Kelvin SHT

Rev 0.03 – 050127 akhe@eurosource.se, http://www.vscp.org

Description

The **Kelvin SHT** module is an open hardware and software temperature and humidity 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/humidity 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.

The temperature data is accurate to +- 0.4 degree at 25 degrees Celsius and is typically +-2 over the sensors entire range. The Humidity data is accurate to +- 3% and reported dew-point typically has a +-1 degree accuracy. A calibration value can be set in the module for both temperature and humidity but is not needed for normal use.

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

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

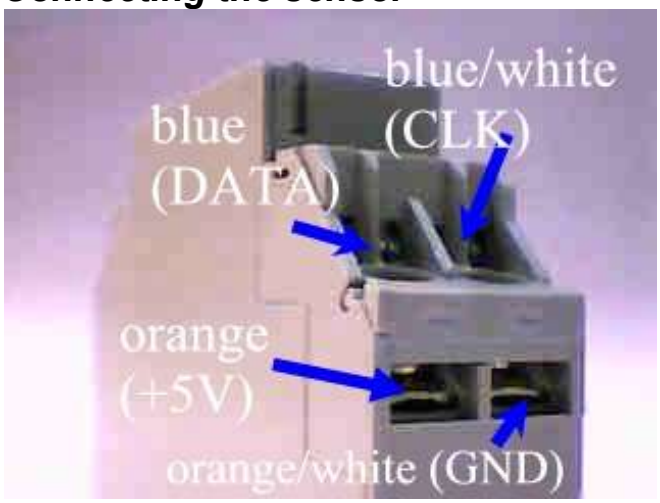
Kelvin SHT is also available in the form of a bare PCB for home builders.

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"**).

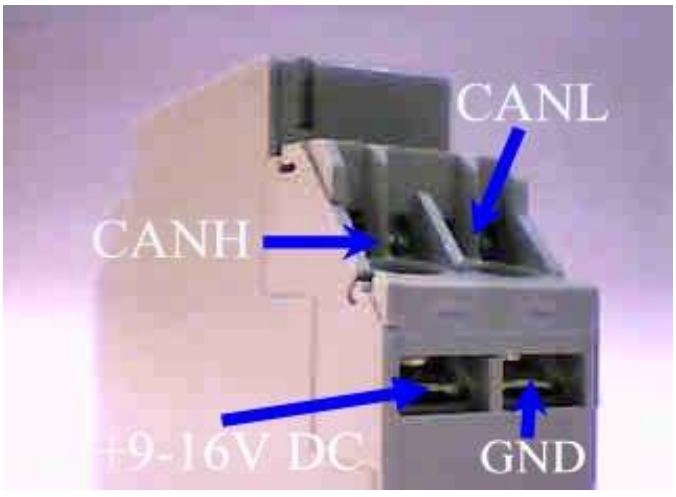
Connecting the sensor



Attach the

- Orange lead to +5V in the lower left.
- orange/white lead to GND in the lower right
- blue lead (DATA) to upper left position.
- blue/white lead (CLOCK) to the upper right position.

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

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

Register 6(0x06) **-** Current dew point, MSB. **Read only**
Register 7(0x07) **-** Current dew point, LSB. **Read only**

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

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

Register 12(0x0C) - Absolute high humidity, MSB. **Read/Write**
Register 13(0x0D) - Absolute high humidity, MSB. **Read/Write**
Writing any value to register 12 or 13 will reset there content.

Register 14(0x0E) - Absolute low humidity, MSB. **Read/Write**
Register 15(0x0F) - Absolute low humidity, MSB. **Read/Write**
Writing any value to register 14 or 15 will reset there content.

Register 16(0x10) - Absolute high dew point, MSB. **Read/Write**
Register 17(0x11) - Absolute high dew point, LSB. **Read/Write**
Writing any value to register 16 or 17 will reset there content.

Register 18(0x12) - Absolute low dew point, MSB. **Read/Write**
Register 19(0x13) - Absolute low dew point, LSB. **Read/Write**
Writing any value to register 18 or 19 will reset there content.

Register 20(0x14) - Running mean of temperature, MSB. **Read/Write**
Register 21(0x15) - Running mean of temperature, LSB. **Read/Write**
Writing any value to register 20 or 21 will set mean value to zero.

Register 22(0x16) - Running mean of humidity, MSB. **Read/Write**
Register 23(0x17) - Running mean of humidity, LSB. **Read/Write**
Writing any value to register 20 or 21 will set mean value to zero.

Register 24(0x18) - Running mean of dew point, MSB. **Read/Write**
Register 25(x019) - Running mean of dew point, LSB. **Read/Write**
Writing any value to register 20 or 21 will set mean value to zero.

Register 26(0x1A) - Temperature low alarm point. 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 27(0x1B) - Temperature high alarm point 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 28(0x1C) - Humidity low alarm point. 255 mean no alarm and is the default value. **Read/Write** Note that the value stored in this register is the real value not the 100* value used for other registers.

Register 29(0x1D) - Humidity high alarm point .255 mean no alarm and is the default value. **Read/Write** Note that the value stored in this register is the real value not the 100* value used for other registers.

Register 30(0x1E) - Temperature sensor read error counter. **Read/Write**
A write of any value set the regsiter to zero.

Register 31(0x1F) - Humidity sensor read error counter. **Read/Write**
A write of any value set the regsiter to zero.

Register 32(0x20) – Sensor Status register read/write. **Read/Write**

Register 33(0x21) – Time in seconds between temperature events. (0 is no temperature event, 30 is default). **Read/Write**

Register 34(0x22) – Time in seconds between humidity event. (0 is no temperature event. Set to 30 by default). **Read/Write**

Register 35(0x23) – Time in seconds between dew point event. (0 is no temperature event. Set to 30 by default). **Read/Write**

Register 36(0x24) – Temperature format. **0x00** – Kelvin, **0x01** Celsius (default), **0x02** Fahrenheit. **Read/Write**

Register 37(0x25) - Temperature calibration MSB. (default is zero). **Read/Write**
Register 38(0x26) - Temperature calibration LSB. (default is zero). **Read/Write**

Register 39(0x27) - Humidity calibration MSB (default is zero). **Read/Write**
Register 40(0x28) - Humidity calibration LSB (default is zero). **Read/Write**

Register 41(0x29) – Hysterisis for temperature (default is five degrees Celsius). **Read/Write**
Register 42(0x2A) – Hysteresis fro humidity (default is five percent). **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. Thiscan also be used as a safeguard against missed alarm events.

Bit 7 – Temperature high alarm.
Bit 6 – Temperature low alarm.
Bit 5 – Humidity high alarm.
Bit 4 – Humidity low alarm.
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 (always 0x6 in high nibble)
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 is reported as:

Byte 0: 0x81
Byte 1: 0x02
Byte 2: 0x00
Byte 3: 0x00
Byte 4: 0x0F
Byte 5: 0xA0

+120 degrees Celsius is reported as:

Byte 0: 0x81
Byte 1: 0x02
Byte 2: 0x00
Byte 3: 0x00
Byte 4: 0x2E
Byte 5: 0xE0

0 degrees Celsius is reported as:

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

-40 degrees Celsius is reported as:

Byte 0: 0x81
Byte 1: 0x02
Byte 2: 0x80
Byte 3: 0x00
Byte 4: 0x0F
Byte 5: 0xA0

1.38 degrees Celsius is reported as:

Byte 0: 0x81
Byte 1: 0x02
Byte 2: 0x00
Byte 3: 0x00
Byte 4: 0x00
Byte 5: 0x8A

Humidity

canid = 0x80a23xx where xx is node nickname id.

The humidity is reported as a floating point value by this event. The event frequency is set in register 34 (0x22) (default one event per 30 seconds). Set this register to zero to disable the event. Humidity is always reported in percent (0-100%).

For most 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: 0x23

Format: See below.

Package:
Byte 0: 0x60
Byte 1: 0x02 (exponent)
Byte 2: `0x00`
Byte 3: `0x00`
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

47.54% humidity is reported as:

Byte 0: 0x81
Byte 1: 0x02
Byte 2: 0x00
Byte 3: 0x00
Byte 4: 0x12
Byte 5: 0x92

Dew point

canid = 0x80a31xx where xx is node nickname id.

The calculated dew point is reported as a floating point value by this event. The event frequency is set in register 35 (0x23) (default one event per 30 seconds). Set this register to zero to disable the event. Dew point can be reported in in one of three units. Kelvin, Celsius (default) and Fahrenheit as set in register 36 (0x24).

For most nodes which are low level devices floating point is not the preferred data format. This is not a problem as the value 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: 0x31
Format: See below.

Package: **Byte 0**: format (always 0x6 is high nibble)
Byte 1: 0x02 (exponent)
Byte 2: smmmmmmmm
Byte 3: mmmmmmmmm
Byte 4: mmmmmmmmm
Byte 5: mmmmmmmmm

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.

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).
- Humidity over limit (code = 3).
- Humidity under limit (code = 4).

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.

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.

Email:

akhe@eurosource.se

Company:

eurosource
Brattbergavagen 17
820 50 LOS
SWEDEN
info@eurosource.se
http://www.eurosource.se
Phone: +46 657 413430
Fax: +46 657 413503

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