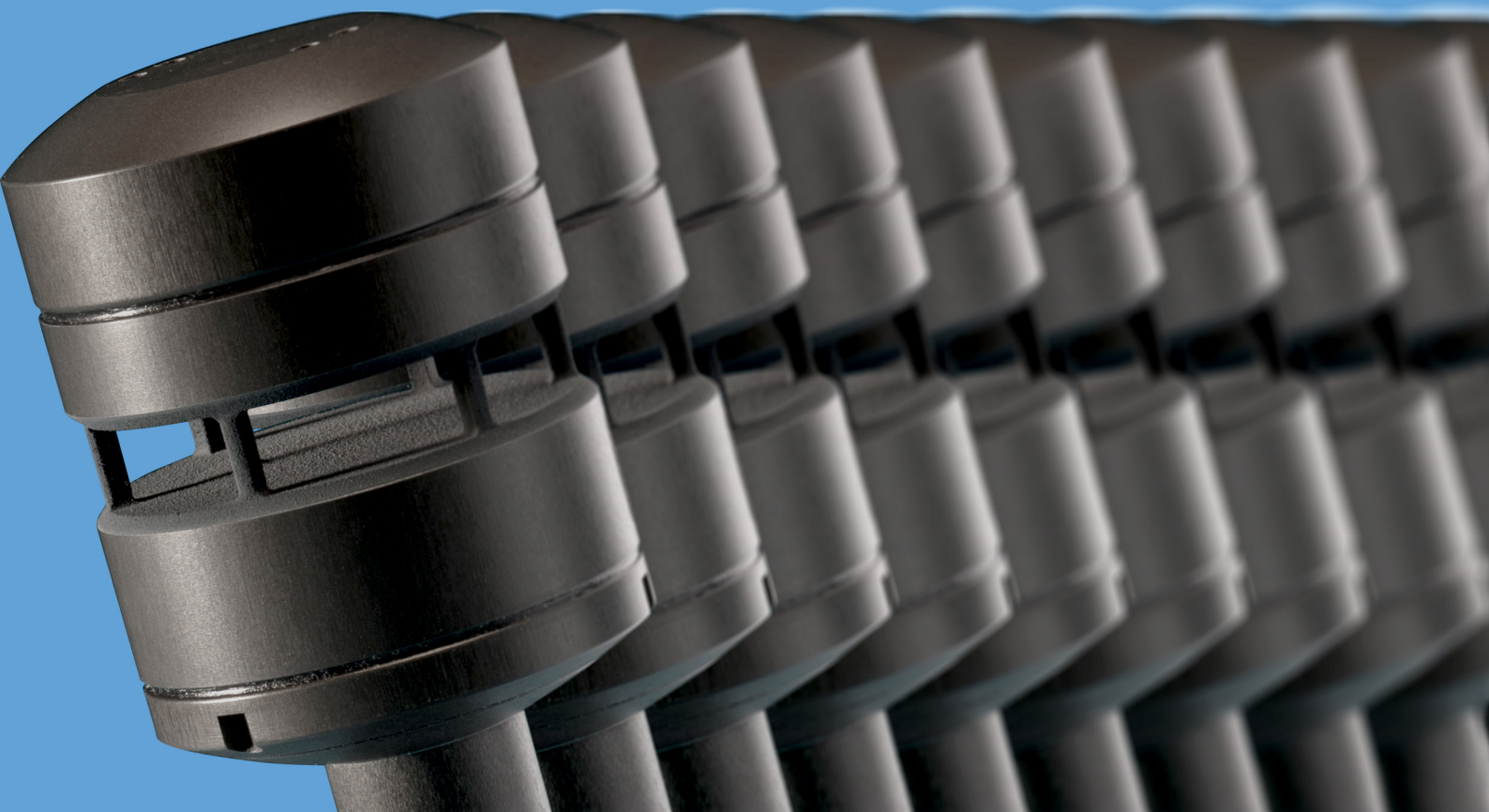


## FT702LT Turbine control wind sensor...



...gives durability a new meaning

# FT702LT series



# Proven

## High Availability

The FT702LT ultrasonic anemometer is the result of FT Technologies' 10 years of experience in designing durable turbine control wind sensors for the demanding environment outside a wind turbine. Users typically experience data availability of more than 99.9% as the ultrasonic anemometer keeps on working in many adverse environments where traditional sensors fail.

These high levels of availability are achieved through the use of Highly Accelerated Lifecycle Testing during design, an extensive independent testing programme and a robust solid state design with no moving parts to degrade. The sensor is probably the most tested wind sensor in the world. It has passed over 28 independent tests including sand, dust, ice, vibration, drop, corrosion, hail and lightning protection.

Powered by our patented Acu-Res technology the FT702LT delivers reliable measurements for many years. All our sensors are 100% wind tunnel checked before dispatch to ensure that the sensor will make a significant contribution to turbine availability and productivity.

## Powerful De-Icing

The sensor is fitted with a thermostatically controlled 'all-body' heating system. The sensor maintains its temperature at a user specified heater set point of between 0°C and 55°C. Three software controlled heaters are used to distribute heat intelligently over the entire sensor.

In standard format the heaters draw a maximum of 99W. For extreme environments the current limit can be adjusted (power supply and cabling permitting) from 0.1 to 6 Amps. The sensor's small size means that the power is used very effectively ensuring that the sensor can stay ice-free.

## Proven Lightning Protection

Wind sensors are exposed to high levels of electromagnetic interference from static discharges and nearby lightning strikes. The sonic FT702LT incorporates robust protection circuitry to shield it against these effects. The sensor will survive undamaged lightning induced surges in excess of 4kA 8/20µs.

## Installation Flexibility

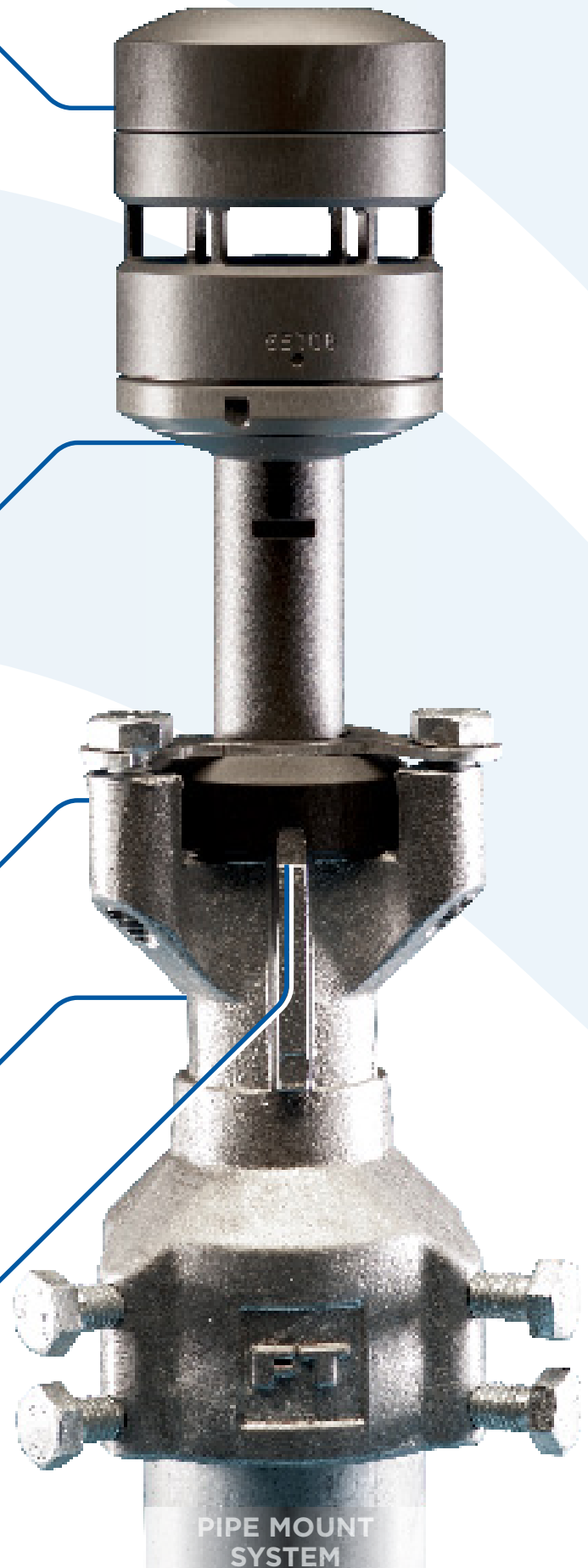
The FT702LT series has two physical mounting options.

The flat front mounting for fitment to a bar or the pipe mount system for fitment to a pipe. The pipe mount system gives improved environmental protection as the communication and power cable is kept fully protected inside the pipe.

## Used Everywhere

The FT702LT series has been used on wind turbines for over 10 years. In that time more than 65,000 sensors have been installed all over the world from Mongolia to Alaska.

Over 70% of all offshore wind turbines are fitted with an FT702LT sensor and the sensor is used by 12 of the largest manufacturers in the world.



# Reliable

## Environmental Protection System

The Acu-Res EPS means the sensor works reliably in the most extreme conditions and helps to guarantee high data availability.

The EPS incorporates:

### Robust, compact form

**Designed for:** Impact



**Tested and Proven:** Drop resistant: EN 60068-2-31 (2008) dropped 6 times at different angles from 1 metre onto steel faced concrete.



**Tested and Proven:**

Hail resistant: EN 61215 (2005) 10 hail stones, 7.5 grams each shot at the sensor at 23 m/s.

### Hard anodised alloy body

**Designed for:** Salt, sand and water



**Tested and Proven:**

Corrosion resistant: ISO 9227 (2006) & IEC12944 (1998) corrosion class C5M High corrosion test in Neutral salt spray atmosphere for 1440 hours.



**Tested and Proven:**

Sand and Dust resistant: DEF STAN 00-35 CL25 (2006) sand particles for 3 hours and dust particles for 3 hours, at 29 m/s air velocity, concentration 1.1g/m3.

### Three heaters: total temperature control

**Designed for:** Harsh winters



**Tested and Proven:**

Ice resistant MIL-STD-810G: Sensor remains ice free when freezing rain applied in a chamber with temperature -14°C wind speed 15m/s.



**Tested and Proven:**

De-icing MIL-STD-810G: Sensor exposed to freezing rain in airflow of 15m/s and -14°C. Ice built up to 45mm. Heaters switched on. Airflow and temperature unchanged. The sensor was ice free in under 15 minutes.

### Surge protection electronics

**Designed for:** Lightning



**Tested and Proven:**

- > Immunity for industrial environments EN 61000-6-2.
- > Electrostatic discharge immunity test EN 61000-4-2.
- > Electrical fast transient/burst immunity test EN 61000-4-4.
- > Surge immunity test EN 61000-4-5.
- > Pulse magnetic field immunity test EN 61000-4-9.
- > Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests EN 61000-4-29.

Additional EMC tests and full details available on request.

## Start

Eight sensors were independently calibrated prior to the following accelerated life tests.



### Solar Radiation

24 hours of UV radiation with an ambient temperature of 55°C, irradiance of 1120 W/m2.

Passed: EN 60068-2-5 (2000)



### Altitude

4 hours at a constant low pressure typical to 3000 metres above sea level. Additional tests in a dedicated altitude wind tunnel have shown that the sensor measures accurately up to 4000m

Passed: EN60068-2-13 (1999)



### Heat and Cold

16 hours of cold air at -40°C. 16 hours dry heat at +85°C. 74 hours of heat and cold, 16 temperature cycles from -40°C to +70°C.

Passed: EN 60068-2-1 (2007), EN 60068-2-2 (2007), EN 60068-2-14 (2009)



### 3 axis Sinusoidal & Random Vibration

5-500 Hz, 1 octave/min sweep range for sinusoidal 5-500 Hz, 90 mins per axis, 0.0075g2/Hz for random.

Passed: EN 60068-2-6 (2008), EN 60068-2-64 (2008)



### Water and Dust Protection

Exposed to a dust chamber for 8 hours.

Submerged in 1 metre depth of water for 30 mins.

Passed: EN 60529 (2000) - Sealed to IP67



### Stationary & Cyclic Humidity

Stationary relative humidity +93% for 240 hours.

Six 24 hour cycles, upper temperature 55°C.

Passed: EN 60068-2-78 (2002), EN 60068-2-30 (2005)



### Fog and Rain

Fog intensity of 1 to 2 ml/80cm2 for 1 hour.

Rain at 200 ±50 mm for 1 hour.

Passed: DEF STAN 00-35 Test CL26, DEF STAN 00-35 Test CL27

The eight sensors were checked again after the tests and their performance was unchanged.

## Finish

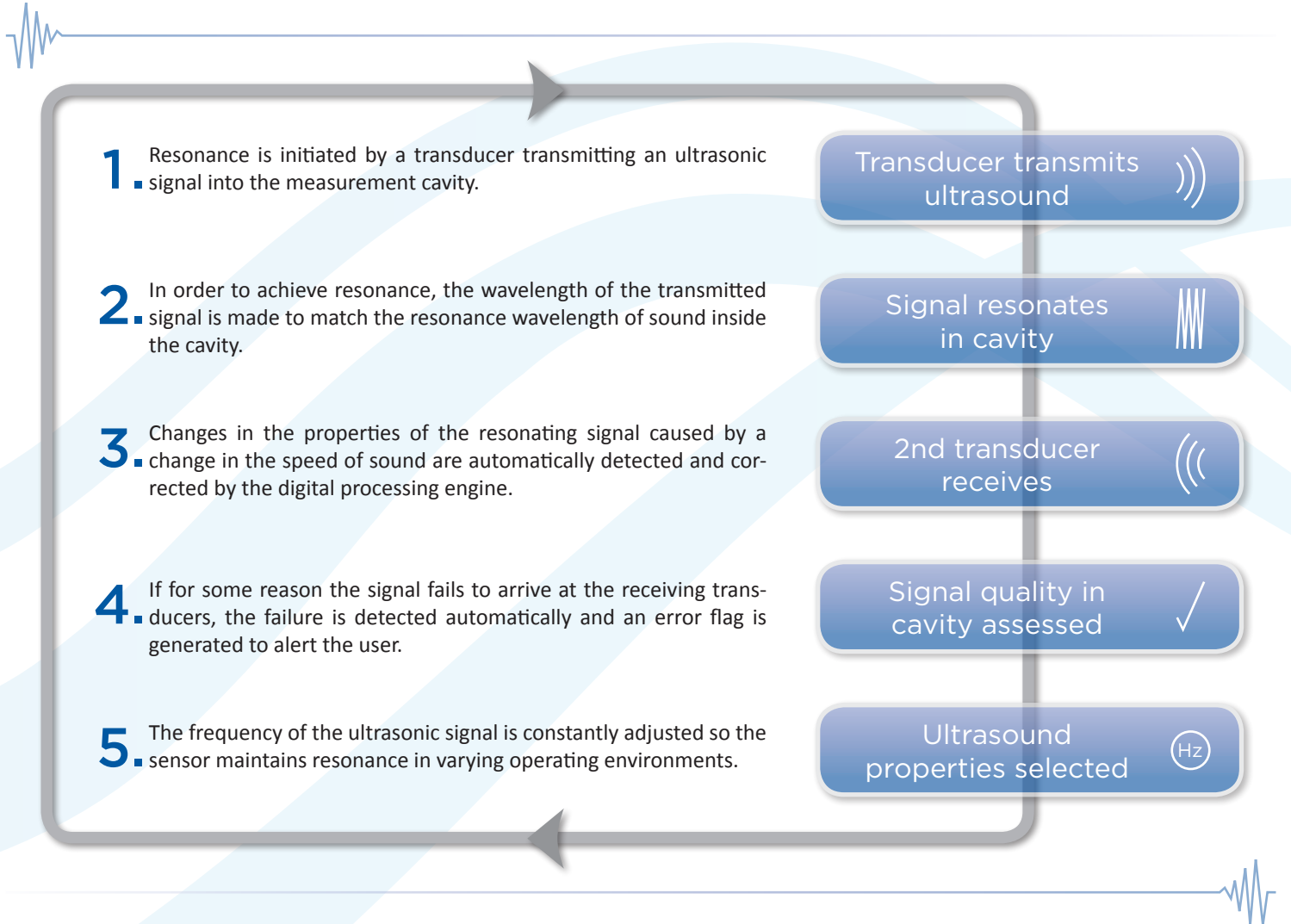
# Technology



This is FT Technologies' patented Acoustic Resonance technology. Acu-Res enables our sensors to take accurate measurements in a small space. This means our sensors are small, easy to heat, durable and strong. Acu-Res sets FT sensors apart from mechanical and other ultrasonic wind sensing technologies to give a more robust and reliable measurement solution.

The sensor works by creating a resonating ultrasonic signal inside the sensor's measurement cavity. The motion of air is sensed by measuring the phase change in the ultrasonic signal caused by the wind as it passes through the cavity. The sensor has three transducers arranged in an equilateral triangle. The net phase difference between a transmitting and receiving transducer pair is indicative of the airflow along the axis of the pair and by measuring all three pairs the component vectors of the airflow along the sides of the triangle are determined.

These vectors are combined to give the overall speed and direction. The sensor uses complex signal processing and data analysis taking a sequence of multiple measurements to calculate regular wind readings.



The sensor inherently compensates for changes in the air's temperature, pressure or humidity.

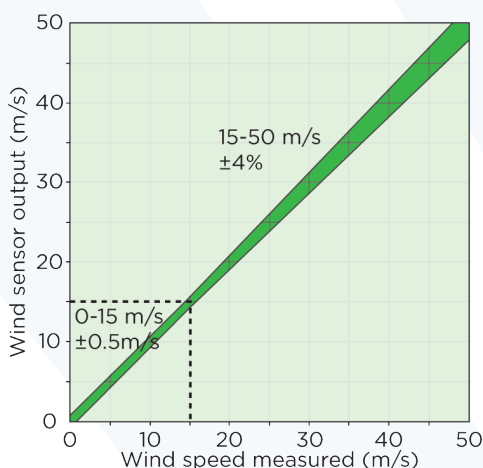
A strong resonating sound wave in a small space provides a large signal that is easy to measure. Acu-Res has a signal to noise ratio more than 40db stronger than other ultrasonic technologies.

# ACU-RES KEEPS WORKING REGARDLESS OF THE WEATHER

# Specification

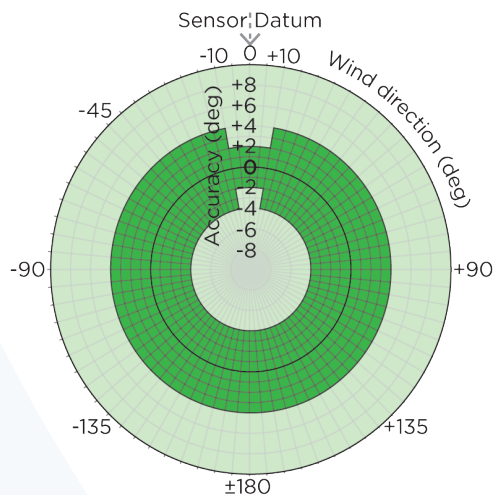
## Wind speed

|            |                                   |
|------------|-----------------------------------|
| Range      | 0-50m/s                           |
| Resolution | 0.1m/s                            |
| Accuracy   | ±0.5m/s (0-15m/s)<br>±4% (>15m/s) |



## Wind direction

|            |                                                    |
|------------|----------------------------------------------------|
| Range      | 0 to 360°                                          |
| Resolution | 1°                                                 |
| Accuracy   | ±2° (within ±10° datum)<br>±4° (beyond ±10° datum) |



## Sensor performance

|                       |                                                                                                    |
|-----------------------|----------------------------------------------------------------------------------------------------|
| Measurement principle | Acoustic Resonance (automatically compensates for variations in temperature, pressure & humidity). |
| Altitude              | 0-4000m operating range.                                                                           |
| Temperature range     | -40° to +85°C (operating and storage)                                                              |
| Humidity              | 0-100%                                                                                             |
| Ingress protection    | IP67, EN 60529 (2000)                                                                              |
| Heater settings       | 0° to 55°C. The heater set point can be configured.                                                |

## Power requirements

|                             |                                                                                                                                                                                                                                                             |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Supply voltage              | 20V to 30V DC (24V DC nominal)                                                                                                                                                                                                                              |
| Supply current (heater off) | 30mA                                                                                                                                                                                                                                                        |
| Supply current (heater on)  | 4A (default), 0.1-6A (max) – Configurable in software. Heater power consumption will depend on the energy required to keep the sensor's temperature at the user determined set point. The heater and sensor power consumption is limited by default to 99W. |
| Safety                      | Certified as Recognized Component to UL 61010-1 and CSA 22.2.61010-1-04 electrical safety standards                                                                                                                                                         |

## Physical

|               |                                                                        |
|---------------|------------------------------------------------------------------------|
| I/O connector | 5-way (RS485 option), 8-way (4-20mA option) multipole connector.       |
| Sensor weight | 320g (max) for Flat Front variant<br>350g (max) for Pipe Mount variant |

## Digital Sensor

|                  |                                                                |
|------------------|----------------------------------------------------------------|
| Interface        | RS485, galvanically isolated from power supply lines and case. |
| Format           | ASCII data, polled or continuous output modes.                 |
| Data update rate | 5 measurements per second.                                     |

## Analogue Sensor

|                           |                                                                                                                                                                                                                                   |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interface                 | 4-20mA, galvanically isolated from power supply lines and case.                                                                                                                                                                   |
| Format                    | One 4-20mA current loop for wind speed (different scaling factors are available). One 4-20mA current loop for wind direction (datum value configurable as 4mA or 12mA). Both analogue channels are updated five times per second. |
| 4-20mA configuration port | This port is for the user to change the internal settings of analogue sensors and to perform diagnostic testing. This interface is not intended for permanent connection to the turbine controller.                               |

## EMC and Environmental Tests

The FT702LT has 28 different environmental test certificates including Corrosion, Icing, De-Icing, Shock, Hail, Drop, ESD, short circuit, power interruption and EMC. **Further test details and full test reports available on request or via our website.**



# Product Range



All dimensions shown in mm

## Flat Front (FF)

## Pipe Mount (PM)

**Digital Sensors**  
**Analogue Sensors**

FT702LT-V22-FF  
FT702LT/D-V22-FF

FT702LT-V22-PM  
FT702LT/D-V22-PM

## Acu-Test Packs

These comprise Acu-Vis software and a specially developed cable which allows connection to a Windows PC and to a power supply. For the analogue sensor the software allows the functioning of the sensor to be checked and configuration changes to be made. For the digital sensor the software displays the sensor's settings and shows wind speed and direction in real time.

## FT089 Pipe Mount Adapter

This enables the pipe mount version of the wind sensor to be easily and securely mounted on to a pipe. It gives improved grounding and additional environmental and electromagnetic protection. The design allows the sensor to be removed and re-fitted without the need for re-alignment. The adapter is available as a finished product or as a set of drawings with a licence to manufacture.

FT Technologies Ltd.  
Sunbury House, Brooklands Close  
Sunbury on Thames, TW16 TDX, UK  
Tel: +44 (0)20 8943 0801 | info@fttechnologies.com

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