

CRUZO SMART RELAY USER MANUAL



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Features

- Wide range input voltage: 7-30VDC
 - Reverse polarity protected
 - Input voltage and current monitoring
 - Over current protection – maximum unit current capacity – 50A
 - Priority control according to input voltage level
- 8 relay outputs:
 - 4X 10A SPST RELAYS
 - 4X 20A SPST RELAYS
 - Current measurement on all outputs
 - Automatic over current trip on all outputs
 - Undercurrent error message
 - Up to 30VDC switching voltage
 - Reverse polarity output (H-Bridge) using 2 channels (CH.3 & CH.4)
- Optically isolated NMEA-2K
- Two opto-coupled digital inputs
- Operating temperature: -15°C to 55°C
- Ignition protected sealed waterproof enclosure
- Status indicator LEDs
- IP67 connectors
- IP67 rated

Theory of Operation

The Cruzo Smart Relay utilizes NMEA-2000 protocol to control 8 relays. Each relay output is current monitored for automatic trip according to the pre-defined current limit.

By placing the Cruzo Smart Relay close to the loads, wiring becomes easier as no extensive wires are required anymore. The Cruzo Smart Relay can be connected anywhere in the vessel, using NMEA 2000 network and a suitable local power supply.

When using Barantech's Cruzo panels, the Cruzo Smart Relay can be connected directly to the panel without any NMEA-2000 network, allowing it to be use either in a small vessel without any NMEA 2000 network or in parallel to the network for redundancy, keeping high priority loads operating even when the network is not functioning properly.

Included In the Package

- 1X CRUZO SMART RELAY
- 1X M5 SPRING WASHER - DIN127B A2
- 1X M5 NUT - DIN934 A2
- 1X M8 SPRING WASHER - DIN127B A2
- 1X M8 NUT - DIN934 A2

Optional Order Parts

*These parts are NOT included with the Cruzro Smart Relay

Catalog number	Description
80110792	Output (J1) Matting connector with 1m Flying Leads – 14AWG
80110791	Output (J2) Matting connector with 1m Flying Leads – 12AWG

Hardware Description

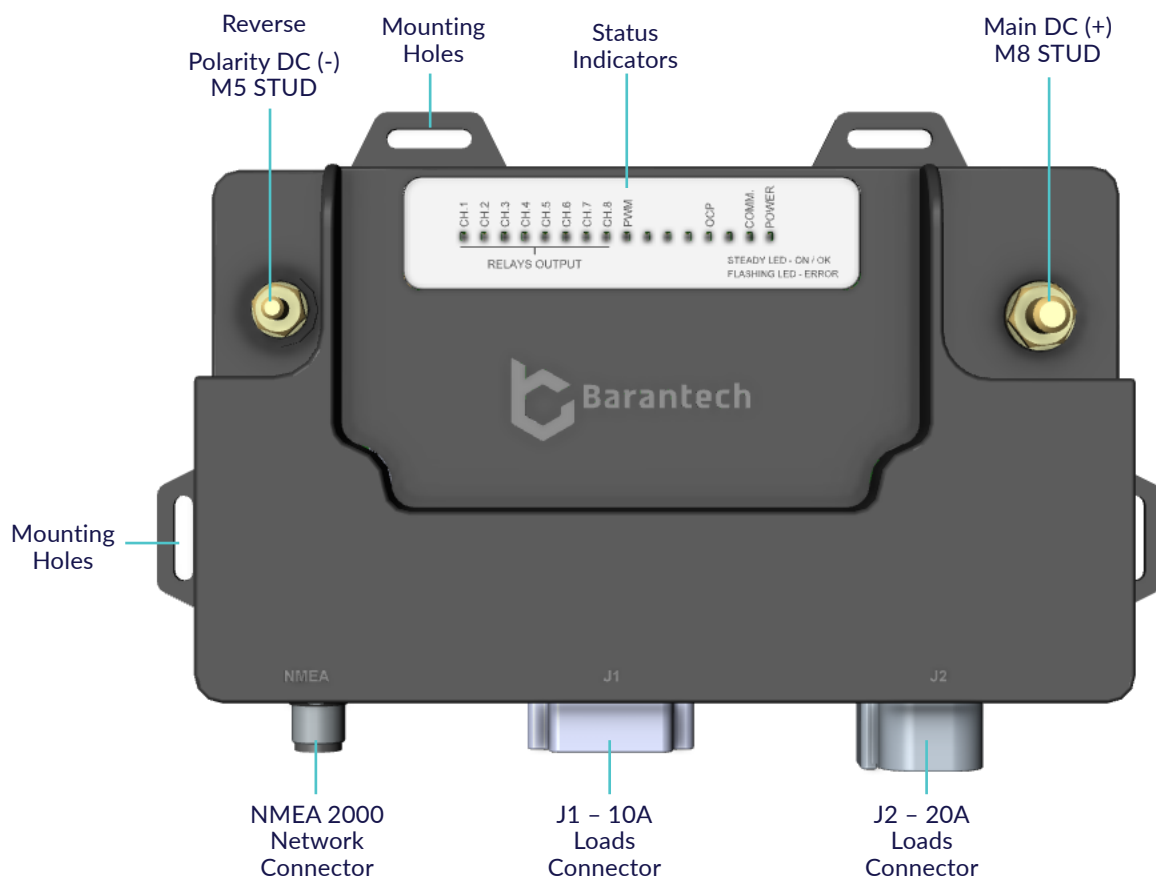


Figure 1 - Hardware Description Front View

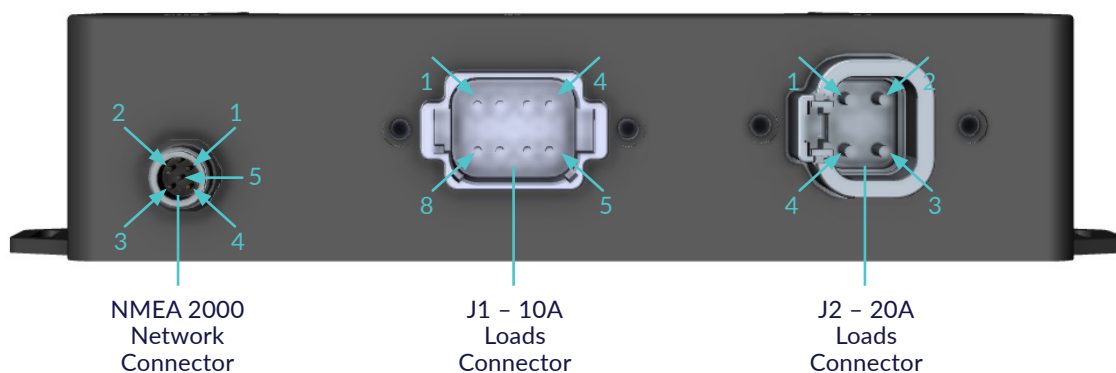


Figure 2 - Hardware Description Bottom View

Connectors

J1 – 10A LOADS & SIGNALS

Mating Connector: AT06-08SA / DT06-08SA

Table 1 - J1 CONNECTOR PINOUT

J1 CONNECTOR				
PIN NO.	DESCRIPTION	PREASSEMBLED CABLE WIRE LABEL (CATALOG NUMBER 80110792)	NMEA PGN 127501 NUMBER	NOTES
1	CHANNEL 1 OUTPUT	J1/1 – CH.1	1	MAX. CURRENT: 10A
2	CHANNEL 2 OUTPUT	J1/2 – CH.2	2	MAX. CURRENT: 10A
3	INPUT SIGNAL 1	J1/3 – INPUT 1	9	MAX. 18VDC
4	INPUT SIGNAL 2	J1/4 – INPUT 2	10	MAX. 18VDC
5	DO NOT CONNECT	J1/5 – PWM	N/A	
6	GND	J1/6 – GND	N/A	FOR CONTROL ONLY (MUST BE CONNECTED)
7	CHANNEL 4 OUTPUT	J1/7 – CH.4	4	MAX. CURRENT: 10A
8	CHANNEL 3 OUTPUT	J1/8 – CH.3	3	MAX. CURRENT: 10A

J2 – 20A LOADS

Mating Connector: ATP06-4S

Table 2 - J2 CONNECTOR PINOUT

J2 CONNECTOR				
PIN NO.	DESCRIPTION	PREASSEMBLED CABLE WIRE LABEL (CATALOG NUMBER 80110791)	NMEA PGN 127501 NUMBER	NOTES
1	CHANNEL 6 OUTPUT	J2/1 - CH.6	6	MAX. CURRENT: 20A
2	CHANNEL 7 OUTPUT	J2/2 - CH.7	7	MAX. CURRENT: 20A
3	CHANNEL 8 OUTPUT	J2/3 - CH.8	8	MAX. CURRENT: 20A
4	CHANNEL 5 OUTPUT	J2/4 - CH.5	5	MAX. CURRENT: 20A

NMEA

Mating Connector: NMEA2000 micro-C

Table 3 - NMEA CONNECTOR PINOUT

J2 CONNECTOR		
PIN NO.	DESCRIPTION	NOTES
1	SHIELD	
2	NET – S (POWER SUPPLY POSITIVE, V+)	
3	NET – C (POWER SUPPLY COMMON, V-)	
4	NET - H (CAN – H)	
5	NET – L (CAN – L)	

Outputs Schematic:

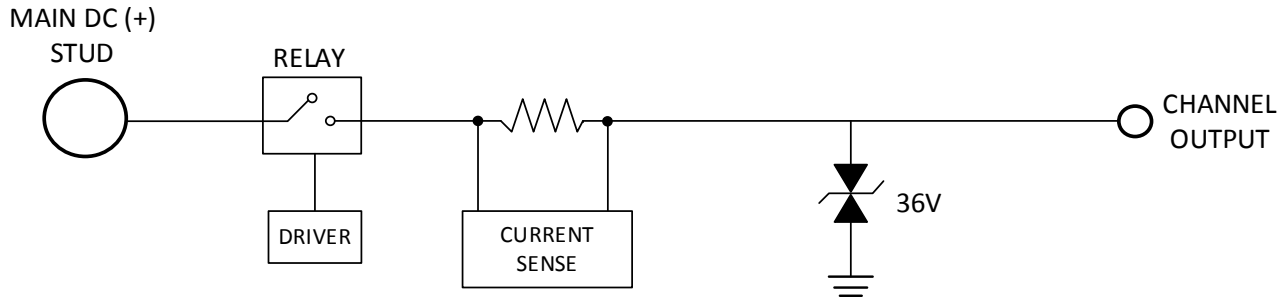


Figure 3 - Output schematic

Overcurrent Protection:

The main purpose of the overcurrent protection is to protect the Cruzo Smart Relay, it can be also used to protect the loads connected to the Cruzo Smart Relay by pre-defending the Trip current values.

If not specifies otherwise, the tripping current value for each channel is according to the maximum output current of each channel. After the overcurrent protection has kicked in the channel will change status to “OFF” and the led indicator of the problematic channel will blink and the “OCP” (overcurrent protection) led indicator will be lit.

In order to reset the channel after tripping has occurred, a signal to activate the channel needs to be sent again via NMEA2000 protocol.

The overcurrent protection also monitors the total current passing through the unit, allowing a maximum current of 50A.

Reverse Polarity Channels:

Channels 3 & 4 can be wired in a way that provides reverse polarity function (H-Bridge). This function can be used to control two direction motors such as actuators and etc.

The Cruzo Cruzo Smart Relay will automatically recognize if this feature is used and monitor the currents in both ways to provide channel tripping if the current exceeds the specified value.

To use this function the motor has to be connected between channels 3 & 4 and also DC (-) M5 stud should be connected to the power supply negative voltage V- / GND.

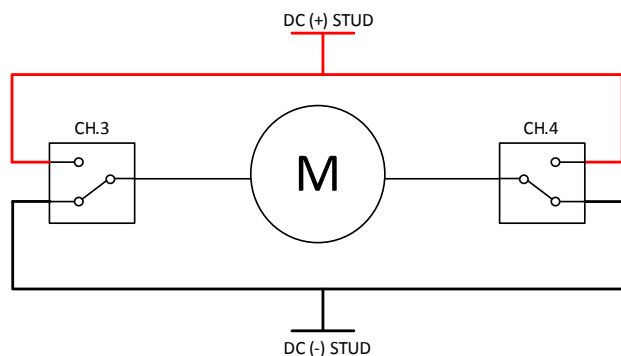


Figure 4 - Reverse Polarity Concept

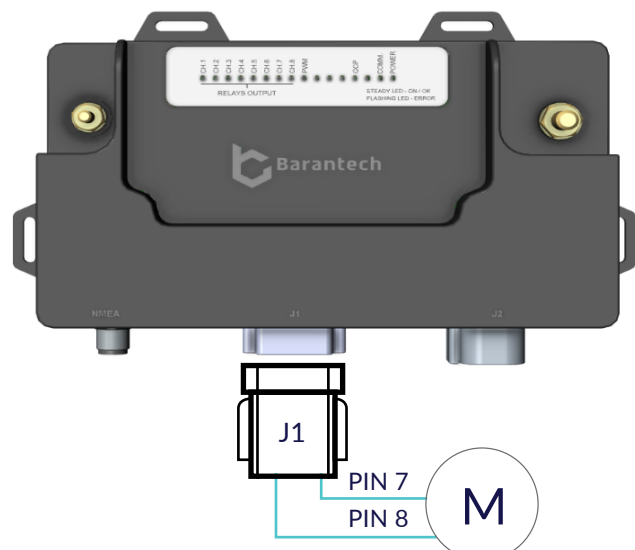


Figure 5 - Reverse Polarity connection

Input Signals:

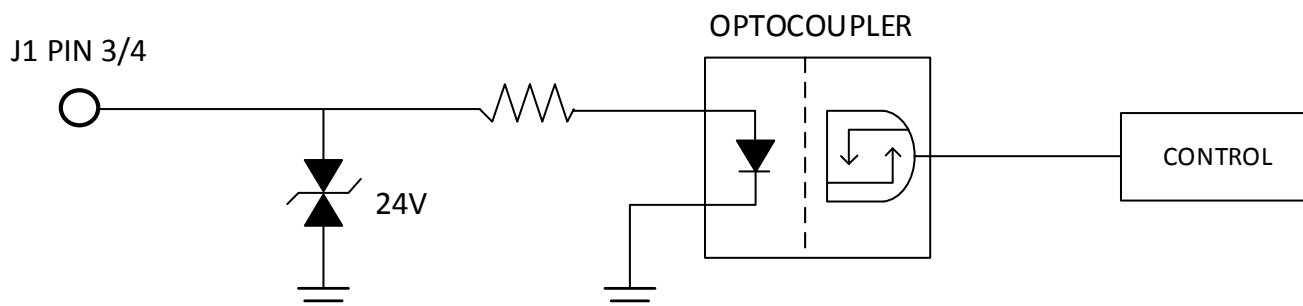


Figure 6 - Input schematic

Each input is configured to output an ON indication in the NMEA2000 Binary status report PGN 127501 when the input changes from LOW to HIGH.

Priority Control:

In order to allow the system to continue functioning properly even when there is a problem with the supply voltage, the Cruzo Smart Relay monitors the input voltage at any given moment and manages an event sequence. This event sequence determines which category of channels will continue to work and which will not.

Table 4 - Priority Categories

CATEGORY	CHANNELS
HIGH PRIORITY	3, 4, 7, 8
MEDIUM PRIORITY	2, 5, 6
LOW PRIORITY	1

Table 5 - Priority Sequence

SUPPLY VOLTAGE	HIGH PRIORITY	MEDIUM PRIORITY	LOW PRIORITY
$V_{in} > 11$	Green	Green	Green
$9 < V_{in} < 11$	Green	Green	Red
$7 < V_{in} < 11$	Green	Red	Red
$V_{in} < 7$	Red	Red	Red

Installation:

- Mounting location:
 - The Cruzo Smart Relay can be installed in a horizontal or vertical position.
 - The Cruzo Smart Relay is rated for maximum of 55°C, avoid installation in part where the operating temperature exceeds the temperature limit specified.
- Mounting:
 - Mount the unit securely to the vessel using mounting screws through the four mounting holes.
 - Do not use thread locking compounds containing methacrylate ester, as they can cause cracking of the plastic enclosure.

Wiring:

Main DC (+) Stud Wiring:

The unit's main DC (+) connector is a M8 screw type stud. The connection is done using commonly available components and the M8 washer + nut provided in the box.

Connect the DC (+) source using a ring terminal and torque the connection within the specified torque (maximum 9Nm / 79 lbs-in.).

- Before tightening the nuts, use a wrench to hold the stud base in place to prevent damage to the stud.

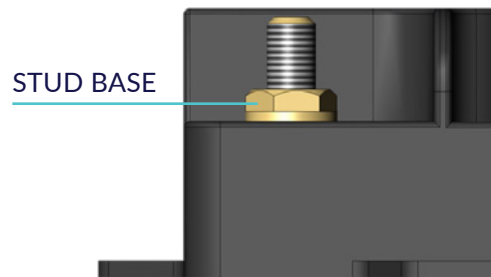


Figure 7 - Input schematic

Use appropriate wire size according to the maximum current that the unit is going to feed. Keep the cable as short as possible to avoid unwanted voltage drop.

Ensure that the cable providing the main DC (+) source is protected by an appropriate fuse or circuit breaker.

DC (-) Stud Wiring:

The unit's DC (-) connector is a M5 screw type stud.

This stud should be connected to the voltage source negative V- only when reverse polarity output is needed – refer to “REVERSE POLARITY FUNCTION” section of this document.

The connection is done using commonly available components and the M5 washer + nut provided in the box. Connect the DC (-) source using a ring terminal and torque the connection within the specified torque (maximum 2.2Nm / 19 lbs-in.).

Before tightening the nuts, use a wrench to hold the stud base in place to prevent damage to the stud. See figure 7.

Studs Base Wrench Size:

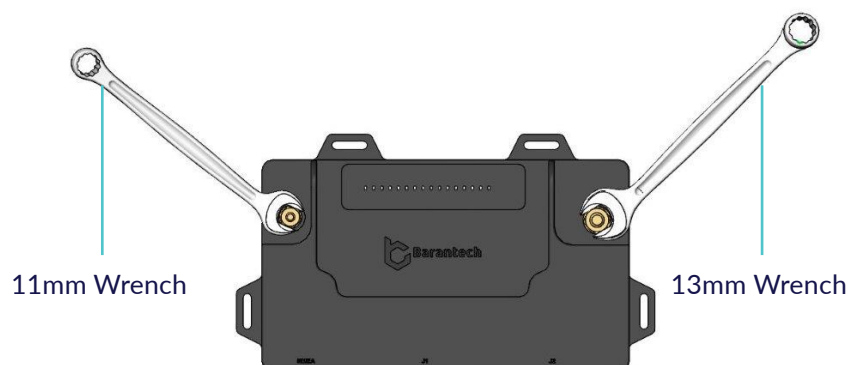


Figure 8 – Wrench sizes

J1 & J2 Wiring:

If the pre-assembled cables are not used, see table below for needed parts for connection to J1 & J2 connectors:

Table 6 - Parts needed for wiring

MFN P/N	Description	Mating	QTY required	Picture
AT06-08SA OR DT06-08SA	Plug Housing 8 positions	(J1)	1	
AW8S	Plug Wedge lock 8 pos.		1	
1062-14-0122	Conn socket 14-18 AWG nickel crimp		As required	
A114017	Sealing plug size 12-16		As required	
ATP06-4S	Plug Housing 4 positions	(J2)	1	
AWP-4S	Plug Wedge lock 4 pos.		1	
1062-14-0122	Conn socket 12-14 AWG nickel crimp		As required	
A114017	Sealing plug size 12-16		As required	

System Connection:

The Cruzeiro Smart Relay can be implemented in the vessel's system in different ways:

Direct Connection To Barantech's Cruzeiro panel:

In this configuration, the Cruzeiro relay panel is connected directly to a Cruzeiro Panel from Barantech. No NMEA network is needed in this configuration.

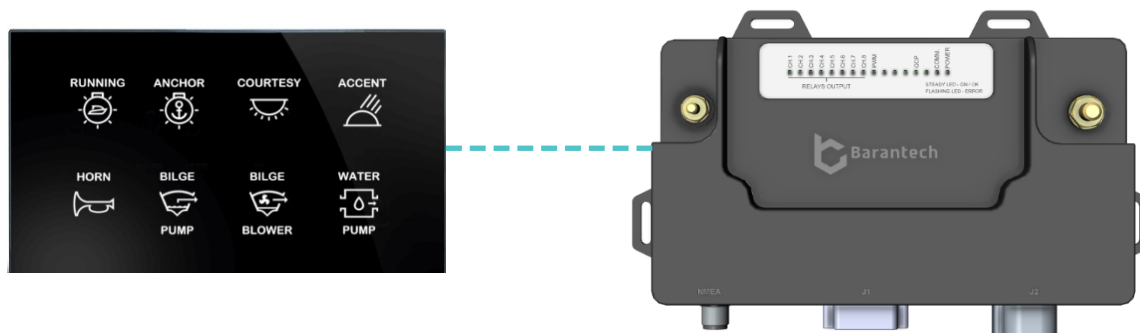


Figure 9 – Direct connection with Barantech's Panel

Connection to NMEA 2000 Network:

In this configuration, the Cruzeiro relay panel is connected directly to the NMEA 2000 Network.

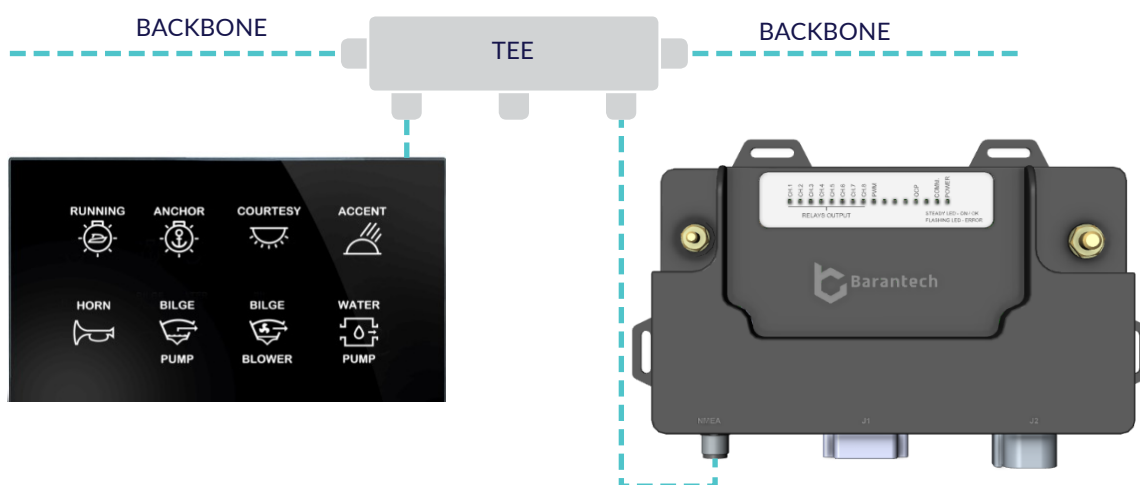


Figure 10 – Connection to NMEA network

Status Indicator LEDs:

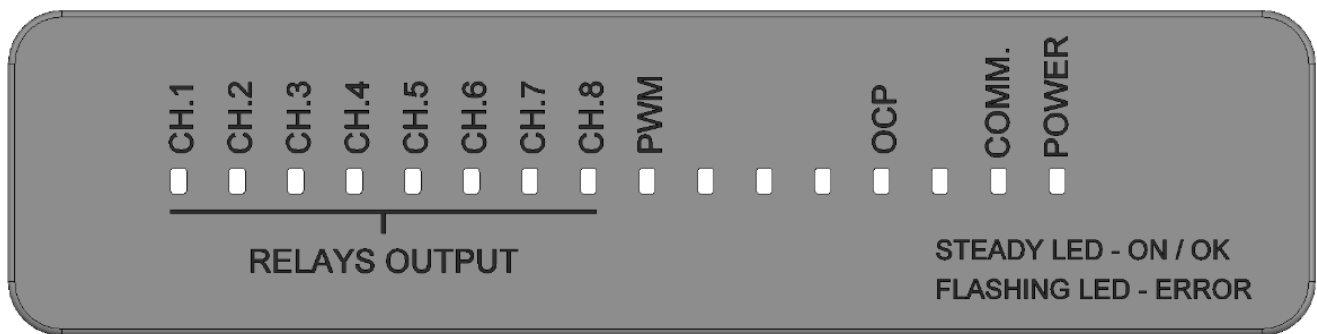


Figure 11 – Status indicator LEDs

- CH.1 → CH.8: These LEDs indicate the status of each channel.
LED OFF = Channel OFF
LED Steady ON = Channel ON
Blinking = Error in the channel (Low current consumption / current trip).
- PWM: This LED indicates the status of the PWM output channel – this channel is a future feature for Version 2 of the Cruzo Smart Relay.
- OCP: Over Current Protection status,
LED OFF = system ok
LED ON = High / Low current consumption on a specific channel or in the total current through the unit.
- COMM.: This LED indicates the status of the NMEA 2000 communication,
Blinking LED = good communication,
Steady ON or OFF = no communication / error.
- POWER: this LED indicates the status of the input voltage. When the input voltage is higher than 11VDC the LED is ON, when voltage drops below 11VDC the LED will blink to indicate low input voltage.

Device Instance:

NMEA 2000 uses a unique instance number to allow more than one Smart Relay to be connected to the network. This instance number is reflected on the binary status report message (PGN 127501).

The Cruze Smart Relay consists 2 rotary dip switches in the back. These switches are used to select the device instance number when more than one Smart Relay is installed on the vessel.

Each rotary switch has 16 positions, this gives the ability to select an instance number from 0 up to 255.

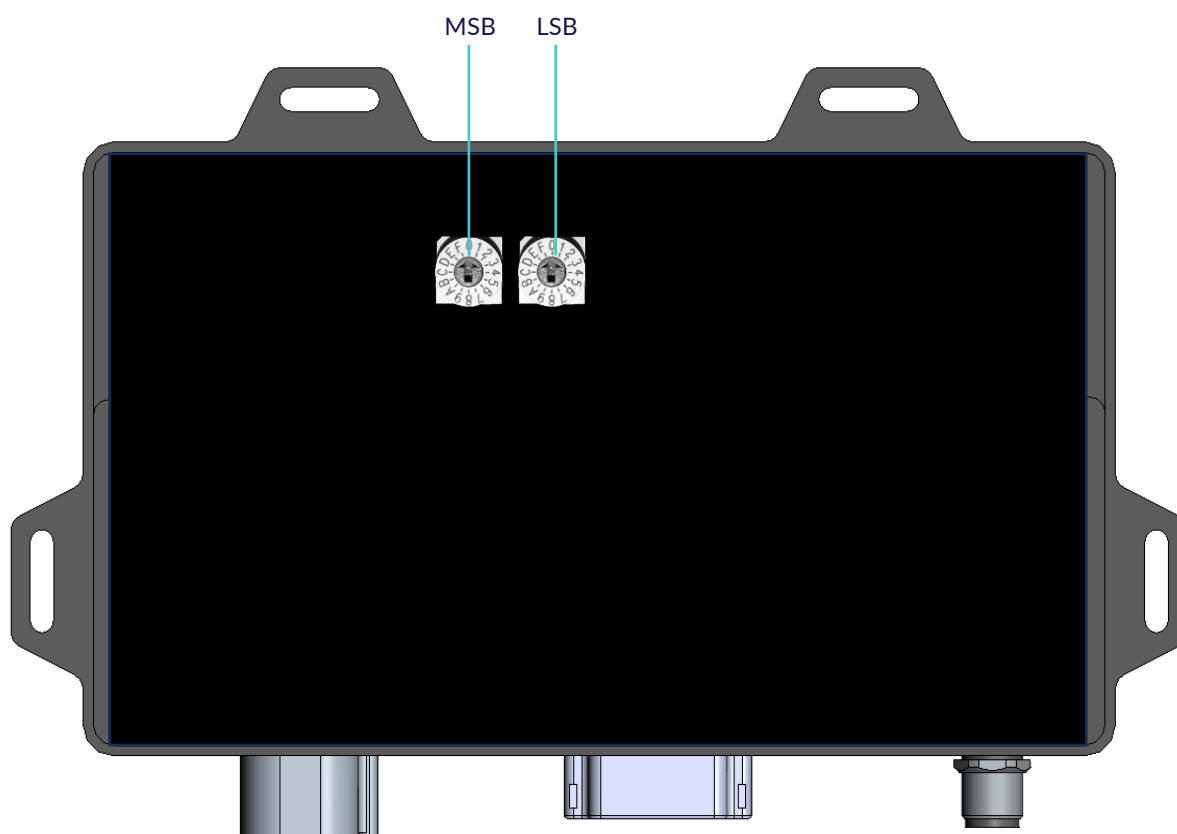


Figure 12 – Instance rotary switches – Smart Relay
bottom view

NMEA 2000 Parameter Group Numbers (PGN):

NMEA 2000 PARAMETER GROUP NUMBERS			
DESCRIPTION	PGN#	PGN NAME	DEFAULT RATE
Periodic Data PGNs	127501	Binary Switch Bank Status	1 time / 2 seconds
Response to Requested PGNs	126464	PGN List	
	126996	Product Information	
	126998	Configuration Information	
Protocol PGNs	059392	ISO Acknowledge	
	059904	ISO Request	
	060928	ISO Address Claim	
	059392	ISO Acknowledge	
	060160	ISO Transport Protocol, Data	
	060416	ISO Transport Protocol	
	126208	Request group function	
	126993	Heartbeat	1 time / 10 minutes

Troubleshooting:

ISSUE	LEDs STATUS	POSSIBLE SOURCE	ACTIONS TO RESOLVE
1 Unit does not turn on	No LEDs are lit	1. Connection to power source. 2. Low input voltage	1. Check connections to power source (Main DC(+) & J1 pin 6). 2. Check that power source voltage is higher than 7V.
2 Panel not reacting	PWR LED is flashing	Low Input Voltage	Check that power source voltage is higher than 7V.
3 No NMEA 2000 signal	COMM. LED is lit – no flashing	Bad connection to NMEA network.	1. Check connection between unit NMEA connector and NMEA bus. 2. Check that NMEA network is working properly.
4 Cannot activate any channel	Channel LED flashes when trying to activate	Bad ground connection	Make sure that power supply negative wire V - is connected to J1 pin 6
	OCP LED is lit, Channel LED flashes when trying to activate	High current	1. Check that the loads connected to the unit do not exceed the current rating according to the channel. 2. Make sure the sum of loads current that are being activated at same time do not exceed 50A
5 Cannot activate some channels	PWR led is flashing	Channels priority sequence due to Low input voltage	If input voltage drops under 11V, the unit will turn off some channels according to Priority Control sequence (see table 5). Check input voltage level.

Revision History

REVISION	DESCRIPTION
1.0	Document Release
1.1	Catalog Number updated
1.2	System connection updated
1.3	Added Instance section and LEDs indicators
1.4	Updated washer and Nut