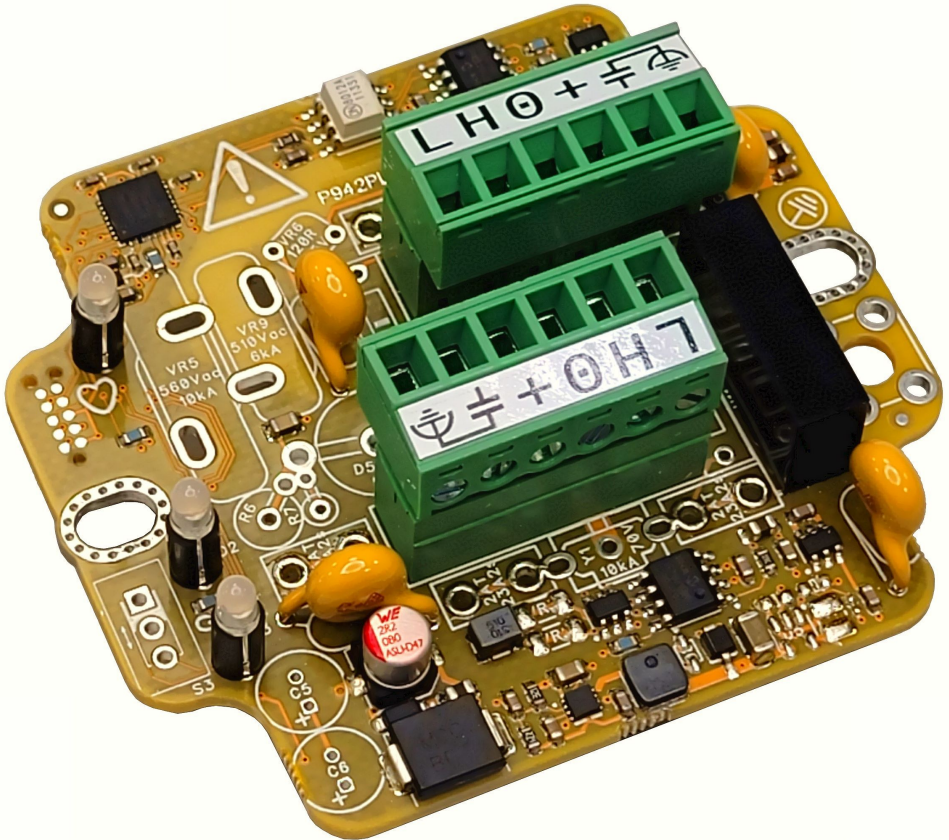


white bream

CAN.net

# CAN-bus Repeater & Isolator (LC)



<b>White Bream Oud-Beijerland The Netherlands</b> <a href="https://whitebream.com">https://whitebream.com</a>		
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# I Preface

## I.1 Disclaimer

White Bream products are not authorized for use in or in connection with surgical implants, or as critical components in any medical, nuclear, or aircraft or other transportation devices or systems where failure to perform can reasonably be expected to cause significant injury to the user, without the express written approval of an executive officer of White Bream. Such use is at buyer's sole risk, and buyer is responsible for verification and validation of the suitability of products incorporated in any such devices or systems. Buyer agrees that White Bream is not liable, in whole or in part, for any claim or damage arising from such use and shall have no obligation to warranty such products. Buyer agrees to indemnify, defend and hold White Bream harmless from and against any and all claims, damages, losses, costs, expenses and liabilities arising out of or in connection with buyer's use of White Bream products in such applications to the extent buyer has not obtained the express written approval of an executive officer of White Bream.

## I.2 Trademarks & copyrights

Throughout this manual, the trade names and trademarks of various companies and products may have been used, and no such uses are intended to convey endorsement of or other affiliations with this manual or product. Any brand names or product names used within this manual are trademarks or registered trademarks of their respective holders.

## I.3 Warranty

This product is warranted to be in good working order for a period of two years from the date of purchase. Should this product fail to be in good working order at any time during this period, we will, at our option, replace or repair it at no additional charge except as set forth in the following terms. This warranty does not apply to products damaged by misuse, modifications, accident or disaster.

## I.4 Liability

White Bream assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use of, misuse of, or inability to use this product. White Bream will not be liable for any claim made by any other related party.

## 1.5 Technical support

White Bream technicians and engineers are committed to providing the best possible technical support for our customers so that our products can be easily used and implemented. We request that you first visit our website at [whitebream.com](http://whitebream.com) for the latest documentation, utilities and drivers, which have been made available to assist you. If you still require assistance after visiting our website then contact our technical support department by email at [support@whitebream.com](mailto:support@whitebream.com).



### Warning

Warning messages in the manual may contain important information against product malfunction or safety information for the (end-)user.



### Caution

Notices regarding proper use of the product and to warn the user about how to prevent damage to hardware or loss of data.



### Anti-static Precautions

The internals of the product are made of static sensitive components. When disassembling the product, it is strongly recommended to use an anti-static bench mat and wrist strap. If this is not possible, at least make sure you always touch an exposed metal part, such as the shield of an connector, each time before you touch anything else inside.



### ROHS - WEEE

White Bream products are manufactured using lead-free components and assembly processes. Please dispose of products according local waste regulations.

## 2 Description

This device provides an isolated repeater function between two CAN-bus segments.

### 2.1 Functionality

- Two-way CAN-bus bridge
- First port for power + primary CAN-bus up to 1Mbps / 8 Mbps FD
- Second port for isolated secondary CAN-bus
- Automatic disable of erroneous segments (non-terminated or stuck dominant)

### 2.2 Specifications

- Bus powered Um 12-36V<sub>DC</sub>, power ≤500mW
- Allowed isolation voltage up to 500VRMS
- Propagation delay 100ns, equivalent to ~20m of cable length
- Connections via 6-way 3.81 mm pluggable terminals

### 2.3 Dimensions

- OEM Module: 60×66mm circuit board

### 2.4 Cautions



IEC 61010-1 requires the installer to check wiring for suitable ratings.






Marking for protective earth connections.

### 3 Operation

The device is operated by connecting power and communication ports. There are a couple of switches that allow for manipulating the electrical and protocol behavior of those communication ports and some indicators that give some insight in the workings of the device.

#### 3.1 Indicators

LED Icon	Function	Description
	Power/heartbeat	Green blink = okay Orange blink = power fail Red = error
 I	Primary CAN RX activity	Green blink = RX (dominant) Orange blink = RX, registered earlier termination error Red = RX stuck dominant or TX termination error
 II	Secondary CAN RX activity	Green blink = RX (dominant) Orange blink = RX, registered earlier termination error Red = RX stuck dominant or TX termination error

#### 3.2 Interfaces

Connection J1 contains the power signals and the CAN-bus for the primary side. Connection J2 contains the CAN-bus for the secondary side. Pin-out is identical except that the +V pin is left not connected.

## 4 Specifications

### 4.1 Electronic

Parameter	Min	Typ	Max	Unit
Nominal input voltage	12	24	36	V
Peak input voltage operating	9		48	V
Peak input voltage non-operating	-48		48	V
Undervoltage threshold, rising		7.4		V
Undervoltage threshold, falling		7.1		V
Input current ( $V_{in}=24V$ )		20		mA
Power dissipation primary side		500	1000	mW
Power dissipation secondary side		0		mW
Isolation voltage			500	$V_{RMS}$
Surge line-neutral, 1.2/50 $\mu$ s 42 $\Omega$		I		kV
Surge neutral-earth, 1.2/50 $\mu$ s 42 $\Omega$		I		kV
<b>CAN-bus</b>				
Common mode voltage	-7		14	V
Fault protection	-24		24	V
Recessive bias voltage		2.5		V
Signaling rate CAN	5		1000	kbps
Signaling rate CAN-FD data			8000	kpbs
Surge line-line, 1.2/50 $\mu$ s 42 $\Omega$		I		kV
Surge neutral-earth, 1.2/50 $\mu$ s 42 $\Omega$		I		kV



## 4.2 Connections

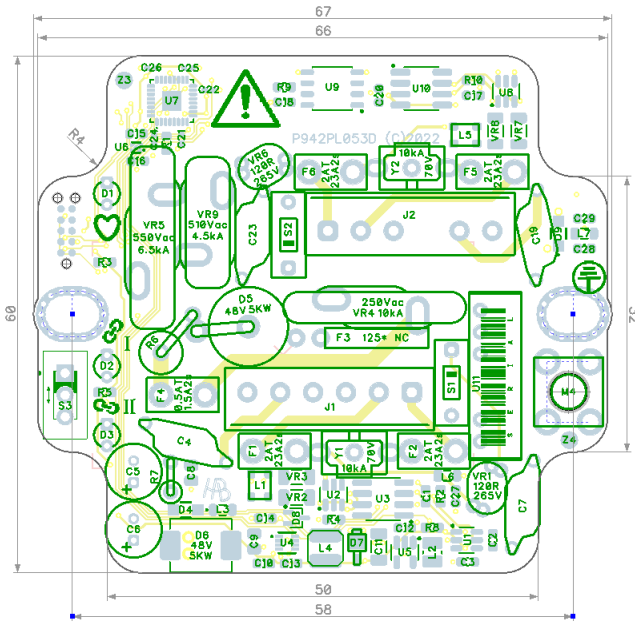
### 4.2.1 CAN-bus connections

#	Name	Description	Signal
1	PE	Earth	PE
2	SHIELD	Cable shield	InF Y1 to PE
3	+V	Bus power supply (line)	12-36VDC
4	-V	Bus ground (neutral)	0V, InF Y1 to PE
5	CAN-H	CAN H-signal	ISO 11898-2
6	CAN-L	CAN L-signal	ISO 11898-2

## 4.3 Environmental

Parameter	Min	Max	Unit
Operating temperature range	-40	+85	°C
Non-operating temperature range	-40	+85	°C
Humidity	0	90	%RH
Conformal coating	Type 2		

### 4.4 Dimensions



## 5 Installation

Always follow applicable installation codes over instructions in this manual. Please let us know if you encounter a conflict between this manual and any such code. Contact support if the device must be integrated into systems that are subject to special conditions as referred to in IEC 61010-1 §5.4.6.

Our instructions assume that you have basic knowledge of industrial wiring and electrical installations. As such, we do not provide instructions for basic activities such as stripping of wires.

Many applications of this kind of devices may be subject to additional rules and regulations. Make sure that you account for such situations.

### 5.1 OEM module specifics

For the bare-board OEM module, a couple of specific conditions apply in order to operate the device with specifications.

#### 5.1.1 Enclosure

The OEM module must be installed in an IP54 environment. No requirement for the pollution degree as the conformal coating will guarantee PD2 for critical clearances.

#### 5.1.2 Mounting

When mounting on a flat surface, use spacers between the circuit board and the surface beneath in order to create appropriate isolation distance between the circuit and that surface. A good measurement for appropriate distance is 6mm, which will leave at some 3mm separation between the solder joints and the surface, whereas 1.6mm is required per Annex K of IEC 61010-1:2010 for clearance of OCV III ≤150V circuits.

### 5.2 Wire selection and preparation

Use wires with outside diameter in less than 2.6mm and with cores within the allowed diameter as given in the specifications; stranded 0.25mm<sup>2</sup> to 1.0mm<sup>2</sup> with suitable ferrule or solid 0.5mm<sup>2</sup> to 1.5mm<sup>2</sup>. Wire should be rated UL 2556 VW-1.

Wires must be stripped for 6.5±0.5mm.

Shielded cables shall be terminated using heat shrink shield-to-wire terminations or an equivalent means of reliably connecting the shield to a terminal connection.

### 5.3 Earthing

The M4 earthing terminal on the PCB is connected to the two oblong mounting holes and to the earth connections on the terminal blocks.

The U-shaped washer must be installed 'upside down', such that the flanges lock around the base of the terminal and thus prevent rotation of the U-washer and of any wires that are clamped underneath this washer.

The anti-static enclosed model of the repeater also has an external earthing terminal which is electrically connected to the internal terminal.

## 5.4 Cable length and sizes

The maximum bit-rate of the CAN-bus is determined by the length of the trunk and by the length of the stubs towards to individual CAN devices. Depending on communication requirements, it might be necessary to shorten the connection cable of this device to match the signal integrity requirements.

Bit-rate	Trunk length (max)	Spur length (max)	Spur length (total)
1Mbps	25m	1.5m	7.5m
800kbps			
500kbps	100m	5.5m	27.5m
250kbps	200m	11m	55m
125kbps	400m	22m	110m
100kbps	500m	27m	137m
50kbps	1km	55m	275m
20kbps	2.5km	135m	680m
10kbps	5km	275m	1375m
5kbps	10km	550m	2750m

Note that each CAN-bus repeater accounts for approximately 20 meters of cable length, which is to be subtracted from the allowable trunk or spur length.

Please be aware of cable resistance and associated voltage drop. Once the lengths go into the three-digit figures, these losses can become quite significant, especially with small conductor sizes!

CiA 303-1 recommends the following wire cross-section:

- 0 to 40m » 0.25mm<sup>2</sup> to 0.34mm<sup>2</sup>

- 40m to 300m » 0.34mm<sup>2</sup> to 0.6mm<sup>2</sup>
- 300m to 600m » 0.5mm<sup>2</sup> to 0.6mm<sup>2</sup>
- 600m to 1km » 0.75mm<sup>2</sup> to 0.8mm<sup>2</sup>

#### 5.4.1 CAN-bus Termination

Short trunk lengths up to 40m can be terminated with a resistor of  $\sim 124\Omega$  at each end of the trunk. For longer lengths (and therefore lower bit-rates), a higher value of termination resistance is more suitable, probably in the range of 150 $\Omega$  to 300 $\Omega$ .

Both segments are independent from a transmission line point of view. So both must be terminated as if they were the only segment.

## 6 Maintenance & support

### 6.1 Repairs

The device has been designed to enable relative easy repair of protection components such as varistors, fuses, surge resistors and transient suppressors. However, non-authorized repair is very likely to void our warranty!

In case of doubt, please contact technical support.

### 6.2 CAN-bus issues

#### 6.2.1 No communication at all

Check if CAN-bus pair is not swapped. If in doubt, just try reversing to eliminate a possible cause, noting will get damaged. Don't forget to undo the reversal if it does not help!

#### 6.2.2 High error rate

Common causes are too high bit-rate versus cable length, badly placed termination resistors, too many (>2) or too few termination resistors.

## 7 Ordering information

Partno	Description	Revision
82-942-539	CAN-bus repeater & isolator (LC OEM)	E', Feb 22, 2024

### 7.1 Hardware revision info

Rev	Date	Changes
E'	Feb 22, 2024	First release version

## 8 Document revisions

### 8.1 Rev 1.0 (Mar 8, 2024)

Ref	Description
-	Initial version



## Annex A: Declaration of Conformity for CE (OEM)

The manufacturer hereby declares that this product is in accordance with the requirements of directive 2014/30/EU regarding electromagnetic compatibility (EMC), directive 2014/35/EU regarding low voltage equipment (LVD), directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) and directive 2012/19/EU on waste electrical and electronic equipment (WEEE).

**Manufacturer, facility:** White Bream  
L.J. Costerstraat 13d  
3261 LH, Oud-Beijerland  
The Netherlands

**Product:** CAN-bus Repeater & Isolator (LC)

**Models:** 80-942-539

**CE & RoHS Marking:**  

Mar 7, 2024

Henk Blik, White Bream, Owner



This product has been found in conformity with directive 2014/30/EU (EMC) by testing and verification with the following standards <sup>1</sup>:

- **EN 61000-6-2:2016** Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments
- **EN 61000-6-3:2020** Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for equipment in residential environments
- **EN 61131-2:2017** Industrial-process measurement and control – Programmable controllers – Part 2: Equipment requirements and tests
- **EN 61326-1:2020** Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements

This product has been found in conformity with directive 2014/35/EU (LVD) by testing and verification with the following standards:

- **EN 61010-1:2010/CI:2011** Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements
- **EN 61010-2-201:2017** Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-201: Particular requirements for control equipment
- **EN 61131-2:2017** Industrial-process measurement and control – Programmable controllers – Part 2: Equipment requirements and tests

This product has been found in conformity with directive 2011/65/EU (RoHS) by testing and verification with the following standards:

- **EN 63000:2018** Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

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<sup>1</sup> Some standards might be more recent than the harmonized versions. Blame Brussels.

## Annex B: Declaration of Conformity for UKCA

The manufacturer hereby declares that this product is in accordance with the requirements of UK SI 2016 No. 1091 "Electromagnetic Compatibility Regulations 2016", UK SI 2017 No. 1206 "Radio Equipment Regulations 2017", UK SI 2016 No. 1101 "Electrical Equipment (Safety) Regulations 2016", and UK SI 2012 No. 3032 "The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012".

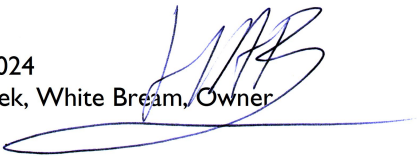
**Manufacturer, facility:** White Bream  
L.J. Costerstraat 13d  
3261LH, Oud-Beijerland  
The Netherlands

**Product:** CAN-bus Repeater & Isolator (LC)

**Models:** 80-942-539

**UKCA Marking:** The UKCA marking consists of the letters 'UK' stacked above 'CA' in a bold, sans-serif font. To the right of this text is a crossed-out recycling symbol, which is a triangle with a circle inside, crossed by an 'X'.

Mar 7, 2024  
Henk Blik, White Bream, Owner

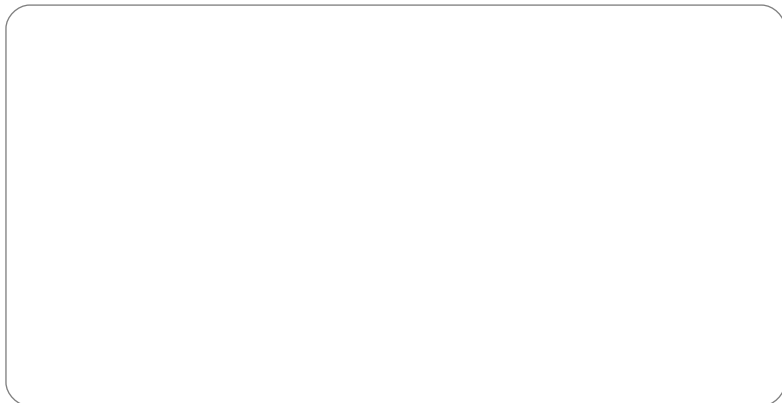
A handwritten signature in blue ink, appearing to read 'H.B.', is written over a horizontal line that extends across the page.

## Annex C: Declaration of Conformity for FCC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help



# CAN•net

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