# Small-scale wind turbine certification with imc systems

## Windtracker – quiet, space-saving and efficient

The new vertical “Windtracker” turbine without blades and with IEC 61400 certificate

## Wind of Change

Directtech has reinvented the wheel with their new Windtracker. To be more precise: the “wind wheel”. The large, rotating wind blades were replaced by a new technology. Unlike the large turbines with their often giant rotor blades that move like a propeller, the Directtech Windtracker has small vertical blades that rotate like a gyro in the wind and thus generate electricity.

The Windtracker is 20 meters high and has a nominal output of 10 kilowatts. The vertical wind turbine not only eliminates the shadowing-effect, but it is almost completely silent and very compact. Thus, the new small-scale Windtracker can be installed in areas where larger turbines can't: e.g., in residential areas, in commercial parks, at charging stations for electric cars or on narrow street medians. It also provides a clean form of power generation for private customers – depending on the location, the Windtracker can generate enough electricity for two to six households.


Vertical wind turbine Windtracker, © Photo Directtech

## Tested according to IEC 61400

The world's first IEC 61400 certificate for a vertical wind turbine has recently been given by TÜV Rheinland to Directtech GmbH.

As part of the certification of the Windtracker turbine, all relevant safety requirements and loads on the wind turbine were tested. The verification and data analysis of the field measurements were carried out by the accredited company Windtest Grevenbroich. For performing the measurement tasks within the scope of small-scale wind turbine certification, Windtest used measurement systems from imc.

The meteorological data (temperatures, atmospheric pressures, etc.), mechanical loads (strain gauges), as well as current quality and sound emissions, were measured in long-term tests. The results are important for certification – as proof that the wind turbine meets the quality requirements for the market.

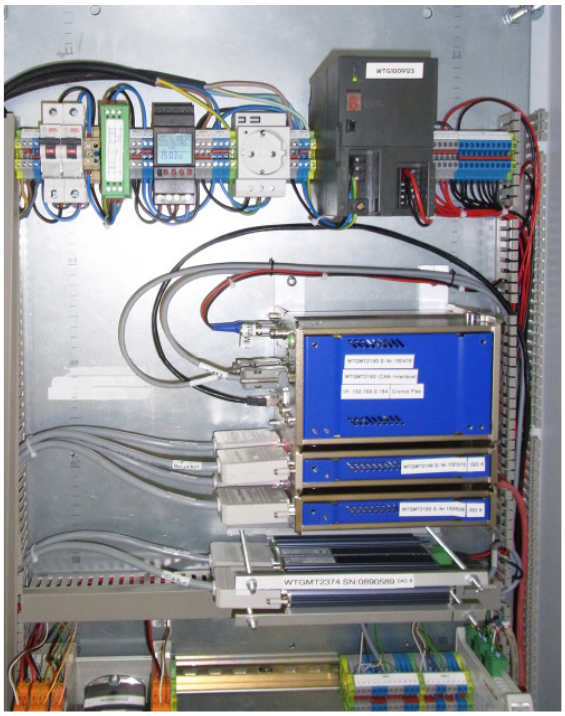
## Robust and distributable: imc CRONOS*flex*

The core of the certification test system is the modularly expandable imc CRONOS*flex* measurement device. It consists of the CRFX-2000 base unit and can be easily expanded with additional measurement amplifier modules. The base unit allows for an aggregate sampling rate of up to 2000 kSamples/s.

Base unit of the imc CRONOS*flex* system

In addition, the base unit offers:

- Integrated real-time analysis and control functionality with imc Online FAMOS
- TCP/IP Ethernet interface for the connection of a PC
- Built-in flash memory and optional hard drive
- Connection possibility for GPS (time and position information)
- Self-starting and data backup function in case of power failure

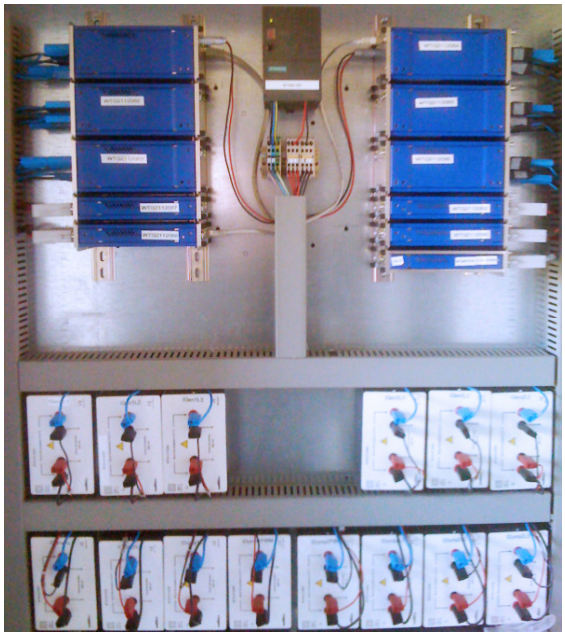


Main cabinet with imc CRONOS*flex* base unit with measurement modules and imc CANSAS

## Measurement modules

The imc CRONOS*flex* series offers a wide range of amplifier types with up to 100 kS/s per channel, integrated signal conditioning and sensor supply. The system supports almost every sensor. Whether analog signals, incremental encoders, digital process variables or data from fieldbus systems such as CAN, CAN FD, PROFIBUS, PROFINET – all are acquired synchronously by the imc CRONOS*flex*.

Thanks to the robust design, the measurement system ensures precise results even under difficult ambient conditions with high temperature fluctuations.



Cabinet with measurement modules from imc

The ISO2-8 and HV-4U modules were chosen for the certification measurement.

The ISO2-8 is an isolated, differential measurement amplifier with 8 galvanically-separated channels for high-precision measuring of:

- Voltage and current (20 mA)
- Temperatures (thermocouples and PT100)
- IEPE/ICP sensors (using an optional DSUB extension plug)

Amplifier module ISO2-8

**Special features of the ISO2-8 amplifier:**

- Channel-wise isolated, galvanically-separated inputs
- Finely adjustable input voltage range (±5 mV to ±50 V)
- High signal bandwidth up to 11 kHz
- Each channel with its own adjustable filter (e.g., anti-aliasing filter) and simultaneous A/D converter
- Supports *imc Plug & Measure* (Transducer Electronic Data Sheets (IEEE 1451))

With the four-channel **HV-4U** amplifier, high voltages up to 1000 V can be measured.

Amplifier module HV-4U

**Special features of the HV-4U amplifier:**

- Measurement of voltages of up to 600 $V_{RMS}$ (CAT III) / 1000 $V_{RMS}$ (CAT II)
- 48 kHz analog bandwidth (-3 dB)
- Phase accuracy better than 1° for measurements of up to the 50th harmonic of 50/60 Hz line voltage
- Input ranges from ±1000 V to ±2.5 V, selectable per channel

## imc CANSAS modules in operation

For the measurements in the tower, imc CANSAS modules are used. The system transmits the recorded data is via CAN bus to the base unit in the station building. The complete test is monitored by a computer in the main building.

The imc CANSAS-CI8 module is an isolated differential measurement amplifier with 8 channels and is ideal for the measurement of:

- Voltage
- Current (20 mA sensors)
- Thermocouples
- PT100 (optional PT1000) temperature sensors
- Resistance

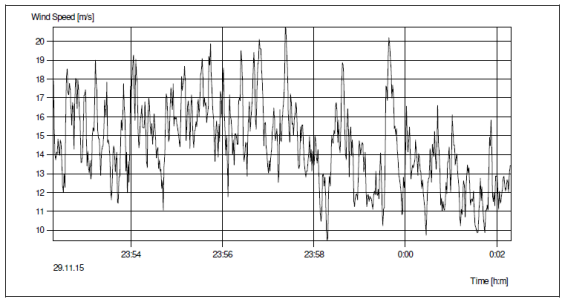
**Special features**

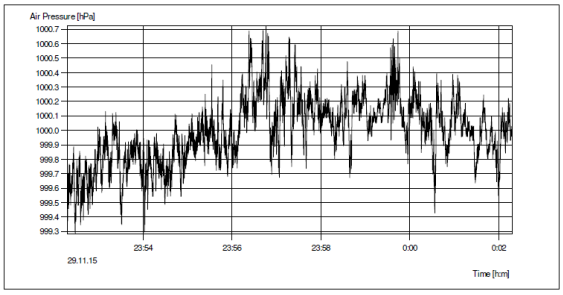
- Isolated channels allow measurements in environments where the potential conditions are not properly defined
- Measurement of signals on high electrical common-mode potential
- 440 Hz bandwidth at max. 1 kSps/channel sampling rate
- Measurement ranges and sampling rates can be individually selected (in 1, 2, 5 steps)
- 16-bit resolution (with internal 24-bit processing)
- Supports imc Plug & Measure TEDS (Transducer Electronic Data Sheets, IEEE 1451.4)

## Data analysis and evaluation with imc FAMOS

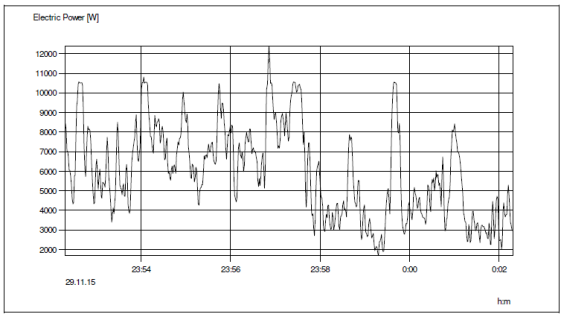
For the visualization, evaluation and documentation of the measurement data, Windtest uses the proven imc FAMOS data analysis software.

In this case, both the meteorological data, such as wind speed, wind direction and air pressure, as well as the performance data of the turbine and its accompanied loads are examined.



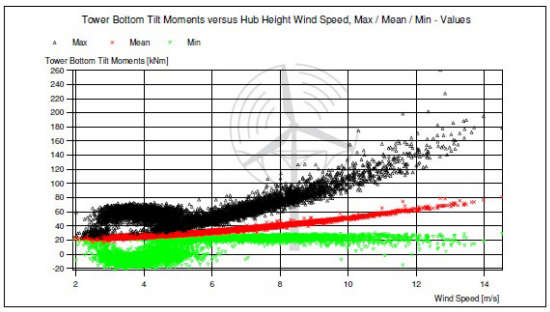



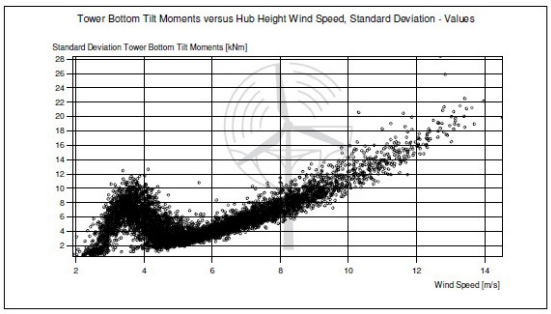

Example: meteorological data such as wind speed and air pressure




Example: electrical power data

Finally, Windtest compiled a comprehensive test report for the customer Directtech, which documented the results of the stress and durability tests of the wind turbine.




Example: load data evaluation

The combination of simple operations and powerful functions ensured productivity throughout the evaluation process. For example:

- Quickly calculate large amounts of data: 64-bit technology
- Visualization at the push of a button
- Comprehensive analysis functions
- Multi-page report generation
- Multi-layered macro creation
- Project management

## Additional information:

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