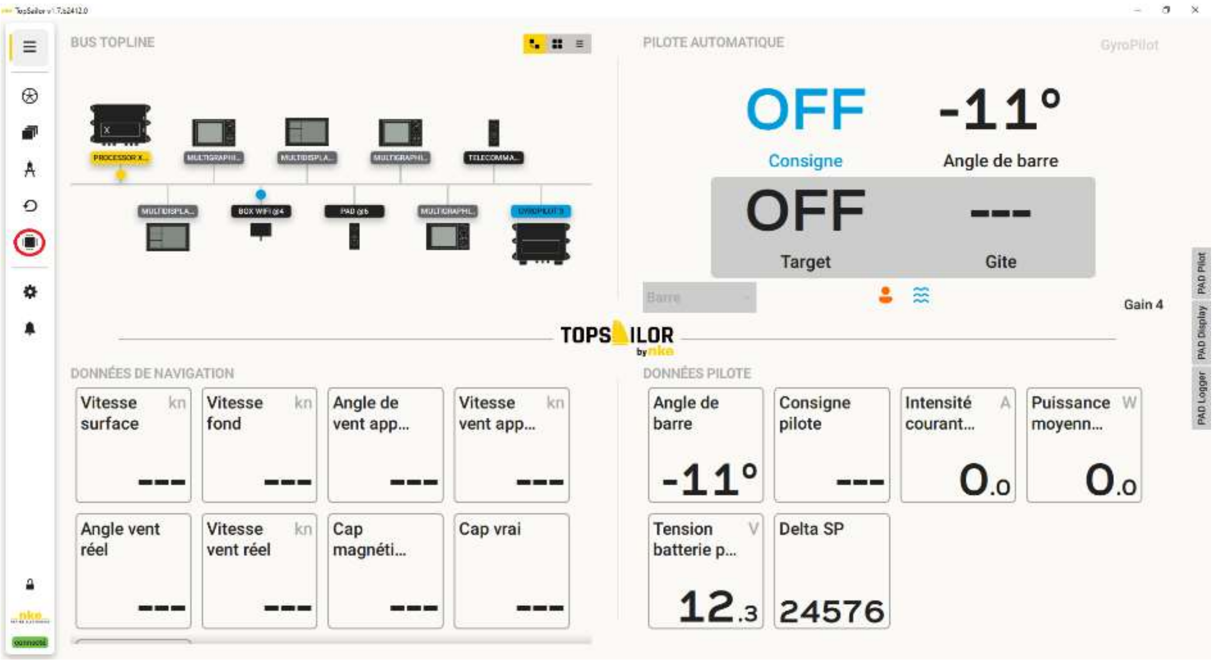
In this case, you can connect to your Processor X by entering the following URL in your browser:

You can then determine the IP address for the Processor X by going into the “SETTINGS” tab of the webpage.



6.4.3 With the TopSailor software

You can use the TopSailor software with a computer connected to the nke bus via a Wi-Fi, N2K or Ethernet Router. At start-up, the software discovers the elements making up the bus. When it discovers the Processor X, it will ask it for its IP address. You can then click on the “Processor” icon in the left-hand menu of the software to connect to the maintenance page. TopSailor will directly access the right IP address. Naturally, the computer needs to be configured to connect to the same network.



6.5 SWITCHING THE PROCESSOR X TO TOPLINE MASTER

The first step is to reinitialise your master display’s address. Refer to the manual for the product concerned.

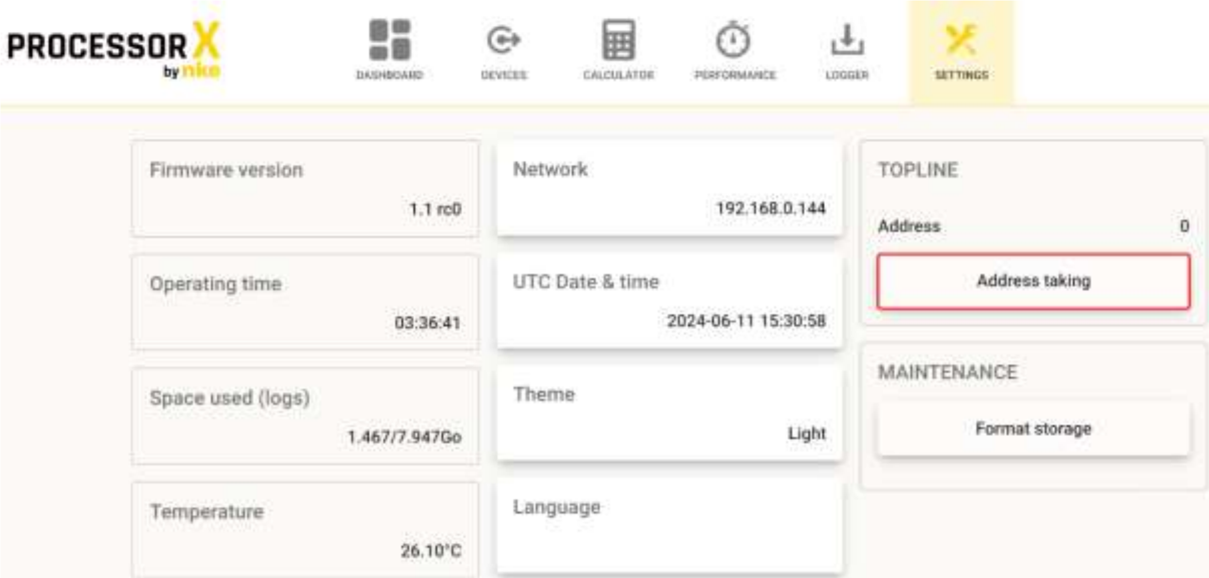
You can then switch the Processor X to Topline master. Go to the webpage to conduct this step.

Go to the SETTINGS and click on “Address taking” in order for your Processor X to take an address and become master, given that there is no master on the bus.

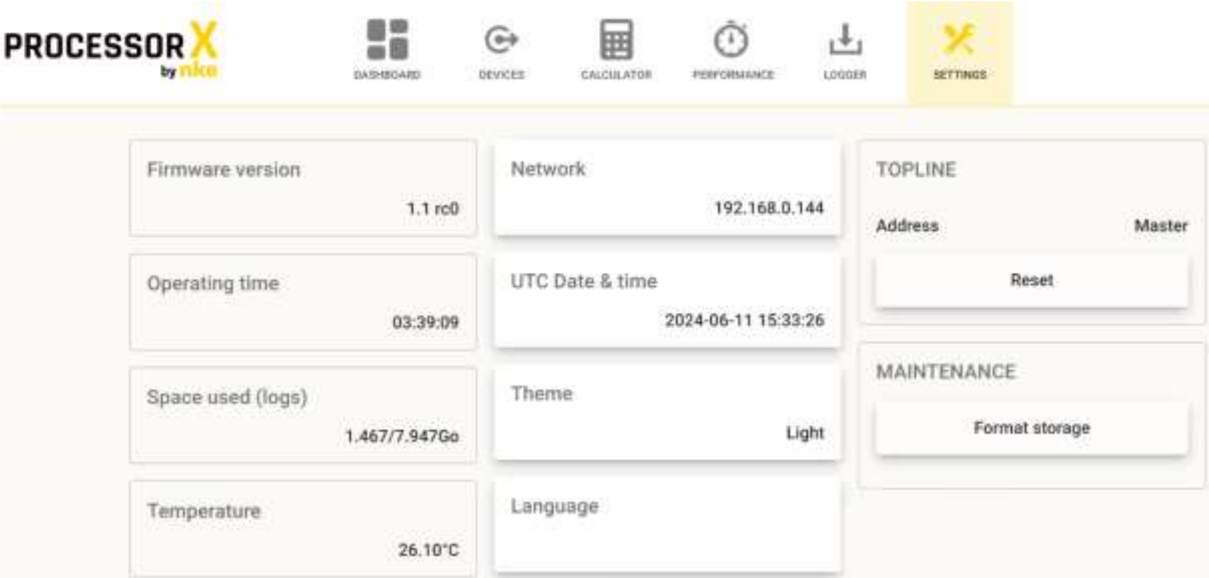
Check that your Processor X is now master.

NOTE: the Processor X is master and will create two lists in order to determine the channels available on the Topline bus.

To take on the master address:



The Processor X is master:



6.6 SETTING UP THE SENSOR BUS

Once the main bus is operational, the secondary bus may be deployed.

This secondary bus makes it possible to connect and acquire data from sensors in order for it to be processed in the "Calculator" function of the Processor X (examples: de-noising, table, selector), before publishing the result on the main bus.

Grab your "Sensor bus" cable to set up your Sensor bus. Switch off your installation. Connect the Sensor bus port of your Processor X to the binder. You can then connect the ground (strip), the power supply (white wire) and the data wire to your junction box which interconnects the Sensor bus instruments.

A few practical cases:

- The main, basic function is to connect a masthead unit HR sensor to acquire wind data quickly and apply the dynamic de-noising with the 3D Sensor HR. This is the basic configuration recommended for the Sensor bus.
- A compass 9X sensor can be added to establish redundancy for the 3D Sensor HR.
- A mast angle sensor can be set up on the Sensor bus in order to apply a table to linearise the mast measurement.

NOTE: The Sensor bus instruments cannot interact directly with the Topline main bus instruments. For example, a display on the Topline bus does not access the sensor data, but the data calculated by the Processor X.
Note that it is advised to have a router per bus in order to ensure all the instruments are maintained using Toplink.

7 CONFIGURING THE PROCESSOR X

The Processor X is configured via its webpage.

7.1 WEB INTERFACE

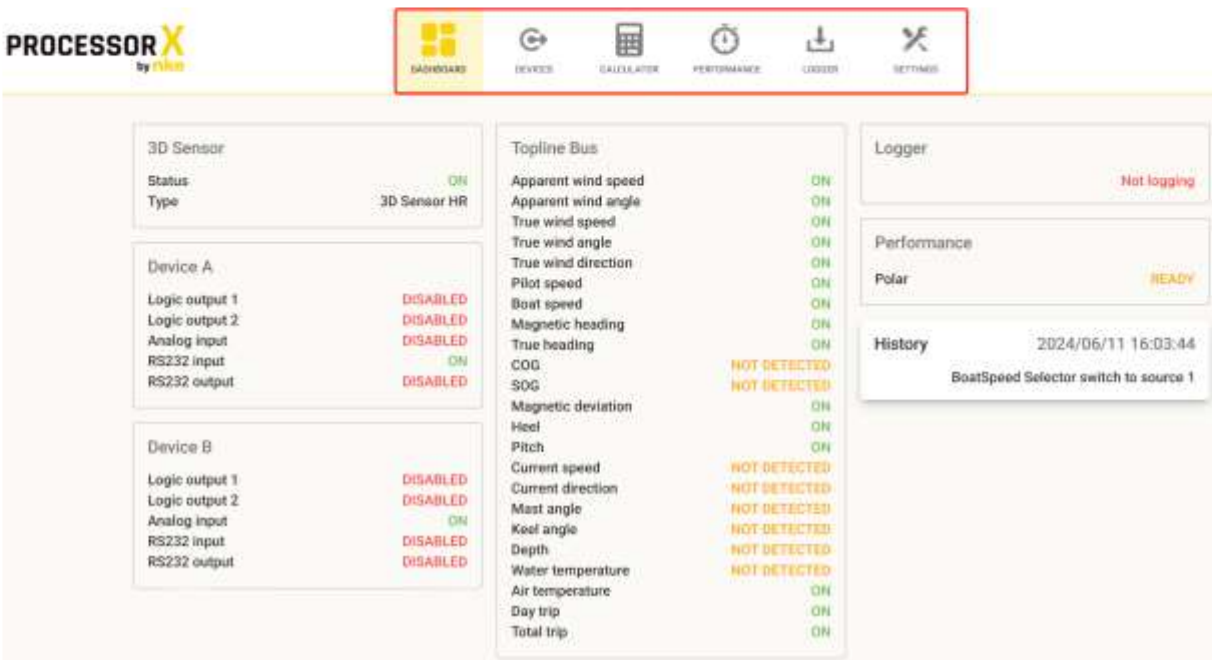
Start by connecting to the Processor X webpage via TopSailor or by entering the IP address directly into your browser:

The on-board webpage is the main HMI for the Processor to:

- configure the Processor on the Topline bus
- configure the Devices
- configure the calculations and create variables
- manage polars
- control and navigate in the Datalogger

The webpage includes 6 tabs enabling you to view:

- your dashboard
- the peripherals
- your calculations
- your performance information
- the datalogger
- the system settings and tools



7.1.1 Browser

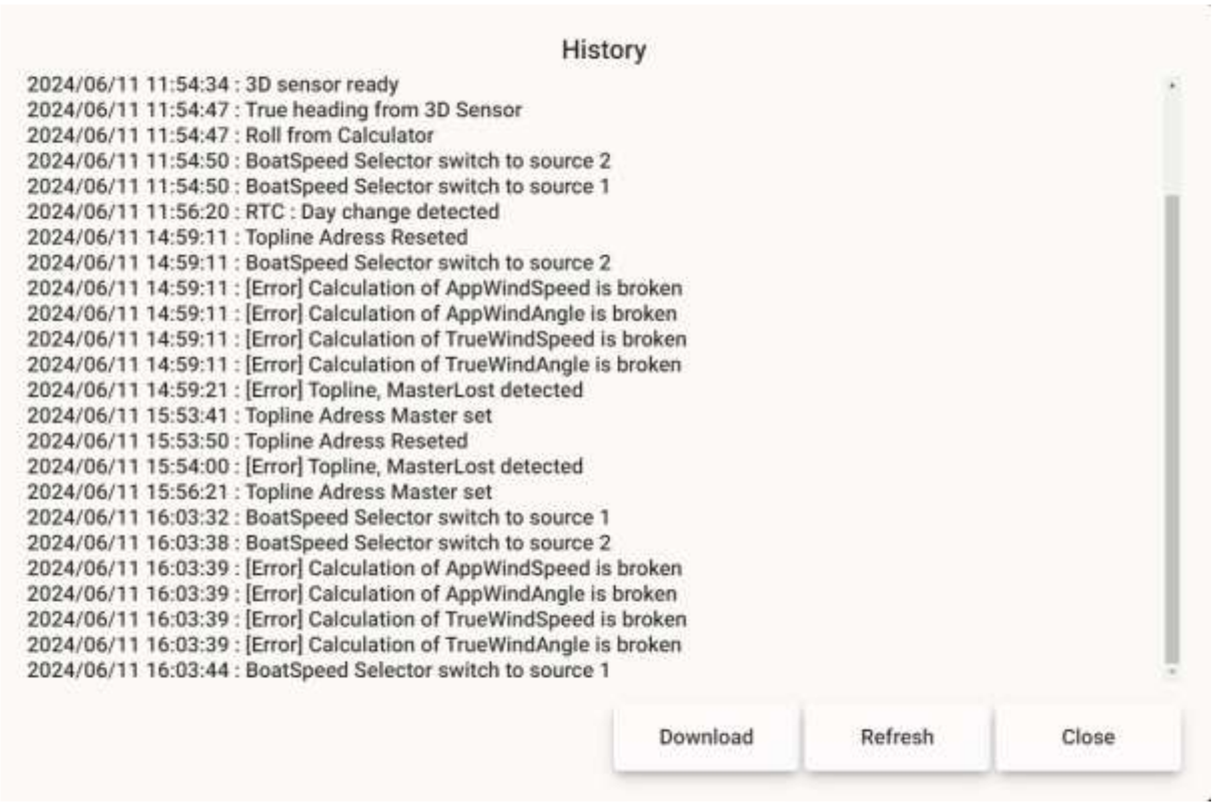
This Webpage was optimised and validated to operate on Chrome and Firefox PC browsers.
It is also accessible and integrated into TopSailor in order to create a comprehensive nke environment.
The webpage is also optimised for both Apple and Android smartphones and tablets.

7.1.2 Dashboard

This tab sums up the general status of the Processor X data and peripherals: the devices, the Topline calculation status, the performance information status (polars), the logger status and a log (see previous image).

Status	DISABLED	READY	ON	FAILURE	NOT DETECTED
Logic output	Not configured	Inactive output	Active output		
RS232 output	Not configured		Active output		
RS232 input	Not configured		Active flow		No flow
Analog input	Not configured		Active measurement		
3D Sensor			OK sensor	Sensor error or timeout detected	Sensor not detected
Topline bus					
Calculations			OK calculation	Calculation failed	Calculation not available
Sensor bus			Bus used		No product detected on the bus

The log summarises the Processor X events such as start-up, device configuration, calculation errors, or the disappearance or appearance of a channel to be published on the Topline bus.
The log size is limited to 512Ko and can be downloaded onto the PC as a text file in order to keep a full history.



7.1.3 Devices

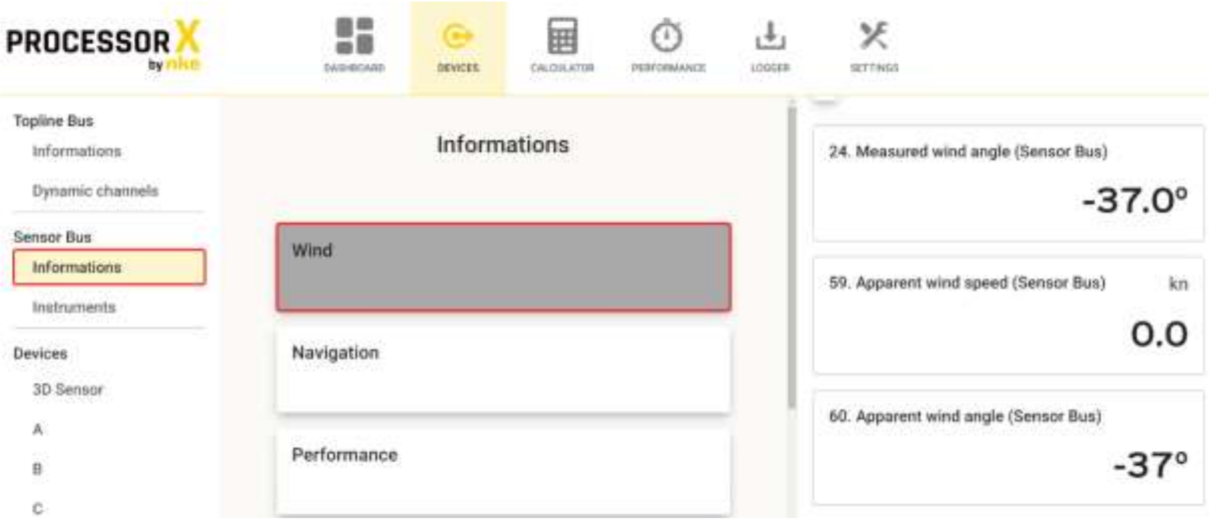
7.1.3.1 *Topline Bus*

This menu makes it possible to visualise the status of the channels disseminated by the Processor X and their source.
The channels published on the Topline bus can be updated with the “Update bus” button. This avoids switching off and on the whole installation, especially after creating a calculation or configuring a new device.
This page also makes it possible to configure a dynamic channel (see use case).
Below are the channels that can be created on the Topline bus:

Channel	Calculator channels	Channel	Calculator channel associated measurements	Channel	Master channels
59	Filtered apparent wind speed			55	Config
60	Filtered apparent wind angle	24	App wind angle fast	186	Max speed
37	Filtered true wind speed	227	True wind speed	185	Avg speed
38	Filtered true wind angle	228	True wind angle	42	Drift
39	Filtered true wind direction			46	Corrected heading
58	Filtered surface speed	21	Surface speed	41	CMG
22	Depth			33	D_dead-reckoning
61	Filtered magnetic heading	25	Mes heading	34	A_dead-reckoning
212	True heading			53	D_Mob
66	Filtered bottom heading	233	Bottom heading	54	A_Mob
65	Filtered bottom speed	232	Bottom speed	101	Next tack heading
229	Magnetic declination			40	Vmg
43	Filtered heel	29	Heel_mes	100	Target speed
115	Filtered pitch	203	Ptich_mes	102	Optimal angle
117	Filtered current speed			106	Opt vmg angle
116	Current dir			108	Course squall vmg
109	Filtered keel angle			219	Polar speed
49	Water temperature			104	Polar performance
48	Air temperature			103	Close-hauled performance
44	Mast angle	194	HR mast angle		
31	LochDay				
32	LochTot				
230	Pilot speed				
72	Wind angle corrected for mast angle	210	girmp mes		
192	Raw wind speed				
193	Raw wind angle				

7.1.3.2 *Sensor Bus*

This menu makes it possible to visualise the channels present on the Sensor bus of the Processor X (and thus not need a display on this bus).
The channels are grouped by type of data.
In the example below, an HR Masthead Unit is connected to the Sensor bus. The Processor thus receives the data linked to the wind channels (Wind tab). There is therefore a "Wind" tab in the "information"



NOTE1: the Processor X must imperatively be set to address 1 on this bus. The Processor address configuration is not available on the Sensor bus.

NOTE2: it is advised to equip this bus with a Router in order to be able to maintain it with TopSailor or Toplink.

7.1.3.3 *3D Sensor Device*

This is where the information on the IMU is found:
- type of sensor connected
- status of the 3D sensor connected
- data communicated by the sensor
- device console

It also makes it possible to conduct the following actions:
- calibrate the sensor
- configure the transmission speed

7.1.3.4 *Devices A, B & C*

Here, you can enable the Processor's logic, analog and digital inputs/outputs. Several cases of use will be presented hereinafter.
Each device can be named on the webpage in order for the user to define the use of the peripheral.

7.1.3.5 *Shortcuts*

This functionality enables you to create programmable buttons linked to variables. A button can increment, decrement, assign or toggle the value of a variable.
A parameter enables each button to define its operating range.
A same variable can be linked to several buttons to assign different values.

Each shortcut can be named and is then displayed on the Processor dashboard page.

The shortcuts can be linked via a Pads Display and the web keyboard.
The link can be enabled via the Shortcut Configuration menu.

7.1.4 Calculator

The calculator is the tool offering the configurable services of the Processor in order to calculate the heading, wind, speed, attitude, etc. It combines the different measurements required. The calculator also offers custom calculations to create variables.

The tool is integrated into the webpage and makes it possible to graphically program the calculations the user wants to modify or integrate into their environment.

There are 11 preconfigured calculations and 10 custom calculations making it possible to create variables internal to the Processor, then use them in the other modules to make them available to the bus or peripherals. The calculations can also be linked together.
Each user calculation can be named on the webpage so they can define how the calculation is to be used.
The following sections are set out in this module.

7.1.4.1 *General*

Calculator Data and Processor Data are the first tabs in the General section. These two tabs make it possible to visualise the data pertaining to these two types of calculation.
Calculations run with "Calculator Data" are accessible to the user. The custom aspect of the calculations is available here.
The calculations run with "Processor Data" correspond to the calculations run internally by the Processor X. The user can simply use the data from these calculations by

configuring the sources they want to use. We will go into more details on the notions of data sources and types later on.

7.1.4.2 *Processor*

This section includes information on the apparent wind, true wind and polars. This is Processor data, thus it will only be possible to view the input/output data linked to these calculations.

7.1.4.3 *Standard*

With this section, the user can customise the standard calculations linked to wind, the boat speed, movements, etc.

7.1.4.4 *User*

This section makes it possible to create up to 10 new custom calculations.

7.1.5 Performance

This module enables you to enter and visualise the boat polar. It also makes it possible to view the performance channels.

7.1.6 Logger

This menu makes it possible to enable or disable the datalogger.
You can also add marks in the current log file and in the Processor history.
Log files are currently available in CTC format.
This is a Topline native format which makes it possible to save all the Topline main bus traffic.
This menu also integrates a file explorer.
The explorer enables you to classify files per day/month/year.
The logs can be downloaded onto the PC, either by folder (day/month/year) or by file.
It is also possible to export files directly in CSV format onto the PC, from the explorer.

7.1.7 Settings

7.1.7.1 *Settings*

This menu gives you access to the Processor X configuration and system tools.
Here, you can configure the IP address, change the theme or language and set the time for the Processor.

NOTE: the clock is saved and calculated during several hours without power supply.

7.1.7.2 *Topline address*

You can reinitialise the address (address 0) here, or insert the Processor into the Topline bus (assign an address other than 0 to the Processor X).

7.1.7.3 *Backup and restore points,*

The user configuration for the devices and calculations, along with the sub-channels can be saved, which makes it possible to restore a saved configuration at any time.
This will be useful after an update or to create restore points during test or calibration phases.

7.1.7.4 *Partial factory reset*

The "1 bus" or "2 bus" factory reset enables the user to reset the calculations and devices, then preconfigure the Processor to run simply with the main bus alone or with the two Topline buses. The Processor system settings are not affected by this reset.

NOTE: the default configuration may not be sufficient to run all the calculations
This factory reset does not reset the Processor X address.

7.1.7.5 *Full factory reset*

The "full" factory reset is accessible on a hidden page: http://px.local/prod.html
It enables you to fully reset the Processor to factory settings.
This factory reset reinitialises the Processor X address and will be effective from the next start-up.

8 USE CASES

8.1 UNDERSTANDING THE NOTIONS OF TYPES AND SOURCES

Before explaining different cases of use and configurations for the Processor X, you first need to understand the notions of types and sources. This product interfaces with many instruments and centralises a lot of data. It is therefore important to properly configure the data processed in the different functionalities of the Processor X.
The type of data corresponds to the measured variable (heel, heading, speed, etc.)
The source corresponds to the Processor X port to which the instrument supplying the data in question is connected (Topline bus, Sensor bus, 3D Sensor, Device A, etc.).

Let's take the case where we want to recover the heel data (channel 43. Heel Angle) with a 3D Sensor HR connected to the 3D Sensor port and a compass 9X on the Sensor bus. In this case, we have access to the same type of data (Heel Angle), available through two different sources. This gives us redundancy.

8.2 USING THE DEVICES

8.2.1 Using a 3D sensor

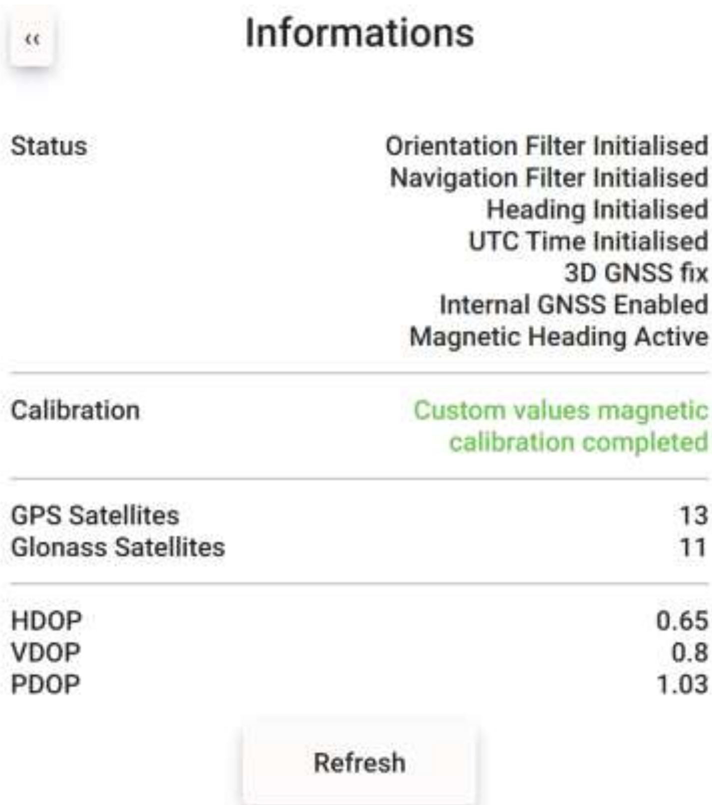
8.2.1.1 *Connecting the 3D sensor*

For this use case, let’s take the example of a 3D Sensor HR we want to use.
After connecting the 3D sensor to the Sensor 3D port of the Processor X and restarting the latter, wait for the 3D Sensor to have the “ON” status in the dashboard on the webpage and check the type of sensor.

Next, go to the “Devices” tab to check different information and calibrate the sensor.

8.2.1.2 *Checking the information supplied by the sensor*

By selecting “3D” in “DEVICES”, we will check the sensor information.



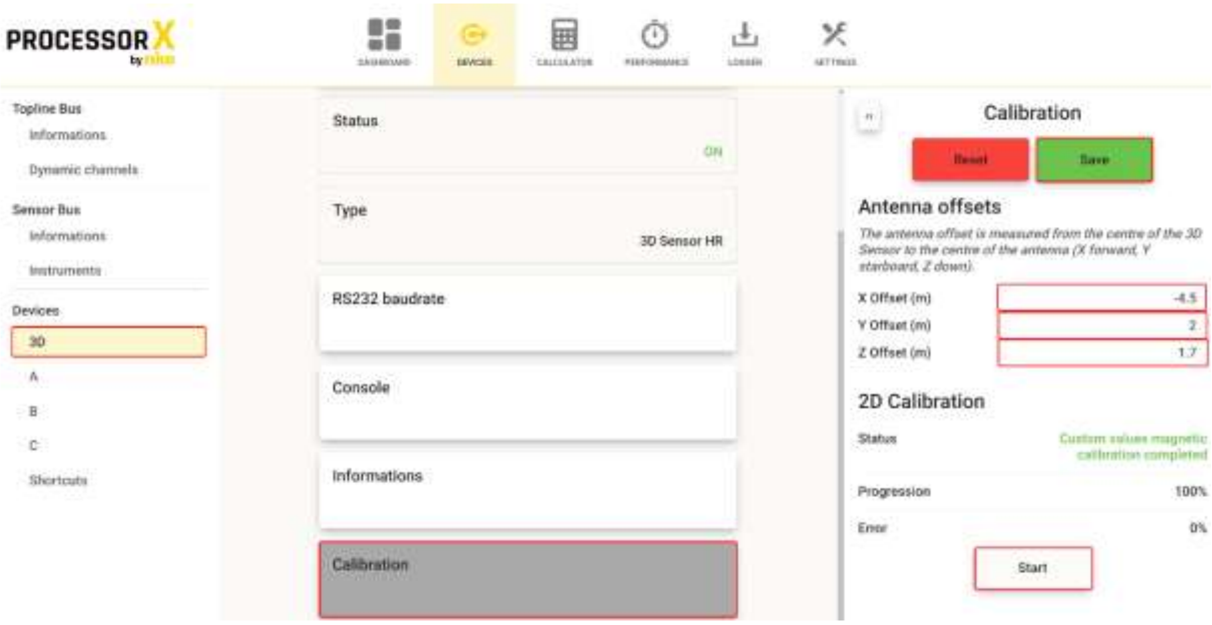
Notice that the sensor was correctly initialised and the calibration was completed. The webpage also provides information on the number of satellites used and the precision of the position.

Next, you can check that you are correctly receiving the data from the sensor by clicking on the "Data" tab of the 3D Device.

8.2.1.3 *Calibrating the sensor*

To calibrate the sensor, you need to click on the "Calibration" tab of the 3D Device.
Enter the position of the antenna on the boat according to the X, Y and Z axes. The X axis is set towards the front of the boat, Y toward starboard and Z towards the keel.
After entering the position of the antenna, click "Save".

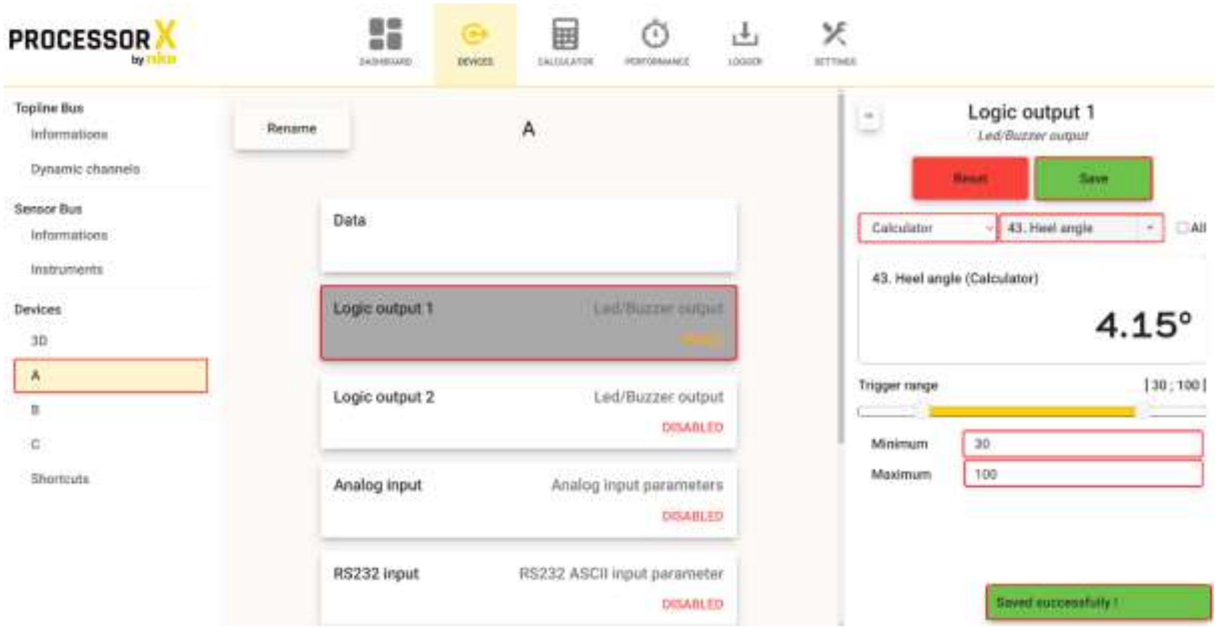
To calibrate the sensor, click "Start" in calibration and refer to the user manual for the 3D sensor to follow the calibration steps.



8.2.2 Using the logic outputs

You can individually enable 4 logic outputs, which enables you to enable elements such as: a buzzer, an indicator light or a relay. These outputs are enabled through a variable for which you select a range of activation for the output.
Once the logic output is properly configured, its status must switch to "READY".
Its status switches to "ON" when the activation criteria is reached and the output is triggered.

NOTE: These outputs are "open-drain" with a current limitation of 300mA.
Let's now take another use case. We want to enable the logic output for Device A when the heel exceeds 30 degrees. For our example, the logic output is connected to a buzzer.
Go into Device A on the webpage and click on "Logic output 1" to configure it.



The upper limit set to 100 degrees is irrelevant in this situation.
Once the logic output is activated, its status may either be "Ready" (out of range => output disabled) or "ON" (in the range => enabled). The status is updated once you refresh the webpage.

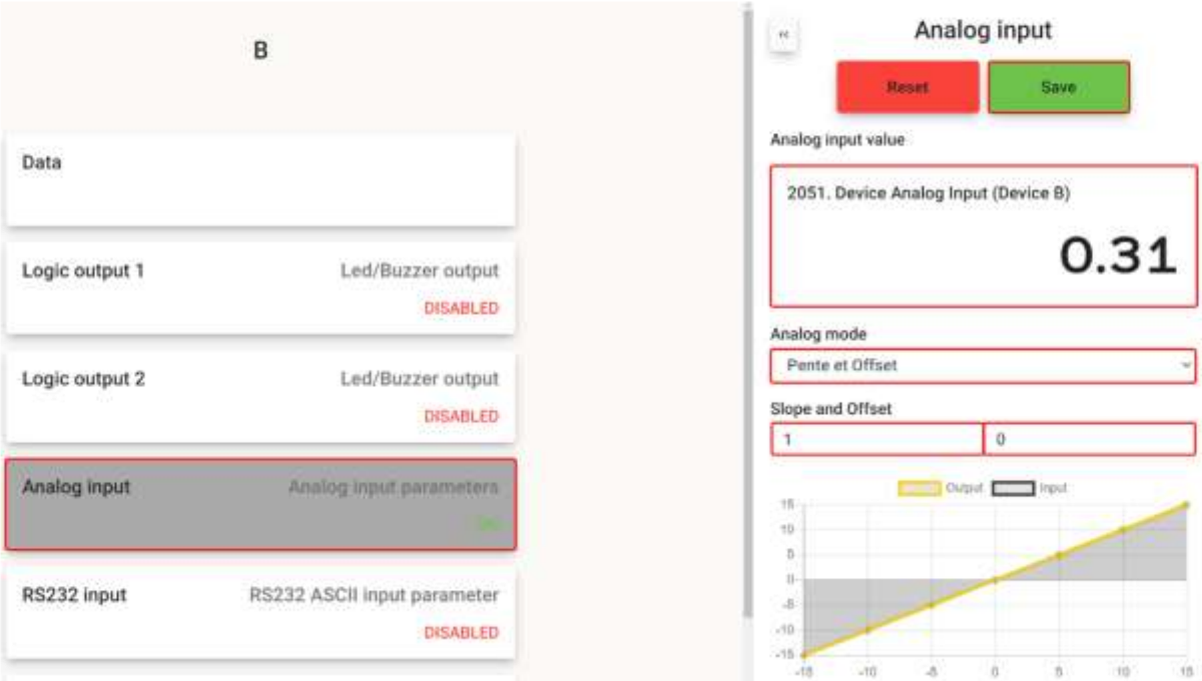
8.2.3 Using the analog input

It is possible to configure an analog input with the possibility to set a slope and offset. To process the data (filtering, linearisation, conversion, etc.), you need to run a custom calculation first.

The analog input is acquired at 25Hz.

Once the analog input is properly configured, its status must switch to "ON".

Let's take the use case in which we want to receive an analog signal on the Analog input for Device B. You need to go into Device B on the webpage and click on "Analog input", which must be "DISABLED" for now.
Select "Slope and Offset" in the "Analog mode", then input the "slope" and "offset" fields. Remember to save your configuration by clicking on "Save".



In the case above, the analog input was connected to a signal between 0V and 5V.

8.2.4 Using the RS232 input

Data can be acquired in ascii format via the RS232 input. This enables you to analyse the data from a third-party sensor or system.

For a NMEA sensor, you can select the header from the list of standard headers (press $). You can also create your own custom header comprising up to 6 characters.

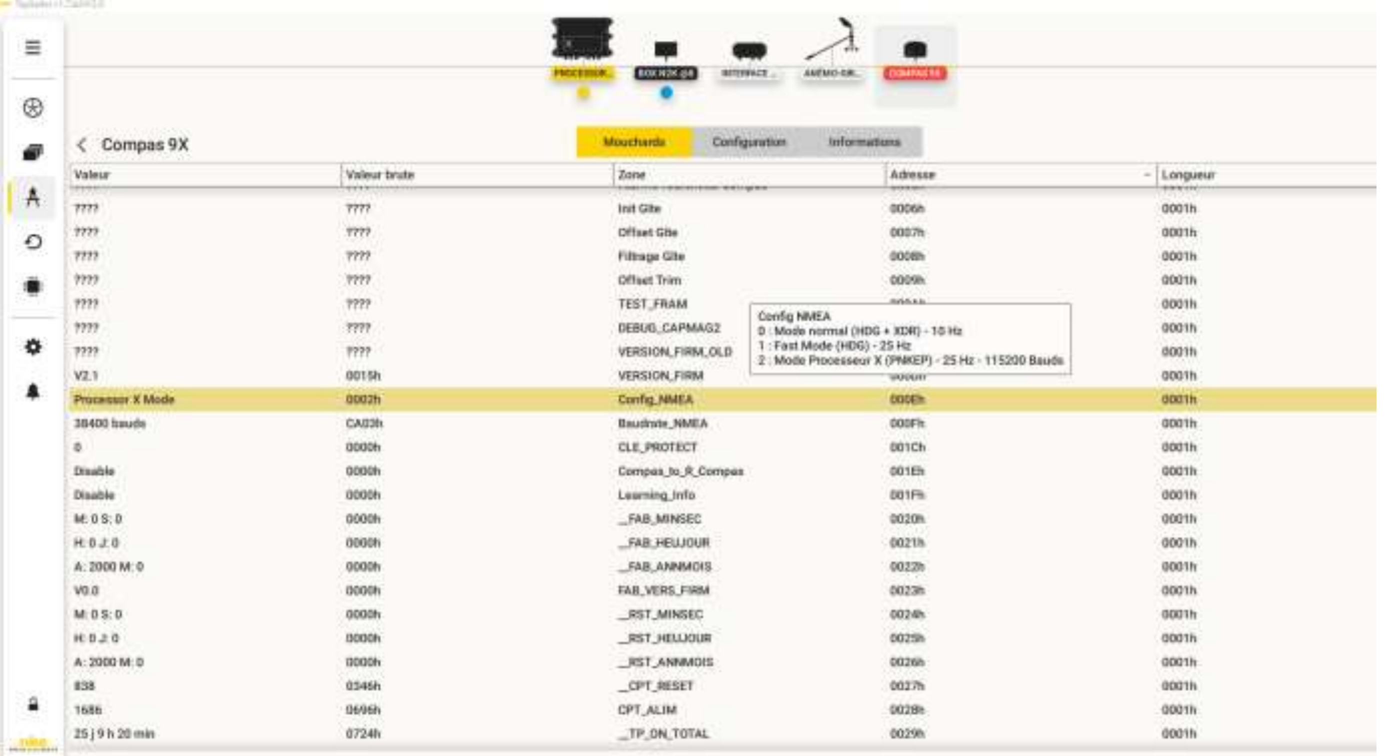
You then need to select the type of variable you want to acquire from the scrolling menu; you can acquire up to 15 variables. Each variable is separated by a coma. You can also ignore some variables by leaving the field on “DISABLED”. The frames are sent at 25Hz.

Once the RS232 input is properly configured and the Processor X is able to analyse the data received, the input status will switch to “ON”.

The “NOT DETECTED” Status indicates the frame was not detected.

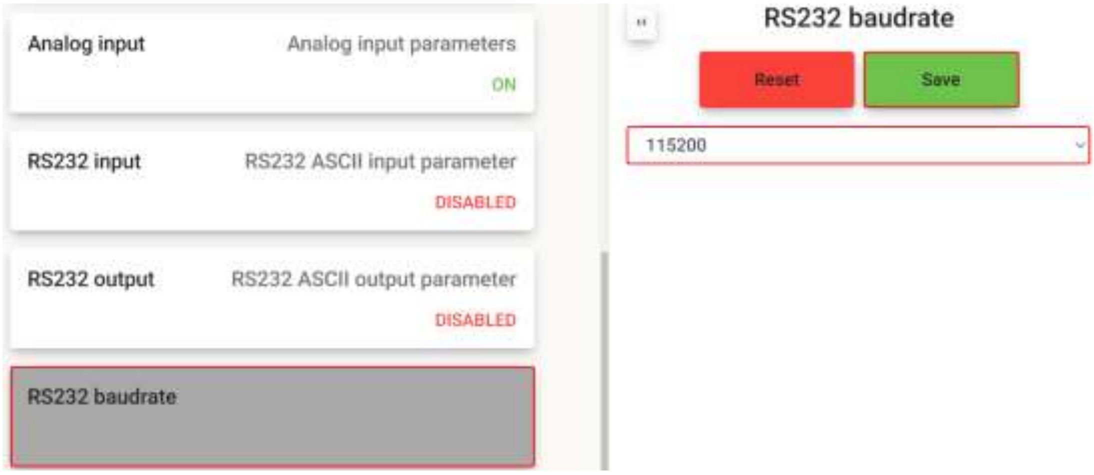
To process the data (filtering or correction), a custom calculation using the acquired variables needs to be run first.

Let's now take the use case where a compass 9X is connected to the Topline bus and we want to connect the NMEA output of the compass to the RS232 input of Device A on the Processor X (to have the compass 9X as a spare for the 3D Sensor HR).
The compass 9X was previously configured to transmit a $PNKEP frame at 25 Hz with a transmission speed of 115,200 baud (see compass 9X user manual)



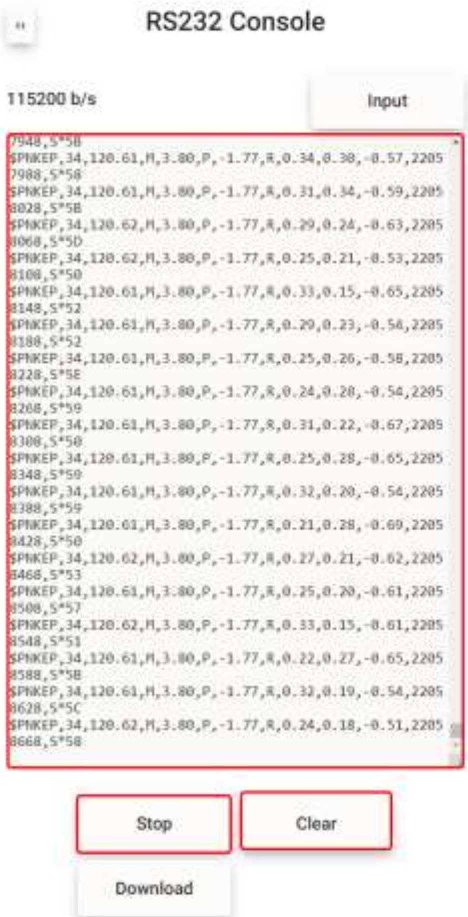
NOTE: By configuring the "Config NMEA" register (formerly called "tracker") in "Processor X Mode" mode, the transmission speed of the compass 9X's NMEA output is set to 115,200 baud. The "Baudrate_NMEA" register value is not used.

You need to go into Device A to configure the RS232 input. Start with setting the transmission speed to 115,200 baud.



Click on "RS232 baudrate", select the transmission speed you want and click "Save". Always remember to check that the message "Saved successfully" displays at the bottom right of your screen.

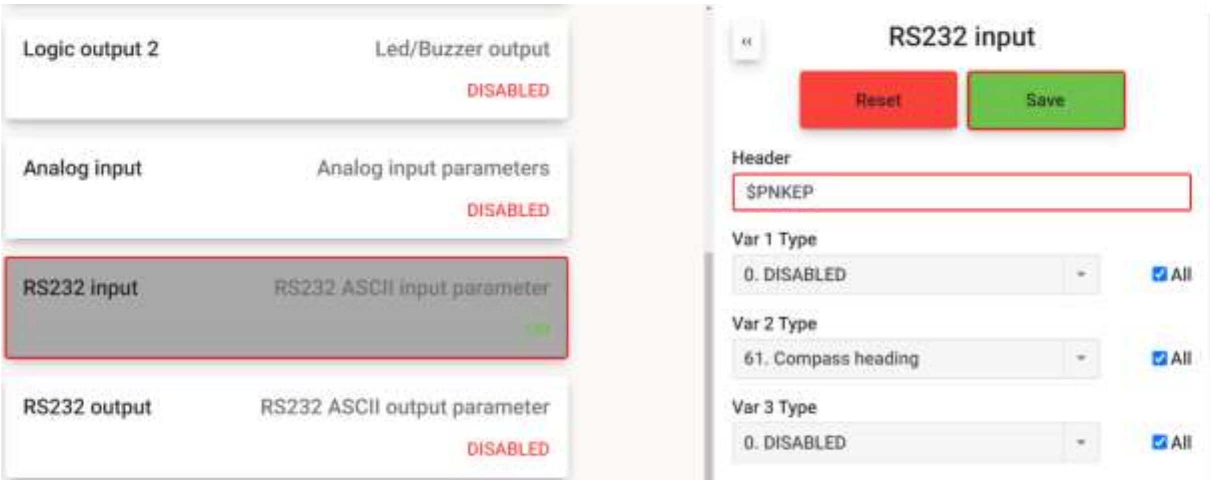
We can now check in the console that we are receiving the $PNKEP frames. The console is a very practical tool to quickly determine if we are receiving the desired data. Click on "RS232 Console".



It may be useful to "clear" the console by clicking on "Clear" to ensure the next data displayed corresponds to the latest data received.

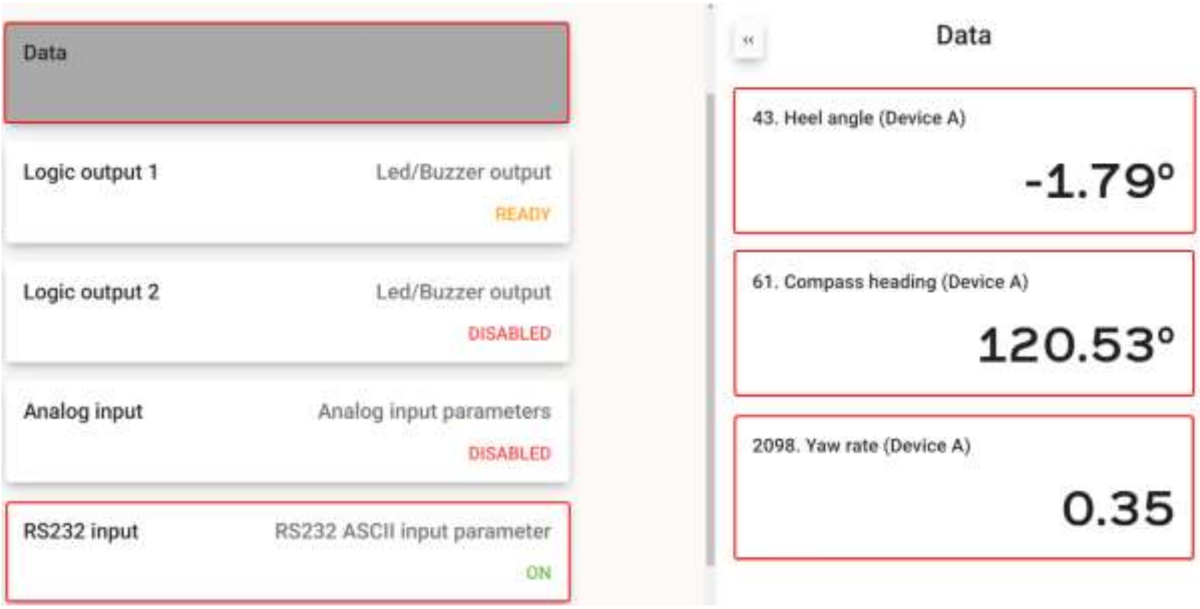
We were able to check we were properly receiving the data from the compass 9X. We will now be able to configure the RS232 input by clicking on "RS232 input". For now, notice the input is "NOT DETECTED" as you have not yet indicated which type of frame you want to receive. This does not mean there is no data to be received (hence the relevance of conducting a quick check on the console).

You need to enter the Header in the frame you want to receive. In our case, it is a $PNKEP. By selecting this frame, the fields corresponding to the different "Var" are automatically input. It is however possible to modify these fields. Notice that the "RS232 input" status has switched to "ON".



Now that the RS232 input is configured, as an example, we have access to a "Compass heading" data from the Device A source.

By clicking "Data" in the Device A, notice the data from the channels supplied by the RS232 input, including for example the compass 9X.

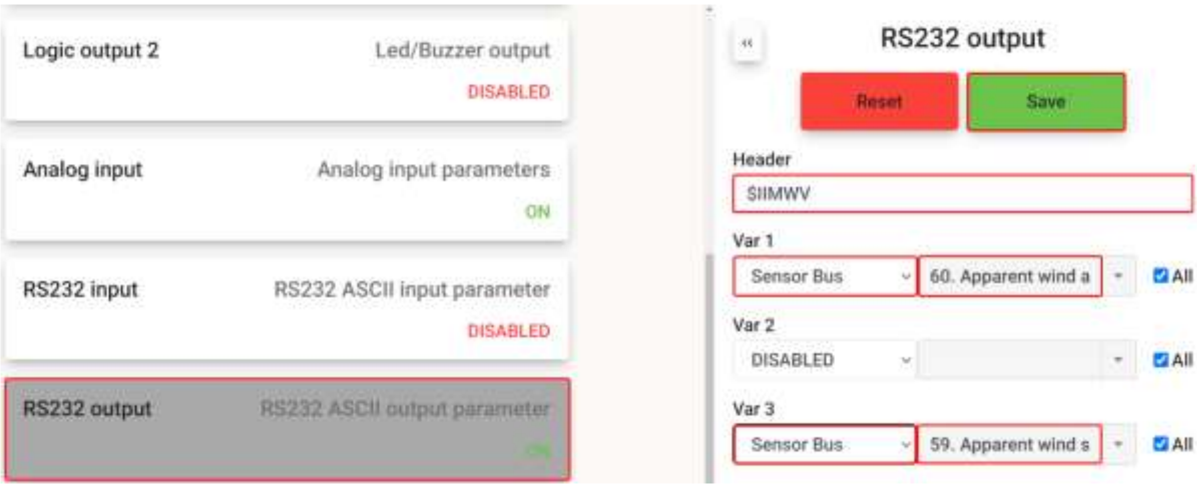


8.2.5 Using the RS232 output

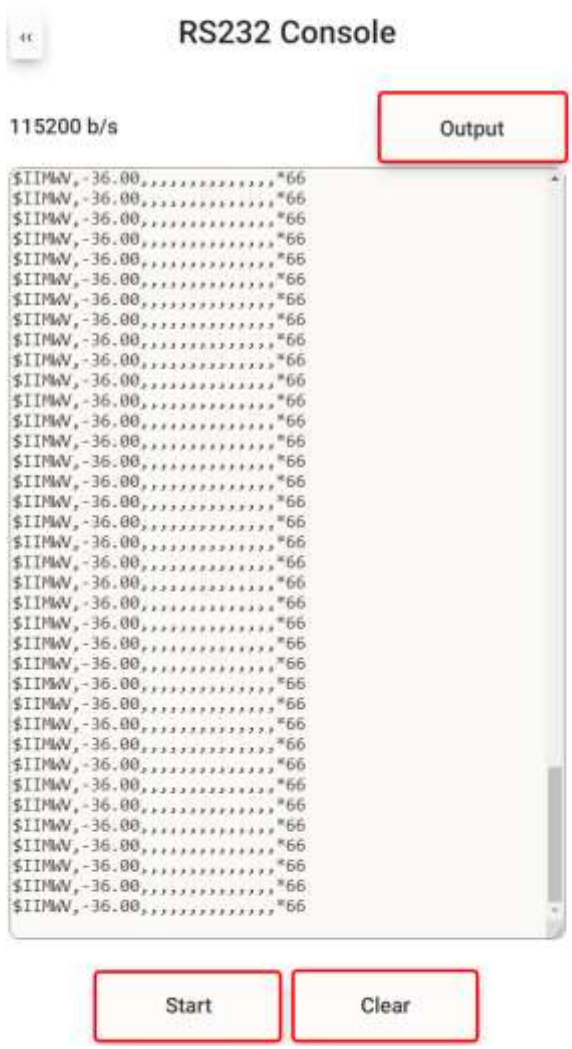
It is possible to issue an ascii frame per customisable RS232 output. To do so, configure the desired header and variables to be issued. Each frame makes it possible to issue 15 variables. The frames are sent at 25Hz.

Once the RS322 output is properly configured, its status must switch to "ON".
The Status switches to "PAN" if no data is available in the frame.

For this use case, we will output a $IIMWV frame which can be used for monitoring.
You also need to enter the header for the frame you want – in this case a $IIMWV.
Save your choice. If the channels linked to this frame are fed (by an HR masthead unit in our case), the status for the RS232 output switches to "ON".



Use the console to check you are sending the right data. Click on "RS232 Console" and configure it as an "Output" to display the data issued.



Notice the $IIMWV frame is properly transmitted.

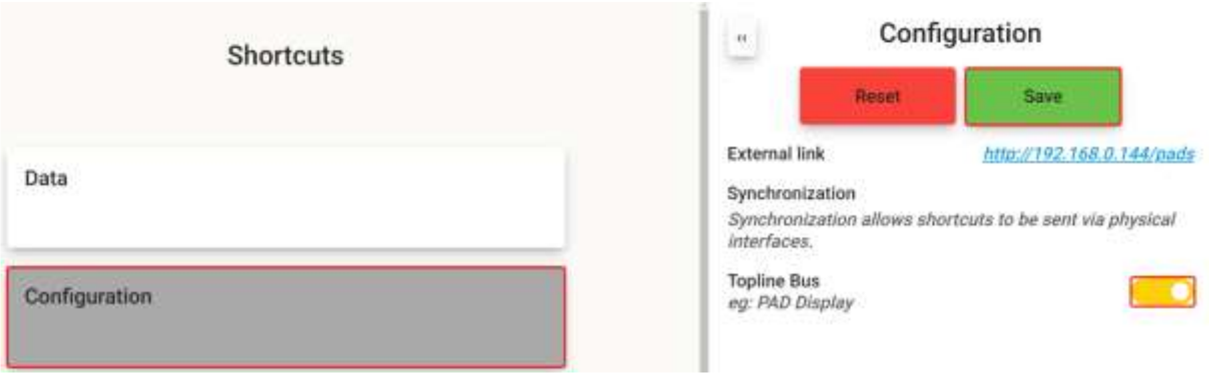
8.2.6 Using Shortcuts

The "Shortcuts" menu makes it possible to configure programmable buttons linked to variables. A button can increment, decrement, assign or toggle the value for a variable. A parameter enables each button to define its operating range.
A same variable can be linked to several buttons to assign different values.
Each shortcut can be named and is then displayed on the Processor dashboard page.
The shortcuts can be linked via the Pads Display and the web keyboard.
The link can be enabled via the Shortcut Configuration menu

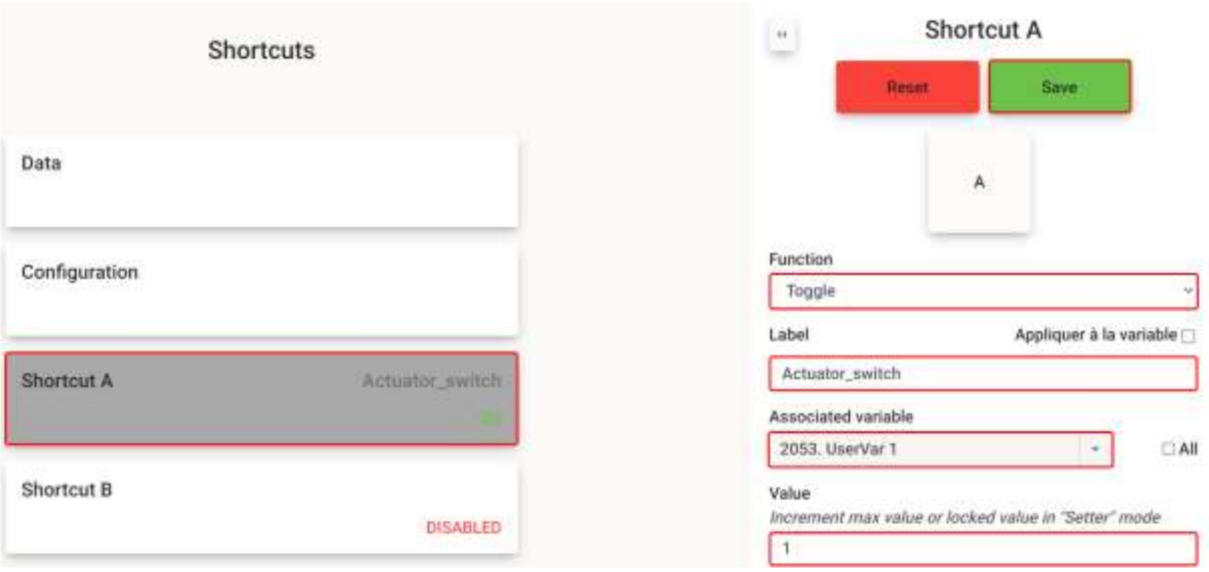
As a use case, we will take the example of a skipper who wants to be able to easily pilot an actuator during changes of tack by using the PAD Display.

To do so, we will configure a Shortcut (Shortcut A) making it possible to toggle a variable (USER VAR1) used to define if a logic output needs to be enabled (Logic output 1 Device A). This logic output pilots the actuator.

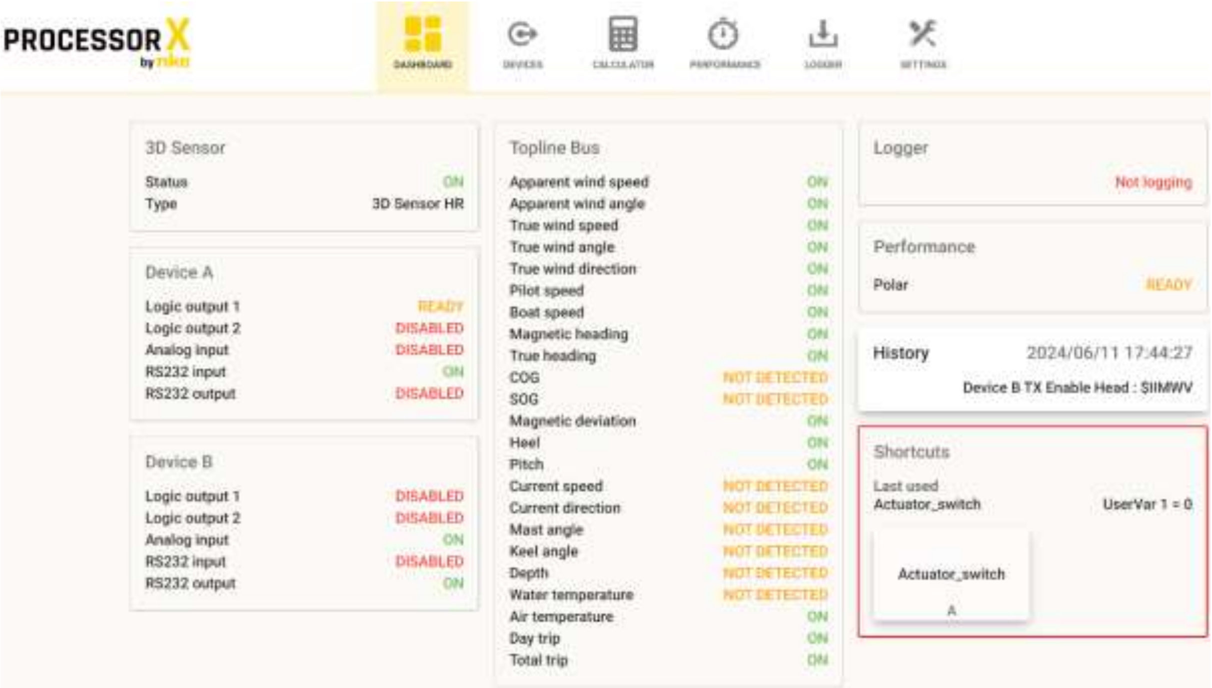
Let's start by configuring the shortcut. Go into "DEVICES" then into "Shortcuts".
Click on "configuration", enable the use of a PAD Display then save.



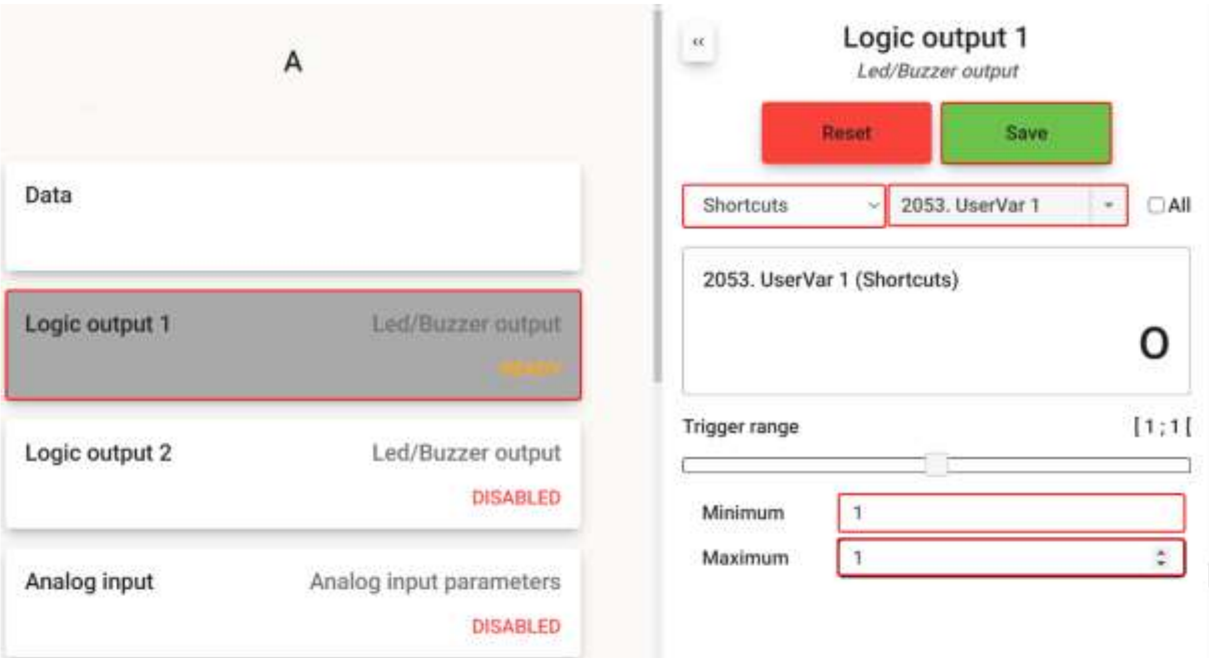
Next, click on "Shortcut A". In "Function" select "Toggle". We will give it the "Label" "Actuator_switch". In "Associated variable" enter "2053. UserVar 1".
Concerning the "Value" field, enter "1". This means the "UserVar1" will toggle between 0 and 1. If you had entered "5", it would have toggled between 0 and 5.
Save your configuration.

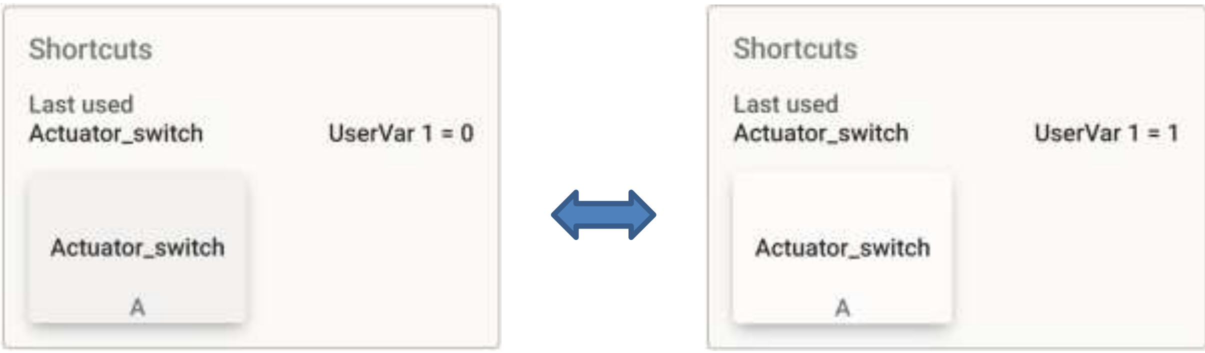


Our shortcut is configured, it is now available on the DASHBOARD.



Notice the dashboard includes a button to use the shortcut. If you click on the "Actuator_switch" button, the "UserVar1" variable will be toggled.
You now need to connect your shortcut to the Device A logic output.
Go into Device A and configure the "logic output 1" for it to use "UserVar1" from the "Shortcuts" source. Select a "Trigger range" that only contains the value 1.



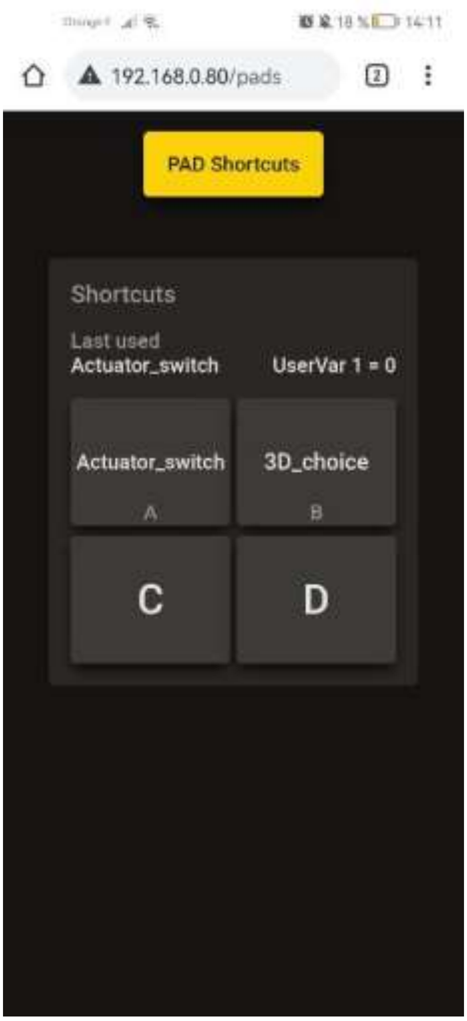


Press the A key on the PAD Display or press the virtual Actuator_switch

You can now control your actuator by pressing the A key on your PAD Display or by pressing the virtual "Actuator_switch" button on the Processor X webpage.

You can view the value for the variable linked to your shortcut by going into DEVICES >> Shortcuts >> Data.

Note that it may be useful to be able to access the Shortcuts from your tablet or smartphone by entering "processor_address/pads" into your browser. In this case, enable a buzzer from your smartphone by clicking on the Shortcut A button. You had also configured shortcut B to change the 3D source.



Other use cases for a Shortcut:

- "Increment" function: this function enables you to increment a variable using the shortcut. In this case, there are two possible uses for the "Value" field. If this field contains a value other than 0 (5 for example), the variable concerned will be incremented by 1 at each use of the shortcut. It will be limited between 0 and 5 included, and reset to 0 if 5 is exceeded. If the "Value" field is equal to 0, there is no set limit, and we are simply limited by the maximum value (3276).
- "Decrement" function: same principle as for incrementation except that we are decrementing.
- "Setter function": This function makes it possible to modify the value for the associated variable by assigning it the value defined in the "Value" field.
- "Toggle" function : see the use case for a change of tack.
- "No Action" function: default case, no action is conducted. This function can be used if you want a shortcut to no longer have any action without needing to reinitialise it. This can also be used as a simple "time marker" for logging, however, there is a tool provided for that purpose (the marks).

Through these different use cases for the Device inputs/outputs, we have seen how to interface data from external elements to the Processor X with the latter.
This data can now be used, by running calculations for example.

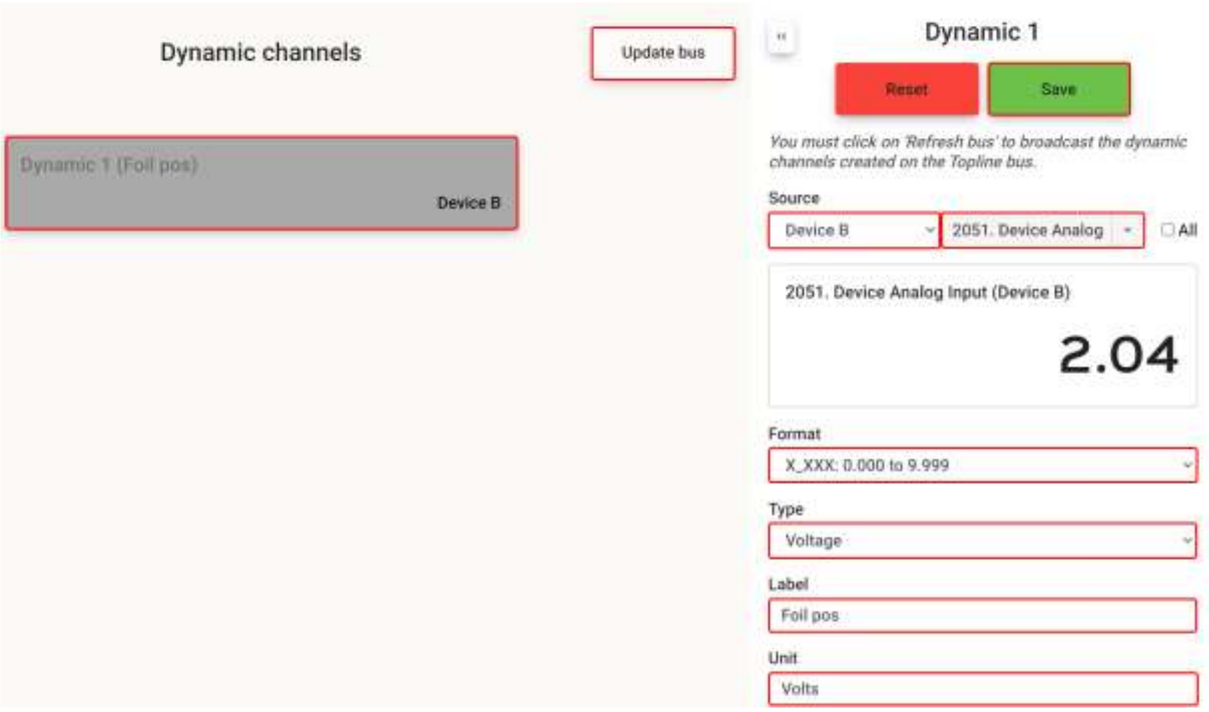
8.3 USING THE DYNAMIC CHANNELS

It is possible to configure up to 16 dynamic channels with the Processor X.

8.3.1 Use case

Let's take the example of a configuration where we want to have a "foil position" channel. This measurement comes from a 0-5V sensor connected onto Device B.
Start by configuring the analog input for the Device B port (refer to the section explaining Device configuration). In our case, we will choose to connect this analog input to a "Device Analog Input" data type

We can then configure our dynamic channel.
Click on "Dynamic channels" in the "Topline Bus" section and add a new dynamic channel. Click on this channel to configure it. Configure "source" with "Device B" and "2051. Device Analog Input".
For the format, choose the "X_XXX : 0.000 to 9.999" format for the "Voltage" type, for the Label enter "Foil pos" and for the unit use "Volts" (raw position sensor measurement).
Save your configuration and update the bus by clicking on "Update bus".



Our dynamic channel "Foil pos" is now available on our Topline bus.

8.4 USING THE CALCULATIONS

A calculation requires to define an output variable, and may include up to 5 input variables and 3 operators.
The output variables are connected to the Calculator or Processor sources of the variables list.

The webpage makes it possible to:

- Select the input data, the operators and the output data
- Visualise the calculations
- Adjust the different calculations (correction tables, formula, value, source selection).

8.4.1 The operators

The calculations are adjusted through the operators provided per calculation.
Operators are available to select, calculate, filter or apply tables.

8.4.1.1 *Selector*

A selector can be applied to the 1st operator.
The input data is selected according to the status or a third-party variable, either by configuring thresholds or manually.

8.4.1.2 *Formulas*

A formula can be applied to one of the 3 operators.

The basic mathematical formulas are: addition, subtraction, multiplication, division and creation of a constant. An optional modulo 360 calculation for angles is available.

When the formula is applied to the 1st operator, the operation is conducted between several sources.
Example: division conducted with source 1 as the dividend and sources 2, 3, 4 and 5 as divisors.
A constant can be associated to the operator (offset or slope, etc.).

8.4.1.3 *Filtration*

A filter can be applied to one of the 3 operators.

It is possible to simply filter with a constant in seconds – the sources 2, 3, 4 and 5 do not have any impact.

For dynamic filtering, a filtration table can be applied to obtain a variable filtering according to the table input parameters. The filter is interpolated on the x and y axes, except for true and apparent wind calculations, where the correction is interpolated on the y-axis but not on the x-axis, where 3 sectors are possible from 0 to 180 degrees. The sources 2, 3, 4 and 5 do not have any impact.

8.4.1.4 *Tables*

A formula can be applied to one of the 3 operators.

The table enables you to correct the input data according to the table input parameters. The correction is interpolated on the x- and y-axes, except for true and apparent wind calculations, where the correction is interpolated on the y-axis but not on the x-axis, where 3 sectors are possible from 0 to 180 degrees. The sources 2, 3, 4 and 5 do not have any impact. The y-axis input source can be disabled to conduct a linear correction.

8.4.2 The standard calculations

8.4.2.1 *True wind speed, True wind angle, Apparent wind speed, Apparent wind angle*

For these standard calculations, we find a correction per table. This is a table interpolated on the y-axis with 9 values. There are 3 fixed corrections on the x-axis to be divided into 3 sectors from 0 to 180 degrees. Input variables different from the source to be corrected can be selected from the table, they must imperatively be configured in order for the correction to be effective. Only the first calculation source is required.

8.4.2.2 *Pilot speed*

This calculation makes it possible to select the source for the boat speed. By default, this can be run per priority, according to the sensor status. It may also be interesting to configure a selection of the source according to the bottom speed, we could thus use the surface speed at low speeds, when the boat is not on-plane. By default, we prioritise in source 1 the surface speed drawn from the surface speed calculation, in source 2 the surface speed directly from the Topline or Sensor bus according to the bus configuration, and in source 3 the bottom speed from the Topline bus.

8.4.2.3 *Surface speed*

This calculation makes it possible to select the source for the boat surface speed. By default, this can be run per priority, according to the sensor status. It may also be interesting to configure a selection of the source according to the heel when the boat is equipped with a port and starboard sensor. It can also be interesting to correct the sensor linearity via the table.

8.4.2.4 *Heading*

This calculation makes it possible to select the source for the compass. By default, this can be run per priority, according to the sensor status. It is also possible to correct the compass measurement via a table.

8.4.2.5 *Heel and pitch*

These calculations make it possible to select the source for the heel and pitch.

8.4.2.6 *Apparent wind correction*

This calculation makes it possible to dynamically correct the apparent wind measurement (de-noising) according to the boat attitude. It is possible to select the source for this input data, adjust the wind filtering and the attitude filtering.

8.4.2.7 *True wind calculation*

This calculation makes it possible to calculate the true wind according to the apparent wind and the boat speed. The input data source can be selected.

8.4.3 The custom calculations

There are 10 custom calculations, which enable the user to create variables.
These variables can be linked with the other calculations.

The default tables are a calculation over two inputs, either in linear correction mode or in dual-input correction mode. You can switch from one mode to the other by filling the table. The value needs to be erased to disable a box.

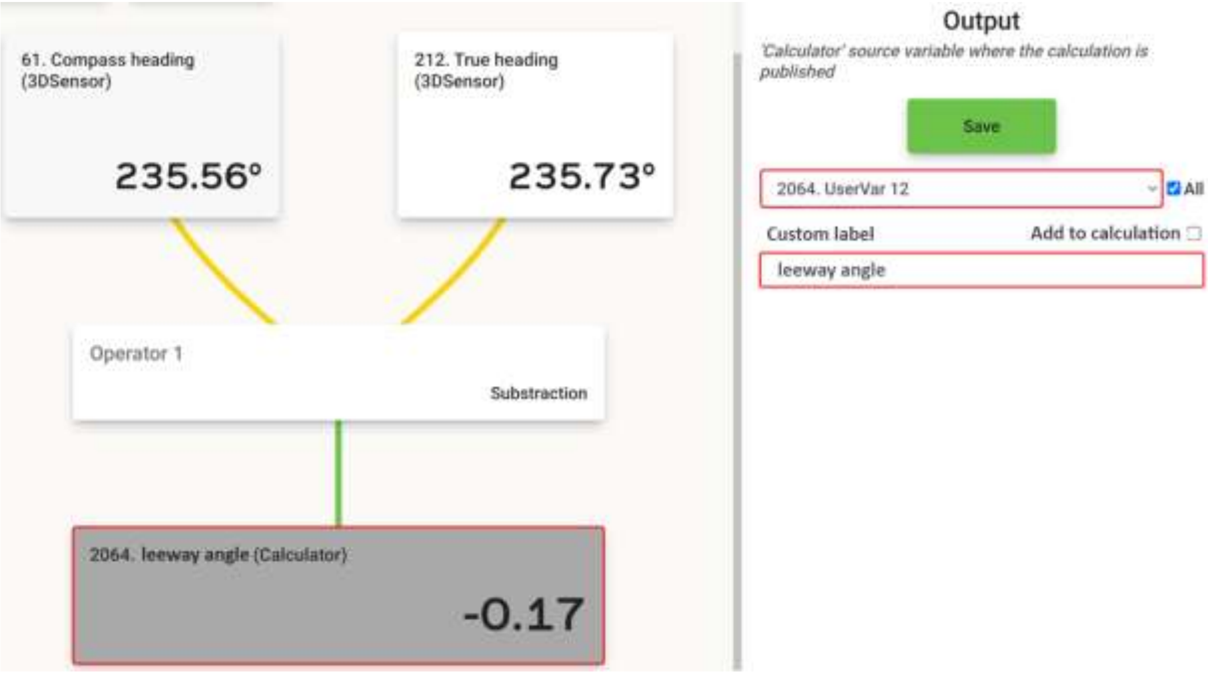
8.4.4 The constants

A constant source makes it possible to create 16 “UserVars” variables to integrate them as calculation input data.

8.4.5 Using the UserVars in the calculations

The “UserVars” are very useful to store calculation data you have created. By running User calculations (custom), you might need new types of data that do not exist. This is where UserVars come in, they enable you to process both your own types of data as well as traditional types of data.

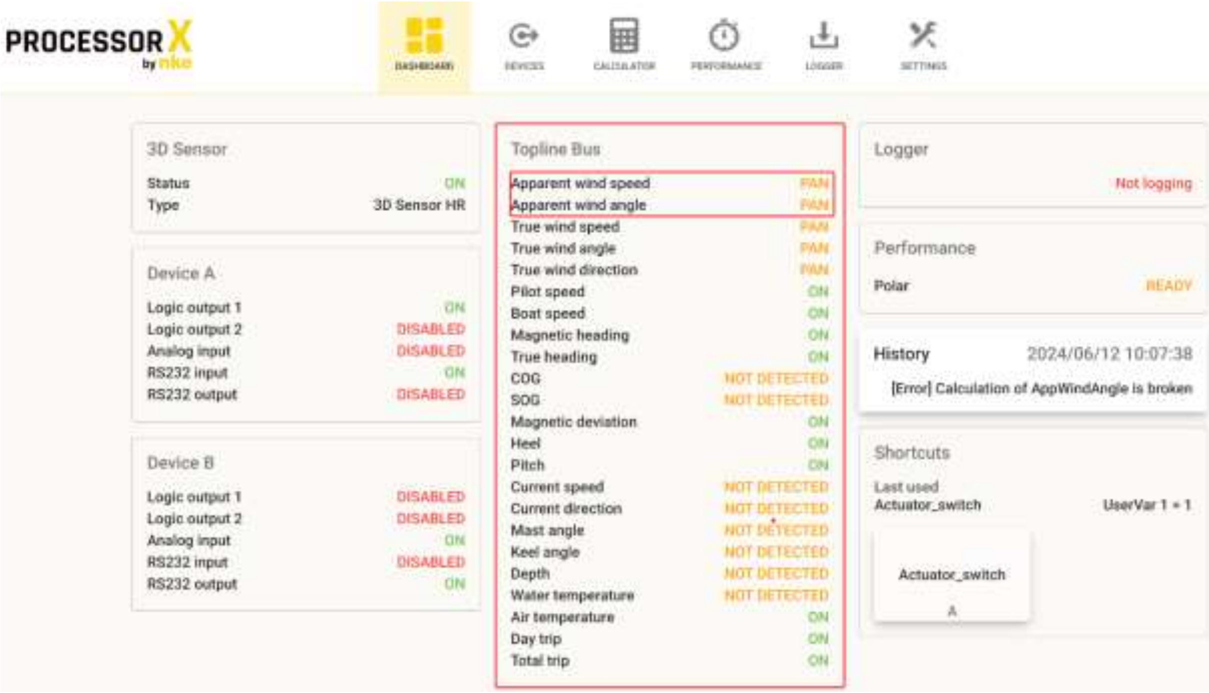
During the creation of your calculations, you can rename your "UserVars" with labels adapted to your situation. In the following example, we renamed "UserVar 12" (channel 2064) as "leeway angle" in the "Leeway angle" calculation.



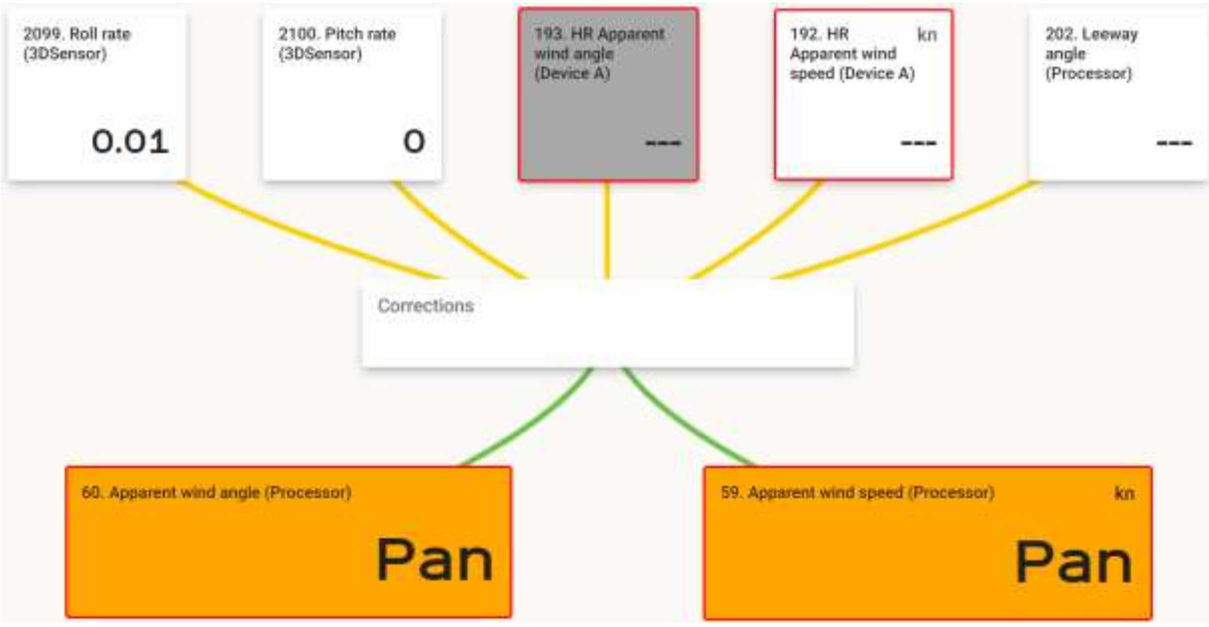
8.4.6 Use case

8.4.6.1 *Understanding why a data item linked to a Processor calculation has failed*

Let's take the case where we notice the de-noised apparent wind data has failed on the dashboard

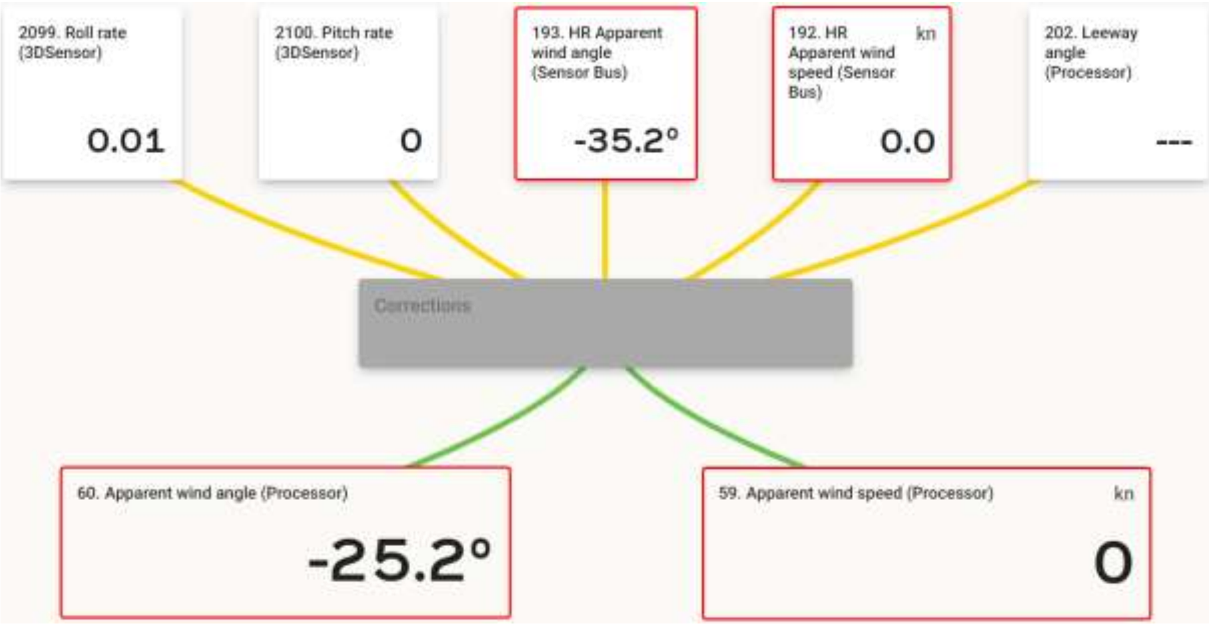


To understand why we do not have the de-noised apparent wind, we need to go into "Calculator" then into "Apparent wind correction".



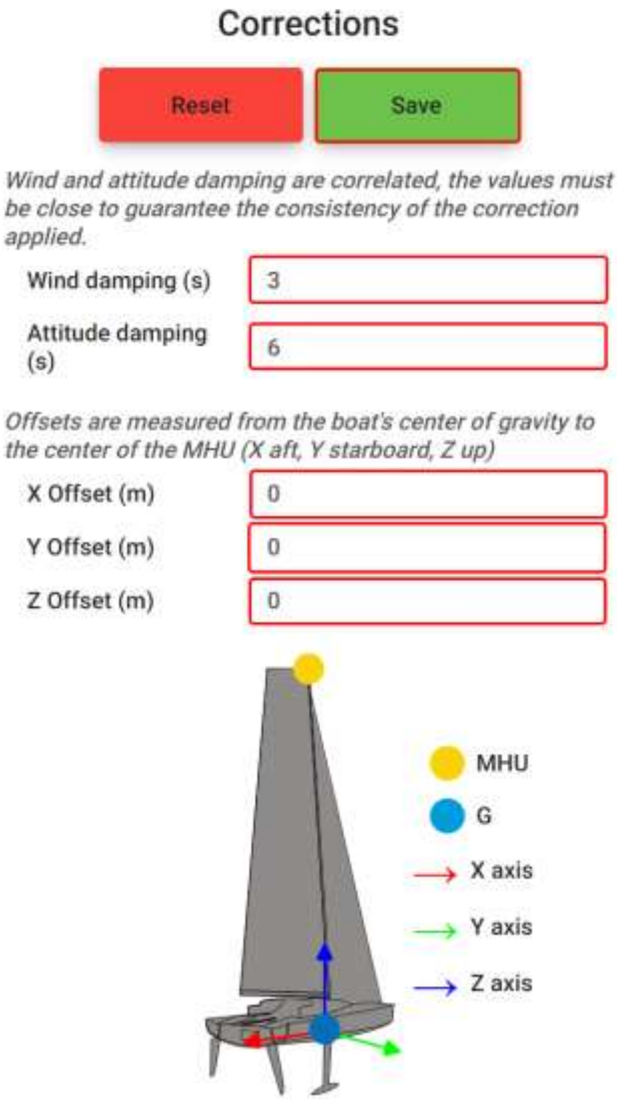
Straight away, we observe that the corrected apparent wind angle and speed channels are in PAN, and this is due to the fact that there is no raw wind data at the calculation input. This is a Processor calculation, and as we have seen previously, these calculations cannot be modified by the user. The latter can only input the sources.

Thus, we need to check our wind data source. Notice we are requesting the Processor to conduct a wind de-noising using wind data (channels 192 and 193) from the Device A source. The HR Masthead Unit is connected to the Sensor bus, meaning this data is not available on the Device A source.
By using wind data from the Sensor bus source, we will find de-noised wind data. Note that the apparent wind de-noising algorithm can operate without leeway angle data.



8.4.6.2 *Configuring the apparent wind correction (de-noising)*

Concerning the apparent wind de-noising, we want to be able to configure filtering (for the IMU and Masthead Unit) and position parameters of the aerial compared to the boat's centre of gravity. To access these parameters, you need to click on the "Corrections" block



The filtering parameters are available along with the “Wind damping” and “Attitude damping” fields.

It is important to keep certain consistency between the IMU filtering and that of the aerial. The de-noising algorithm applies corrections at a given time t according to the wind and movement data. The larger the damping parameters entered, the more the applied filters induce a significant delay. Entering very different damping values between the IMU and aerial introduces a time inconsistency. The boat movement measurements no longer correspond to the apparent wind variations measured.

Enter the aerial position by inputting the X Offset, Y Offset and Z Offset fields.

It is important to enter the aerial position correctly as it defines the lever arm between the WD and the aerial. The bigger the lever arm, the more the boat movements induce strong apparent wind variations for the aerial.

To deactivate the wind de-noising, enter 0 for X Offset, Y Offset and Z Offset.

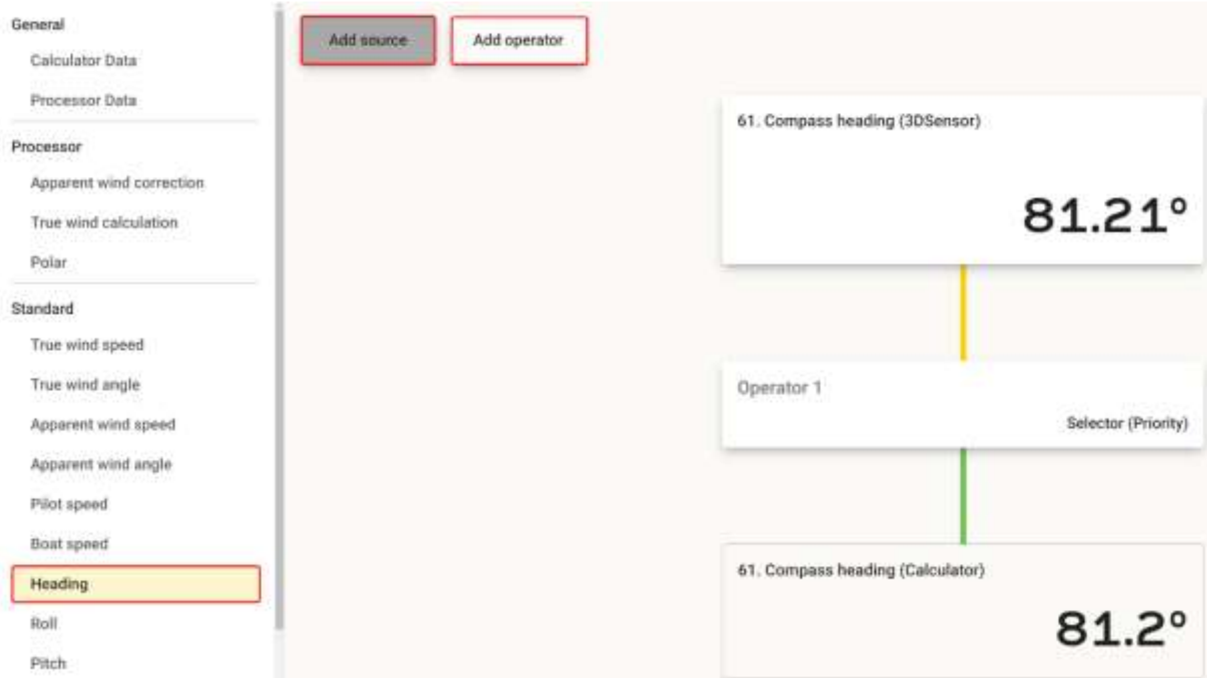
8.4.6.3 *Using the selector to be able to use the compass 9X as a spare for the 3D Sensor*

For this use case, we want to use the 3D Sensor HR as a main IMU and the compass 9X as a spare IMU.

The 3D Sensor HR is connected to the 3D Sensor Device and the compass 9X is on the Sensor bus.

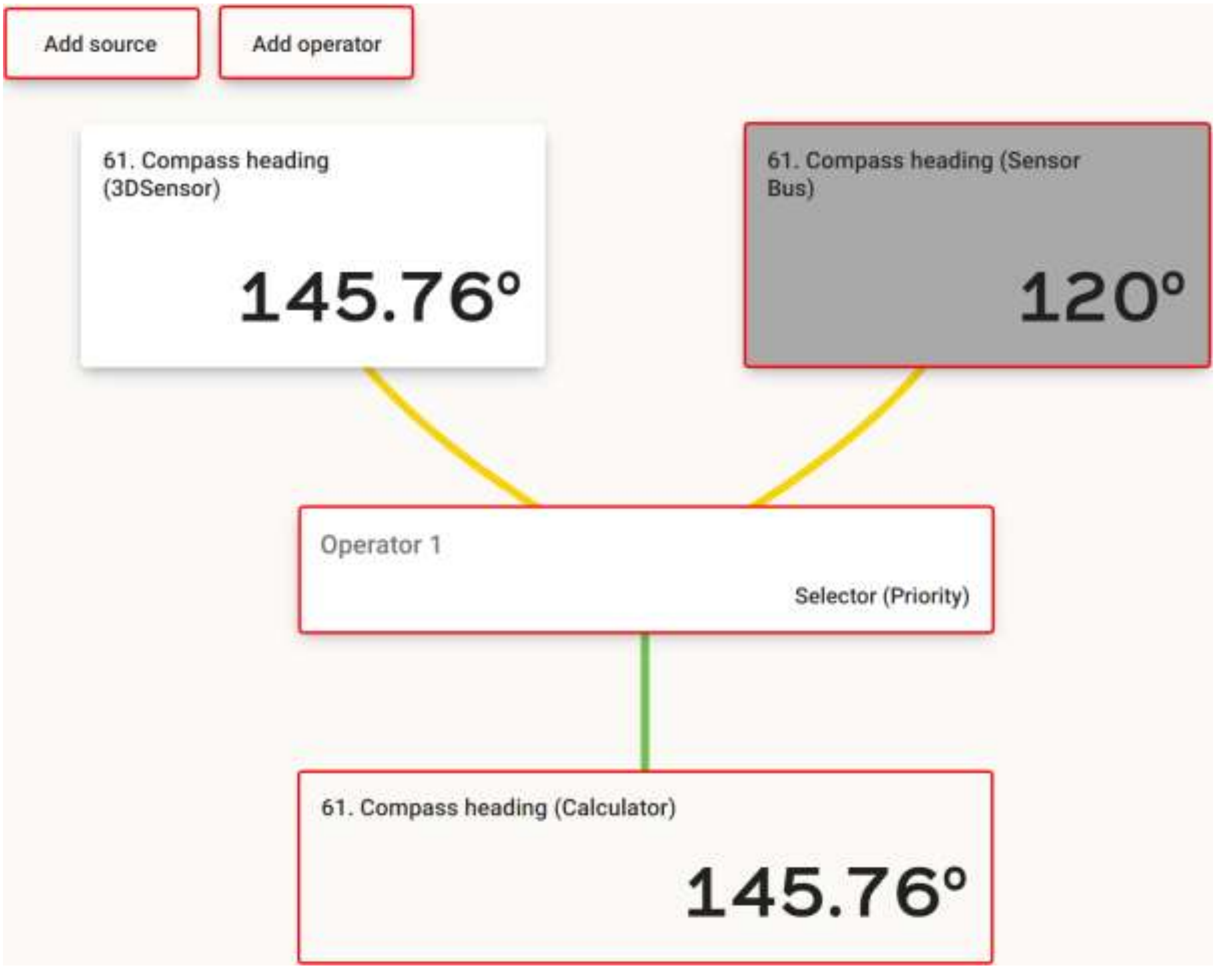
We will configure the standard "Heading" calculation to use the 3D Sensor HR as the main source and the compass 9X as spare.

Go into the "CALCULATOR" module and click on the standard "Heading" calculation.



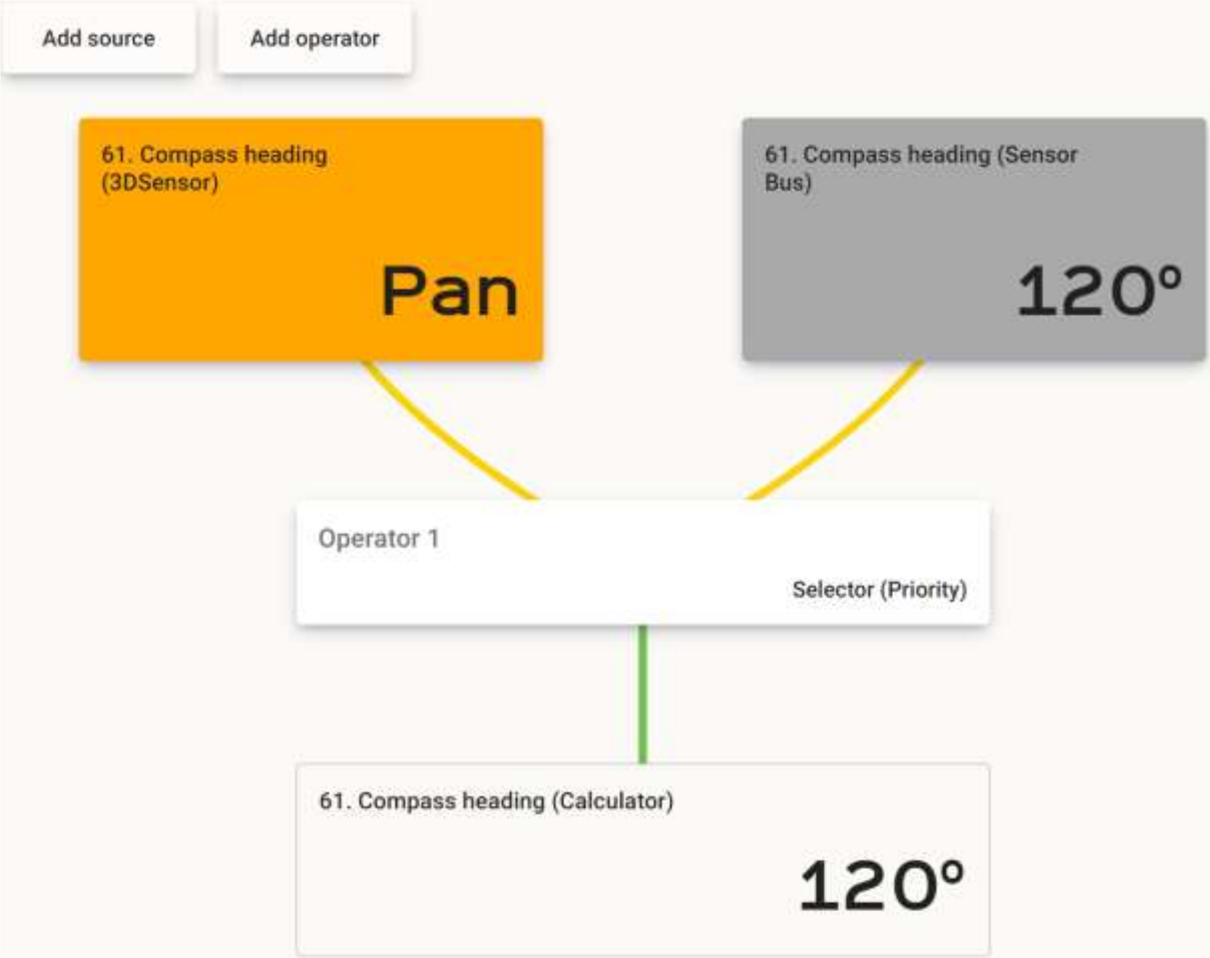
Notice that a default calculation is defined.

There is a selector operator (priority) with a "compass heading" type input data, with the "3DSensor" source. The output data is of "compass heading" type, with the "Calculator" source. Currently, there is no selection as there is only one source available for the operator input. We will therefore click on "Add source" to add another one. Click on the new source to configure it. As the compass 9X is on the Sensor bus, we will therefore enter a "Sensor bus" source with a "Compass heading" type of data. Click on "save".



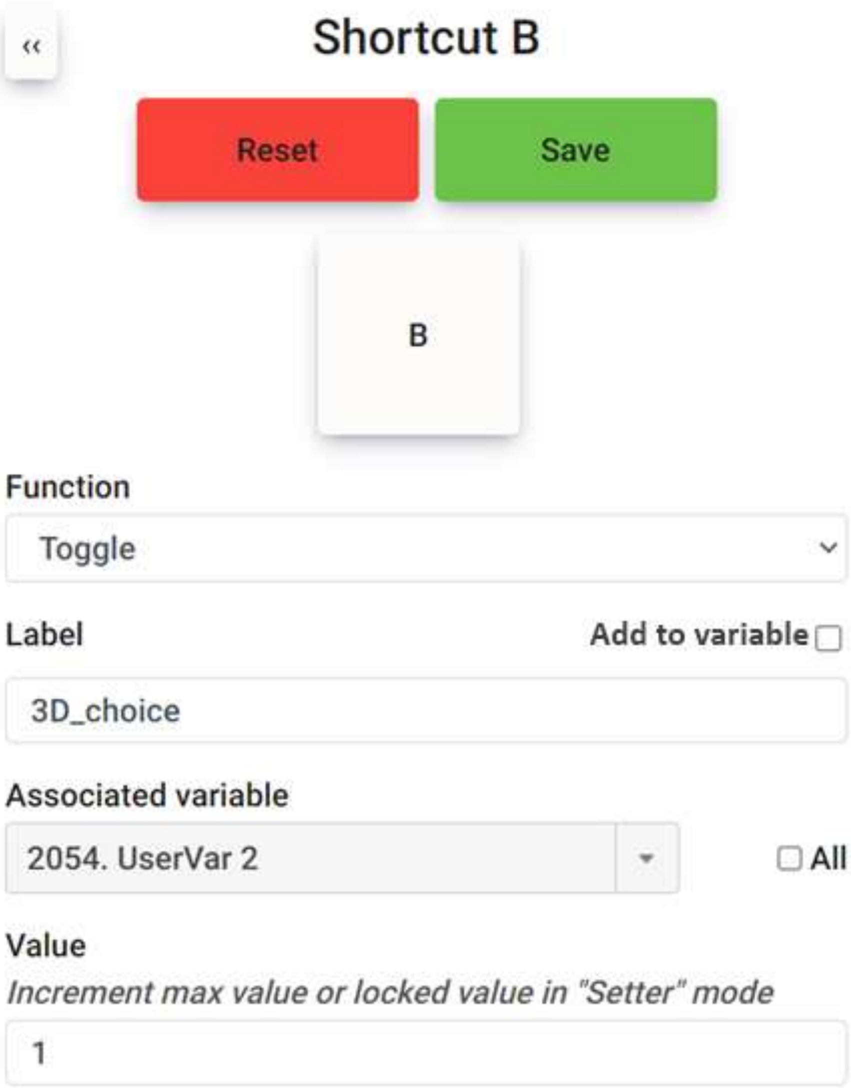
The operator is of selector type and is in priority mode. This means it will feed the output data with the first valid data source starting from the left. In our case, the heading stemming from the 3D Sensor HR is selected.

To test our selector is working correctly, physically disconnect the 3D Sensor HR from the Processor X.



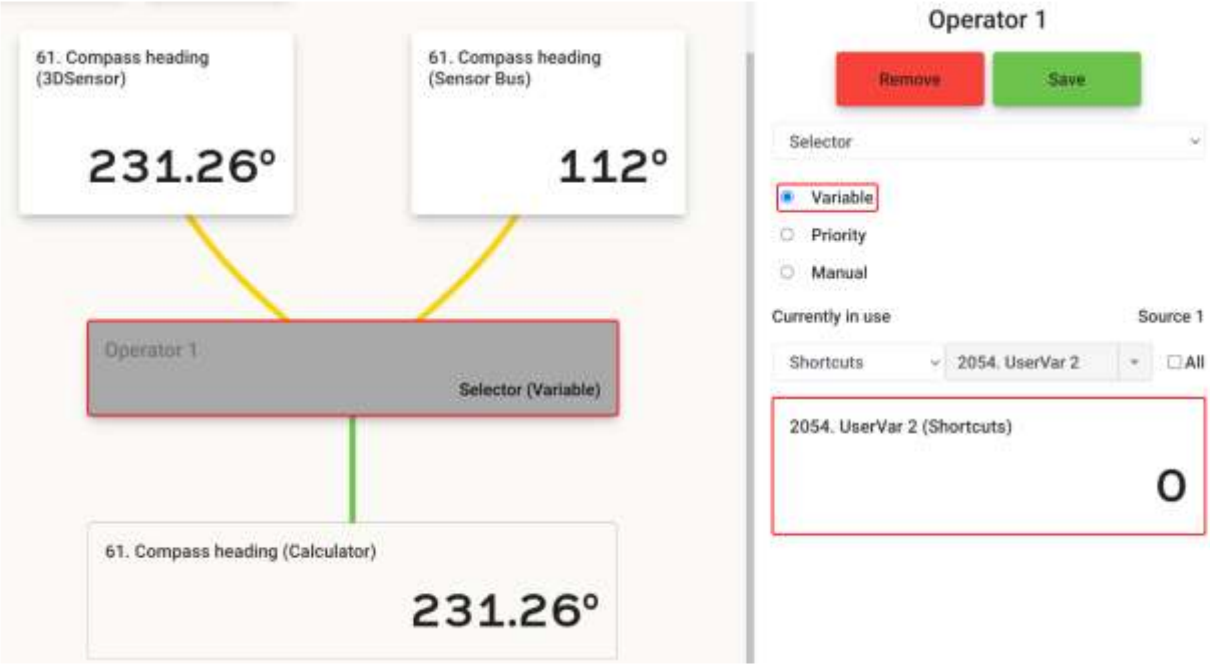
There is no more data from the "3DSensor" source, hence the display of the "pan" message. Observe that the selector is now feeding the "Compass heading (Calculator)" output data with the heading data from the compass 9X.
Click on the selector to change its operating mode. We have just tested the "Priority" mode, there are also the "Variable" and "Manual" modes

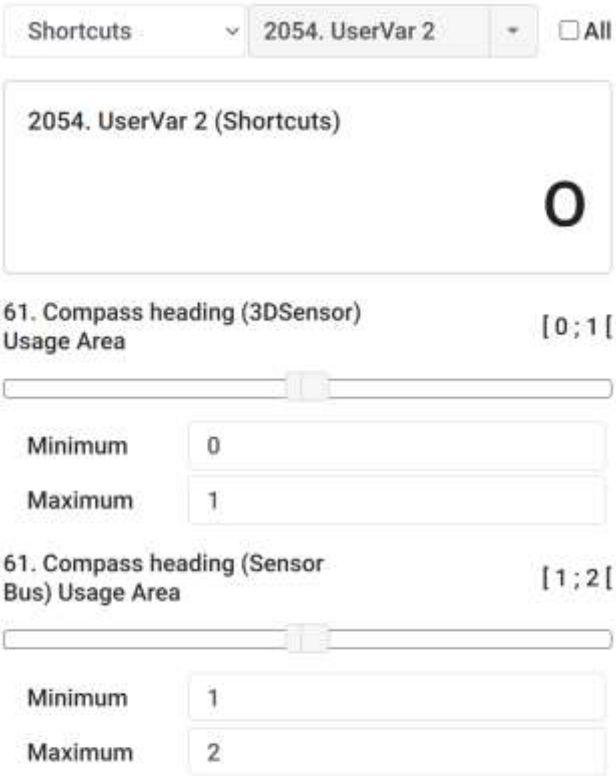
For the "Variable" mode, let's take the use case where the skipper would want to be able to change the compass source by pressing the B button on their PAD Display.
To do so, we will configure Shortcut B for it to toggle the UserVar2 value between 0 and 1 (see Shortcut application case).



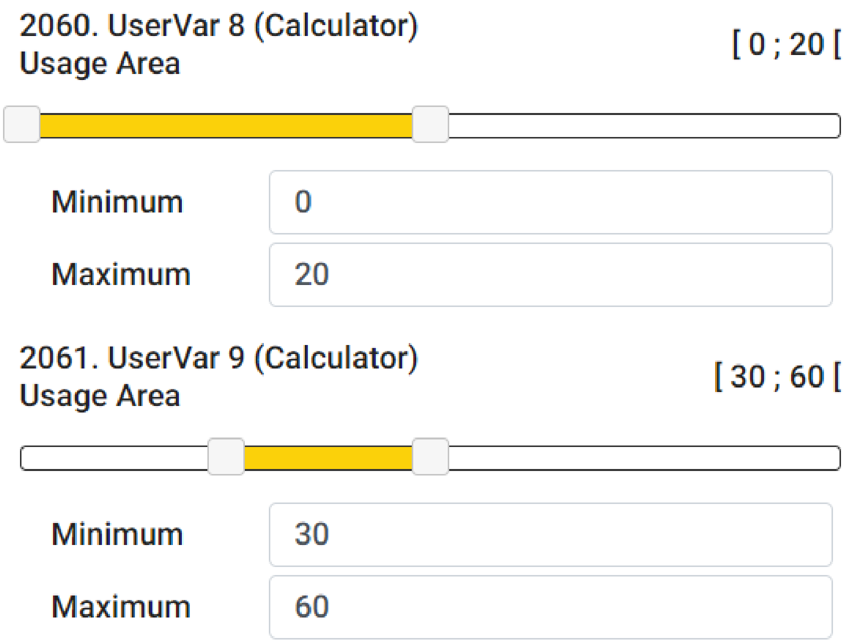
Now, the "Heading" calculation operator needs to be configured as "Selector (Variable)" mode.

Click on the operator and configure it as "Selector" in "Variable" mode.
Indicate the variable used – in our case it is a "USERVar2" data type with the "Shortcuts" sources. The variable must display below.
Next, define the ranges of use. We have defined a shortcut that toggles the "USERVAR2" variable between 0 and 1. We will get the 0 value to correspond to selecting the heading on the 3D Sensor HR and the value 1 to choosing the heading given by the compass 9X.
Note that the value entered in the min limit is included in the set range, whereas the value entered in the max range is excluded (range: [min ; max [ ).
We will therefore obtain the following configuration:

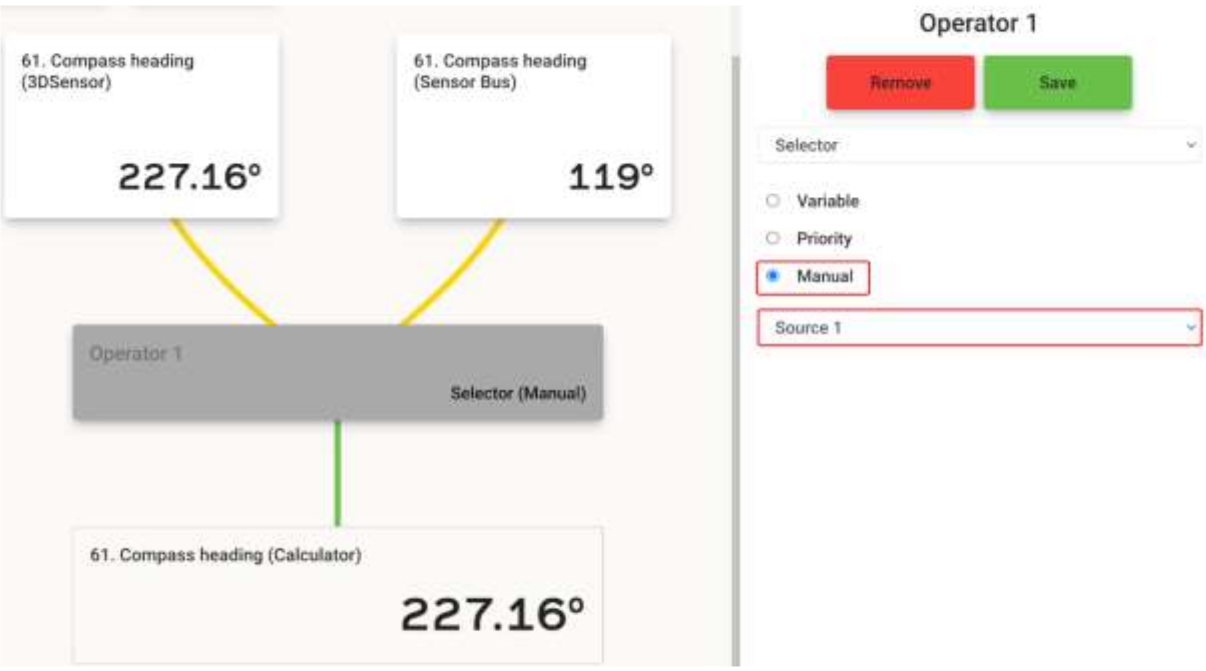




NOTE: We will need to use a Selector (variable) to select per hysteresis variable. To create a hysteresis, leave a margin between the different thresholds, which corresponds to the hysteresis, in the following case, a trigger threshold of 10 units:



The third selection mode is the manual mode.
Click on the selector and configure it in manual mode. You can then manually set the source you want to use.



In our case, we want to use the 3D Sensor HR as the main source, meaning we manually set the selector on source 1.

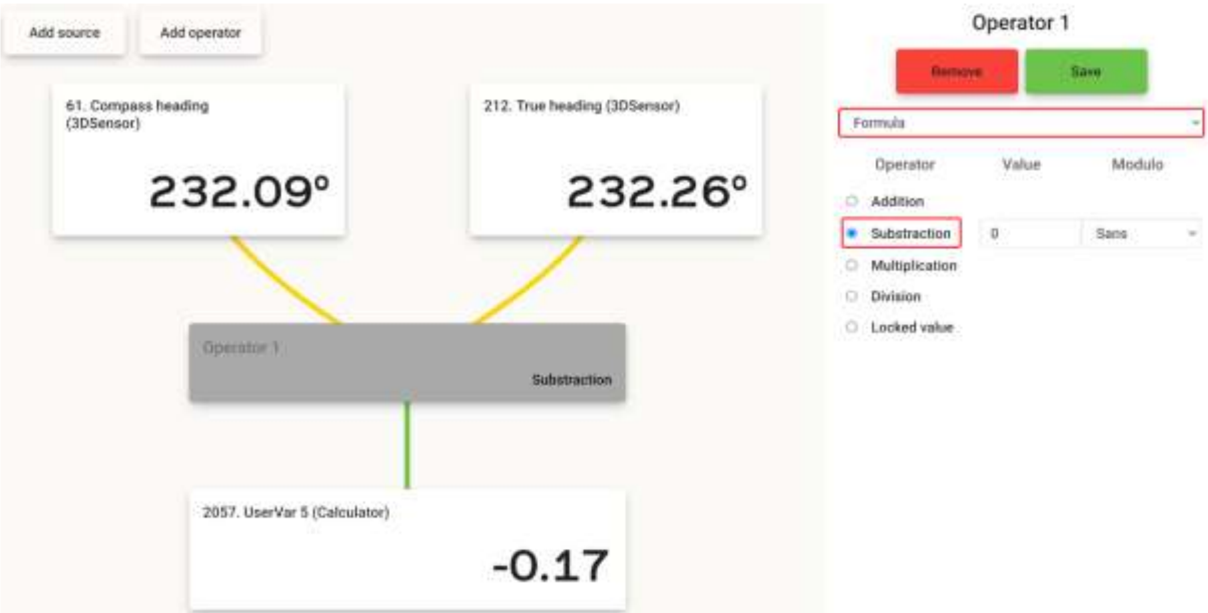
8.4.6.4 *Using a formula to calculate the leeway angle.*

We will now create a leeway angle calculation that may be used to calculate the apparent wind.

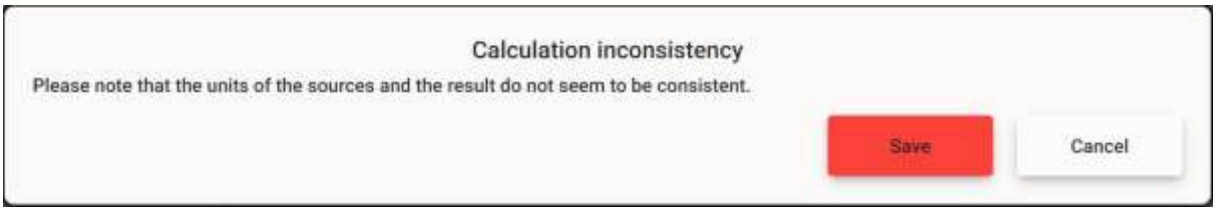
Go to the "User" section of the CALCULATOR module and click on the "+" to add a new calculation. Rename this calculation via its menu. Let's call it "Leeway angle".

Configure your calculation with two input sources, an operator and an output data.

We want to run the following calculation: leeway angle = compass heading – true heading. To do so, configure source 1 for the operator with a "3DSensor" data source of "Compass heading" type then source 2 with a "3DSensor" data source of "True heading" type. Configure the operator to subtract without modulo. As regards the output data, we will use the "USERVAR5", which will be fed by the operator.



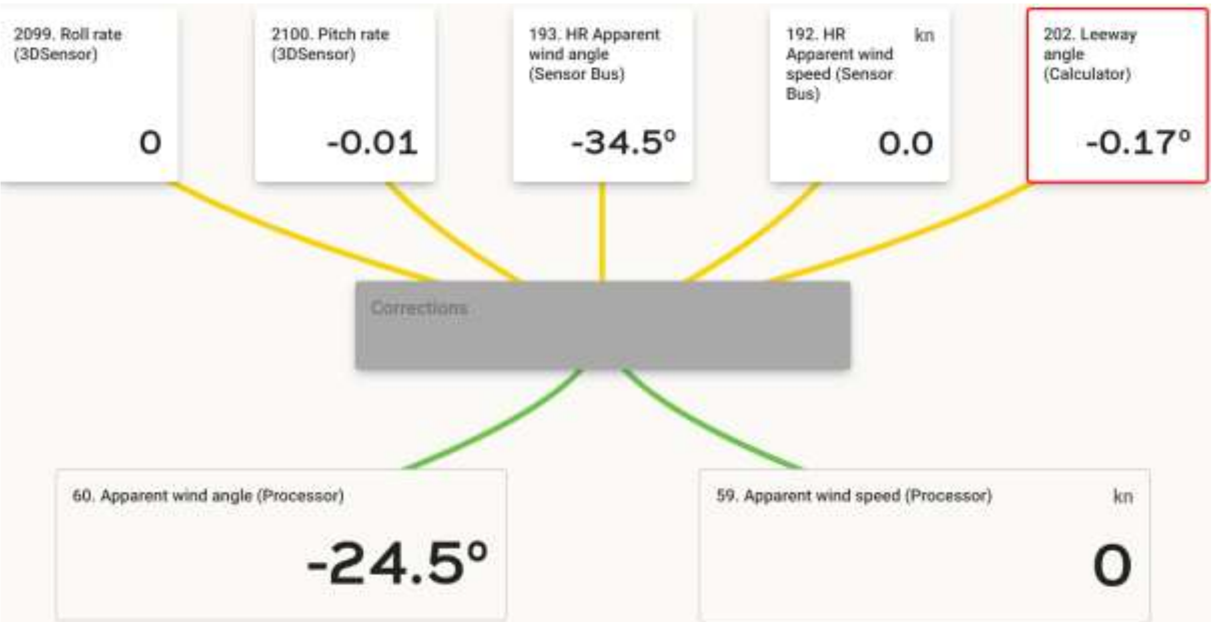
When saving, the webpage may alert you that the result is inconsistent if it deems there are inconsistencies with the values processed. This is only a warning.



We can now decide to use this leeway angle to feed the apparent wind de-noising algorithm.

To do so, we will change the type of output data for the "Leeway angle" calculation. The operator will now feed a "Leeway angle" data type. This channel is used by the de-noising algorithm to take into account the drift.

In the "apparent wind correction" calculation, we check the source for the "Leeway angle" data type. It must use the "Calculator" source. Notice that our leeway angle is correctly injected into the de-noised apparent wind calculation.



The operator also makes it possible to run additions, multiplications, divisions (including options with and without modulo), along with fixing values. You can use these operators with the same reasoning as that explained above.

8.4.6.5 *Using damping to smooth out the data stemming from an analog input.*

For this use case, we want to filter the analog signal received on the analog input for Device A. We will thus create a new calculation which we will name "Analog input filtered". Configure this calculation with an input data, an operator and an output data. We will configure the input data with a "Device A" source and a "Device Analog Input" type. As regards the operator, we will choose the "damping" operator and configure it to 10 for the tests. The output data will use a "calculator" source and a "USERVAR 7" type.

If we vary our input signal, we observe that the signal is filtered.

8.4.6.6 *Using a damping table to filter the boat speed variations measured by the loch when the boat is subject to significant rolling motions.*

For this use case, we will create a new calculation in the User section of the Calculator module. Let's rename this calculation "Speed loch filt". To configure our calculation, we will use two input sources, an operator and an output data.

Configure the first input data to have a "Measured speedo" data type with the "Sensor Bus" source. The second input data is of "Roll rate" type and stems from the "3DSensor" source.

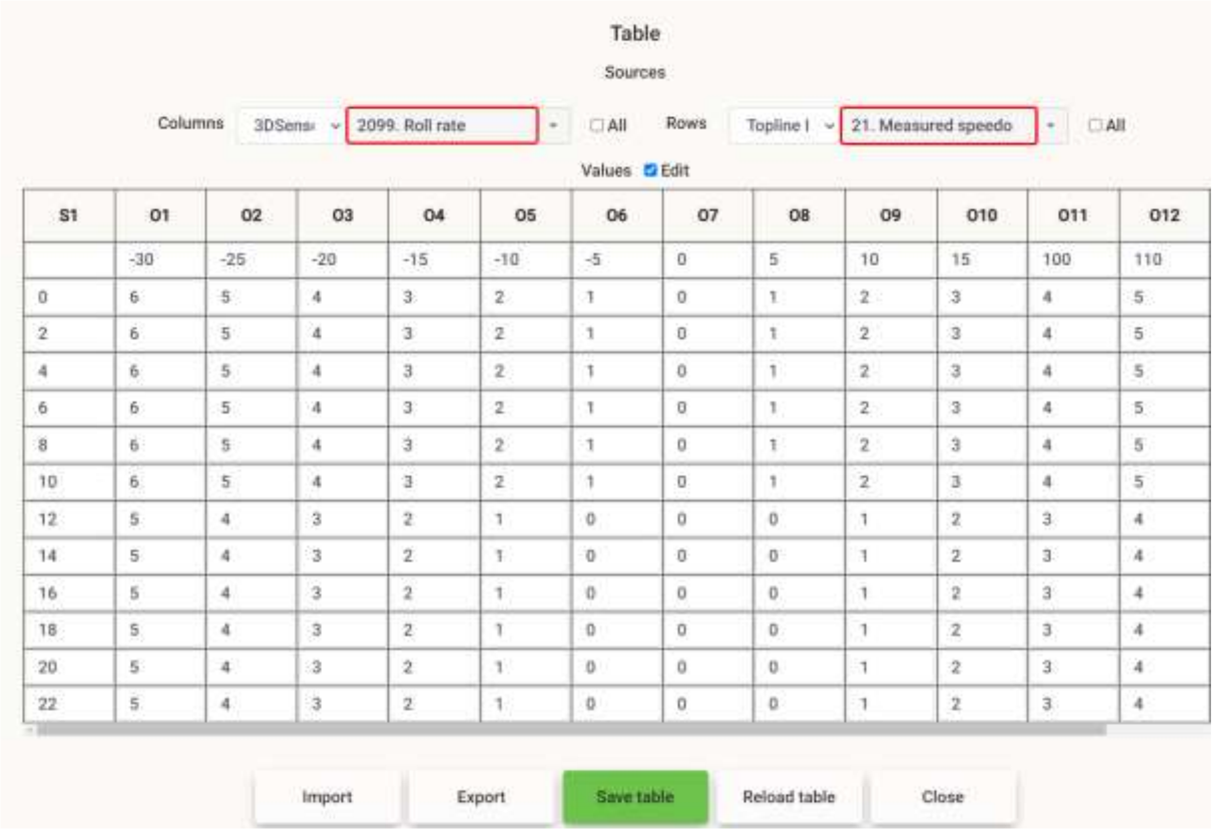
Concerning the output data, we will use a "UserVar8" type of data.

Click on the operator to configure it as a damping table.

To view the table and be able to edit it, click on "Show table".

The type of data that must be filtered corresponds to the rows. In our example, it will be "Measured speedo". The columns will thus correspond to the "Roll rate" data type. A filtering coefficient will thus be applied to the boat speed for a given speed and heel variation.

Tick the edit box and enter your values.



S1	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12
	-30	-25	-20	-15	-10	-5	0	5	10	15	100	110
0	6	5	4	3	2	1	0	1	2	3	4	5
2	6	5	4	3	2	1	0	1	2	3	4	5
4	6	5	4	3	2	1	0	1	2	3	4	5
6	6	5	4	3	2	1	0	1	2	3	4	5
8	6	5	4	3	2	1	0	1	2	3	4	5
10	6	5	4	3	2	1	0	1	2	3	4	5
12	5	4	3	2	1	0	0	0	1	2	3	4
14	5	4	3	2	1	0	0	0	1	2	3	4
16	5	4	3	2	1	0	0	0	1	2	3	4
18	5	4	3	2	1	0	0	0	1	2	3	4
20	5	4	3	2	1	0	0	0	1	2	3	4
22	5	4	3	2	1	0	0	0	1	2	3	4

Make sure to define these boxes (orange boxes), as this would cause undefined behaviours.

S1	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12
	-30	-25	-20	-15	-10	-5	0	5	10	15	100	110
0	6	5	4	3	2	1	0	1	2	3	4	5
2	6	5	4	3	2	1	0		2	3	4	5
4	6	5	4	3	2	1	0	1	2	3	4	5
6	6	5	4		2	1	0	1			4	5
8	6	5	4	3	2	1	0	1	2	3	4	5
10	6	5	4	3	2	1		1	2	3	4	5
12	5	4	3	2	1	0	0	0		2	3	4
14	5	4	3	2	1	0	0	0	1	2	3	4
16	5	4	3	2	1	0	0	0	1	2	3	4
18	5		3	2	1	0	0	0	1	2	3	4
20	5	4	3	2	1	0	0	0	1	2	3	4
22	5	4	3	2	1	0	0	0	1	2	3	4

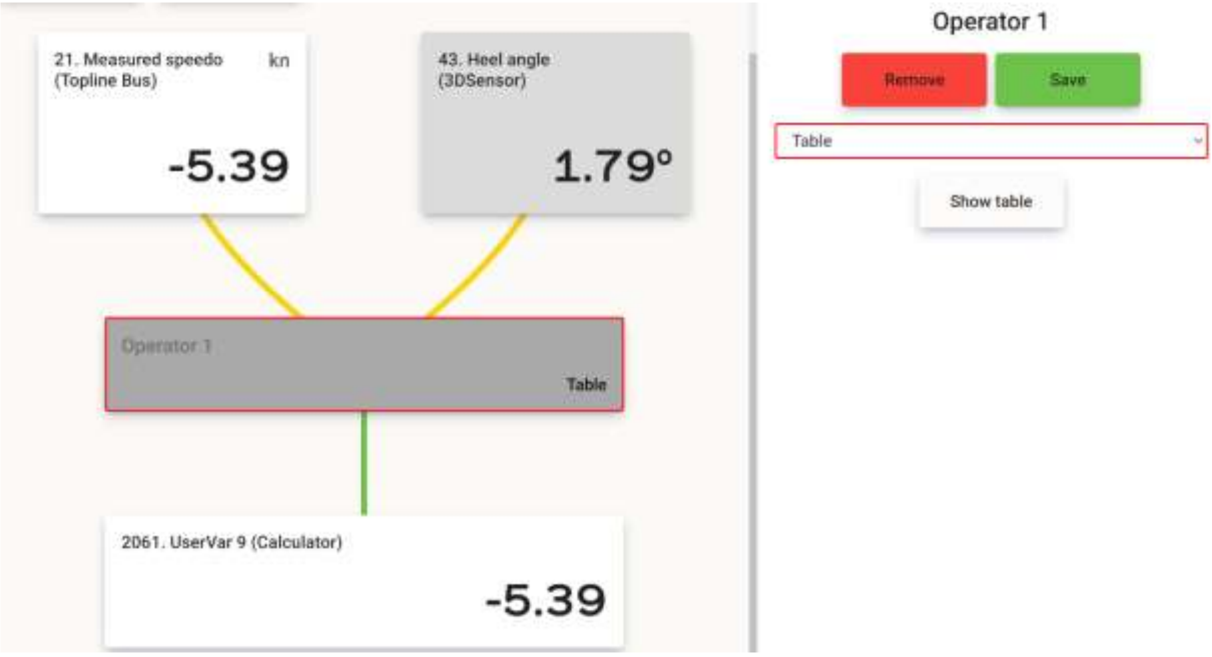
You can then save your table.
Note that your tables can be imported and exported in .csv.

The "UserVar8" data type is now concretely fed to have a "measured speedo" filtered according to the boat heel variations.

8.4.6.7 *Using a correction table to correct the boat speed (measured with the loch) according to the heel.*

In the previous case, we wanted to define a table enabling us to apply a filter onto the boat speed. We now want to be able to define a boat speed correction according to the former and the heel.

Configure your calculation by following the steps set out in the previous use cases. This time, we will use “measured speedo” and “Heel angle” data types with the “Sensor Bus” and “3DSensor” sources.
The operator is a table (correction). We will use a “UserVar 9” data type as the operator output.



You can visualise and edit your correction table by following the same method as for the damping table.

8.4.6.8 *Enabling or disabling a calculation*

We will see how to enable or disable the “Analog input filtered” calculation
Go into the “CALCULATOR” module and click on the standard “Analog input filtered” calculation. The calculation is “enabled” by default. Go into the calculation menu and click on “disable”. You can observe in your output data that the calculation is now disabled.
Calculation “enabled”:

Calculation “disabled”:

If we connect the calculation output data “UserVar 7” to a dynamic channel, we can observe on our displays that the data is available when the calculation is “enabled” and not available when the calculation is “disabled”.

You are now able to use the CALCULATOR module in its entirety. We have seen how a calculation is structured. We have seen the difference between a “processor” calculation from a “calculator” calculation. You now understand the notions of type and source as regards the data used.
You are able to input the sources you want to use for processor calculations. We have shown you how to configure the apparent wind correction. Finally, we have seen how to configure both “standard” and “User” calculations.

8.5 USING PERFORMANCE DATA

8.5.1 Presentation

We will now take a look at the performance data, and mainly the polars.
We will thus go into the PERFORMANCE module.
This module enables us to enter and visualise the polar in the form of a table and a graph.
It also makes it possible to view the channels calculated by the performance module polar.
With the PERFORMANCE module, there is a “polars” section, which in the case of the Processor X, contains a single polar.

A polar gives access to the 3 following tabs:

- Table: We find here a polar table with 32 rows and 17 columns.
- Chart: Enables you to visualise the polar
- Data: Enables you to visualise the data from the performance channels

This module enables you to calculate the following channels using the speed polar table:

100. Target speed:
This is the boat theoretical speed at the best VMG, based on the polar.
This variable is useful both for close-hauled and downwind sailing. For reaching points of sail, it is preferable to use the polar speed.

102. Optimal angle/Wind:
This is the optimal wind angle to achieve the best VMG based on the current true wind speed, both for close-hauled and downwind sailing.

103. Close-hauled performance:
This is the percentage between the current boat speed and the target speed.

104. Polar performance:
This is the percentage between the current boat speed and the polar speed.

105. Optimal VMG angle:
This is the difference between the optimal true wind angle to achieve the best VMG and the current true wind angle. This information enables you to know the correction needed to be at the optimal angle.

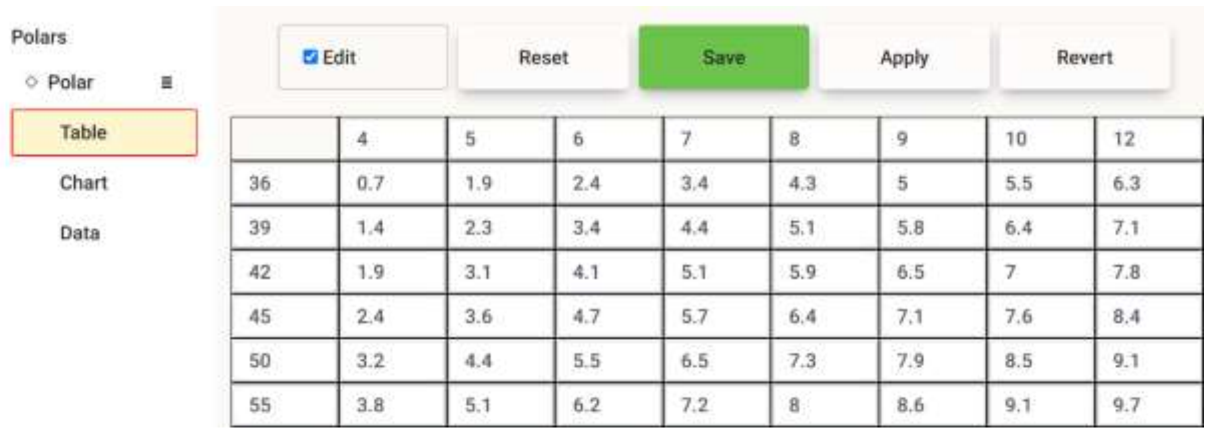
108. VMG course gain:
This is the percentage between the current boat VMG and the best VMG.

219. Polar speed:
This is the optimal boat speed based on the polar for the current true wind conditions (angle and speed).

8.5.2 Use case

8.5.2.1 *Creating my polar*

To create your polar, you need to go into the "table" tab for your polar. The values entered by default correspond to a Class40 polar. Click on edit to modify the table.



	4	5	6	7	8	9	10	12
36	0.7	1.9	2.4	3.4	4.3	5	5.5	6.3
39	1.4	2.3	3.4	4.4	5.1	5.8	6.4	7.1
42	1.9	3.1	4.1	5.1	5.9	6.5	7	7.8
45	2.4	3.6	4.7	5.7	6.4	7.1	7.6	8.4
50	3.2	4.4	5.5	6.5	7.3	7.9	8.5	9.1
55	3.8	5.1	6.2	7.2	8	8.6	9.1	9.7

While editing, the "Reset" button makes it possible to load the default table. The "Save" button makes it possible to save the table and relaunch the performance calculations with the new table. The "Apply" button is similar to the "Save", except that it enables you to continue editing the table. The "Revert" button makes it possible to cancel an unsaved entry.
While the table can be incomplete, it must not include any gaps, as in this case, the performance calculations will be disabled. It is therefore possible to leave several empty columns to the right or several empty rows at the bottom.

	4	5	6	7	8	9	10
36	0.7	1.9	2.4	3.4	4.3	5	5.5
39		2.3	3.4	4.4	5.1		6.4
42	1.9	3.1		5.1	5.9	6.5	7
45	2.4	3.6	4.7	5.7	6.4	7.1	7.6
50	3.2	4.4	5.5	6.5	7.3	7.9	8.5
55		5.1	6.2	7.2	8		9.1
60	4.5	5.7	6.8	7.8	8.6	9.2	9.6
65	4.9	6.2	7.3	8.3	9.1	9.6	10

Invalid

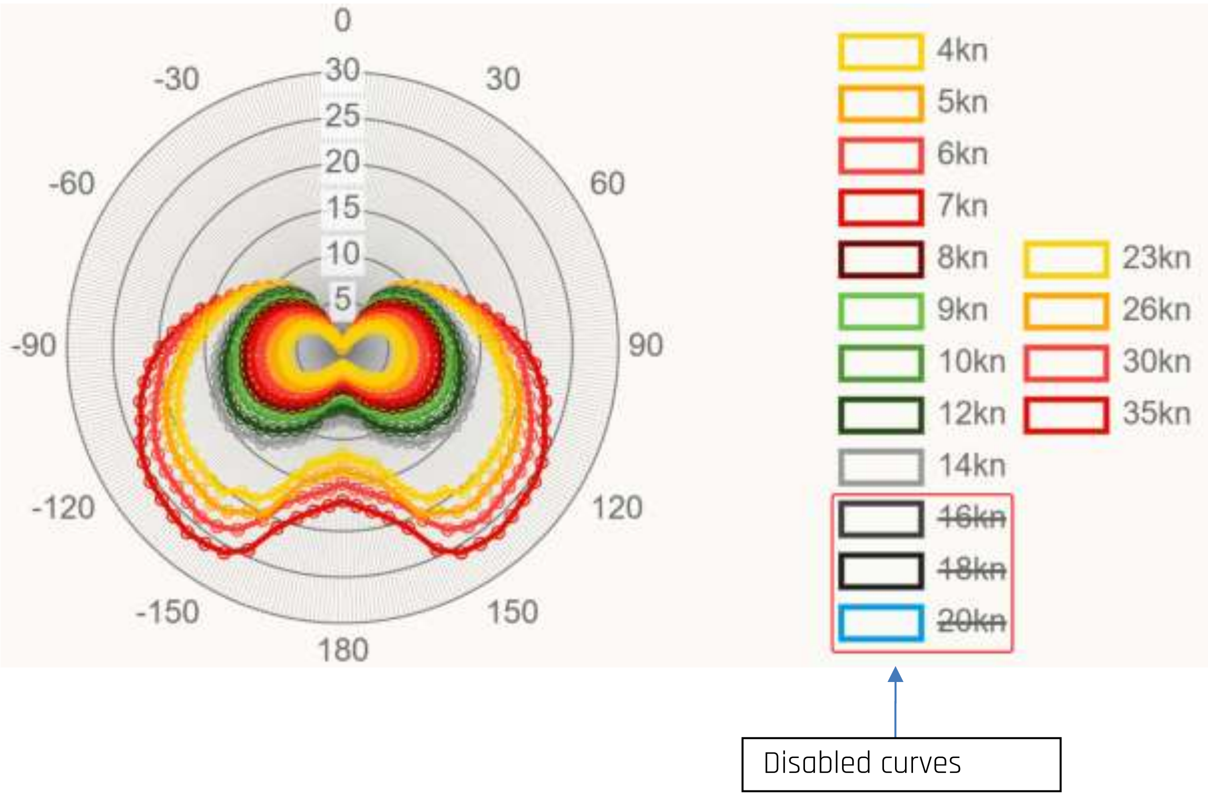
	4	5	6	7	8	9	10	12
36	0.7	1.9	2.4	3.4	4.3	5		
39	1.4	2.3	3.4	4.4	5.1	5.8		
42	1.9	3.1	4.1	5.1	5.9	6.5		
45	2.4	3.6	4.7	5.7	6.4	7.1		
50	3.2	4.4	5.5	6.5	7.3	7.9		
55	3.8	5.1	6.2	7.2	8	8.6		
60								
65								

Valid

Once your table correctly edited, save it and we will see how to view it in the following paragraph.

8.5.2.2 *Viewing the polar*

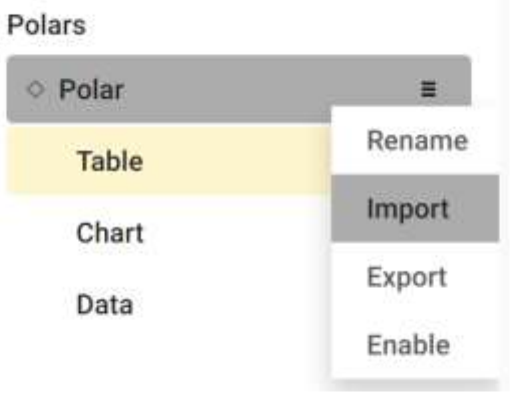
We have just created our polar and we now want to see what it looks like.
Go into the “Chart” tab. This tab enables you to visualise the polar as a chart. This is useful to check that there is no inconsistency linked to an input error or omission during editing.



It is possible to enable or disable a curve by clicking on the rectangle with the corresponding wind speed. Especially if a wind speed value is incomplete.
Your polar can now be used by the PERFORMANCE module, which will be able to feed the performance channels once you have enabled the polar.
We have just checked that our polar was properly input.

8.5.2.3 *Importing / exporting a polar*

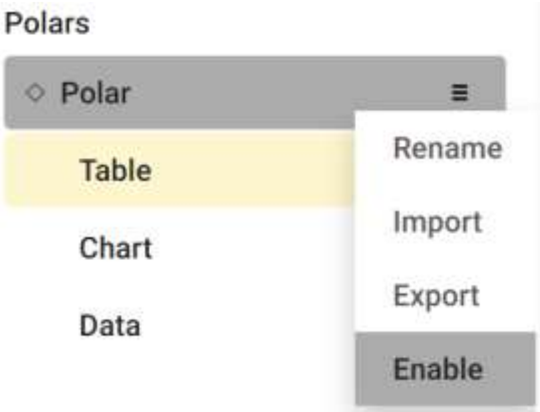
The webpage enables you to import a .pol file made up of values and tabulations. The table can also be exported to save it. To do so, go into the menu for the "polar" section which will enable you to manage polar imports and exports.



8.5.2.4 *Enabling my polar*

We have seen how to configure our polar (edit or import) and check it. Now, we need to enable it in order for it to be used to generate performance channel data.

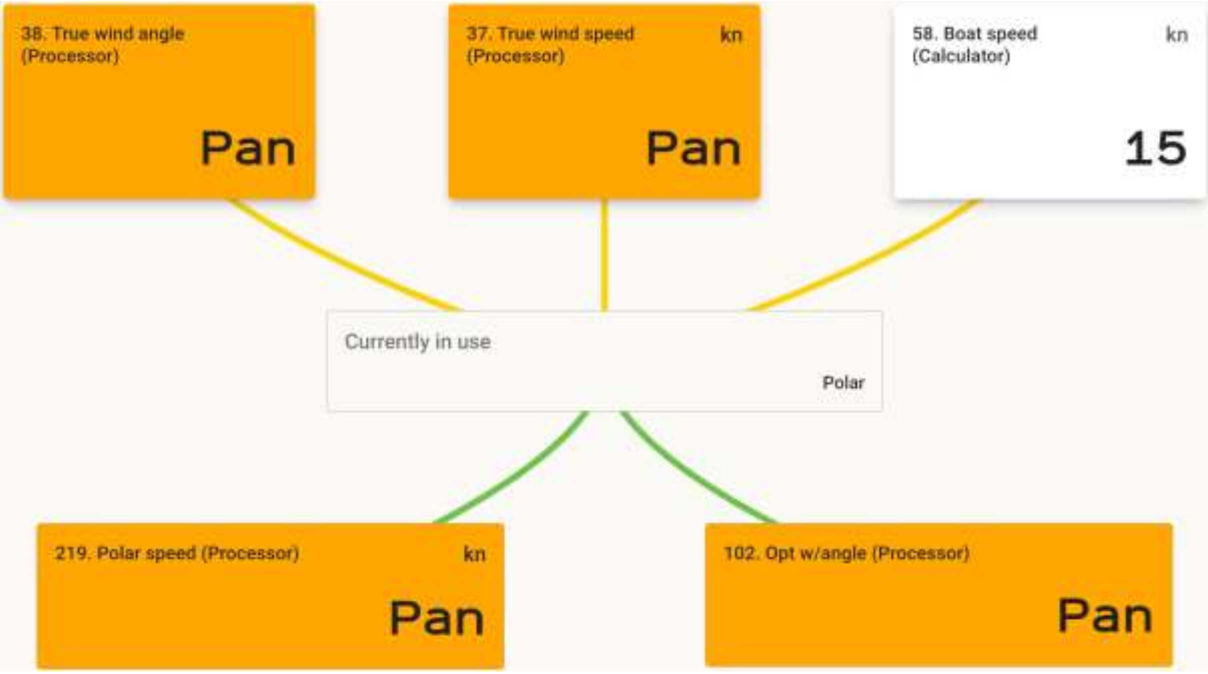
To do so, go into the menu for the "polar" section and click on "Enable"
By enabling your polar, the currently white diamond will become green.



8.5.2.5 *Understanding why my performance data has failed*

Let's take the use case where you want to understand why the data for your performance channels has failed.
First of all, if your data has failed, this means the polar is enabled. It is therefore not an enabled/disabled issue. Performance calculations are no different from other

calculations. You therefore need to go and check which input data is missing to have valid output data.
To do so, go into the CALCULATOR module and go into the "Polar" calculation in the "Processor" section. In my case, I notice that I do not have any input wind data (my masthead unit is physically disconnected).



The issue has been diagnosed, and I reconnect my masthead unit. The calculator now has the input data required to generate the performance data

The performance data is now valid. It is accessible by clicking on the “Data” tab of the “PERFORMANCE” module.

8.6 USING THE LOGGER

The Processor X offers an autonomous datalogger.
Data is recorded onto the SD card integrated in the Processor with proprietary formats.

8.6.1 Logging with CTC files

The CTC file format makes it possible to save all the data of the Topline main bus.

The logger can be launched or stopped from the webpage, in the "Logger" menu.
Its status is restored when powered up.
The logger continuously assesses the space available and stops automatically when its memory is full.

The "Logger" menu comprises an interface to start/stop the logger, save marks and consult the saved files.

8.6.1.1 *The marks*

The Processor enables you to add custom marks in the logs and history.
4 marks are thus accessible with a customisable text.

8.6.1.2 *Files*

The datalogger uses the CTC file format, which makes it possible to save all the data of the Topline main bus.
These files are compatible with the nke Toplink and TopSailor tools.
The files are stored on the SD card of the Processor X per folder (year, month, day).

8.6.1.3 *Downloading and erasing*

The downloading and erasing operations are to be conducted by the user when the recording is stopped.

Warning: erasure cannot be reverted.

Downloading from a conventional browser requires to zip the downloaded files in an archive. The operation may take a long time, anticipate around 5 minutes/24H of CTC log.

The TopSailor Processor X interface may be used, which makes it possible to retrieve the files directly from the processing repository without needing to zip them.

8.6.1.4 *Export*

The log files can be exported directly from the logger webpage.
As an example, this enables you to do without the nke processing tools and export directly to a third-party tool (example: Excel or Scilab).

The data is exported as a CSV text file and requires to choose the data to export and time base for the CSV file (Auto, 1Hz, 2Hz, 5Hz, 10Hz, 25Hz).

The operation may take a long time, anticipate around 7 minutes/24H of CTC log

NOTE1: downloading and exporting are only available when the logger is stopped.

NOTE2: TopSailor enables you to download the files without zipping them, which allows direct processing.

8.6.1.5 *Processing*

TopSailor enables the user to process the Processor's log files.
It enables the user to conduct a first diagnostic of the bus, analyse the content, then export the data as CSV, and finally publish the required data automatically on the M2 platform of AIM45 (requires a subscription).

See TopSailor User Manual

8.6.1.6 *Maintenance*

The maintenance mainly consists in downloading and erasing the Processor files.

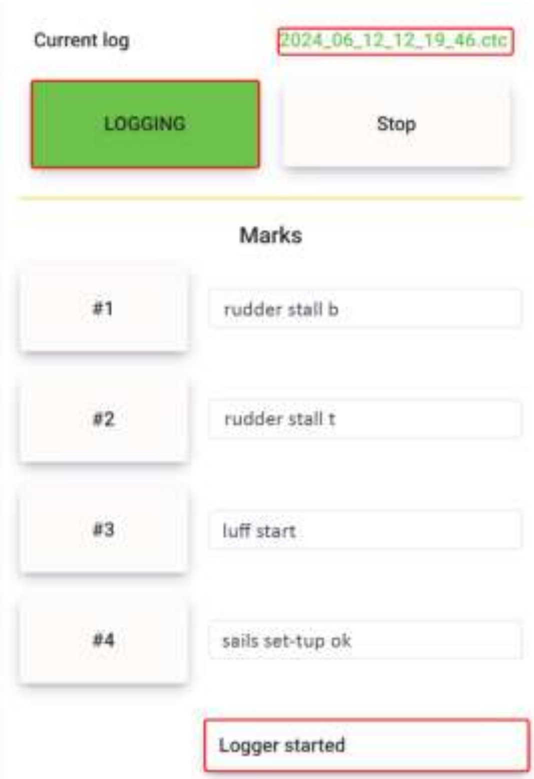
In the event of an issue with the memory card, it can be formatted from the Processor webpage. Warning: this operation will erase all the data on the card.
The formatting operation takes 5 to 15 seconds according to the SD card used.

In the event of a faulty card, the maintenance is ensured by the nke after-sales team in order to replace it.

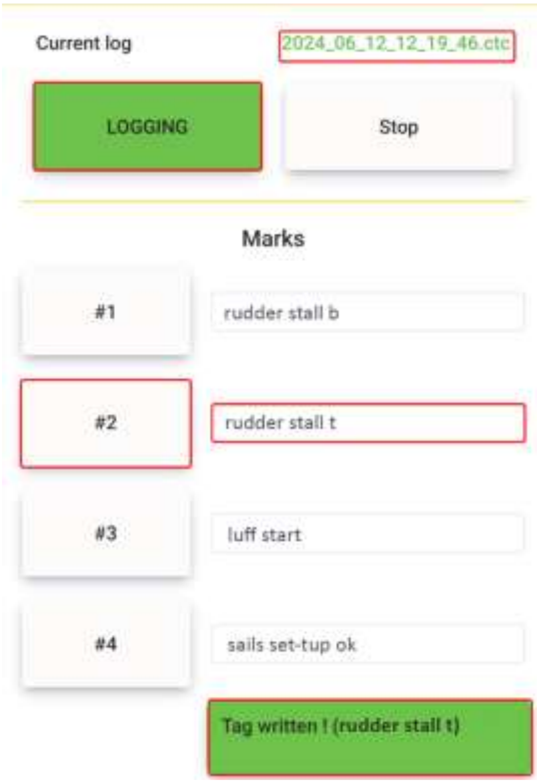
8.6.2 Use case

We will now log a short period, use the marks, and analyse our logs with Topsailor.

Go into the "Logger" menu, enter the 4 "marks" available and click "Start" to launch the logger.
The grey "Start" button is now green and displays "LOGGING". The .ctc file name corresponds to the logger start date, which appears in green above the "STOP" button. A message displays at the bottom of your screen to confirm that the logger has started successfully.



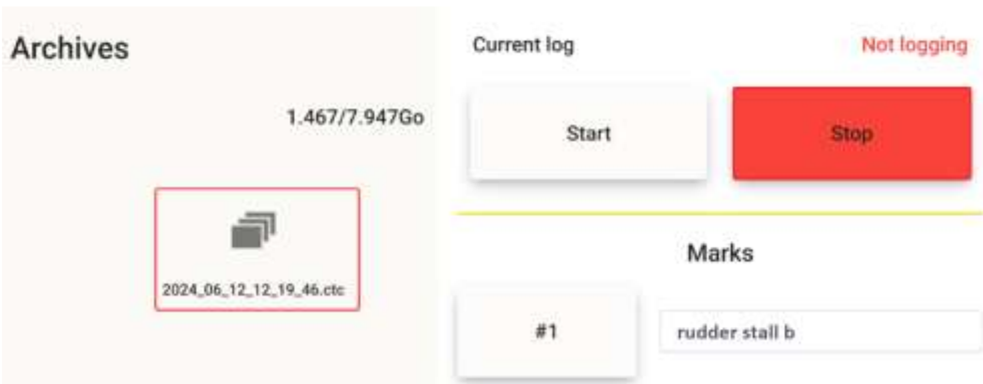
You can now click on the buttons corresponding to the marks to leave marks we will be able to find again in the logs.



When you drop a mark, a message displays at the bottom of your screen to confirm it was saved.

Stop the logger by clicking "Stop"

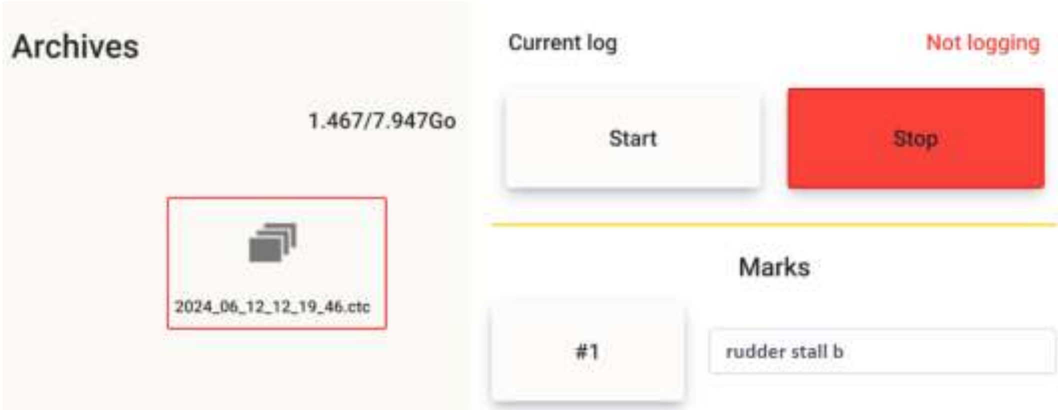
Next, check in the archives that you find the file containing your CTC logs.



Download the CTC files by clicking on "download".

Now, launch the TopSailor software to analyse these logs. Go into the "Analyser" module

In the "Events" tab you will find the different marks you dropped.



8.6.3 Logging with CSV files

A CSV datalogger is also integrated in the Processor X, on the USB flashdrive.
This logger makes it possible to record up to 20 variables by selecting the source (Topline bus, Sensor bus, Device, Calcul) and sampling at 25, 12, 8, 1 Hz
This enables you to save the internal Processor X variables directly.

To enable it, you need to format a USB flashdrive in FAT32.
Then, drop the "Logger.csv" file configured with the separator ';' at the root of the flashdrive. This file lists all the available variables.

You can add as many datatypes and datasources as you want, making it possible to log different sources for a same datatype.

In the following example, we connected a 3D Sensor HR sensor to the 3D Sensor port of the Processor X and a compass 9X to DEVICEB. We wanted to retrieve the attitude information from these two sensors. We therefore entered the same type of data with two different sources.

2098	RATE_YAW	3DSENSOR
2099	RATE_ROLL	3DSENSOR
2100	RATE_PITCH	3DSENSOR
2098	RATE_YAW	DEVICEB
2099	RATE_ROLL	DEVICEB
2100	RATE_PITCH	DEVICEB

The different DataSources possible are the following:

- CHANNEL: Topline bus source
- TOPSENSOR: Sensor bus source
- DEVICEA: device A source
- DEVICEB: device B source

- DEVICEC: device C source
- 3DSENSOR: 3D Sensor source
- SYSVAR: Processor-X internal source

During the first log csv phase, you will only have the Logger.csv configuration file at the root of your USB flashdrive. When you insert the flashdrive in the Processor X, a SysLog file is created, which is simply needed for the CSV logs to function. Your log files are also at the root, under the name: LOGGER_yearmonthdayhourminutesec.csv

Rechercher dans : HP x796w (F:)

Nom	Modifié le	Type	Taille
SysLog		Dossier de fichiers	
Logger.csv	19/03/2024 11:34	Fichier CSV Micro...	7 Ko
LOGGER_20240318113828.csv		Fichier CSV Micro...	63 Ko

By opening your file containing your CSV logs, you will find a first column with the chosen logging frequency, along with the different measurement dates in the format: “year-month-daysThour :min :sec.millisecZ”. The following columns contain your data

Freq=25hz	DYN_1	GITE_3D	HR_VVA	HR_AVA	GITE_3D	SPEEDO_MES
2024-03-18T12:01:11.410Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.453Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.492Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.531Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.570Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.613Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.652Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.691Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.730Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.773Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.812Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.890Z	65535	0.39	0.00	-37.40	-10.00	0.00
2024-03-18T12:01:11.933Z	65535	0.39	0.00	-37.40	-10.00	0.00

In the example above, we can observe a “DYN_1” column with “65535” values. This means (in most cases) that you do not have any data available with the type and source entered in the “Logger.csv” file

Note that this file does not make it possible to directly link a type of data to its source. The columns are ordered in the same way as the rows of your “Logger.csv” file. You must thus keep your different Logger.csv files to be able to correctly link a type to its source.

By following this principle we know the “GITE_3D” column with 0.39 values corresponds to the 3DSsensor, whereas the other “GITE_3D” column corresponds to the “TOPSENSOR” source, i.e. the compass 9X.

8.7 UPDATE

All the Processor firmware is updated through Toplink on the Topline bus. The update function is also available from the Sensor bus.

The firmware update includes:

- Update of the on-board software
- Update of the web application
- Reinitialisation of the user settings, if needed

It is advised to backup the Processor before updating it.
This makes it possible to restore the user settings after the update.

NOTE1: a version manager is integrated with the settings in order to reinitialise useful settings. In this case, they need to be reconfigured manually.

9 FUNCTIONS

The basic functions of our Processor are:

- Web Application to configure and monitor the Processor.
- Saved events log
- Topline bus manager (master, languages, man overboard, etc.)
- Connect a 3D Sensor HR
- Connect RS232, GPIO or analog inputs/outputs
- Acquire sensors (on Device A, B and C, 3D sensor and Sensor bus)
- Create and select variables, apply formulas, etc.
- Calculate the navigation data: wind, speed, heading, attitude, etc.
- Build and provide calibrated data to the Topline main bus
- Provide up to 16 custom channels to the Topline main bus
- Internal datalogger with several gigas and saved clock
- Performance table, polar calculation, close-hauled and downwind performance.

10 FAQ

10.1 PERIPHERALS

10.1.1 Can I use a NMEA-2000 peripheral?

The NMEA-2000 bus is not handled directly by the Processor X.
However, this functionality is supported by the N2K Router which can be used on one of the Processor's buses (Topline and Sensor).

10.1.2 Can I connect a NMEA aerial?

Yes, you can by connecting the aerial to a Device port configured as "RS232 input". You will be able to receive a $IIMWV frame (for example). Warning: there is no insulation between your aerial and your Processor X. You are therefore exposing your installation to the electrostatic discharges sustained by your aerial.

10.1.3 Topline Channels disseminated onto the Topline bus

The Processor X detects the channel sources automatically at start-up, according to a priority order for each channel. If a sensor is configured after the start up, it is possible to update the channels published with an "Update Bus" in the Device/Topline 1 tab.

10.2 CALCULATIONS

10.2.1 Wind tables

Wind correction can be made in three different ways via tables:

- By correcting the true wind via the default calculation with 3 wind sectors and 8 wind ranges.
- By correcting the apparent wind via the default calculation with 3 wind sectors and 8 wind ranges.
- By correcting the wind of your choosing via a custom calculation with a table interpolated in 2 dimensions with 13 wind angle ranges and 12 wind speed ranges, which makes it possible to have a more linear correction according to the wind angle.

11 SPECIFICATIONS

Parameter	**Value**
Power supply	DC (continuous) 8V – 32V
Consumption in 12Volt operation	100 mA
Weight without cable	450g
Dimensions	212-161x71mm
Operating temperature	-10°C / +50°C
Storage temperature	-20°C / +60°C
Watertightness	IP66

12 VERSIONS

OVERHAUL	Date	Information
V1.0	August 2022	- Initial version
V1.1	March 2024	- Validation of the apparent wind de-noising algorithm with 3D Sensor HR and Compass 9X - Management of a polar table - Addition of the calculation for performance channels - New web application version - Addition of a web remote control for shortcuts - Integration of dynamic channels for the Sensor and Topline buses - Validation of the Compass 9X v2.1 compatibility with the 3D Sensor port - Validation of the 3D Sensor FOG compatibility - Addition of 4 "Shortcut" variables - Addition of "Constants" variables - Addition of the function to disable a calculation - Addition of the RS232 console - Management of new sub-channels (boat length and position of the GPS antenna)