CAN4VSCP - RS232IF

Smart CAN4VSCP serial interface

Reversion 1.0 - 2014-04-03

Abstract

CAN4VSCP-RS22 is a very simple interface module for connecting a computers RS-232 interface (TTL or RS-232) to the VSCP4CAN bus or if one want the other way around a CAN4VSCP bus to a serial interface. The module is constructed to interface the VSCP network and is hardwired for its speed and other VSCP specific parameters. This lowers the cost for the device and makes it very easy to use. The module comes with a serial boot loader installed which makes it very easy to update the software in the module when the need occurs. The module fully adopts to the CAN4VSCP specification and is powered directly over the bus with a 9 - 28VDC power source.

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All boards produced by *Grodans Paradis AB* are ROHS compliant.

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Chapter 1

CAN4VSCP - RS232

CAN4VSCP-RS232 is a serial interface to the CAN4VSCP bus. The module can be attached to a standard DIN Rail or be mounted directly on a wall (ordered separately). The module fully adopts to the CAN4VSCP specification and is powered directly over the bus with a 9-28V DC power source (for example with CAN4VSCP-POWER). All that is needed is a CAT5 or better twisted pair cable. Buss length can be a maximum of 500 meters with drops of maximum 24 meters length (up to a total of 120 meters). As for all VSCP4CAN modules the communication speed is fixed at 125 kbps.

1.1 Most current information

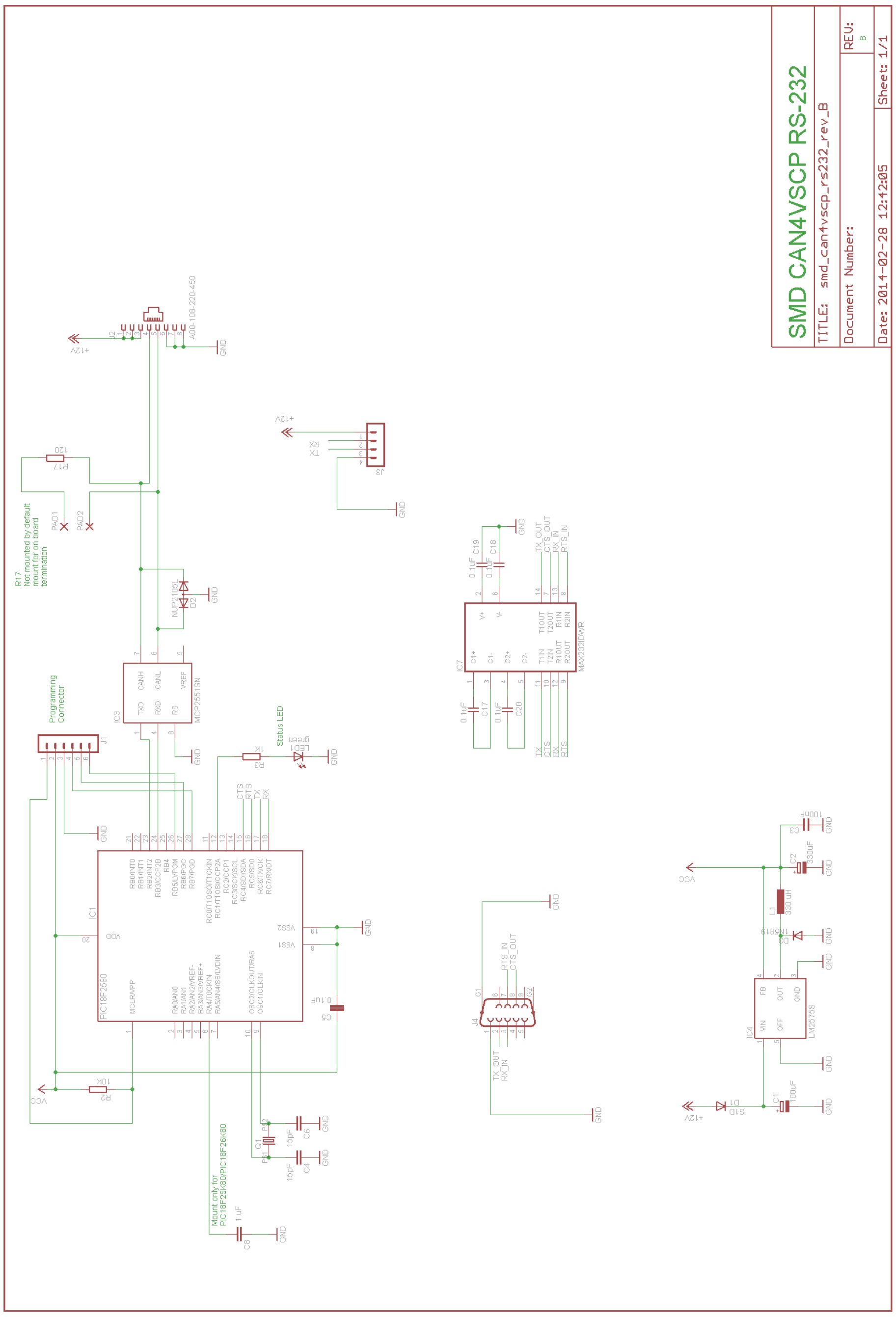
You can find the most current information about the CAN4VSCP-RS232 module at http://www.grodansparadis.com/can4vscp_rs232/can4vscp_rs232.html. On the site you can also find links to the latest firmware and schematics and recipes for its use.

Parameter	Value
Supply voltage	9-28VDC
PCB Size	42 mm x 72mm
Power requirements	0.1W.
Communication RS-232	57500 baud, 8N1, without hardware/software handshake.
Communication VSCP4CAN	125kbps

Table 1.1: The raw facts

1.2 The raw facts

1.3 Hardware



SMD CAN4VSCP RS-232
TITLE: smd_can4vscp_rs232_rev_B
Document Number:
REV: B
Date: 2014-02-28 12:42:05
Sheet: 1/1
PIC18F2580
MCP2551SN
MAX232IDWR
LM2575S
Programming Connector
Status LED
Mount only for PIC18F25K80/PIC18F26K80
R17 Not mounted by default mount for on board termination

Figure 1.1: Schema for the Paris relay module

Some key positions on the module is outlined in the figure below

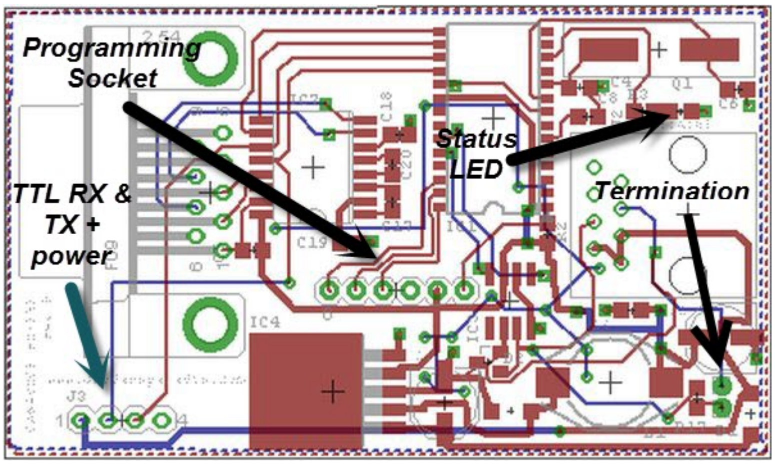


Figure 1.2: Road map to module

1.3.1 TTL level pinhead

J3 can be used if you want to connect CAN4VSCP-RS232 to another card using TTL serial levels. On this pin RX/TX + power and ground is available.

Pin	Description
1	Power: 9V+28V
2	RX
3	TX
4	GND

1.3.2 ICSP Programming pinhead

The in circuit programming pinhead can be used to program (or debug) the mikroprocessor. The socket directly fits the low cost PICKIT2 programmer, but any pic programmer can obviously be used. The pinput is described below. Pin 6 is connected to RB5/LVPGM of the processor.

Figure 1.3: PICKIT2 programmer

Pin	Description
1	VPP/MCLR
2	VDD (+5V)
3	VSS (Ground)
4	PGD
5	PGC
6	LVPGM

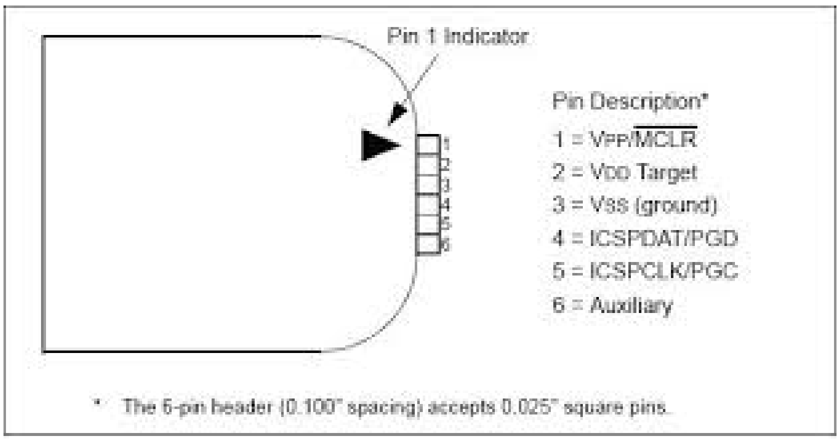


Figure 1.4: Pinout for ICSP programming socket

1.3.3 Termination

Both ends of a CAN4VSCP bus should be terminated with a 120 ohm resistor. If the CAN4VSCP RS-232 is on one end of a bus this termination can be shorted to enable the onboard resistor.

1.3.4 Status LED

The power LED is steady on when the device is powered and will blink shortly when events are received. Fault conditions are indicated by a blinking LED. Fast blinking: bus error. Slow blinking: Bus warning.

LED	Description
Steady	Powered. No error. No traffic on bus.
Short untimed blinks	Traffic on bus.
Slow blinking	Bus error warning. Something is wrong on the CAN4VSCP bus and if not fixed a bus off will result.
Fast blinking	Bus off. Something is very wrong of the CAN4VSCP bus and the driver to the bus has unconnected itself from the bus. When the bus behaves as normal again it will automatically connect again. The problem can typically be shorted CANH/CANL, only one devices on the bus, a device with wrong bitrate on the bus. To not terminate both ens of the bus with a 120 ohm resistor can also give problems.

1.4 Cable and connectors

The unit is powered over the CAN4VSCP bus. The CAN4VSCP normally uses CAT5 or better twisted pair cable. You can use other cables if you which. The important thing is that the CANH and CANL signals uses a twisted cable. For connectors you can use RJ10, RJ11, RJ12 or the most common RJ45 connectors. There are different versions

1.4.0.1 Serial connection - DSUB9, female

The DSUB-9 connector can connect the device to a computer or other device with a RS-232 serial connection. The communication parameters are always set to 57600, N81 (No parity, eight databits, one stopbit), no handshake. A standard USB to RS-232 adapter fits directly if a RS-232 serial port is missing.

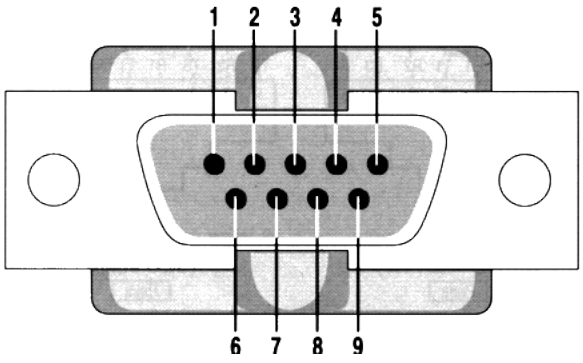


Figure 1.5: RS-22 connector

Pin	Description
1	GND
2	Transmit data (TXD) out
3	Receive data (RXD) in
4	Not used
5	Not used
6	Not used
7	Request to send (RTS) in
8	Clear to send (CTS) out
9	Not used

RTS and CTS is currently not used.

1.4.0.2 RJ-XX pin-out

Pin	Use	RJ-11	RJ-12	RJ-45	Patch Cable wire color T568B
1	+9-28V DC			RJ-45	Orange/White
2 1	+9-28V DC		RJ-12	RJ-45	Orange
3 2 1	+9-28V DC	RJ-11	RJ-12	RJ-45	Green/White
4 3 2	CANH	RJ-11	RJ-12	RJ-45	Blue
5 4 3	CANL	RJ-11	RJ-12	RJ-45	Blue/White
6 5 4	GND	RJ-11	RJ-12	RJ-45	Green
7 6	GND		RJ-12	RJ-45	Brown/White
8	GND			RJ-45	Brown

Table 1.2: RJ-XX pin-out

RJ-11/12/45 pin-out

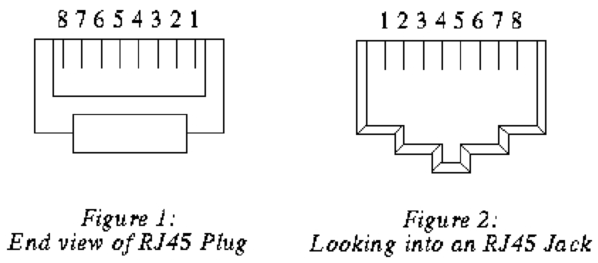


Figure 1.6: RJ-45 pin out

Always use a pair of wires for CANH/CANL fort best noise immunity. If the EIA/TIA 56B standard is used this condition will be satisfied. This is good as most Ethernet networks already is wired this way.

1.4.1 Cable length

CAN4VSCP always communicate with 125kbps. This means that if you use a good quality cable it can be up to a maximum of 500 meters using AWG24 or similar (CAT5) . Actual length depend on the environment and other parameters. Drops with a maximum length of 24 meters can be taken from this cable and the sum of all drops must not exceed a total of 120 meters.

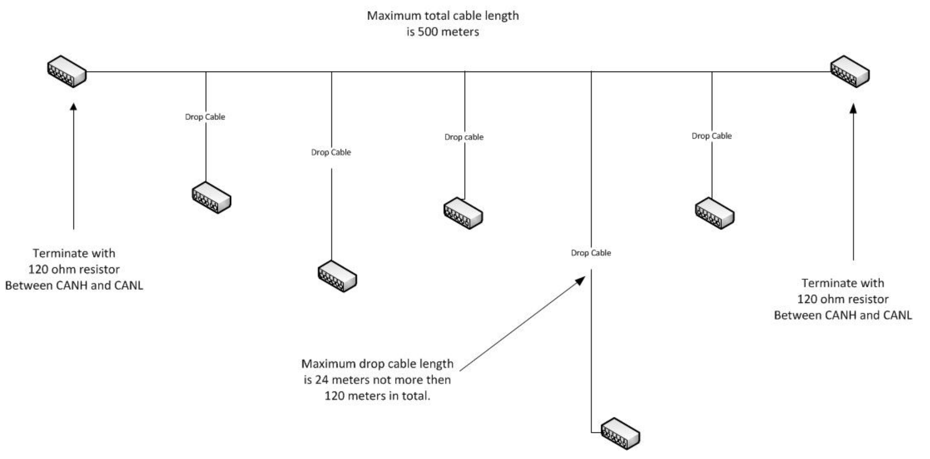

Maximum total cable length is 500 meters
Drop Cable
Drop Cable
Drop cable
Drop Cable
Drop Cable
Terminate with 120 ohm resistor Between CANH and CANL
Terminate with 120 ohm resistor Between CANH and CANL
Maximum drop cable length is 24 meters not more then 120 meters in total.

Figure 1.7: CAN4VSCP bus with drops and terminations

1.4.2 Termination

The CAN4VSCP bus, as all CAN based networks, should be terminated with a 120 ohms resistor between CANH and CANL at both ends of the cable.

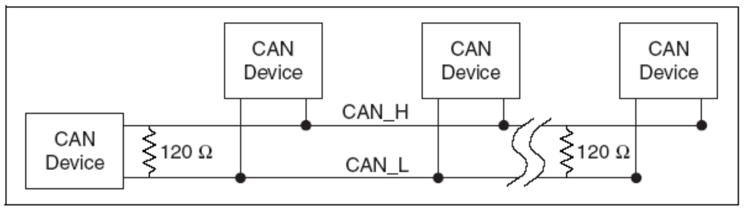


Figure 1.8: Termination

If you use CAT5 this termination should be placed between the blue - blue/white cables at both end of your bus.

On the board there is a jumper for an on-board terminator. See figure above.

1.4.2.1 Why are terminators required?

Terminators are needed to cancel signal echos in the cable. In short you get less noise in the cable if you use them. It is recommended to use them even if at 125 kbit it is possible that your bus will work anyway.

1.4.3 Power the module

You normally power the module through the RJ45 connector over the CAN4VSCP bus. See 1.4.0.2 for a description of which pins to use for power and ground. The voltage range is +9VDC - 28VDC. The current need depend on how many modules you want to power.

An alternative way to power the module is through the daisy chain connector described above. Just connect +9V - 28V to it's pin 1 and ground to pin 4. Needless to say you can't have power supplied by the CAN4VSCP bus at the same time.

1.4.4 Best practice

Even if it is possible to have cable lengths up to 500 meters it is better to stay at shorter distances to have some margins. Here are some guidelines for a reliable set up

- Total cable length of 300m, stub cables count double their length in that total.
- Nodes count as 6m in that total.
- Never less than 30cm of cable between nodes, nor between a stub connection and a node.
- No more than 50 nodes connected.

Following this best practice you will have a setup that will work reliable even in harsh environments.

1.5 Installing the module

Connect the module to the CAN4VSCP bus. The green led on the module should light up indicating that the device is powered. Connect a serial device to the RS-232 connector and now your module is ready to use.

1.6 Updating firmware

There is two ways you can use to update the firmware of the device. You can program the device using the programming socket on board or you can use a special bootloader program to program the device over the serial channel.

1.6.1 Update firmware using the ICP connector

The firmware of a circuit equipped with a Microchip microprocessor usually can be programmed in circuit. That is when it is mounted on a printed circuit board. This is also true for the CAN4VSCP RS-232 module which have the programming connector on-board (J3). If you have a programmer for Microchip processors (Real ICE, ICD-2, ICD-3, PICKIT-2, PICKIT3 or other) you can program your own firmware or the latest official firmware into the module using MPLAB or similar tools. You can always find a link to the latest firmware on the CAN4VSCP RS-232 module home page.

1.6.2 Update firmware with bootloader program

You need a Windows/Linux equipped PC to load the CAN4VSCP-RS-232 module with new firmware. Download the bootloader from the CAN4VSCP RS-232 homepage. You can always find a link to the latest firmware and bootloader on the CAN4VSCP RS-232 module home page (here).

The bootloader code is described here and a Linux version is here here.

1.7 Driver

A CANAL driver (VSCP Level I driver) is available for the CAN4VSCP RS-232 module both for windows and for Linux. This driver can be used with the VSCP daemon and with VSCP Works and other software. The interface that is exported is described in part VII of the specification document (http://vscp.org/docs.php) and it is easy to interface from your own programs. The VSCP helper dll can also be a convinient tool to use for this.

1.8 Interface

The interface of the module is text based. The module is normally always connected. So the only thing that is needed to see traffic on a CAN4VSCP bus is to connect the module to a serial device.

1.8.1 Data frame

All data is always represented in hexadecimal form. A sent frame and a received frame have the same format.

Byte	Character	Number of characters	Description
0	+	1	Start of frame
1,2.3	000-1FF	3	VSCP class
4,5	00-FF	2	VSCP ctype
6	0-8	1	Number of databaytes
7,8,9,10,11,12,13,14	00-FF	0-8	Databytes
(15)*	0D	1	End of frame.

* The end of frame byte (0x0D) is the last character of the frame so it can be placed at position 7,8,9,10,11,12,13,14,15 depending on the size of the data in the frame.

When a frame is sent "+" followed by a carrige return is received from the module.

1.8.2 Commands

Commands is used to control the behaviour of the CAN4VSCP RS-232 module. A command is acknowledged with "+OK<CR>" for a valid command and "-ERR<errorcode><CR>" for an invalid command.

Function	Description
SET ON	The CAN4VSCP interface works as normal and frames can be sent and received. (default). Response is always *“+OK<CR>”* even if the channel already is on. The command is persisent so if the node is unpowered and powered again the module will be on-line.
SET OFF	The CAN4VSCP interface is decoupled from the CAN4VSCP and frames will not be receiced nor possible to send. Response is always *“+OK<CR>”* even if the channel already is off. The command is persisent so if the node is unpowered and powered again the module will be off-line.
SET AUTO	The CAN4VSCP will be a an autonomus working node on the bus after this command has been issued. Any sent data on the serial interface will be sent out on the bus a serial data (if configured to do so) and serial streams received will be sent out on the serial interface (if configured to do so). The module confirm the mode change with *“+OK<CR>”* . The command is persisent so if the node is unpowered and powered again the module will be in auto-mode.
SET LISTEN	The CAN4VSCP interface is connected to the CAN4VSCP and frames will be receiced but not sent. For other devices on the CAN4VSCP bus the module looks like it’s not conected. This is useful for investigating a CAN4VSCP bus without disturbing the connected devices. Response is always *“+OK<CR>”* even if the channel already is listen mode. The command is persisent so if the node is unpowered and powered again the module will be in listen only mode.
SET LOOPBACK	The interface is set into loopback mode that is the things that is sent is received. Response is always *“+OK<CR>”* even if the channel already is in loopback mode. The command is persisent so if the node is unpowered and powered again the module will be loopback-mode.
SET FILTER	Set a receive filter. Argument is *priority,class, type, nickname*. Response is *“+OK<CR>”* for a valid argument or “*-ERR<CR>*” for an invalid argument. The filter command is persistent.
SET MASK	Set a receive mask. Argument is *priority,class, type, nickname*. Response is *“+OK<CR>”* for a valid argument or “*-ERR<CR>*” for an invalid argument. The mask command is persistent.
SET BOOT	Enter bootloader mode.
READ STATS	Return statistics !error-counter,flags,send frames,received frames

Pos	Description
0	Status byte.
1	Error counter.
2	Overruns. Cleared on read.
3	Receive error counter
4	Transmit error counter
	Sent frames (four bytes)
	Received frames (four bytes)

Ths status byte has the following bits

Bit	Description
7	Bus off
6	Bus Warning
5	Error passive
4	
3	Transmission Lost Arbitration
2	Transmission Error Detected Status bit(
1	

1.9 Where can I find the source code?

Most VSCP modules from Grodans Paradis AB is Open hardware/Open source meaning that both the hardware information as well as the source code is available. This means that you can modify the source code and /or the hardware to your specific needs if you want.