KAMAMI

KAmod RPI 485 CAN Hat

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Źródło: https://wiki.kamamilabs.com/index.php?title=KAmod_RPI_485_CAN_Hat

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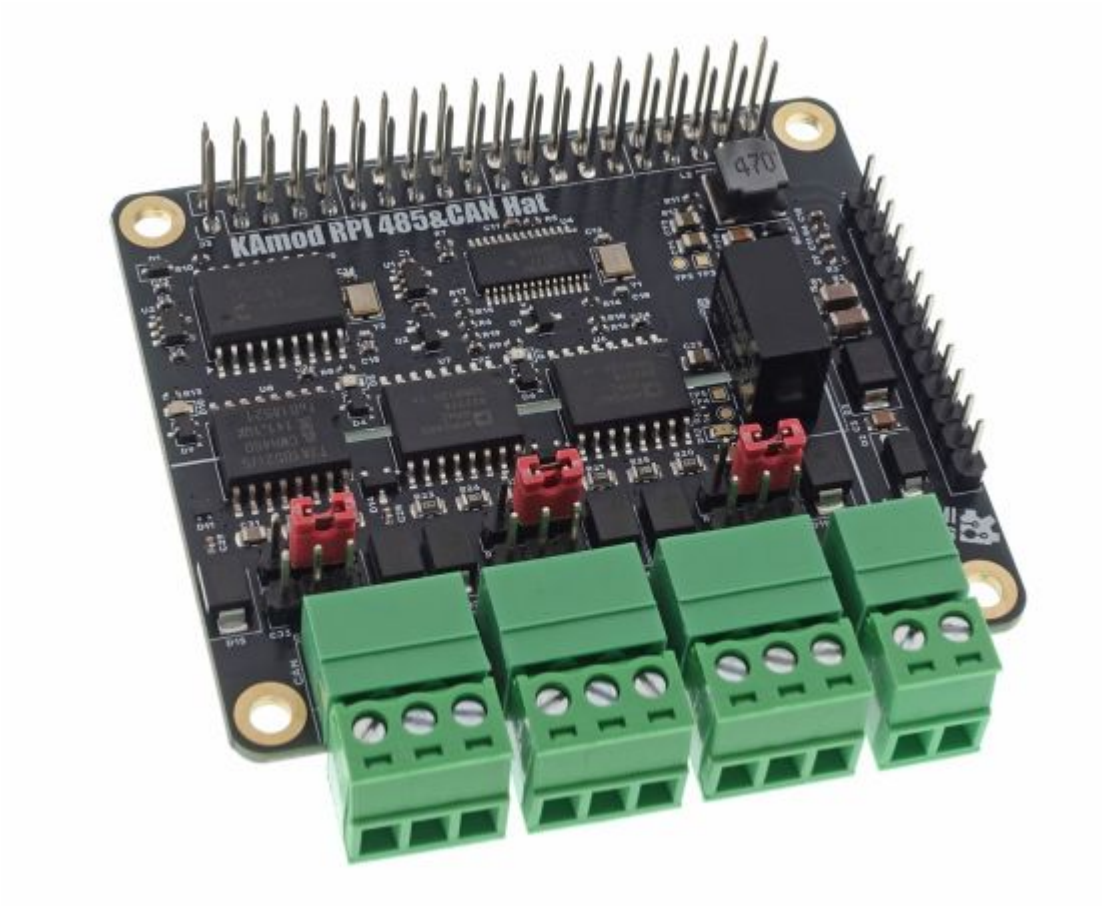
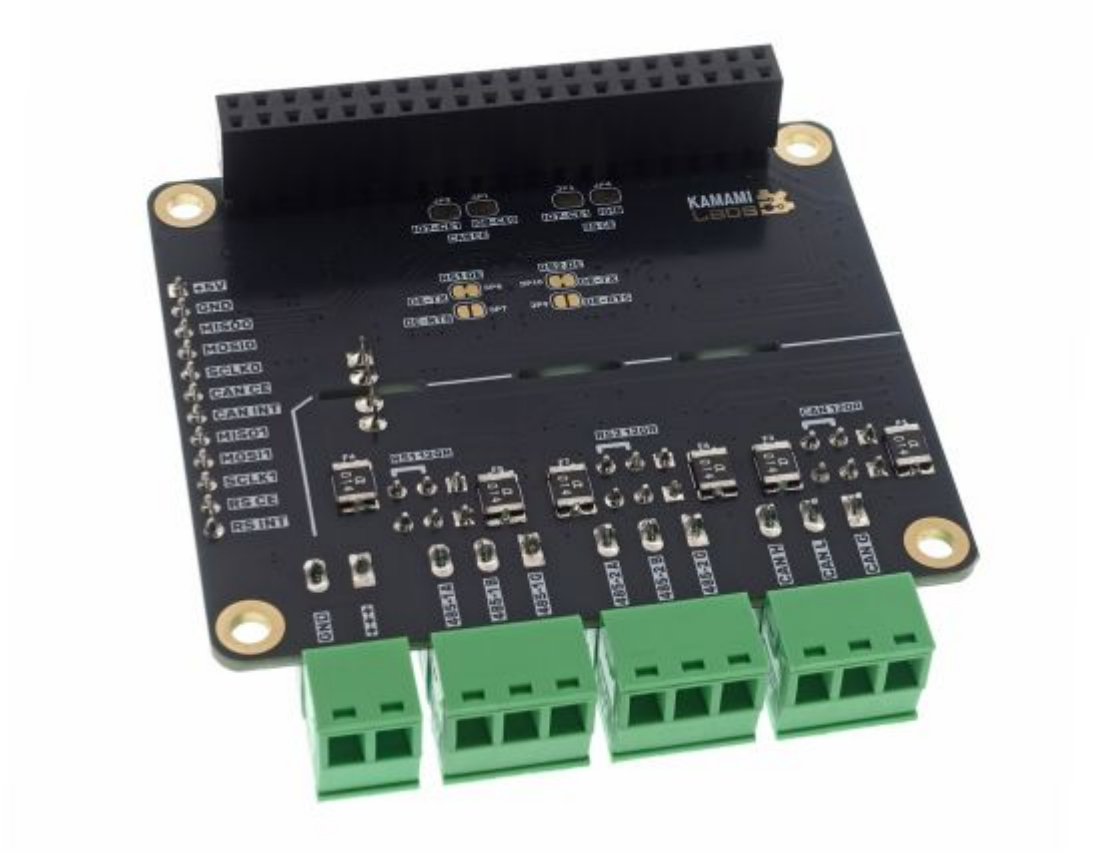
Description

KAmod RPI 485&CAN Hat - Module with two RS485 interfaces and a CAN interface for Raspberry Pi

KAmod RPI 485&CAN Hat allows you to easily expand Raspberry Pi 5 computers with two RS485 interfaces and one CAN 2.0B interface. The interfaces contain extensive protection circuits and are galvanically isolated from the control circuits, which guarantees stable operation and resistance to interference and failures. The module has been designed to be compatible with Raspberry Pi series boards not only in version 5. It is controlled via 2 SPI interfaces, available on the 40-pin RPi connector, and in many other boards, e.g. Arduino, STM32, etc.



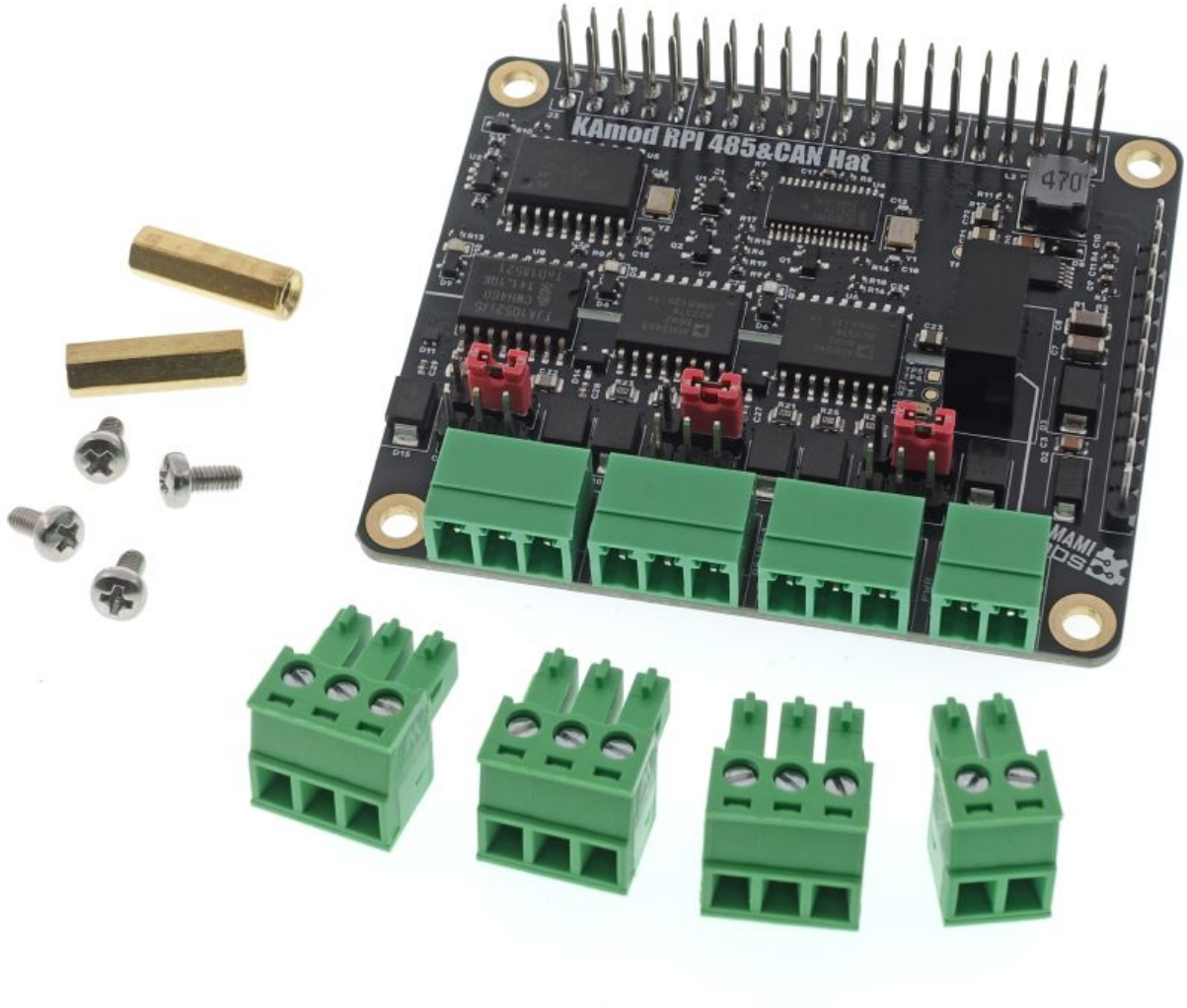

KAMAMI
+5V
GND
MISO0
MOSI0
SCLK0
CANCE
CAN INT
MISO1
MOSI1
SCLK1
NSCE
RS-INT
GND
CANH
CANL
CANG

Basic features and parameters

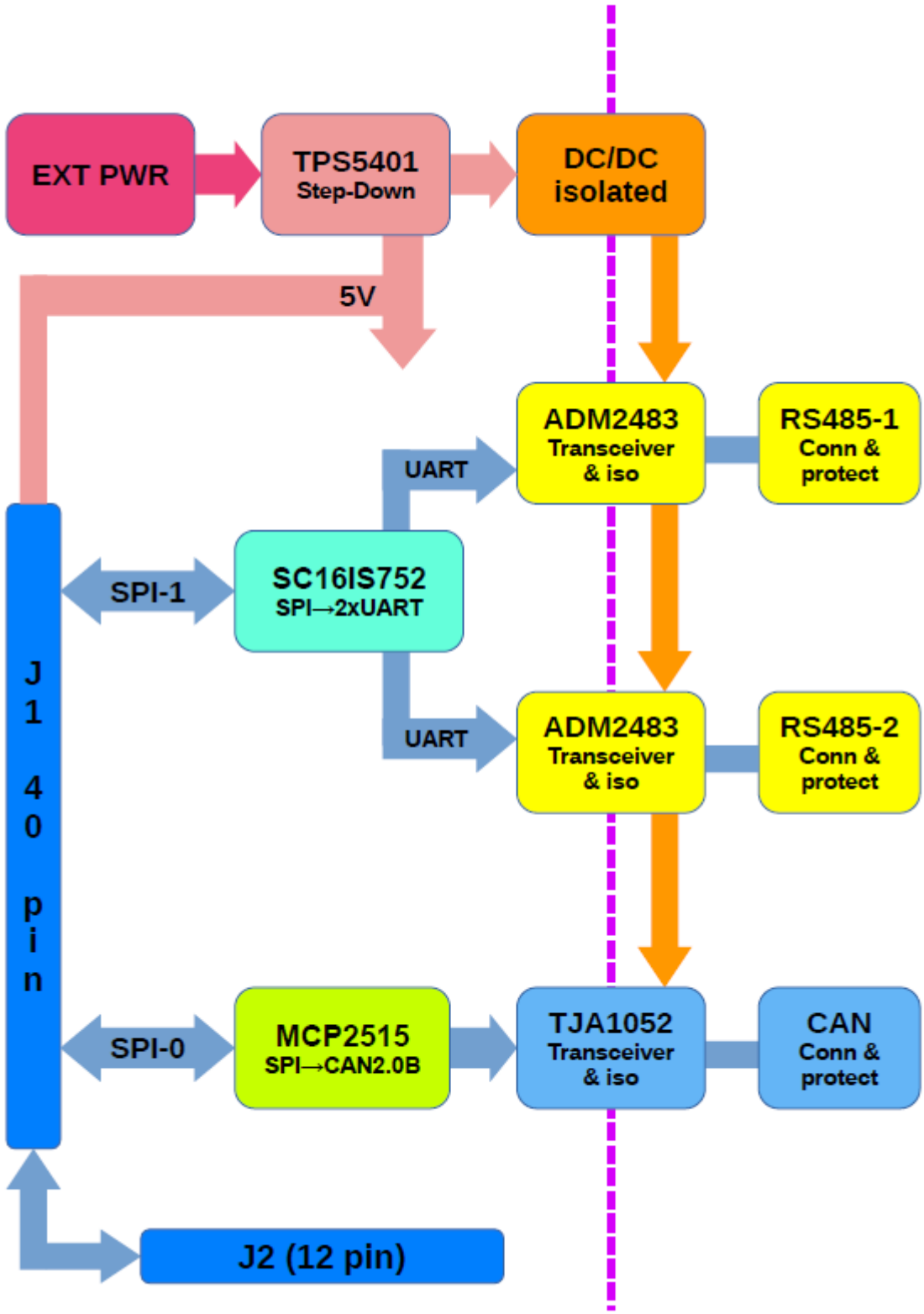
- 2 RS485 interfaces – controlled by SC16IS752 controller (SPI→2xUART)
- 1 CAN 2.0B interface – controlled by MCP2515 controller (SPI→CAN)
- RS485 interfaces equipped with 2 isolated ADM2483 transceivers
- CAN interface equipped with isolated TJA1052 transceiver
- RS485 and CAN interfaces galvanically separated from control circuits
- Possibility to connect 120 Ω terminating resistors to each interface line
- Maximum RS485 interest communication speed: 500 kbps
- Maximum CAN interest communication speed: 1 Mbps
- Control via two SPI interfaces operating with 3.3 V voltage
- Automatic control of RS485 transceiver transmission direction
- Power supply 5 V/0.3 A taken from the Raspberry Pi board or from an additional source
- Optional power input adapted to a voltage in the range of 8...32 V
- Stabilized power output 5 V, max 0.5 A
- Easy installation on Raspberry Pi 5, also in the version with the RPi Active Cooler radiator
- Can work with many boards from the Raspberry Pi family and others equipped with SPI interfaces operating at a voltage of 3.3 V
- Module dimensions 65x56 mm, height approx. 15 mm (and a connector under the board with a height of approx. 13 mm)

Standard Equipment

Code	Description
KAmod RPI 485&CAN Hat	• Assembled and started module
Mounting Kit	• Set of screws and spacers to attach the overlay to the Raspberry board



Block diagram



Circuit diagram

The circuit diagram of the **KAmod RPI 485&CAN Hat** module can be downloaded here: KAmod RPI 485&CAN Hat diagram

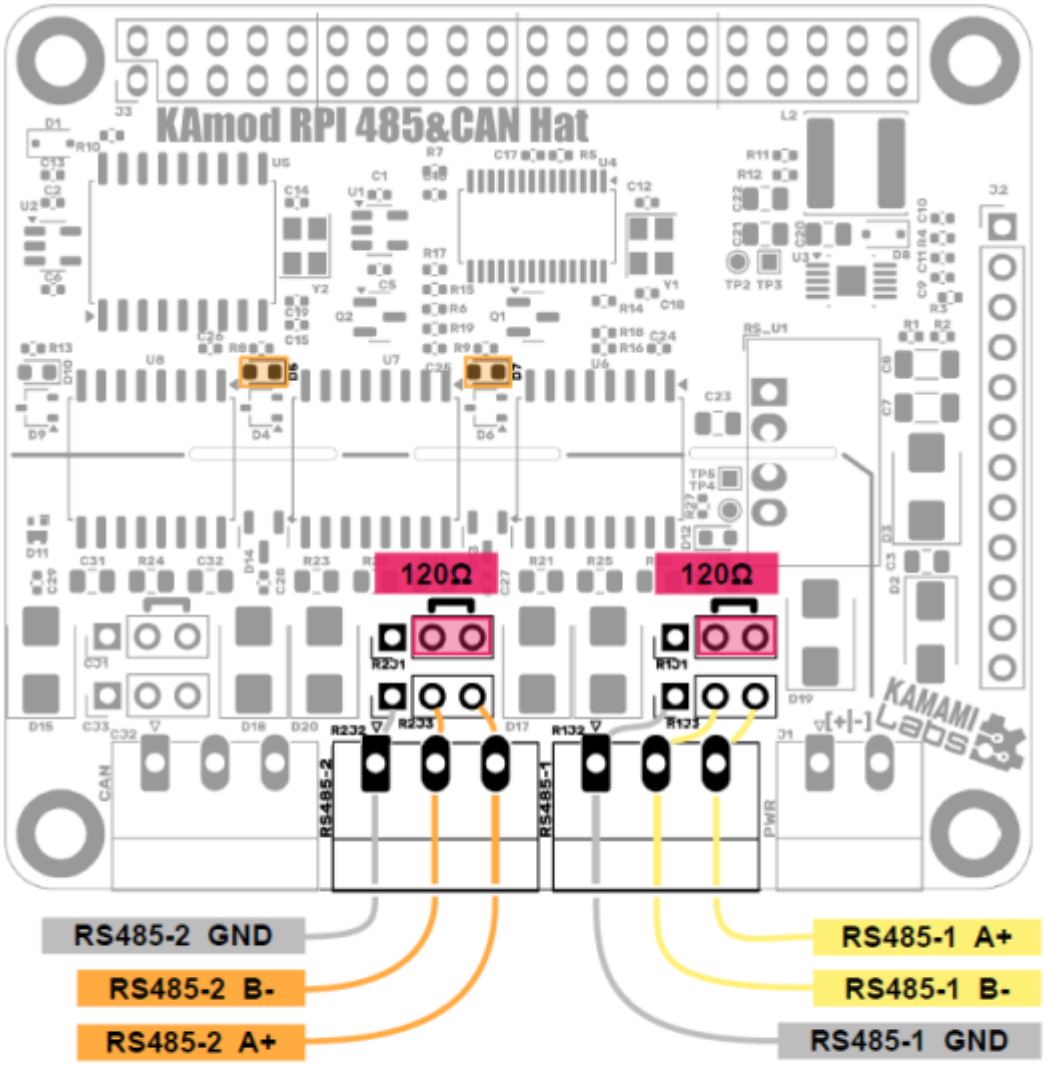
RS485 Interfaces

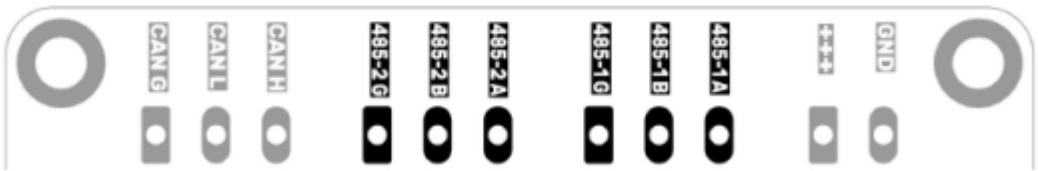
Interface	Element	Function
RS485-1	Connector 3x1,2,54 mm pins **R1J1**	Connecting a 120 Ω terminating resistor to the RS485-1 bus line, when the jumper is placed on pins 2-3
	Connector Phoenix MC 3.81 mm **R1J2**	Main RS485-1 bus connector, pin 1 – GND; pin 2 – B(-); pin 3 – A(+)
	Connector 3x1, 2.54 mm pins **R1J3**	Additional RS485-1 bus connector, pin 1 – GND; pin 2 – B(-); pin 3 – A(+)
	LED **D7**	The diode lights up to indicate data transmission/reception on the RS485-1 interface signal lines
RS485-2	Connector 3x1,2,54 mm pins **R2J1**	Connecting a 120 Ω terminating resistor to the RS485-2 bus line, when the jumper is placed on pins 2-3
	Connector Phoenix MC 3.81 mm **R2J2**	Main RS485-2 bus connector, pin 1 – GND; pin 2 – B(-); pin 3 – A(+)
	Connector 3x1 pins, 2.54 mm **R1J3**	Secondary RS485-2 bus connector, pin 1 – GND; pin 2 – B(-); pin 3 – A(+)
	LED **D7**	The diode lights up to indicate data transmission/reception on the RS485-2 interface signal lines

The RS485 interfaces are controlled by ADM2483 transceivers, which also provide galvanic separation between the control signals and the RS485 bus lines.

The bus lines are marked as: A(+), B(-) and GND ground and are available on the Phoenix MC connector (R1J2, R2J2) and on goldpin pins with a standard 2.54 mm pitch (R1J3, R2J3). Their arrangement is shown in the drawing and is described on the bottom side of the module board.

The RS485 bus lines are equipped with circuits protecting against overvoltages. Putting a jumper on pins 2-3 of RxJ1 allows you to connect a 120 Ω terminating resistor between lines A and B of the interface.


KAmod RPI 485&CAN Hat
120Ω
120Ω
RS485-2 GND
RS485-2 B-
RS485-2 A+
RS485-1 A+
RS485-1 B-
RS485-1 GND
CAN
RS485-2
RS485-1
PWR
KAMAMI Labs


CANG
CANL
CANH
485-2G
485-2B
485-2A
485-1G
485-1B
485-1A
GND

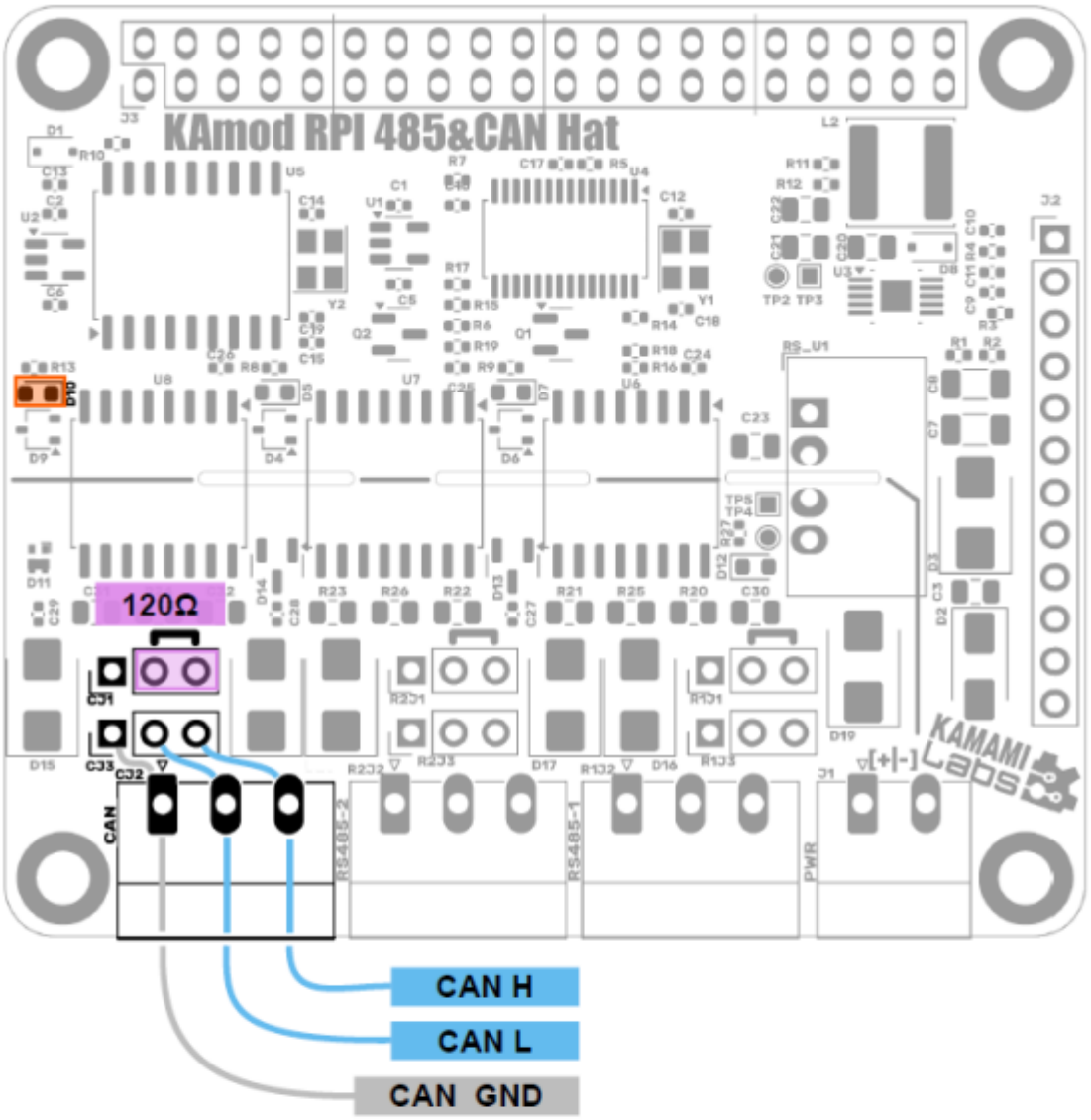
CAN Interface

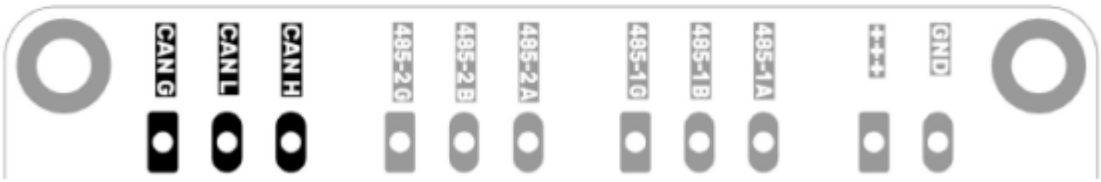
Interface	Element	Function
CAN	Connector Pins 3x1.2.54 mm **CJ1**	Connecting a 120 Ω terminating resistor to the CAN bus line, when the jumper is placed on pins 2-3
	Connector Phoenix MC 3.81 mm **CJ2**	Main CAN bus connector, pin 1 – GND; pin 2 – CAN L; pin 3 – CAN H
	Connector 3x1, 2.54 mm pins **CJ3**	Additional CAN interface connector, pin 1 – GND; pin 2 – CAN L; pin 3 – CAN H
	LED **D10**	The diode lights up to indicate data transmission/reception on the CAN interface lines

The CAN interface is controlled by a TJA1052 transceiver, which also provides galvanic separation between control signals and the CAN bus lines.

The bus lines are marked as: CAN H, CAN L and ground GND and are available on the Phoenix MC (CJ2) type connector and on goldpins (CJ3) with a standard 2.54 mm pitch. Their layout is shown in the drawing and is described on the bottom side of the module board.

The CAN bus lines are equipped with circuits that protect against overvoltages. Putting a jumper on pins 2-3 of CJ1 allows you to connect a 120 Ω terminating resistor between the CAN H and CAN L lines.


KAmod RPI 485&CAN Hat
120Ω
CAN H
CAN L
CAN GND

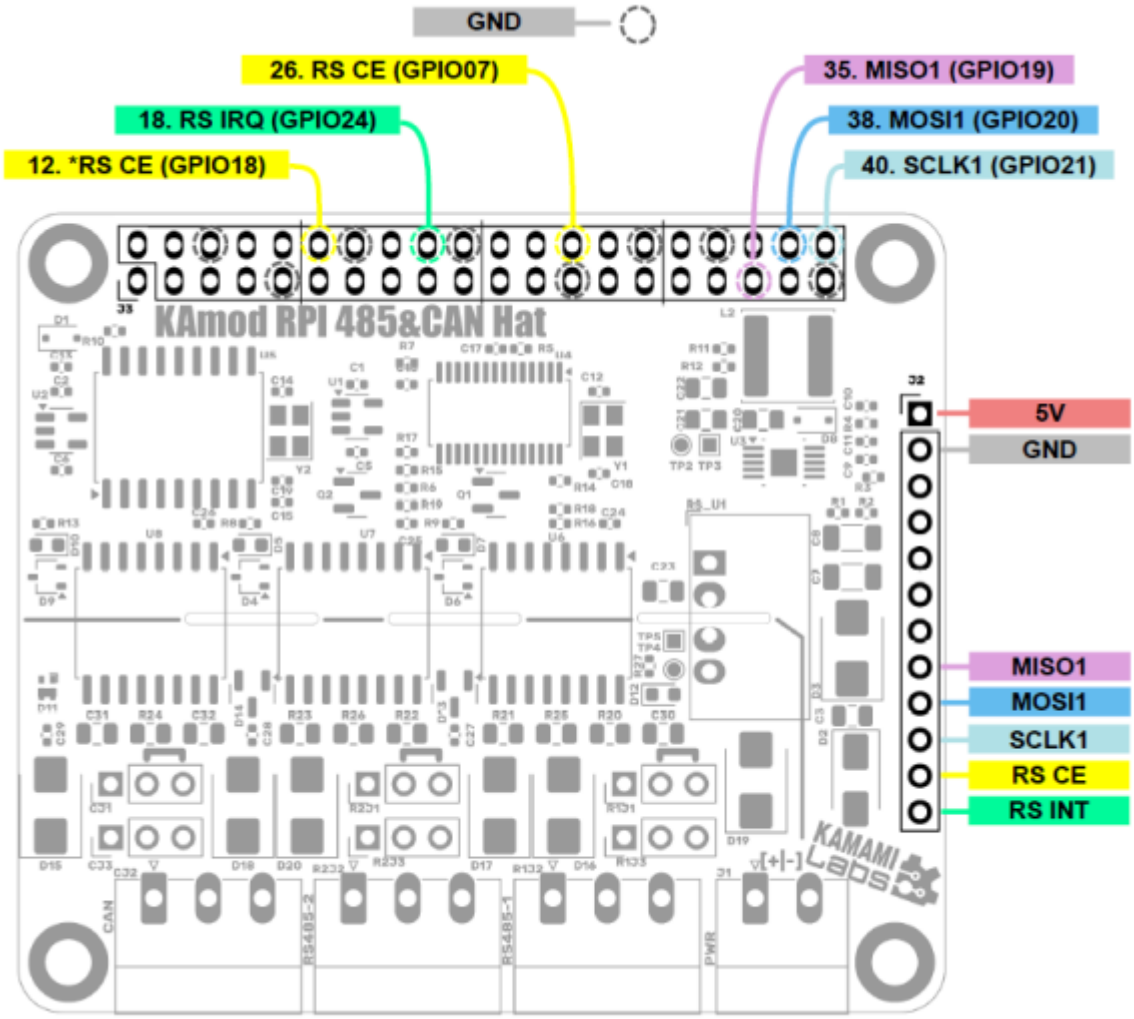

CANG
CANL
CANH
485-2G
485-2B
485-2A
485-1G
485-1B
485-1A
GND

RS485 Control

RS485 Interfaces	
Control Signal	**Function**
MOSI1 (SPI 1)	SPI data input of SC16IS762 controller, connected to GPIO20 RPi (pin 38 of J3)
MISO1 (SPI 1)	SPI data output of SC16IS762 controller, connected to GPIO19 RPi (pin 35 of J3)
SCLK1 (SPI 1)	SPI clock input of SC16IS762 controller, connected to GPIO21 RPi (pin 40 of J3)
RS CE	SPI interface activation input of SC16IS762 controller
	By default connected to GPIO07 (pin 26 of J3 connector) - Shorted jumper JP3
	Optionally connected to GPIO18 (pin 12 of J3 connector) - Shorted jumper JP4
RS INT	SC16IS762 controller IRQ interrupt output connected to GPIO24 (pin 18 of J3 connector)

All control signals are led out on connector J1 (40-pin, compatible with Raspberry Pi boards) and on pin header J2. The signal layout is shown in the figure below, additionally the signals on connector J2 are described on the bottom side of the KAmod RPI 485&CAN Hat board.

RS485 interfaces are implemented via the SC16IS762 controller, the description of this system is available in the manufacturer's documentation.

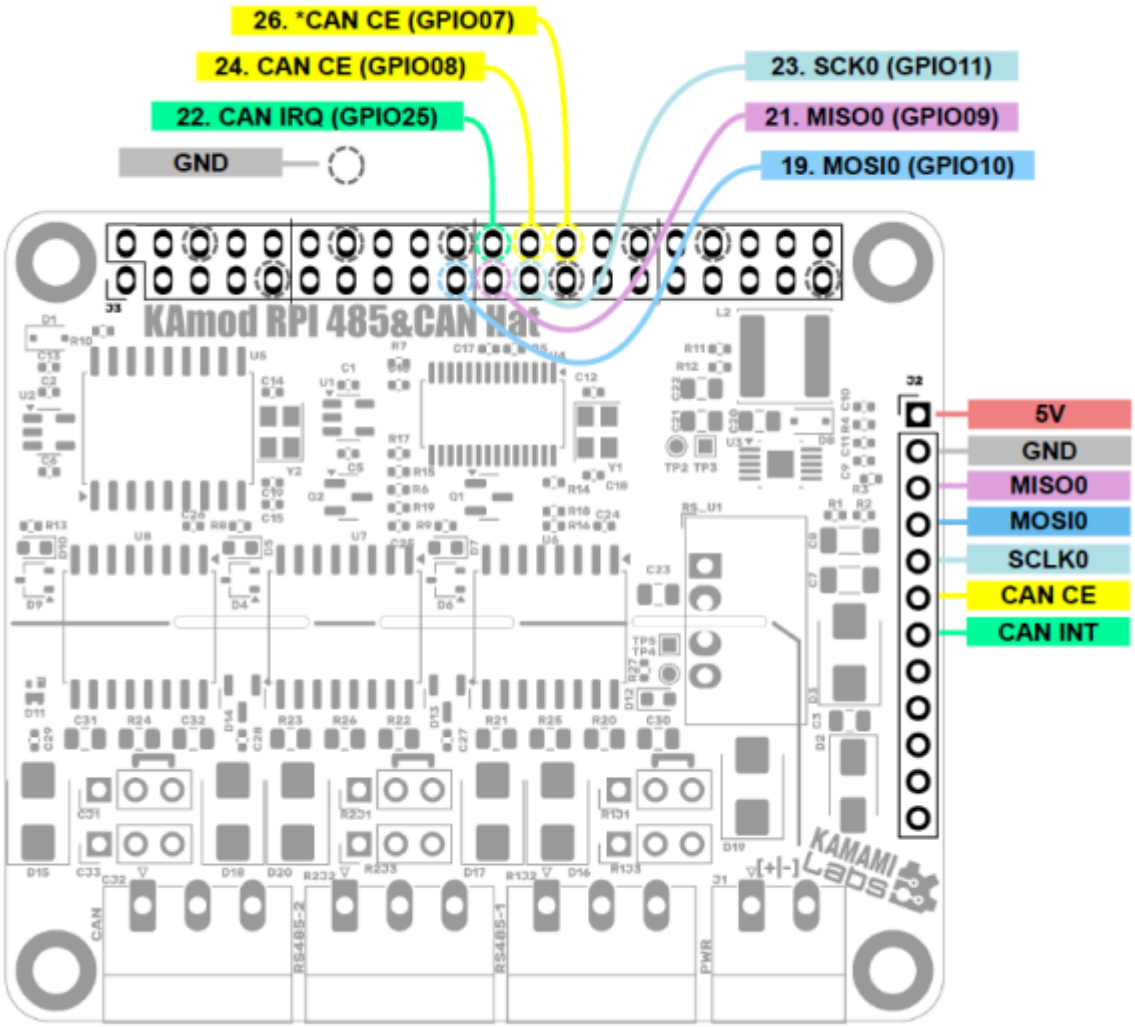


CAN Control

CAN Interface	
Control Signal	**Function**
MOSI0 (SPI 0)	MCP2515 Controller SPI Data Input Connected to GPIO10 RPi (J3 Pin 19)
MISO0 (SPI 0)	MCP2515 controller SPI data output connected to RPi GPIO09 (J3 pin 21)
SCLK0 (SPI 0)	MCP2515 controller SPI clock input connected to RPi GPIO11 (J3 pin 23)
CAN CE	MCP2515 controller SPI interface enable input
	By default connected to GPIO08 (J3 pin 24) - JP1 jumper closed
	Optionally connected to GPIO07 (pin 26 of J3 connector) - Shorted jumper JP2
CAN INT	MCP2515 controller IRQ interrupt output connected to GPIO25 (pin 22 of J3 connector)

All control signals are output on connector J1 (40-pin, compatible with Raspberry Pi boards) and on pin connector J2. The signal layout is shown in the figure below, additionally the signals on connector J2 are described on the bottom side of the KAmod RPI 485&CAN Hat board.

The CAN interface is implemented via the MCP2515 controller, a description of the operation of this system is available in the manufacturer's documentation.



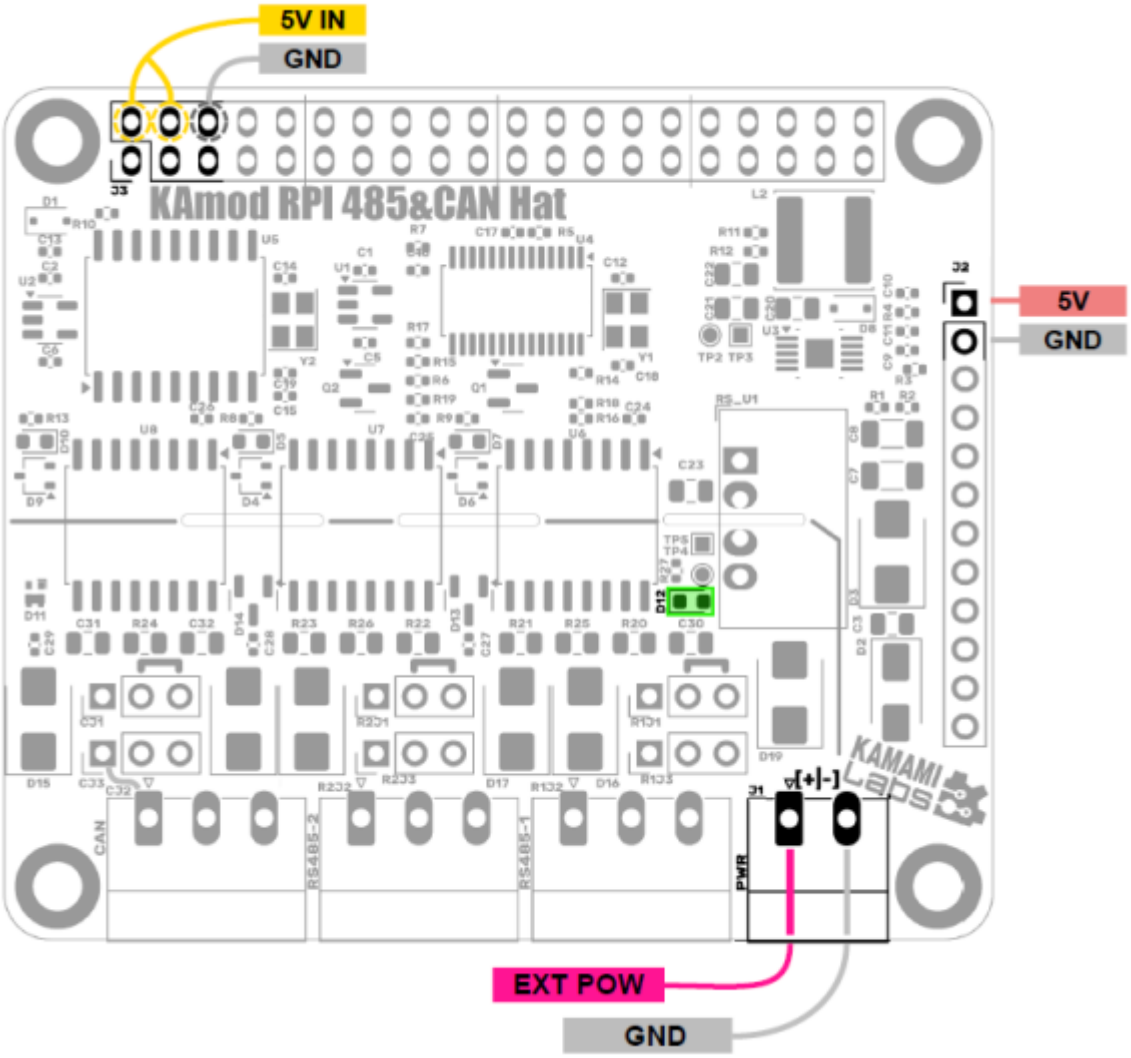
Power Supply

Element	Function
Connector **J1 PWR**	Optional power supply input adapted to a voltage in the range of 8...32 V. Powers the integrated switching regulator, which provides a voltage of 5 V with a capacity of up to 0.5 A, to power the components of the KAmod RPI 485&CAN Hat module.
Connector **J2**	Connector J2 provides 5V from the integrated regulator. It can be used as a power source for additional circuits or modules. The current consumption should not exceed 0.5A.
Connector **J1**	Connector J1 provides 5V from a base board, e.g. Raspberry Pi. This voltage is connected via a rectifier diode to the 5V power supply of the KAmod RPI 485&CAN Hat module, so the module is powered from the base board, but the module cannot supply power to the base board.
LED **D12**	LED D12 lighting indicates power supply

The KAmod RPI 485&CAN Hat module offers various power supply options:

- can be powered by 5V from a base board connected to connector J1, e.g. Raspberry Pi. No external power supply is required;
- can be powered by a voltage in the range of 8...32 V connected to connector J1 PWR. Then a stabilized voltage of 5 V is available on connector J2, but it does not power the base board connected to connector J1;
- can be powered by a stabilized voltage of 5 V connected to connector J2, but it does not power the base board connected to connector J1;

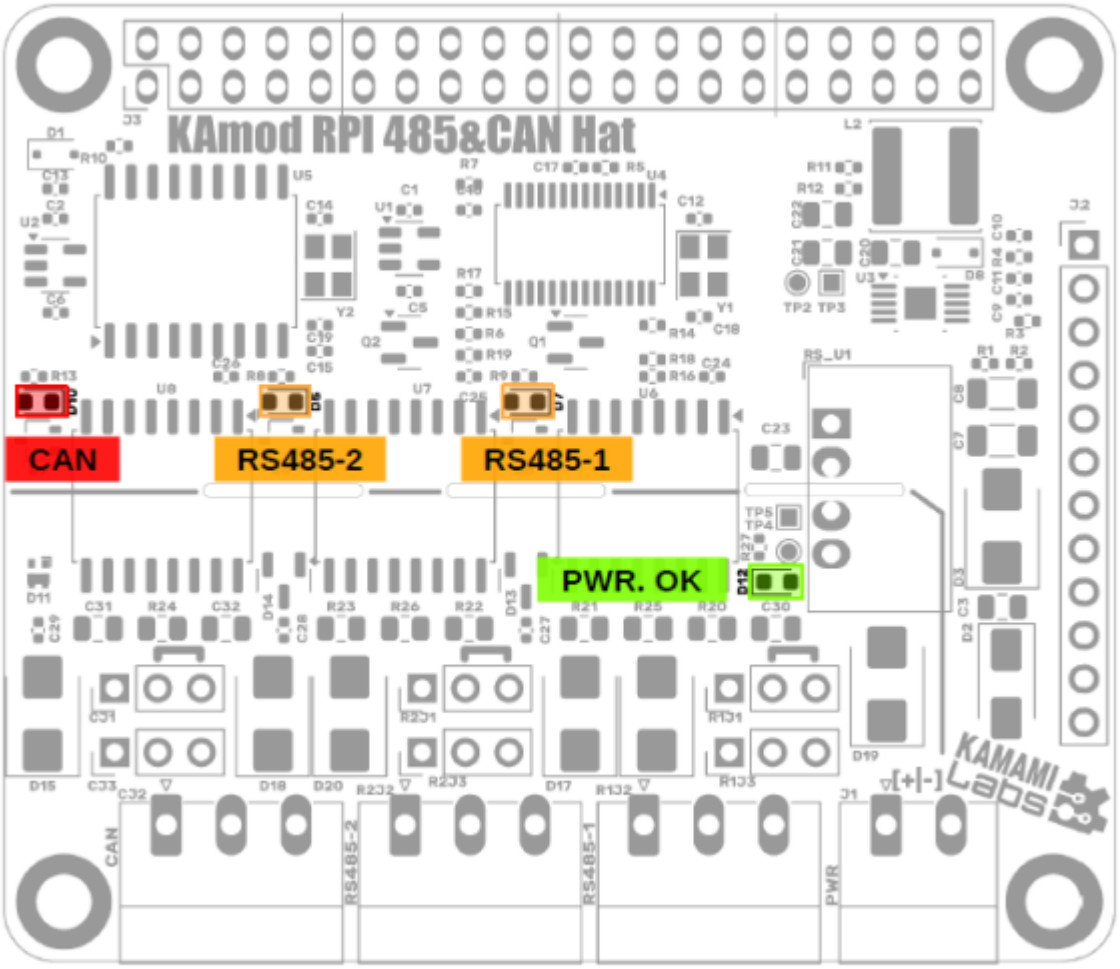
The layout of the connectors and contacts and their polarity are shown in the figure.


5V IN
GND
KAmod RPI 485&CAN Hat
5V
GND
EXT POW
GND
CAN
RS485-2
RS485-1
PWR
[+|-]
KAMAMI Labs

Indicator lights

Indicator light	Function
D7	The diode lights up to indicate data transmission/reception on the RS485-1 interface signal lines
D5	The diode lights up to indicate data transmission/reception on the RS485-2 interface signal lines
D10	The diode lights up to indicate data transmission/reception on the CAN interface signal lines
D12	The diode lights up to indicate power supply

The layout of the signaling lights on the KAmod RPI 485&CAN Hat board is shown in the figure.

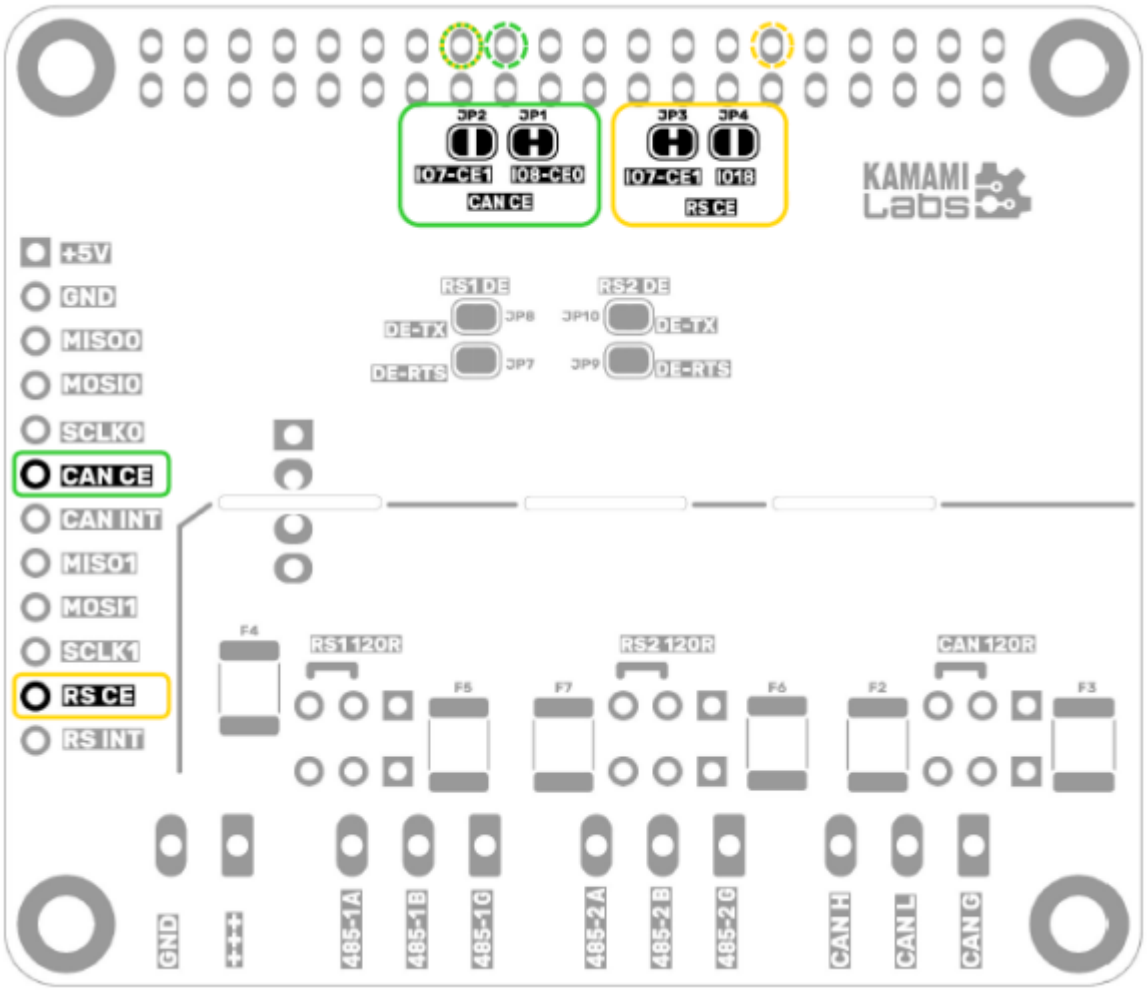


Configuration of SPI CE signals

Signal	Function	
CAN CE	Input activating the SPI interface of the MCP2515 controller	
	By default connected to GPIO08 (pin 24 of J3 connector)	Shorted jumper JP1
	Optionally connected to GPIO07 (pin 26 of J3)	Shorted jumper JP2
RS CE	Input activating the SPI interface of the SC16IS762 controller	
	By default connected to GPIO07 (pin 26 of J3)	Shorted jumper JP3
	Optionally connected to GPIO18 (pin 12 of J3)	Closed jumper JP4

The KAmod RPI 485&CAN Hat module communicates with a base board, e.g. Raspberry Pi, via two SPI interfaces. The CE – Chip Enable signals of both interfaces can be connected in two configurations, depending on the setting of jumpers JP1...JP4, as described in the table above.

The jumpers are located on the bottom side of the module board, which is precisely illustrated in the figure below. By default, jumpers JP1 and JP3 are connected. In case of a configuration change, cut the connected jumpers and connect the appropriate jumpers using a soldering iron and a drop of solder.

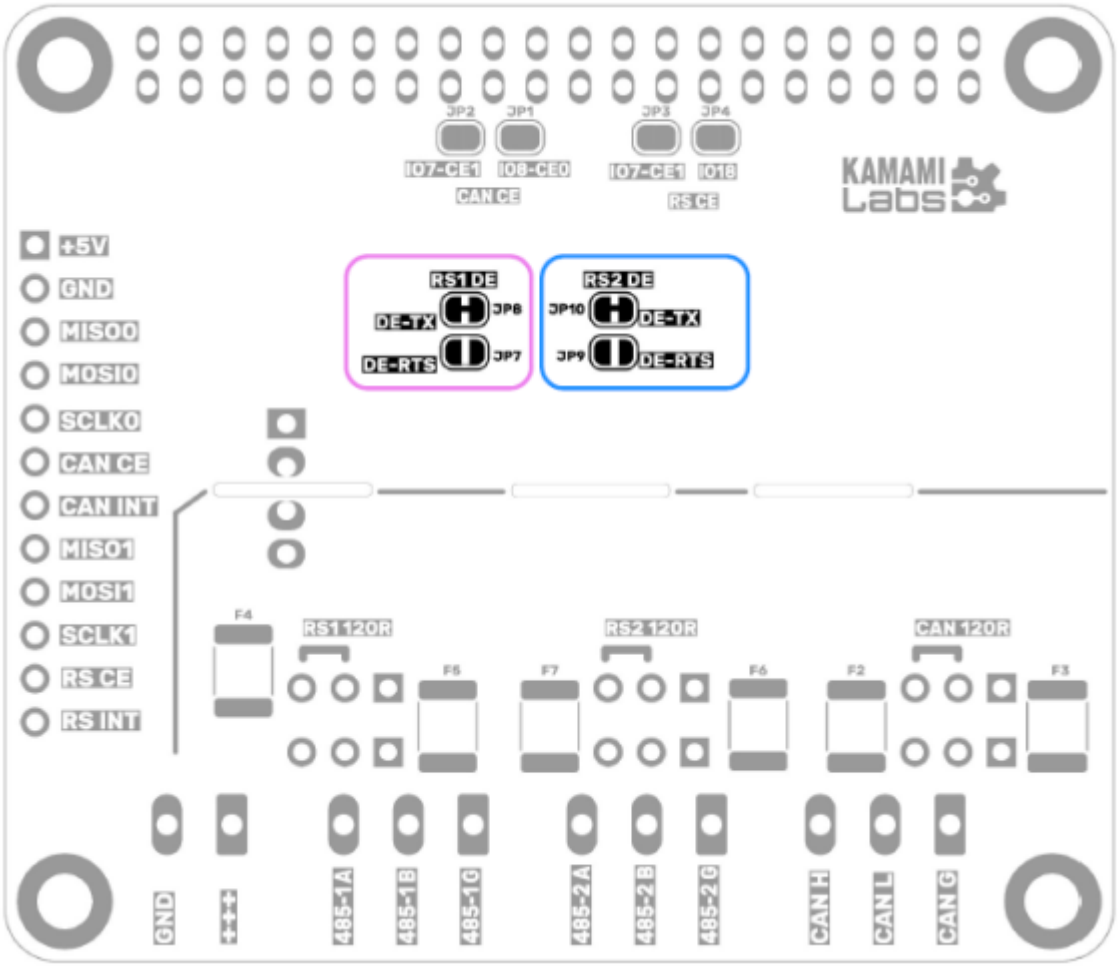


RS485 operating mode configuration

Signal	Function	
RS1 DE	RS485-1 interface transceiver control signal	
	By default, automatic TXD signal control is active	JP8 jumper closed
	Optionally, it is possible to control the RTS signal	Closed jumper JP7
RS2 DE	RS485-2 interface transceiver control signal	
	By default, automatic TXD signal control is active	Closed jumper JP10
	Optionally, it is possible to control the RTS signal	Closed jumper JP9

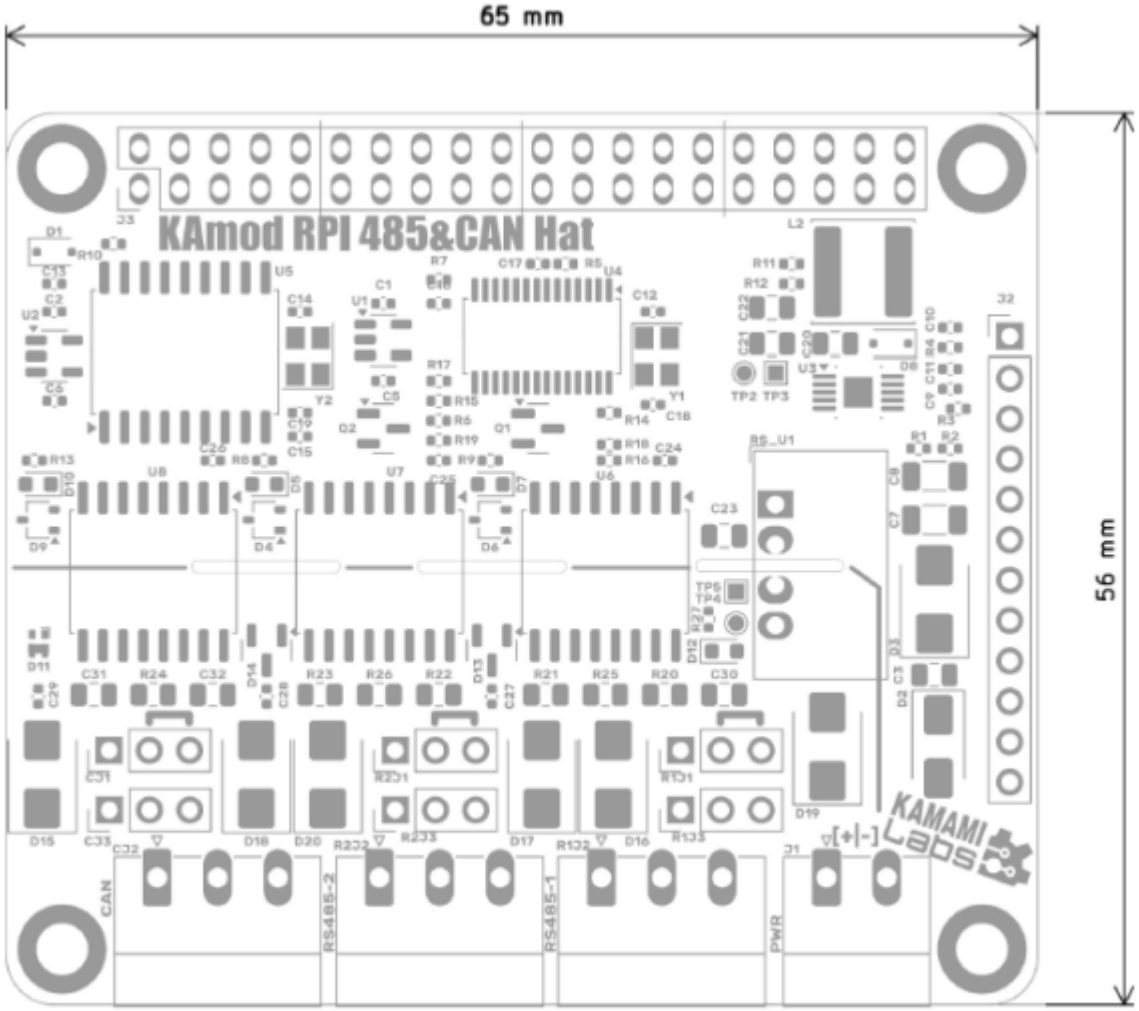
RS485 interface transceivers require a signal controlling the bus transmitter - activating the transmission mode. The control signal can be obtained from the data signal sent to the bus - TXD, or can be supplied independently - via the RTS line status. The KAmod RPI 485&CAN Hat module allows you to select one of these options for each of the RS485-1 and RS485-2 interfaces, by setting jumpers JP7...JP10, as described in the table above.

The jumpers are located on the bottom side of the module board, which is precisely illustrated in the figure below. By default, jumpers JP8 and JP10 are connected - automatic mode for both interfaces. In case of a configuration change, cut the connected jumpers and connect the appropriate jumpers using a soldering iron and a drop of solder.



Dimensions

The dimensions of the KAmod RPI 485&CAN Hat board are 65x56 mm. The board height is about 15 mm, and the connector on the bottom side of the board, which fits the base board, is about 13 mm high.



Startup

Start Raspberry Pi 5 with the operating system installed on the memory card or other media. After the system desktop is displayed, open the console window (Terminal), e.g. using the Ctrl+Alt+T key combination and enter:

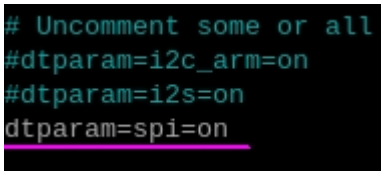
```
sudo nano /boot/firmware/config.txt
```

(in earlier versions of the operating system, the config.txt file was placed directly in the /boot directory)

In the file whose content we will see, remove the comment (remove the # sign) from the line:

```
dtparam=spi=on
```

However, if there is no such line, you should add it.

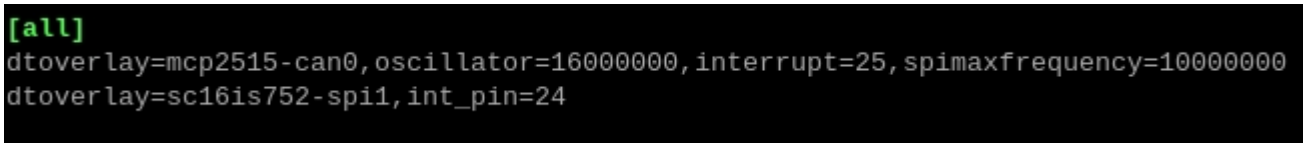


Then at the end of the file (scroll to the bottom with the arrows) add the following lines:

```
dtoverlay=mcp2515-can0,oscillator=16000000,interrupt=25,spimaxfrequency=10000000
```

and

```
dtoverlay=sc16is752-spi1,int_pin=24
```



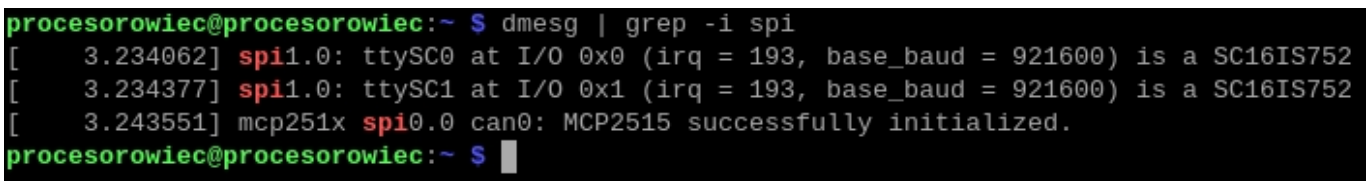
Then save the changes using the Ctrl+O keys, close the editor using the Ctrl+X keys and restart the system, e.g. by entering the command:

```
sudo reboot
```

After the system desktop is displayed, open the console window (Terminal), e.g. using the Ctrl+Alt+T key combination and enter:

```
sudo dmesg | grep -i spi
```

If the previous steps were performed correctly, the following summary should be displayed:



This means that both the SC16IS762 and MCP2515 controllers have been correctly installed in the system.

Testing the CAN interface requires entering 3 commands:

```
sudo ip link set can0 up type can bitrate 1000000
sudo ifconfig can0 up
cansend can0 000#11.22.33.44
```

The D10 LED should flash, indicating activity on the CAN bus.
RS485 interfaces can be tested using the minicom, for RS485-1 enter:

```
minicom -D /dev/ttySC0
```

while for RS485-2 enter:

```
minicom -D /dev/ttySC1
```

The minicom program allows you to send characters entered from the keyboard and displays characters received via the selected RS485 interface. During the interface activity, the D5/D7 diodes will flash, but at high transmission speeds, e.g. 115200, the flashing of the LEDs will be barely noticeable.

Links

- Datasheet MCP2515
- Datasheet SC16IS762IPW
- Datasheet ADM2483
- Datasheet TJA1052
- Datasheet TPS5401
- CAD Model (STEP)

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