SAILSENSE

POWERAIL V8

USER MANUAL

DC 12-24V Digital Switching & Power Distribution Module

24 Bipolar 20A Outputs • PWM Dimming • WS281x LED Engine • Multi-Input Control

Version	Modification	Date
V1.0	First version of the manual	01/26

SUMMARY

1. General Information

1.1 Purpose of this Manual

This manual provides the information necessary for the correct use and understanding of the Powerail V8. It explains the module's operational behaviour, indicators, communication interfaces and interaction within a Sailsense electrical system. Although the Powerail V8 forms part of a distributed digital switching network, this document focuses exclusively on user-relevant functionality. Installation, wiring and commissioning instructions are provided separately in the Powerail V8 Installation Manual and must be consulted before any work is carried out on the system.

1.2 Description of the Powerail V8

The Powerail V8 is a multifunction DC power distribution module designed for marine environments. It combines electronic circuit protection, high-power switching, current measurement, input processing and lighting control into a single unit. Featuring 24 electronically protected outputs, multiple input channels, integrated PWM and addressable LED control, and communication via CAN J1939 and LINbus, the Powerail V8 is intended to simplify vessel electrical architecture while improving reliability and diagnostic capability. All logic coordination and system configuration are managed by the Sailsense Hub, to which the Powerail V8 is connected through a dedicated CAN backbone.

1.3 System Architecture

Within a Sailsense-equipped vessel, the Powerail V8 operates as a peripheral module controlled by the Hub. The Hub is responsible for configuration storage, automation logic, communication with user interfaces, and cloud connectivity. The Powerail V8 provides the actual electrical switching and sensing functions for onboard circuits, including lighting, pumps, fans and auxiliary equipment. CAN input gateway and keypads may be used to trigger functions locally through the J1939 network, while the Sailsense App or integrated displays allow monitoring, control and diagnostics from anywhere on the vessel. Communication between modules is handled through a J1939 network, with LINbus available for supported sensors such as IBS/BMS units.

While the Sailsense HUB normally coordinates logic, vessel-wide automation and user interface interactions, each Powerail stores its own internal configuration and remains fully functional even in the event of HUB failure or communication loss.

1.4 Delivery Scope

A standard Powerail V8 delivery includes the Powerail module, factory-mounted MegaFuse protection, removable connector blocks (depending on ordering specification) and the

accompanying documentation package. Auxiliary components such as the Hub, PG8 keypads, sensors may be supplied separately based on vessel configuration requirements. Before installation, the contents should be checked for completeness and any transport damage reported immediately.

1.5 Intended Use

The Powerail V8 is intended for use in 12 V or 24 V DC marine applications. It is designed to control and protect electrical consumers within the limits specified in this manual. The device must be installed in an enclosed, dry location protected from excessive heat, spray, vibration and contamination. The Powerail V8 must only be operated in conjunction with a Sailsense Hub. It must not be used for AC circuits, propulsion-critical functions, or applications exceeding defined current or environmental limits.

1.6 Regulatory Information and Warranty

The Powerail V8 conforms to applicable marine electrical and environmental standards. Operation outside the specifications provided in this manual, modification of the device, use of non-approved accessories, incorrect wiring or installation performed by unqualified personnel may void the warranty. Sailsense Analytics SA accepts no liability for damage arising from improper use, negligence or deviations from recommended installation practices.

2. Safety Information

The Powerail V8 has been designed for use in marine DC electrical systems and incorporates a range of protective features intended to ensure safe operation under normal conditions. Nevertheless, digital switching equipment introduces specific requirements and risks that must be understood and respected. Incorrect installation, handling or operation may result in equipment malfunction, loss of vessel services, or personal injury. All personnel working on or around the Powerail V8 must read and fully understand this section before energising the device or interacting with the connected electrical system.

2.1 Safety Symbols and Conventions

The following symbols are used throughout this manual to draw attention to critical safety information.
These definitions mirror conventions used in marine electrical standards and comparable digital switching systems.

- ⚠ **CAUTION** — Indicates a situation which, if not avoided, *could result in equipment damage or degraded operation*.

- 🕮 **NOTICE** — Highlights recommended practices or operational guidance important for correct system behaviour.

2.2 General Safety Requirements

The Powerail V8 may only be installed, commissioned, and serviced by qualified marine electricians familiar with DC vessel systems and applicable marine standards (such as ABYC E-11 or ISO 10133/13297). The operator must ensure that the device is used exclusively within the limits and conditions described in this manual. Before performing any work on the system, all power sources must be isolated at their main disconnect points, and appropriate measures taken to prevent accidental re-energisation. The device must not be operated if any visible signs of mechanical damage, overheating, moisture ingress or corrosion are present. Failure to adhere to these requirements may compromise vessel safety.

2.3 Electrical Safety

The Powerail V8 distributes, switches and monitors significant DC currents, and must therefore be treated with the same level of caution as traditional breaker panels. All supply feeds must be protected with correctly rated fuses or circuit breakers suited to the conductor size, load characteristics and vessel architecture. Incorrect cable gauges, loose terminals, corrosive environments or damaged insulation may cause excessive heating,

arcing or fire. The output current limits specified for each channel must never be exceeded. The internal protective mechanisms (over-current, short-circuit and thermal protection) are designed to safeguard the module under fault conditions; under no circumstances should these protections be bypassed except as described in the manual override provisions below. Reverse polarity or incorrect battery wiring can cause irreversible damage and must be checked carefully before the system is energised.

2.4 Environmental Conditions

The Powerail V8 must be mounted in a clean, dry and well-ventilated location where it is protected from spray, condensation, bilge vapours and excessive mechanical vibration. The enclosure must not be exposed to dripping or standing water, nor installed in locations subject to immersion or frequent wash-down. Adequate clearance must be maintained around the enclosure to ensure heat dissipation. Operating the unit outside its specified environmental or thermal limits may degrade performance or prematurely activate its protection mechanisms. Long-term exposure to corrosive atmospheres, salt deposits or fuel vapours must be avoided.

2.5 Use Restrictions

The Powerail V8 is intended exclusively for auxiliary DC electrical consumers and must not be used for AC systems, propulsion-critical functions, fail-safe emergency circuits or life-safety systems. Loads exceeding the module's or the output's current ratings must never be connected directly. Devices producing regenerative currents or inductive kickback must be equipped with appropriate external suppression. All firmware, configuration and accessories must be provided or approved by Sailsense; modification of device firmware, connectors or protective components voids warranty and may present a safety hazard.

2.6 Maintenance and Servicing

The Powerail V8 contains no user-serviceable internal electronic components. The enclosure must not be opened, and internal circuits must not be probed, modified or accessed. Routine maintenance is limited to periodic inspection of connector integrity, absence of corrosion, correct cable routing, and verification that the device remains securely mounted.

The only field-replaceable component is the main MegaFuse, which protects the Powerail supply rail. This fuse is intentionally accessible by removing the front cover only, without opening the enclosure or accessing internal electronics. Fuse replacement must be carried out using the correct fuse type and rating, in accordance with the installation guidelines.

Any signs of overheating, abnormal smell, discoloration, excessive temperature, or repeated protection activation must be investigated immediately. If the device is suspected to be defective beyond fuse replacement, it must be removed from service and returned to an authorised Sailsense service centre. Only Sailsense-certified personnel may perform

operations requiring access to internal electronics or install firmware updates that require direct device access.

2.7 Liability and Compliance Responsibilities

Sailsense Analytics SA cannot be held liable for damage or personal injury arising from improper installation, unauthorised modifications, incompatible third-party equipment or operation outside specified limits. The user and installer bear responsibility for ensuring that all work complies with local marine electrical regulations and that the installed system behaves correctly under all foreseeable conditions. The correct integration of the Powerail V8 into the vessel’s electrical design, including fuse sizing, cable selection, grounding and bus architecture, is the responsibility of the installer.

3. Product Overview

3.1 Functional Role of the Powerail V8

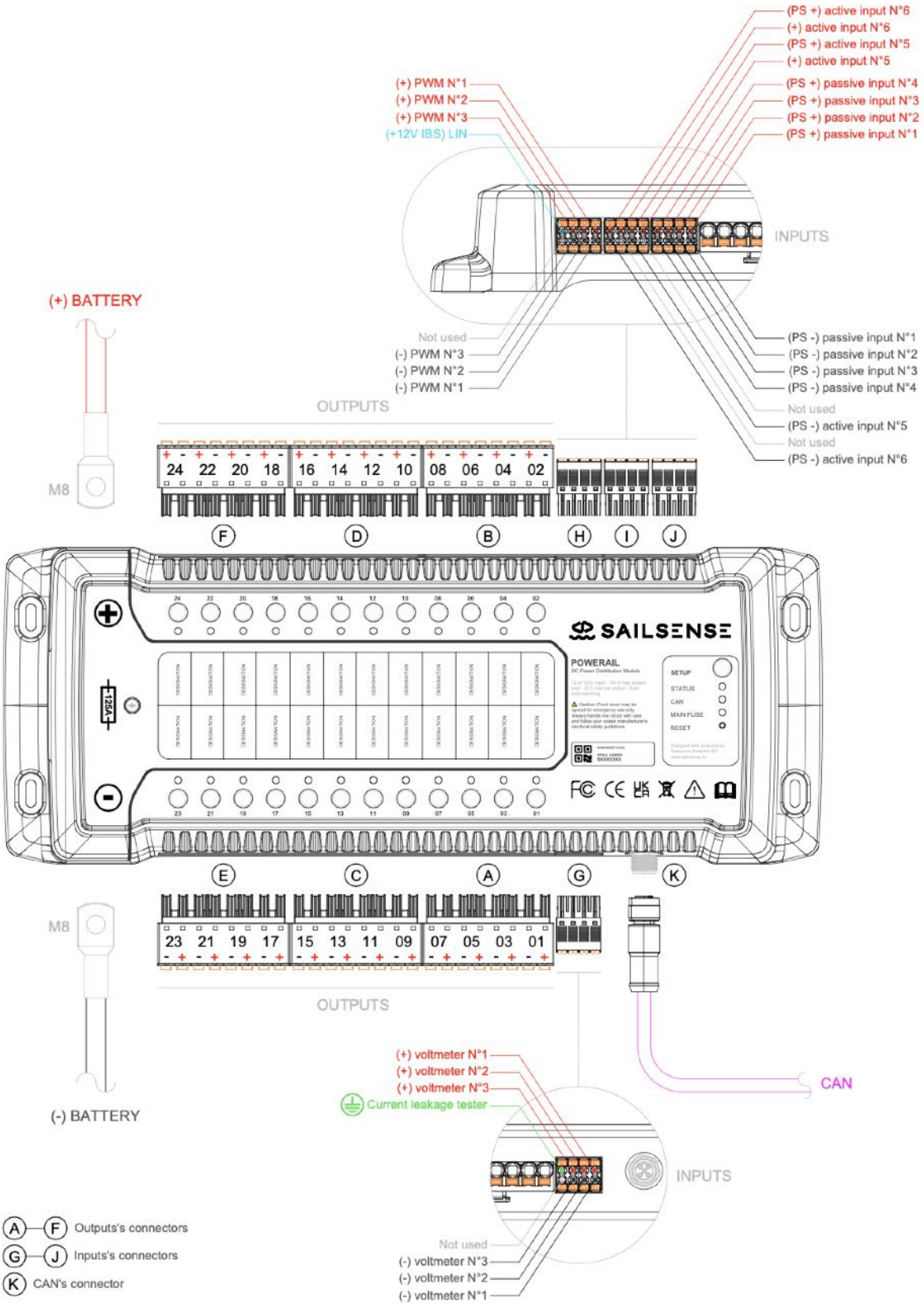
The Powerail V8 acts as the distributed power switching and protection layer within the Sailsense digital switching system. While the HUB provides configuration, automation logic and user interfaces, the Powerail V8 is responsible for the real-time switching, protection and monitoring of DC electrical loads. Each output channel is independently supervised, allowing the module to react immediately to abnormal electrical conditions and report status and faults to the system. Input acquisition, PWM dimming, addressable LED control and LIN-based sensor interfaces are handled locally, enabling efficient integration of switches, gauges and lighting without additional hardware. By combining load control, measurement and protection in a single unit installed close to the consumers, the Powerail V8 significantly reduces wiring complexity while improving reliability and diagnostic visibility.

3.2 Key Features

The Powerail V8 incorporates a number of capabilities typically distributed across separate marine electrical devices. These include:

- 24 individually protected high-power outputs suitable for lighting, pumps, fans and auxiliary loads
- A mixed-input block supporting active and passive switch inputs
- Integrated PWM channels for non-addressable LED lighting
- A dedicated hardware engine for WS281x addressable LED strips
- Three voltmeter inputs for monitoring battery banks or system buses
- A LINbus interface for supported sensors such as IBS/BMS units.

Communication with the HUB is achieved using a J1939 CAN backbone, enabling continuous telemetry and coordinated system behaviour. All components are housed within a compact enclosure designed to withstand the environmental constraints typically encountered onboard.

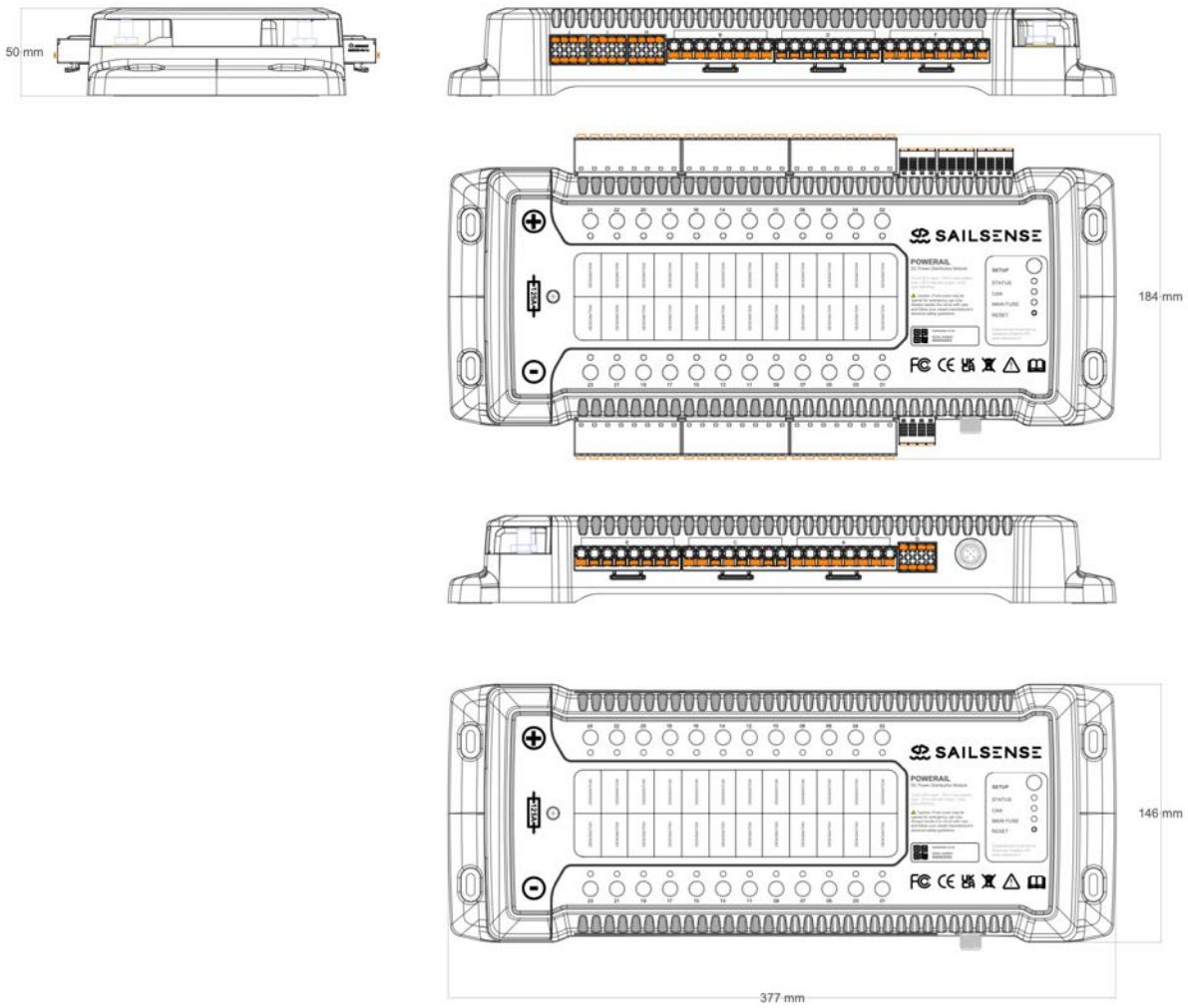

(PS +) active input N°6
(+) active input N°6
(PS +) active input N°5
(+) active input N°5
(PS +) passive input N°4
(PS +) passive input N°3
(PS +) passive input N°2
(PS +) passive input N°1
(+) PWM N°1
(+) PWM N°2
(+) PWM N°3
(+12V IBS) LIN
INPUTS
(+) BATTERY
Not used
(-) PWM N°3
(-) PWM N°2
(-) PWM N°1
OUTPUTS
(PS -) passive input N°1
(PS -) passive input N°2
(PS -) passive input N°3
(PS -) passive input N°4
Not used
(PS -) active input N°5
Not used
(PS -) active input N°6
M8
24 22 20 18 16 14 12 10 08 06 04 02
F D B H I J
SAILSENSE
POWERAIL
SETUP
STATUS
CAN
MAIN FUSE
RESET
125A
E C A G K
M8
23 21 19 17 15 13 11 09 07 05 03 01
OUTPUTS
(+) voltmeter N°1
(+) voltmeter N°2
(+) voltmeter N°3
Current leakage tester
CAN
INPUTS
(-) BATTERY
A F Outputs's connectors
G J Inputs's connectors
K CAN's connector
Not used
(-) voltmeter N°3
(-) voltmeter N°2
(-) voltmeter N°1

3.3 Environmental & Certification Data

- **Operating temperature range**: –40 °C to +45 °C
- **Storage temperature**: As per shipment and packaging guidelines (non-condensing environment)
- **Mechanical mounting**: Vertical or horizontal on rigid bulkhead
- **Approximate weight**: ~1.4 kg
- **Dimensions (overall, including side connectors)**: 377 mm × 146 mm × 50 mm (≈184 mm height including connectors, as per mechanical drawing)
- **Intended environment**: Enclosed technical spaces, not subject to submersion,, protected from direct spray and bilge vapours

3.4 Mechanical Characteristics

The enclosure of the Powerail V8 is designed for installation on rigid bulkheads inside technical spaces. The module measures approximately **377 mm × 146 mm (184 mm with connectors) × 50 mm** and provides sufficient clearance for both high-power terminals and low-power signal connectors. Cable routing is facilitated by the horizontal layout of the connectors, reducing strain and simplifying service access. The housing incorporates mounting points compatible with standard marine installation practices and is constructed to support long-term resistance to vibration and mechanical stress within the stated environmental limits.

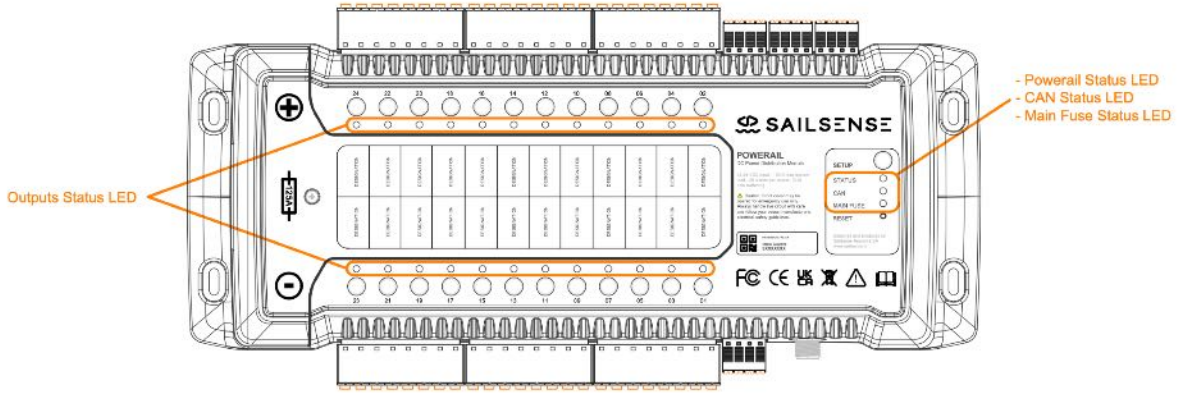


3.5 Hardware Architecture Overview

Internally, the Powerail V8 combines several subsystems designed to operate together as part of a cohesive digital switching unit. The main power path is protected by a high-capacity fuse and distributed across 24 MOSFET-based output channels, each equipped with current sensing and thermal monitoring. A dedicated measurement front-end is used to acquire voltmeter readings and to supervise output behaviour. The input subsystem incorporates active channels with integrated sensor supply and passive channels with configurable resistance for switch-to-ground or simple analogue detection. Lighting control is provided through independent PWM generators and a hardware timing unit supporting WS281x addressable LED signalling. Communication is managed through a CAN J1939 transceiver for system integration and a LINbus interface for external device support. All subsystems are supervised by the device firmware, which implements protections and communicates status to the HUB.

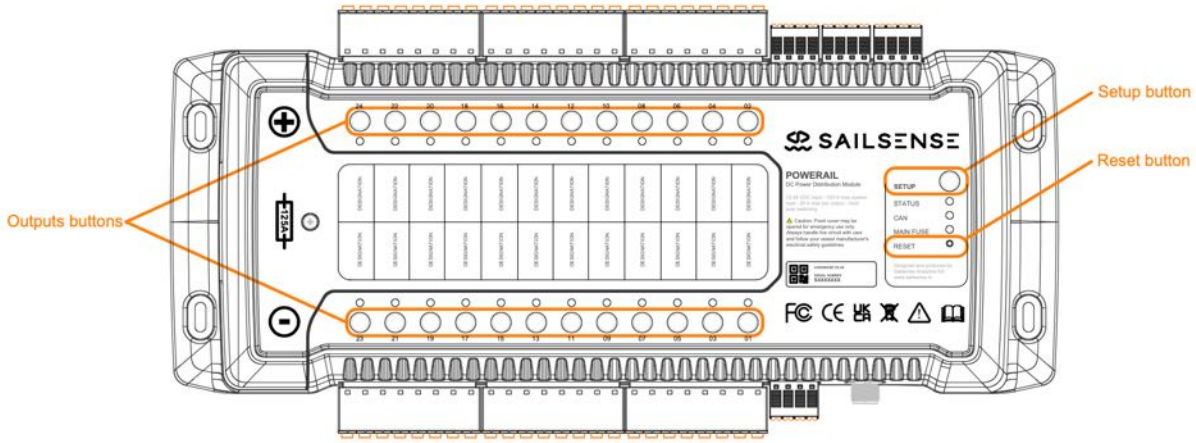
3.6 Status LEDs

The Powerail V8 includes several status indicators to provide immediate feedback on module health, protection activity and communication state. These LEDs allow installers and operators to diagnose power availability, fault conditions, and bus activity without relying solely on the HUB interface. Specific LED behaviours and diagnostic codes are detailed in Section 10.



3.7 Front Panel Buttons

The Powerail V8 includes several buttons dedicated to controlling operation, forced reset, and manual output control. These buttons allow installers and operators to diagnose, reset the Powerail and/or its configuration.



4. Installation Overview

The Powerail V8 has been designed to simplify installation onboard while maintaining compliance with marine electrical standards. Although the complete installation and wiring procedure is documented in the *Powerail V8 Installation Manual*, this chapter provides essential information for users and service personnel to understand the physical integration of the module within the vessel's electrical system. This includes mounting considerations, routing concepts and the general approach used by shipyards when installing the device.

4.1 Installation

The Powerail V8 must be installed in a **clean, dry and protected technical compartment**, typically close to the primary loads it serves. Short cable runs reduce voltage drop, improve dimming quality and minimise heat dissipation across conductors.

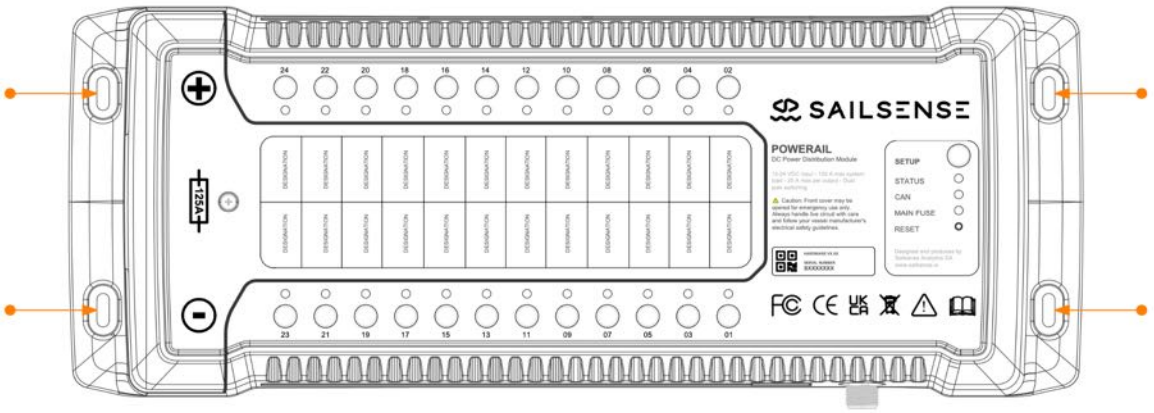
The device should be mounted:

- on a rigid bulkhead or equipment panel,
- vertically or horizontally, provided ventilation is maintained,
- away from water spray, bilge vapours, salt ingress or continuous mechanical vibration,
- as close as possible to 12V (12V Battery) or 24V (24V Battery) DC power source,
- At least 1 meter above the level of the water,
- At a distance of at least 0.5 m from other metal objects or water or fuel tanks,
- With its front plate easily accessible,
- Leaving enough space to access the device's connectors later

The installer ensures that cable entry points, glands and harness supports allow the Powerail to operate within its temperature and mechanical limits (see "**3.3 Environmental & Certification Data**"). The module's front-panel buttons and LEDs must remain visible and accessible after installation.

The Powerail V8 enclosure includes mounting points sized for standard marine fixings. Once mounted, the device must sit flush against the installation surface without mechanical stress or torsion.

Shock absorption or rubber spacing may be added if the installation panel is subject to vibration.



4.2 Power supply

4.2.1 Specifications:

- **Nominal system voltage**: 12 V DC or 24 V DC
- **Operating voltage range**: 10 V DC to 30 V DC
- **Internal main protection**: 125 A MegaFuse (factory installed, user-serviceable)
- **Maximum continuous internal rail current**: 100 A
- **Reverse polarity tolerance**: Limited (incorrect polarity may cause irreversible damage; not intended for continuous reverse operation)
- **Supply connection**: 2 × M8 studs (positive / negative), beneath front cover

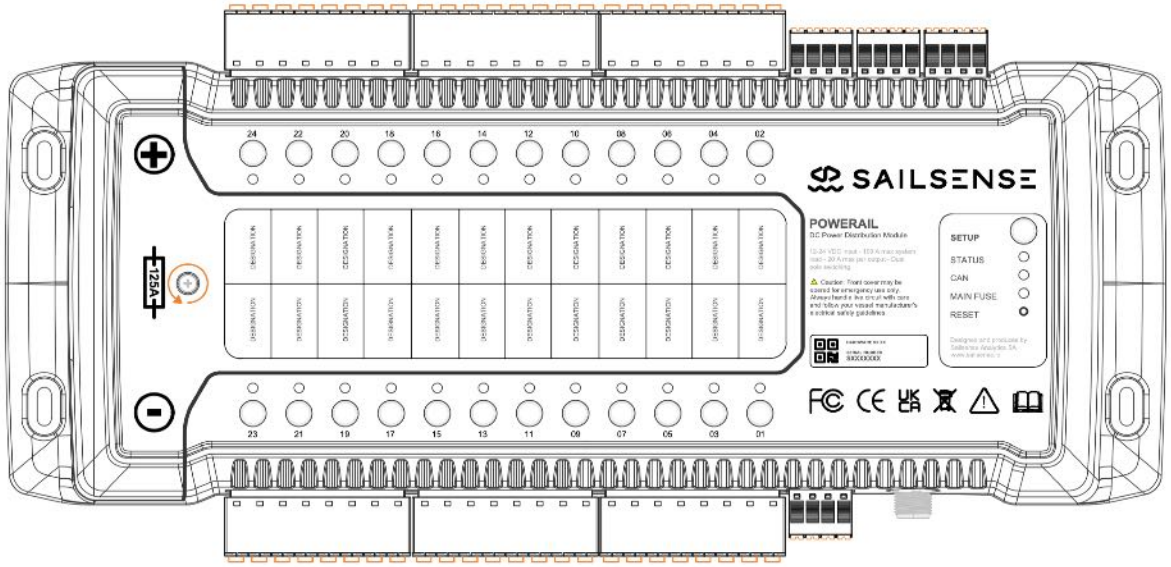
The Powerail V8 is supplied through two M8 threaded studs located beneath the removable front cover of the enclosure. These studs provide the module's primary DC interface: one for the positive supply and one for the negative return. The front cover must be removed to access these high-current terminals, both for installation and for service operations. Removal of the front cover also ensures safe access to the internal MegaFuse housing and to the strain-relief zone designed for large-section conductors.

The positive terminal feeds the internal power distribution rail and is protected by an integrated 125 A MegaFuse, factory-installed inside the Powerail enclosure. This fuse protects the module from severe overcurrent or short-circuit conditions on the main supply line. The installer must additionally ensure that upstream protection—when required by the vessel's architecture—is correctly sized and positioned according to marine electrical standards.

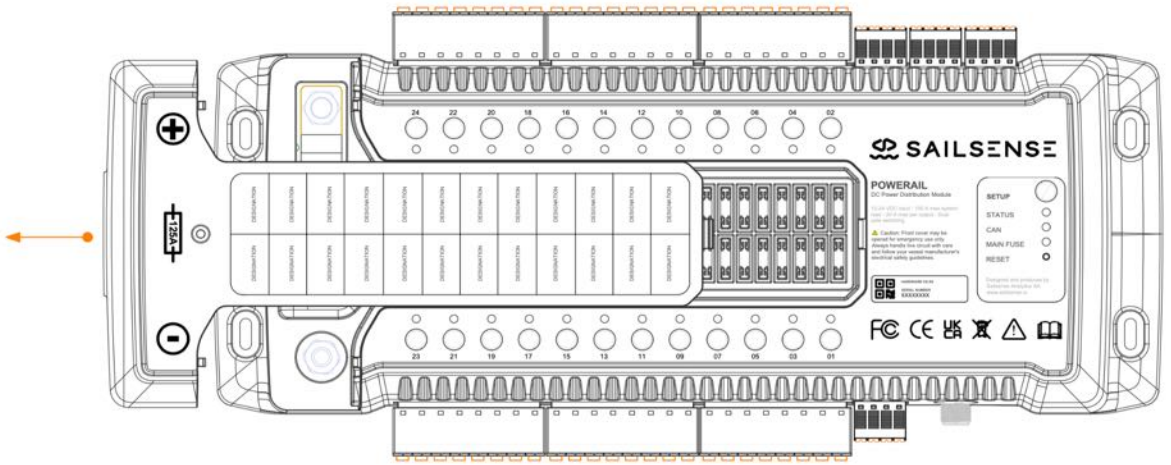
The negative terminal must be bonded to the vessel's DC negative bus using a conductor sized to support the total current supplied by the Powerail V8. Poor negative bonding, undersized cables or loose terminations can lead to voltage drop, erratic behaviour, CAN communication instability, or overheating of the return conductor.

4.2.2 Main Power Supply Connection:

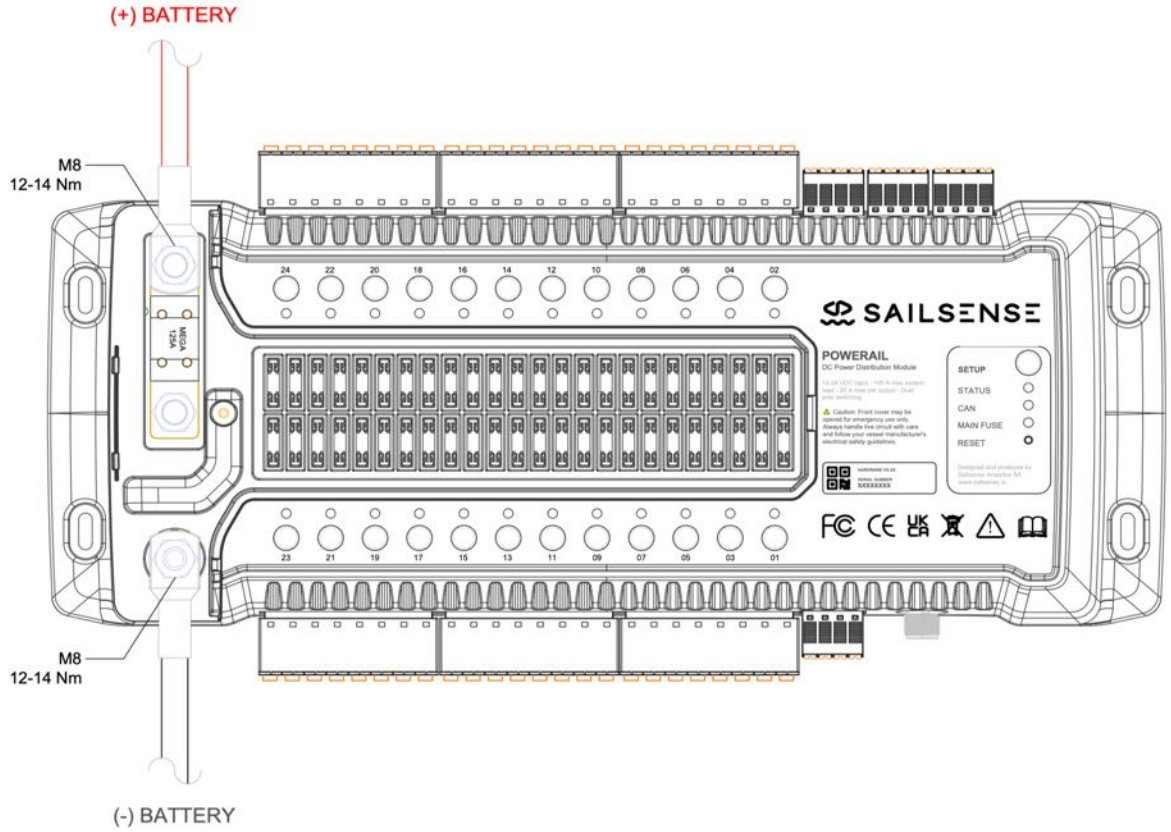
1- Unscrew the fuse box cover



2- Remove the fuse box cover



3- Connect positive & negative wires to Powerail main terminals



4- Reinstall the fuse box cover

The cable lugs used for the M8 studs must be crimped with approved tools and installed with the necessary mechanical support to prevent vibration damage. After tightening, terminals must be protected with suitable insulation boots or covers to prevent accidental contact with adjacent metallic structures.

For M8 high-current terminations, a tightening torque of 12–14 Nm is typically recommended. This ensures sufficient contact pressure to minimize electrical resistance at the interface while avoiding mechanical deformation of the stud or lug.

Installation Notes

⚠️ *Loose or under-torqued connections significantly increase contact resistance, which can lead to:*

- *voltage drop under load,*
- *localized heating at the junction (I^2R losses),*
- *progressive carbonization of the contact surfaces,*
- *thermal runaway during high-current operation,*
- *and, in severe cases, melting of the insulation or damage to the Powerail.*

Conversely, excessive tightening may deform the lug barrel or damage the threaded stud, reducing long-term reliability. Torque must therefore be applied using a calibrated tool appropriate for marine high-current terminations.

Correct installation of the main supply conductors is essential for the reliable operation of the Powerail V8. All further functionality—including output switching, input processing, LED control and communication—depends on a clean and stable DC supply delivered through these two primary terminals.

After installation or service, the front cover must be reinstalled to restore environmental protection and avoid accidental contact with high-current terminals.

4.3 High Power Outputs

The Powerail V8 is equipped with a set of high-reliability marine-grade connectors designed to support both high-current distribution and low-level signal interfaces. This chapter describes the physical connections available on the module, their function, and the conventions used for numbering and identification. All connectors are designed to ensure secure electrical contact under the vibration and environmental constraints typical of marine installations.

High-power outputs and the main supply feed use heavy-duty terminal blocks suitable for large-section conductors. Each connector has a defined orientation and pin numbering scheme, and these must be respected to ensure correct wiring.

Installation Notes

⚠️ *Before connecting any wiring to the Powerail V8, installers must verify conductor size, fuse rating and mechanical strain relief according to the applicable marine standards. Incorrect selection or assembly of connectors may lead to overheating, intermittent operation or communication faults. The diagrams and tables provided in this section are intended to support accurate cabling and to assist in identifying each terminal group during commissioning and servicing.*

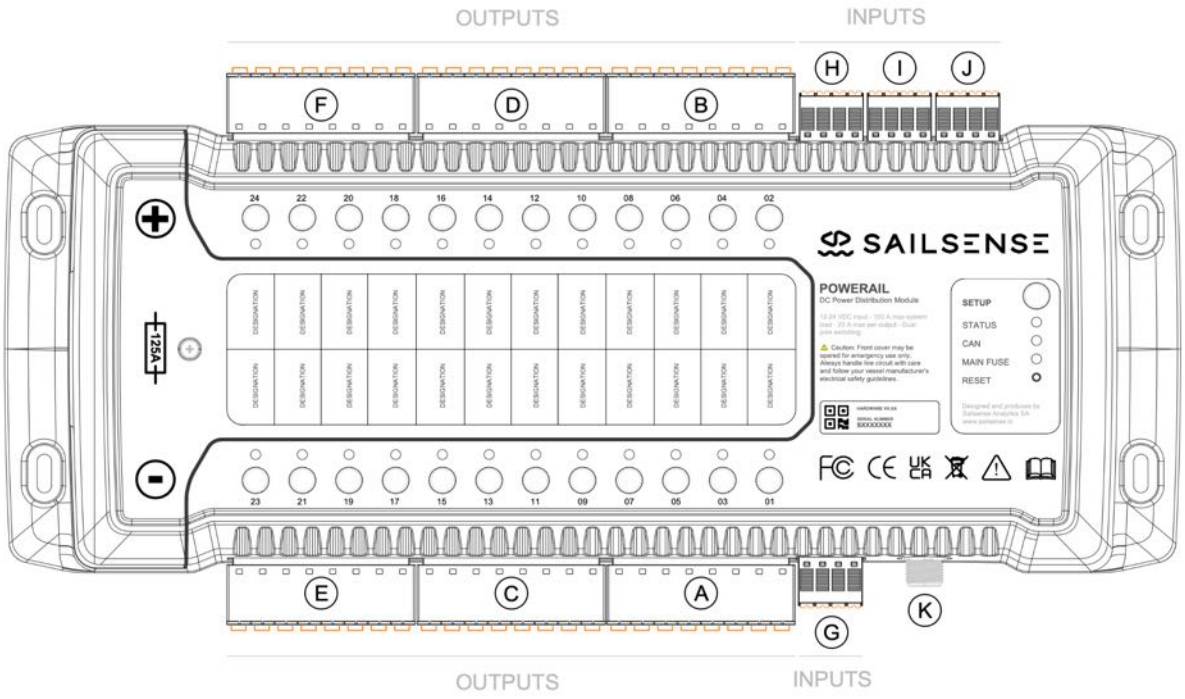
4.3.1 Specifications:

- **Number of high-power channels**: 24
- **Type**: Solid-state MOSFET high-side switching
- **Rated continuous current per channel**: 1–20 A (within device thermal limits)
- **Permitted grouping**: Up to 3 physically adjacent terminals on a single rail (e.g. 24–22–20 or 23–21–19) for a maximum of 60 A combined
- **Output voltage**: Follows input supply (10–30 V DC)
- **Connector family**: Degson 9EDGKD-HC-7.5 mm (device side), 9EDGK-HC 7.5-x8 (loom side)
- **Recommended conductor cross-section**: 1.0–6.0 mm² / 17–10 AWG (depending on current and distance)

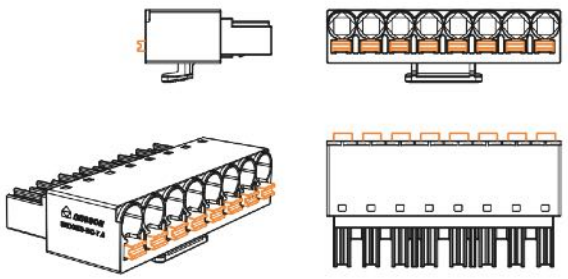
4.3.2 Connector Architecture and Layout

The Powerail V8 distributes its twenty-four bipolar outputs across six pluggable Degson 9EDGKD-HC 7.5 mm connectors. Each connector carries four complete outputs, and each output includes a dedicated positive (+) and negative (–) terminal. Both conductors are independently switched by the Powerail MOSFET array, providing full double-pole isolation of the connected load.

These connectors are designed for fast serviceability, factory pre-looming and high reliability in marine environments.



Outputs connectors :
Degson 9EDGKD-HC-7.5 series

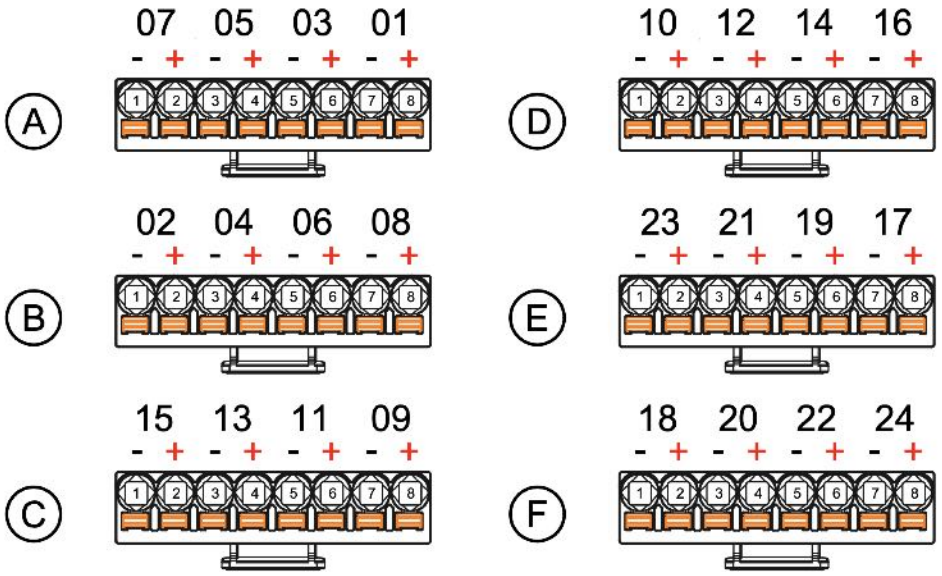


Each of the six output connectors (A to F) includes 8 pins, arranged as:

- four “+” terminals
- four “–” terminals

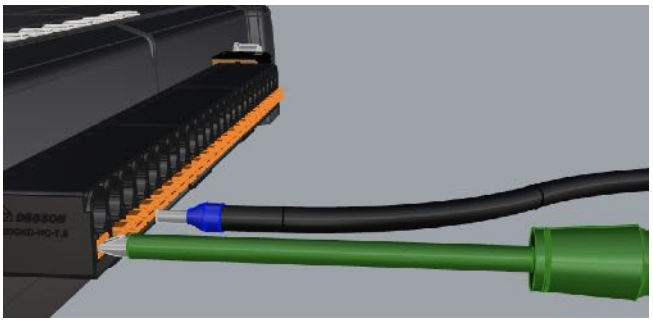
corresponding to 4 fully independent bipolar outputs.

Outputs are assigned as follows:



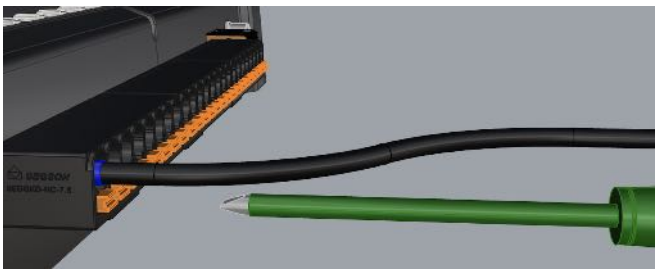
The male counterparts (Degson 9EDGK-HC 7.5-x8P) can be ordered separately, to produce pre-fabricated harnesses. All terminals use push-in spring retention with individual release triggers.

Open connector:



Insert wire:

Close connector:



To ensure a reliable and vibration-resistant connection, all stranded conductors must be terminated with a crimped ferrule (metal end sleeve) before being inserted into the Degson push-in terminals. Bare stripped wire shall never be inserted directly into the connector. The ferrule must be crimped using an approved tool and fully seated into the spring-clamp mechanism to guarantee proper electrical contact and long-term mechanical retention.

4.3.3 Output Electrical Behaviour

Each Powerail V8 output is a bipolar MOSFET switching stage, allowing both the positive and negative conductors of the load to be opened when the output is OFF. Benefits include:

- complete isolation of the load,
- safer integration in humid or conductive environments,
- reduced leakage paths,
- accurate fault detection,
- compatibility with any DC load topology.

All outputs support 1–20 A continuous current and include internal protections:

- over-current protection,
- short-circuit cutoff,
- over-temperature shutdown,
- abnormal load behaviour detection.

When a fault is detected, the output is isolated on both poles (+ and –) and the event is reported to the Sailsense HUB via CAN.

4.3.4 Output Grouping Rules (up to 60 A)

For high-current applications, the Powerail V8 allows multiple complete outputs to be connected in parallel. Since each output includes its own + and – terminals, grouping must always be performed per output, not per individual terminal.

A correct grouping is achieved by:

- electrically joining the **“+” terminals** of the selected outputs together, and
- electrically joining the **“–” terminals** of those same outputs together.

This preserves double-pole isolation and ensures balanced current sharing across the MOSFETs.

Grouping is generally limited to three outputs from the same connector region (e.g., 01-03-05 on A, 09-11-13 on B), allowing a combined current of up to 60 A. Grouping outputs across different connectors is discouraged due to harness complexity and mechanical constraints.

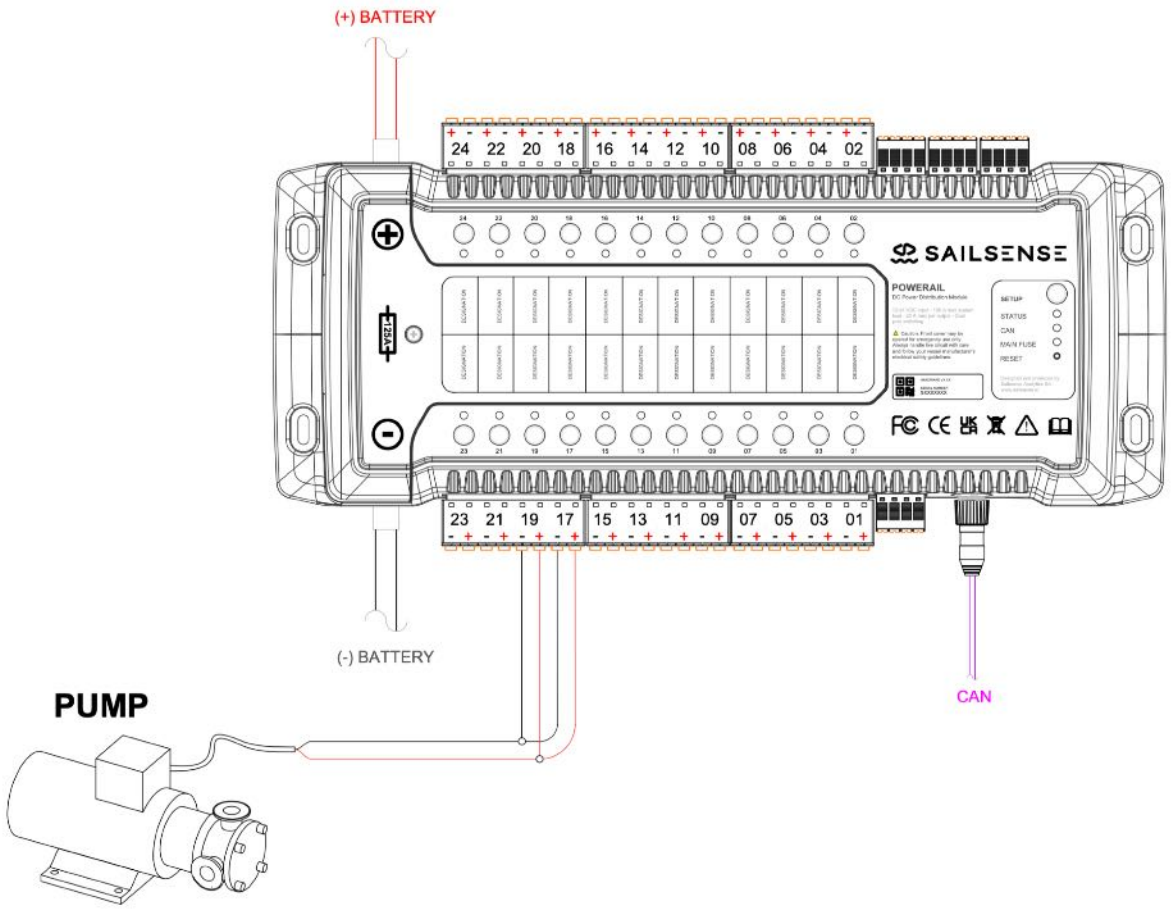
The installer must ensure that:

- conductor sizing is suitable for the total combined current,
- downstream protection is sized accordingly,
- wiring remains consistent with the A–F connector layout.

Installation Notes

⚠️*Incorrect grouping — such as paralleling only a "+" conductor, mixing outputs from different connectors, or joining mismatched poles — must never be performed and will lead to unsafe operation.*

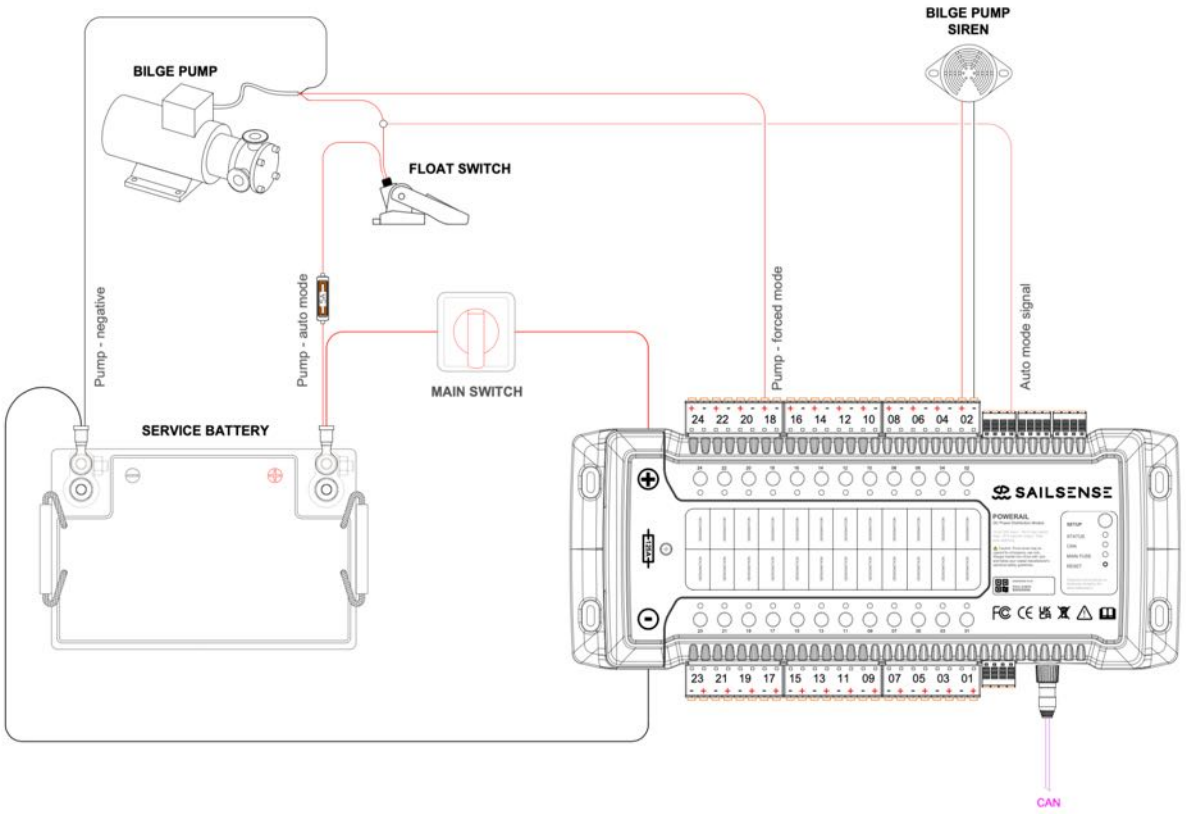
Connexion example, 1 pump connected to outputs 17 & 19 :



4.3.5 Bilge pump(s)

The Sailsense ecosystem allows you to monitor the behavior of the bilge pumps and FORCE the activation of one or more pumps depending on the boat's configuration.

Bilge pump integration exemple:



AUTO mode: directly connected to service batteries + and -

Auto mode signal: when connected to a Powerail input, the signal (+12V) triggers the siren of the bilge pump connected to the Powerail output.

FORCED mode: Positive wire only connected to a Powerail output

Installation Notes

⚠️*The bilge pump(s) must be able to operate independently (connected directly to the service batteries) in AUTO mode, thus protecting the vessel.*

4.4 Emergency fuses

Emergency Manual Bypass (Double-Pole Fuse Requirement)

Although the internal MOSFET protection system ensures robust switching and safety, exceptional conditions may require the user to bypass an output manually to restore power to a critical load. Situations may include:

- confirmed MOSFET failure on a channel,
- persistent fault detection preventing re-arming,
- temporary loss of software control or firmware stability,
- emergency scenarios requiring immediate restoration of service.

Because every Powerail output is a double-pole circuit, the emergency bypass must preserve double-pole protection. This means:

- a **fuse must be added to the positive conductor**, **and**
- a **second fuse must be added to the negative conductor** for the same output.

⚠️*Installing only one fuse, or tying the negative conductor directly to vessel ground, is unsafe and must never be done. Both conductors must remain individually protected to prevent uncontrolled return paths, ground faults or hidden short circuits. Make sure that the external fuse complies strictly with the electrical characteristics of the circuit it protects, including conductor gauge, load type and expected inrush behaviour.*

When a manual fuse override is installed:

- *The external fuse becomes the sole protective element for the circuit.*
- *The user must clearly label the Powerail to indicate that the MOSFET protection is overridden and to specify the rating of the external fuse.*
- *The user assumes full responsibility for validating the safety and compliance of the modified circuit.*

for handling example see: **7.1.5 Control Via Emergency fuses**

4.5 Inputs

The Powerail V8 is equipped with a set of high-reliability marine-grade low-level signal interfaces. This chapter describes the physical connections available on the module, their function, and the conventions used for numbering and identification. All connectors are designed to ensure secure electrical contact under the vibration and environmental constraints typical of marine installations.

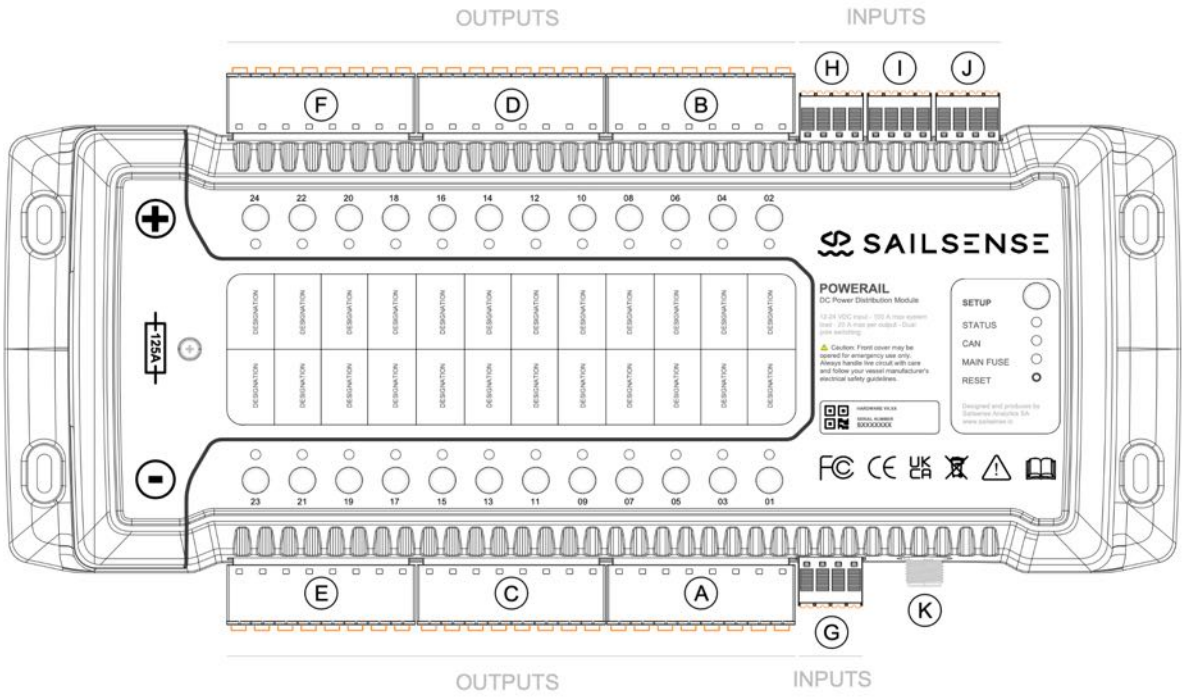
All signal-level interfaces—including inputs, PWM channels, LINbus and voltmeter connections—are provided through compact pluggable blocks to facilitate installation and

service operations. Each connector has a defined orientation and pin numbering scheme, and these must be respected to ensure correct wiring.

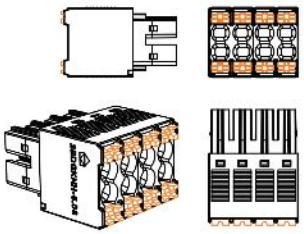
Before connecting any wiring to the Powerail V8, installers must verify conductor size, fuse rating and mechanical strain relief according to the applicable marine standards. Incorrect selection or assembly of connectors may lead to overheating, intermittent operation or communication faults. The diagrams and tables provided in this section are intended to support accurate cabling and to assist in identifying each terminal group during commissioning and servicing.

The Powerail V8 includes four dedicated low-power connector blocks located on the side of the enclosure. Each block serves a specific category of inputs or signal interfaces and uses Degson 2EDGKNH-5.08 mm pluggable connectors, allowing wiring to be pre-assembled off-device and plugged in during installation. All terminals feature the same tool-free push-in technology as the high-power blocks, enabling rapid and repeatable wiring without specialised crimp tools.

The four connector blocks are organised as follows:



Inputs connectors :
Degson 2EDGKNH-5.08 series

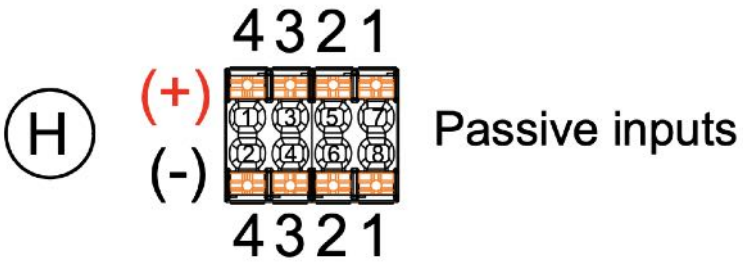


4.5.1 Passive Inputs

Specifications

- **Number of passive input channels**: 4 (inputs 1–4)
- **Wiring per channel**: PS+, PS–
- **Supported modes (via configuration)**:
  - Switch-to-ground input
  - Internal pull-up / pull-down
  - Simple analogue level detection
- **Typical applications**: Float switches, panel buttons, low-power contacts
- **Connector family**: Degson 2EDGKNH-5.08 mm

Pin structure:



Input #	Connector	Pin “PS+”	Pin “PS–”
01	H	H-07	H-08
02	H	H-05	B-06
03	H	H-03	H-04
04	H	H-01	H-02

This block contains **four passive inputs**, each implemented as a two-wire interface providing both PS+ and PS– terminals.

Passive inputs support contact-based devices and resistive sensors. Each passive input is interpreted according to the operating mode defined during configuration:

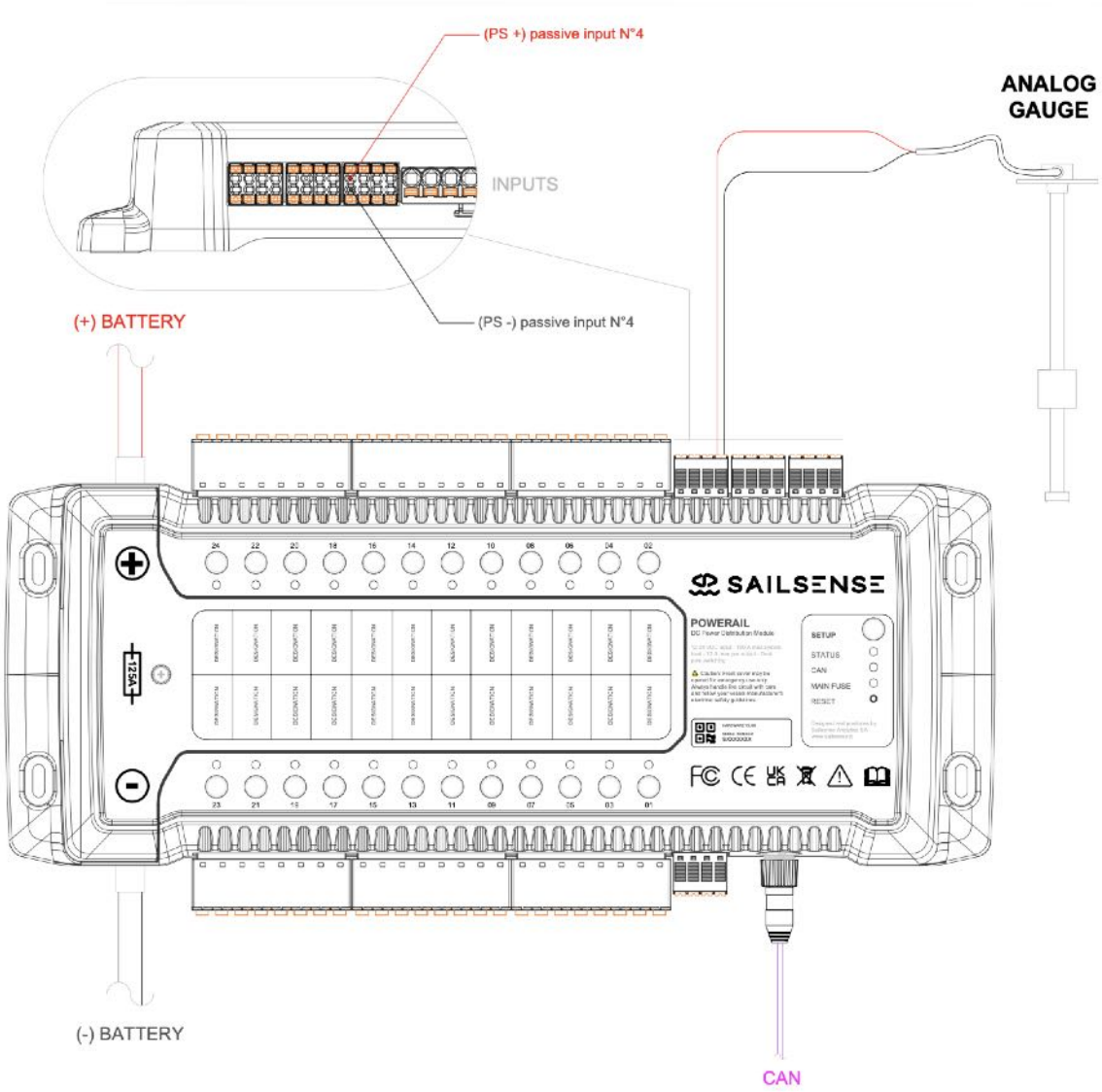
- **Digital switch detection** (open/closed)
- **Pull-up or pull-down biased sensing**
- **Threshold-based analogue interpretation** (simple resistive behaviours)

These inputs are suited for pushbuttons, float switches, mechanical limit switches or low-power signalling devices. Firmware-level debounce and edge detection ensure clean transitions.

Each input is read by the Powerail and communicated to the HUB in real time. The HUB applies vessel-specific logic (scenes, tank interpretation, alarms, automation rules), while the Powerail ensures clean signal acquisition, electrical isolation and stable sensing.

All inputs operate independently from the high-power output stage and from the LED control system.

Example of analog gauge integration:



4.5.2 Programmable Passive Input Resistance

Each passive input includes a configurable internal resistor. The HUB defines the biasing mode, allowing the same physical input to behave as:

- a switch-to-ground detector,
- a pull-up referenced logic input, or
- a floating analogue input.

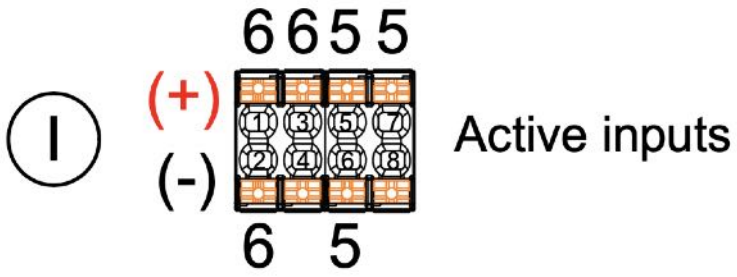
This removes the need for external resistors or signal-conditioning hardware and ensures consistent behaviour across vessel installations.

4.5.3 Active Inputs

Specifications:

- **Number of active input channels**: 2 (inputs 5 and 6)
- **Wiring per channel**: PS+, Signal (+), PS–
- **Use cases**: Analogue gauges, sensors requiring local supply
- **Isolation**: Low-level signal referenced to Powerail ground
- **Connector family**: Degson 2EDGKNH-5.08 mm

Pin structure:



Input #	Connector	Pin “PS+”	Pin “PS–”	Pin “+”
05	I	I-05	I-06	1-07
06	I	I-01	I-02	1-03

Installation Notes

⚠️ *Pin N°4 & 8 in this 8-pin connector are marked “Not used” and must remain unconnected*

The second connector block provides two active inputs designed for analogue gauges or sensors requiring a local powered reference.

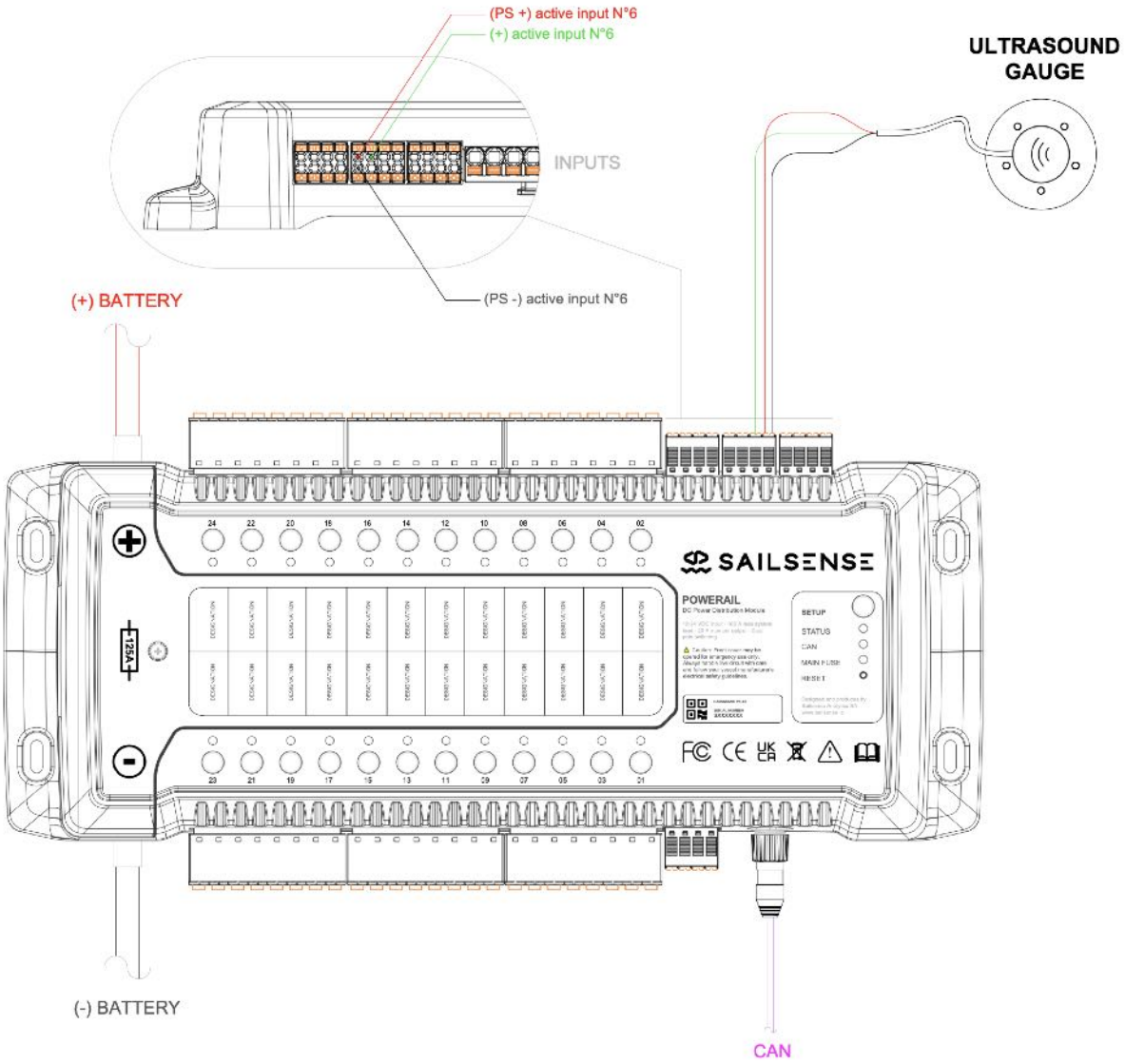
Active inputs provide a stabilized supply (PS+) and a dedicated signal return path (PS–) for analogue gauges or sensors. They allow the Powerail to power a sender and measure its

response (+) under controlled conditions.
The HUB applies calibration curves defined during commissioning, enabling interpretation of tank levels, position sensors or resistive gauges.

Noise filtering, smoothing and validity checks are performed automatically to ensure stable readings even in possibly electrically noisy marine environments.

Exact sensor type, ranges and calibration curves are defined in the project-specific configuration.

Example of ultrasound gauge integration:



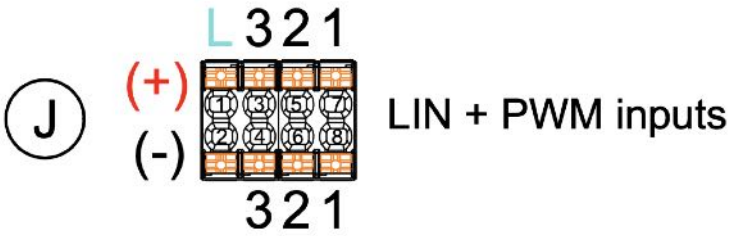
4.5.4 PWM

Specifications:

- **Number of PWM channels**: 3
- **Output type**: High-frequency PWM control signal (not a power output)

- **Typical use**: Non-addressable LED dimming / lighting control inputs
- **Connector family**: Degson 2EDGKNH-5.08 mm (PWM/LIN block)
- **Supported LED protocols**: WS2812B, WS2813, WS2814, WS2815 (WS281x family)
- **Signal format**: 5 V digital data, precise timing generated in hardware
- **Control features** (via configuration/HUB):
    - Multi-zone addressing
    - Dynamic patterns and effects
    - Intensity and colour control (depending on LED type)
- **Powering**: LED strips must be powered separately; only data is provided by the Powerail
- **Maximum length**: Depends on strip type, cable length, and EMI conditions; to be validated in each installation

Pin allocation:

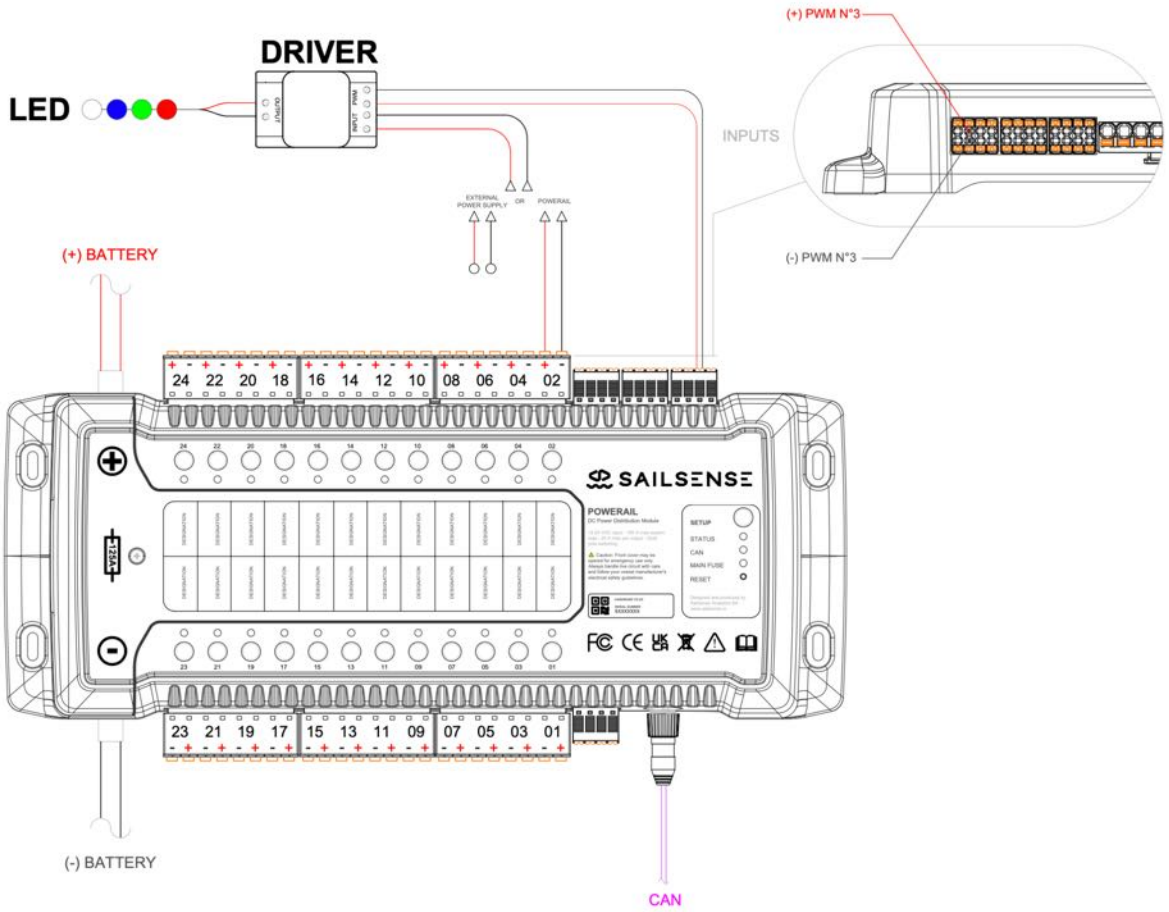


PWM #	Connector	Pin “PS+”	Pin “PS-”
01	J	J-07	J-08
02	J	J-05	J-06
03	J	J-03	J-04

The third low-power connector block on the side of the Powerail V8 provides three 5 V PWM control outputs. Current drawn from the PWM pins must remain within low-signal levels as defined by the lighting driver or interface circuit.

The PWM outputs generate high-frequency 5 V control signals suitable for non-addressable LED lighting systems. Each channel consists of a positive and negative terminal and is intended for low-power signalling rather than direct LED strip power. These outputs allow smooth dimming control and must be interfaced with fixtures or drivers designed for PWM input.

Example of LED integration:



Installation Notes

⚠️*The Powerail V8 includes high-frequency PWM channels and a hardware LED engine capable of controlling WS281x addressable LEDs. These systems require strict adherence to correct wiring practices. Incorrect polarity, insufficient grounding, or overrated loads may result in erratic operation, visible flicker or permanent damage to connected LED products. Long data cables for WS281x installations may require shielding to avoid signal degradation. LED strips must be powered appropriately and must not exceed the current ratings of their supply circuits. Only compatible LED products should be used; the installer is responsible for verifying electrical and thermal characteristics of all connected lighting systems.*

LED strips can be powered externally, with only the DATA signal sourced from the Powerail.

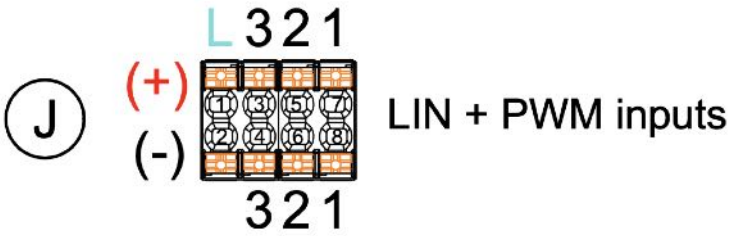
4.5.5 LIN

Specifications:

- **Number of LIN ports**: 1 (shared in PWM/LIN block)
- **Nominal voltage**: 12 V LIN supply provided on the LIN pin
- **Device capacity**: 1 LIN node (e.g. IBS / simple BMS / LIN sensor)
- **Connector family**: Degson 2EDGKNH-5.08 mm
- **Use case examples**:

- Intelligent battery sensor (IBS)
- Simple BMS status feed
- Single LIN-based monitoring device

Pin allocation:



LIN	Connector	Pin “PS+”	Pin “PS-”
01	J	J-01	

Installation Notes

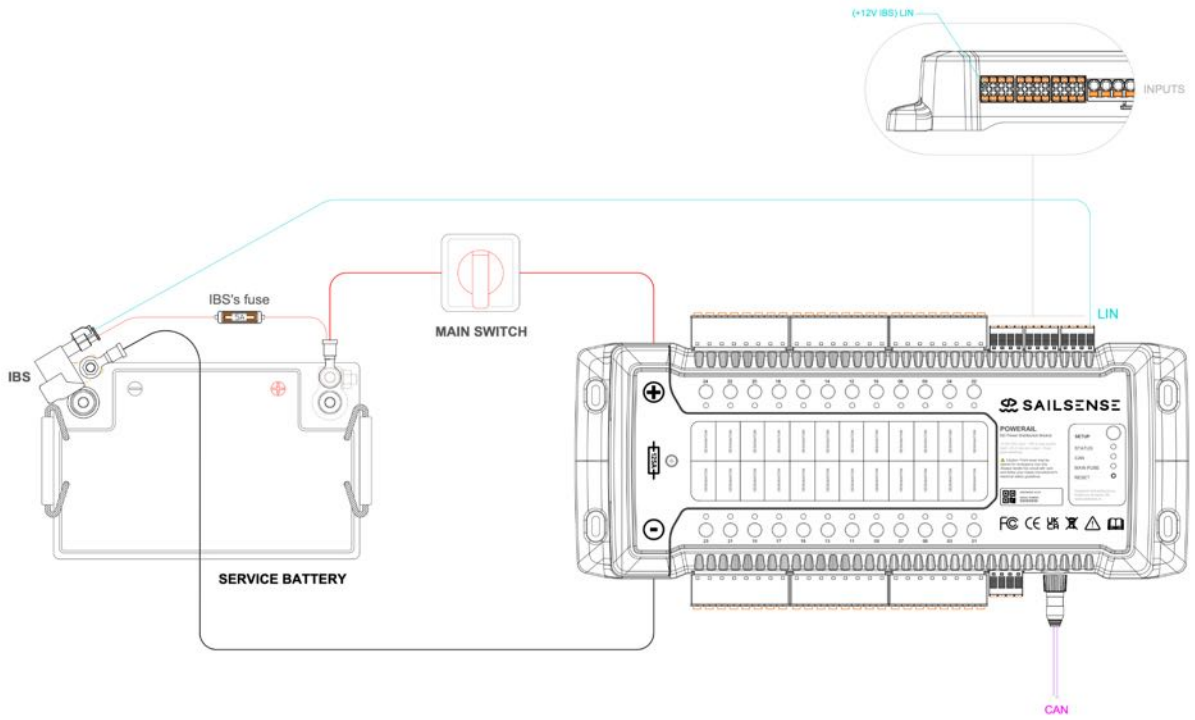
⚠️***Pin N°2*** *in this 8-pin connector is marked* ***“Not used”*** *and must remain unconnected*

The final active pin in this connector block provides the LIN (+12 V IBS) interface, enabling communication with a single LIN-compatible peripheral such as:

- an Intelligent Battery Sensor (IBS),
- a basic BMS module,
- a simple LIN sensor.

The module supplies the LIN device and manages timing, polling and error detection.
Sensor readings are forwarded to the HUB, which interprets them according to system configuration (battery condition, state of charge, alarms, etc.).

Example of LIN IBS integration:



Installation Notes

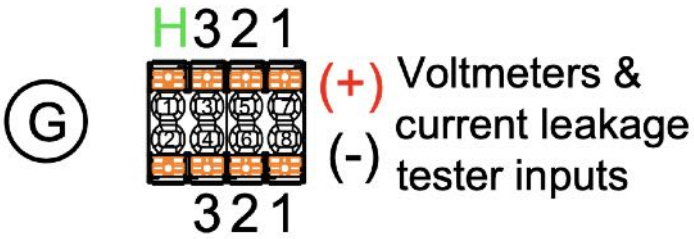
⚠️*Only one LIN device may be connected at a time; the LIN bus cannot be daisy-chained. Only LIN-compliant devices may be connected; incompatible equipment or wiring errors may damage the LIN transceiver. Signal wiring should be routed away from high-current conductors to minimise electromagnetic interference.*

4.5.6 Voltmeters

Specifications:

- **Number of voltmeter channels:** 3
- **Measurement type:** Differential (+ / – sense pair per channel)
- **Typical measurement range:** –30 V DC to +30 V DC
- **Connector location:** Lower side “voltmeter & hull leak” block
- **Use cases:** Engine batteries, service bank, generator battery, or DC bus measurement

Pin structure:

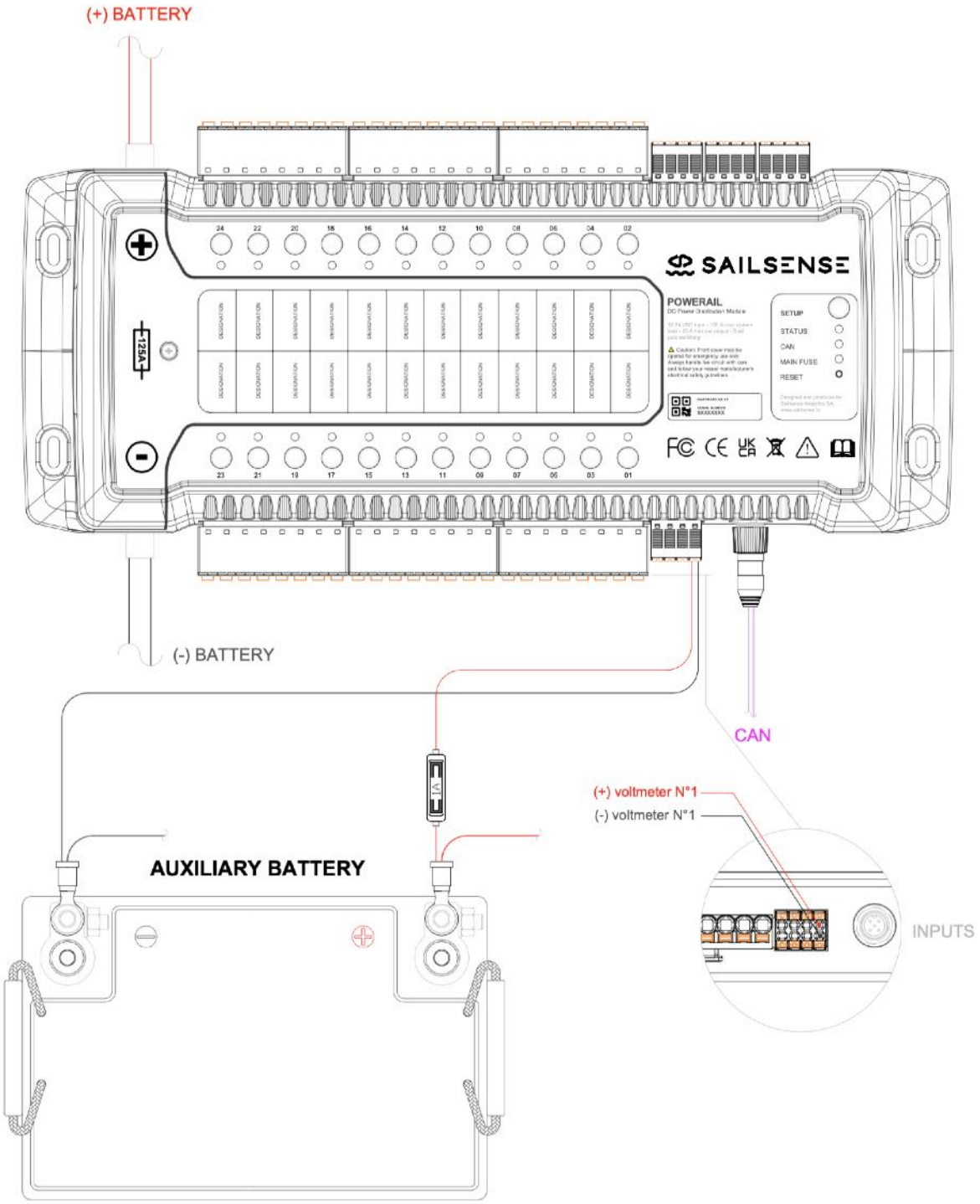


VM # / HL	Connector	Pin “PS+”	Pin “PS-”
VM #01	G	G-07	G-08
VM #02	G	G-05	G-06
VM #03	G	G-03	G-04

Located on the lower side of the device, this connector provides access to three isolated voltmeter channels, each implemented as a differential (+/–) pair.

The voltmeter channels are designed as high-impedance sense inputs intended for low-current measurement only. They are not protected against high-energy surges or fault currents, and therefore must not be connected directly to circuits capable of delivering significant current in the event of a short-circuit or wiring failure.

Example of voltmeter usage:



Installation Notes

⚠️*For safety and to protect the Powerail V8 measurement front-end, each voltmeter sense line should be protected upstream by an appropriate fuse, typically placed as close as possible to the battery or DC bus being monitored. The value of the fuse must be chosen according to the wiring gauge and the characteristics of the measured circuit, in compliance with marine electrical standards.*

Measurement resolution and accuracy are defined by the HUB and Powerail firmware and may be subject to revisions through software updates.

4.5.7 Hull Leakage

The Powerail V8 includes a Hull Leakage detection input designed to assist in monitoring the electrical isolation between the DC system ground and the hull or chassis of the installation. This feature provides valuable (remote) diagnostic insight into the overall health of the electrical installation, particularly in environments where moisture, vibration, or ageing can progressively affect insulation quality.

The Hull Leakage input is intended to be connected to a conductive structural element, such as a boat hull, vehicle chassis, or metallic frame. By observing how the electrical potential of this structure behaves over time relative to the DC ground, the Powerail can detect subtle changes that indicate the presence of unintended electrical coupling.

Operating Principle

The Hull Leakage function operates by observing the natural evolution of the hull or chassis electrical potential when referenced to the DC system ground.

In practice, the Powerail briefly establishes a reference condition, then allows the hull to float electrically and monitors how its potential changes over time. If the hull is well isolated, this potential remains stable. If there is a weak electrical connection—caused for example by moisture, insulation degradation, or wiring damage—the hull potential will gradually move toward another reference, such as the DC ground or the surrounding environment.

The Powerail evaluates this behaviour as a rate of voltage change over time, providing a consistent and repeatable indicator of insulation quality.

Diagnostic Use and Interpretation

The Hull Leakage measurement is particularly effective as a trend-based diagnostic tool. Rather than relying on a single absolute value, users can observe how the measured behaviour evolves:

- Stable readings over time indicate good electrical isolation.
- Gradual increases suggest progressive insulation degradation.
- Sudden changes often correlate with recent modifications, water ingress, or developing wiring faults.

Because the hull or chassis may be immersed in water or coupled to other conductive elements, the measured potential may rise or fall depending on the surrounding conditions. This behaviour is normal and expected; the diagnostic value lies in changes over time, not in the absolute voltage itself.

Typical Applications

The Hull Leakage feature supports several practical use cases:

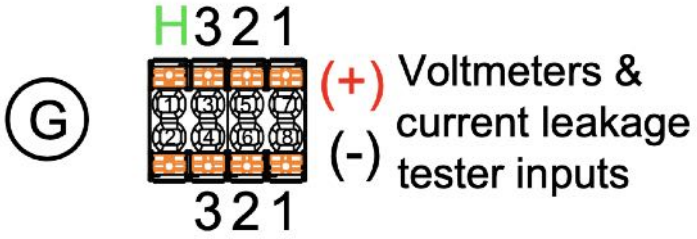
- Early detection of unintended ground paths.
- Monitoring electrical insulation condition over the lifetime of the installation.
- Assisting troubleshooting when unexplained electrical behaviour is observed.
- Verifying system integrity after maintenance or refit operations.

Used in combination with the Powerail's other diagnostic functions, it contributes to a more comprehensive understanding of the electrical system state.

Connector and Wiring Overview

The Hull Leakage input is located on the **lower-side 8-pin connector**, shared with the three voltmeter channels.

Pin assignment:



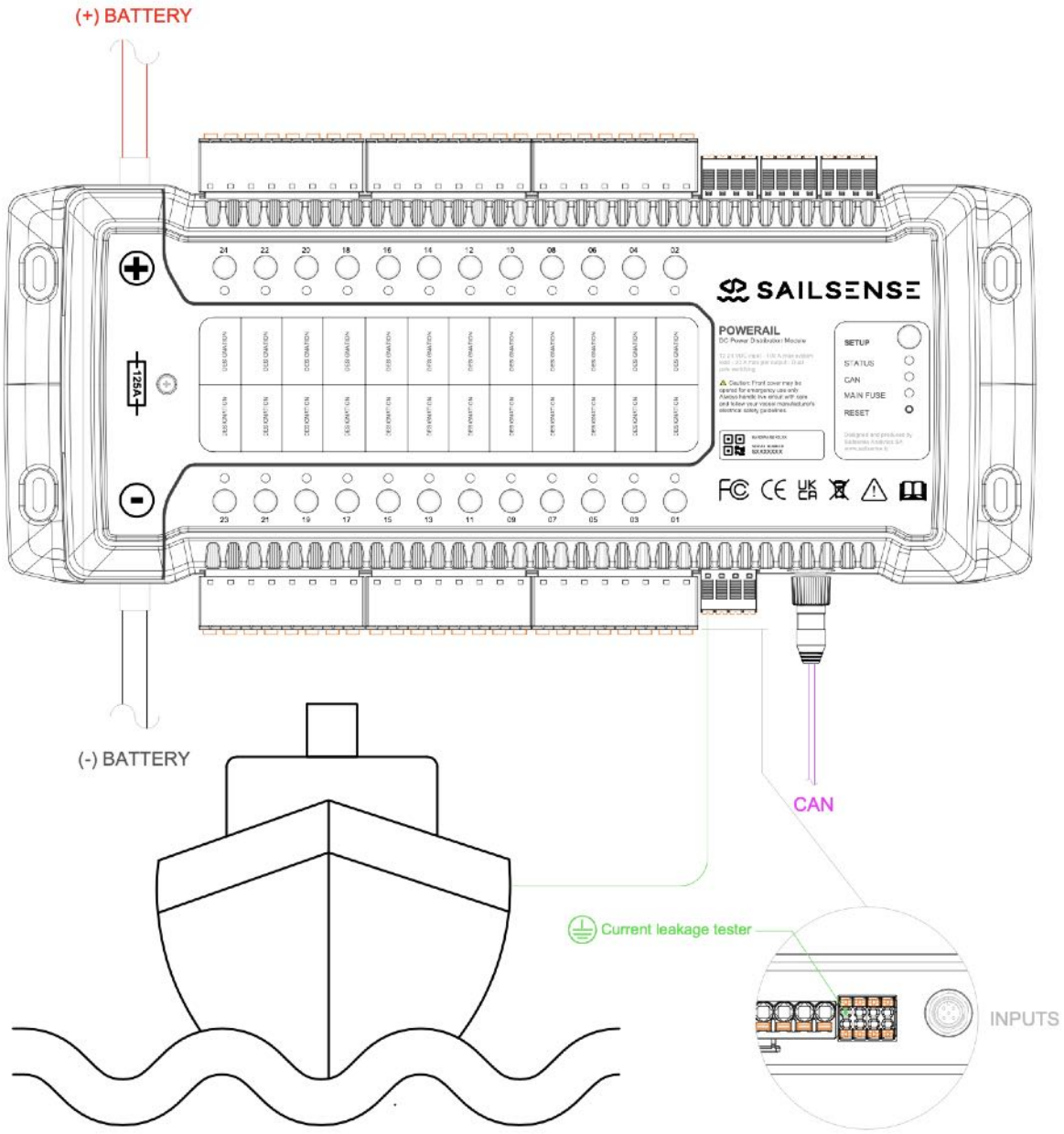
HL	Connector	Mass
HL	G	G-01

Installation Notes

⚠️*Pin N°2 in this 8-pin connector is marked "Not used" and must remain unconnected*

Located on the lower side of the device, this connector provides access to a hull leakage detection input.

These sense lines must be wired using small-gauge instrumentation conductors and routed separately from high-current circuits to ensure measurement stability.



4.7 Lighting System

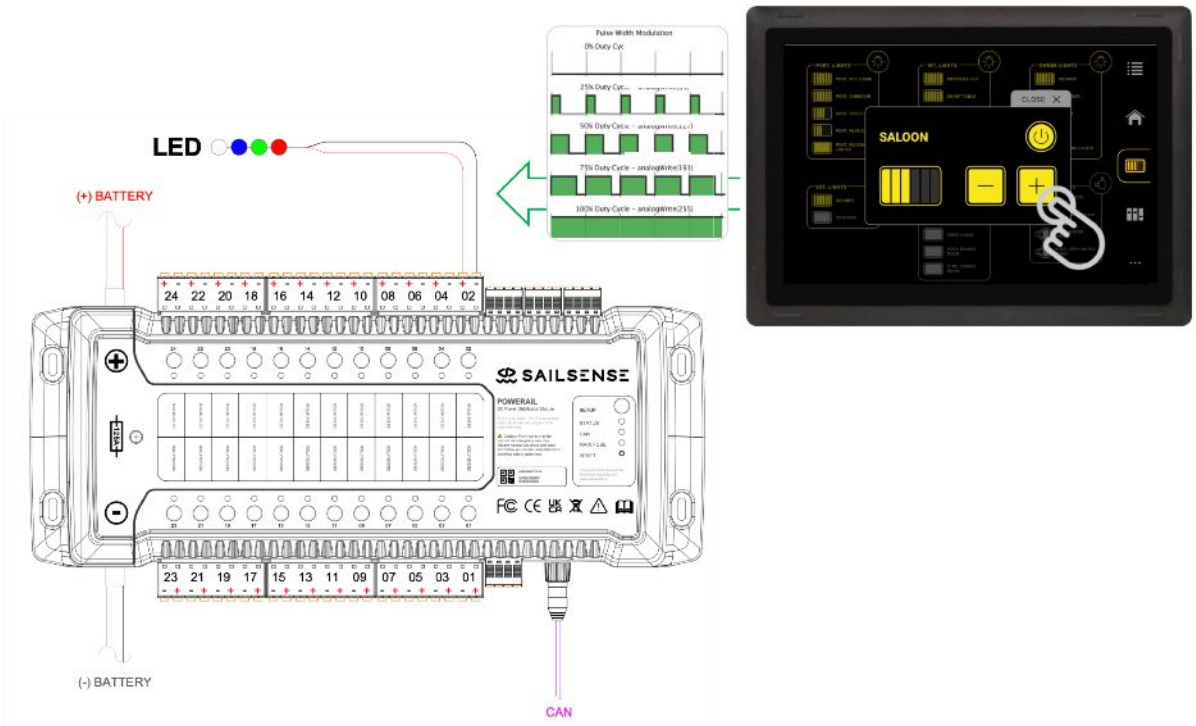
The Powerail V8 integrates a versatile low-power interface for switches and LED control systems. All inputs and LED control lines are continuously monitored or driven by the module, while the Sailsense HUB interprets and coordinates their behaviour according to vessel configuration. This architecture ensures deterministic response, robust lighting control and reliable acquisition of user inputs.

4.7.1 High-Power Output Dimming (24 Channels)

All **24 MOSFET high-power outputs** of the Powerail V8 support built-in PWM dimming. Dimming is achieved by modulating the output duty-cycle at battery voltage (12 V or 24 V), allowing smooth and silent control of compatible loads, such as:

- LED luminaires supplied directly through the Powerail,
- ambient and courtesy lighting,
- incandescent lamps,
- low-power lighting drivers for mood zones.

Each output can be dimmed independently. The HUB defines dimming levels, ramps, night-mode brightness and scene-based logic.The Powerail executes PWM timing locally, ensuring stable dimming regardless of system load.



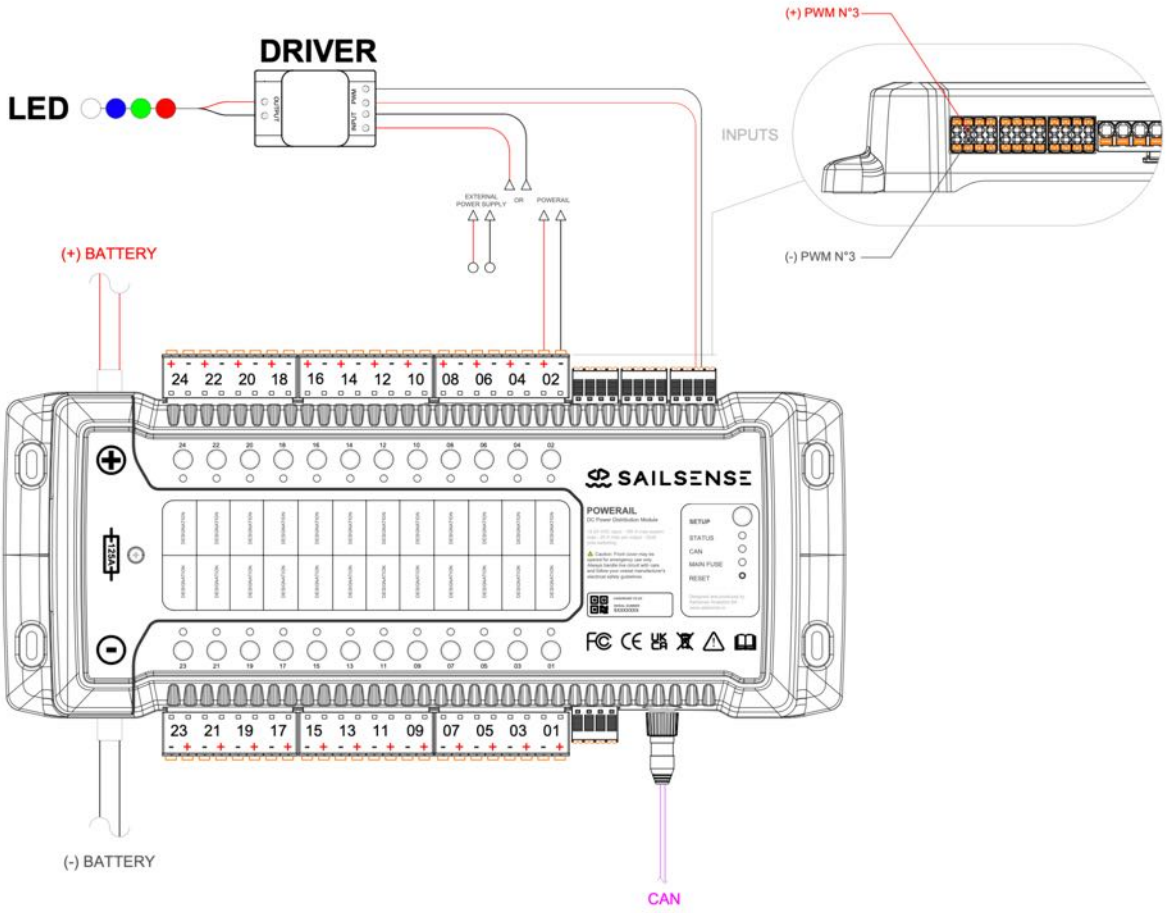
This dimming capability is **independent of the addressable LED system** described below.

4.7.2 WS281x Addressable LED Control (3 Independent Data Lines)

The Powerail V8 includes three independent 5 V DATA lines for driving WS281x-compatible addressable LED strips (WS2812B / WS2813 / WS2814 / WS2815).
These data lines provide timing-critical LED control frames, enabling:

- per-LED colour control,
- multi-zone addressing (three fully independent LED zones),
- dynamic lighting effects,
- animations and scene-based transitions.

The Powerail generates WS281x timing in hardware, guaranteeing signal precision even when multiple outputs and sensors are active.



Installation Notes

⚠️*These data lines provide DATA only. Addressable LED strips must be powered separately according to their rated voltage and current requirements. The LED power supply must share a common ground reference with the Powerail to ensure correct signalling.*

4.7.3 Sensor and Lighting Compatibility Table

Device Type	Compatible Interface	Behaviour
Standard LED fixtures	High-power outputs	PWM dimming
Incandescent lamps	High-power outputs	PWM dimming
WS281x addressable LED strips	WS281x data lines	Per-LED control

4.8 J1939 CAN Network

4.8.1 Communication Architecture Overview

In a typical vessel installation, all user interactions originate from keypads or external sensor interfaces and travel through the CAN bus. Under normal operating conditions, the HUB serves as the central interpreter, receiving keypresses or sensor events, applying the vessel configuration, and issuing the corresponding commands to the Powerail V8.

However, the architecture has been designed so that control does not collapse if the HUB becomes unavailable. Because the Powerail stores its own mapping tables, dimming parameters, output roles and lighting profiles, it can continue to interpret J1939 commands coming from keypads as long as the CAN bus remains powered. This allows essential functions such as lighting, pumps, ventilation or alarm-dependent switching to remain available, even when the logic engine (HUB) is restarting or offline.

Communication remains deterministic: the Powerail V8 processes messages intended for it, reports its internal states when possible, and ensures that safety behaviours such as overcurrent protection, thermal shutdown or fallback dimming modes continue to operate locally.

The Powerail V8 is designed to operate within a distributed digital switching environment where various user interfaces and input modules coexist on a common J1939 CAN network. Two families of user interfaces are commonly integrated into the Sailsense ecosystem:

- the CAN input gateway, which extends the system with additional digital and analogue inputs as well as low-power indicator outputs
- the CAN keypads, which provide fully customizable, multicolor, J1939-enabled user input surfaces.

4.8.2 CAN J1939

Specifications:

- **Protocol**: J1939 (CAN-based)
- **Physical connector**: Circular marine CAN connector (Micro-C / NMEA2000 style)
- **Signalling**: CAN-H, CAN-L, Shield, optional power/ground depending on harness
- **Bus termination**: 120 Ω at each backbone end (external)
- **Functions**:
    - Output state and current reporting
    - Input state reporting
    - Fault and alarm reporting
    - Configuration synchronisation

The Powerail V8 connects to the vessel’s digital switching network through a dedicated CAN J1939 interface located on the side of the device. This connector is the communication

backbone not only between the Powerail and the Sailsense HUB, but also among all other J1939-compatible devices installed on the vessel, including:

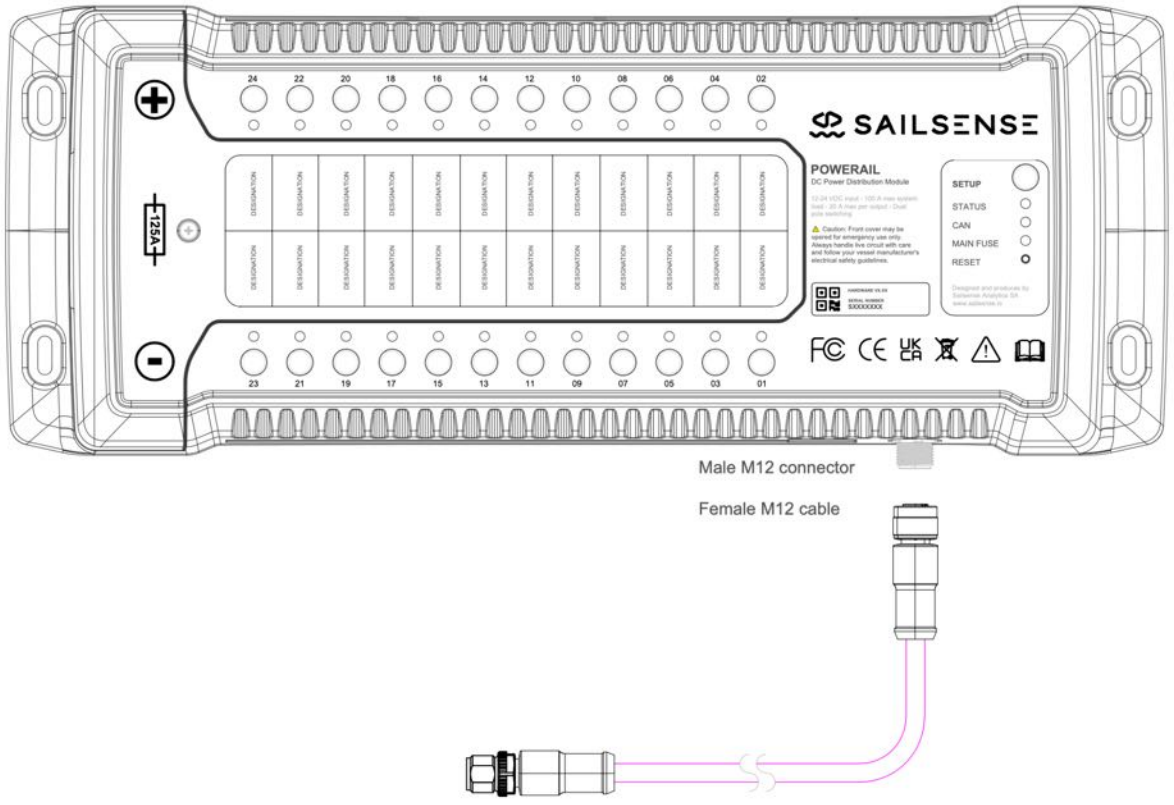
- additional Powerail V8 modules,
- CAN input gateways,
- CAN keypads,
- and any other compatible third-party J1939 sensors or control devices.

The connector uses a marine-grade circular Micro-C / NMEA2000-style format, offering excellent vibration resistance, environmental sealing and mechanical robustness.

Interface Signals

The connector provides the following lines:

- **CAN-H** – High side of the differential CAN pair
- **CAN-L** – Low side of the differential CAN pair
- **Shield / Drain** – Cable shield grounding reference
- **+12 V CAN supply**
- **Ground reference**



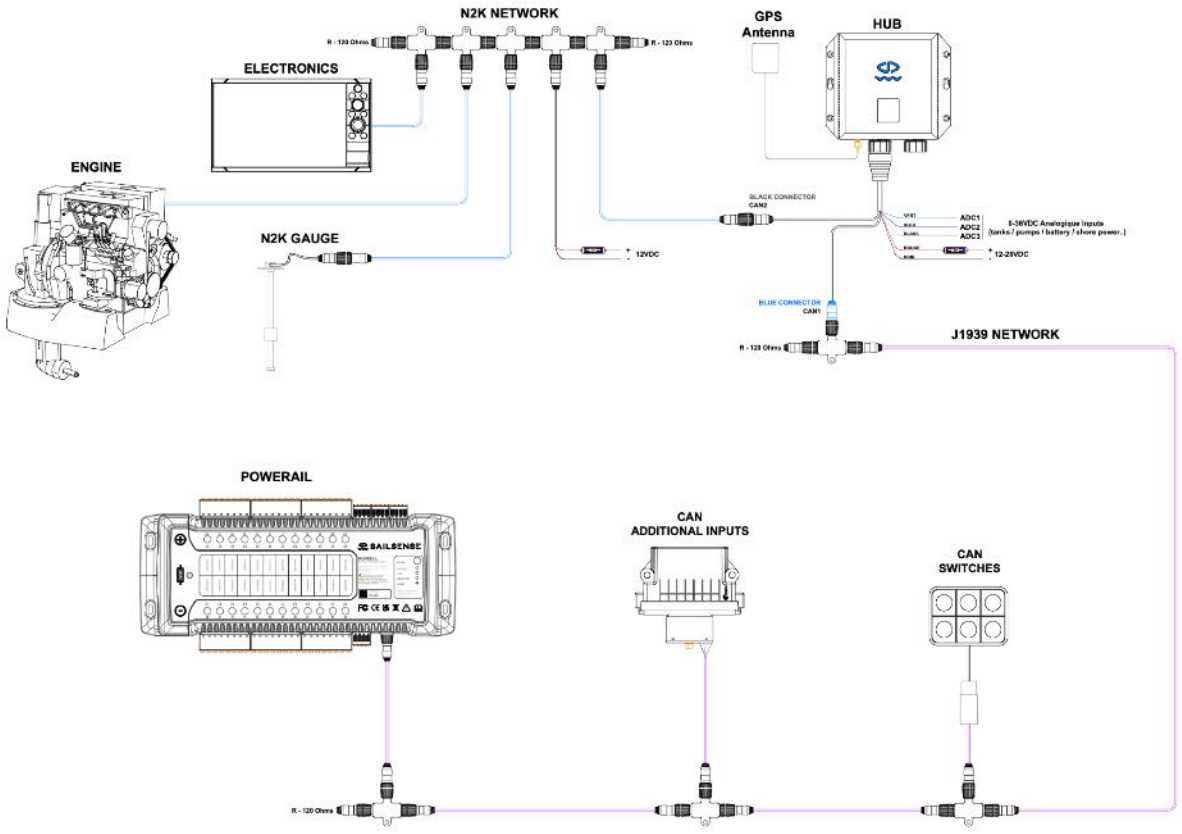
Role of the Powerail V8 on the CAN Network

The CAN interface is not limited to communication with the HUB. The Powerail participates fully in a multi-node J1939 ecosystem, where keypress events, input states, alarms, output statuses and system commands circulate among all connected devices.

This enables:

- seamless interaction with CAN switches and sensors,
- coordinated behaviour across multiple Powerail units,
- synchronised lighting, scenes and alarms,
- network-wide diagnostic distribution.

Every device receives only the frames relevant to its assigned J1939 address, ensuring deterministic, collision-free operation.



Installation Notes

⚠️*Standard twisted-pair shielded marine CAN cable must be used. Correct 120 Ω termination at each end of the backbone is essential for stable operation. Incorrect wiring of CAN-H and CAN-L, missing shield termination or cable routing near high-current conductors may cause communication loss or unpredictable behaviour. Proper strain relief and cable support must be applied. Under no circumstances should the Powerail J1939 bus be merged with unrelated CAN networks without explicit architectural validation.*

4.8.3 Power Supply On CAN J1939

On all standard Sailsense installations, the Powerail V8 acts as the power source for the CAN network, supplying a stable J1939 CAN voltage between 11 V and 13.5 V, with a maximum load capability of 1 A.

This supply powers all low-consumption devices connected to the J1939 backbone, including:

- CAN input gateways,
- CAN keypads,
- auxiliary sensors,
- and any compatible low-power J1939 modules.

The CAN power generated by the Powerail ensures that the CAN network remains powered without requiring a separate CAN power cable.

This means:

- The Powerail V8 is the master power provider for the CAN bus.
- All J1939 devices draw their logic power directly from the J1939 CAN network.
- The J1939 CAN is internally protected and limited to 1 A total output.
- High-power devices must never be powered from the CAN bus.

4.8.4 Installation With Multiple Powerails

Depending on vessel architecture, multiple Powerail V8 units may be installed. In multi-module layouts, each Powerail stores its own configuration and operates independently, ensuring that essential switching functions remain available even if communication with the HUB is interrupted.

By default, a Sailsense digital switching system can accommodate up to 15 Powerail V8 modules on the same J1939 CAN network. This limit ensures predictable network traffic, deterministic response times and proper address allocation across the CAN network. For installations requiring a larger number of Powerail units—such as large multizone vessels, superyachts or professional work platforms—Sailsense must be consulted to validate CAN bandwidth, addressing strategy and system topology.

In multi-Powerail systems:

- Each Powerail executes its own switching logic autonomously.
- Modules remain electrically isolated but logically coordinated through the HUB when available.
- CAN input gateway and keypad events may address multiple Powerails depending on the configuration.
- Distributed electrical zones (e.g., port hull, starboard hull, flybridge, engine rooms, deck services) are easily supported using separate Powerails.

This architecture provides excellent scalability and fault-tolerance, allowing vessels to expand electrical capacity without introducing a single point of failure.

4.8.5 Integration With CAN Inputs Gateway

Functionalities:

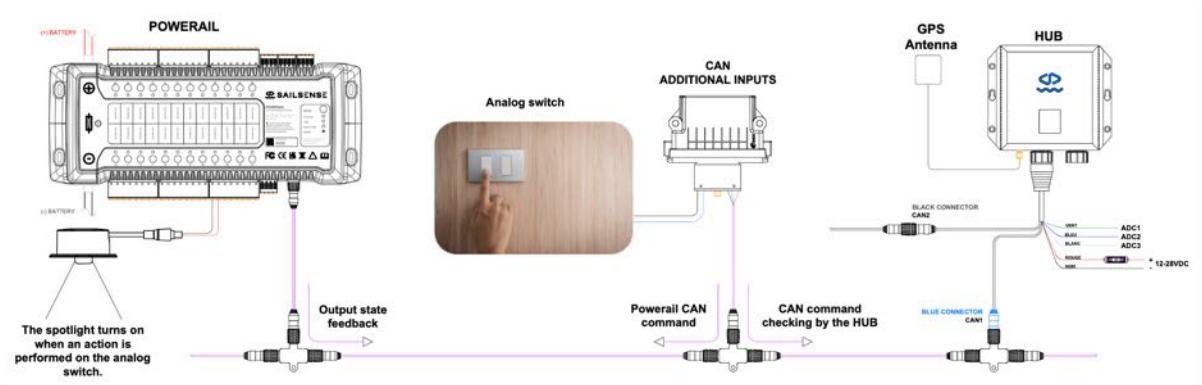
The **CAN input gateway** functions as a versatile input expansion module. It may provide:

- Multiple digital inputs (depending on the device)
- Multiple analogue inputs (depending on the device)
- Multiple low-power outputs (depending on the device)

Under normal conditions, the HUB receives this event, interprets it according to the configuration logic (scene activation, switching, dimming, etc.), and issues a command to the Powerail V8.

However, because the Powerail V8 maintains a **local action map**, it can also respond directly to CAN input gateway messages if required. This capability ensures that, even when the HUB is temporarily unavailable, CAN input gateway can still control Powerail outputs, preserving continuity of service for critical onboard circuits.

Example of PG8 integration:



📖 The exact usage and cabling specifications will be defined in the project-specific configuration.

4.8.6 Integration With CAN Keypad

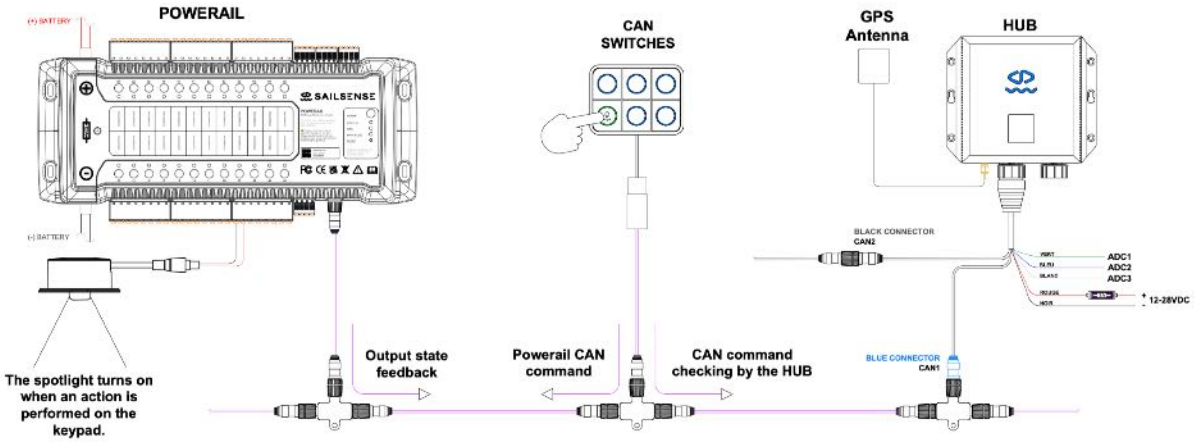
Functionalities:

The **CAN keypad** communicates over J1939 using a well-defined set of proprietary PGNs, including keypress messages, LED control commands, brightness settings, address claim and heartbeat signals.

When the user presses a key, the keypad transmits a **Key Contact State** message (PGN), identifying the key number and its press or release state. The HUB normally interprets this message and issues the matching command to the Powerail V8. LED control is handled similarly: the HUB sends a “Set Single LED State” or “Set Multiple LED State” command (PGN) to illuminate, blink or animate keypad LEDs according to system status.

As with the CAN input gateway, however, the Powerail V8 may continue operating key functions autonomously if the HUB becomes unavailable. Keypad messages that correspond to locally stored actions will still produce the appropriate switching or dimming effect. In such a scenario, some enhanced behaviours (e.g., advanced scene sequencing or synchronization between multiple modules) may be unavailable, but **direct user control is preserved**.

Example of keypad integration:



📖 The exact usage will be defined in the project-specific configuration.

4.8.7 Multi-Device Synchronisation and Behavior

The coexistence of CAN input gateways, CAN keypads and Powerail V8 units on the same J1939 network enables complex control scenarios—dual helm stations, remote panels, distributed sensors—while maintaining consistent behaviour across the vessel.

Under normal operating conditions, the HUB coordinates these devices:

- updating keypad LED colours to reflect Powerail output state,
- synchronising lighting scenes across several Powerails,
- orchestrating WS281x animations,
- triggering outputs based on combinations of inputs or timed logic.

4.8.8 System Reliability and Redundancy

The combination of J1939 communication, local configuration storage inside each Powerail V8 and distributed input modules offers a high degree of system resilience. Key advantages include:

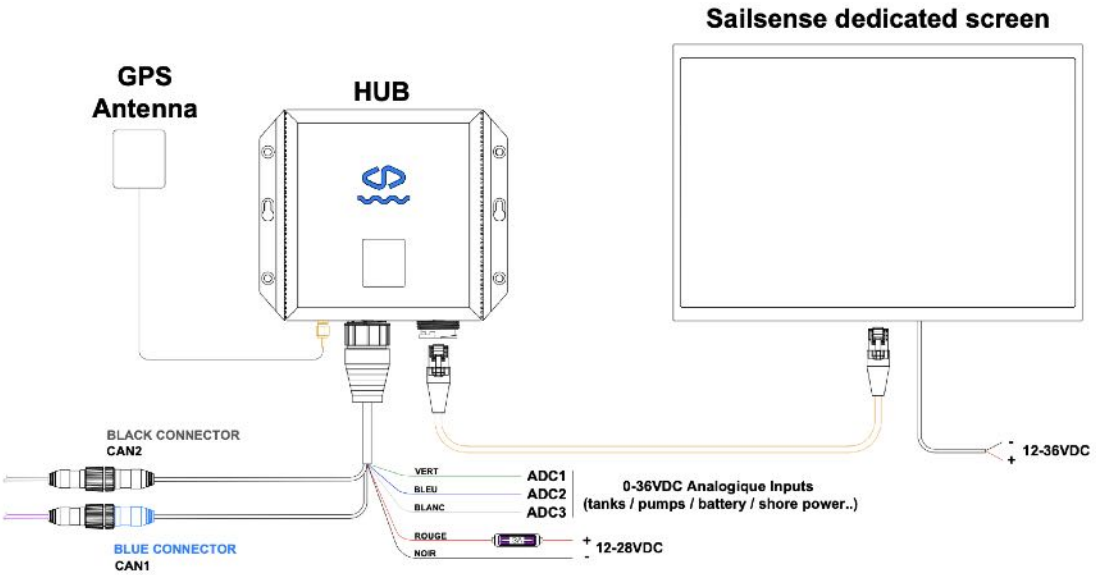
- **No single point of control failure**: the HUB enhances the system but does not govern basic output behaviour.
- **Deterministic fallback mode**: Powerail V8 continues executing locally defined mapping rules.
- **CAN Keypads retain operational capability**: user actions continue to be transmitted via J1939.
- **CAN input gateways continue to report input changes**: ensuring functional switching where required.

This architecture aligns with best practices in modern marine digital switching, where safety, continuity and modularity are paramount.

4.8 Ethernet Network

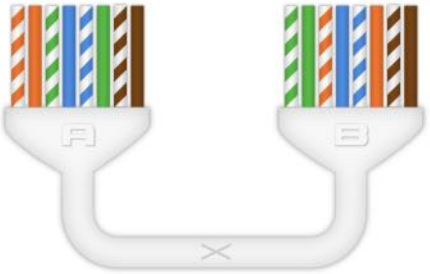
The HUB's Ethernet port allows, in the case of an installation including one or more Powerail, the embedded application to be displayed on a screen dedicated to Sailsense or on navigation screens such as B&G, Raymarine, etc.

Dedicated screen:



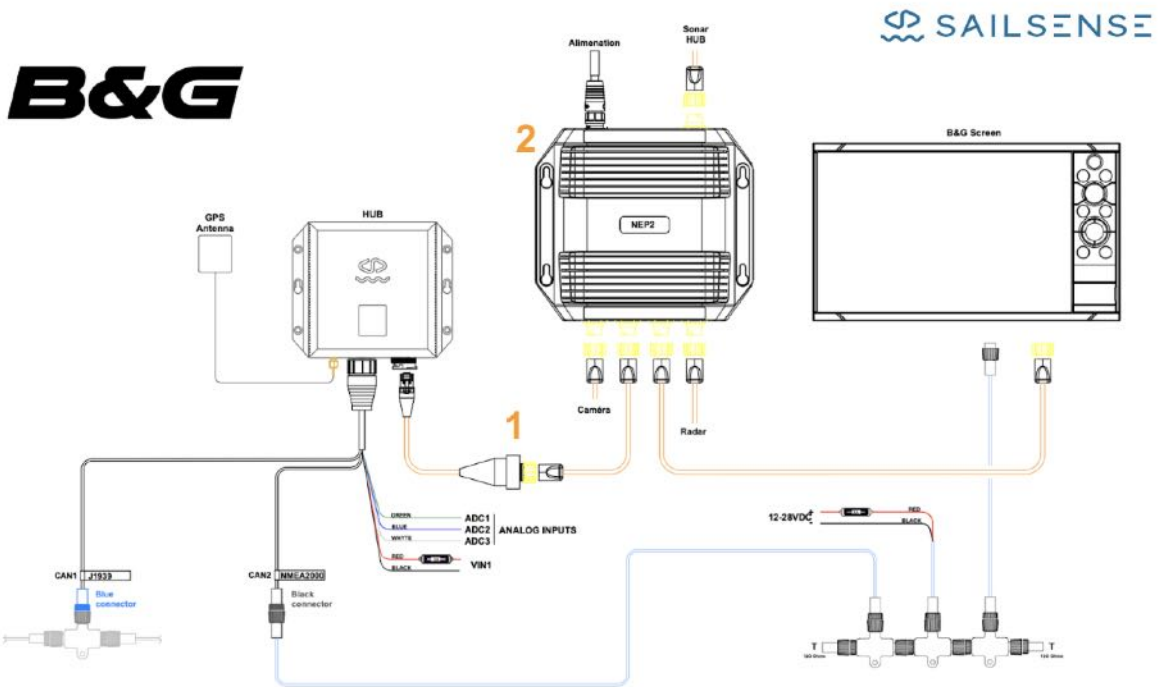
Installation Notes

To connect a screen **directly** to the hub, you must use a **crossover** Ethernet cable:



A	B
Orange / White Orange Green / White Blue Blue / White Green Brown / White Brown	Green / White Green Orange / White Blue Blue / White Orange Brown / White Brown

B&G screen:

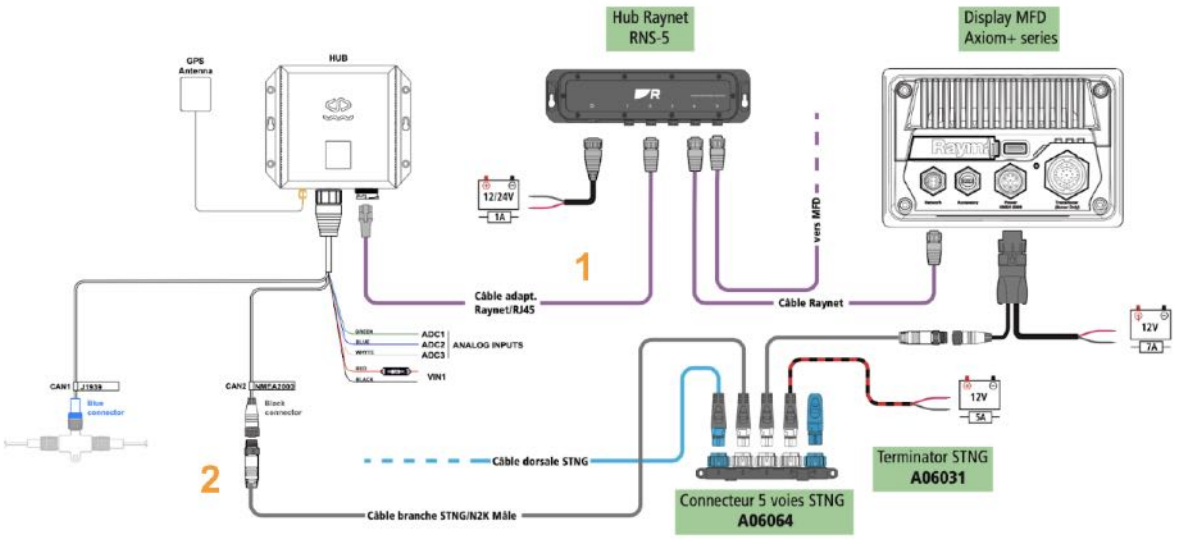


Installation Notes

1- To connect the HUB to the B&G Ethernet network, an adapter is required

2- If multiple devices are connected to the B&G Ethernet network, you must connect the HUB to the NEP-2

Raymarine screen:



Installation Notes

1- To connect the HUB to the Raymarine Ethernet network, an adapter Raynet/RJ45 is required

2- To connect the HUB to the Raymarine CAN network, an adapter STNG/NMEA2000 is required

5. Preliminary Check and Power-Up

It is important to carry out checks before any commissioning. In this section, we outline the main verification measures for each critical component of the installation.

5.1 Powerail Check

Although full commissioning procedures are documented separately, users and technicians should confirm the following before energizing the system:

- all connectors are properly seated and locked,
- high-power conductors are correctly torqued,
- fusing on external voltmeter circuits is appropriate,
- no harness strain or sharp-edge contact is visible,
- the Powerail's front panel is accessible for manual control.

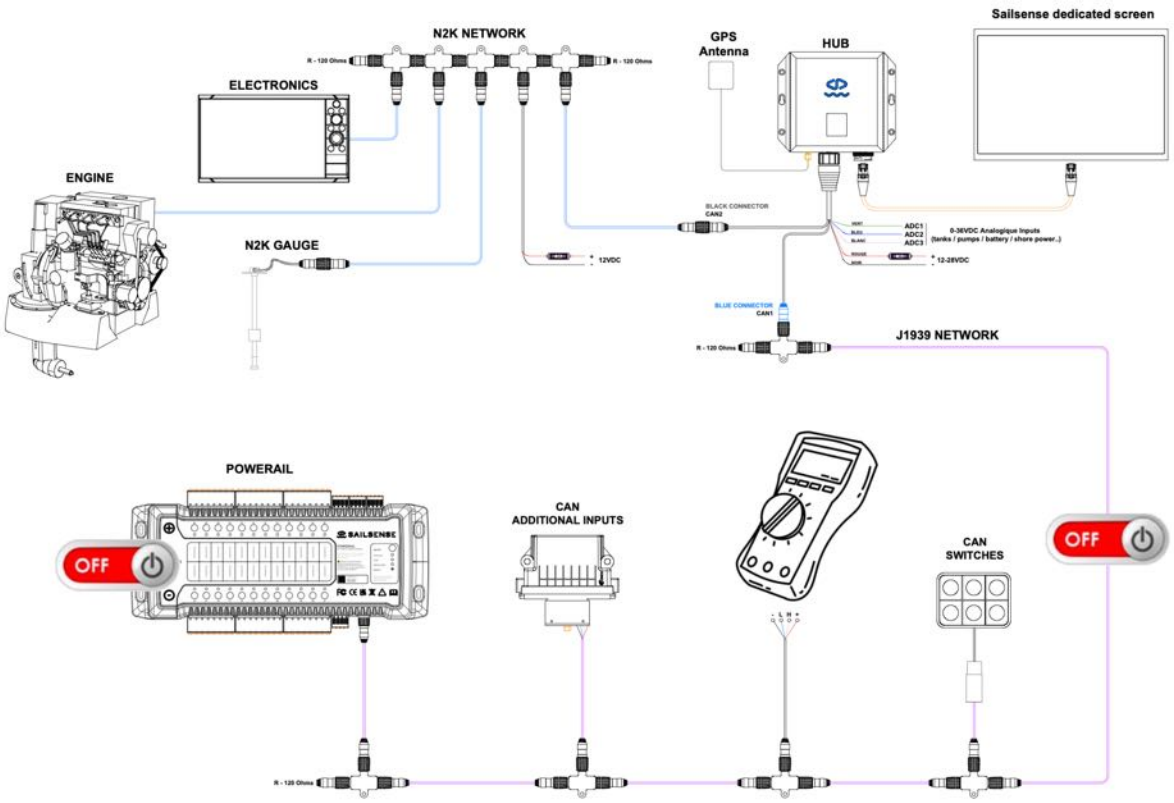
These checks support safe startup and predictable operation.

5.2 CAN J1939 Network Check

CAN network being one of the most important part of the installation, users and technicians should confirm the following before energising the system:

- Does the installation conform to the CAN bus wiring diagram of the boat?
- Are the cables correctly labeled?
- Are the connectors accessible and correctly connected to each other?

Connect a CAN cable to the network using a T-connector or available connector. This cable must be stripped at the other end, and the +/-/H and L wires must be electrically insulated. Then, take measurements with your multimeters.
The readings should be taken with the Powerail(s) and the CAN bus switched off.



- Tension must be equal to 0V between + (red wire) and - (black wire).
- Resistance must be equal to 60 *Ω* between L (blue wire) and H (white wire).
    - If not equal to 60 *Ω* check your network and *120 Ω termination*
        - 120 *Ω* = missing one termination
        - 40 *Ω* = 3 terminations on the CAN bus
        - 0 *Ω* = short circuit on the CAN bus
        - ∞ = No terminations on the CAN bus

5.3 Ethernet Network Check

Ethernet network being important for embedded Application display, users and technicians should confirm the following before energising the system:

- Does the installation conform to the Ethernet wiring diagram of the boat?
- Are the cables correctly labeled?
- Are the connectors accessible and correctly connected to each other?

5.4 Startup and Synchronisation

After verifying that the entire installation is compliant and that the batteries and switching devices are properly wired and connected, activate the installation by switching the service battery ON.

Upon energisation, the Powerail V8 performs a short initialization sequence verifying supply voltage stability, MOSFET temperature, internal rail integrity, and availability of WS281x timing resources. Once internal checks pass, the module activates its CAN J1939 interface, announces its address and begins synchronising with other devices on the network.

All configuration parameters—such as output associations, dimming profiles, input modes and LED zone mappings—will be updated once the configuration will be sent (see **6.4 Deploying or Editing the Configuration)**.

5.5 Integration with J1939 Control Devices

Most operational commands originate from external J1939 devices such as:

- **CAN input gateways** (digital & analogue input modules with indicator outputs)
- **CAN keypads** (up to 15 buttons RGB backlit J1939 HMIs)

All configuration parameters will be updated once the configuration will be sent (see **6.4 Deploying or Editing the Configuration)**.

6. Configuration

The configuration of a Powerail V8 system is performed exclusively through the Sailsense cloud platform, using a Sailsense HUB installed on the vessel. The HUB acts as the secure bridge between the onboard electrical system and the configuration tools hosted on Sailsense.io. No configuration is carried out directly on the Powerail V8; instead, each module retrieves its parameters from the HUB and stores them locally for autonomous operation.

To configure a vessel for the first time, users must follow the standard Sailsense workflow:

6.1 Account Creation on Sailsense.io

Configuration requires a user account on **www.sailsense.io**, where all project documents, configuration files and system states are stored securely. This account identifies the installer, shipyard or vessel owner responsible for the commissioning process.

6.2 Creating or Selecting a Vessel Profile

Within the Sailsense platform, users may either:

- create a new boat profile from scratch, defining its electrical architecture, or
- duplicate an existing vessel configuration, which is common in production environments where multiple identical boats are built.

Duplicating an existing vessel preserves the output mapping, lighting zones, dimming profiles and logic structures, significantly reducing setup time.

6.3 Pairing the HUB with the Vessel Profile

The onboard HUB must be paired with the vessel profile using its unique identifier. Once paired, the HUB becomes the active configuration host for the entire electrical system. This pairing ensures that any Powerail modules connected to the J1939 backbone automatically receive their configuration from the correct vessel project.

6.4 Deploying or Editing the Configuration

Once paired, users can:

- import an existing configuration,
- adjust the mapping of outputs, inputs, and lighting zones,
- enable or disable addressable LED segments,
- modify dimming curves and fallback rules,
- define LIN sensor behaviour,

- specify CAN keypad and CAN input gateway control logic,
- or build a completely new configuration.

Changes are validated and synchronised automatically with the onboard HUB, which distributes the updated parameters to each Powerail V8 module on the J1939 network.

6.5 Local Storage and Autonomy

After configuration, each Powerail V8 stores its assigned parameters locally, ensuring that the system continues to operate even if the HUB becomes unavailable. The HUB enriches and coordinates system-level logic, but switching, dimming and sensor response remain functional based on the Powerail’s stored configuration.

7. Operation

7.1 High Power Outputs Control

7.1.1 Control Via Embedded Application

The onboard application allows the user to control Powerail outputs and view all battery and tank data. This application also displays and alerts the user to various alerts, ranging from minor to critical.

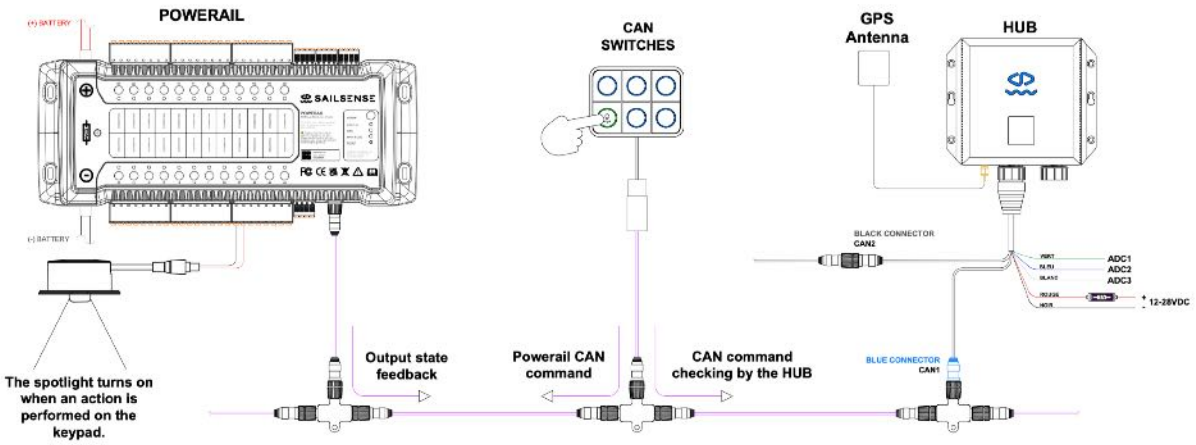
Action performed on embedded Application:

You can activate each consumer individually by clicking on each of the digital buttons associated with the different Powerail outputs (depending on the boat's configuration). Once the action is performed, the HUB analyzes it and sends the command (on or off) to the relevant Powerail(s). The Powerail(s) then sends back the output status to change the color of the corresponding button in the embedded application.

Learn more about the Sailsense mobile app here

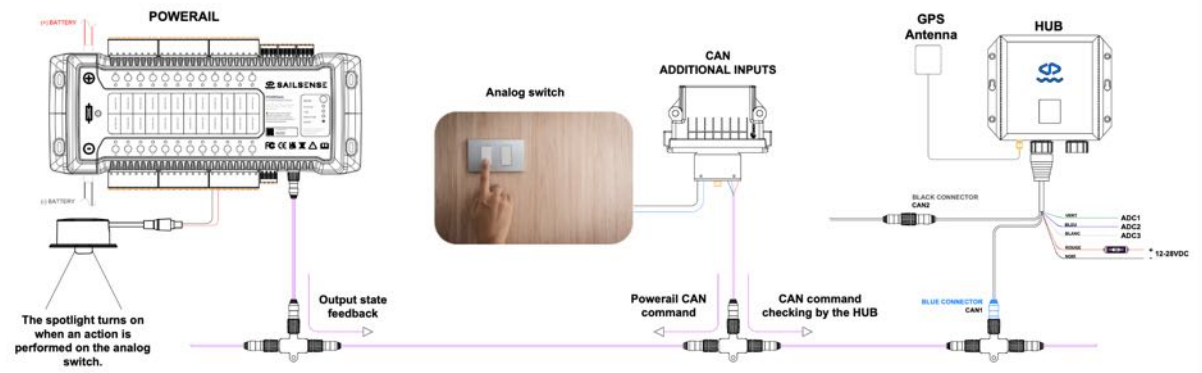
7.1.2 Control Via CAN Keypad And CAN Input Gateway

CAN Keypad



You can activate each consumer individually or in groups by clicking each button on the keypad(s) associated with the different Powerail outputs (depending on the boat's configuration). Once the action is performed, the HUB analyzes it and sends the command (on or off) to the relevant Powerail(s). The Powerails then sends back the output status to change the color of the corresponding button in the onboard application and on the keypad(s).

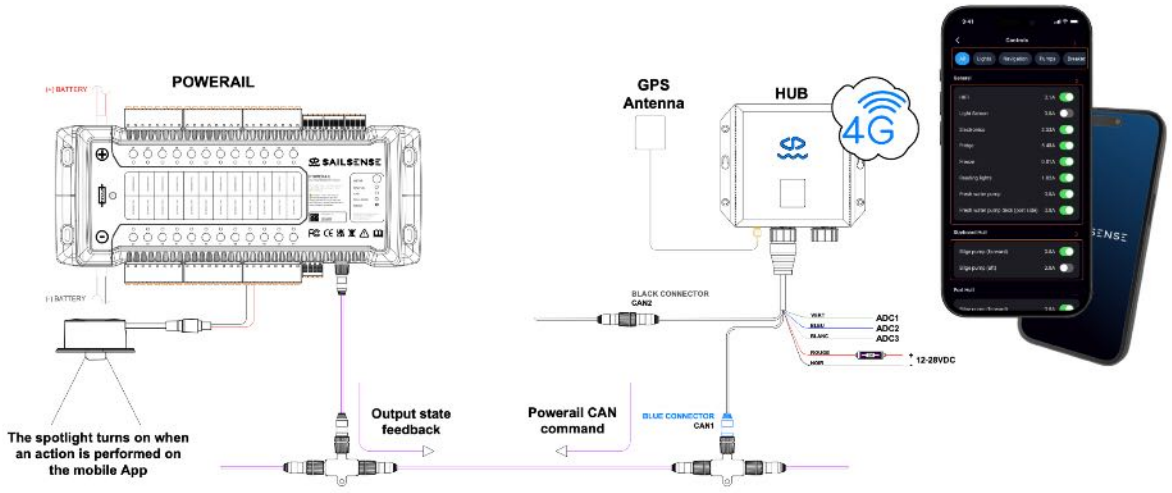
CAN Input Gateway



You can activate each consumer individually or in groups by clicking the physical switch (connected to the CAN input gateway’s connector) associated with the various Powerail outputs (depending on the boat's configuration). Once the action is performed, the hub analyzes it and sends the command (on or off) to the relevant Powerail devices. These devices then send back the output status, which changes the color of the corresponding button in the onboard application.

However, because each Powerail V8 stores a local action map, the Powerail can still respond directly to CAN keypad or CAN input gateway messages even if the HUB becomes temporarily unavailable. This guarantees continuity of operation for lighting, bilge pumps, fans or other vital consumers.

7.1.3 Control Via Mobile Application



Thanks to the SIM card embedded in the HUB, you can activate each power outlet individually by clicking on each of the digital buttons associated with the different Powerail outputs (depending on the boat's configuration). Once the action is performed, it is sent via the secure Sailsense cloud. The HUB analyzes the command (on or off) and sends it to the relevant Powerail(s). The Powerail(s) then send back the output status to update the color of the corresponding button in the mobile and embedded applications.

Connectivity Notes

⚠️*If the HUB's 4G coverage is insufficient or of poor quality, the command will not be transmitted. Commands sent from the mobile application are only active for a few seconds to prevent the Powerail outputs from switching on and off repeatedly if the HUB fails to process the command(s).*

Learn more about the Sailsense mobile app here

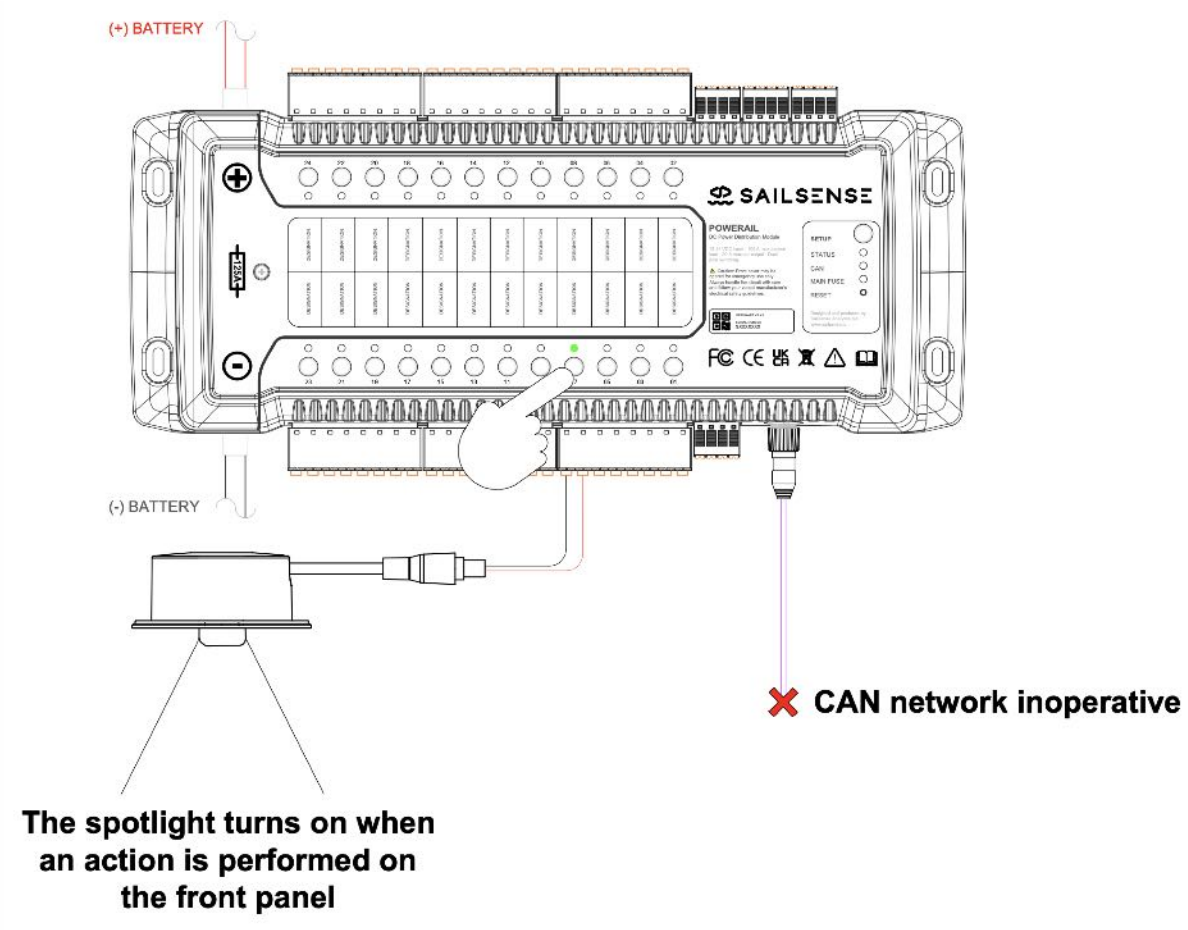
7.1.4 Control Via Front Panel Buttons

In addition to CAN-based control, the Powerail V8 provides 24 dedicated front-panel buttons, each associated with one of the 24 high-power output channels. These buttons are intended for normal operational use, not only for commissioning. Pressing a button directly activates, deactivates or reset the associated output depending on the configuration stored locally.

This interface ensures redundancy:

- If keypads fail, the Powerail remains usable.
- If the HUB is offline, outputs remain fully controllable.
- If CAN is disrupted, local operations continue uninterrupted.

Front-panel control provides a tactile and immediate means of operating essential circuits anywhere on the vessel.

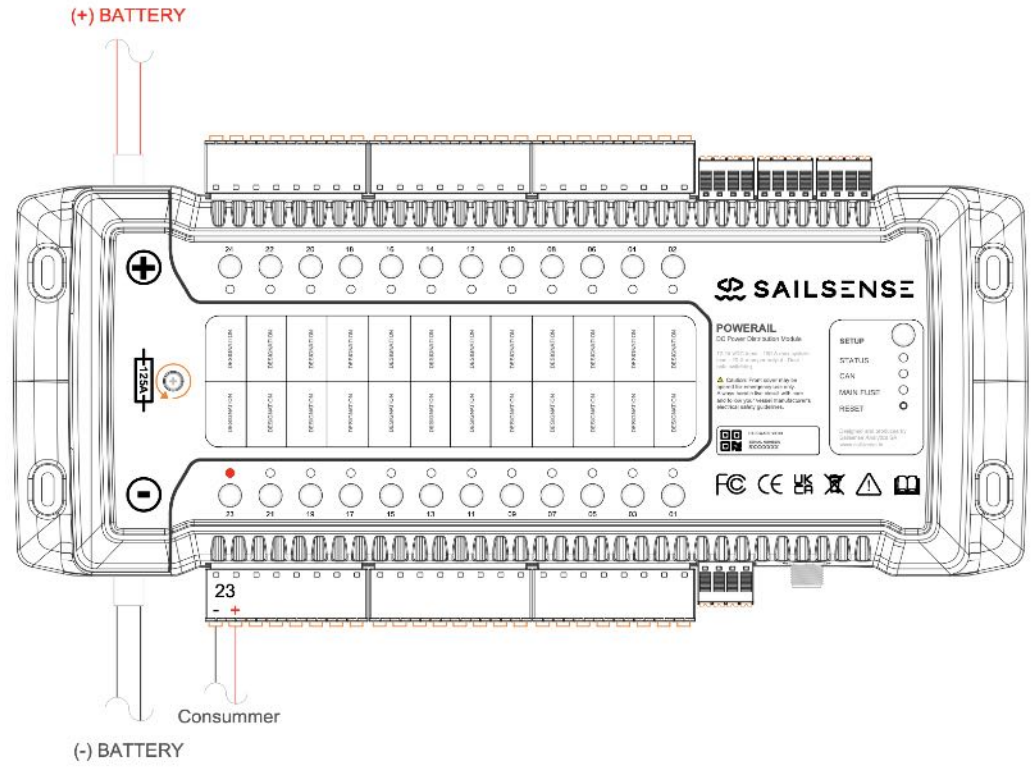


7.1.5 Control Via Emergency fuses

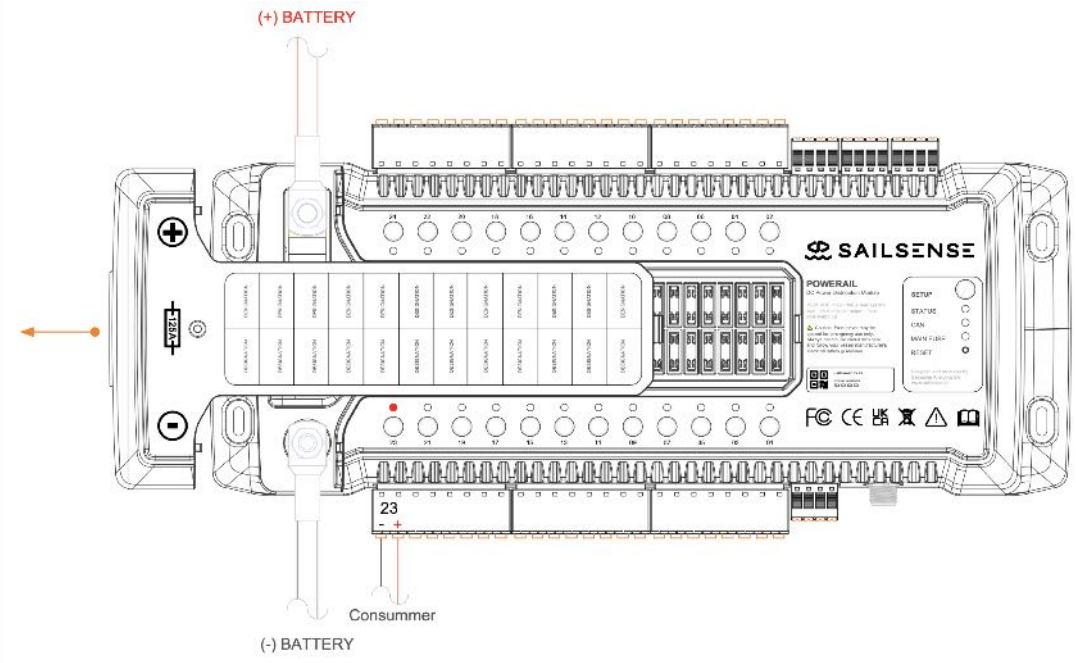
When and why use emergency fuses? See: **4.4 Emergency fuses**

You are experiencing a problem with output 23 on your Powerail: the LED is red or off. The load and wiring harness are in good condition, and resetting the Powerail did not resolve the issue. The Sailsense support team confirms the problem with this output.

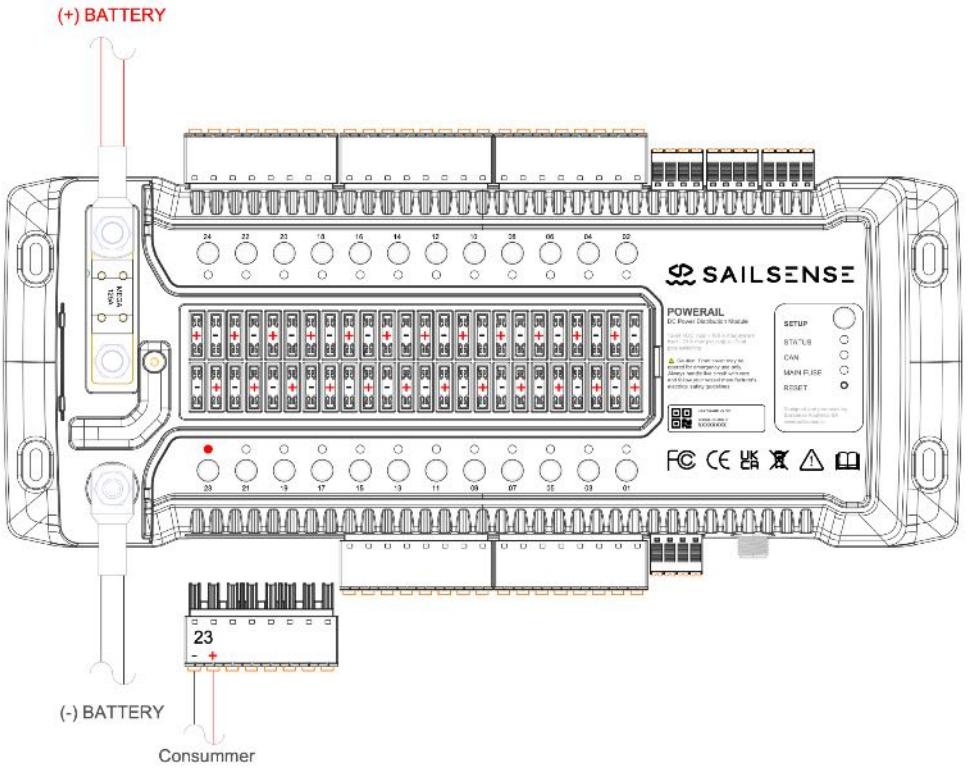
1- Unscrew the fuse box cover



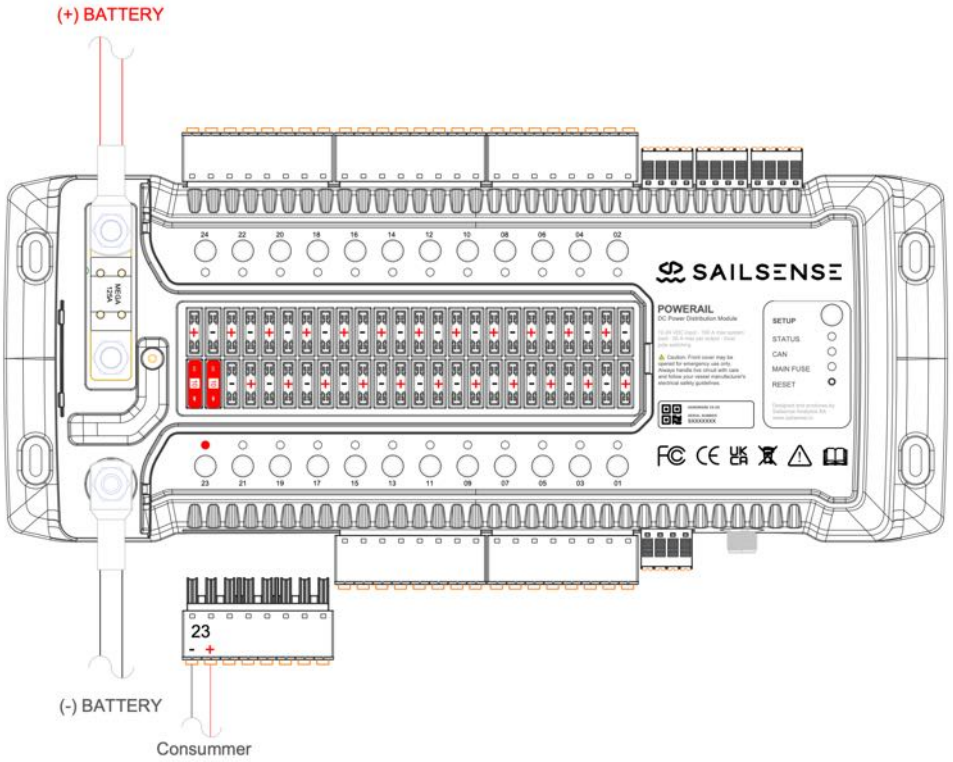
2- Remove the fuse box cover



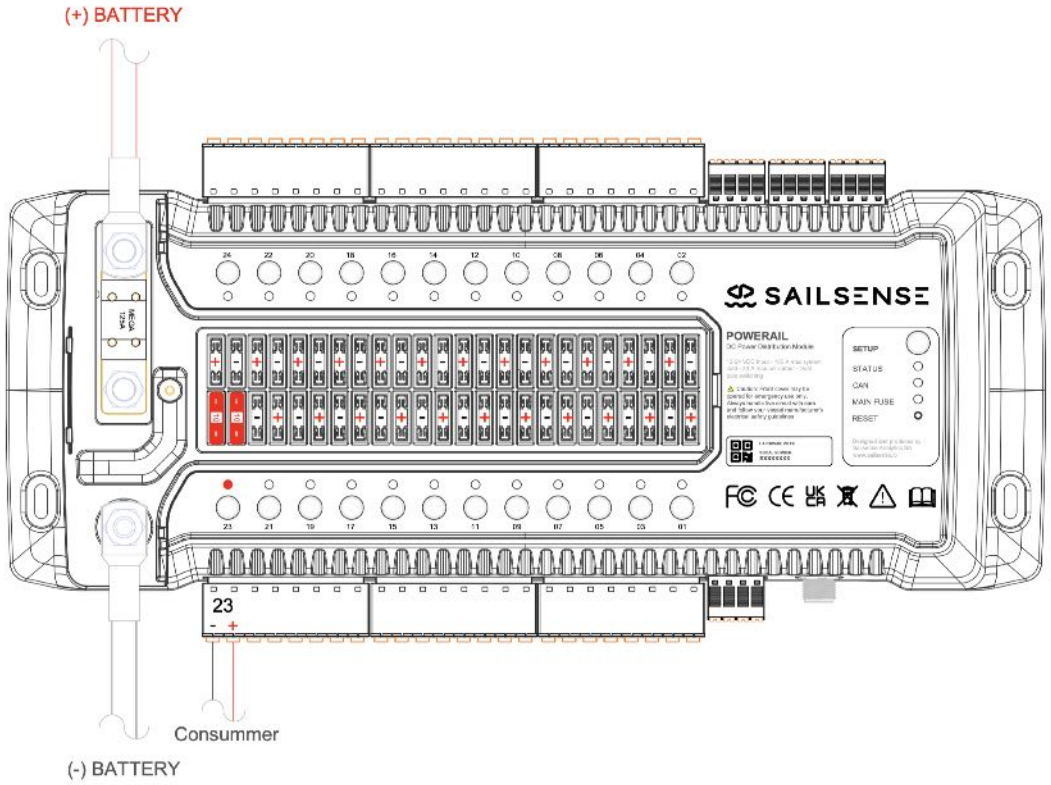
2- Disconnect the connector linked to the faulty output, in this example output 23:



3- Install <u>two fuses of the same type</u> in the positive and negative fuse holders of output 23:



4- Reconnect the connector linked to the faulty output:



5- Put the fuse box cover back in place

Installation Notes

⚠️*Backup fuses should never be installed without first disconnecting the connector associated with the faulty output. This is to prevent an electrical arc during fuse installation. Manual overrides must never be used to circumvent legitimate protection triggers, compensate for inadequate wiring or support loads beyond the module's intended capacity. Improper use may result in overheating, equipment damage or fire.*

The output LED will remain red even if the emergency fuses are installed.

To remove the fuses, use the fuse puller supplied with the Powerail :

7.2 High Power Output Status LEDs

Each of the 24 outputs includes a **dedicated LED indicator** on the front face. The colour and behaviour of these LEDs reflect the exact electrical state of the output MOSFET:

- **Off** — Output inactive
- **Green** — Output active and operating normally
- **Red** — Output has been shut down by protection (overcurrent, short circuit, thermal event)
- **Flashing red** — Persistent or repeated fault; output latched off until reset

These LEDs provide immediate visual diagnostics and complement status information available through CAN.

7.3 High-Power Output Switching

The Powerail V8 executes switching commands using solid-state MOSFETs on all 24 channels. Switching behaviour depends on configuration and may include:

- simple ON/OFF control,
- momentary or latching actions,
- timed outputs,
- user-defined fallback modes during communication loss,
- grouped operation when outputs are paralleled.

Channel state changes occur smoothly, and the Powerail applies internal protection continuously to prevent damage to the vessel electrical system.

7.4 High-Power Output Dimming

All 24 high-power outputs support native PWM dimming at system voltage (12 V or 24 V). The HUB determines brightness curves, transitions, and effects. The Powerail executes these instructions locally, adjusting the MOSFET duty cycle to modulate illumination without external dimming hardware.

Dimming adjustment:

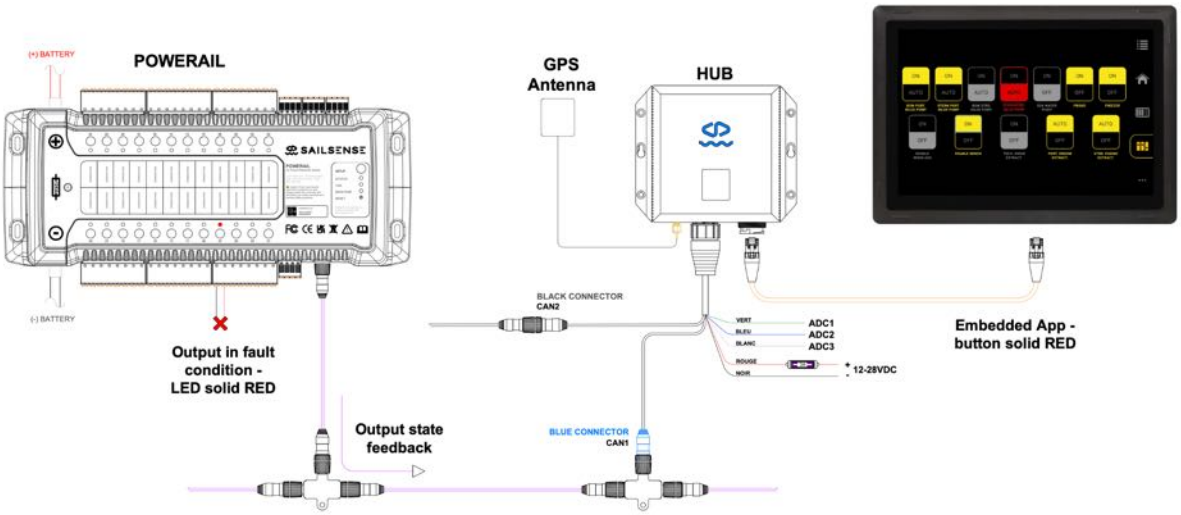
By clicking on the battery logo of the light area, you enter in the dimming calibration pop-up window. You can select your brightness level and turn the zone ON or OFF.

⚠️*If the HUB, for an undetermined reason, becomes inoperative, the variation of light intensity continues according to the **last values stored locally**, which allows the lights to remain usable but the adjustment is temporarily inoperative.*

7.5 High Power Output Under Fault Conditions

Each output is supervised by electrical and thermal protections. If a fault is detected, the Powerail:

- isolates the affected channel,
- applies the configured retry or latch-off policy,
- updates the output LED status on the front panel,
- reports the fault to the HUB when online.



Faults never propagate to other outputs, ensuring stable operation across the board. **To reactivate an output**, simply turn the button off and then back on (either in the app or on the

front panel). First, you must ensure that the problem has been correctly identified and resolved.

7.6 WS281x Addressable LED Zones

The Powerail V8 includes three (3) hardware-timed LED engine capable of driving **three independent WS281x data outputs**, supporting WS2812B, WS2813, WS2814 and WS2815 LED strips. These channels provide:

- per-LED colour and brightness control,
- multi-zone effects (three independent segments),
- animations, alerts and scene transitions,
- precise timing unaffected by CAN traffic or processor load.

The user interface will be deployed in the Sailsense mobile application - coming in 2026

⚠️*LED strips can be **powered externally**, with only the DATA signal sourced from the Powerail. In case of communication loss, the driver maintains the last valid LED frame to ensure stable visual behaviour.*

7.7 Input Signal Processing

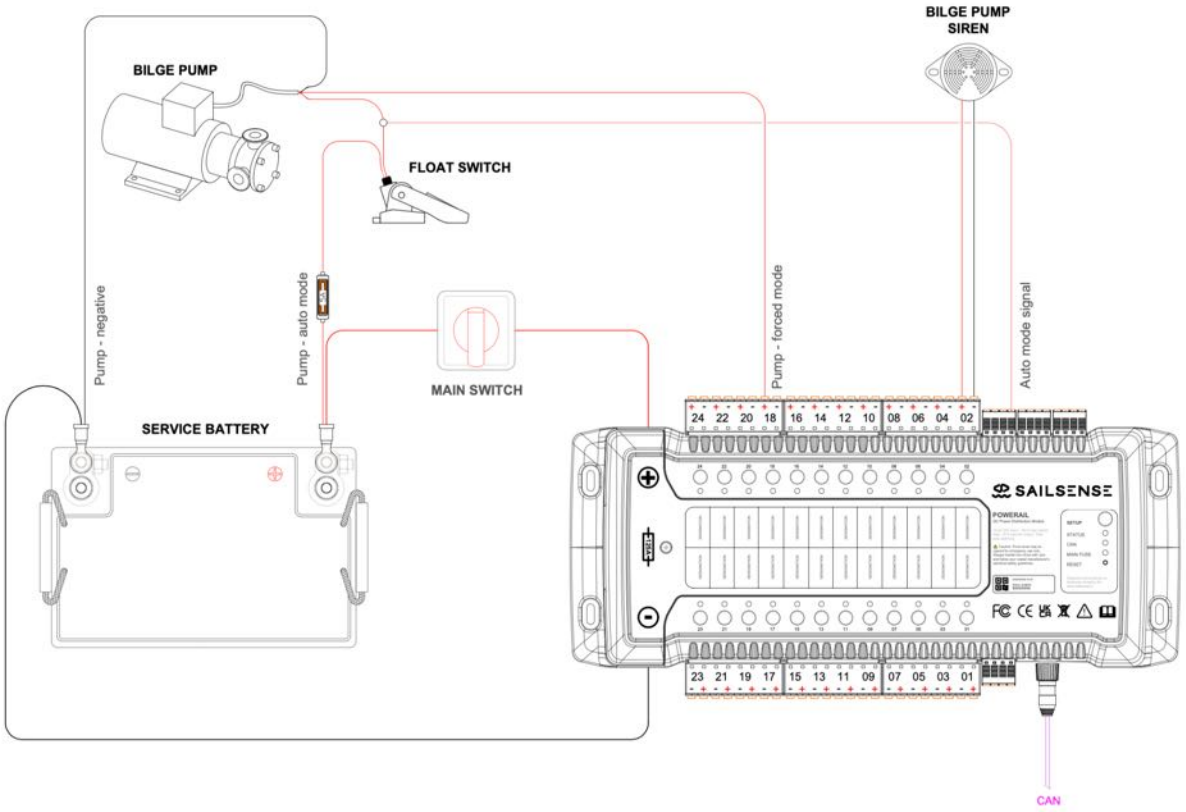
Passive and active inputs are sampled continuously and filtered for noise, vibration and transient events. Input behaviour depends on the configuration stored in the Powerail:

- digital switch detection,
- analogue threshold detection,
- gauge calibration,
- scene triggers.

Example gauge display:

Input events are relayed to the HUB when available, but can also directly drive outputs in a HUB-loss scenario if mapped accordingly (e.g. float switch → bilge pump).

NOTIFICATION example: triggered by Powerail input in this example. Alert message is displayed on the embedded App and Notification is sent to mobile and Web Applications.

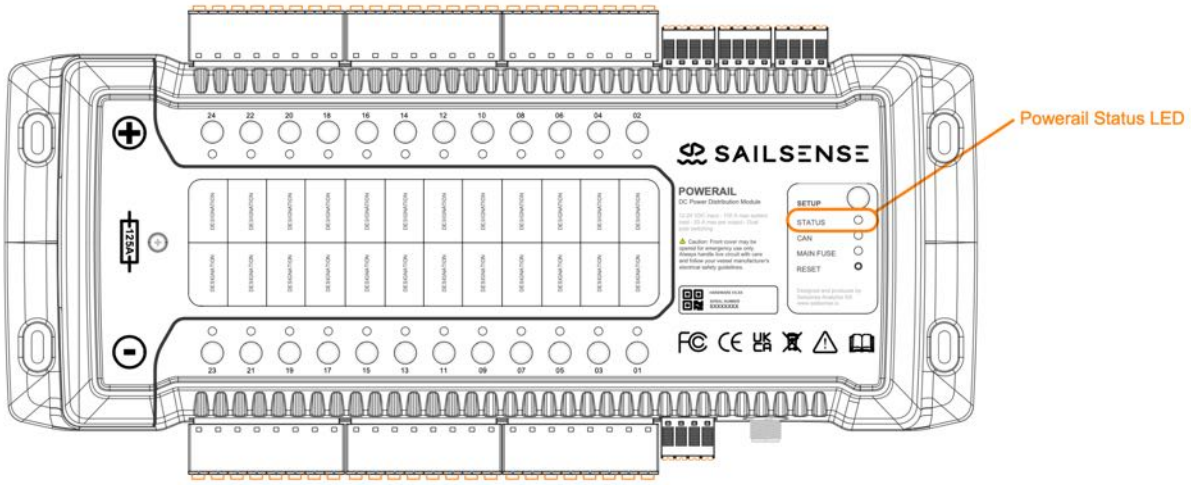


8. Diagnostics and Troubleshooting

The Powerail V8 integrates several layers of diagnostic capability designed to assist technicians and operators in identifying and resolving electrical, communication and configuration issues.

8.1 Front-Panel LEDs

8.1.1 Powerail Status LED



- **LED Off** — The Powerail is inactive. No load is powered.
- **Solid Blue** — The Powerail is connected to the HUB and operating correctly.
- **Solid Red** — The Powerail is in fault condition.

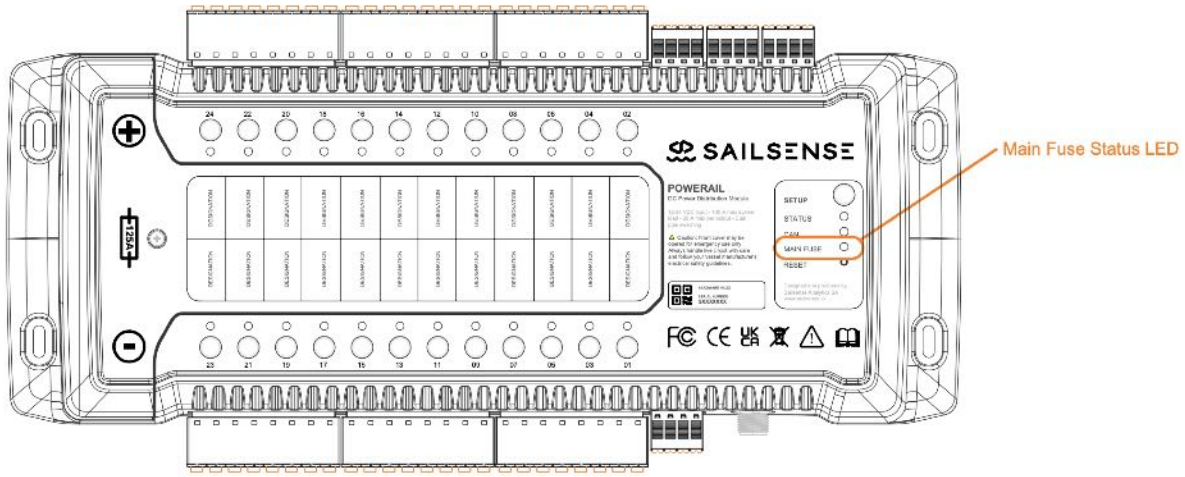
A **Powerail faulty condition** indicates that the module has detected an internal state that prevents it from operating safely or reliably. When this occurs, the Powerail places itself in a protective state and reports the fault through the front-panel Status LED and the system diagnostics.

Such a condition may be triggered by issues including, but not limited to:

- incomplete or failed system initialisation at power-up,
- unstable or insufficient supply voltage,
- communication problems with connected peripherals (CAN devices, LIN sensor, keypads),
- configuration inconsistencies or missing configuration data,
- repeated protection events that prevent normal operation,
- or internal self-diagnostic checks that did not complete successfully.

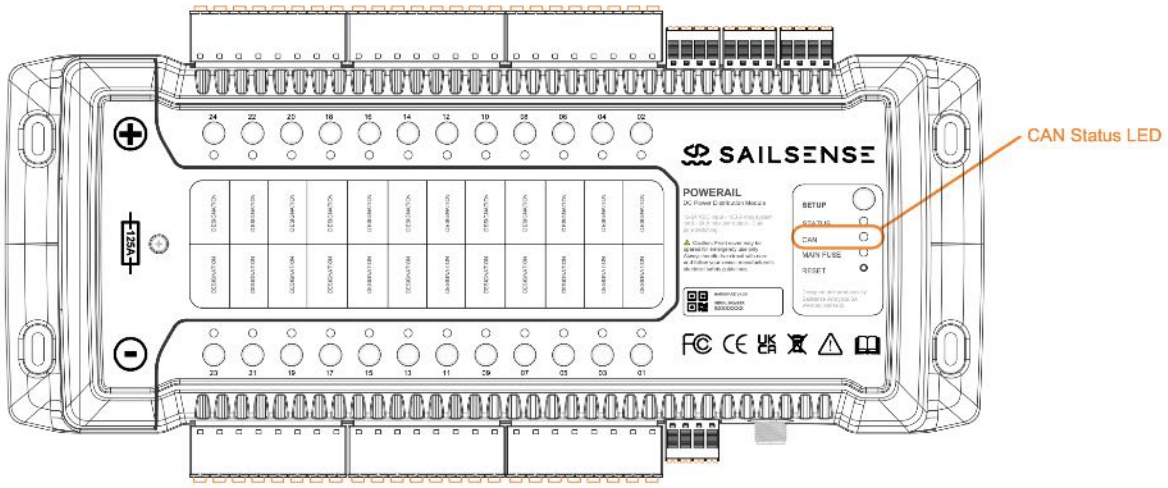
In most cases, a Powerail fault condition is **not caused by a hardware failure**, but by an external factor such as wiring, power quality, configuration state, or communication integrity.

8.1.2 Main Fuse Status LEDs



- **LED Off** — The Powerail is inactive. No load is powered.
- **Solid White** — The Fuse is OK.

8.1.3 CAN Status LEDs



- **LED Off** — The CAN network is inactive. No load is powered.
- **Solid Green** — The CAN network is active.
- **Flashing white** — The Powerail transmits and/or receives CAN messages.
- **Solid Red** — The CAN network is in fault condition

A **CAN faulty condition** indicates that the Powerail has detected a problem affecting its communication on the CAN J1939 network. When this condition is active, the Powerail may not be able to exchange commands, status information or diagnostics reliably with other devices on the network, such as the HUB, keypads or I/O modules.

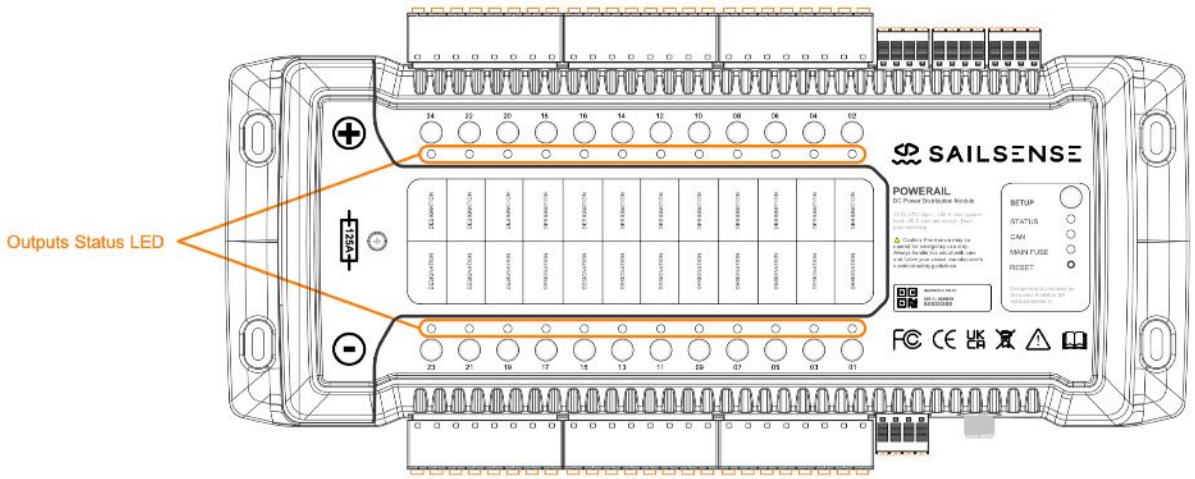
A CAN fault condition may be triggered by issues such as:

- loss or instability of CAN bus power (PowerNet),
- wiring faults on the CAN network (open circuit, short circuit, reversed polarity),
- missing or incorrect CAN termination,
- communication timeouts or excessive bus errors,
- network configuration issues (address conflicts, missing devices),
- or a temporary unavailability of the CAN network during startup.

In many cases, a CAN fault condition is related to **external wiring or network topology**, rather than a failure of the Powerail itself.

8.1.4 Output Status LEDs

Each of the 24 high-power outputs has a dedicated LED on the Powerail front face. These indicators provide immediate status information without requiring any CAN communication or HUB connectivity.

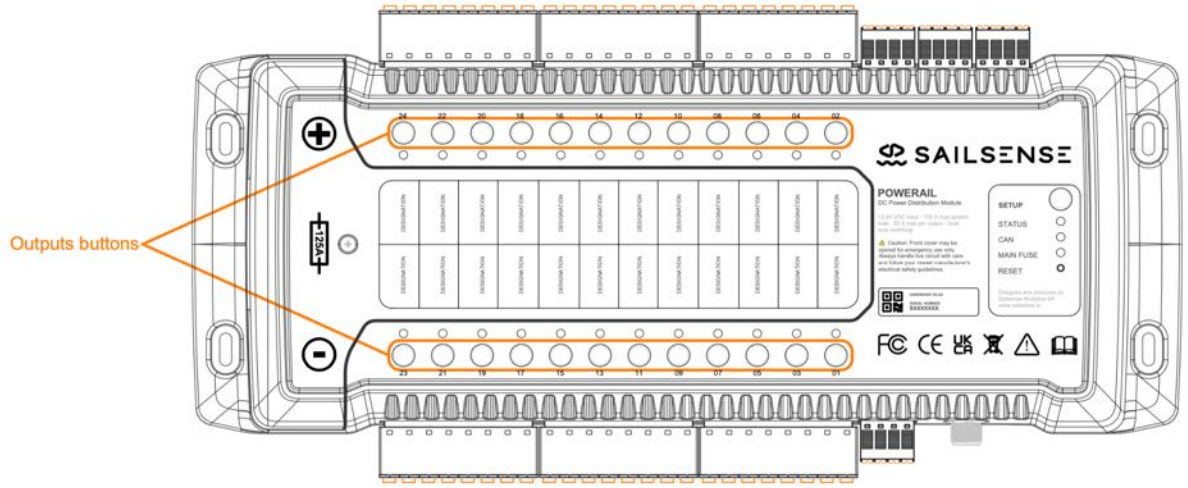


- **LED Off** — The output is inactive. No load is powered.
- **Solid Green** — The output is active and operating correctly.
- **Solid Red** — The output has been shut down by internal protection due to overcurrent, short circuit or thermal overload.
- **Flashing Red** — Persistent or repeated fault condition. The output remains latched off until user intervention or configuration-defined reset logic is applied.

These LEDs provide the fastest method to determine whether faults originate from the load, wiring or the Powerail itself

8.2 Local Manual Operation for Diagnostics

The 24 front-panel buttons allow **manual operation** of each output channel. This capability is not limited to service procedures: it is a core operational feature that also serves as the simplest diagnostic tool.



Pressing a button forces the output to follow its assigned behaviour: ON/OFF ; reset.

- If the output operates normally when activated manually, wiring and load integrity are confirmed.
- If the output enters a fault state, the issue lies in the connected load or wiring.
- If the output cannot be activated manually and no LED lights, the module may be unpowered or internally faulted.

This local interface is especially valuable in **HUB-loss scenarios** and when troubleshooting electrical systems without network connectivity.

8.3 CAN / HUB Diagnostic Messages

When online with the HUB, the Powerail V8 reports faults, sensor anomalies and state transitions using J1939 messages. The Sailsense HUB aggregates these diagnostics and displays them through the Sailsense App.

Typical reported events include:

- Overcurrent shutdown
- Short circuit detection
- Thermal protection activation
- Voltage irregularities on the main rail
- LIN sensor communication loss
- Input state anomalies
- Configuration mismatch or missing profile
- Main Fuse is blown or Powerail main supply not connected

The HUB may also provide recommendations (e.g. load inspection, wiring check, temperature reduction).

8.4 High Power Output Troubleshooting Procedure

When an output does not behave as expected, the recommended diagnostic sequence is:

1. Observe the front-panel LED

- Off → no command or open circuit
- Red → protection event
- Flashing red → persistent load/wiring fault

2. Activate the output manually

- If manual activation works:
  → the issue lies upstream (CAN command, keypad, PG8, HUB configuration).
- If it fails:
  → the load, wiring or connector is likely faulty.

3. Inspect load & wiring

- Inspect the load
- Inspect connectors for corrosion or poor seating
- Verify wire gauge and polarity
- Check grouped outputs when loads exceed 20 A

4. Remote diagnostics

CAN frames often reveal configuration errors, unexpected retries or temperature-related shutdowns (see **8.8 CAN J1939 Troubleshooting).**

8.5 Input Troubleshooting

Input issues (passive or active) may manifest as unresponsive switches, incorrect gauge readings or unexpected triggers.

Troubleshooting steps:

- Verify wiring polarity and grounding
- Check that input biasing mode (pull-up / pull-down / floating) is correctly configured
- Confirm sensor supply on active inputs (PS+/-)
- Validate input signals in the Sailsense App
- Investigate CAN input gateway if the signal originates from an external device

8.6 WS281x Addressable LED Troubleshooting

Addressable LED systems depend on precise timing and reliable data propagation.

Common issues:

- **No LEDs responding** → missing GND reference or external LED power
- **Flickering or noise** → excessive cable length, poor shielding or inadequate power injection
- **Colour corruption** → mixed LED strip models, damaged LED early in chain
- **Partial strip operation** → a failed LED blocking downstream DATA

Resolution steps:

- Ensure LED power supply and ground reference are correct
- Keep data cable length within recommended limits
- Use shielded cable for long runs
- Replace defective LED segment when the chain stops propagating data

8.7 High-Power Dimming Troubleshooting

PWM dimming on MOSFET outputs may be affected by:

- insufficient supply voltage (notably under heavy loads),
- incompatible LED,
- wiring with excessive resistance,

Solutions include ensuring stable supply, verifying correct grouping on the same rail, and validating the load's compatibility with PWM dimming.

8.8 CAN J1939 Troubleshooting

Typical CAN faults include reversed polarity, missing termination, cable damage, or address conflicts.

Symptoms:

- slow or unresponsive keypad buttons
- CAN devices events not triggering actions
- missing HUB status updates
- intermittent or dropped messages

Steps:

1. Check CAN power supply (see: **5.2 CAN J1939 Network Check**)
2. Confirm both 120 Ω terminators
3. Inspect shielding continuity
4. In multi-module networks, ensure total bus length and device count do not exceed marine CAN guidelines.

By using **Sailsense remote checking tools** you can diagnose the J1939 CAN network. It permit to:

- Verify that all devices are communicating on the CAN bus.
- Verify that Powerails, CAN keypads and CAN input gateway use unique addresses (configurable via Sailsense tool)
- Verify alert messages such as output default for example.

8.9 LINbus Troubleshooting

Only one LIN device (e.g., IBS battery sensor) may be connected to the Powerail V8.

Typical diagnostic steps:

- Confirm LIN device power (+12 V IBS)
- Ensure common ground reference
- Inspect wiring integrity
- Validate device compatibility and address
- Review HUB error frames indicating LIN timeout or missing ACK

8.10 Bluetooth (Planned Feature)

The Powerail V8 hardware includes support for Bluetooth Low Energy (BLE), which is planned to be enabled in a future software release.

This direct Bluetooth connection is intended to provide local, short-range access to the Powerail for commissioning, basic diagnostics and service operations, particularly in situations where the HUB or CAN network is not yet available or temporarily unavailable.

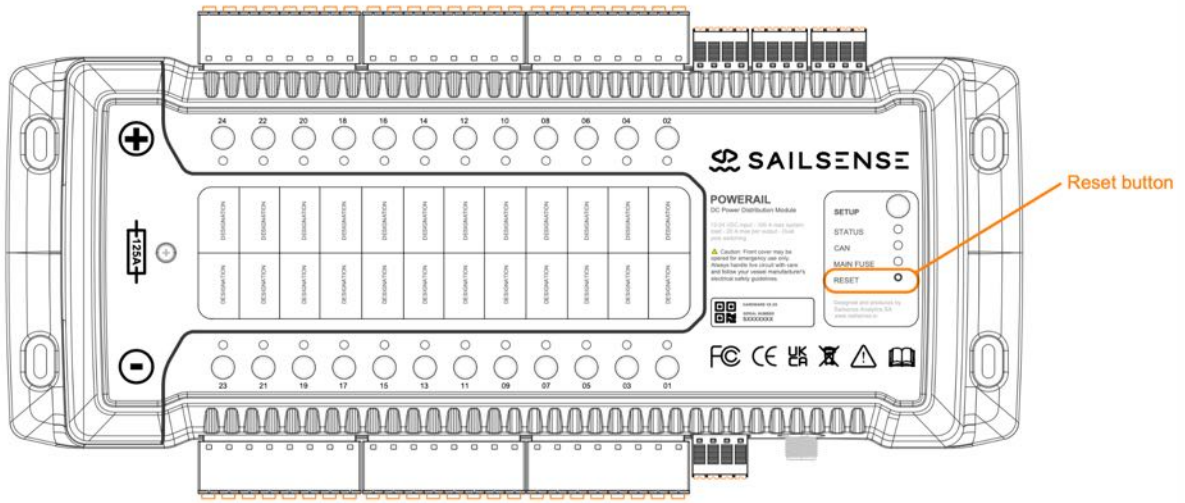
Bluetooth will complement the existing CAN and HUB-based architecture by offering an additional local access layer, without replacing the HUB as the central control and remote access gateway.

Availability and supported features will be announced in a future release.

8.11 System Reset and Setup Recovery

The Powerail V8 includes two system-level recovery functions designed for exceptional scenarios.

RESET Pin – Hard System Reboot

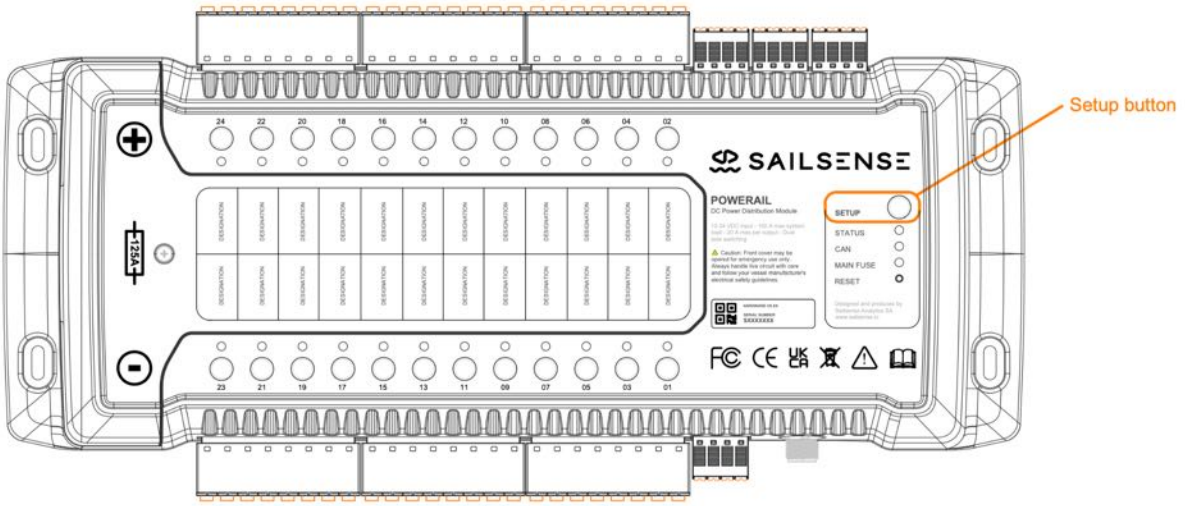


Activating the RESET pin forces the Powerail V8 to restart its internal controller. This action:

- resets internal protection logic,
- reinitialises CAN communication,
- reloads the locally stored configuration.

It does **not** erase configuration data and has no adverse effect on wiring or external devices. It is used when the module becomes unresponsive or after correcting persistent protection faults.

SETUP Button – Firmware Recovery & Reconfiguration Request



Pressing the SETUP button for **more than 10 seconds** initiates a firmware recovery process:

- critical firmware components revert to a safe baseline,
- configuration pointers are cleared,
- the Powerail enters a state where it **requests a fresh configuration from the HUB**.

Until the HUB responds:

- outputs remain OFF,
- LEDs may indicate configuration wait state,
- the module will not execute previous mappings.

This procedure must only be used intentionally, typically during module replacement or when instructed by support.

9. Appendices

The following appendices consolidate all reference information required for understanding the Powerail V8 pin layout, electrical capacities, connector types, and overall system integration. This chapter serves as a technical reference to support installation, commissioning, diagnostics and certification.

9.1 Complete Output/Input Pinout

9.1.1 Output Pinout

The 48 outputs' terminals are arranged into **six 8-pin connectors** (A to F), each carrying **four complete outputs**.

Correct pairing of harness connectors with the module connectors (A→A, B→B, etc.) is essential for reliable operation.

Output Pin Mapping Table

Output #	Connector	Pin “–”	Pin “+”
01	A	A-07	A-08
02	B	B-01	B-02
03	A	A-05	A-06
04	B	B-03	B-04
05	A	A-03	A-04
06	B	B-05	B-06
07	A	A-01	A-02
08	B	B-07	B-08

09	C	C-07	C-08
10	D	D-01	D-02
11	C	C-05	C-06
12	D	D-03	D-04
13	C	C-03	C-04
14	D	D-05	D-06
15	C	C-01	C-02
16	D	D-07	D-08
17	E	E-07	E-08
18	F	F-01	F-02
19	E	E-05	E-06
20	F	F-03	F-04
21	E	E-03	E-04
22	F	F-05	F-06
23	E	E-01	E-02
24	F	F-07	F-08

Notes for Installers

- Each connector **A to F** contains **four complete outputs**, including their "+" and "–" terminals.
- The "+" terminal of a channel must be wired to the **positive conductor** of the load; the "–" terminal must be wired to the **negative conductor**.
- Both conductors are switched electronically, ensuring **full isolation** when the output is OFF.
- Harness plugs must be **explicitly labelled A/B/C/D/E/F**, and connected to the matching connector on the Powerail V8.
- Grouping of outputs (up to 60 A) must always be done at the output level (Output 1 + 3 + 5 …), **never** by mixing terminals across connectors.
- The physical numbering (01→24) corresponds to the LED and button numbering on the front panel, simplifying diagnostics.

9.1.2 Input Pinout

The Powerail V8 provides:

- A mixed-input block supporting active and passive switch inputs
- Integrated PWM channels for non-addressable LED lighting
- A dedicated hardware engine for WS281x addressable LED strips
- Three voltmeter inputs for monitoring battery banks or system buses
- A LINbus interface for supported sensors such as IBS/BMS units.

These inputs are arranged into **four 8-pin connectors** (G to J). Correct pairing of harness connectors with the module connectors (G→G, H→H, etc.) is essential for reliable operation.

Voltmeters + Hull Leakage Pin Mapping Table

VM # / HL	Connector	Pin “PS+”	Pin “PS-”	Mass
VM #01	G	G-07	G-08	
VM #02	G	G-05	G-06	
VM #03	G	G-03	G-04	
HL	G			G01

Passive Input Pin Mapping Table

Input #	Connector	Pin “PS+”	Pin “PS–”
01	H	H-07	H-08
02	H	H-05	B-06
03	H	H-03	H-04
04	H	H-01	H-02

Active Input Pin Mapping Table

Input #	Connector	Pin “PS+”	Pin “PS–”	Pin “+”
05	I	I-05	I-06	1-07
06	I	I-01	I-02	1-03

LIN + PWM Pin Mapping Table

PWM # / LIN	Connector	Pin “PS+”	Pin “PS-”
PWM #01	J	J-07	J-08
PWM #02	J	J-05	J-06
PWM #03	J	J-03	J-04
LIN	J	J-01	

9.2 Electrical Specification Table

Parameter	Value	Notes
System voltage	10–30 V DC	12/24 V systems
Max internal rail current	100 A	Protected by integrated MegaFuse
Number of outputs	24 bipolar	48 MOSFET terminals
Max current per output	20 A continuous	Thermal & overcurrent-protected
Maximum grouping capacity	60 A	Grouping of 3 outputs (A+A+A / B+B+B)
Output type	MOSFET solid-state	PWM dimming supported
Addressable LED lines	3 × WS281x	DATA only, 5 V logic
Active inputs	2	With PS+ / PS–
Passive inputs	4	Software-configurable internal bias
LIN interface	1 device	IBS / sensor
Voltmeters	3 channels	±30 V each
Environmental	–40°C to +45°C	
Dimensions	377 × 146 × 50 mm	377 x 184 x 50 mm with connectors
Weight	~2.0 kg	Depending on revision

9.3 Connector Reference List

This table summarises all connectors used on the Powerail V8.

High-power connectors (outputs)

- **Device side**: Degson **9EDGKD-HC-7.5 mm**
- **Harness side**: Degson **9EDGK-HC-7.5-xxP**
  → Allow pre-assembled looms, push-in terminals, release latch.

Low-power connectors (inputs / LED data / LIN / voltmeters)

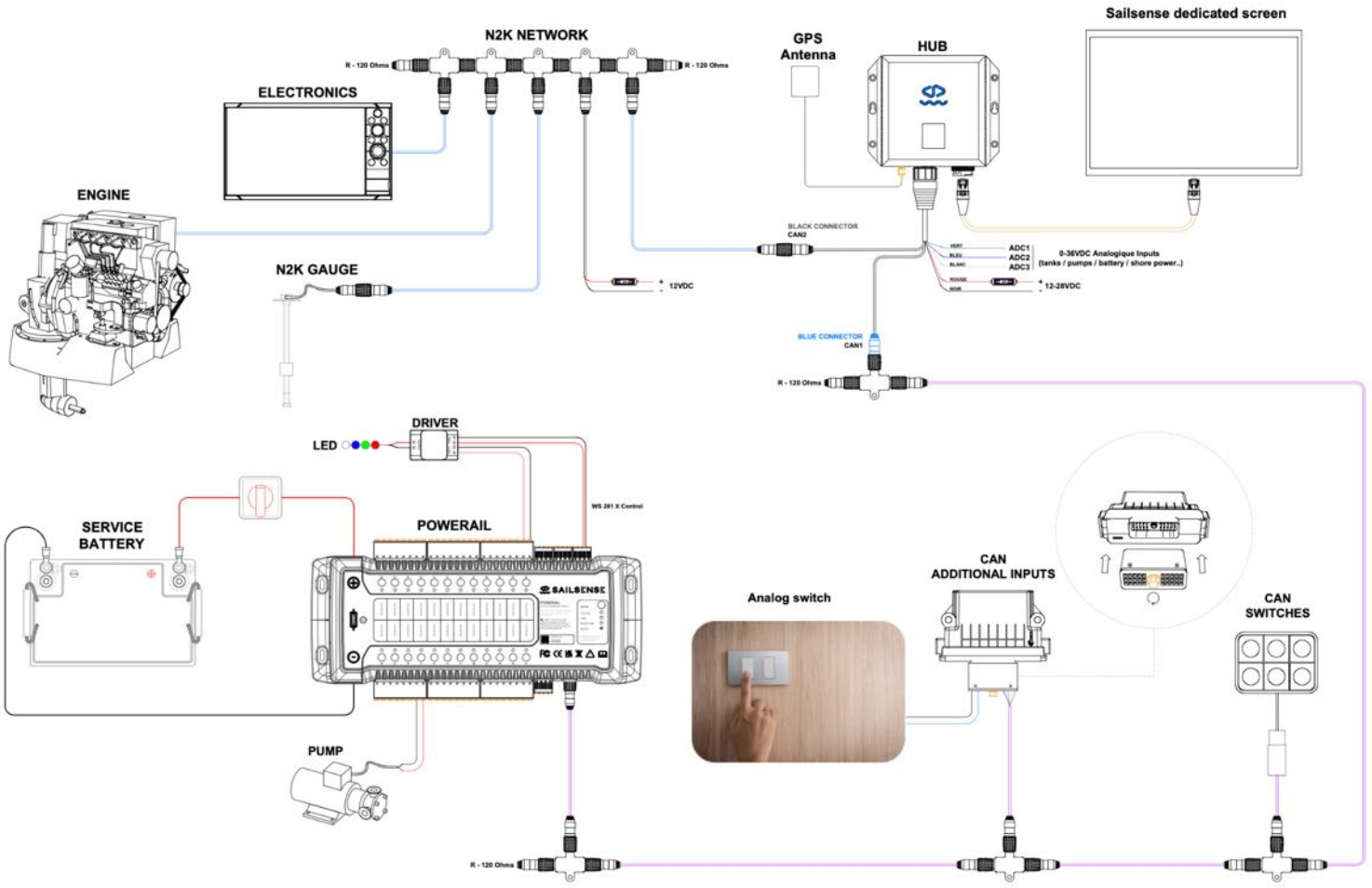
- **Device side**: Degson **2EDGKNH-5.08 mm**
- **Harness side**: Degson **2EDGK-5.08-xxP**

CAN J1939 connector

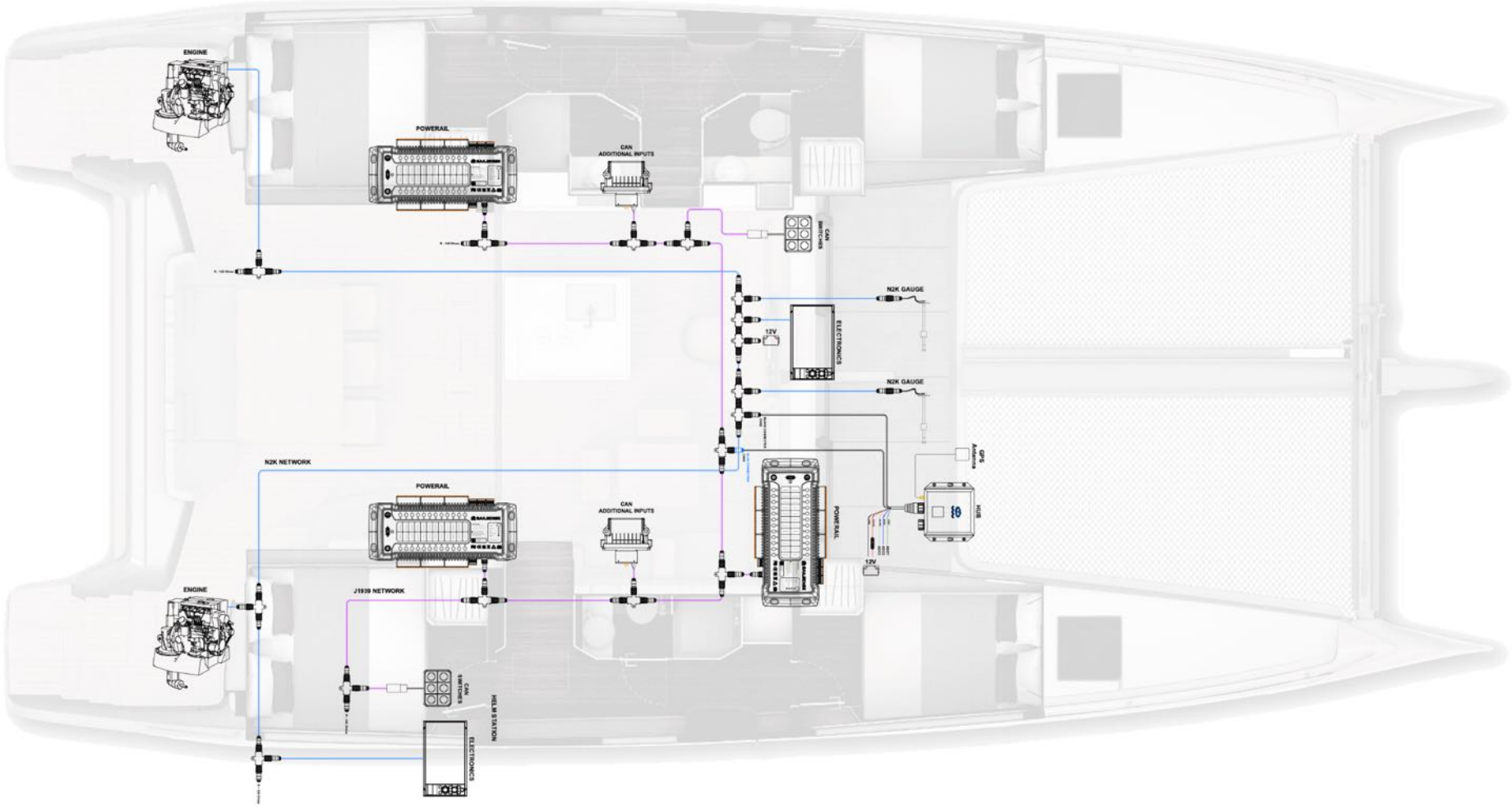
- **Device side**: Standard **marine circular CAN connector** (Micro-C / NMEA2000 style) - male
- **Harness side**: Standard **marine circular CAN connector** (Micro-C / NMEA2000 style) - female

9.4 Functional Architecture Diagrams

Example of Sailsense ecosystem integration:



Example of Sailsense ecosystem integration on a catamaran with multiple Powerails:



10. Sailsense contacts

For any question or feedback, please contact Sailsense via :

Mail : hello@sailsense.io / support@sailsense.io
WhatsApp (message only) : +44 7418 310794

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