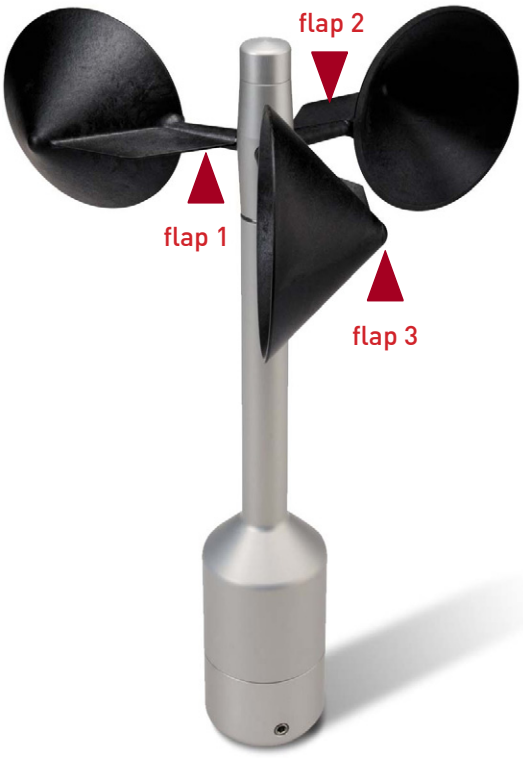
Thies Anemometer First Class Advanced

S11100 / S11100H
(P6101 / P6101H)

Accredited according to: IEC 61400-12-1 (2005-12), CLASS A 0.9, B 3.0 & S 0.5
MEASNET, ISO 17713-1, CLASSCUP



Classification:
IEC 61400-12-1 (2005-12)

Class A	Classification Index A 0.9
Class B	Classification Index B 3.0
Class S	Classification Index S 0.5

Linearity (MEASNET):
r > 0.999 99 (4...20 m/s)

Optically Scanned Cup Anemometer

The anemometer Thies First Class Advanced gives outstanding performance. It is the only anemometer on the market that complies with all the requirements of IEC 61400-12-1 (2005-12), Class S 0.5.

Its performance ratings have even improved on the previous Thies First Class anemometer, which was rated the best of its kind according to the CLASSCUP / ACCUWIND Study, (Risø-R-1563-EN, Table 4-4).

This anemometer gives optimal dynamic performance with the following characteristics:

- High accuracy
- Minimal deviation from cosine line
- Excellent behaviour to turbulences
- Minimum overspeeding
- Small distance constant
- Low start up value
- Low power consumption
- Digital output

Measurement of power curves and site assessment reports are the main tasks for this instrument. The patented design is the result of long testing in the wind tunnel.

The sensor is designed for measuring the horizontal component of wind velocity in the fields of meteorology, climate measuring technology, site assessment, and the measurement of capacity characteristics of wind power systems (power curves).

For winter operation this instrument is equipped with electronically regulated heating to guarantee smooth running of the ball bearings and prevent the shaft and slot from ice build up.

Comparison of Performance of Anemometers

Cup Anemometer	Class A	Class B	
NRG max 40	2.4	7.7	Information as stated according to CLASSCUP & ACCUWIND Study (Table 4-4 horizontal wsp definition Risø R-1563-EN)
Risø P2546	1.9	8.0	
Vaisala WAA151	1.7	11.1	
Vector L100	1.8	4.5	
Thies First Class	1.5	2.9	
Thies First Class Advanced	0.9	3.0	IEC 61400-12-1 (2005-12) according to Deutsche WindGuard

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Specification

Characteristics		
Physical functionality	Optically scanned cup anemometer	
Delivered signal	Frequency output (pulse)	
Accuracy		
Accuracy	0.3...50 m/s 1% of meas. value or < 0.2 m/s	
Linearity	Correlation factor r between frequency and wind speed y = 0.0462* f + 0.21 typical r > 0.999 99 (4...20 m/s)	
Starting velocity	< 0.3 m/s	
Resolution	0.05 m wind run	
Distance constant	< 3 m (acc. to ASTM D 5096 - 96) 3 m acc. to ISO 17713-1	
Turbulent flow	Deviation Δv turbulent compared with stationary horizontal flow -0.5 % < Δv < +2 % Frequency < 2 Hz	
Inclined flow - mean deviation from cosinus line - Turbulence effect	 < 0.1 % (in range of ±20°) < 1 % (in the range up to 30% turbulence intensity)	
Wind load	Approx. 100 N @ 75 m/s	
Operating range		
Measuring range	0.3...75 m/s	
Survival speed	80 m/s (mind. 30 min)	
Permissible ambient conditions	-50...+80 °C, all occuring situations of relative humidity	
Electrical data		
Output signal	Form rectangle, 1082 Hz @ 50 m/s, supply voltage max. 15 V	
Electrical supply for optoelec. scanning	Voltage: Current:	3.3...42 VDC (galvanic isolation from housing) 0.3 mA @ 3.3 V (w/o external load) < 0.5 mA @ 5 V (w/o external load)
Electrical supply for heating*	Voltage: Idling Voltage: Power Consumption:	24 V AC/DC (galvanic isolation from housing) max. 30 V AC, max. 42 VDC 25 W
General		
Connection	8-pole plug-connection for shielded cable in the shaft	
Mounting	on mast tube R1"	
Dimensions	290 x 240 mm	
Fixing boring	35 x 25 mm	
Weight	approx. 0.5 kg	
Finishes - housing	Anodised Aluminiun	
Fineshes - cup star	Carbon-fibre-reinforced plastic	
Protection	IP 55 (DIN 40050)	
Patented	EP 1398637	
EMC	EN 61000-6-2:2001 (immunity)	
	EN 55022:2001, Class B (interfering transmission)	
Manufacturer	Thies 4.3351.10.000 (without heating) / 4.3351.00.000 (with heating)	

* applies only for S11100H (P6101H)

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Cable Connection

Characteristics curve / Calibration
Wind speed Y is determined by the linear function of the frequency output f:

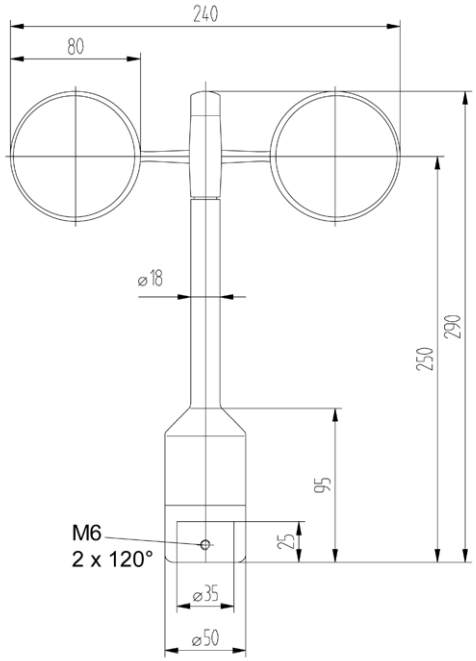
Y = a* f + b

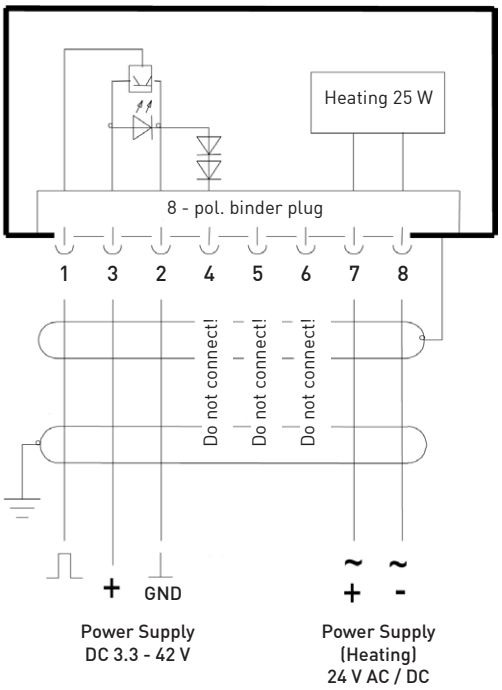
Y = corrected values (m/s)
a = slope (m)
f = row data (1/s)
b = Offset (m/s)

Manufacturers instructions:
Slope = 0.046 m
Offset = 0.21 m/s

For wind assessment campaigns it is required to perform an individual MEASNET calibration of each ane-mometer in a wind tunnel test to achieve an opti-mum accuracy and precision. After calibration please use the values for slope and offset according to the calibration protocol.

Dimensional Drawing





Sensor Connection

Sensor	Plug Pin No.	Ammonit Cable Wire Colour	Meteo-40 Counter	Supply Sensor
Wind speed Pulse output	1	white	CNT	
Supply	3	red		12V
Ground	2	black		Main Ground
Heating	7	orange, orange		24V AC/DC
	8	violet, violet		

Connect the shield logger-sided to Ground (GND)

Cable type without heating: LiYCY 3 x 0.25mm²
Cable type with heating wires: LiYCY 7 x 0.25mm²

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Abstract: Summary of Cup Anemometer Classification

According to IEC 61400-12-1 [2005-12] Classification Scheme

Reference:
Deutsche WindGuard Wind Tunnel Services GmbH AK 08 1662.01
Measuring period: 09.2007 - 05.2008
Test site: Varel
Wind Tunnel: Deutsche WindGuard GmbH, Varel

Off Axis Response

According to:

WindGuard Calibration Procedure 04/2008

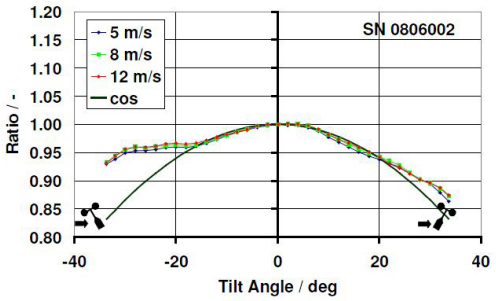
IEC 61400-12-1
Wind Turbine Power Performance Testing 2005-12

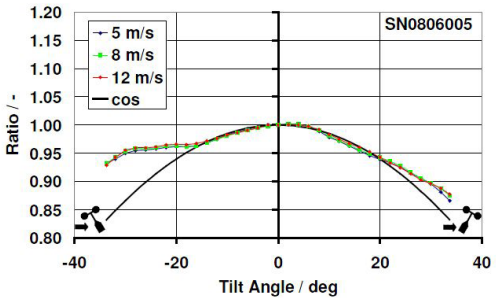
ISO 17713-1
Wind tunnel test methods for rotating anemometer performance 2007-05

Result:

Figures sowing the of axis response of Thies First Class for tunnel speed of 5 m/s, 8 m/s and 12 m/s.
Average deviation of cosine response 0.1 percent in the range of ±16 degree.

Uncertainty in angle measurement: 0.2 deg
Uncertainty in zero tilt angle < 0.1 deg
Uncertainty due to wind tunnel < 0.1 m/s





Class A Classification

According to:

IEC 61400-12-1
Wind Turbine Power Performance Testing 2005-12

ACCUWIND - Method for Classification of Cup Anemometers Risø-P-1555

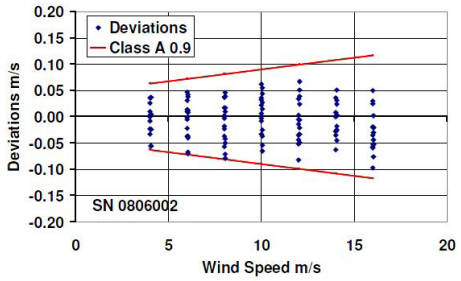
Influence parameter range:

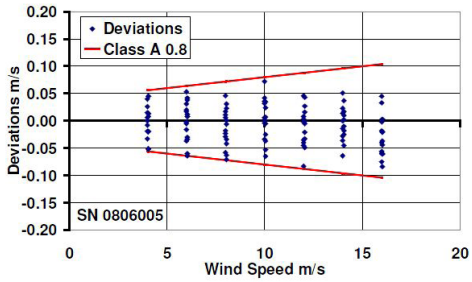
Wind speed range:	V = 4m/s - 16m/s
Turbulence intensity range:	0.003 - 0.12+0.48/V
Turbulence structure:	1.0/0.8/0.5
Air temperature:	0°C - +40°C
Air density:	0.8 - 1.3kg/m³
Flow angle:	-3 deg - 3 deg
Wind simulation:	Kaimal wind spectrum with longitudinal turbulence length scale of 350m

Result:

Figures showing the calculated total measurement error of the Thies First Class aAdvanced anemometer taking into account all influencing parameters. Negative sign: underestimation of wind speed.

Classification Index: **A 0.9**





Source: Summary of Cup Anemometer Classification, Adolf Thies GmbH & Co.KG, Deutsche WindGuard GmbH, Varel, 2008.

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