POWERAIL
Specifications

Output
. 24 Outputs **(Positive and negative)** - configurable 1-16A,
• Current sensor - overrange current protection,
• Thermal protection,
• Dimmable light

Input
• 8 Inputs analog or digital,
• Sensitivity 100mV,
• Pull up,
• Analog 0-30V for tank sensor,
• Timed and damped,
• Dedicated power supply for sensor

Voltmeter
• 3 voltmeters,
• Input -30V to +30V,
• Auxiliary battery monitoring

Circuit isolation (hull)
• Positive and negative monitor : -16mA to +16mA,
• Automatic diagnostic,

Power
• 100 A max (1200 W)

Supply
• DC 10V to 30V,
• Connector bolt M8 stainless steel,
• internally protected MegaFuse 100A,
• Consumption 40mA

Communication
• CAN J1939 (Charger, Battery Lithium, ...)
. LIN (BMS, Sensors, Heating, ...)

SAILSENSE

POWERAIL
Specifications 1/2

Environment
- Nominal -41°F + 113°F,
- IP61,
- MIL-STD810

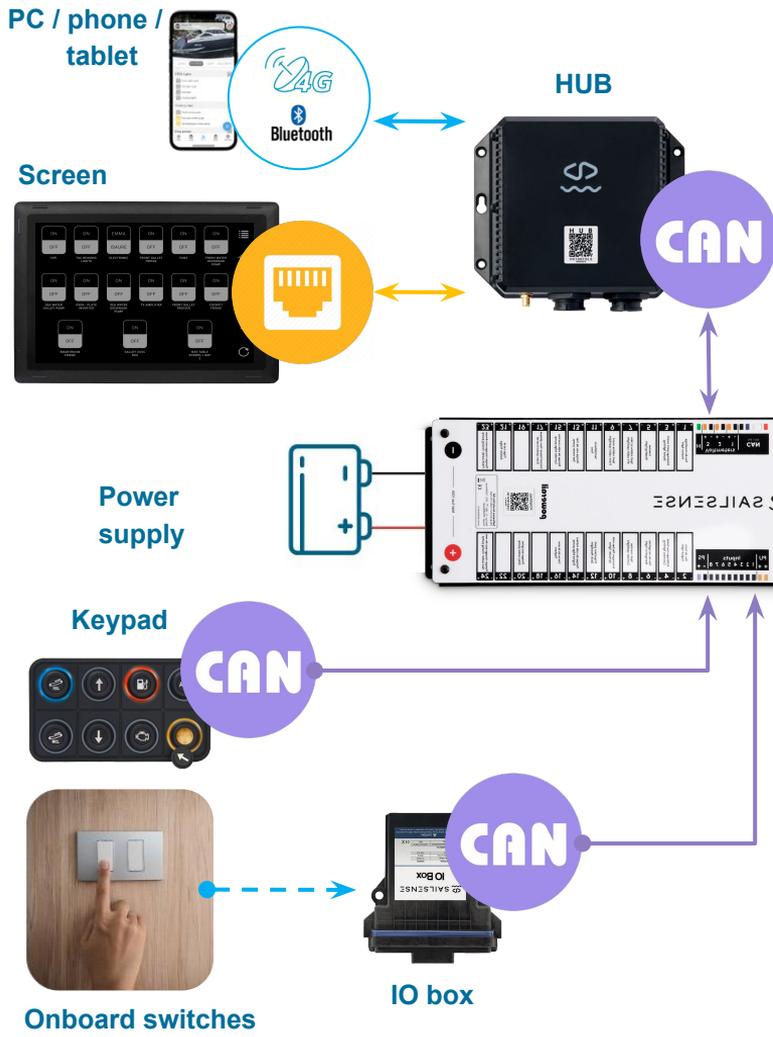**Dimension**
- 300 mm x 140 mm x 50 mm

Weight
- 1.4kg

Configuration
- Downloaded and stored automatically on the Sailsense HUB

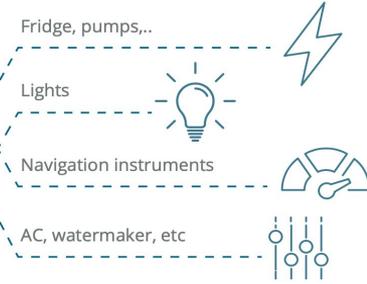# POWERAIL
How does it work ?

PC / phone / tablet

HUB

Screen

Command via the HUB :
The command is transmitted to the HUB via Ethernet / 4G or BT, the HUB transforms this command into CAN code to send it to the Powerail.
The Powerail provide also input data to the HUB to feed the applications

CAN

Consumers and input

Fridge, pumps,..

Lights

Power supply

Navigation instruments

AC, watermaker, etc

Keypad

CAN

Command via Keypad :
The command is directly send in CAN to the Powerail

CAN

Command via switches through IO box :
The switches send a tension to the inputs of the IO box who transforms this into CAN command to send it to the Powerail

IO box

Onboard switches

POWERAIL
How does it work ?
1/6

On a **CAN network**, it is imperative to loop the network with a **120 Ohms resistance at each end of it**. This is so that the network returns to its initial state after the passage of a signal and that a new pulse can thus be emitted.

The Powerail is factory-fitted with a 120 Ohms resistance, which is why they do not appear on the Sailsense CAN network with Powerail(s).
But it's important to have Powerail(s) (or 120 Ohms resistance) at the end of the backbone :

(In the case of an installation with more than 2 Powerails, they will activate their resistance automatically to have the correct impedance on the network)

The supply of the CAN1 network is provided by the Powerail as well, no need for a power cable. In addition, in the case of an **installation with two (or more) Powerails**, this offers **power supply redundancy**, which is an additional security.

SAILSENSE

POWERAIL
How does it work ?
2/6

Output activation :

Once the **action is performed** via the screen, keyboard or I/O box, **the Power-IC** (brain of the Powerail) **interprets** the CAN command and closes (or opens) the output following the action performed and **compared to the Powerail configuration**.
In doing so, it allows the battery to power the consumer (or not) after the output.

Power supply

Powerail

Fridge, pumps,..

Lights

Navigation instruments

AC, watermaker, etc
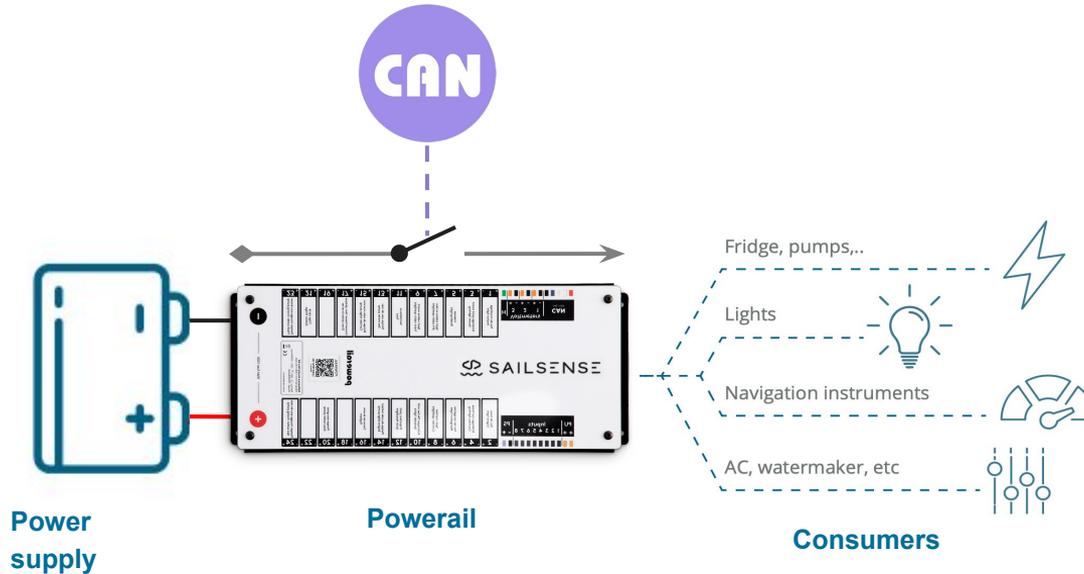
Consumers

Output disjunction :

When a **problem occurs** on a consumer or its electrical harness, the Powerail activates a **series of tests** on the output(s) which supply the consumer.
In a short time (5 seconds), the output is activated and deactivated more than 250,000 times with a cycle governed by the temperature of the output component (when the max T° is reached - 80°C - the tests stop) .
After this **5 secondes** the output will go into **ERROR** mode.

On-screen display
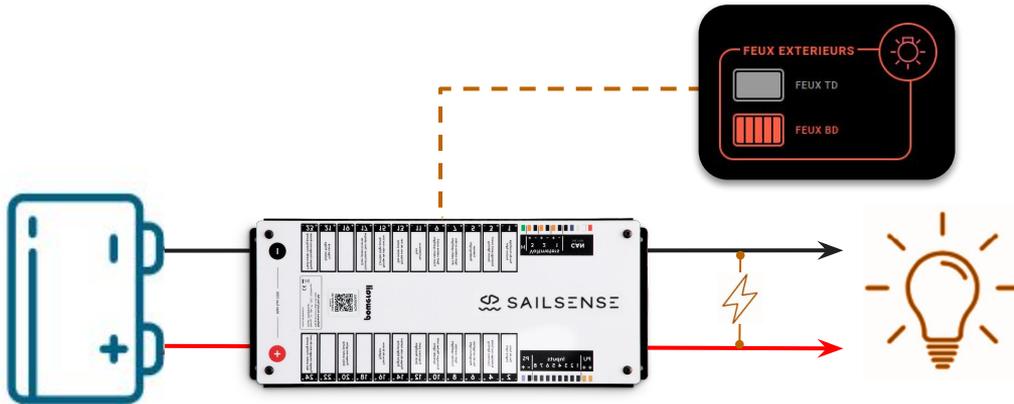
Power supply　　　　**Powerail**　　　　**Shortcut**　　**Consumers default**

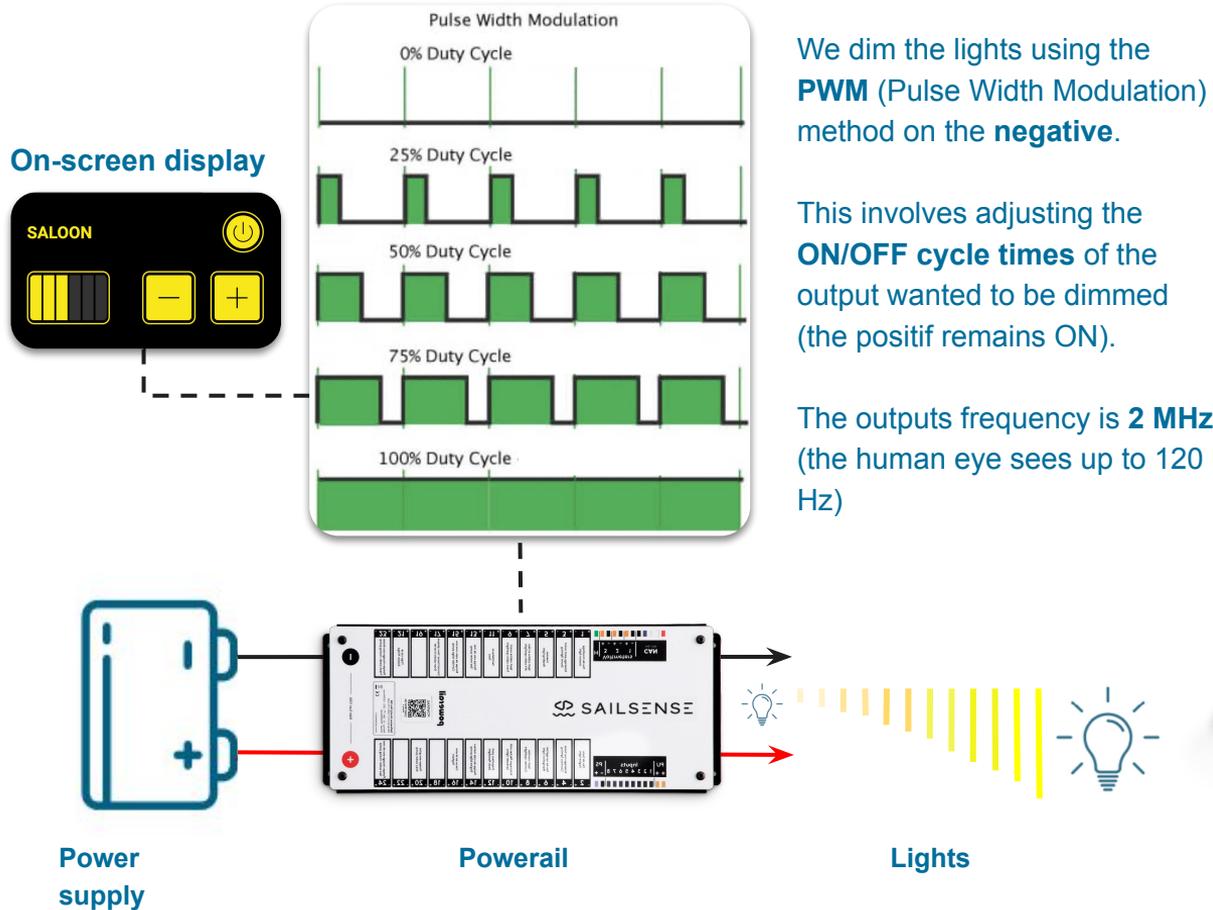To **clear the error**, you must **turn** the consumer **OFF** and then back **ON** on the screen (or keypad).

Dimming functionality :

POWERAIL
How does it work ?
5/6

On-screen display

SALOON

We dim the lights using the **PWM** (Pulse Width Modulation) method on the **negative**.

This involves adjusting the **ON/OFF cycle times** of the output wanted to be dimmed (the positif remains ON).

The outputs frequency is **2 MHz** (the human eye sees up to 120 Hz)

Pulse Width Modulation

0% Duty Cycle

25% Duty Cycle

50% Duty Cycle

75% Duty Cycle

100% Duty Cycle

SAILSENSE

SAILSENSE

Power supply

Powerail

Lights

Leak control functionality :

The powerail **checks** whether there are any **leaks** (**positive and/or negative**) **between the service battery and the hull** using a shunt (current measuring device) integrated into the "H" input.

Once the **"H" input is connected to the boat's ground**, the Powerail briefly **presents** its main power supply **"+" then "-"** (therefore the service battery) **every 10 seconds** (and when an output is activated) at the **shunt "H"**.

If the **values** (voltage and current) reported by the shunt are **equal to zero**, everything is **good**. On the other hand, **if one of the values is greater than 0**, a **leak is present**. The **galvanic isolation problems are vast** and the Powerail can very well detect the leak from the neighboring boat at the pontoon for example. The **safest way** to control a leak is to **remove the boat from the water** and carry out control measures.

Power supply   **Powerail**   **Hull**
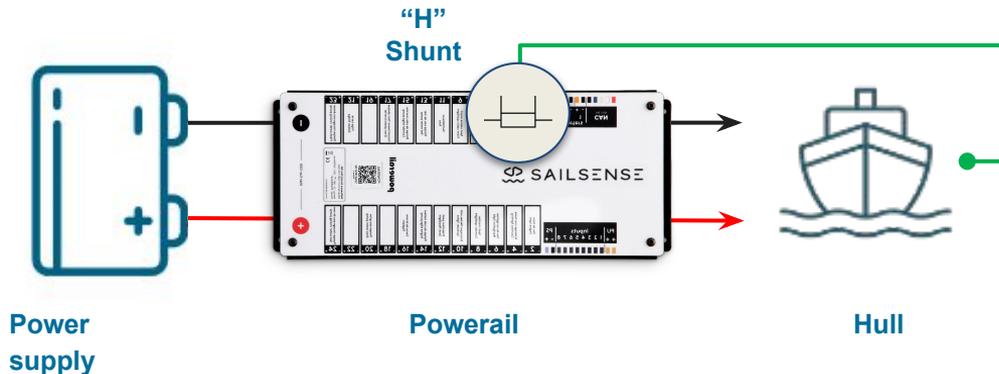
POWERAIL
Installation

POWERAIL
Installation

1- The Powerail must be installed inside the boat.
To minimize installation time and limit the need to run additional cables, the Powerail should be placed as close as possible to the following:
- A 12V (12V Battery) or 24V (24V Battery) DC power source
- If possible in the "middle" all of the consumers you want to control to avoid excessively long wires

2- Screw the Powerail horizontally or vertically to the boat, with its front plate easily accessible, leaving enough space to access the device's terminals later.
We recommend installing the Powerail
- At least 1 meter above the level of the water
- At a distance of at least 0.5 m from others metal objects or water or fuel tanks
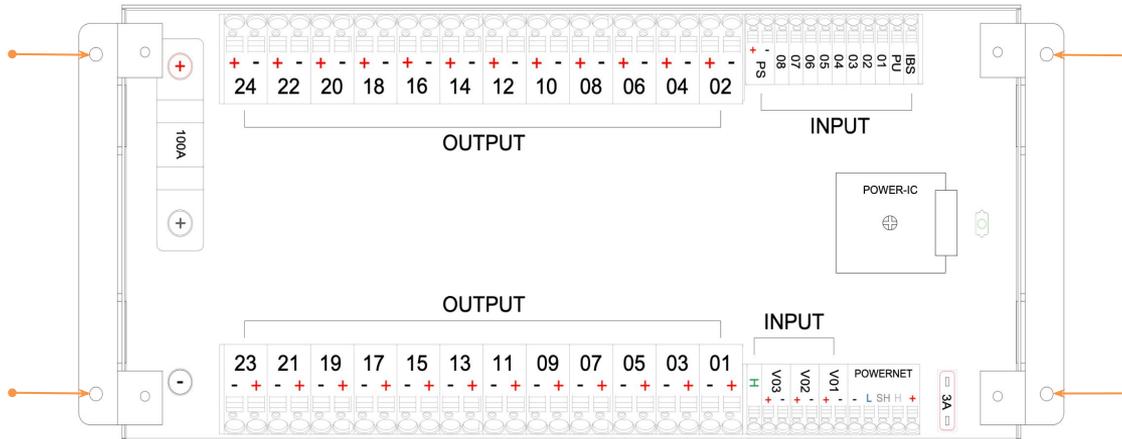
POWERAIL
Connection

Main informations

POWERAIL
Connection overview

M8 main terminal **+**

Inputs < 1,5mm2 maximum

Main protection fuse: 100A

+	-	+	-	+	-	+	-	+	-	+	-	
24	22	20	18	16	14	12	10	08	06	04	02	

OUTPUT

INPUT

- PS +
08 07 06 05 04 03 02 01 PU IBS

POWER-IC

OUTPUT

INPUT

23	21	19	17	15	13	11	09	07	05	03	01
-	+	-	+	-	+	-	+	-	+	-	+

V03 V02 V01 POWERNET
H + - + - + - L SH H +

3A

M8 main terminal -

Outputs < 6mm2 maximum

PowerIC (the intelligence of the Powerail) protection fuse : 3A

⚠️
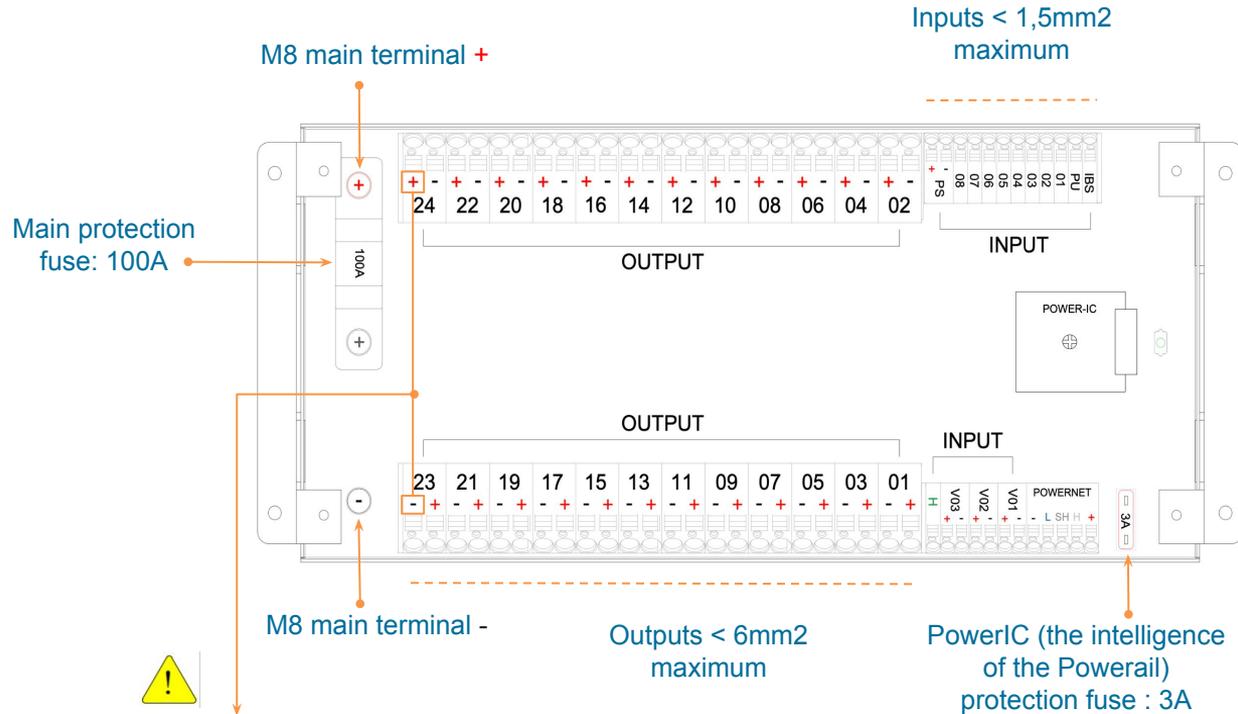
The polarity order of the outputs changes:

Main terminal + ●——→ 1st wire +

Main terminal - ●——→ 1st wire -

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Connection to the Powerail :
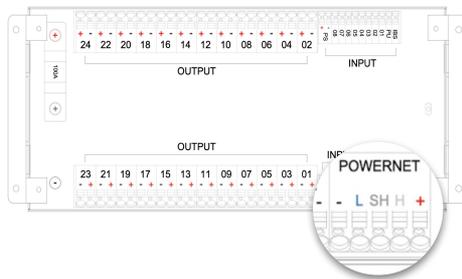
The only way to connect the CAN network to the Powerail is to use a CAN cable stripped at one end to be able to connect the wires into the terminals :
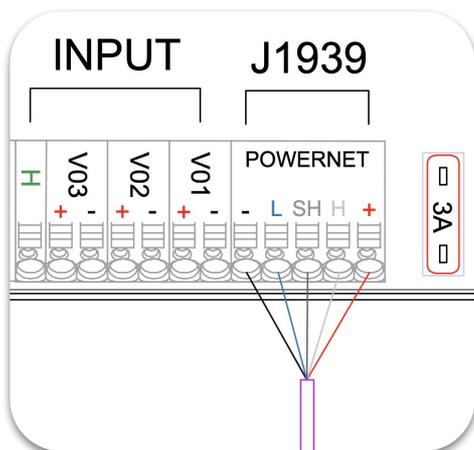
- ⚫ Black wire = Négative
- 🔵 Blue wire = CAN Low
- ⚪ Grey wire = Cable shield
- ⚪ White wire = CAN High
- 🔴 Red wire = Positive

15
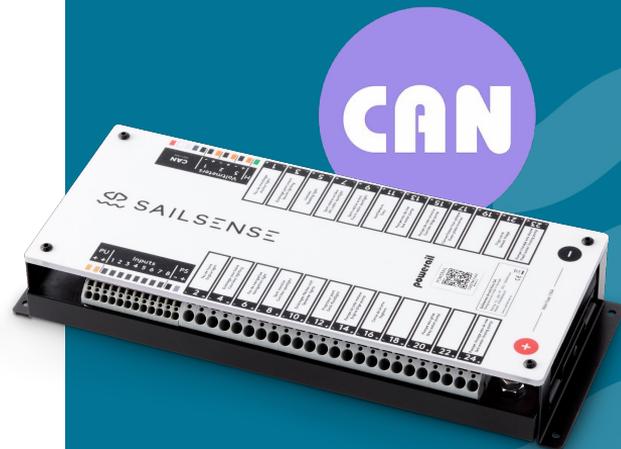
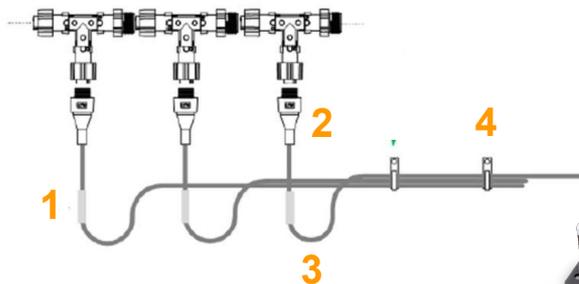# Compliance with installation rules:

Avoid water-related problems :
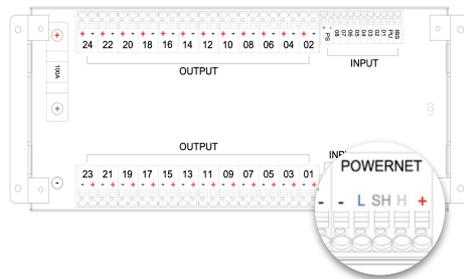
Avoid interference :
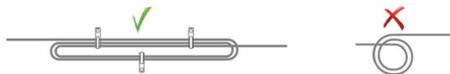
Good practices

1- All cables are labelled 30cm from the connection point

2- Provide some length to be able to easily disconnect the devices in case of replacement

3- Make loops in damp places (drip loops)

4- Attach the cables every 45cm

POWERAIL
CAN connection 2/2

Output wires connection
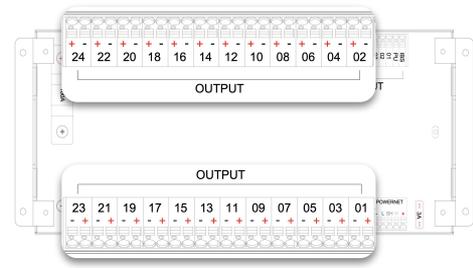
To improve **heat dissipation** of the Powerail, remember to allocate the most energy-intensive consumables close to the main Powerail supply terminals :
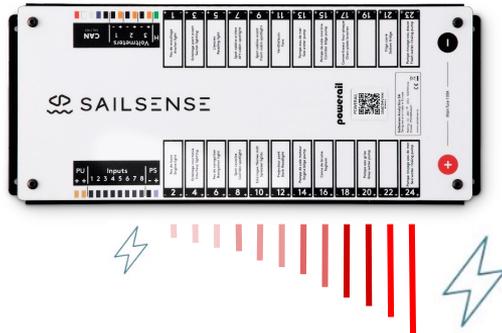
GOOD TO KNOW

1- You can use only the + or - of an output to control a consumer.
For example: Victron converter control need a + to turn ON

2- Two outputs can be used in parallel to supply one consumer

POWERAIL
Heat dissipation

Output wires identification

Sailsense provide you with tips to name your wires :
Example Powerail - output 1 :
    PS01A - P (Powerail) / S (output) / 01 (N°output) / A (+)
    PS01B - P (Powerail) / S (output) / 01 (N°output) / B (-)
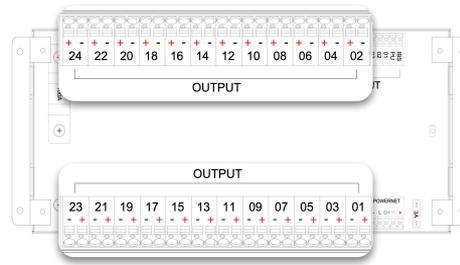
In case you install **multiple Powerail** :
Powerail #01 :
    P1S01A - P1 (Powerail #01) / S (output) / 01 (N°output) / A (+)
   P1S01B - P1 (Powerail #01) / S (output) / 01 (N°output) / B (-)
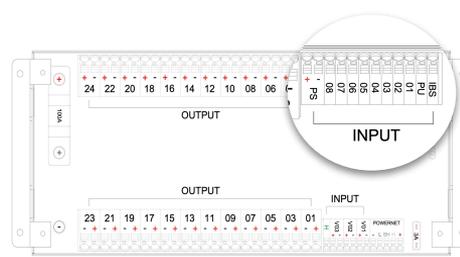
Powerail #02 :
    P2S01A
    P2S01B

When an output supply multiple consumers, the best way to name the wires is to keep the root (P1S07) and change the pairs after the root (A/B - C/D - E/F - …), for example :

P1S07B   P1S07D   P1S07F
P1S07A   P1S07C   P1S07E

This way of naming allows to be more efficient in troubleshooting, in this case we know that the source is output 7 of Powerail #01

POWERAIL
Output connection

POWERAIL
Input connection 1/5
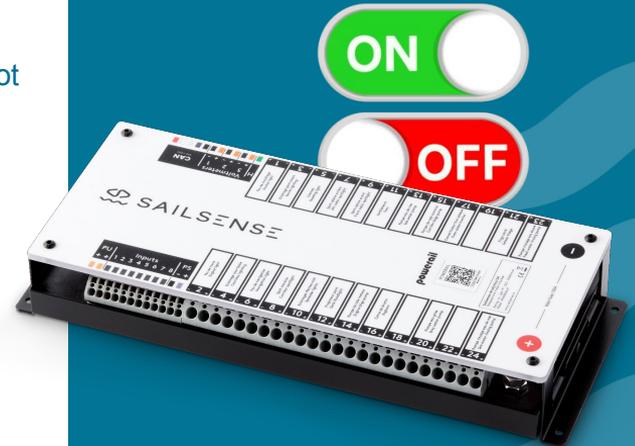
Input wires identification

Sailsense provide you with tips to name your wires :
Example Powerail - input 1 :
        PE01A - P (Powerail) / E (input) / 01 (N°input) / A (+)
        PE01B - P (Powerail) / E (input) / 01 (N°input) / B (-)

In case you install **multiple Powerail** :
Powerail #01 :
        P1E01A - P1 (Powerail #01) / E (input) / 01 (N°input) / A (+)
        P1E01B - P1 (Powerail #01) / E (input) / 01 (N°input) / B (-)

Powerail #02 :
        P2E01A
        P2E01B

This way of naming allows to be more efficient in troubleshooting.

In the following pages we explain how to connect :
-        Analog gauge
-        Ultrasound gauge
-        Voltmeters
-        Lin for IBS battery
-   Bilge pump : auto and force mode + alert signal
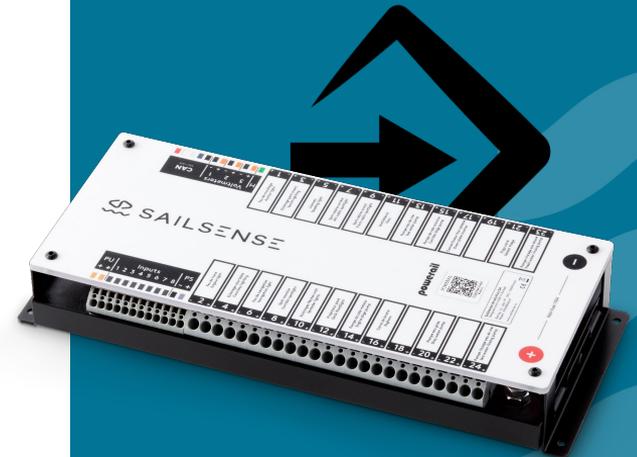
Analog gauge connection
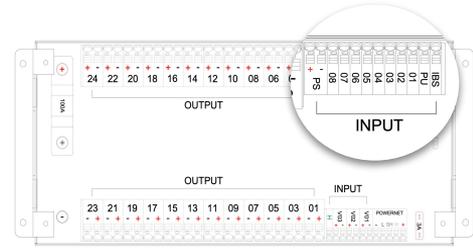
The only way to connect analog gauge to the Powerail is to **implement an 180 Ohms resistance (or 1200 Ohms to reduce consumption)** between the gauge power supply "PS" (who is a stable power supply, "independent" of battery voltage) and the positive wire of the gauge. Example input 1 below :

*In case you have **multiple gauges** in the inputs of one Powerail, the best and cleanest way to connect it all is to pass through a **junction box**.*
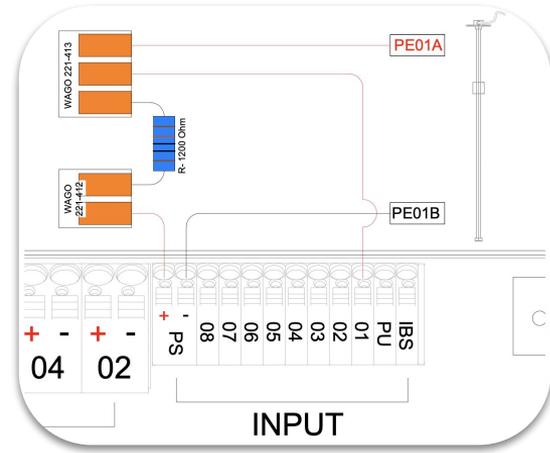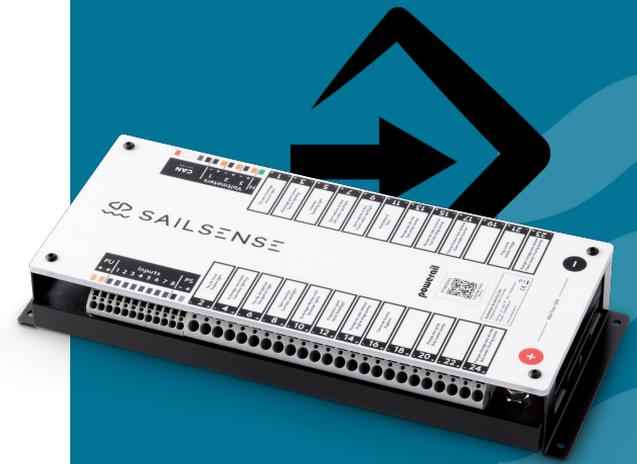
The Powerail reads the difference between the implemented resistance and the gauge's variable resistance. It sends these readings to the HUB which, through the tank equation (calculate during the study), displays the correct value on the screen.

Ultrasound gauge connection

The ultrasound gauge are simpler to connect but may represent a cost for the yard.
To connect it to the Powerail, follow the instruction below (example input 1):

Tips to name your wires:
PE01A -> **+** sensor supply
PE01B -> **-** probe power supply
PE01C -> signal (generally between 0V and 5V,
   gauge's specifications to check)

*In case you have **multiple gauges** in the inputs of one Powerail, the best and cleanest way to connect it all is to pass through a **junction box**.*
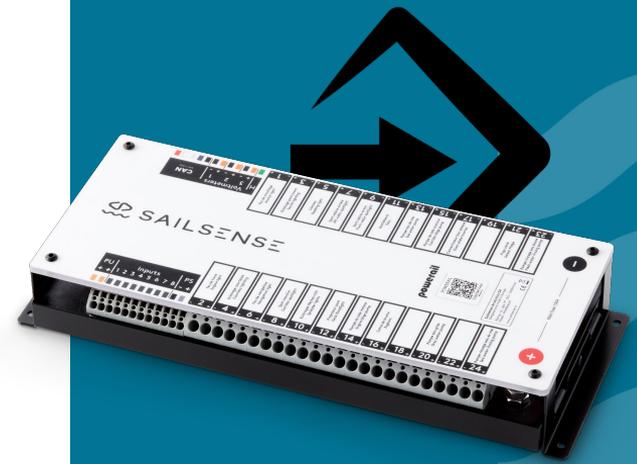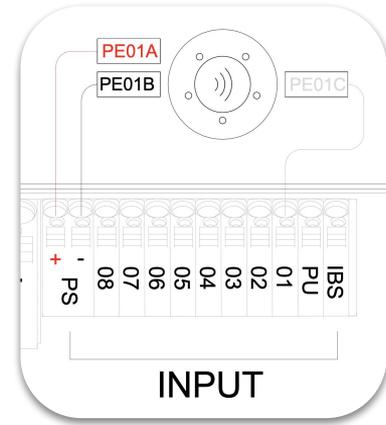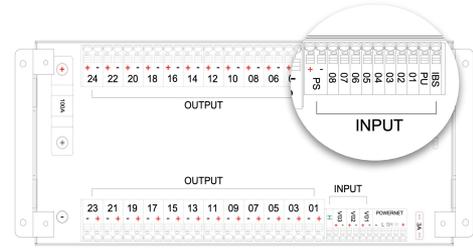

The Powerail reads the signals, sends these readings to the HUB which, through the tank equation (calculate during the study), displays the correct value on the screen.

POWERAIL
Input connection 3/5

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Voltmeters connection

Number of voltmeter per Powerail : 3
Reading range : -30VDC // +30VDC
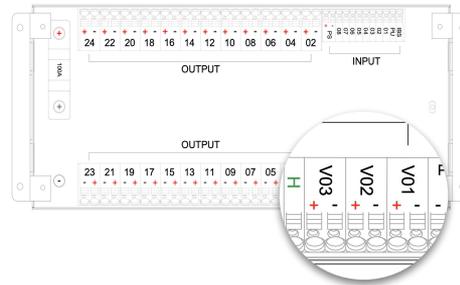
IMPORTANT : Don't forget to add a 3A fuse to the (+) voltmeter wire at the battery outlet. To be sure of the reading, Sailsense advises you to pass wires **+** and - between the battery you want to monitor and the voltmeter of the Powerail.
Example voltmeter 1 :
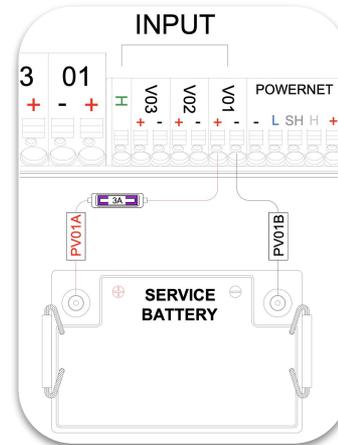
Sailsense provide you with tips to name your wires :
Example Powerail - voltmeter 1 :
PV01A - P (Powerail) / V (voltmeter) / 01 (N°voltmeter) / A **(+)**
PV01B - P (Powerail) / V (voltmeter) / 01 (N°voltmeter) / B (-)

In case you install **multiple Powerail** :
Powerail #01 :
P1V01A - P1 (Powerail #01) / V (voltmeter) / 01 (N°voltmeter) / A **(+)**
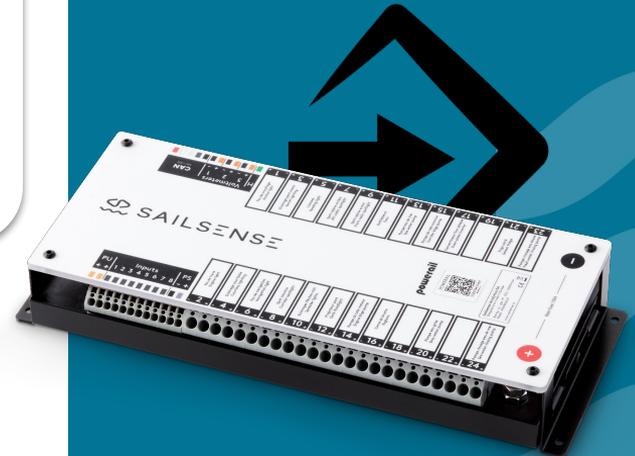P1V01B - P1 (Powerail #01) / V (voltmeter) / 01 (N°voltmeter) / B (-)

Powerail #02 :
P2V01A
P2V01B

**This way of naming allows to be more efficient in troubleshooting.**

LIN connection :

Instead of voltmeter you can use **IBS** to monitor your batteries.
- Maximum number of IBS per Powerail : **1**
- Tension : 12VDC / 24VDC
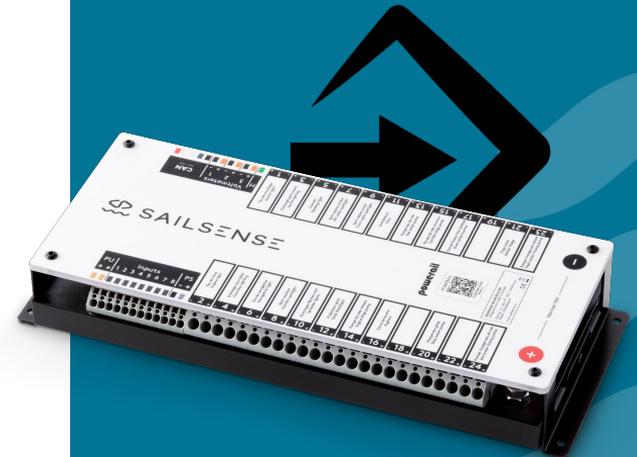- Maximum current -> follow the specifications of your supplier

IBS provide **more informations** : current consumption and production, temperature, state of charge, state of health.
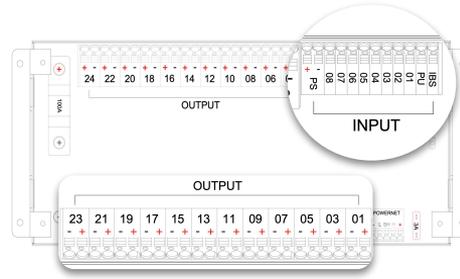To connect it to the Powerail, follow the instruction below :
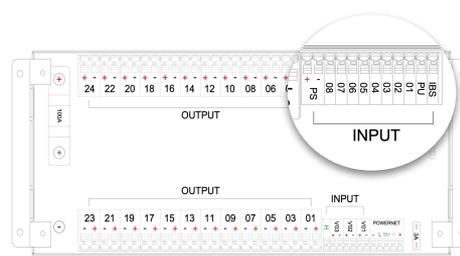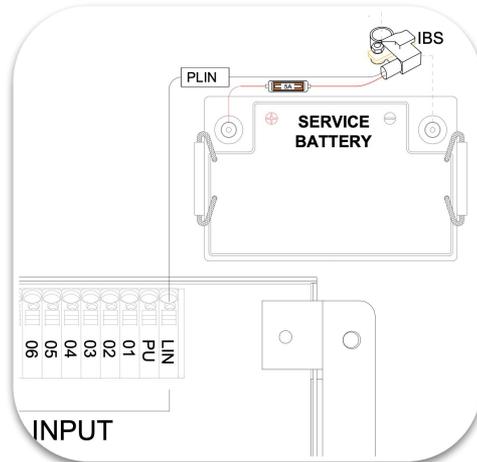
POWERAIL
Input connection 5/5

Bilge pump : AUTO and FORCED mode + alert signal connection

Bilge pump being a security component of your boat, we advise you to power supply them in two different ways :
- AUTO mode, power supply directly by the service battery (+ and -) and protected by a fuse.
- FORCED mode, power supply by the Powerail with only a +.

To be alerted when a bilge pump run in AUTO mode, connect a wire between the float (after contact) and an input on the Powerail.

The Powerail will receive the voltage when the contact closes and after several seconds of operation will send an alert message to the HUB which will display it on the screen and inform you remotely by sending an SMS/email.

On the next page you will find a scheme of a bilge pump + a float connected to the battery and the Powerail.

Some bilge pumps do not need a float because it is integrated into the pump. In this case you can take the input alert directly from the FORCED mode wire because most of the time the voltage returns via this wire when AUTO mode is running (check your pump specifications).

⌀ SAILSENSE

POWERAIL
Bilge pump connection 1/2

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Bilge pump : AUTO and FORCED mode + alert signal connection
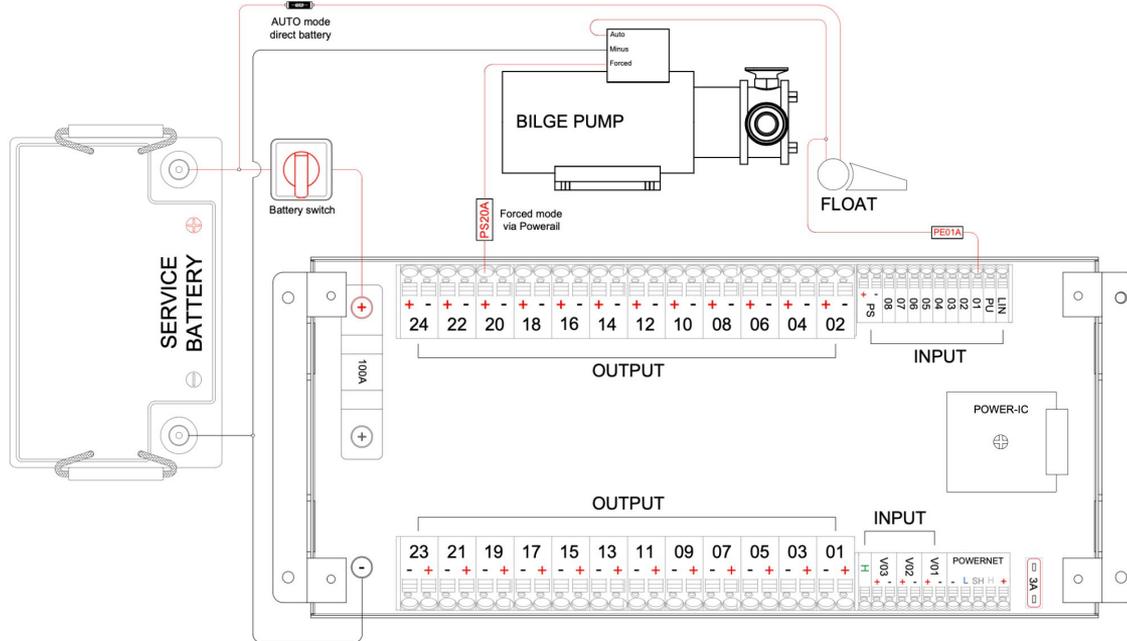
POWERAIL
Bilge pump connection 2/2
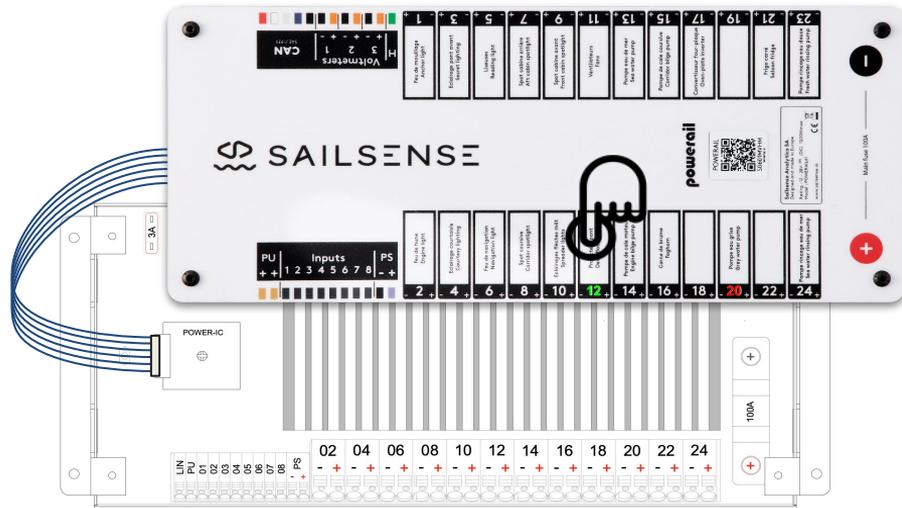
POWERAIL
Optional features

As an option you can have digital control panel for your Powerail

The idea is to provide a **backup switching mode**. It consists of replacing the classic front plate with the digital one which is **equipped with switches on each output hidden behind the designations**.

To do this, the panel is connected **directly to the Power-IC** (brains of the Powerail), meaning that **commands do not go through CAN1**.

Working in this way allows us to **avoid CAN problems** that can arise: unplugged wire / cut cable / broken connector / etc. And it **provides security to the user(s)**.

When an output is activated, the LED behind the number turns green (example output 12), when there is a problem with the output, the network or the consumer it turns red (example output 20) :
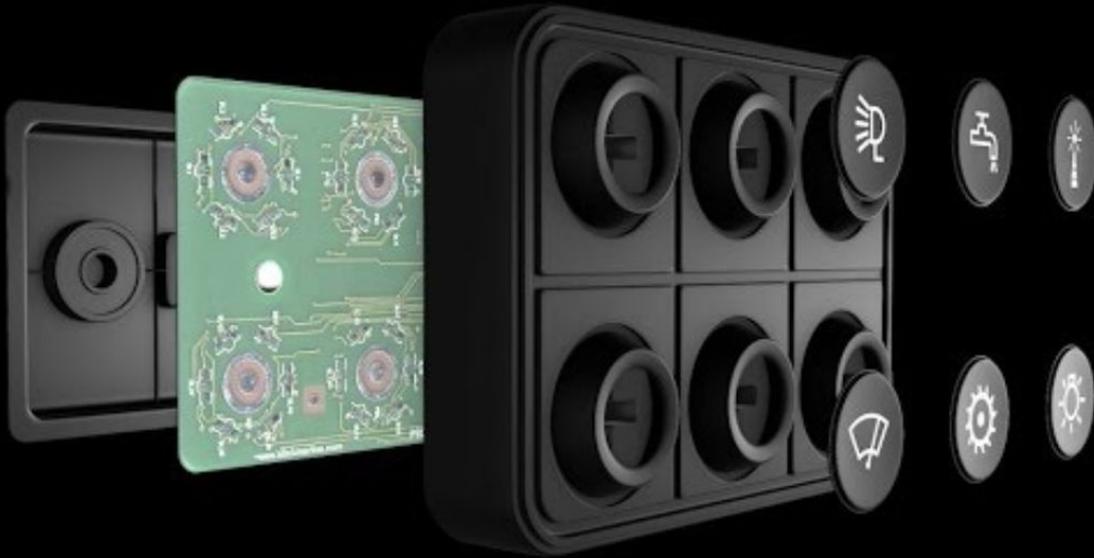

POWERAIL
Optional feature
Digital control panel

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BLINK KEYPAD

Optional feature
Presentation

BLINK KEYPAD

Specification

CAN

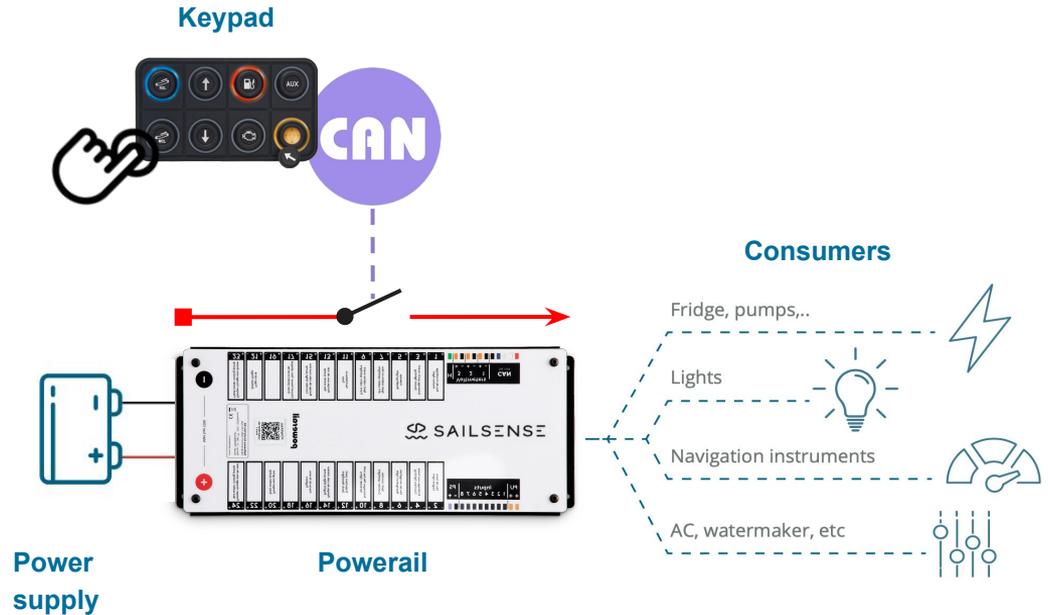|	
Link Blink marine	products
Water and dust resistant	Yes
Dimensions	Varies depending on product choice - from 2 to 15 switches
Supply	8-32VDC
Power drain	<50mA
Protocol (Blink offer the choice between 3 protocols : RS385 / CANopen / J1939) ⚠️	J1939
Icon	Blink marine offers a large choice

BLINK KEYPAD

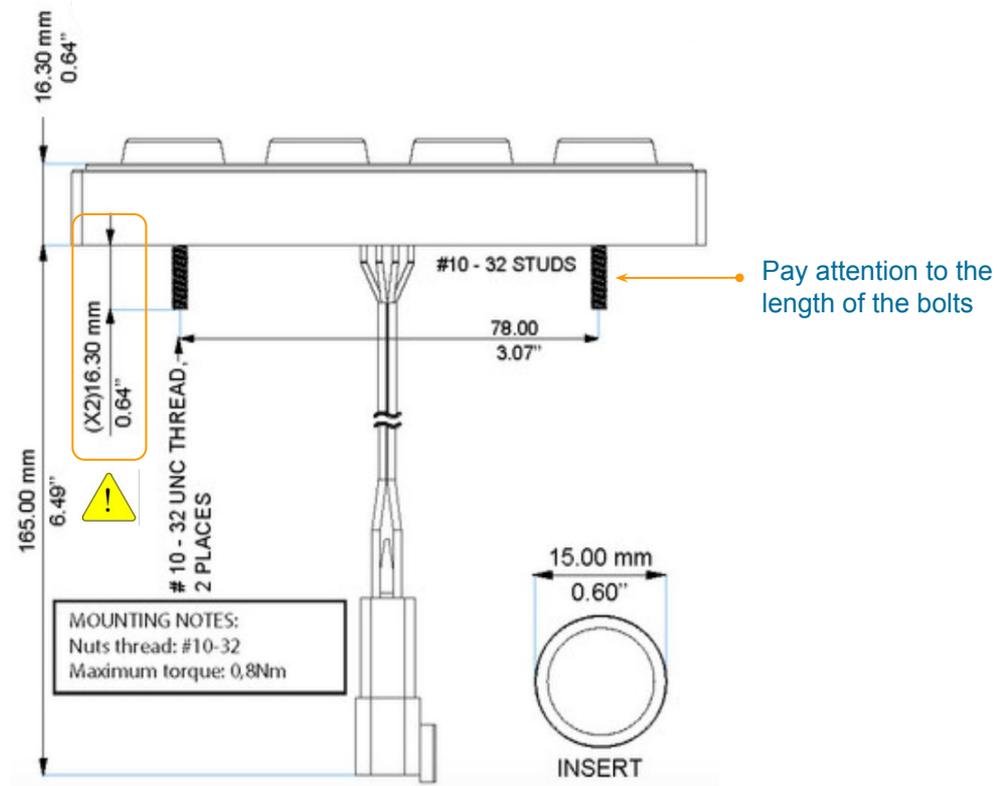How does it work ?

Output activation :

Once the action is performed via the keyboard, the Power-IC (brain of the Powerail) interprets the CAN command and closes (or opens) the output following the action performed and compared to the Powerail configuration.
In doing so, it allows the battery to power the consumer (or not) after the output.

Keypad

CAN

Consumers
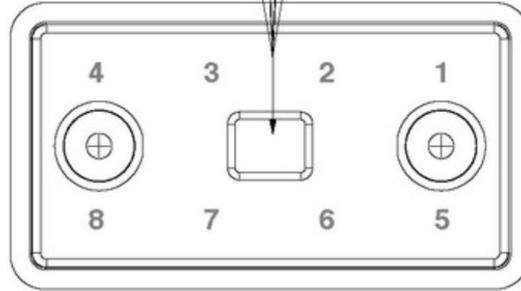
Fridge, pumps,..

Lights

Navigation instruments

AC, watermaker, etc

Power supply

Powerail

BLINK KEYPAD

Installation

Pay attention to the length of the bolts

#10 - 32 STUDS

MOUNTING NOTES:
Nuts thread: #10-32
Maximum torque: 0,8Nm

INSERT

BLINK KEYPAD

Connection

GREEN= TxRx-(RS485)   ORANGE= TxRx+(RS485)
BLACK=GROUND   WHITE=CAN HIGH
RED=POWER   BLUE=CAN LOW

| 4 | 3 | 2 | 1 |
| 8 | 7 | 6 | 5 |

All Blink keypads are supplied as standard with an Amphenol AT04-4P socket fitted.
The mating plug is NOT supplied (but is available as an optional accessory) :
Kit-amphenol

To connect the keypad to the Sailsense CAN1 you must create this cable :

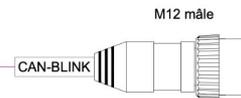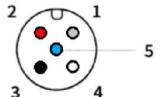**BLINK KEYPAD**   **SAILSENSE CAN1**

M12 mâle

1	CAN-L
2	CAN-H
3	V-
4	V+

CAN-BLINK

Shield	1
V+	2
V-	3
CAN-H	4
CAN-L	5

Deutsch connector DT 4 ways female

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BLINK KEYPAD

Led behaviour

Color code :

- 🔵 Blue : Off
- 🟢 Green : On
- 🔴 Red : error

BLINK IO BOX

Optional feature
Presentation

Water and dust resistant	Yes
Dimensions	130x42x63 mm
Supply voltage	8 to 32 VDC
Power drain	< 30mA
Protocol	J1939

(Blink offer the choice between 3 protocols : RS485 / CANopen / J1939) ⚠️

Contact switch input   8

The input voltage corresponds to the battery voltage

…

IO box
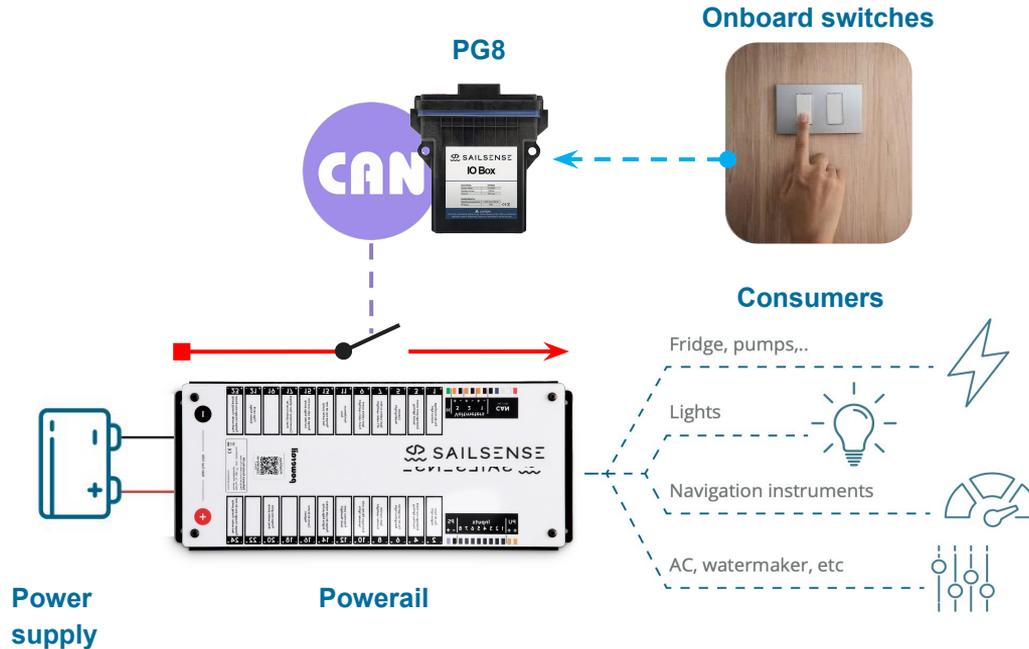## Specification

CAN

Output activation :

Once the action is performed via an onboard switch, a tension is send to an input of the IO box. The IO box then transforms this signal to an CAN command.
The Power-IC (brain of the Powerail) interprets the CAN command and closes (or opens) the output following the action performed and compared to the Powerail configuration.
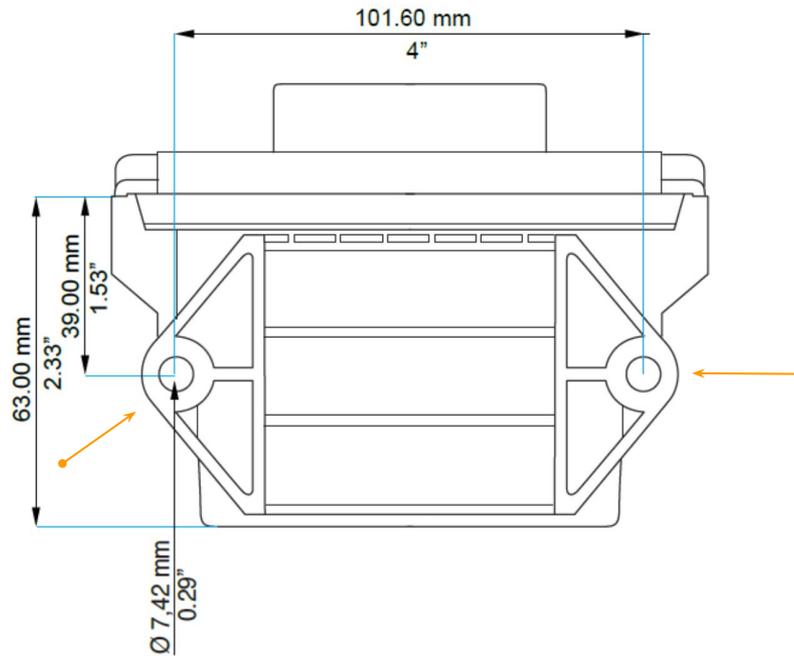In doing so, it allows the battery to power the consumer (or not) after the output.

Onboard switches

PG8

Consumers

Fridge, pumps,..

Lights

Navigation instruments

AC, watermaker, etc

Power supply

Powerail

IO box
How does it work ?

Screw the IO box horizontally or vertically to the boat, with the connector easily accessible for the aftersale :
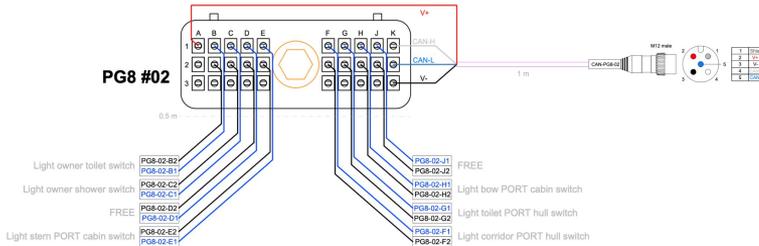
IO box
Installation

All IO box are supplied as standard without Cinch connector but is available as an optional accessory :

30-ways Cinch connector for IO box
Kbconn30

Sailsense **can provide** this connector with the **right length and configuration** needed for your boat. Just send us the specifications and we'll do the work and test :

JOTFORM
Configuration tool presentation

Sailsense provide tools to configure your BOAT :

We create online forms for you using the JotForm tool, to help you configure your installation. Depending on your needs, you can use :

- JotForm for **HUB only.**

- JotForm for **HUB + Powerail + Blink keypad / IO box** with full customization.

- Jotform for **shipyard with mass production**, allows you to choose the boat model and the options you want to activate.

- Jotform **on request for large projects**.

The advantage of this tool is that it can update a configuration remotely so no need to be on board ;)

SAILSENSE

BOAT
Configuration

1. The Sailsense team sends an **invitation email** to join the Jotform platform :

2. Click on **"view form"**

3. The internet link is activated and **you arrive at the form** (remember to save the link as favorites on your browser) **->**
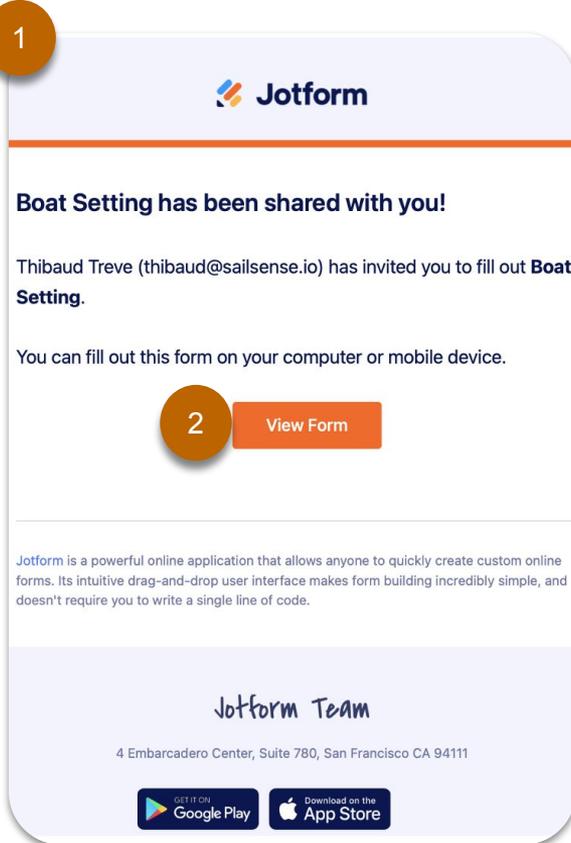
BOAT

Configuration example 1/6

Jotform for shipyard with mass production, allows you to choose the boat model and the options you want to activate.
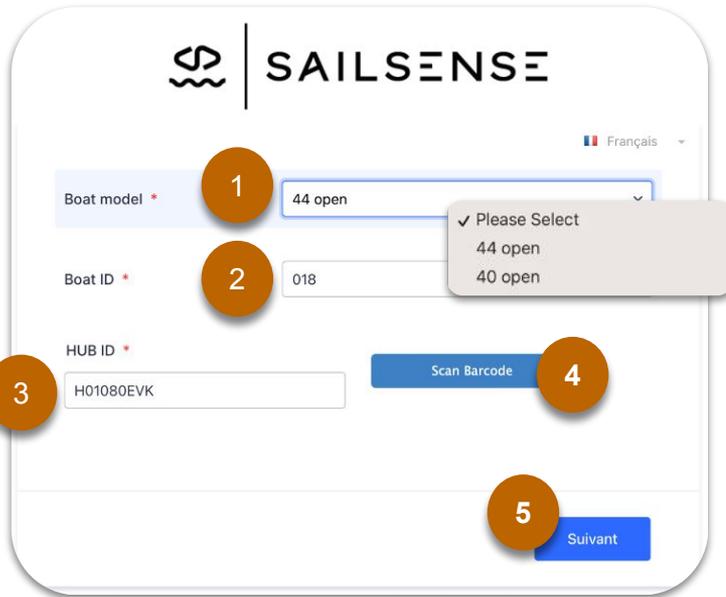
BOAT

Configuration example 2/6

Jotform for shipyard with mass production, allows you to choose the boat model and the options you want to activate.

1. Choose the boat model from the list

2. Enter the **Boat ID**

3. Enter the **HUB ID** present on the QR code label **or 4. scan it** with your phone / tablet to avoid errors :

5. Click **next ->**

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1. Select the options according to the boat's configuration

2. Click **next ->**

BOAT

Configuration example 3/6

Jotform for shipyard with mass production, allows you to choose the boat model and the options you want to activate.

1. Enter your **email address**

2. Click **submit ->**

BOAT

Configuration example 4/6

Jotform for shipyard with mass production, allows you to choose the boat model and the options you want to activate.

1. If asked, answer the **CAPTCHA**

2. Click **submit form ->**

BOAT

Configuration example 5/6

Jotform for shipyard with mass production, allows you to choose the boat model and the options you want to activate.

A **confirmation email** will be sent to you and the Sailsense team will be informed that a new configuration has been uploaded by you for this boat :

BOAT

Configuration example 6/6

Jotform for shipyard with mass production, allows you to choose the boat model and the options you want to activate.
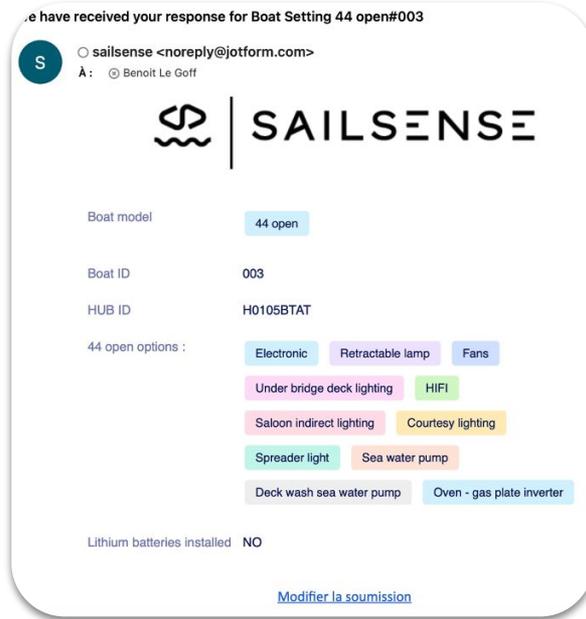
The new configuration is sent to the **Sailsense Cloud.** The HUB (provided it is connected to 4G) will download this new configuration. The old one will be stored in archives in the Cloud.

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POWERAIL
LED color

POWERAIL
LED color

Running :

Flashing white : the device start (only with PowerIC V1)

3 yellow flashes / red fix : starting process (only with PowerIC V3)

https://help.sailsense.io/en/articles/421356-powerail-update-poweric-v3

Flashing white / green : the device is locally connected to CAN network

Flashing blue / green : the device is connected remotely and to CAN network (only with PowerIC V3)

Error :

Flashing red : CAN error
https://help.sailsense.io/en/articles/421467-my-powerail-flashes-red

Fixed light blue : the device does not start

https://help.sailsense.io/en/articles/421485-my-powerail-is-fixed-blue

For any question or feedback, please contact Sailsense via :

Mail : support@sailsense.io
WhatsApp : +44 7418 310794

Sailsense knowledge base : https://help.sailsense.io/en