Kelvin Smart II

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Description

The **Kelvin Smart II** module is an open hardware and software temperature module for the VSCP (Very Simple Control Protocol) for use over CAN (Controller Area Network). The module is mounted in a DIN norm box with standard one unit width (17.5 mm) The unit is delivered with a two meter cable to a temperature sensor and is designed for indoor use.

The module is built around a Microchip PIC 18F258 and the code is written in C using the Microchip MCC-18 compiler.

Data for sensors

Usable Range: −45 till +130 °C

Total Accuracy: 0,7 °C in the range −30 to +100 °C
1,2 °C in the range +100 to +130 °C

Non-linearity: 0,2 °C

Repeatability: 0,1 °C

Long Term Drift: 0,05 °C

Power:

The **Kelvin Smart II** can be powered with 9-16V DC and draws about 0.15W.

Enclosure:

Material for the box: Polycarbonate (UL 94-V1)
Colour: Grey
Enclosure class: IP20
Dimensions for module: B17,7×H89×D59 mm

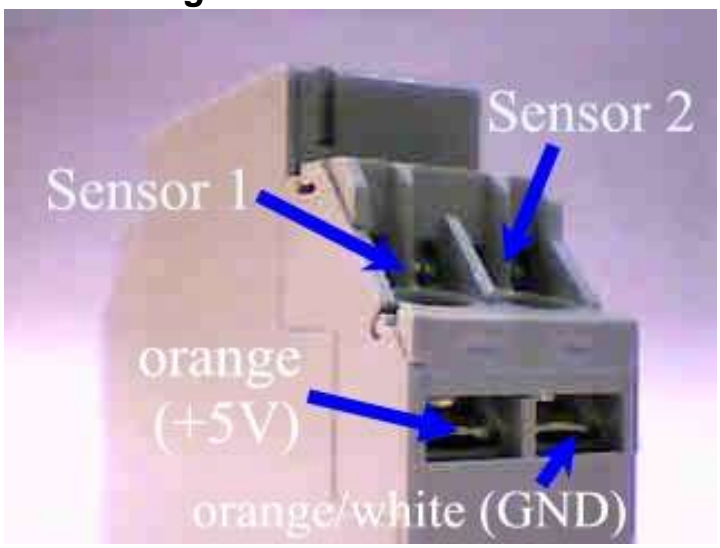
Kelvin Smart II is also available in the form of a bare PCB for home builders.

Complete data for the module including drawings and code is available at http://www.vscp.org The module, the PCB and components for it can be bought at http://www.eurosource.se

Installing

The module have screw connections on two sides. One side is for CAN and power (**marked "CAN + Power"**) and the other side is for the sensor (**marked "sensor"**).

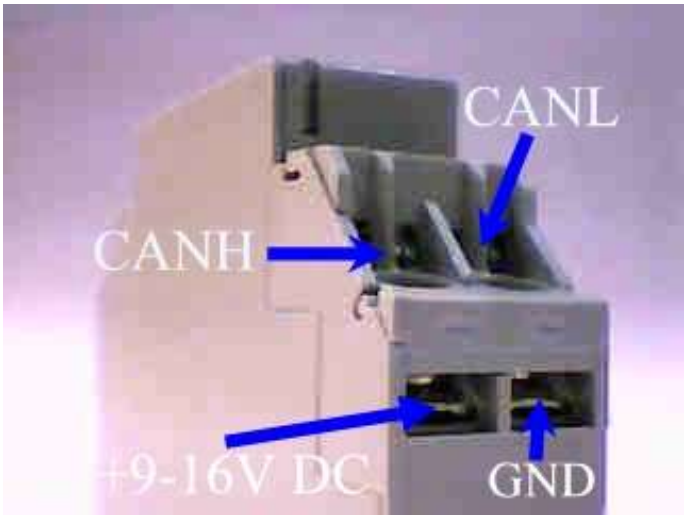
Connecting the sensor



Attach the

- Power lead of sensor (usually orange) lead to +5V in the lower left.
- GND lead of sensor (usually orange/white) to GND in the lower right
- blue lead to upper left position. Sensor 1
- blue/white lead to the upper right position. Sensor 2

Connecting CAN



Attach **CANL** to the upper right position and **CANH** to the upper left position. If this is the first or the last module in the chain set the 120 ohm terminator (a standard 120 ohms resistor) between CANL and CANH.

CAT5 twisted pair cable should be used and there should be less than 500 meters between the first and the last node. Both ends of the bus should be terminated with a 120 ohm resistor (coupled between CANL and CANH).

Connect the ground cable from the bus to the ground position in the upper right position.

Connecting power

First you have to decide if the module should be powered from the bus or from a local power source. If powered from the bus just connect the power line to the upper left position. Depending on modules you can power about 50 modules from the bus if 24V is used.

If you have a local DC power source between 9-16V connect ground to upper right position and positive to the upper left position.

Your module is now ready for some real work.

Starting it up

When the module is first powered up the green lamp starts to blink to indicate that the module is uninitialized. Press the red button on the device. The address negotiation now starts. The lamp will stop blinking and light steady when initialized or be turned of if an error occurs

It is important to understand as VSCP over CAN requires at least two modules on the bus to be working. If you have a computer CAN interface this is counted as one node. The interface should be open and the CAN bitrate set to 500 kbps.

Registers

Register 0(0x00) - Reserved
Register 1(0x01) - Reserved

Register 2(0x02) - Current temperature sensor 1, MSB. **Read only**
Register 3(0x03) - Current temperature sensor 1, LSB. **Read only**

Register 4(0x04) - Current temperature sensor 2, MSB **Read only**
Register 5(0x05) - Current temperature sensor 2, LSB **Read only**

Register 6(0x06) - Absolute high temperature sensor 1, MSB. **Read/Write**
Register 7(0x07) - Absolute high temperature sensor 1, LSB. **Read/Write**
Writing any value to register 8 or 9 will reset there content.

Register 8(0x08) - Absolute high temperature sensor 2, MSB. **Read/Write**
Register 9(0x09) - Absolute high temperature sensor 2, LSB. **Read/Write**
Writing any value to register 8 or 9 will reset there content.

Register 10(0x0A) - Absolute low temperature sensor 1, MSB. **Read/Write**
Register 11(0x0B) - Absolute low temperature sensor 1, LSB. **Read/Write**
Writing any value to register 10 or 11 will reset there content.

Register 12(0x0C) - Absolute low temperature sensor 2, MSB. **Read/Write**
Register 13(0x0D) - Absolute low temperature sensor 2, LSB. **Read/Write**
Writing any value to register 12 or 13 will reset there content.

Register 14(0x0E) - Running mean of temperature sensor 1, MSB. **Read/Write**
Register 15(0x0F) - Running mean of temperature sensor 1, LSB. **Read/Write**
Writing any value to register 14 or 15 will set mean value to zero.

Register 16(0x10) - Running mean of temperature sensor 2, MSB. **Read/Write**
Register 17(0x11) - Running mean of temperature sensor 2, LSB. **Read/Write**
Writing any value to register 16 or 17 will set mean value to zero.

Register 18(0x12) - Temperature low alarm point for sensor 1. 255 mean no alarm and is the default value. This value is read and written degrees Celsius **Read/Write** Note that the value stored in this register is the real value not the 100* value used for other registers.

Register 19(0x13) - Temperature low alarm point for sensor 2. 255 mean no alarm and is the default value. This value is read and written degrees Celsius **Read/Write** Note that the value stored in this register is the real value not the 100* value used for other registers.

Register 20(0x14) - Temperature high alarm point for sensor 1. 255 mean no alarm and is the default value. This value is read and written degrees Celsius **Read/Write** Note that the value stored in this register is the real value not the 100* value used for other registers.

Register 21(0x15) - Temperature high alarm point for sensor 2. 255 mean no alarm and is the default value. This value is read and written degrees Celsius **Read/Write** Note that the value stored in this register is the real value not the 100* value used for other registers.

Register 22(0x16) - Temperature sensor 1 read error counter. **Read/Write**
A write of any value set the register to zero.

Register 23(0x17) - Temperature sensor 2 read error counter. **Read/Write**
A write of any value set the register to zero.

Register 24(0x18) - Sensor Status register read/write. **Read/Write**

Register 25(x019) - Time in seconds between temperature events for sensor 1. (0 is no temperature event, 30 is default). **Read/Write**

Register 26(0x1A) - Time in seconds between temperature events for sensor 2. (0 is no temperature event, 30 is default). **Read/Write**

Register 27(0x1B) - Temperature format. **0x00** – Kelvin, **0x01** Celsius (default), **0x02** Fahrenheit. **Read/Write**

Register 28(0x1C) - Temperature calibration sensor 1 MSB. (default is zero). **Read/Write**
Register 29(0x1D) - Temperature calibration sensor 1 LSB. (default is zero). **Read/Write**

Register 30(0x1E) - Temperature calibration sensor 2 MSB. (default is zero). **Read/Write**
Register 31(0x1F) - Temperature calibration sensor 2 LSB. (default is zero). **Read/Write**

Register 32(0x20) – Hysteresis for temperature sensor 1 (default is five degrees Celsius). **Read/Write**

Register 33(0x21) – Hysteresis for temperature sensor 2 (default is five degrees Celsius). **Read/Write**

All values, temperature, humidity, dew point are stored as 100 * the real value. This is to preserve two decimals as they are stored as integers. This means that you should divide a read value with 100 to get the real value. This is true for all registers except for the alarm points.

Alarm register

You can read standard VSCP register 128 (0x80) to get alarm status for the device. When an alarm is generated the corresponding bit in the alarm register will be set. The bit will be cleared by a read of the alarm register .You can therefore pick up alarm conditions without looking for alarm events. This can also be used as a safeguard against missed alarm events.

Bit 7 – Temperature high alarm.
Bit 6 – Temperature low alarm.
Bit 5 – Reserved
Bit 4 – Reserved
Bit 3 – Reserved.
Bit 2 – Reserved.
Bit 1 – Reserved.
Bit 0 – Reserved.

Events

The following events are generated by this device.

Temperature

canid = 0x80a06xx where xx is node nickname id.

The temperature is reported as a floating point value by this event. The event frequency is set in register 33 (0x21) (default is one event per 30 seconds). Set this register to zero to disable the event. Temperature can be reported in one of three units. Kelvin, Celsius (default) and Fahrenheit as set in register 36 (0x24).

For most other nodes which are low level devices floating point is not the preferred data format. This is not a problem as the data can be read in byte 4 (MSB) and byte (5(LSB) as a value 100 times the measured value. The sign for this value can be fetched from bit 7 of byte 2.

Class: 0x00A
Type: 0x06
Format: See below.
.
Package: **Byte 0**: format.
Byte 1: 0x02 (exponent)
Byte 2: `s0000000`
Byte 3: 00000000
Byte 4: `mmmmmmmm`
Byte 5: `mmmmmmmm`

s is sign and is set to one for a negative value.
m represent the mantissa with the LSB in byte 5

format is the measurement data coding format described in the VSCP specification

Bits 5,6,7 ***0x08*** - Normalized integer format.
Bits 3,4 ***0x00*** - Kelvin, ***0x01*** – Celsius, ***0x02*** – Fahrenheit.
Bits 1,2,3 ***0x00*** or ***0x01*** for sensor 1 or sensor 2.

Package examples

+40 degrees Celsius from sensor 1 is reported as:

Byte 0: 0x88
Byte 1: 0x02
Byte 2: 0x00
Byte 3: 0x00
Byte 4: 0x0F
Byte 5: 0xA0

+120 degrees Celsius for sensor 2 is reported as:

Byte 0: 0x89
Byte 1: 0x02
Byte 2: 0x00
Byte 3: 0x00
Byte 4: 0x2E
Byte 5: 0xE0
Byte 6: 0x01

0 degrees Celsius for sensor 2 is reported as:

Byte 0: 0x81
Byte 1: 0x02
Byte 2: 0x00
Byte 3: 0x00
Byte 4: 0x00
Byte 5: 0x00
Byte 6: 0x00

-40 degrees Celsius for sensor 1 is reported as:

Byte 0: 0x88
Byte 1: 0x02
Byte 2: 0x80
Byte 3: 0x00
Byte 4: 0x0F
Byte 5: 0xA0
Byte 6: 0x01

1.38 degrees Celsius for sensor 1 is reported as:

Byte 0: 0x88
Byte 1: 0x02
Byte 2: 0x80
Byte 3: 0x00
Byte 4: 0x00
Byte 5: 0x8A
Byte 6: 0x00

Alarm

canid = 0xe0102xx where xx is node nickname id.

The module can send alarm events on a number of conditions:

- Temperature over limit (code = 1).
- Temperature under limit (code = 2).

Code = 0 is reserved for a general alarm and is not used at the moment.

One event will be sent for each alarm type generated. When the corresponding alarm flag is set in the alarm register set after an alarm no new alarms will be generated until the bit is cleared and a new alarm condition occurs.

Class: 0x001
Type: 0x02
Format: none

Package: **Byte 0:** code for alarm type.
Byte 1: Alarm register.
Byte 2: Sensor 1 = 0 / Sensor 2 = 1.

Error

canid = 0xe140dxx where xx is node nickname id.

An error message is sent out if a failure is detected with the module or the SHT-xx sensor.

- Error code = 0 – Reserved
- Error code = 1 – Sensor fault.
- Error code = 2 – Module fault.

Class: 0x014
Type: 0x0d
Format: **none**

Package: **Byte 0:** error code.

Contact Information

This is open hardware / software that is made by Ake Hedman, eurosource, Sweden. It is free to use for commecial or non commercial use.

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Modules and componets are sold at http://www.eurosource.se/catalog

More info about the VSCP and CANAL protocol can be found at http://www.vscp.org