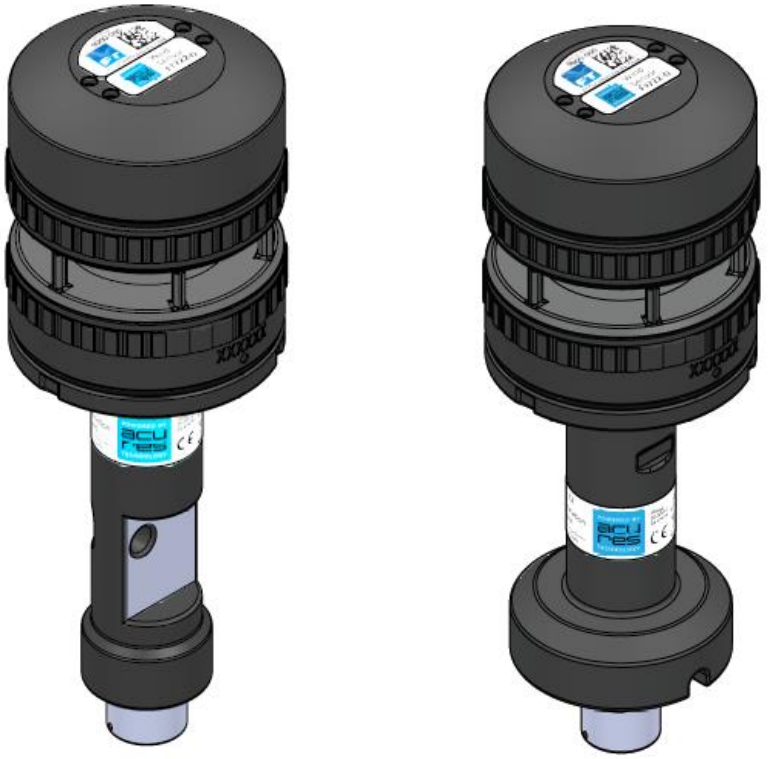
FT722 & FT742 - Analogue (4-20mA) Wind Sensor Manual

Flat-Front and Pipe-Mount Variants



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Contents

Product Symbols

The following symbols may be used upon the product and within the manual.

Meaning / Description	Symbol	Signification / Description
Warning/ Caution An appropriate safety instruction should be followed, or caution to a potential hazard exists		**Avertissement / Attention** Une instruction de sécurité doit être suivie ou attention portée à un danger potentiel qui existe.
DC Current only Equipment operates under Direct Current (DC) supply only.		**Courant continu uniquement** L'équipement fonctionne sous une alimentation en courant continu (CC) uniquement.
Product Disposal In accordance with European directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), these product components must be recycled. This should be done by returning the product to FT Technologies or by using an appropriate waste disposal company. This product should not be disposed of in general waste of landfill. This product complies with the RoHS2 (2011/65/EU) directive.		**Élimination du produit** Conformément à la directive européenne 2012/19/EU relative aux déchets d'équipements électriques et électroniques (DEEE), ces composants du produit doivent être recyclés. Cela doit être fait par le retour du produit à FT Technologies ou en utilisant une entreprise d'élimination de déchets. Ce produit ne doit pas être éliminé avec les ordures ménagères ou en décharge. Ce produit est conforme à la directive RoHS2 (2011/65/EU).
Recognized Component Sensors marked with the ETL label indicate that the product conforms to UL Standard 61010-1 and is certified to CSA Standard C22.2 No. 61010-1.		**Composant Reconnu** Les capteurs marqués avec l'étiquette ETL indiquent que le produit est conforme à la norme UL 61010-01 et est certifié à la norme CSA22.2 61010-01.
CE Mark The EU Declaration of Conformity complies with the essential requirements of the following applicable EMC Directive 2014/30/EU, and carries the CE Marking accordingly.		**Marquage CE** Déclaration de conformité CE de la compatibilité électromagnétique (EMC) et marquage CE conformément à la directive CE 2014/30/EU.

Safety Instructions

English

To ensure the safe installation and operation of this product

- The equipment must be installed and integrated;
    - Using suitably qualified and trained personnel
    - In accordance with any regional electrical codes
    - In accordance with the instructions set out in this manual, observing all information, warnings and instructions
    - In accordance with any other instructions or guidance FT Technologies provide
- To ensure that the product remains compliant with the electrical safety requirements of the UL / CSA 61010-1 Standards it must be;
    - Connected to an appropriately approved isolated power supply (for example UL/CSA IEC 60950-1:2005 + A1:2009 + A2:2013) rated 12-30VDC and be current limited (6A Max)
    - Protected by UL 1449 Listed surge protection devices
    - Connected with an approved interface cable (for example UL/ CSA recognised AWM style 21198, rated 300V, 80°C)
- The equipment must only be operated within the range of the specified technical data and used for the purposes for which it was designed
- The equipment should always be transported in packaging which is appropriate, that will prevent any accidental damage from occurring.
- Always ensure that any failures or errors from the product cannot cause any damage to any other equipment or property or cause any other consequential effects.

Consignes de Sécurité

Français

Pour assurer la sécurité de l'installation et le fonctionnement de ce produit

- L'équipement doit être installé et intégré ;
    - À l'aide de personnel qualifié et formé.
    - Conformément à tous les codes électriques régionaux.
    - Conformément aux instructions figurant dans ce manuel et en observant toutes les informations, avertissements et instructions.
    - Conformément à d'autres instructions ou directives que FT Technologies fournit.
- Pour garantir que le produit reste compatible avec les exigences de sécurité électrique de l'UL/CSA 61010-1 normes, l'équipement doit être :
    - Connecté à une alimentation agrée convenablement isolée (par exemple UL/CSA IEC 60950-1:2005 + A1:2009 + A2:2013) de tension nominale 12-30 VCC et avec courant limité (6 A max).
    - Protégé par des dispositifs de protection UL 1449 contre les surtensions.
    - Connecté avec un câble d'interface (par exemple UL/CSA reconnu AWM style 21198, de valeur nominale 300 V, 80°C).
- L'équipement doit être utilisé uniquement dans la plage des données techniques spécifiées et utilisé aux fins pour lesquelles il a été conçu.
- L'équipement doit toujours être transporté dans un emballage qui est approprié, qui permettra d'éviter qu'un quelconque dommage accidentel ne survienne.
- En toutes circonstances, garantir que les défaillances ou les erreurs du produit ne puissent pas causer des dommages à d'autres équipements ou autres biens ou provoquer d'autres effets indirects.

1 INTRODUCTION

1.1 Product Overview

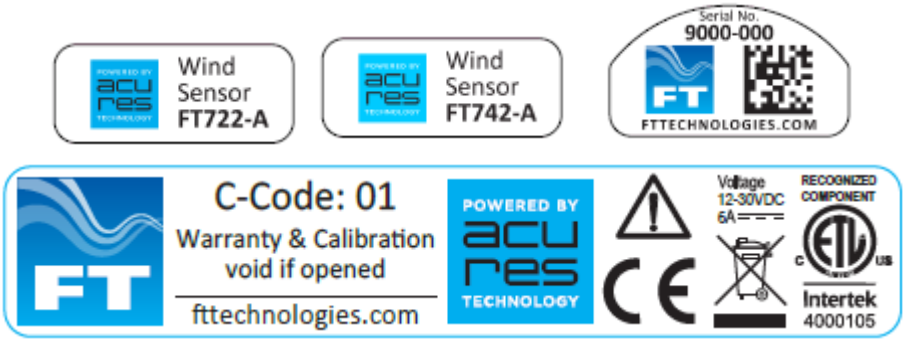
The FT722 and FT742 are solid-state ultrasonic wind sensors using a patented Acoustic Resonance airflow sensing technique to measure accurately both wind speed and direction. The sensors have been specifically designed to operate in harsh environments including offshore, lightning and ice-prone areas. The wind sensor has no moving parts to degrade or wear-out and is designed for applications requiring high reliability. They help reduce costly down-time and unscheduled maintenance visits.

Mounting and aligning the sensor is very simple. A 0° wind datum marking can be used to align the sensor to a reference point. For operation in ice-prone areas, the FT722 and FT742 are fitted with a highly-effective thermostatically controlled all-body heating system. A three element heater is used to ensure heat is evenly distributed over the entire surface area.

1.2 Build Versions and Labelling

The electrical interface is the same as our previous range of FT702LT/D (4-20mA) sensors. Pin-outs and default signal characteristics are unchanged.

Figure 1 shows how to identify a sensor, the serial number and calibration code (if applicable). See Section 2.2.3 for further calibration details.



Additional labels may be attached. Only sensors marked with the Intertek label conform to the UL Standard 61010-1 and are certified to CSA Standard C22.2 No. 61010-1.

Figure 1: Examples of Main Sensor Labels

1.3 Scope of Use

The sensors are designed, manufactured and optimised for high availability.

No promise in part or full can be given to guarantee a wind sensor's continuous operation, as exceptional circumstances can occur that may result in the failure of the output from a sensor. Exceptional circumstances can include;

- Poor installation
- Inadequate inspection
- Power supply failures
- Poor quality electrical connections
- Lightning exposure
- Problematic environmental conditions or combination of conditions
- Physical damage

Typically higher levels of wind speed and wind direction data availability are achieved through the use of an additional FT sensor or an alternative sensor. Control strategies or controller algorithms, which compensate in whole or in part, for any temporary interruption of data from individual sensors, should also be applied. The choice and implementation of such methods is entirely the Purchaser's responsibility.

1.4 Major Changes Compared to Previous FT702LT/D Analogue Products

- The FT742 has a higher speed range available (0-75m/s).
- A larger range of scaling options is available on the speed current loop (up to 0-100m/s), see Section 2.2.3 for full details.
- The FT722 and FT742 feature improved accuracy.
- A new innovative mechanical design incorporating a series of “turbulators” (patent pending) which condition the air flow to deliver improved accuracy.
- New optional Overspeed Warning Scheme introduced with new current loop behaviour (see Section 2.2). Disabled by default to match legacy behaviour.
- Faster 4-20mA current loop refresh rate (was 5Hz, now 10Hz). The averaging filter samples over the same time period but averages twice as many data points.
- An optional Selective Filter can be enabled (see Section 2.2.7), which rejects invalid wind data from entering the averaging filter, thus improving data quality and reducing error flags. Feature is disabled by default to match legacy behaviour.

It is strongly recommended that customers carry out their own product validation before deployment of the FT wind sensor.

1.5 FT722 and FT742 differences.

The FT722 is capable of recording 0-50m/s wind speeds.
The FT742 is capable of recording 0-75m/s wind speeds.

Since the maximum speeds are different, the optional overspeed warning is triggered at different speeds.

1.6 Disclaimer

There are no warranties, representations or conditions, expressed or implied of any kind given in this manual for any particular design application. The Purchaser should independently undertake sufficient testing to confirm validity and suitability of any design. The Purchaser assumes all risks and liability in conjunction with the use of the information given.

Any warranty given by FT Technologies in respect of the equipment is conditional upon the sensor being handled, installed, integrated and operated in accordance within the guidelines given in this manual.

FT Technologies can take no responsibility for the effectiveness of any sensor lightning protection scheme implemented. The wind sensor has passed a wide range of EMC tests but FT Technologies does not warrant the sensor to survive lightning strikes.

Information supplied by FT Technologies Ltd. shall not be construed as permission to license to operate under, or recommendation to infringe any existing or pending patent, patent applications or trademarks.

2 FUNCTIONAL DESCRIPTION

2.1 Technical Performance

Sensor Performance[1 & 2]

Measurement Principle	Acoustic Resonance, compensated against variations in temperature, pressure and humidity.	
Wind speed Measurement		
Range	FT722 0-50m/s	FT742 0-75m/s
Resolution	0.1m/s.	0.1m/s
Accuracy	±0.3m/s (0-16m/s) ±2% (16m/s-40m/s) ±4% (40m/s-50m/s)	±0.3m/s (0-16m/s) ±2% (16m/s-40m/s) ±4% (40m/s-75m/s)
Wind Direction Measurement		
Range	0 to 360°	
Accuracy	2° RMS (within ±10° of 0°) 4° RMS (beyond ±10° of 0°)	2° RMS (within ±10° of 0°) 4° RMS (beyond ±10° of 0°)
Resolution	1°	
Environment		
Temperature Range	-40 to +85°C (operating & storage)	
Humidity	0 - 100%	
Altitude	0 - 4000m	

Data I/O

Analogue Option	
Interface	4-20mA, galvanically isolated from power supply lines and case
Format	1x 4-20mA current loop for wind speed (see Section 2.2 for scaling factors) 1x 4-20mA current loop for wind direction (4-20mA = 0 to 360°) (see Figure 5 for offset options)
Reading Update Rate	10Hz
Configuration Port[3]	RS485 half-duplex, non-isolated relative to power ground

Power Requirements[4]

Supply Voltage	12V to 30V DC (24V DC nominal)
Supply Current (Heater off)	31mA typical
Supply Current (Heater on)	6A (max) – The heater is thermostatically controlled. Heater power consumption will depend on the heater energy required to keep the sensor's temperature at a user determined set point. The sensor is limited to 4A and 99W[5] by the default software settings.

Physical

Weight	Flat-Front - 320g (max). Pipe-Mount 350g (max. excluding adaptor)
Material	Aluminium alloy, hard anodised
I/O Connector	8 way (Analogue option)
Mounting Method	Flat-Front or Pipe-Mount options. Self-aligning, screw fixing

Notes:

1. All specifications subject to change without notice.
2. Specifications calculated with default settings.
3. The Configuration Port is provided to allow the user to change the internal settings of the sensor and to perform diagnostic testing. This interface should only be used for configuration and test purposes. This interface is not intended for permanent connection to the computer.
4. See safety instruction requirements (pages 4 & 5).
5. The heater set point, current limit and maximum power limits can be configured by programming the sensor's internal parameter settings.

2.2 Current Loops

2.2.1 Current Loop Characteristics

The wind sensor incorporates two galvanically isolated 4-20mA current loop outputs, one loop for wind speed and one loop for wind direction. These current loop outputs can be converted into measurable output voltages with the addition of external resistors.

Each loop should be powered from a DC supply in the range 12V to 30V. A positive supply must be provided to one of the current loop wires. The other wire must then be connected through a current meter to ground. This is because the current loops **sink** current, they do **not** source it. A common supply can be used if required. Loop connections are polarity insensitive so that the +ve or –ve loop supply connection can be made to either of the current loop connection pins. See example wiring in Figure 41.

The current loops are able to operate over long cable distances; however the overall loop resistance should not exceed the values given in Figure 2. It is recommended that twisted pair interconnection cabling should be used. The cable should also include an overall braided screen.

Loop Supply	Maximum Loop Resistance
20V	500 Ω
24V	700 Ω
30V	1000 Ω

Figure 2: Maximum Current Loop Resistance

The wind sensor's current loop outputs are updated at a rate of 10 times per second. An average of several readings should always be used for any calculations or control decisions because single readings can accidentally become corrupted (see Section 2.2.6).

2.2.2 Averaging Filter Characteristics

The sensor has an internal averaging filter enabled by default, which dampens the speed and wind direction outputs by averaging the previous 1.6 seconds of data (16 readings). It is possible to disable the internal filter (but not recommended) via the Acu-Test Analogue test software. Contact FT technologies for further information.

2.2.3 Wind Speed Loop

The default wind speed scaling is such that a change from 4 to 20mA represents either 0-50m/s (FT722) or 0-75m/s (FT742). This corresponds to a scaling factor of 0.3200mA (FT722) or 0.2133mA (FT742) per m/s. The measurement scaling factor can be changed for the wind speed current loop, however this can only be set in the factory. Figure 3 shows the wind speed calibrations that are available.

Wind Speed Scaling references	4mA	20mA	Scaling Factor (mA per m/s)
30	0m/s	30m/s	0.5333
35	0m/s	35m/s	0.4571
40	0m/s	40m/s	0.4000
45	0m/s	45m/s	0.3556
50	0m/s	50m/s	0.3200
55	0m/s	55m/s	0.2909
60	0m/s	60m/s	0.2666
65	0m/s	65m/s	0.2462
70	0m/s	70m/s	0.2286
75	0m/s	75m/s	0.2133
80	0m/s	80m/s	0.2000

85	0m/s	85m/s	0.1882
90	0m/s	90m/s	0.1778
95	0m/s	95m/s	0.1684
100	0m/s	100m/s	0.1600

Figure 3: Wind Speed Scaling Factors

On models where the full scale current has been configured above the maximum speed of the sensor, the maximum output current will be limited to an amount equivalent to the maximum speed.

The wind speed loop can also be calibrated with non-linear scaling functions.

If a wind sensor is replaced care must be taken to ensure that the 2 sensors have the same scaling. Otherwise the system processing the wind data might perform differently after the sensors are swapped

2.2.4 Wind Direction Loop

The wind direction scaling is such that a change from 4 to 20mA represents 360 degrees (with no dead band) which corresponds to a scaling factor of 0.0444mA per degree.

The sensor measures the wind direction relative to the 0 degree datum. The 0 degrees datum location for the sensor is shown in Figure 4.

The default current loop output when the wind is blowing towards the 0° datum direction is 12mA. If required, the direction loop can be set to give an output of 4mA at the datum direction. The output options are shown in Figure 5.

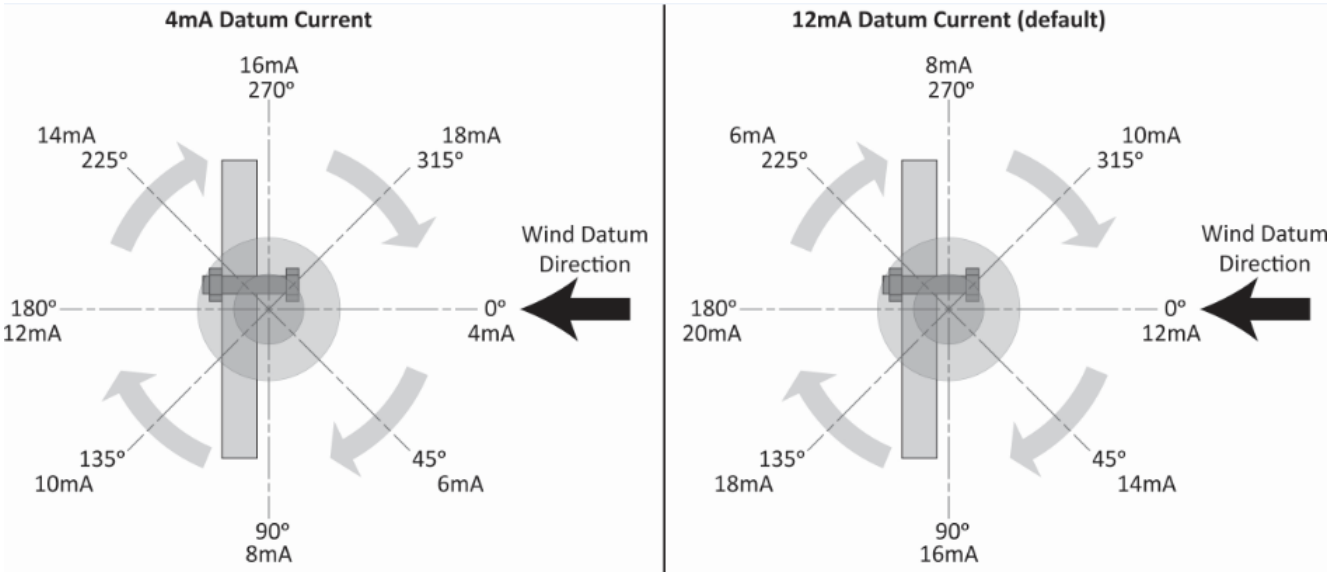


Figure 4: Visualisation of Direction with 4mA (left) and 12mA (right) Current Offsets (Flat-front Sensor Example)

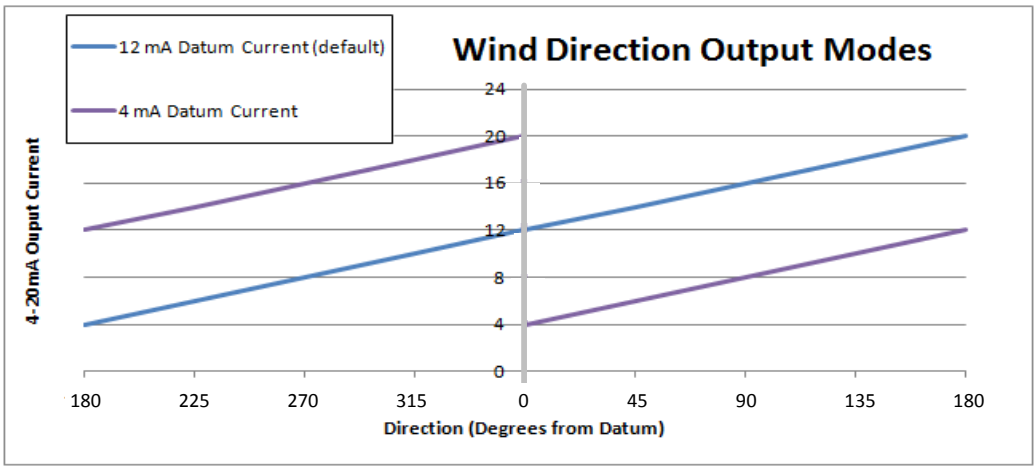


Figure 5: Comparison of Wind Direction Current Offsets

When operating in the 4mA datum current mode there is a 16mA transition each time the wind direction crosses the datum. In the 12mA datum current mode the output current varies linearly about the 12mA value as the wind direction moves around the datum.

2.2.5 Changing the Wind Datum Direction

The datum direction can be electronically rotated (either clockwise or counter clockwise) in 1° increments using the Acu-Vis Analogue software (see Section 4) to apply this adjustment. Once the datum offset has been set it will be retained in the sensor's Flash memory.

2.2.6 Error Detection

If the sensor detects that a reading may be invalid this is signalled to the controller or data logger by setting the current of both loops to a value of 1.4mA by default. The error current level can be configured (see Section 4) by the user from 1.4mA up to 3.9mA in steps of 0.1mA.

Note: An optional Overspeed Warning Scheme can be enabled (but is disabled by default). See below for further details.

The error condition must occur for more than 0.5 seconds for the current loops to be set to this condition. If an error occurs for less than 0.5 seconds then the loop outputs will be held at the last valid reading for the duration of the error.

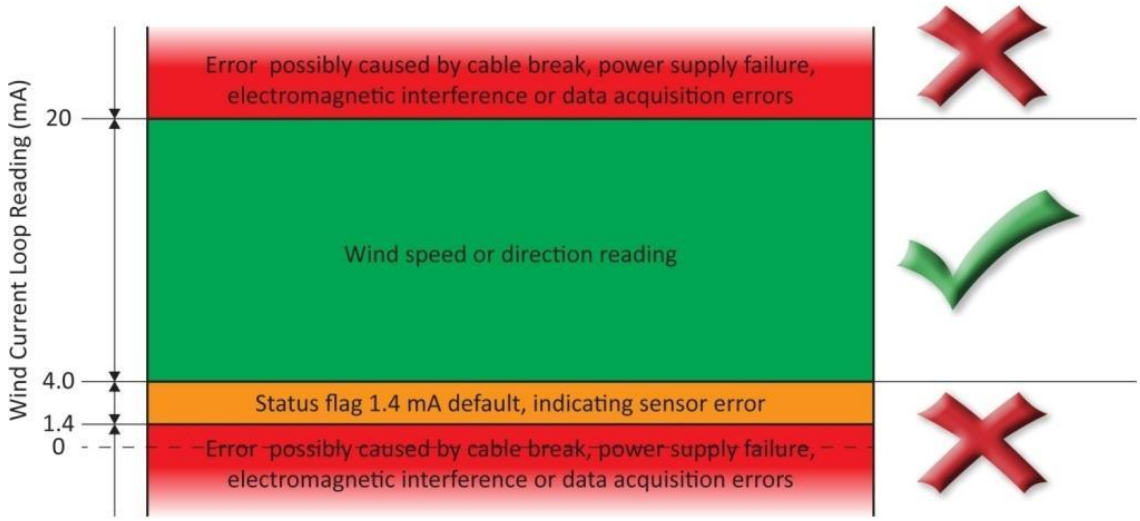


Figure 6: 4-20mA Valid Measurement Range

Always use an average of many readings for any calculations or control decisions because single readings can accidentally become corrupted.

The data acquisition system needs to not only sample the 4-20mA measurement range, but also should include logic to process and exclude data if it is outside of this range. The data acquisition system should distinguish between a status flag error sent by the wind sensor and other out of range readings (see Figure 6) in order to help diagnose if a fault has occurred with the power supply, cable or wind sensor.

It is important that error flags are not ignored. The system should be capable of riding through rare periods when data may be temporarily unavailable. If errors are ongoing (more than several seconds), a reset of the sensor should be applied (power-cycle the unit).

It is recommended that errors are monitored and logged. If the frequency of errors has recently increased, then inspection of the sensor for physical blockages may be required (see Section 4.1).

Overspeed Warning Scheme

During periods where the sensor detects wind speed beyond the rating of the sensor, the sensor will (by default) indicate an error by setting both current loops to the error flag current level, the same as it does for other invalid readings. This is to match the legacy behaviour of the FT702LT/D sensor.

An additional feature is included in the sensor called the Overspeed Warning Scheme (disabled by default). This scheme can be used to distinguish between overspeed events and other invalid readings. When enabled and during overspeed events, the scheme works in the following way:

1. The direction current loop will be set to the error flag current level (1.4mA by default).
2. If the wind speed scaling range is equal or above the maximum speed; the speed current loop is set to maximum (FT742 example: default 0-75m/s range, will read 20mA in overspeed conditions).
3. For scaling ranges below the maximum speed; the speed current loop is set to a value of 20.48mA. (FT722 example, set to 0-40m/s range, set to 20.48mA).

The Overspeed Warning Scheme can be enabled in the factory, or by the user using the Acu-Vis test software.

2.2.7 Selective Filter

In addition to the averaging filter described in Section 2.2.2, the sensor has an optional feature called the Selective Filter that may improve data quality. The scheme allows the user to set a “validity period”, during which the sensor will exclude invalid readings from entering the averaging filter. The output will freeze on the last previous “good” reading and only raise an error flag (see Section 2.2.6) once the number of bad readings exceeds the validity period. This scheme can be enabled by factory configuration. The filter is turned off by default to match legacy behaviour.

2.3 Heater Setup

The sensor is fitted with an integral three-element distributed heater that can be used to prevent icing-up of the sensor in freezing temperatures. The heater is controlled automatically by the sensor using a user programmable ‘set point’ temperature. The sensor uses a control scheme which dynamically changes the current supplied to each individual heater element in order to maintain the programmed set point temperature.

It is important to consider the resistive losses in the cable and rate the cable appropriately. In general, power losses in the cable should be minimised in order to maximise the available heating power to the sensor.
A heater setpoint temperature of 30°C+ is recommended for most applications. To change the heater set point or to disable the heater use the Acu-Vis test software (see Section 4).

Since the heater circuit is thermostatically controlled, the actual power being drawn from the supply will depend on the programmed set-point and the environmental conditions (i.e. ambient temperature, wind speed, precipitation etc.). The maximum power that the sensor can consume is by default limited to 99W (with the heater enabled). The power supply must be rated to provide the maximum power that the sensor can consume.

The maximum current limit of the sensor can be adjusted between 0.1 and 6.0 Amps (from the default of 4 Amps and in increments of 100mA). The current limit can be modified by the factory or by using the Acu-Test PC software (see Section 4). The heater requires a minimum voltage for operation, by default this is set to 11VDC, this can be modified by the factory.

3 MECHANICAL INSTALLATION & LIGHTNING PROTECTION

Two mounting options are available and have different mechanical dimensions and properties. The Flat-Front sensor allows for simple mounting against a flat bar using a single screw, nut and washer. The Pipe-Mount sensor offers enhanced cable shielding from environmental factors and an improved low-resistance ground path for lightning protection - the pipe mount sensor may be preferred for difficult or lightning-prone areas. See Section 3.1 for Flat-Front sensors, Section 3.2 for the Pipe-Mount sensors.

Ensure the airflow into the sensor is not obstructed or influenced by nearby objects. We recommend a minimum clearance distance of 20cm between the sensor and other objects.

See safety instruction requirements on pages 4 & 5.

The wind sensor installation must be properly designed to ensure the correct operation of the sensor. This section is for guidance only. It is the responsibility of the designer and installer to ensure that the installation and its design is fit for purpose. Please see disclaimer Section 1.6.

3.1 Flat-Front Sensors

3.1.1 Mechanical & Electrical Integration

The flat-front model has a flat contact area used to attach the sensor onto a mechanical bracket.

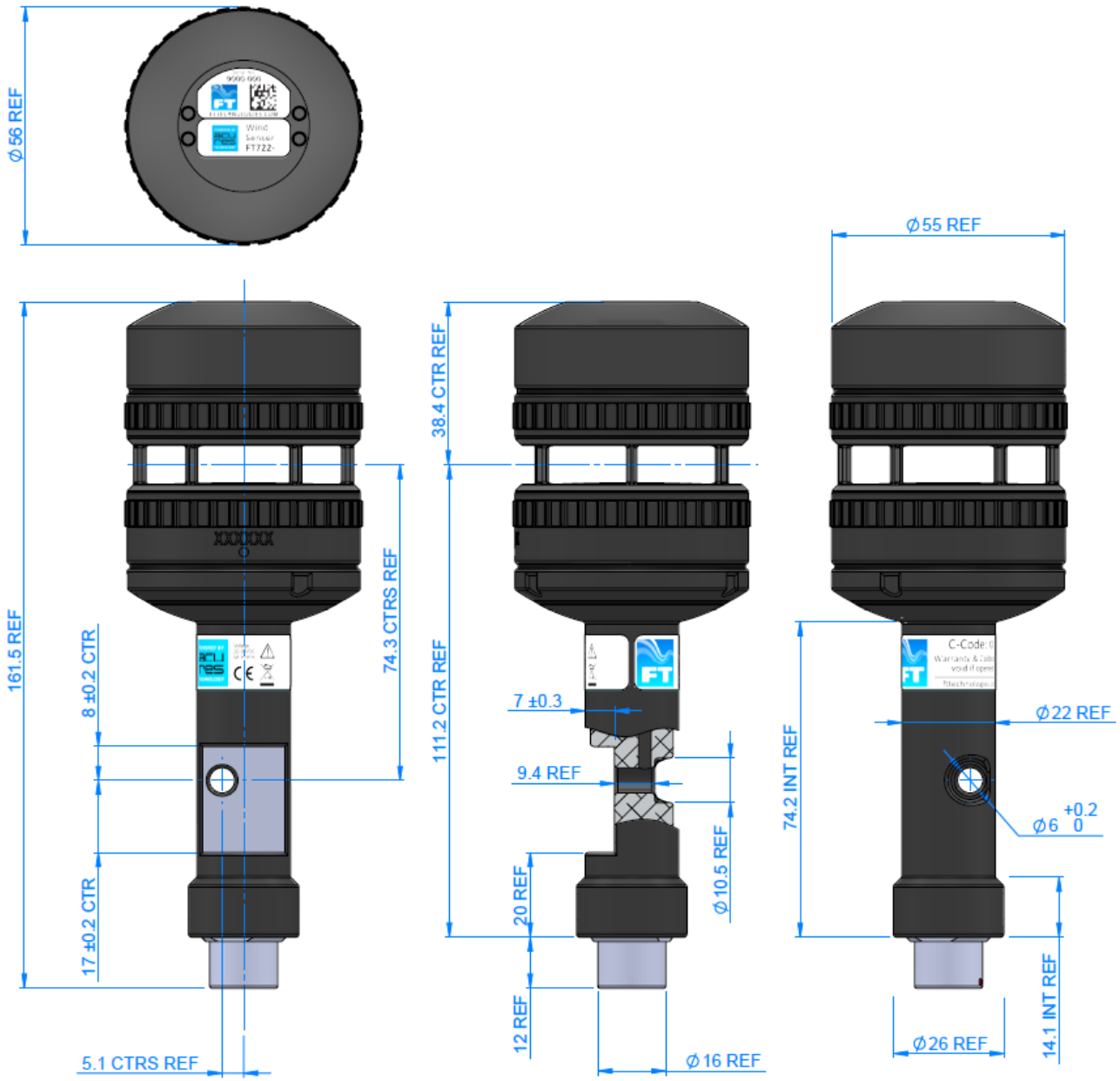


Figure 7: Flat-Front Wind Sensor

The sensor measures the wind direction relative to the mounting flat. When the wind sensor is correctly aligned the wind direction measurements will be as shown in Figure 8.

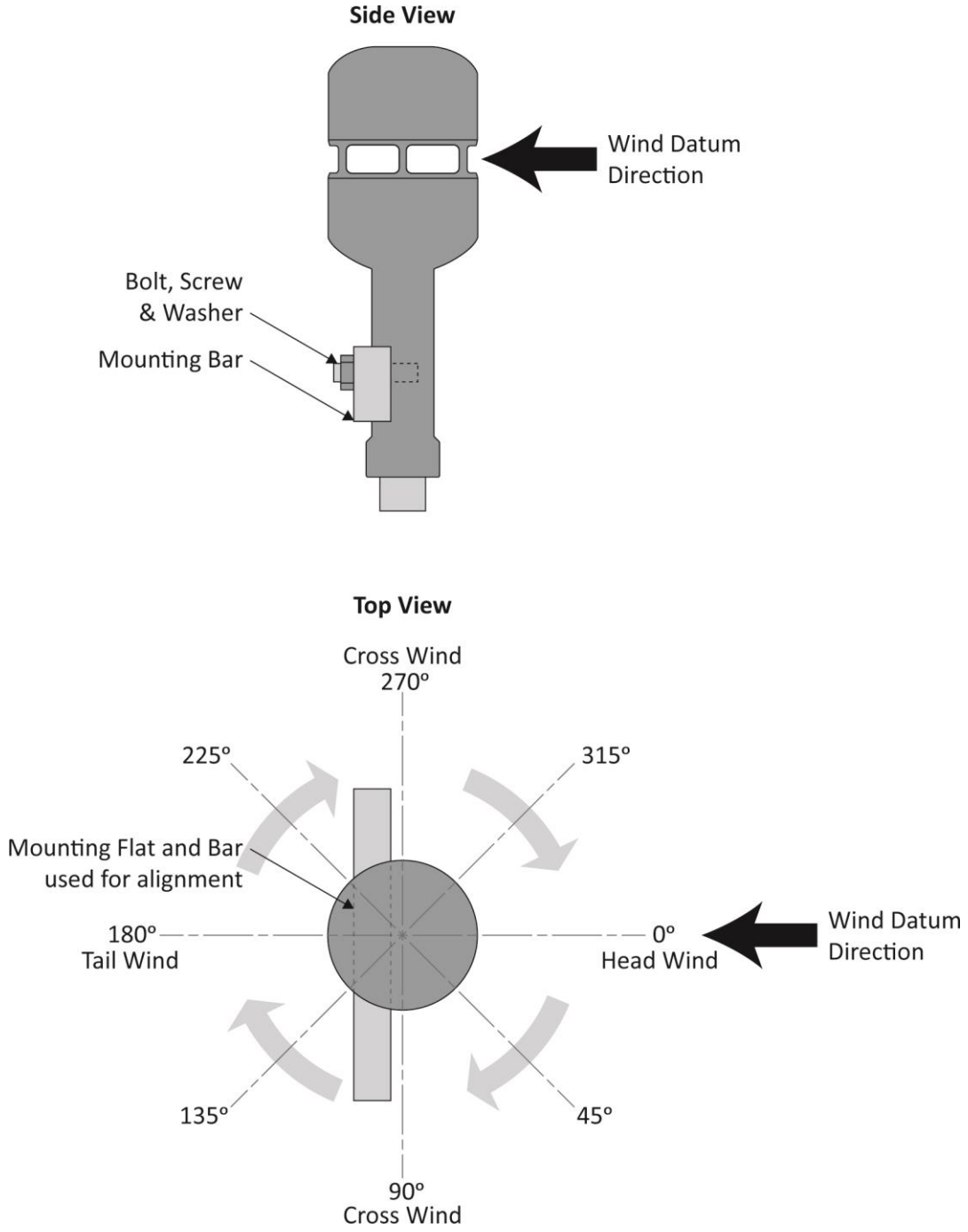


Figure 8: Correct Sensor Alignment

This option is designed to be mounted using an M6 socket head cap screw, nut and washer made from galvanised steel.

The mounting flat on the support tube of the sensor (see Figure 9) allows for firm fitting against a flat surface. The preferred finish of the mounting bar is an appropriate grade of aluminium. As an alternative hot dipped galvanised steel can be used (aluminium is preferred as it provides superior thermal conduction in icing conditions). If galvanised steel material is selected, the mounting bar should have a minimum galvanising thickness of 50µm to ensure long-term protection against corrosion. The galvanising quality should conform to ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanised) Coatings on Iron & Steel Products.

The mounting flat of the sensor is provided free of coatings to allow for a good electrical connection between the body of the sensor and ground through the mounting bar. In order to protect the mounting flat against corrosion, a very thin layer (<0.2mm) of electrical joint compound should be applied. An example of this could be AFL Global's Electrical Joint Compound # 2. It should be applied directly to the sensor's mounting flat, whilst avoiding the fixing hole. Use of an electrical joint compound will also help to maintain long-term low impedance connection to ground. This connection should be checked as part of the annual inspection of the sensor as detailed in Section 4.2.

Some electrical joint compounds contain fluoride etchants which may react with certain materials. Material compatibility should therefore be checked prior to application (refer to the electrical joint compound manufacturer's data).

In order to keep the pressure within the sensor equalised with the atmospheric pressure, a small breather hole is located within its support tube. It is therefore important that the airway to this breather hole be kept clear. This can be achievable by cutting a small 3mm channel in the mounting bar as shown (see Figure 9).

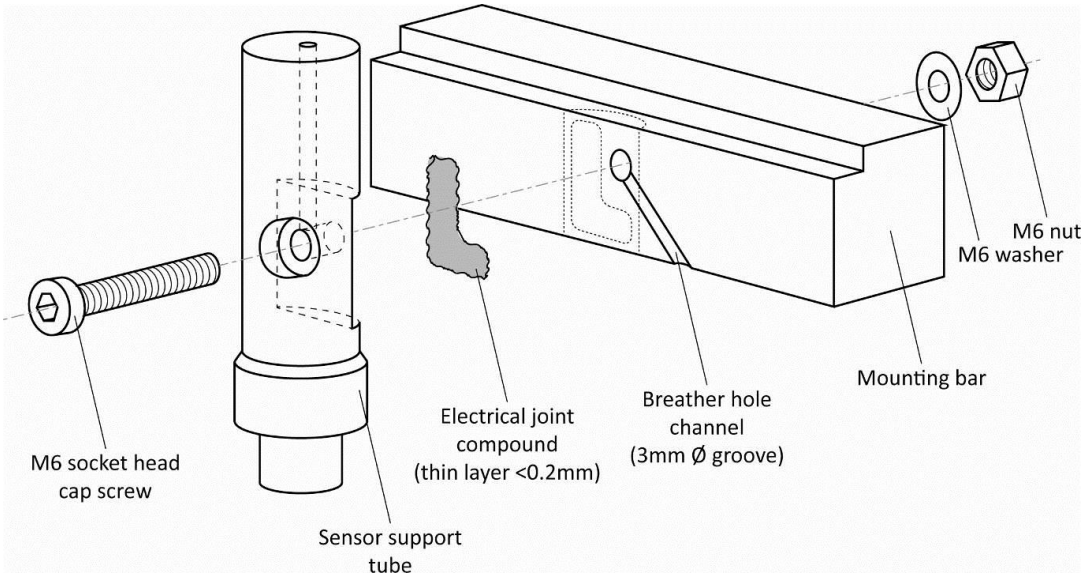


Figure 9: Sensor Installation

It is recommended that a protective sleeve be fitted over the base of the sensor and the connector. This will provide environmental protection as well as stress-relief from vibration. Heat shrink or cold shrink would be suitable for this purpose. FT offer a cold shrink solution which is available on request (part number FT909). The sleeve should cover the lower part of the support tube; the connector itself and at least 25mm of cable (see Figure 10).

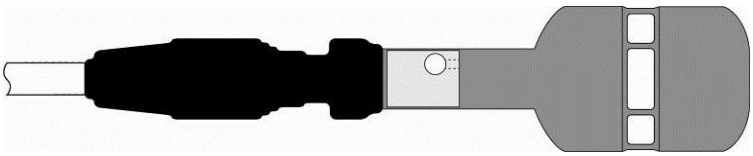


Figure 10: Flat-Front Sensor with Protective Sleeve

3.1.2 Connector Details

All electrical connections are made to the sensor via an 8-way multipole connector located in the base of the wind sensor housing. The wind sensor connector pin designations are shown in Figure 11 and the mating connector manufacturer's part numbers in Figure 12.

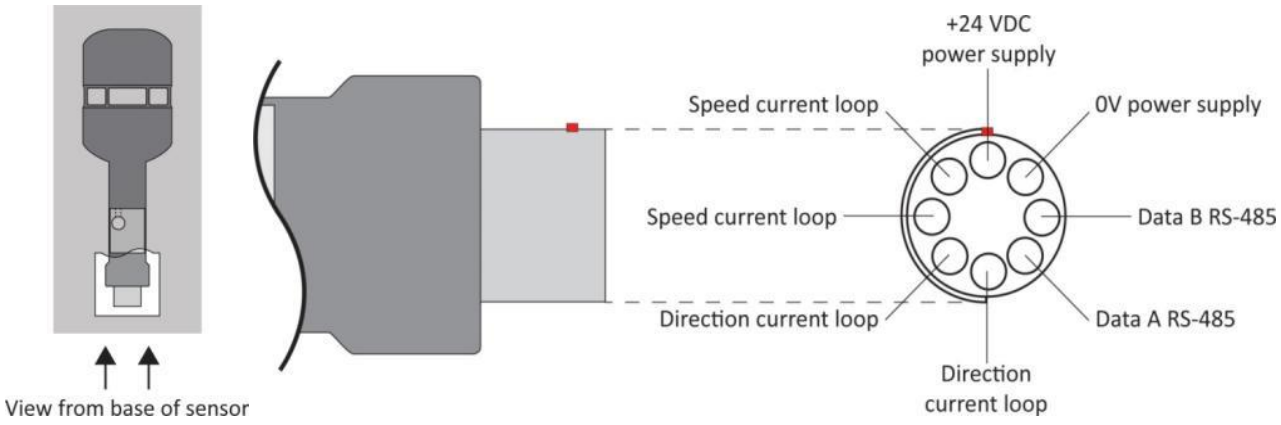


Figure 11: Sensor Connector Pinout

Manufacturer	Connector Type	Connector Description	Manufacturers Part Number	Maximum Outer Cable Diameter
W.W.Fischer	4-20mA Cable Side Connector	8 way plug	SS104Z129-1	8.0mm
ODU	4-20mA Cable Side Connector	8 way plug	SX2F1C-P08NJH9-0001	9.2mm

Figure 12: Cable Connector Sourcing Options

3.1.3 Cable Details

The mating connectors for the sensors are suitable for use with cables with overall diameters as per the table values above and for individual cores of diameters of up to 1.2mm. Cable such as SD980CPTP 3x2x0.5mm² from SAB Brockskes or similar types may be used. Care must be taken to ensure that the cable is suitable for the environment it will be used in and is adequately approved, for example AWM Style 21198.

In an area with a moderate or severe lightning strike exposure the cable shield may not provide sufficient protection. In this case the cable will require further shielding such as being enclosed in a metallic pipe or conduit.

FT can supply cables with a mating connector leading to bare wires at the other end, for connection to user systems. The analogue 4-20mA version of the -FF and -PM sensors use either the FT005 (15m), FT004 (8m) or FT008 (5m) cables. Note: The digital (RS4xx) sensors use a different connector and will require an alternative cable.

Please ensure that when sourcing cables from alternative sources that the cables are suitable for the requirements and the cable wiring is equivalent. The sensor is protected against common miswiring events within the operating range of the sensor.

For further details of cables and accessories please visit the FT website at https://www.fttechnologies.com/Wind-Sensors/Accessories

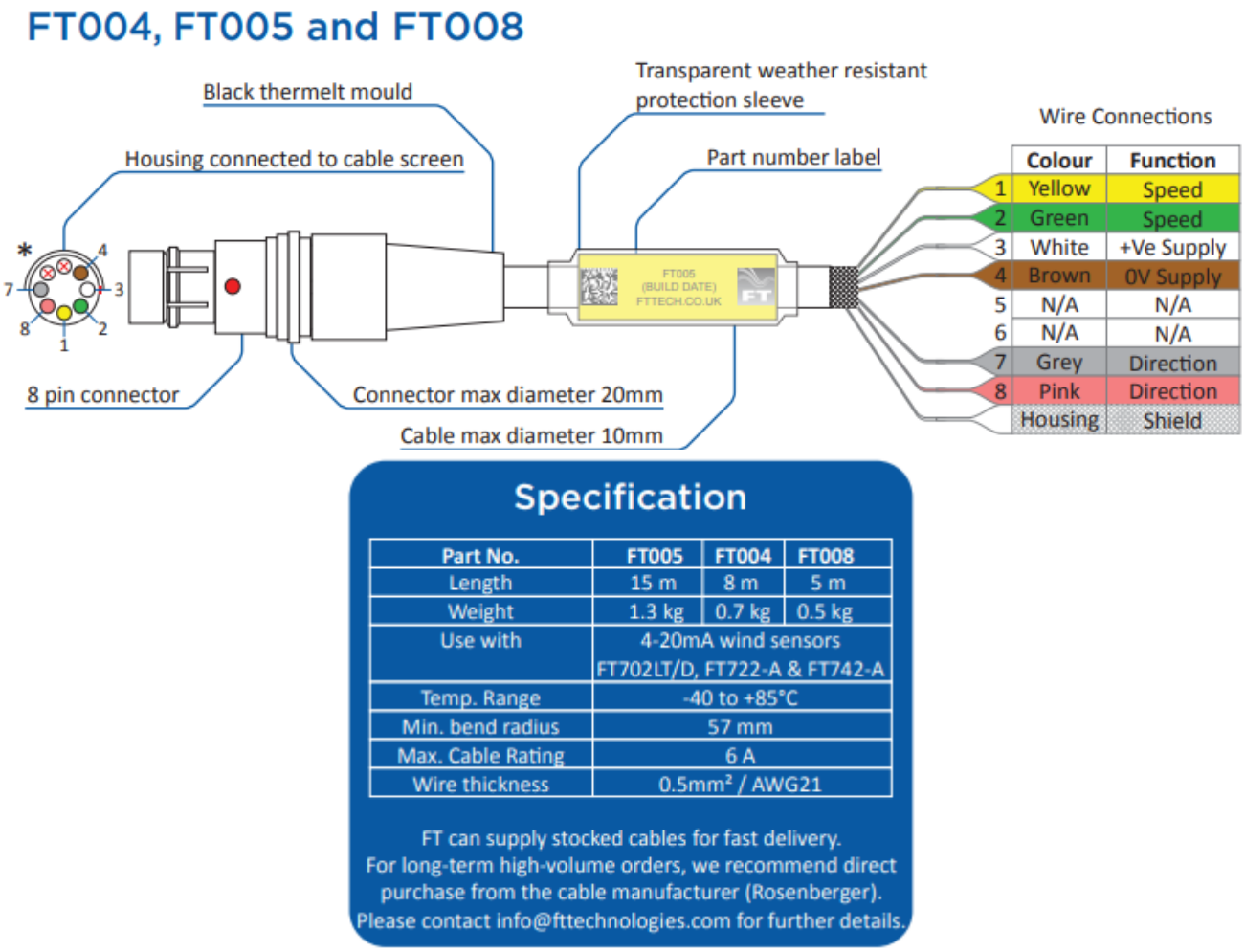


Figure 13: Cable Specifications

FT can also provide Acu-Test cables allowing operators to view wind speed and direction data with the Acu Vis software. These cables are intended for short testing periods and are not suitable for long-term datalogging. Please see Section 4.4 for further details.

3.1.4 Lightning, Surge & EMI Protection

It is important to install the sensor with appropriate protection against lightning and other sources of electromagnetic interference in order to maximise its chance of survival and continued operation during and after exposure.

Protection against direct lightning effects:

The sensor installation must be designed in such a way that a protection zone is created around the sensor so that its body can never be subjected to a direct lightning strike.

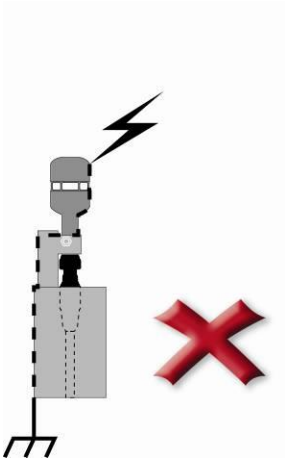


Figure 14: Direct Lightning Strike

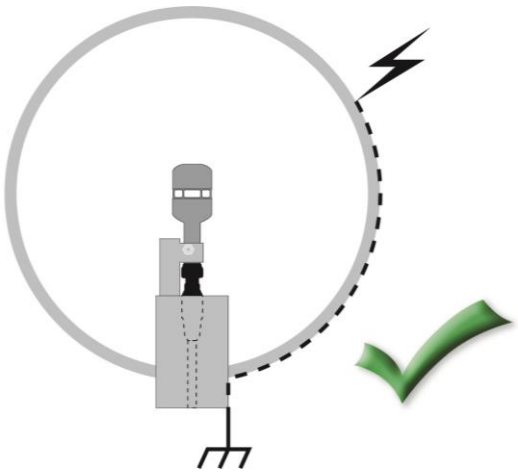


Figure 15: Indirect Lightning Strike

This level of protection is achievable through the use of conductive structural parts known as “lightning interceptors”. These help to create the protection zone and to divert the majority of the lightning current away to ground.

The lightning interceptor must have a direct connection to ground through metal parts with a minimum cross-sectional area of 50mm^2 (see Figure 17). The length of any grounding wire or strap must be kept to a minimum. This will help to provide the lowest possible impedance path to the ground reference.

The recommended clearance distance between the sensor and the lightning interceptor should be 30x the diameter of the interceptor material, but never less than 20cm (due to aerodynamic factors and an increased risk of lightning flashover).

Figure 16 below shows examples of lightning interceptors* and how they can be used to create a protection zone around the sensor. It is recommended that the interceptor is made from an appropriate grade of aluminium or hot-dipped galvanised steel. These materials help to ensure a long-term low impedance connection to ground.

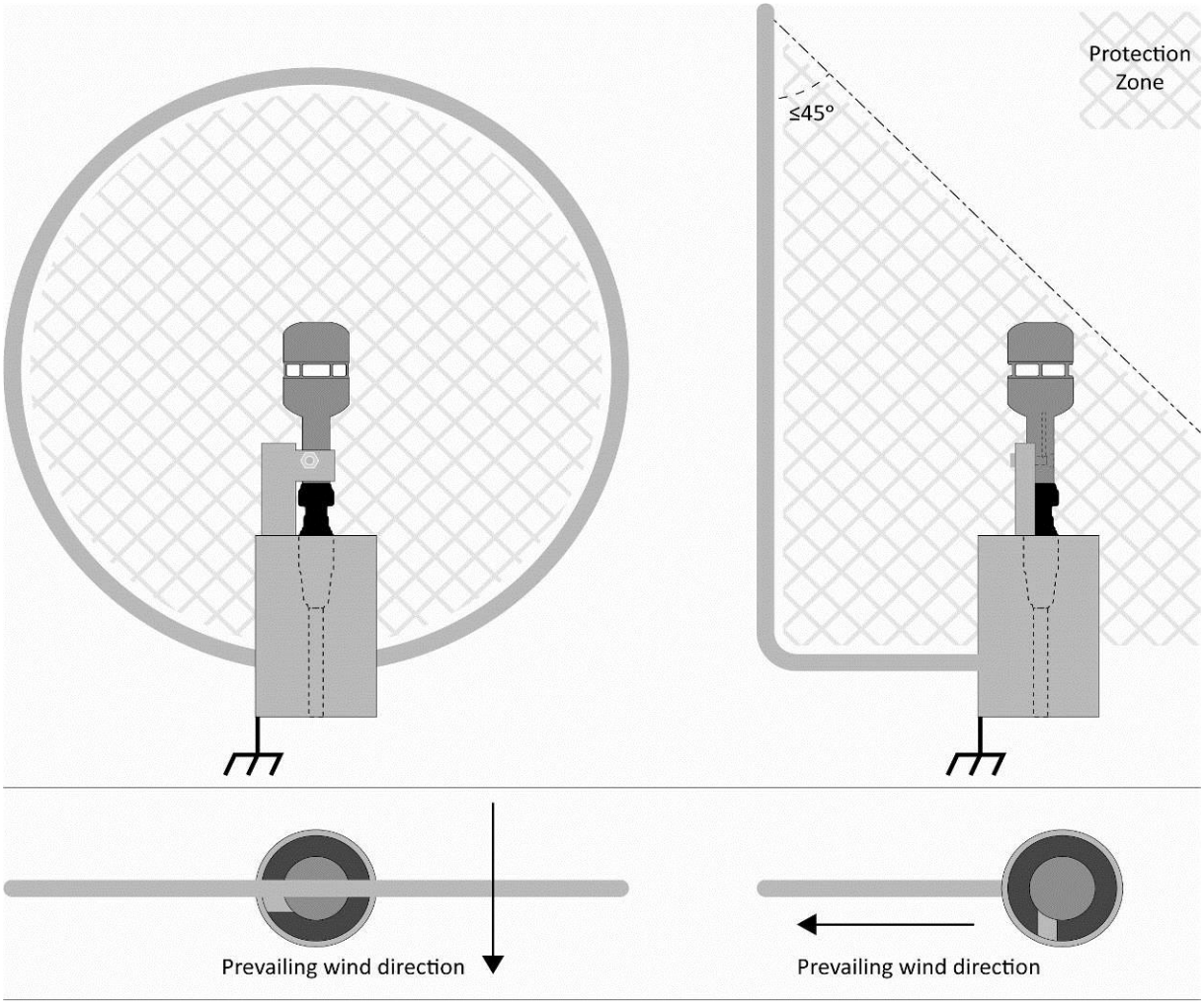


Figure 16: Ring and Rod Lightning Interceptors

*The standards for Lightning Protection of Wind Turbines are described in IEC 61400-24. The installation instructions in this manual should be sufficient to ensure that the lightning protection zone around the sensor will achieve a lightning protection level of LPZ0B as described in the standard.

It is recommended that the installation is reviewed by an appropriate lightning design expert. Companies such as GLPS (Global Lightning Protection Systems) can provide design advice.

Protection Against Indirect Lightning Effects & Electromagnetic Interference

Objects within the protection zone described above can still be subject to very high electromagnetic field and partial lightning surge currents. It is therefore critical that appropriate shielding and termination is used throughout the system to reduce these effects. A shielded signal cable will offer some protection however it is recommended that double shielding is employed between the sensor and the chassis of the data acquisition and power supply cabinet.

A metal conduit surrounding the shielded cable is a good way of providing this additional protection and will also help to prolong the life of cables and connectors. The impedance of this metal conduit needs to be as low as possible since a substantial proportion of the lightning current will flow in it. An example of metal conduit could be HellermannTyton's HelaGuard steel conduit with plastic coating and steel overbraid.

All cable shielding must be continuous and 360° terminated at both ends using EMC glands or cable clamps with a direct connection to the cabinet chassis. There must also be a direct connection from the cabinet chassis to the grounding reference. Any metal conduit used must also be continuous and terminated at both ends with appropriate fittings. Figure 17 below shows the principle of the protection scheme. The cabinet should be protected with a metallic grounded housing.

① Preferably this connection is established using structural aluminium parts or alternatively by use of a copper cable with a cross section of min. 50mm^2

② Any shielding conduit must be terminated at both ends

③ Shielded cable must either be 360° terminated using an EMC cable gland in the cabinet wall - or alternatively using a cable clamp in direct connection with the cabinet chassis

④ The chassis of the cabinet must have a direct connection to ground

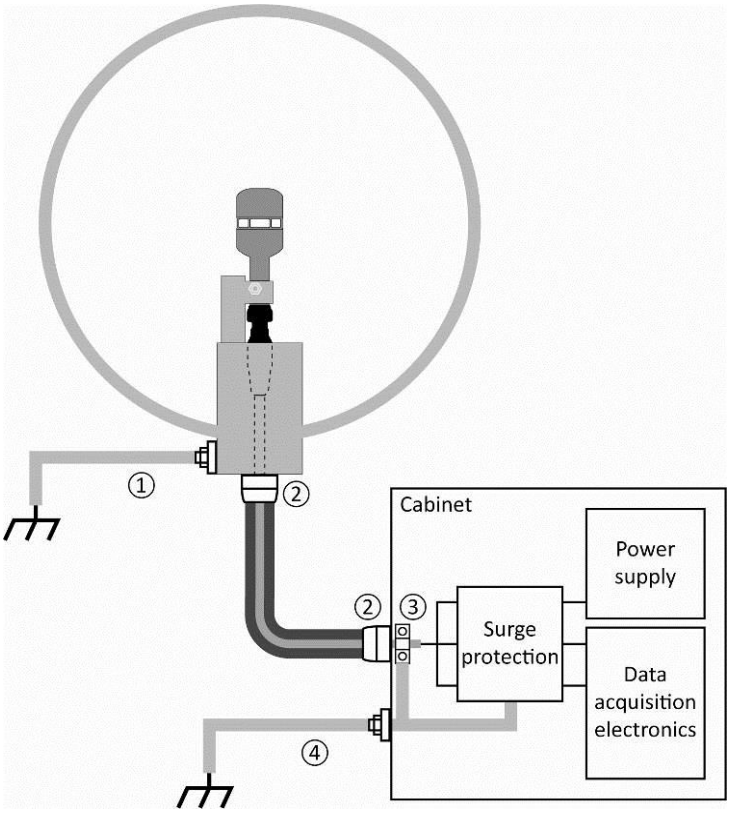


Figure 17: Protection of Equipment Against Indirect Effects

Surge protection

All connections from the wind sensor to any data acquisition equipment and power supply should run through Surge Protection Devices (SPDs). This will suppress any unwanted overvoltage transients present on the signal or power lines. The surge suppression devices are to be UL 1449 listed.

The ratings of the SPDs must be suitable for the surge conditions. Assuming that appropriate shielding and termination has been used throughout, then the SPDs used with our sensor should have a minimum surge current rating of 20kA (8/20µs) and be capable of clamping the output below the maximum input voltage accepted by the electronic systems they are connected to. This will prevent any surges or large voltage differences being present at the inputs to the wind sensor, data acquisition electronics or power supply.

The SPDs should be installed as close as possible to the point where the signals enter the cabinet in order to prevent noise propagating to other electronics. The SPDs should also be grounded appropriately. Figure 18 shows how the SPDs should be installed.

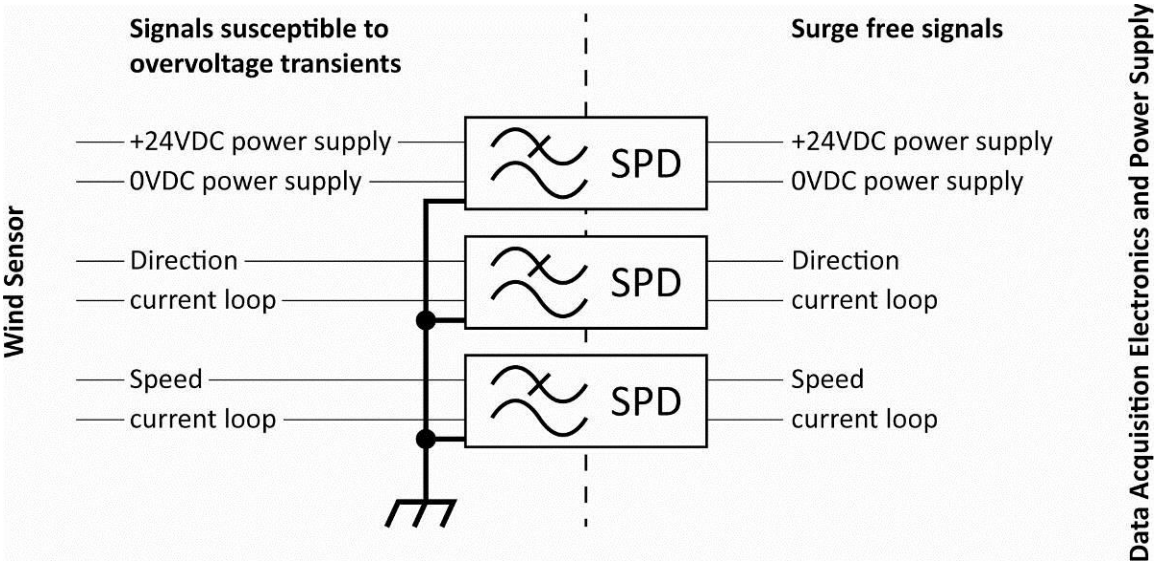


Figure 18: Analogue Interface Surge Protection

The supply pair [24VDC / 0VDC] is electrically isolated from the other lines and the chassis. The four current loop signals are isolated from the power supply lines and the chassis. An example of SPD suitable for this protection can be sourced from Phoenix Contact as shown in Figure 19 below. Users are responsible for ensuring the suitability of these components for their application.

Manufacturer	Type	Manufacturers part number
PSU lines		
Phoenix Contact	Surge protection plug (x1)	2819008 PT PE/S+1X2-24-ST
	Base element (x1)	2856265 PT PE/S+1X2-BE
Current Loop Lines		
Phoenix Contact	Surge protection plug (x2)	2856058 PT 1x2-24AC-ST
	Base element (x2)	2856113 PT 1x2-BE

Figure 19: Typical SPD Configuration used to Protect Sensor

3.2 Pipe-Mount Sensors

3.2.1 Mechanical & Electrical Integration

The pipe mount sensor is designed to fit onto the FT Pipe Mount Adaptor (part number FT090). The adapter can be fitted on top of a wide variety of pipe sizes (OD 40-51mm).

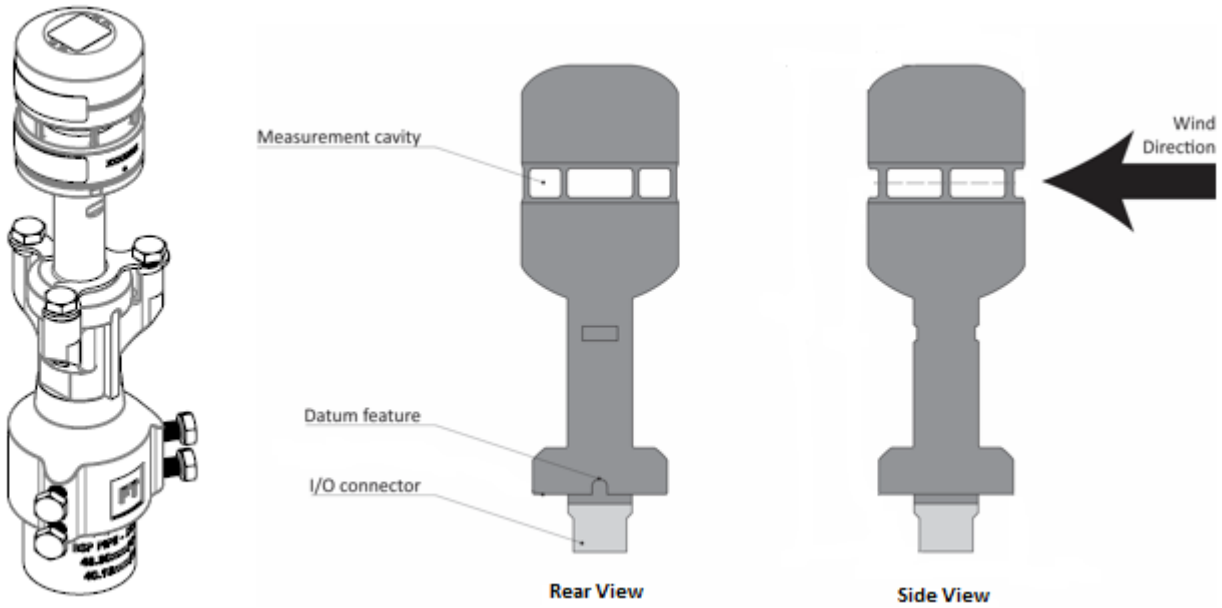


Figure 20: Pipe Mount Wind Sensor

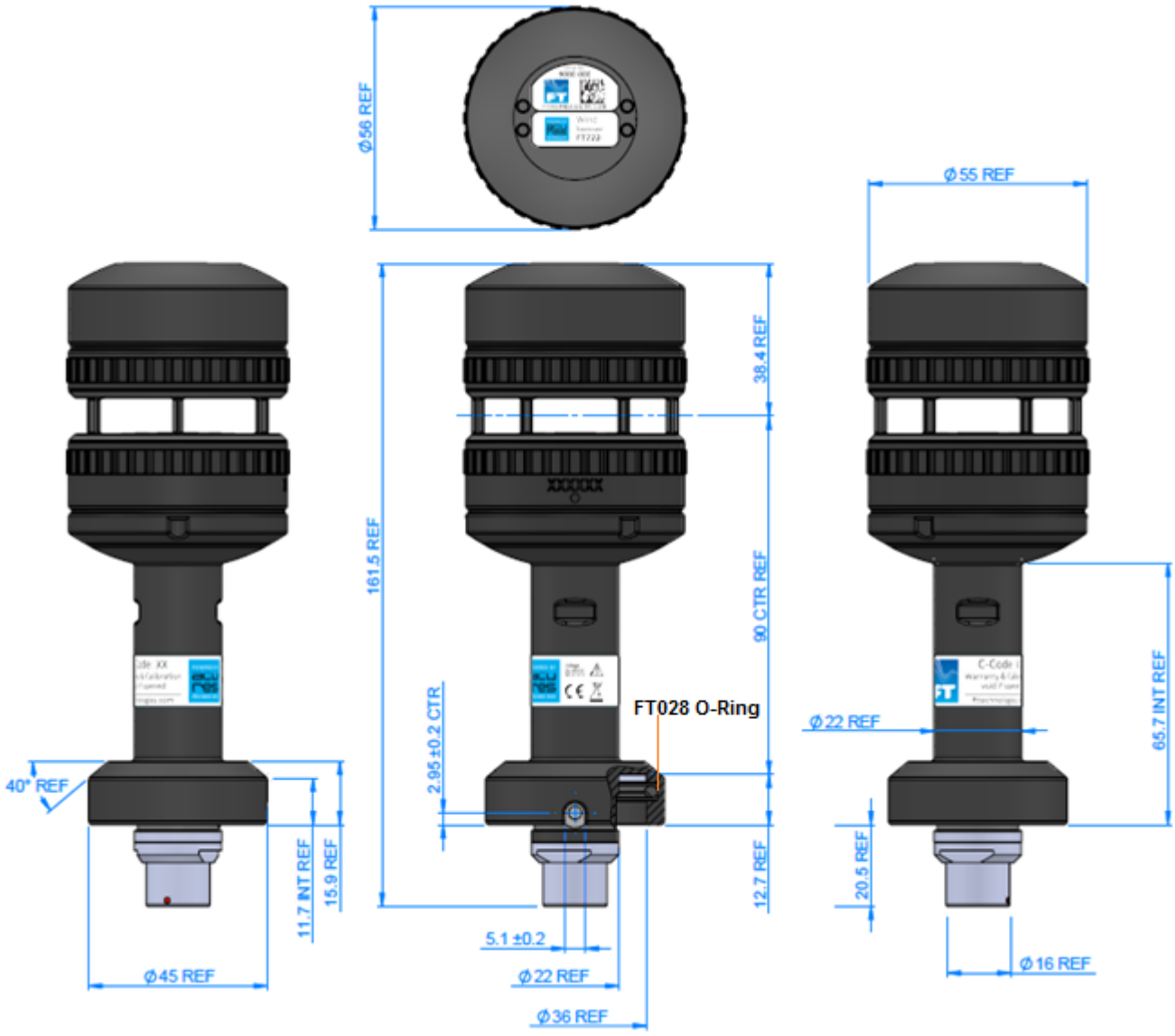


Figure 21: Pipe Mount Wind Sensor Dimensions

The system ensures that the base of the sensor and connector/cable are sealed inside the pipe and adaptor. This helps to protect against environmental degradation, as well as against the effects of indirect lightning strikes. The FT028 O-ring (see location in Figure 21) is fitted to provide protection to the grounding surface and additional protection for the connector.

The adapter can be secured tightly to the pipe using 4x M8 bolts. The sensor is secured to the adapter, using a spring clip and 3 more M8 bolts (supplied with the pipe mount adaptor, part number FT090). The adaptor includes an alignment notch to ensure repeatable and accurate orientation. The adapter and spring clip are made from LM25/LM5 series aluminium-magnesium alloy and 5052/5454 grade ‘A’ aluminium respectively. The M8 bolts have a hot-dip galvanised steel finish.

The vertical pipe should be made of an appropriate grade of aluminium (aluminium is preferred as it provides superior thermal conduction in icing conditions), or alternatively hot-dip galvanised steel. If galvanised steel material is selected, a minimum galvanising thickness of 50µm should be used to ensure the pipe has adequate

long term corrosion protection. The galvanising quality should conform to ASTM A123, Standard Specification for Zinc (Hot-Dip Galvanised) Coatings on Iron & Steel Products.
The pipe should have a direct connection to ground and its top surface should be flat. A liberal amount of electrical joint compound should be applied to this top surface before the adaptor is fitted so that a long term low impedance connection to ground is maintained. An example of this could be AFL Global's Electrical Joint Compound # 2.

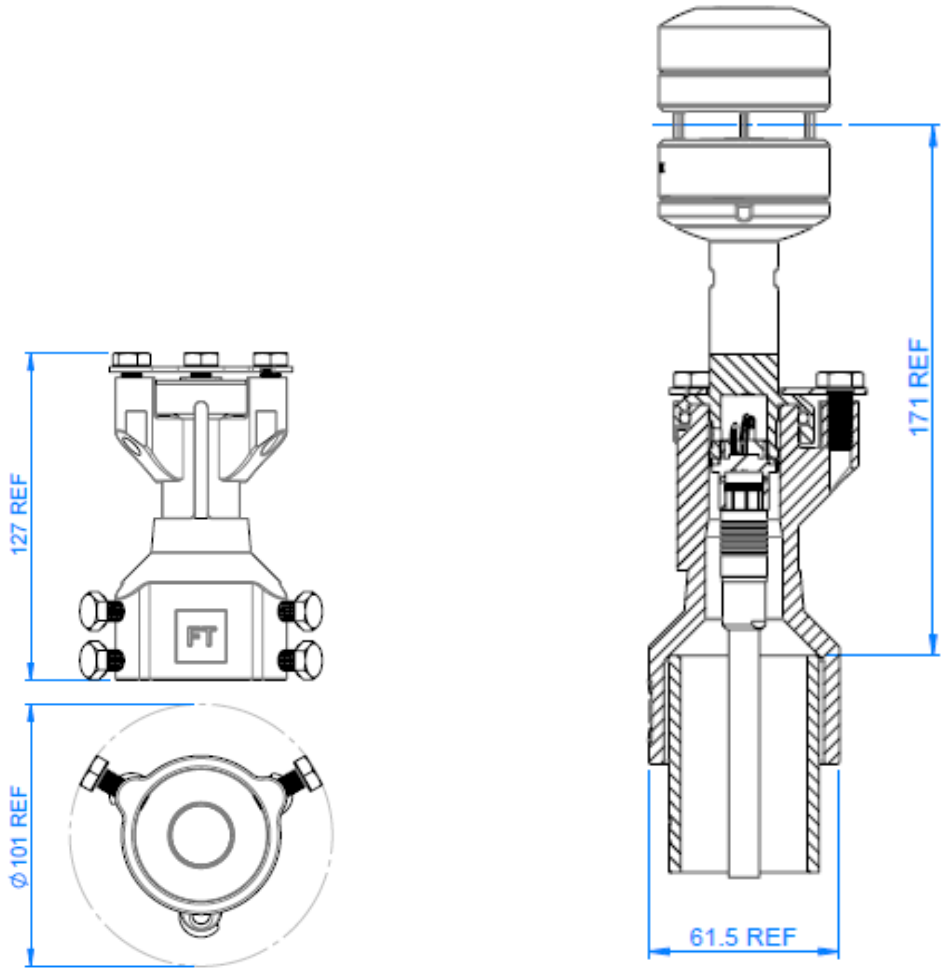


Figure 22: Pipe Mount Wind Sensor with Adapter (all dimensions in mm)

Alignment

The sensor measures the wind direction relative to the datum feature (see Figure 23). The pipe mount system is designed for fitting to a vertical pipe. The datum feature can be used in combination with a laser tool to ensure correct alignment and spirit level to ensure that the top of the adapter is flat. The position of the adapter can be adjusted to remove any misalignment if the pipe is constructed slightly off vertical. Once the adapter is aligned correctly the 4 bolts at the bottom of the adapter are used to lock it securely to the pipe, preventing further movement.

The sensor can only fit on top of the adapter in one orientation. If the sensor needs replacing, this can be done without having to realign the adapter.

The sensor measures the wind direction relative to the datum feature on the adapter. When the wind sensor is correctly aligned the wind direction measurements will be as shown in Figure 23.

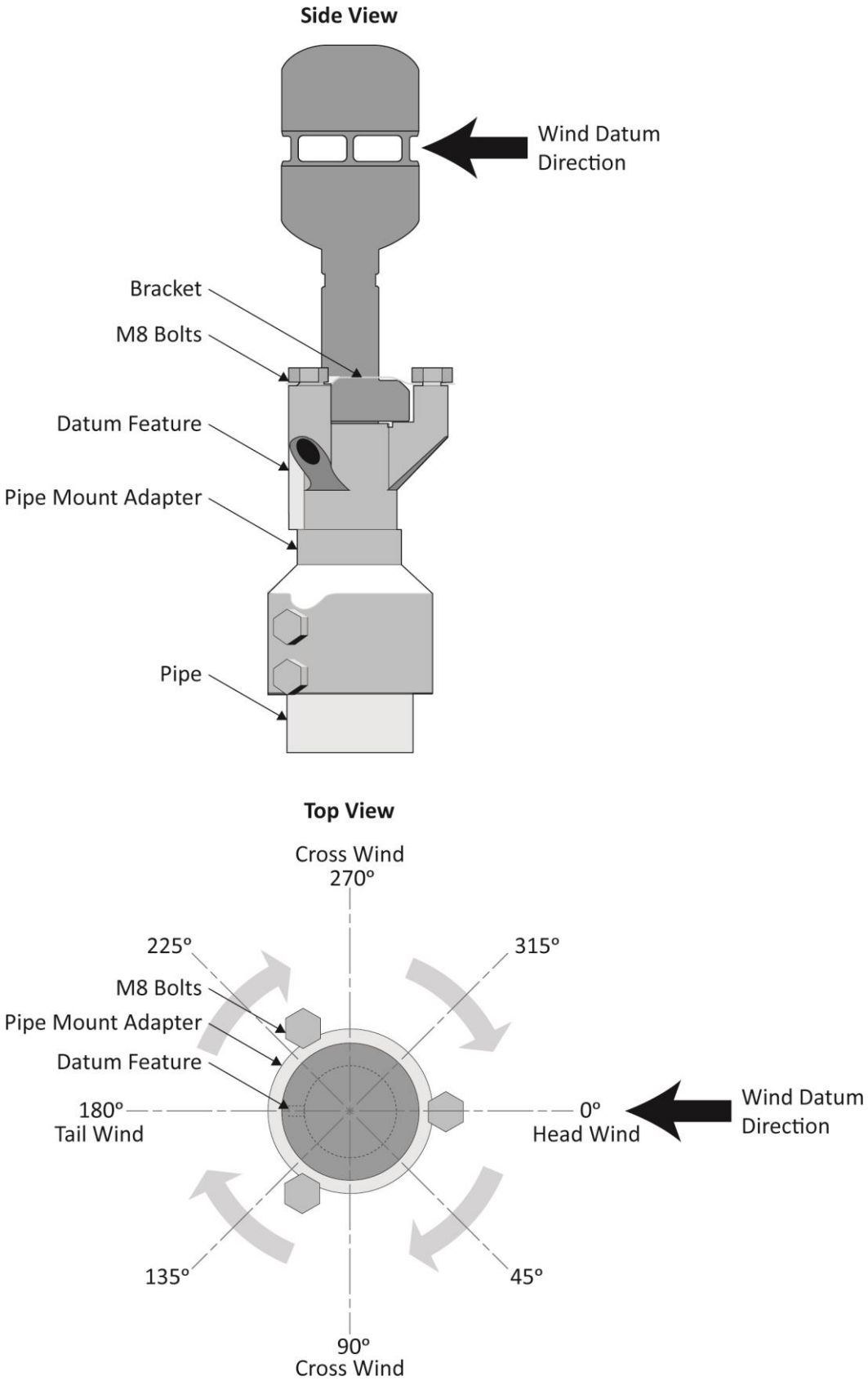


Figure 23: Correct Sensor Alignment

3.2.2 Assembling the Pipe Mount Adapter

a) The adapter should be fitted onto a pipe with an outer diameter of 40-51mm.
b) The pipe end is to be 172 mm below the desired measuring point; the mid-point of the sensor's measurement cavity.
c) Run the sensor cable up through the pipe and through the adapter (which should not be fitted to the pipe yet) and secure it so that it cannot fall back down inside either.

Figure 24: Preparing the Adapter

d) Apply a liberal amount of electrical joint compound to the top surface of the pipe
e) Place the adapter on top of the pipe. A spirit bubble can be used to ensure the installation is flat.
f) Rotate the adapter to align the datum feature as required. The datum feature should be at the back of the wind sensor, with respect to the wind direction. A laser alignment tool could be used to ensure accuracy of alignment.
g) Tighten the 4x M8 bolts to fix the adapter securely in position
h) If a gap exists between the side of the pipe and the bottom edge of the adaptor, sealing can be further improved by applying silicone sealant (see Figure 25). Suitable sealants could be either Dow Corning 790 Silicone Building or Pecora 864 Silicone Sealant.

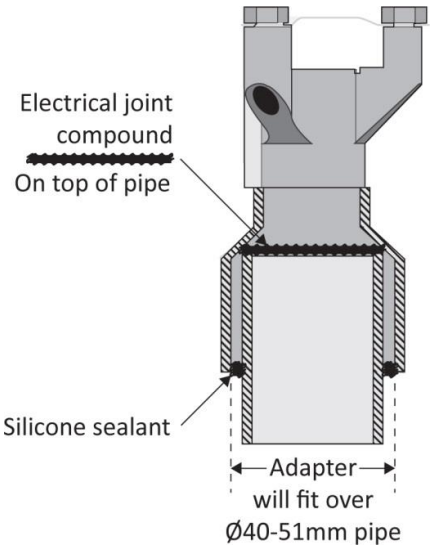
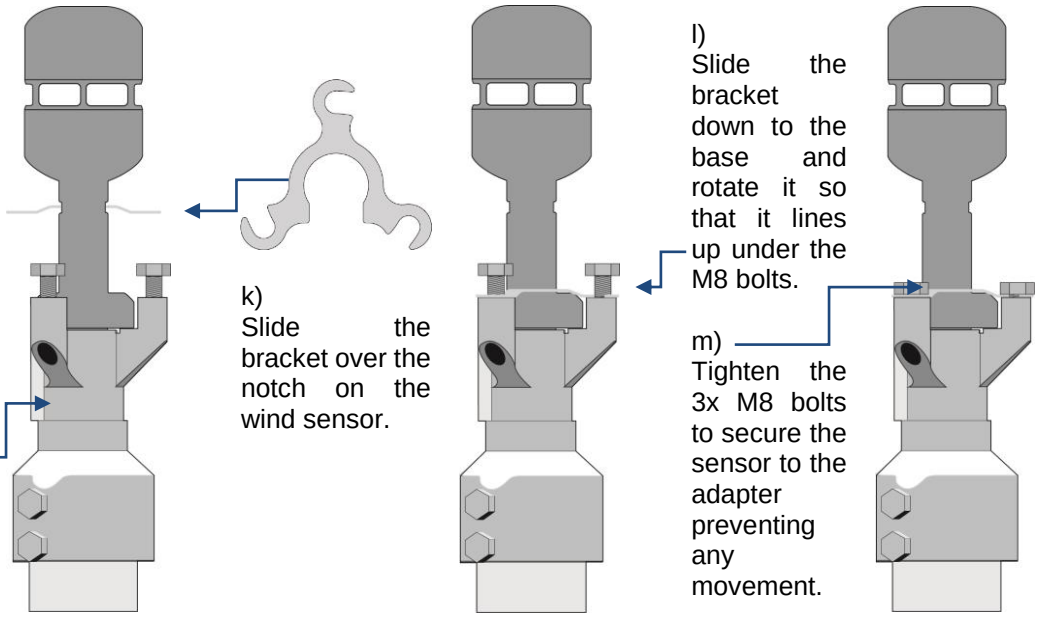


Figure 25: Installing the Adapter

Securing the Sensor

i) Remove any connector protection caps and mate the cable and sensor connectors.

j) Place the sensor on top of the adapter, orientated on the datum feature



k) Slide the bracket over the notch on the wind sensor.

l) Slide the bracket down to the base and rotate it so that it lines up under the M8 bolts.

m) Tighten the 3x M8 bolts to secure the sensor to the adapter preventing any movement.

Figure 26: Sensor Installation Instructions

3.2.3 Connector Details

All electrical connections are made to the sensor via an 8-way multipole connector located in the base of the wind sensor housing. The wind sensor connector pin designations are shown in Figure 27 and the mating connector manufacturer's part numbers in Figure 28.

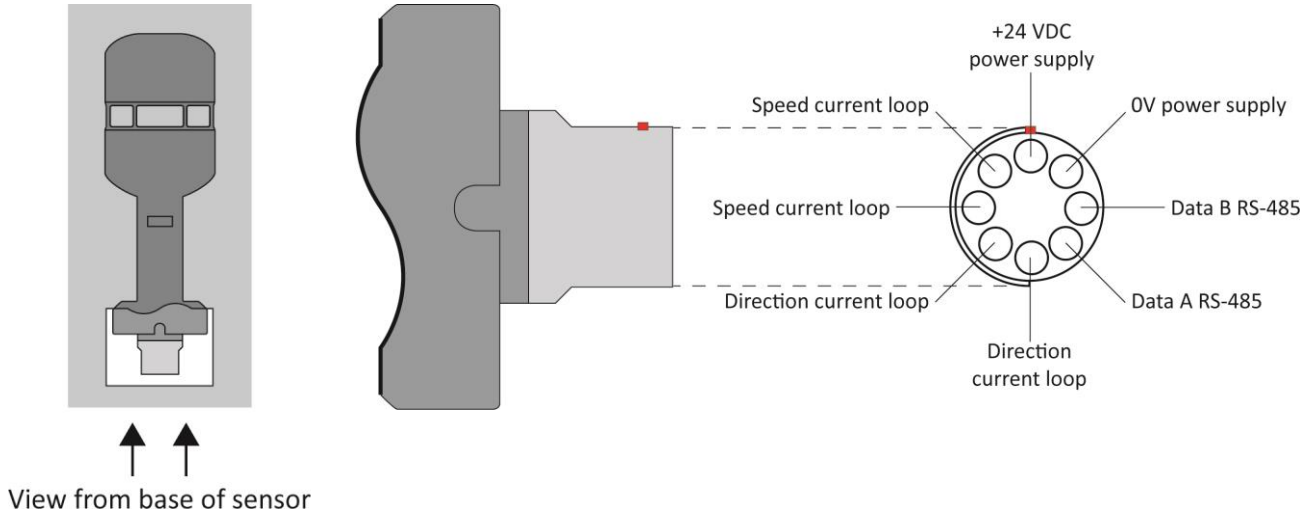


Figure 27: Sensor connector pin out

Manufacturer	Connector Type	Connector Description	Manufacturers Part Number	Maximum Outer Cable Diameter
W.W.Fischer	Cable Side Connector	8 way plug	SS104Z129-1	8.0mm
ODU	Cable Side Connector	8 way plug	SX2F1C-P08NJH9-0001	9.2mm

Figure 28: Cable Connector Sourcing Options

3.2.4 Cable Details

The mating connectors for the sensors are suitable for use with cables with overall diameters as per the table values above and for individual cores of diameters of up to 1.2mm. Cable such as SD980CPTP 3x2x0.5mm2 from SAB Brockskes or similar types may be used. Care must be taken to ensure that the cable is suitable for the environment it will be used in and is adequately approved, for example AWM Style 21198.

In an area with a moderate or severe lightning strike exposure the cable shield will not provide sufficient protection. In this case the cable will require further shielding such as being enclosed in a metal pipe or conduit.

FT can supply cables with a mating connector leading to bare wires at the other end, for connection to user systems. The analogue 4-20mA version of the -FF and -PM sensors use either the FT005 (15m), FT004 (8m) or FT008 (5m) cables. Note: The digital (RS4xx) sensors use a different connector and will require an alternative cable.

Please ensure that when sourcing cables from alternative sources that the cables are suitable for the requirements and the cable wiring is equivalent. The sensor is protected against common miswiring events within the operating range of the sensor.

For further details of cables and accessories please visit the FT website at https://www.fttechnologies.com/Wind-Sensors/Accessories

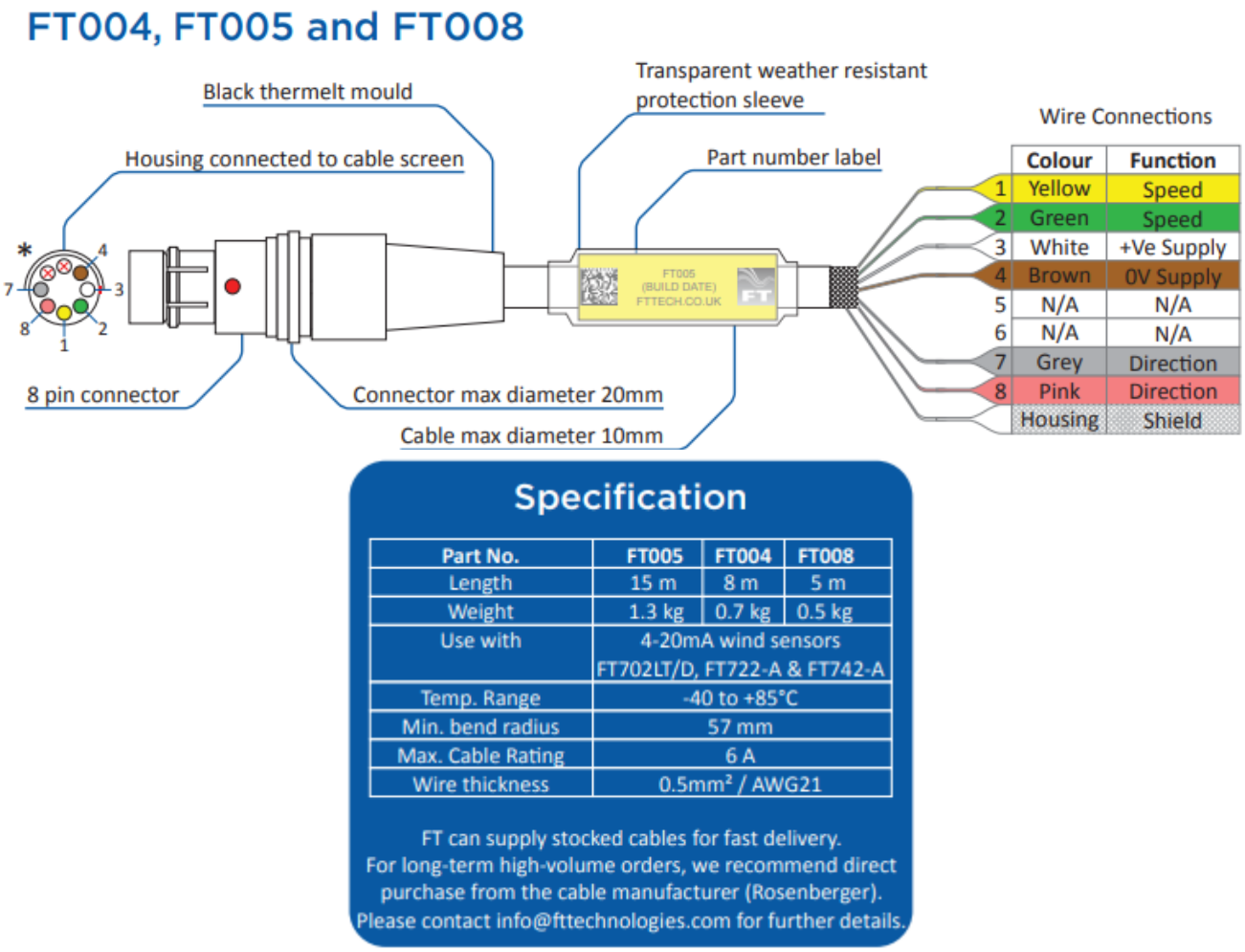


Figure 29: Cable Specifications

3.2.5 Lightning, Surge & EMI Protection

It is important to install the sensor with appropriate protection against lightning and other sources of electromagnetic interference in order to maximise its chance of survival and continued operation during and after exposure.

Protection against direct lightning effects

The sensor installation must be designed in such a way that a protection zone is created around the sensor so that its body can never be subjected to a direct lightning strike.

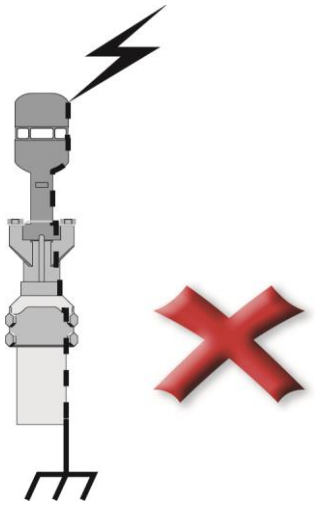


Figure 30: Direct Lightning Strike

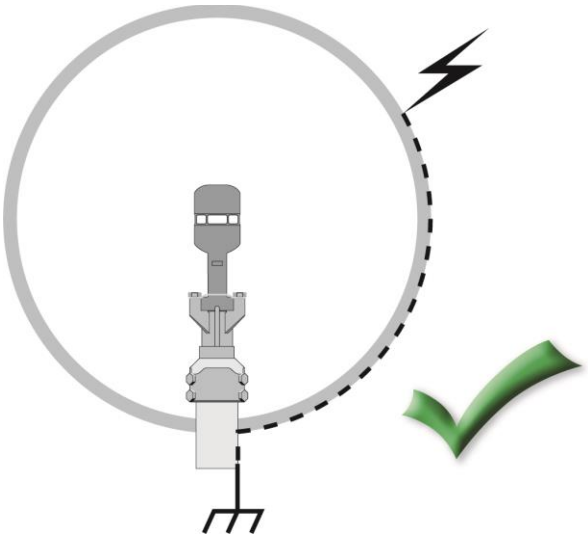


Figure 31: Indirect Lightning Strike

This level of protection is achievable through the use of conductive structural parts known as “lightning interceptors”. These help to create the protection zone and to divert the majority of the lightning current away to ground.

The pipe which the Pipe Mount Adapter is fixed to must have a direct connection to ground and the lightning interceptor must have a direct connection to the pipe. All connections should be through metal parts with minimum cross-sectional area of 50mm^2. The length of any grounding wire or strap used must be kept to a minimum. This will help to provide the lowest possible impedance path to the ground reference.

The recommended clearance distance between the sensor and the lightning interceptor should be 30x the diameter of the interceptor material, but never less than 20cm (due to aerodynamic factors and an increased risk of lightning flashover).

Figure 32 below shows examples of lightning interceptors and how they can be used to create a protection zone around the sensor. It is recommended that the interceptor is made from an appropriate grade of aluminium or hot dipped galvanised steel. These materials help to ensure a long-term low impedance connection to ground.

The standards for Lightning Protection of Wind Turbines are described in IEC 61400-24. The installation instructions in this manual should be sufficient to ensure that the lightning protection zone around the sensor will achieve a lightning protection level of LPZ0B as described in the standard.

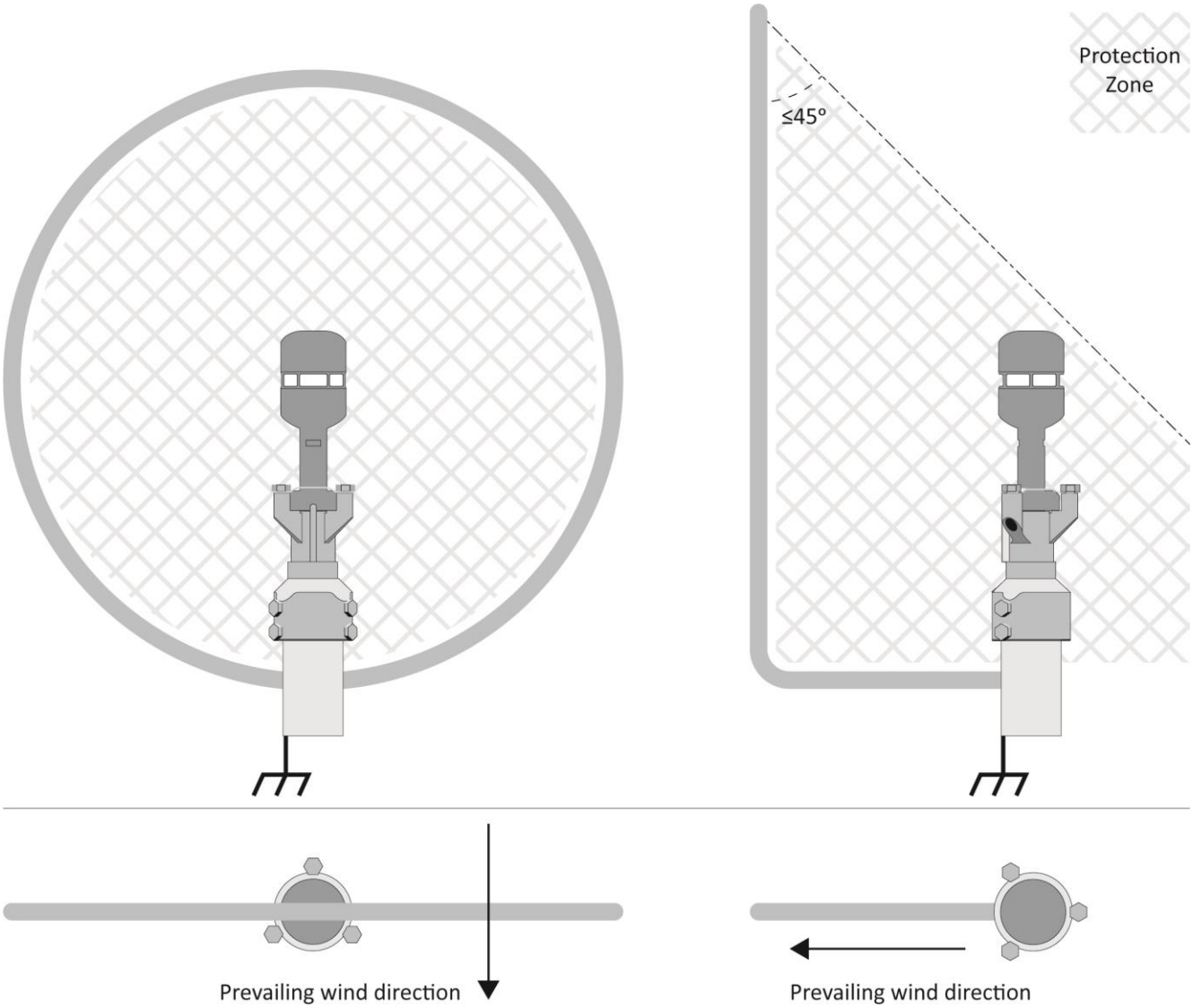


Figure 32: Ring and Rod Lightning Interceptors

It is recommended that the installation is reviewed by an appropriate lightning design expert. Companies such as GLPS (Global Lightning Protection Systems) can provide design advice.

Protection Against Indirect Lightning Effects & Electromagnetic Interference

Objects within the protection zone described above can still be subject to very high electromagnetic field and partial lightning surge currents. It is therefore critical that appropriate shielding and termination is used throughout the system to reduce these effects. A shielded signal cable will offer some protection however it is recommended that double shielding is employed between the sensor and the chassis of the data acquisition and power supply cabinet.

This can be in the form of continuous pipe between the Pipe Mount Adapter and the data acquisition and power supply cabinet. If the pipe is not continuous, then metal conduit surrounding any exposed sections of the shielded cable is a good way of providing this additional protection and will also help to prolong the life of the cable. The impedance of this metal conduit needs to be as low as possible since a substantial proportion of the lightning current will flow in it. An example of metal conduit could be HellermannTyton's HelaGuard steel conduit with plastic coating and steel overbraid.

All cable shielding must be continuous and 360° terminated at both ends using EMC glands or cable clamps with a direct connection to the cabinet chassis. There must also be a direct connection from the cabinet chassis to the grounding reference. Any metal conduit used must also be continuous and terminated at both ends with appropriate fittings. Figure 33 below shows the principle of the protection scheme.

① Preferably this connection is established using structural aluminium parts or alternatively by use of a copper cable with a cross section of min. 50mm^2

② Any pipe or shielding conduit must be terminated at both ends

③ Shielded cable must either be 360° terminated using an EMC cable gland in the cabinet wall - or alternatively using a cable clamp in direct connection with the cabinet chassis

④ The chassis of the cabinet must have a direct connection to ground

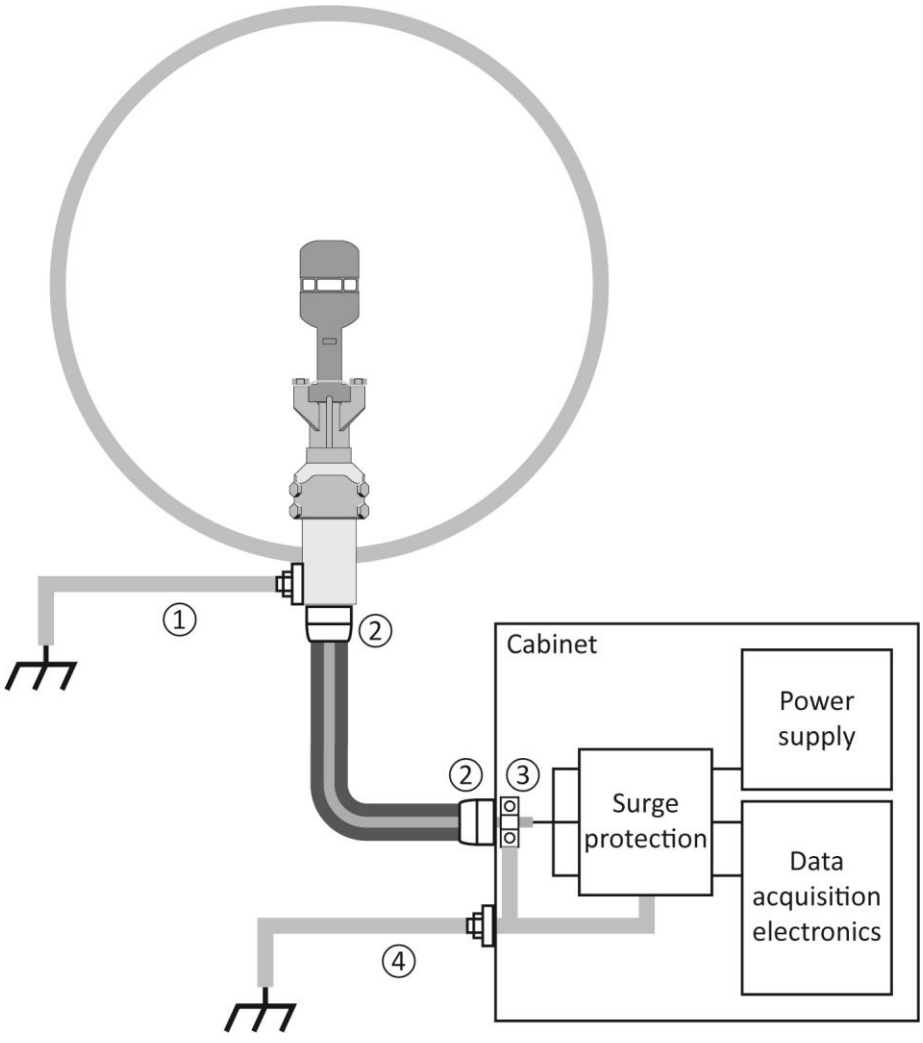


Figure 33: Protection of Equipment Against Indirect Effects

Surge Protection

All connections from the wind sensor to any computer equipment and power supply should run through Surge Protection Devices (SPDs). This will suppress any unwanted overvoltage transients present on the signal or power lines. The surge suppression devices are to be UL 1449 listed.

The ratings of the SPDs must be suitable for the surge conditions. Assuming that appropriate shielding and termination has been used throughout, then the SPDs used with our sensor should have a minimum surge current rating of 20kA (8/20µs) and be capable of clamping the output below the maximum input voltage accepted by the electronic systems they are connected to. This will prevent any surges or large voltage differences being present at the inputs to the wind sensor, data acquisition electronics or power supply.

The SPDs should be installed as close as possible to the point where the signals enter the cabinet in order to prevent noise propagating to other electronics. The SPDs should also be grounded appropriately. Figure 34 shows how the SPDs should be installed.

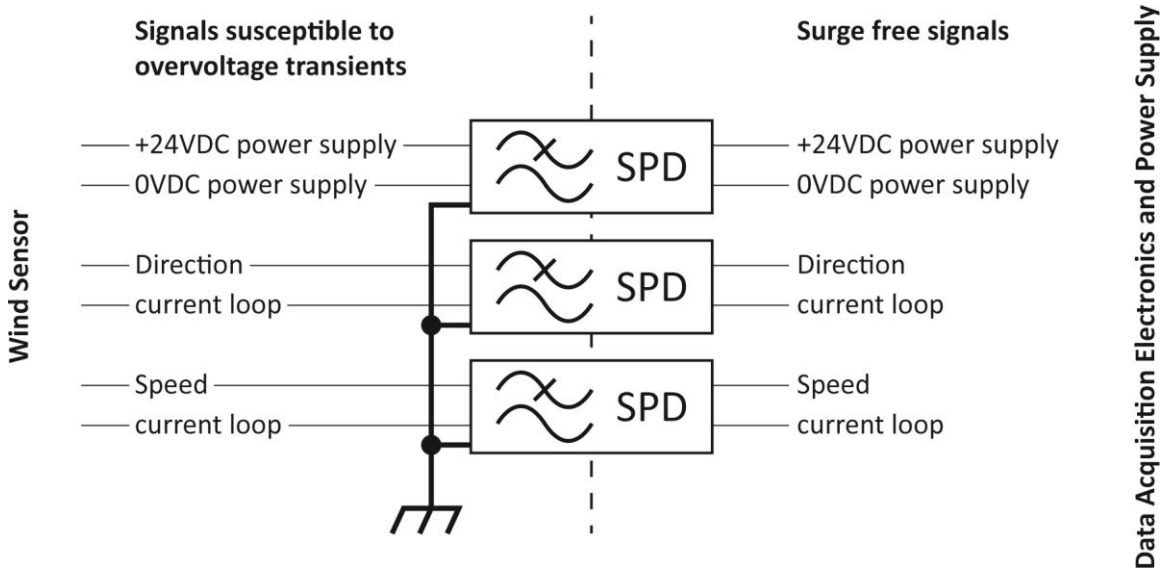


Figure 34: Analogue Interface Surge Protection

The supply pair [24VDC / 0VDC] is electrically isolated from the other lines and the chassis. The four current loop signals are isolated from the power supply lines and the chassis. An example of SPD suitable for this protection can be sourced from Phoenix Contact as shown in Figure 35 below. Users are responsible for ensuring the suitability of these components for their application.

Manufacturer	Type	Manufacturers part number
PSU lines		
Phoenix Contact	Surge protection plug (x1)	2819008 PT PE/S+1X2-24-ST
	Base element (x1)	2856265 PT PE/S+1X2-BE
Current Loop Lines		
Phoenix Contact	Surge protection plug (x2)	2856058 PT 1x2-24AC-ST
	Base element (x2)	2856113 PT 1x2-BE

Figure 35: Typical SPD Configuration Used To Protect Sensor

4 SERVICE, CONFIGURATION & TEST

4.1 Inspection

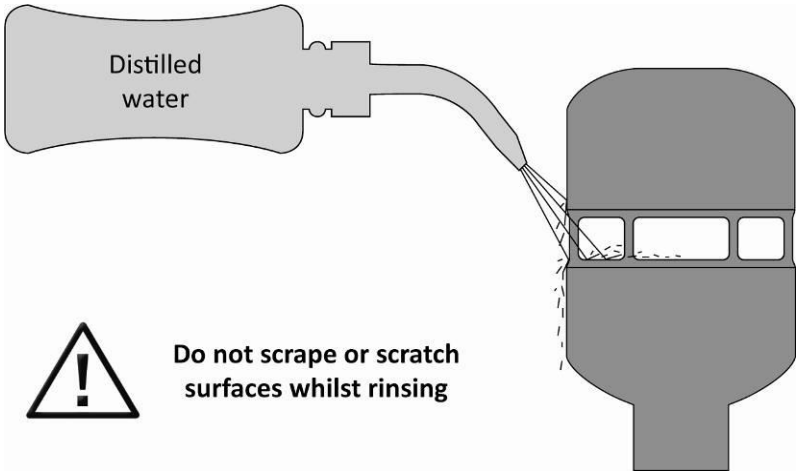
The following checks are required to identify any signs of corrosion or damage on the sensor which may hinder its performance. It is recommended that these checks be carried out annually.

Mechanical Damage; Check the sensor body for signs of damage, paying particular attention to the seals. Also inspect for signs of lightning damage which may appear as burns or scorch marks (or burnt smells). If damage has occurred replace the sensor immediately. Inspect the hydrophobic cavity coating for wear, corrosion and damage.

Corrosion; Inspect the mounting surface of the sensor and the surfaces of other mounting parts for signs of corrosion. If corrosion is present on the mounting interface it should be removed using an abrasive cloth. Before re-installing the sensor, electrical joint compound should be applied to the sensor's uncoated mounting surfaces (see Section 3). Check that any mounting screws, nuts and washers are in good condition with no signs of corrosion and tighten as necessary. If corrosion is present replace with parts of the appropriate finish (see Section 3).

Interconnection Cable; Inspect the condition of the cable. If any part has become frayed or damaged in any way, it should be replaced immediately. Intermittent cable faults may not be visible, but may show up as errors in data. See Section 2.2.6 for details on how to identify such faults. Confirm the intended network component values.

Connector Protective Sleeve ('Cold-Shrink'); Check for any signs of damage or degradation to the connector protection. If the sleeve is damaged it should be replaced (FT offer a protective sleeve 'cold shrink boot' on part number FT909).



Cleaning: The measurement cavity has a super-hydrophobic coating which helps to prevent water building up. When water enters the measurement cavity the surface helps to wash away dust and debris which may have settled. If any debris is present this can be removed by gently rinsing the measurement cavity surface with distilled water using a laboratory wash bottle or similar. Please note excess water droplets can be removed by lightly blowing or shaking the sensor.

Do not scrape or scratch the surfaces whilst rinsing. **Under no circumstances** should objects be inserted inside the measurement cavity, as this can cause irreparable damage. If the coating has been damaged then it may need to be re-applied. The body of the sensor can be washed if required using the same method as described above. Whilst washing the sensor care must be taken not to get water in the breather hole or into the connector at the base of the sensor.

Do not use cleaning chemicals to clean the sensor. If washing a nearby item protect the sensor with a suitable cover. Ensure the cover is removed before re-enabling the wind data survey.

4.2 Fault Finding & Troubleshooting

To determine whether a sensor has a fault carry out the following steps;

- Follow the inspection procedure above to identify signs of physical damage.
- Remove any objects or insects lining the cavity or blocking the airflow.
- Restart the sensor (power-cycle the unit if necessary).
- Test that the sensor is communicating properly using the Acu-Test Evaluation Pack (see Section 4.4).

If there are signs of physical damage and/or the sensor is failing to communicate properly, it should be replaced. If required, sensors may be returned to FT Technologies for further analysis (see Section 4.3).

- A current probe may be useful to monitor the current supply and the 4-20mA current loops.

Warning – The sensors contain no user serviceable components. Do not attempt disassembly as damage may result and product warranties will be invalidated.

During extreme weather conditions there may be periods where data is temporarily unavailable. However there are ways to mitigate against these affects. The following steps should be taken to ensure the highest levels of data availability from the sensor:

- Using the Acu-Test Evaluation Pack (see Section 4.4)
    - Check that the sensor has the latest version of software (please contact FT Technologies for more information on latest software releases)
    - Check that the heater set point is at least 30˚C (see Section 2.3).
    - Ensure that the internal filtering in the sensor is enabled (see Section 2.2.2)
- Check that the wind sensor data and status flag errors are being processed in accordance with guidelines in Sections 2.2.1 and 2.2.6.
- Ensure the sensor has been installed with adequate lightning and EMI protection (see Section 3) and the cable shielding is terminated at both ends. All mating surfaces must be free of paint and corrosion so that impedances between the sensor and ground are kept as low as possible
- Check that the measurement cavity's special coating is in a satisfactory condition. Debris can be blown out or washed out with distilled water spray.

Please contact FT Technologies for further information and advice if required.

4.3 Returns

If a sensor appears to be faulty, compile a detailed fault description for each sensor, then contact FT Technologies to request a Returns Materials Authorisation (RMA) form. Please complete the form and return as instructed. Returns cannot be accepted without prior approval via this authorisation form.

Any units damaged by lightning or disassembled by the customer cannot typically be repaired, however an inspection fee may still apply.

4.4 The Acu-Test Evaluation Kit

FT can provide Acu-Test Evaluation Kits and power supplies to assist users with connection, development and testing. The kit connects the sensor to a power supply and a Windows PC using virtual COM ports. The USB test cables converts RS485HD to USB. The 4-20mA output models described in this user manual use the FT055 Acu-Test cable:

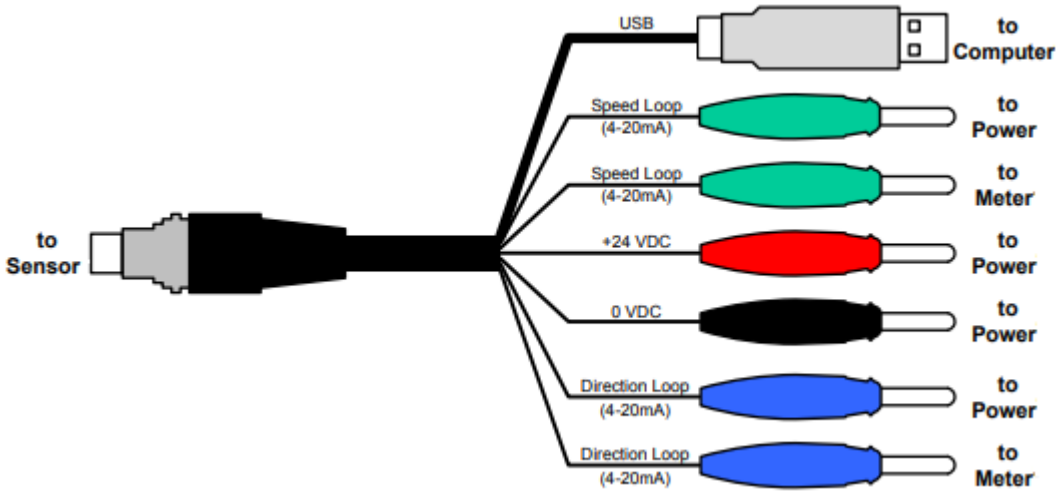


Figure 36: FT055 Acu-Test Evaluation Cable

The Acu-Test Evaluation Kit includes a USB test cable and a CD containing the Acu-Vis 2.0 software and user manuals. An external power supply capable of 6-30VDC and 4A is necessary, the FT062 power supply may be used in locations unsuitable for a benchtop electronics power supply.

Note: The FT062 power supply requires a regional C13-style adaptor for mains connection. All connections should be mated and operated in a dry and suitable working environment for electronics

Figure 37: The FT062 Power Supply (left) & Benchtop Electronic PSU Example (right)

The Acu-Test kit allows the checking and modification of various settings, including a real-time wind data user-interface. Acu-Vis 2.0 software will work on a PC running Microsoft Windows 7, 8, 8.1 and 10. The Acu-Test cable is not intended for long-term datalogging use.

Caution: Live connection/disconnection of the power and/or sensors during live operation, or miswiring of the power leads could damage the equipment and is not covered by FT's standard warranty terms

Warning: Modifying settings may alter the performance of FT wind sensors, ensure the user understands the potential risks

Warning: Users should perform a risk assessment and be suitably trained before attempting to use any electrical equipment. Personal injury may result from unsuitable working practices

4.4.1 Software Installation

1. Insert the Acu-Vis 2.0 CD into the PC. Begin the installation by running the setup.exe file, it may be necessary to contact an IT administrator. Follow the on-screen instructions.

2. Remove the FT742 sensor and USB test cable from their packaging

3. Ensure the power supply is disabled

4. Connect the test cable to the relevant parts

    a. Connect the red Acu-Test connector (white cable) to the red (+24VDC) positive connector of the power supply

    b. Connect the black Acu-Test connector (brown cable) to the black (0V) ground connector of the power supply

    c. Connect the USB to a spare USB PC socket and remove any unnecessary USB devices

5. Windows will automatically detect the USB cable and attempt to update the FTDI drivers

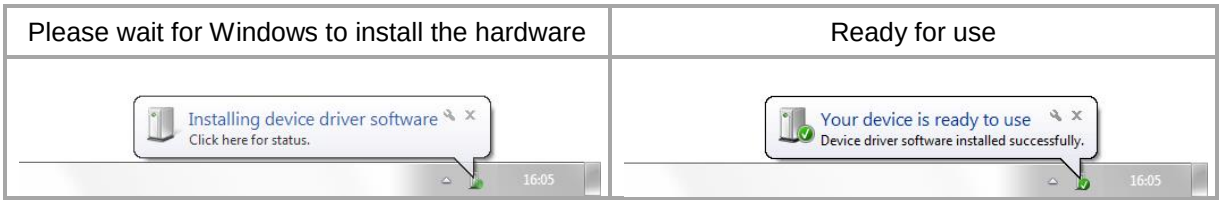


Figure 38: Windows Driver Installation Sequence

6. When the user is ready to operate the sensor - enable the power. When using a benchtop PSU ensure the required voltage is supplied (6-30VDC) and the current output is enabled

7. Once the above sequence is complete, wait approximately 5 seconds and then run Acu-Vis by selecting the shortcut icon on the desktop

Figure 39: Acu-Vis 2.0 Windows Launch Icon

8. If you need to change the Acu-Test cable it is recommended to press the 'Disconnect' button and follow the exit process, close the Acu-Vis program and then disable the power. Remove the USB cable and replace with the required cable

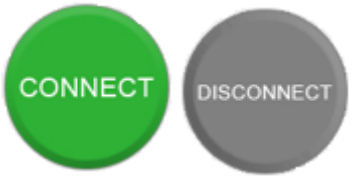
In case of technical issues please contact the technical support team at FT Technologies.

Quick Start Steps:

1. Ensure the power supply is switched off
2. Connect the FT055 Acu-Test cable to the FT wind sensor and the PC
3. Connect the FT055 Acu-Test cable to the power supply:
    a. Connect the red power connector (white cable) to the red (+24VDC) positive connector of the power supply
    b. Connect the black power connector (brown cable) to the black (0V) ground connector of the power supply

Figure 40: Acu-Test Cable Power Connections

4. If the user will be testing the 4-20mA current loop output functionality with an Ammeter, it will be necessary to connect the 4-20mA current loop wires to a 4-20mA power supply source (if this is not necessary then the following connections are not required):
    a. Connect the yellow wire (wind speed 4-20mA output) to a +24VDC power supply
    b. Connect the green wire (wind speed 4-20mA output) to an ammeter and then connect the other terminal on the ammeter to the 0V terminal on the DC power supply
    c. Connect the purple wire (wind direction 4-20mA output) to the +24VDC terminal on the power supply
    d. Connect the grey wire (wind direction 4-20mA output) to an ammeter and then connect the other terminal on the ammeter to the 0V terminal on the DC power supply
    e. Note: The current loops use a ‘sink’ topology, i.e. the sensor controls the current allowed to pass through the sensor, the sensor does not ‘supply’ the 4-20mA signal from its own power supply
5. Start Acu-Vis 2.0 and press the green CONNECT to begin a test session. At the end of the test press the grey DISCONNECT button to exit the program and re-enable the 4-20mA current loop output



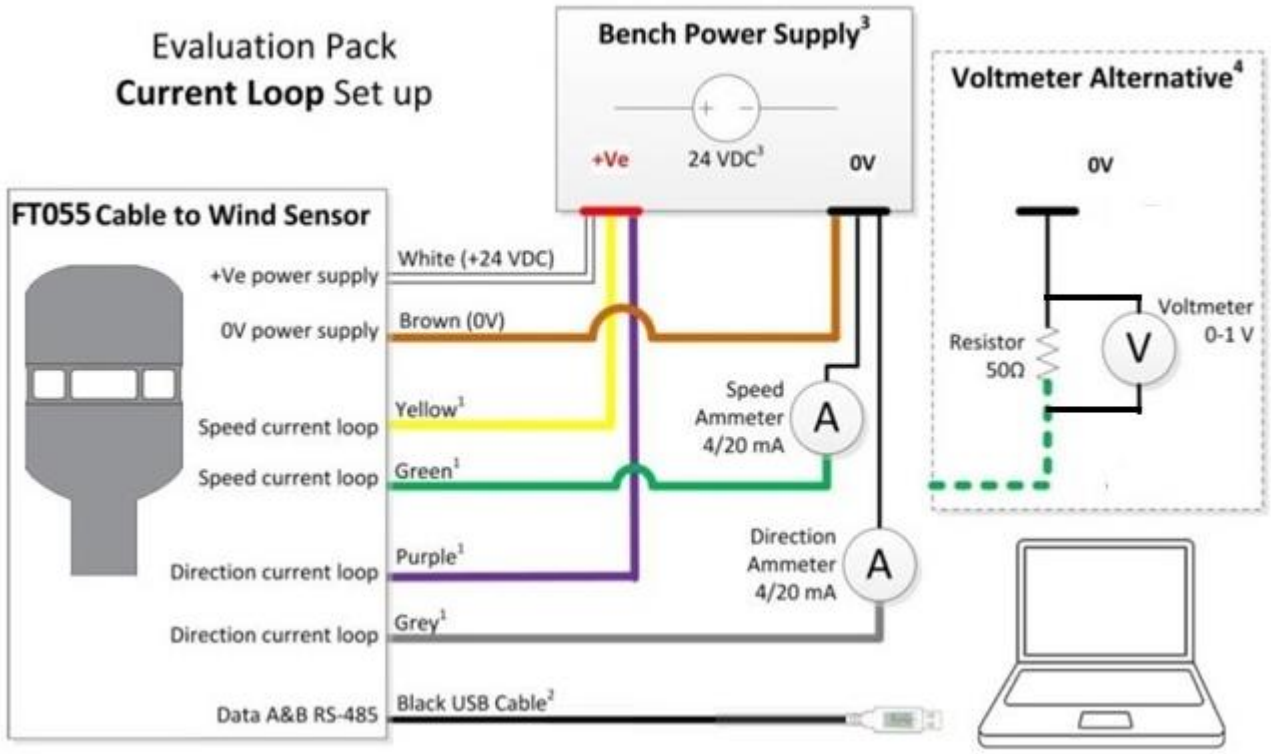


Figure 41: Evaluation Pack Current Loop Set Up

The sensors can be tested by connecting a DC Ammeter in series with each current loop. A positive supply must be provided to one of the current loop wires. The other wire must then be connected through an ammeter to ground. This is because the current loops **sink** current, they do not source it. Figure 41 shows how the Evaluation Pack can be quickly set up to evaluate the current loops.

The 4-20mA current loops are polarity insensitive, therefore the yellow wire can be swapped with the green, while the purple wire can be swapped with the grey.

The DC power supply should be able to supply the maximum heater current of up to 6A (the current limit can be modified by the user and is typically set to 4A). The heater will automatically turn-on if the ambient temperature is below the programmed set point (the recommended setting is 30°C).

Alternatively connect a 50Ω resistor in place of the ammeter and measure the voltage across the resistor with a DC voltmeter or oscilloscope.

Warning: Live connection/disconnection of the power and/or sensors during live operation, or mis-wiring of the power leads could damage the equipment and is not covered by FT's standard warranty terms.

4.4.2 Acu-Vis 2.0 Software Operation

Acu-Vis 2.0 opens on the Connect display window. Press the green ‘CONNECT’ button to begin a user session, the program will detect the wind sensor as long as it is powered up and operating normally.

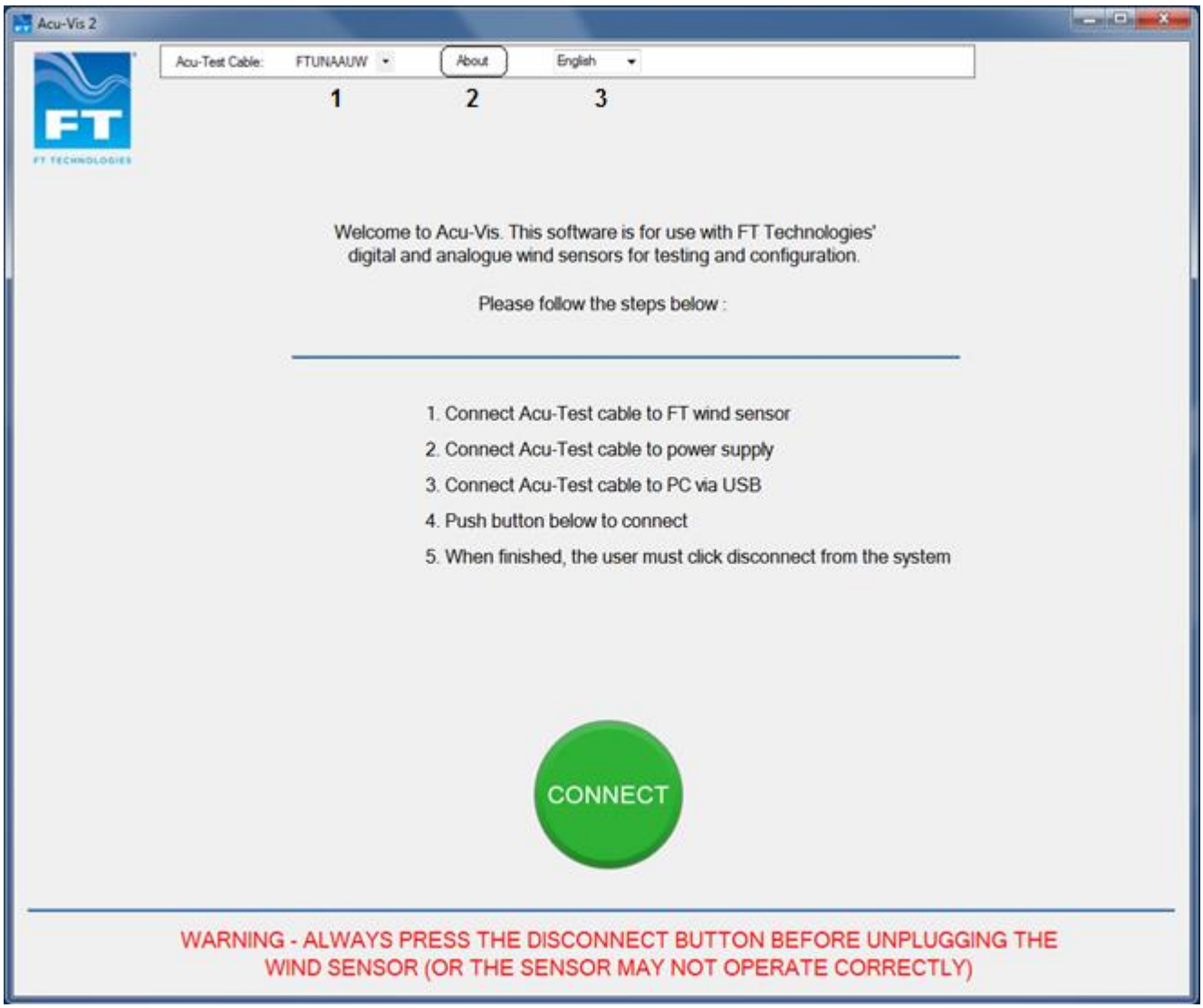


Figure 42: Acu-Vis 2.0 Connect Display

1. The Acu-Test cable serial number
2. About Window: FT Technologies contact information and software build versions
3. Language selection options: English, French, Chinese, Spanish, Japanese and Korean

Analogue Settings Tab

The Analogue Settings tab allows the user to modify core settings and run service diagnostics:

- Datum Current (direction current centred at 4mA or 12mA)
- Error Current (typically 1.4mA)
- Wind Speed Scaling Range – Typically 0-50m/s or 0-75m/s wind scaling (4mA = 0m/s, 20mA = variable)
- Test the 4-20mA Current Loop outputs – This test will cycle through various mA outputs
- Sensor Logging: This will download relevant sensor settings in a .CSV file for analysis by the FT Technologies technical team

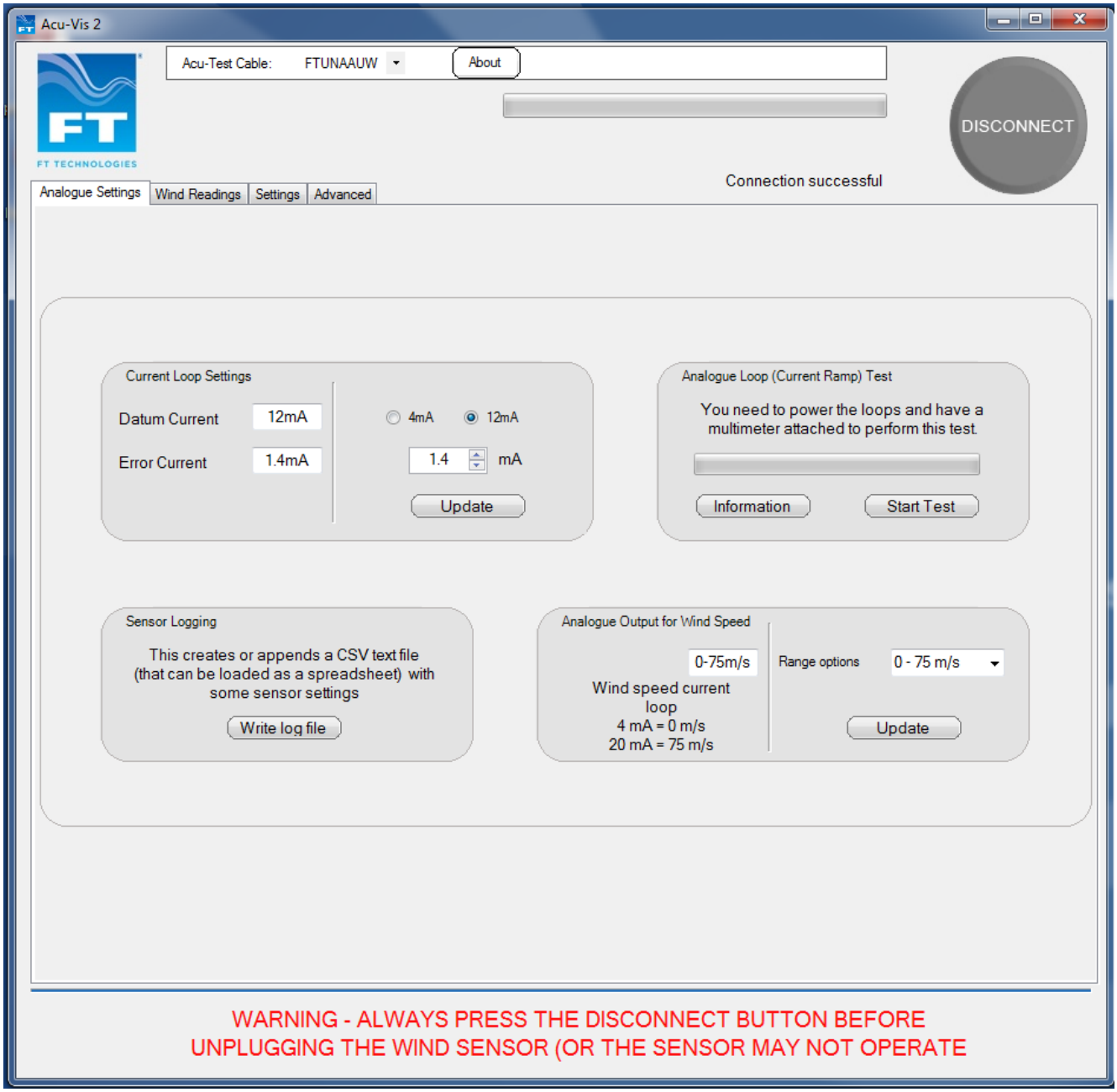


Figure 43: Acu-Vis 2.0 Analogue Settings Display

Wind Readings Tab

The Wind Readings display includes:

- Sensor settings
- Serial Number & Software Version
- Acu-Test cable details
- Real-time wind speed and direction data
- Heater Setpoint and Internal Temperature.

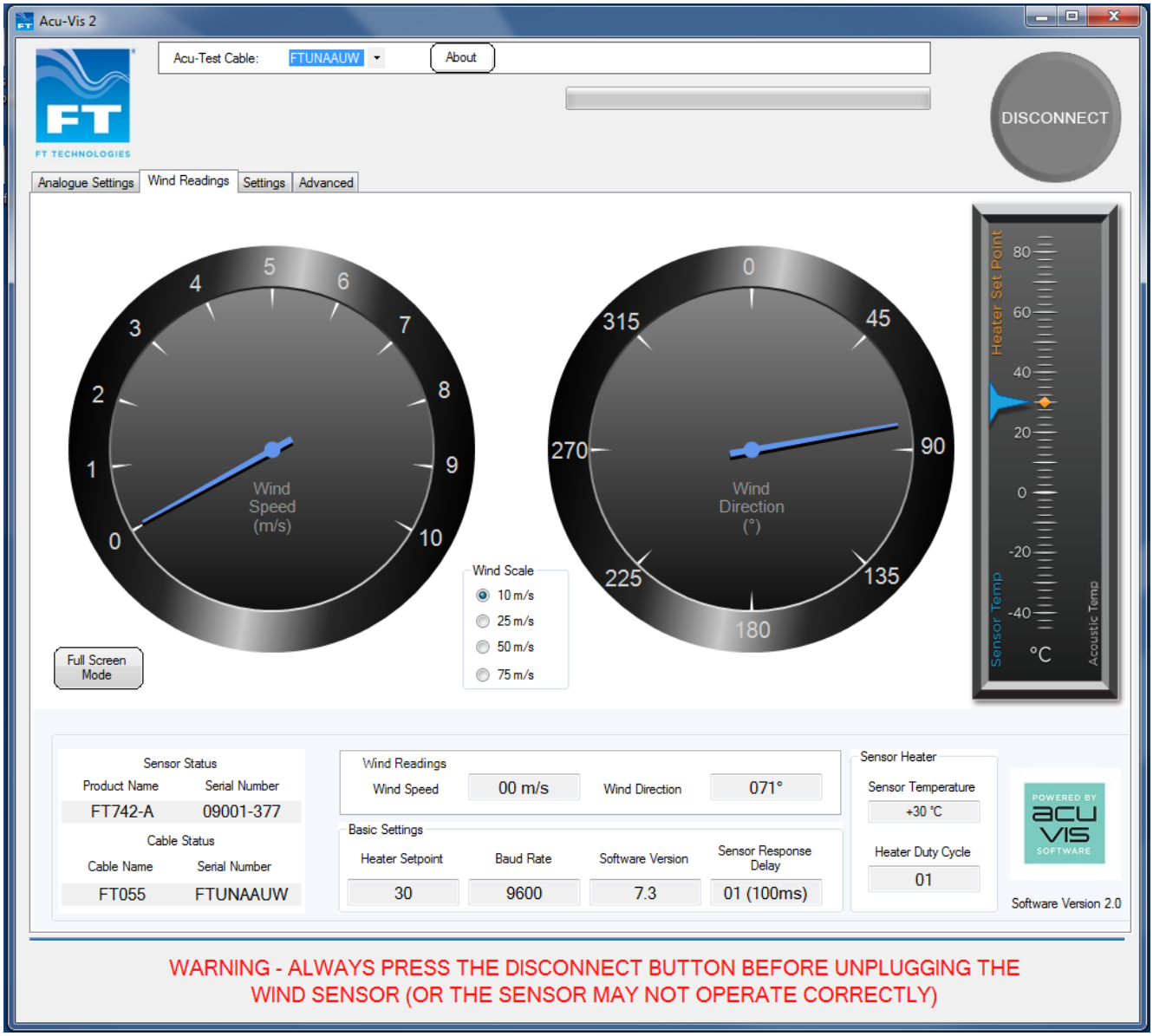
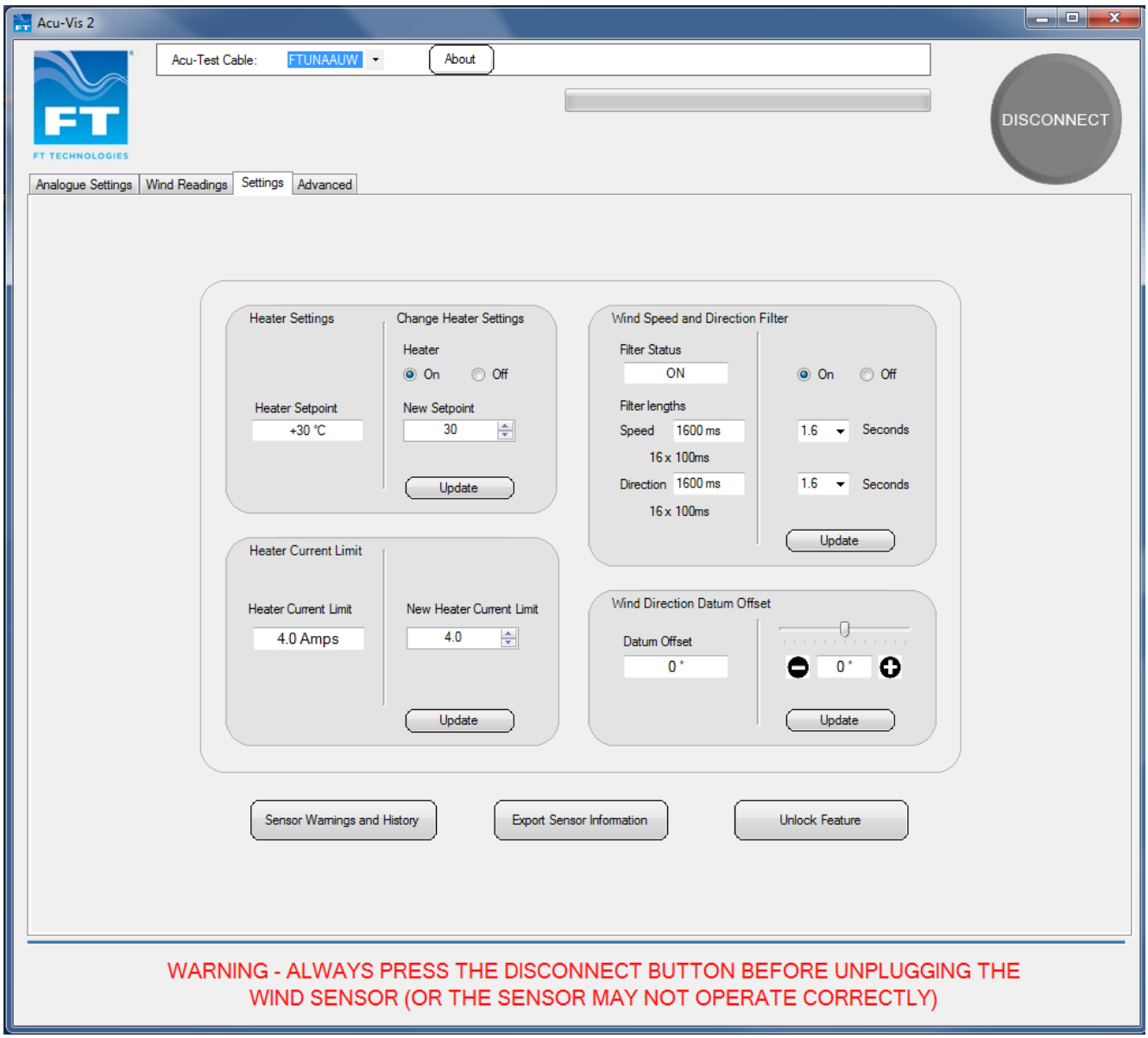


Figure 44: Acu-Vis 2.0 Real-Time Wind Readings Display

Settings Tab

The Settings tab provides an interactive user interface for changing basic sensor settings with point and click operation. Consult the user manual for full software command details.

- Heater Settings: On/Off and Heater Setpoint
- Wind Speed & Direction Filter: On/Off and the averaging time period
- Heater Current Limit: Change the maximum current limit used by the sensor
- Wind Direction Datum Offset: Apply a directional offset to the sensor



The ‘Sensor Warnings and History’ button will provide a history of the connected sensor settings where it has been connected to the PC.

The ‘Export Sensor Information’ button creates an encrypted file containing current user settings and diagnostic information. This feature will export a file in .fff format that can be forwarded to the FT Technologies support teams.

The ‘Unlock Feature’ button is used to unlock advanced features in Acu-Vis 2.0, including the ‘Commands’ and the ‘User Calibration Table’ tabs.

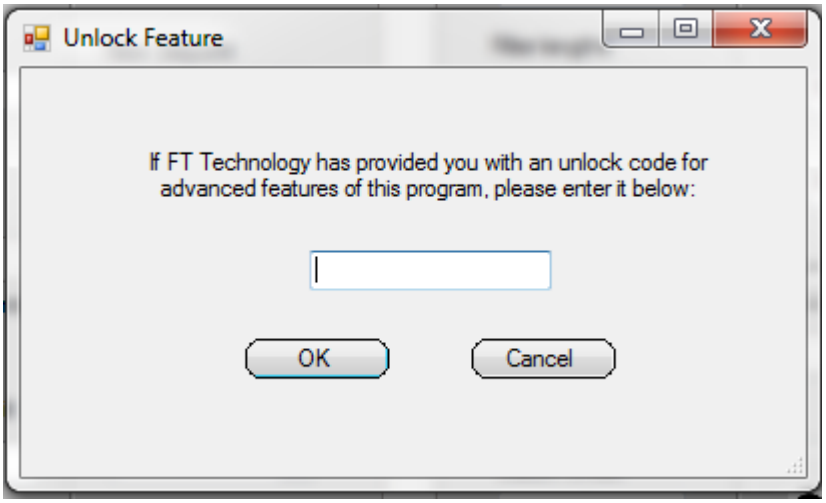


Figure 45: Acu-Vis 2.0 Settings Display & Unlock Feature Window

Advanced Tab

The Advanced Settings tab provides an interactive user interface for changing advanced sensor settings with point and click operation. Consult the user manual for full software command details.

- Selective Filter: On/Off, time setting
- Overspeed Warning: On/Off

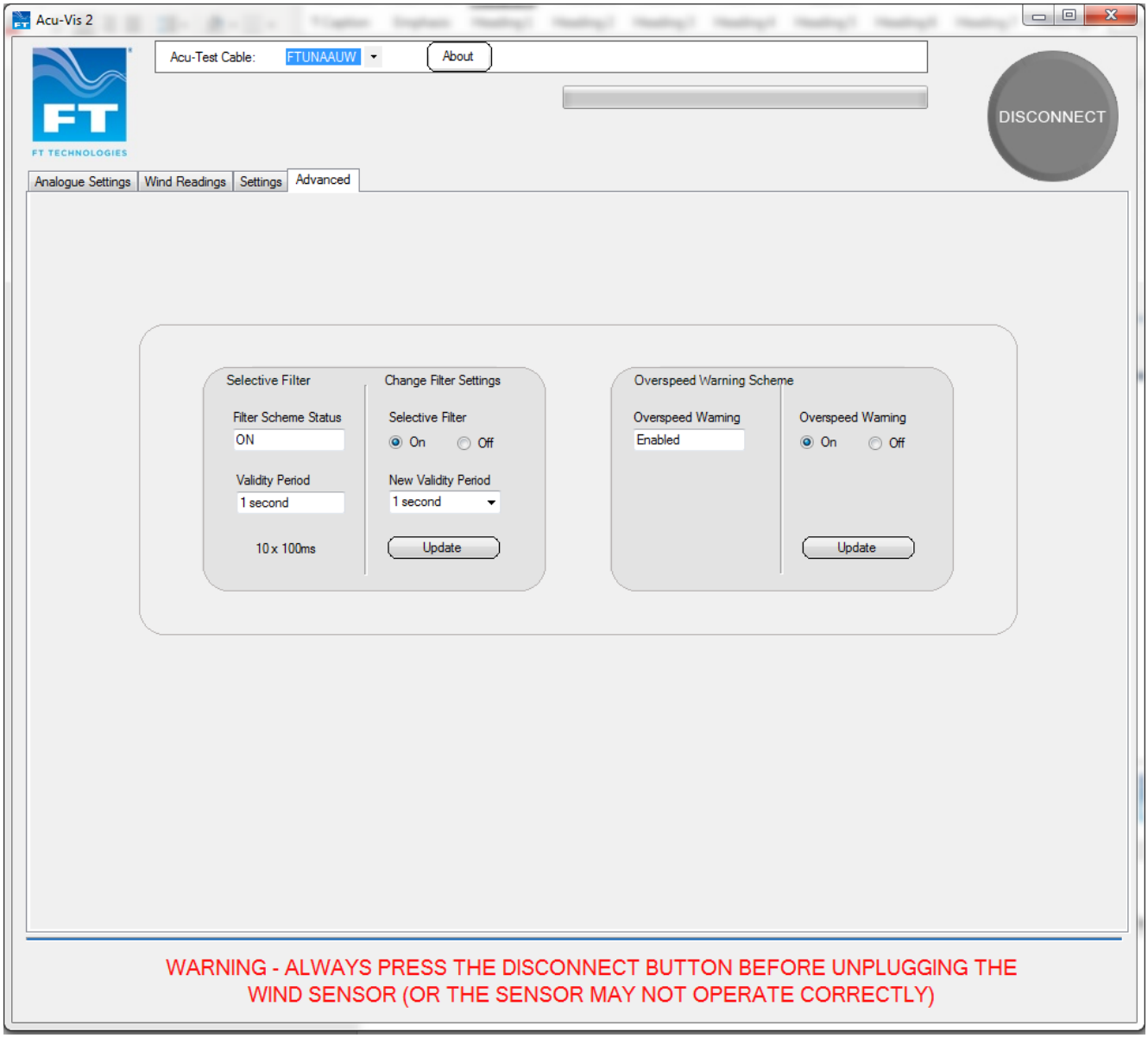


Figure 46: Acu-Vis 2.0 Advanced Display

UCT ('User Calibration Table') Tab

The UCT window provides the user with a simple method of changing the calibration performance of the sensor. Refer to the UCT commands detailed in the user manual for further information.

Acu-Vis 2.0 will download any existing UCT settings and display them on the table and graph.

The easiest method of changing the UCT is to use the 'Standard % Offset" buttons to establish a calibration change.

When the calibration change has been selected press the orange 'Save UCT to Sensor' button and ensure the 'UCT Status' is set to Enabled.

Caution: This feature will change the calibration profile of the sensor and may compromise survey data and/or system performance

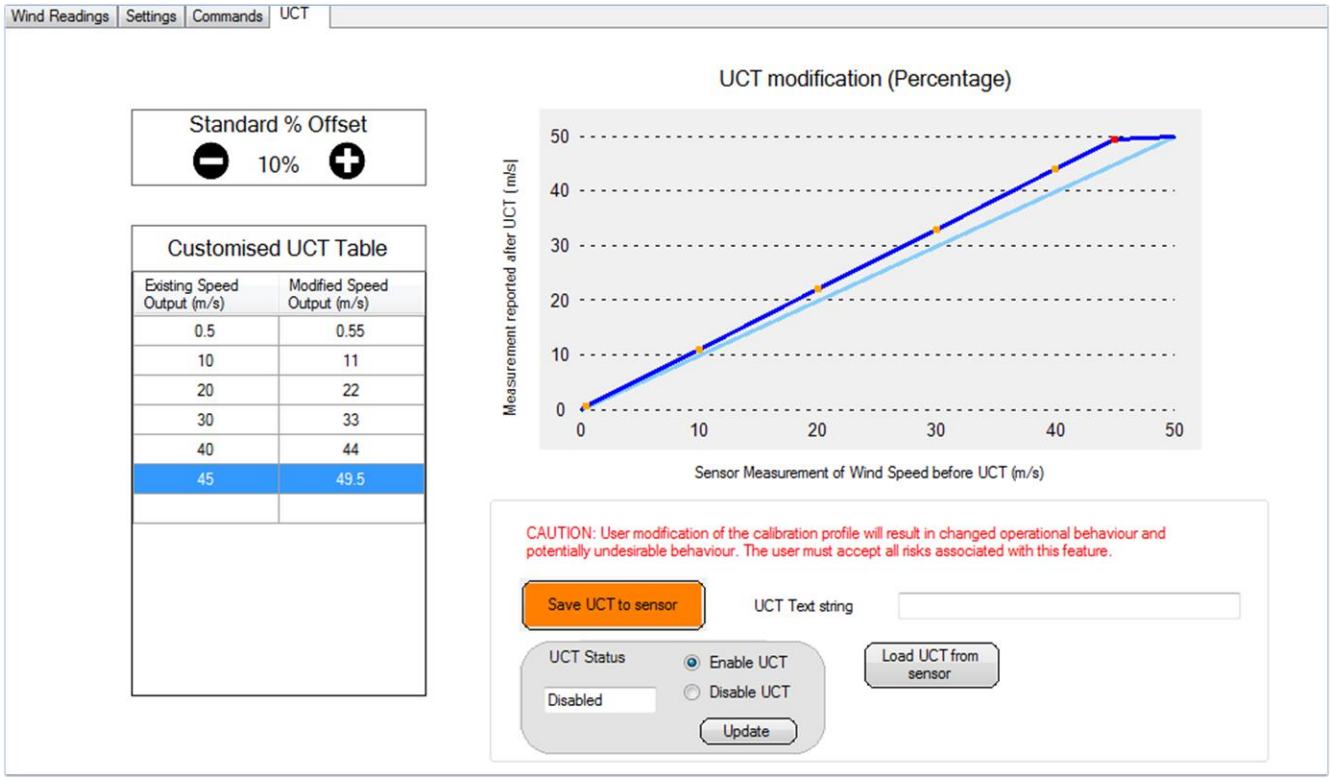


Figure 47: UCT Modification Window

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