ULTRASONIC ANEMOMETER

THIES 3D

KINTECH ENGINEERING

ULTRASONIC ANEMOMETER | THIES 3D

APPLICATION

Given the multimillion investments in wind energy projects, the importance of high quality data from the wind resource assessment is of key importance. Ultrasonic anemometers in addittion to cup anemometers can help you characterize the site even better. Here are some of the advantages of Ultrasonic sensors:

- Better characterization of turbulence intensity
- Better data availability in cold climates
- Inertia-free measurements
- Maintenance free (no moving parts)
- No need for re-calibration

The Ultrasonic Anemometer Thies 3D is compatible with the EOL Zenith data logger and is used to detect the horizontal and vertical components of the wind speed, the wind direction as well as the acoustic virtual temperature.

CONSTRUCTION AND MODE OF OPERATION

The Utrasonic Anemometer Thies 3D can generate measuring data with very high accuracy even in unheated state at temperatures of up to below –40 °C.

2 options for heating the Ultrasonic Anemometer 3D:

- Heating of sensor arms + ul. sensors
- Heating of sensor arms + ul. sensors + housing

The heating elements are activated using the built in temperature sensor. Both heating options will keep the temperature of the outer surfaces (ref. options above) at approx. + 5°C even at high wind speeds. This means that the full heating power is activated until the reference temperature is reached and is repeatedly switching heating on and off (2-point controller) by a hysteresis of approx. 2 kΩ.

ULTRASONIC MODULE

In order to connect the Ultrasonic Anemometer Thies 3D to the EOL Zenith data logger, Kintech Engineering supplies an Ultrasonic Module. An EOL Zenith data logger provided with the Ultrasonic Module will poll the configured dataset from the sensor once per second through its serial port.

The Ultrasonic Module includes both the hardware and firmware necessary for connecting ultrasonic sensors to the EOL Zenith:

- Isolated RS-485 / RS-232 converter. Due to the long distances between the sensor and data logger.
- An independent power source due to the power consumption of the sensor (without heating).
- Solar charge regulators with “load” to shut down the sensor in case of low battery. This is to avoid damaging the battery because of deep discharge.

MEASURING PRINCIPLE

The Ultrasonic Anemometer Thies 3D consists of 6 ultrasonic transformers, in pairs facing each other at a distance of 200 mm. The 3 resulting measurement paths are vertical in relation to each other. The transformers function both as acoustic transmitters and receivers.

The electronic control system is used to select the respective measurement path and its measuring direction. When a measurement starts, a sequence of 6 individual measurements is performed in all 6 directions of the measurement paths in a preselect able timing cycle.

The measuring directions (sound propagation directions) rotate clockwise (looking from above), firstly from top to bottom and then from bottom to top.

The mean values are worked out from the 6 individual measurements of the path directions depending on the measuring speed and output rate selected and used to make further calculations.

The time required for a measuring sequence is approx. 3.5 m sec at +20°C with the maximum measuring speed, which is only limited by the sound speed over the measurement paths.

ULTRASONIC ORDER KEY

Kintech Engineering recommend using only known and recognized manufacturers of ultrasonic instruments like Gill, Thies Clima or Vaisala.

4.3830.22.300

HEATING	
0	Standard heating, stainless-steal caps
1	Reserved
2	PTC Heating
3	PTC Heating, stainless-steal caps
4	3 Plus additional, chassis heating 42 V
5	Reserved
6	Reserved
7	Reserved
8	Reserved
9	Reserved

GENERAL INTERFACE	
0	Full duplex
1	Half duplex, analog (mA)
2	Half duplex, analog (V)
3	Half duplex / Bayern-Hessen telegram
4	Half duplex ADIO
5	Full duplex LON
6	Full duplex DWD
7	Full duplex ADIO
8	Reserved
9	Reserved

RS422 CONFIG	
0	Baud rate 1200/N81
1	Baud rate 2400/N81
2	Baud rate 4800/N81
3	Baud rate 9600/N81
4	Baud rate 19200/N81
5	Baud rate 38400/N81
6	Baud rate 1200/E71
7	Baud rate 4800/E71
8	Baud rate 9600/E71
9	Baud rate 19200/E71

INPUT/OUTPUT		
0	0-10 V, 0-20 mA	Polling
1	2-10 V, 4-20 mA	
2	Input 0-10 V	
3	Telegram VD	
4	Telegram VDT	
5	Telegram V4DT	
6	Telegram NMEA default 4800/N81	
7	Telegram VX/VY	
8	Standard deviation	
9	Reserved	

BAYERN - HESSEN TELEGRAM		OTHERS
0	BH 0	Standard
1	BH 1	Reserved
2	BH 2	Reserved
3	BH 3	Reserved
4	BH 4	Reserved
5	BH 5	Reserved
6	Reserved	
7	Reserved	
8	Reserved	
9	Reserved	

☐ Recommended Order N° by Kintech Engineering

TECHNICAL DATA

WIND SPEED		
CHARACTERISTIC	**DESCRIPTION / VALUE**	
Measuring range	0.01...85 m/s (Starting threshold: 0.01 m/s) Up to 99.99 m/s is measured and output	
Accuracy	≤5m/s	±0.1 m/s rms (root mean square over 360°)
	>5 m/s ≤35 m/s	±1% rms of measured value (root mean square over 360°)
	>35 m/s ≤65 m/s	±2% rms of measured value (root mean square over 360°)
	>65 m/s ≤85 m/s	±3% rms of measured value (root mean square over 360°)

WIND DIRECTION		
CHARACTERISTIC	**DESCRIPTION / VALUE**	
Measuring range	Azimuth	0...360°
	Elevation	-90°...+90°
Accuracy	±1°	with wind speed 1...35 m/s
	±2°	with wind speed 35...65 m/s
	±4°	with wind speed 65...85 m/s
Resolution	1°	in telegrams No. 1 to 4
	0.1°	in telegrams No. 5 to 12 and user-defined telegrams

ACOUSTIC VIRTUAL TEMPERATURE	
CHARACTERISTIC	**DESCRIPTION / VALUE**
Measuring range	-40 ...+70 °C
Accuracy	±0.5 K
Resolution	0.1 K (in telegrams No. 1 to 5)

GENERAL		
CHARACTERISTIC	**DESCRIPTION / VALUE**	
Internal measuring rate	Up to 285 complete measuring sequences per second at 20 °C 6 individual measurements	
Bus mode	Bus mode of up to 98 devices possible	
Measuring mode	Standard measuring mode (continuous measurement)	
	Burst mode: measurement at maximum speed followed by output (max. 40,000 measured values)	
	Synchronous measurement: measurement specified by external clock pulse via PIN 3 (ADIO) input (maximum 250 Hz)	
	Measurement can be initiated via rising or falling edge (selectable) of trigger signal	
	Start of measurement <0.5 ms after flank detection	
	Triggered individual measurement: the flank of an external signal is used for measurement Measurement can be initiated via rising or falling edge (selectable) of trigger signal Start of measurement <0.5 ms after flank detection	
Temperature range	Operating temperature	–50°C...+80°C heated –30°C...+80°C unheated
	Storing	–50°C...+80°C
	Measuring operation possible with heating up to - 75°C	
Operating voltage	Supply electronics	U: 8...78 VDC or 12...55 VAC, 5…65Hz
	No heating	P: typ. 1.5 VA, maximum 2.5 VA

DATA OUTPUT DIGITAL	
CHARACTERISTIC	**DESCRIPTION / VALUE**
Interface	RS 485 / RS 422 Electrically isolated from supply voltage and housing
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 adjustable
Output	Instantaneous values: wind speed & direction, acoustic virtual temperature
	Sliding mean values 0.5 sec. ...100 min. freely selectable
	Standard deviations, covariances and turbulence intensities for wind speed & direction, acoustic virtual temperature
	Predefined data telegrams or user-defined data telegram
Output rate	1 per 1 msec. ... 1 per 60 sec. adjustable in msec. steps
Status identification	Heating, failure of measurement path, DT path temperatures

RS-232 / RS-485 CONVERTER (ADAM-4520)

The ADAM-4520 is an isolated converter used to converts RS-232 signals into isolated RS-485 signals.

The RS-485 standard supports half-duplex communication. This means that just two wires are needed to both transmit and receive data. Handshaking signals, such as RTS (Request To Send), are normally used to control the direction of the data flow. A special I/O circuit in ADAM-4520 automatically senses the direction of the data flow and switches the transmission direction. No handshaking signals are necessary.

SWITCH CONFIGURATION

SWITCH 1		DESCRIPTION
0	1	
-	-	9 bits
ON	-	10 bits (default)
-	ON	11 bits
ON	ON	12 bits

SWITCH 2									DESCRIPTION
1	2	3	4	5	6	7	8	9	RTS Control
ON	-	-	-	-	-	-	-	-	1200 bps
-	ON	-	-	-	-	-	-	-	2400 bps
-	-	ON	-	-	-	-	-	-	4800 bps
-	-	-	ON	-	-	-	-	-	9600 bps (default)
-	-	-	-	ON	-	-	-	-	12.5 kbps
-	-	-	-	-	ON	-	-	-	38.4 kbps
-	-	-	-	-	-	ON	-	-	57.6 kbps
-	-	-	-	-	-	-	ON	-	115.2 kbps
-	-	-	-	-	-	-	-	ON	RS-422

TECHNICAL DATA

CHARACTERISTIC	DESCRIPTION / VALUE
Power Requirement	Unregulated 10...30 VDC with protection from power reversals
Case	ABS with captive mounting hardware
Plug-in screw terminal wiring	0.5...2.5 mm wires
Operating Temperature	0...+70° C
Storage Temperature	-25...+85° C
Humidity	5...95%, non-condensing
Baudrate (bps)	1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 57.6 k, 115.2 k, RTS control and RS-422 mode (switchable)
Isolation Voltage	3000 VDC
RS-232 Interface Connector	Female DB-9
RS-422/RS-485 Interface Connector	Plug-in screw terminal
Power Consumption	1.2 W

SOLAR CHARGE CONTROLER (STECA SOLSUM8.8F)

The solar charge controller monitors the voltage of the battery bank, controls the charging process as well as the connection/disconnection of loads. This optimises usage and significantly extends the battery life.

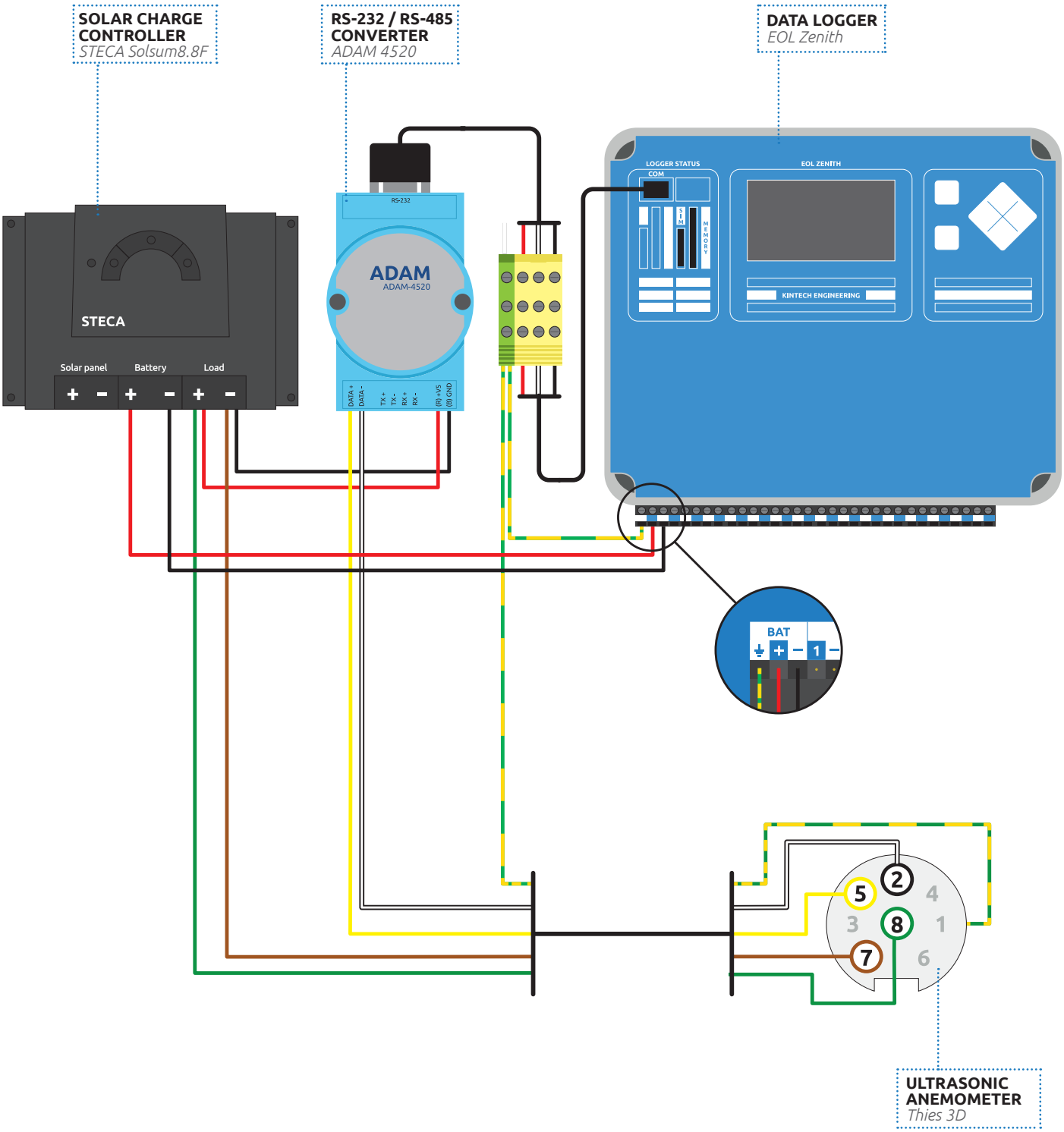
The following features are part of the basic functions of the charge controller: overcharge protection, deep discharge protection, battery undervoltage protection, solar module reverse current protection.

TECHNICAL DATA

CHARACTERISTIC	DESCRIPTION / VALUE
System voltage	12 V (24 V)
Own consumption	<4 mA
DC input side	Open circuit voltage solar module at minimum operating temperature: <47 V
	Module current: 8 A
DC output side	Load current: 8 A
	End of charge voltage: 13.9 V (27.8 V)
	Boost charge voltage: 14.4 V (28.8 V)
	Reconnection voltage (SOC / LVR): >50%/12.4…12.7 V (24.8…25.4 V)
	Deep discharge protection (SOC / LVD): <30%/11.2…11.6 V (22.4…23.2 V)
Operating conditions	-25…+50 °C
Fitting and construction	Degree of protection: IP 32
	Dimensions (X x Y x Z): 145 x 100 x 24 mm
	Weight: approx. 150 g

INSTRUCTIONS

Use the following setup to connect an ultrasonic sensor to the ADAM. See highligted input channels marked here below. The wire colors used in the connection diagram below only applies in case the cable is supplied by Kintech Engineering.



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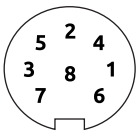
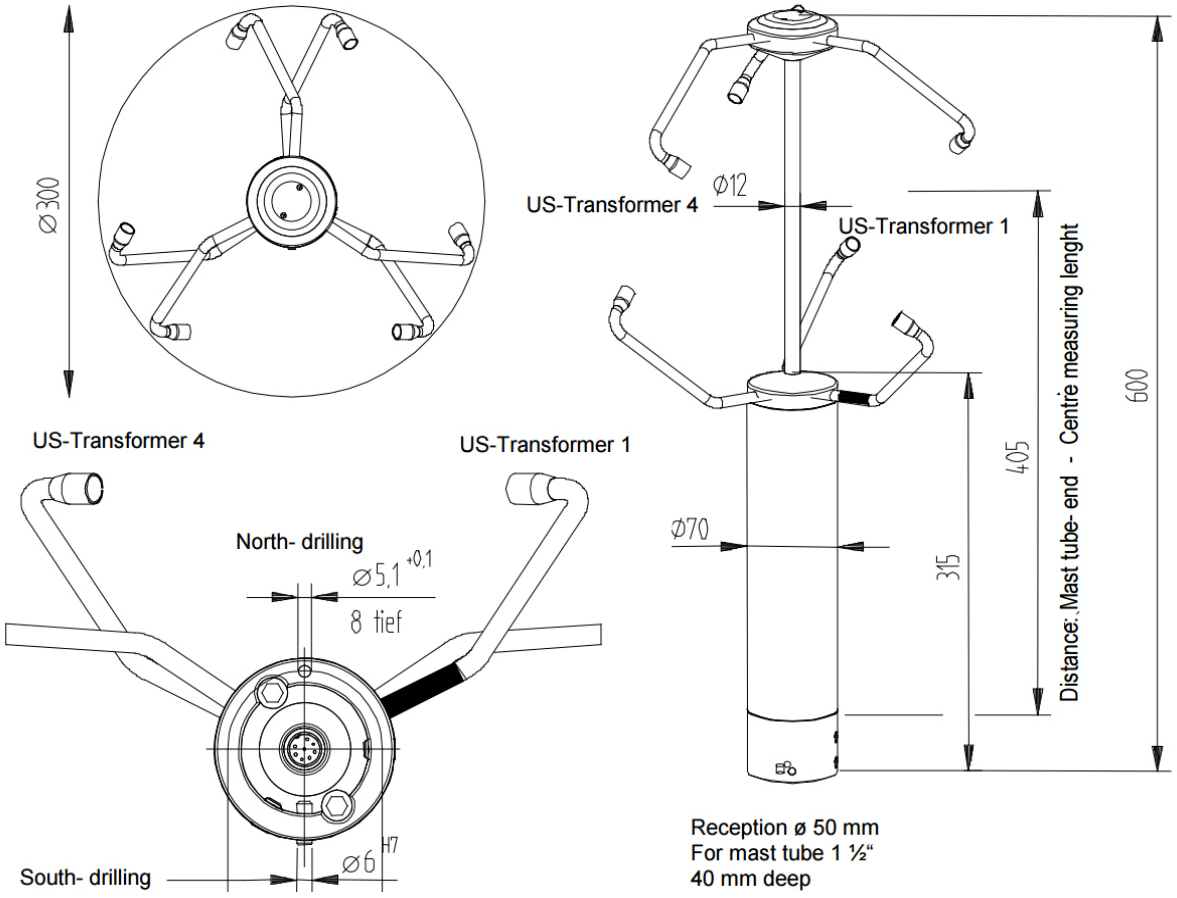
SENSOR PIN DESCRIPTION			ADAM-4520		STECA SOLSUM8.8F		DATA LOGGER INPUT CHANNEL		KINTECH COLOR CODES	
	1	**Do not connect!**								
	2	TX- / RX-	DATA	(-)					○	White
	3	**Do not connect!**								
	4	**Do not connect!**								
	5	TX+ / RX+	DATA	(+)					●	Yellow
	6	**Do not connect!**								
	7	Power (-)			Load	(-)			●	Brown
	8	Power (+)			Load	(+)			●	Green
	-	Shield					BAT	GND	◐	Yellow - Green
			Vs	(+)	Load	(+)			●	Red
			GND		Load	(-)			●	Black
					Battery	(+)	BAT	(+)	●	Red
					Battery	(-)	BAT	(-)	●	Black

SENSOR DIMENSIONS



HOW TO CONFIGURE THIS SENSOR IN EOL MANAGER

Open EOL Manager and go to the data logger you are working on. Open the "inputs" tab and select the following type and model for the 4 available magnitudes measured by the Ultrasonic Anemometer:

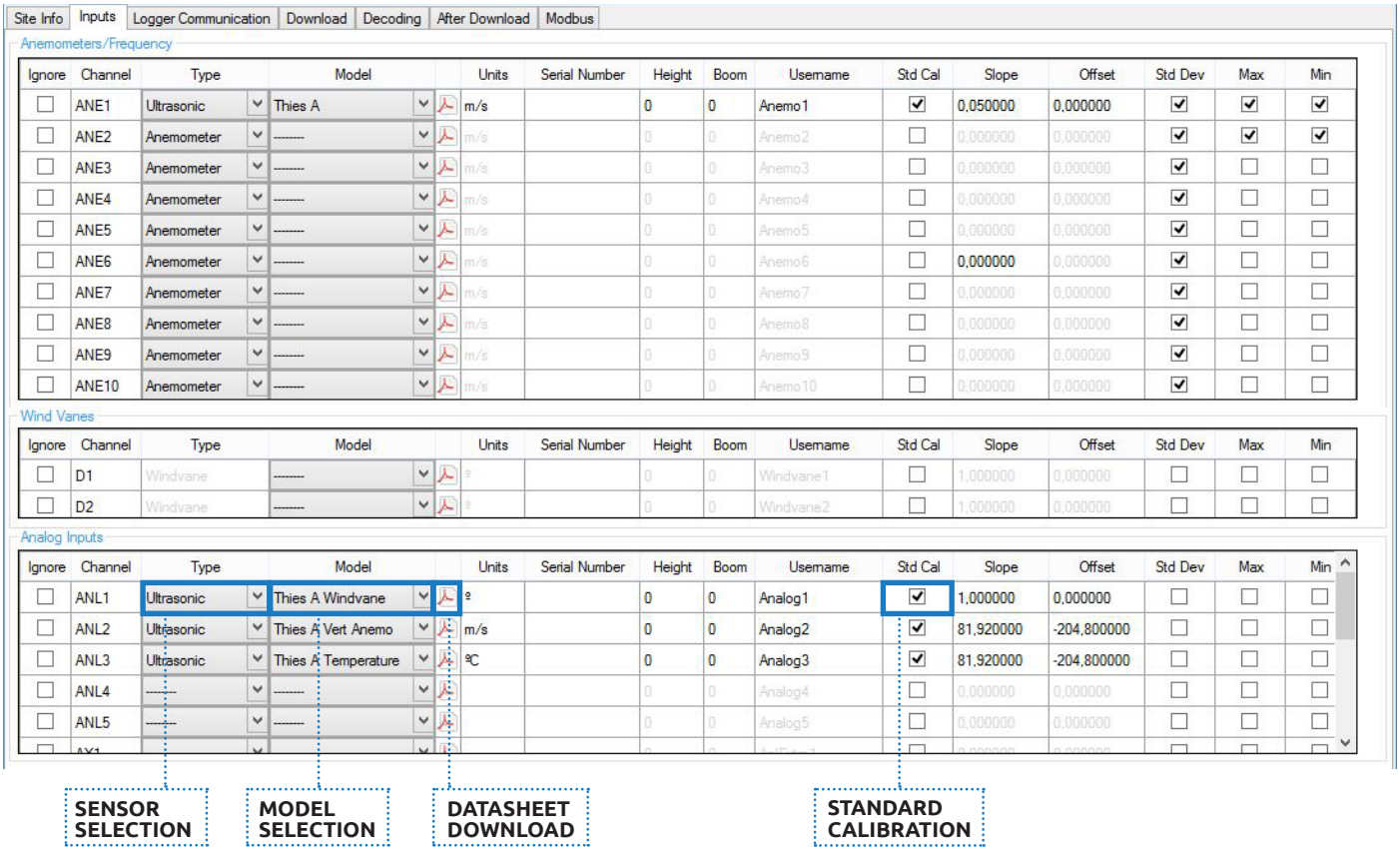
WIND SPEED	
Section	Anemometer/Frequency
Type	Ultrasonic
Model	Thies A

WIND DIRECTION	
Section	Analog Inputs
Type	Ultrasonic
Model	Thies A Windvane

VERTICAL WIND SPEED	
Section	Analog Inputs
Type	Ultrasonic
Model	Thies A Vert Anemo

ACOUSTIC VIRTUAL TEMPERATURE	
Section	Analog Inputs
Type	Ultrasonic
Model	Thies A Temperature

Calibration values: Tick the "Std Cal" to use this sensors standard slope and offset. If you have an independent calibration certificate for this sensor insert the slope and offset values from this certificate.



IMPORTANT

- After configuring the sensor in EOL Manager make sure to upload the configuration file to your EOL Zenith data logger. See the "Quick User Guide" how to upload configuration files to the data logger.
- All sensor wire shields must be connected to the data logger GND terminal.
- The data logger should always be connected to a separated ground rod. **Not** to the lightning rod of the tower.
- To store data such as Std Dev, Max and Min you should tick the corresponding boxes next to each anemometer channel when setting up your site file. Otherwise these parameters will not be stored.
- The datasets configured on the ultrasonic sensor in EOL Manager will automatically "overwrite" the analog channels on the data logger. E.g. you configure the horizontal wind speed on Anemometer Channel 1 in EOL Manager (and the sensor is connected via the ADAM module) the physical Anemometer Channel on the logger cannot be used.
- Up to 4 ultrasonic instruments can be connected to a single Eol Zenith data logger. If you wish to connect more than one Ultrasonic Anemometer, please contact our technical support.
- Cable recommendation:

Sensor	Signal cable 4x0.5 mm^2

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