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

Direct-Mount Variant

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A4277-3-EN
November 2017

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 provides
- 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 FT742-A-DM sensor is designed for general meteorological applications - particularly in harsh environments such as areas of icing, sand, dust and offshore installation. The solid-state ultrasonic wind sensor uses acoustic resonance airflow sensing techniques to measure both wind speed and direction. The wind sensor has no moving parts to degrade or wear-out and is designed for applications requiring high reliability.

Mounting and aligning the sensor is simple. A compass (not supplied) can be used to align the sensor with magnetic North (0°) using the 0° wind datum marking feature (see Figure 12). For operation in ice-prone areas, the FT742 is 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.

FT sensors are configurable and can be factory programmed to the required customer settings, contact FT Technologies for further details.

Note: The FT742-DM range is not suitable for turbine control applications. The FT742-FF and FT742-PM ranges are designed for this application.

The standard FT742-DM, when installed to FT Technologies recommendations, is electrically isolated from the mounting pole, making it unsuitable for conductively-grounded lightning protection schemes. The addition of the FT035 grounding accessory provides a reliable, low-resistance grounding path. Refer to Section 3.3 or contact FT Technologies for further information.

1.2 Build Versions & Labelling

Figure 1 shows how to identify a sensor, the serial number and calibration code (if applicable). Section 2.2.3 describes how you can use the wind speed scaling reference to identify the calibration of the sensor.

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
- Physical damage
- Problematic environmental conditions or combination of conditions

1.4 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.

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	0-75m/s
Resolution	0.1m/s
Accuracy	±0.3m/s (0-16m/s) ±2% (16m/s-40m/s) ±4% (40m/s-75m/s)
Wind Direction Measurement	
Range	0 to 360°
Accuracy	4° RMS
Resolution	1°
Environment	
Temperature Range	-40 to +85°C (operating & storage)
Humidity	0 - 100%
Altitude	0 - 4000m

Data I/O

Analogue Option	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	24VDC nominal (12-30VDC range)
Supply Current (Heater off)	31mA typical for the sensor + 2x current loops (4-20mA)
Supply Current (Heater on)	6A (max) [5] – 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 (the current limit can be modified, see Section 4 or contact FT for details).

Physical

Weight	380g (without size adaptors)
Material	Aluminium alloy (hard-anodised)
I/O Connector	8 way
Mounting Method	Pipe-Mount screw-fix (33.7mm external diameter EN10255 pipe). Various size adaptors and pipe-inserts available.

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. The heater set point and current limit can be pre-configured in the factory or adjusted using the FT Acu-Test Analogue kit.
5. See safety instruction requirements (pages 4 and 5).

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 Section 4.4.

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
12V	100 Ω
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 because single readings can accidentally become corrupted (see Section 2.2.6).

2.2.2 Using the Averaging Filter

The sensor has an internal averaging filter enabled by default, which dampens the speed and wind direction outputs by averaging previous data values. By default this feature averages the last 16 readings (1.6s), this can be factory configured to values 0.1-6.4s in 0.1s increments. It is possible to disable the internal filter (but not recommended) via the Acu-Test Analogue test software. Contact FT technologies for further details.

Selective Filter

In addition to the averaging filter described above, 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.

2.2.3 Wind Speed Loop

The default wind speed scaling is such that a change from 4 to 20mA represents 0-75m/s. This corresponds to a scaling factor of 0.2133mA per m/s. The wind speed scaling factor can be factory programmed to the customer requirements, contact FT for further details. Figure 3 shows the available wind speed scalings.

Wind Speed Scaling References (m/s)	Value @ 4mA	Value @ 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. For further information on this advanced feature contact FT Technologies.

If a wind sensor is replaced care must be taken to ensure that the replacement sensor has the same scaling. Otherwise the data will have reduced quality.

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° datum. The 0° 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.

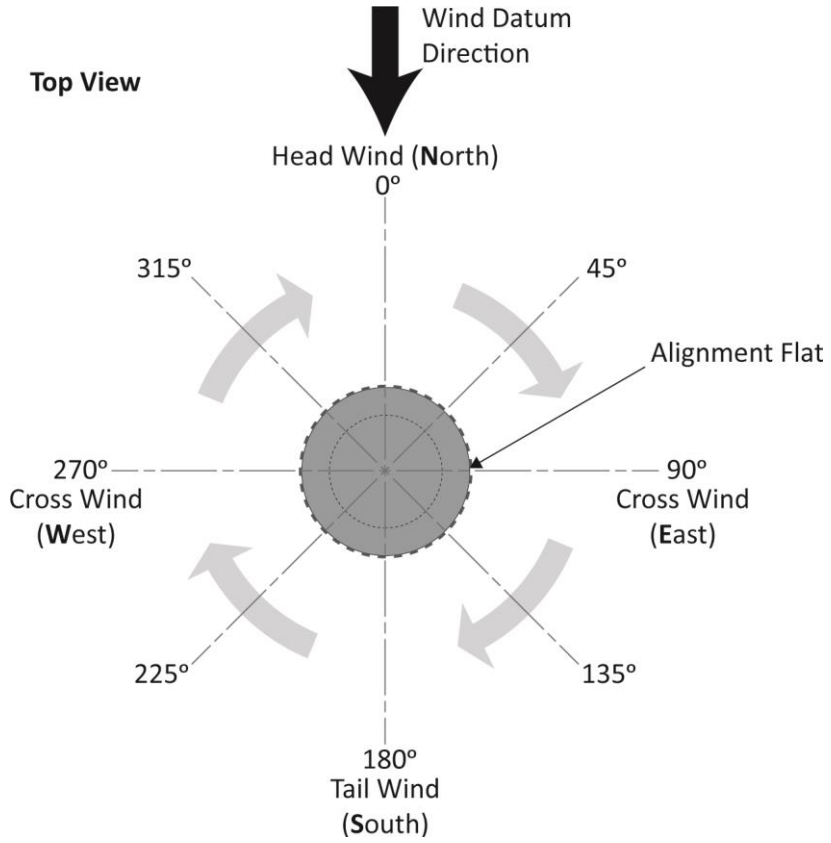


Figure 4: Wind Direction (view from above)

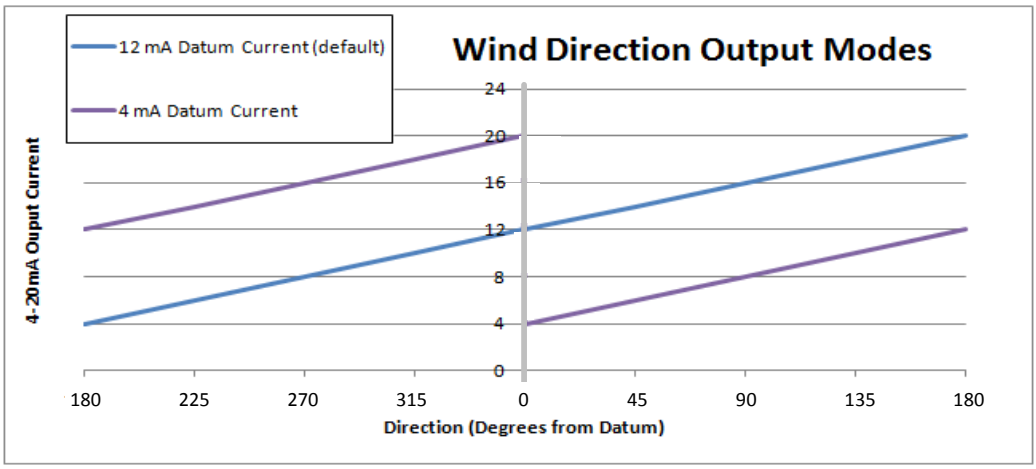


Figure 5: Visualisation of direction with 4mA (left) and 12mA (right) current offsets

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 4.4) 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 Conditions

If the sensor detects that a reading may be invalid this is signalled to the 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 4.4) by the user from 1.4mA up to 3.9mA in steps of 0.1mA.

Note: An optional Overspeed Warning Scheme can be enabled (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.

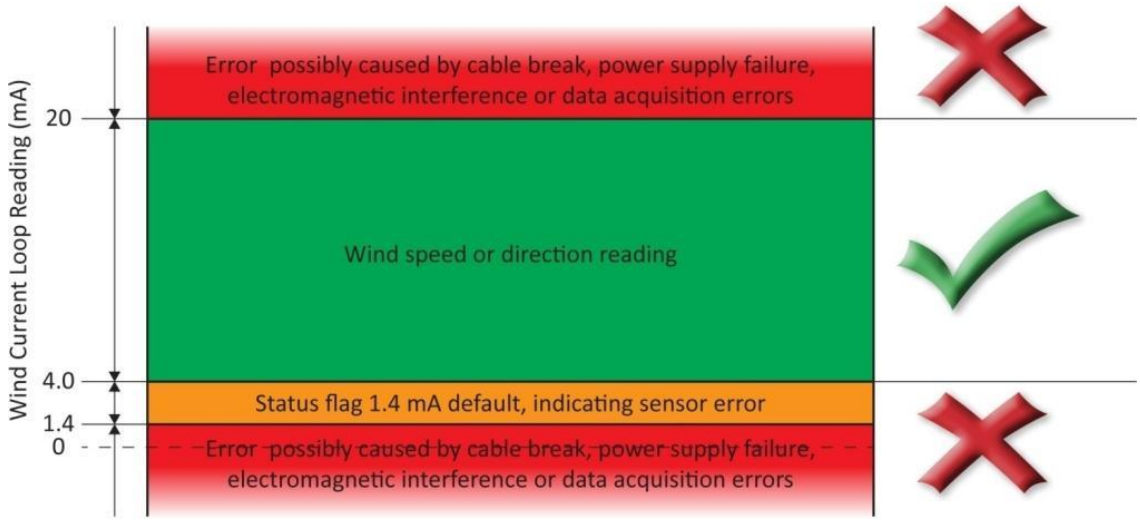


Figure 6: 4-20mA valid readings range

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 datalogger should be able to recognise and interpret error codes within the data. If errors are ongoing (more than several seconds), a power reset of the sensor should be performed.

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 settings) 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 FT742 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. (FT742 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.

2.3 Heater Operation

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.

We recommend selecting a suitable set-point temperature for the sensor environment. Factors to consider include ambient temperature, relative humidity, wind speed and ice/snow conditions. This setting can be programmed by the factory, or by using the Acu-Test software (see Section 4.4).

It is important to consider cable resistance losses and use a suitably rated cable of an appropriate length. FT recommends cable types in Section 3.2.

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 (4A 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 in software from 0.1 – 6A (from the default of 4A and in increments of 0.1A). The current limit can be programmed at the factory or modified using the Acu-Test PC software (see Section 4.4). By default the heater requires a minimum of 11V for operation.

2.4 Low Power Operation

The sensor is designed for typical operation at 24VDC, however the sensor can operate below this with reduced performance between 12-30VDC. By default, the heater will shut down at approximately 11VDC. Below approximately 8V the sensor may shut down. Lower voltages reduce the overall power consumption and heater performance.

For further advice on power and heater management strategies, contact FT Technologies.

3 MECHANICAL & ELECTRICAL INSTALLATION

The wind sensor has no moving parts to degrade or wear-out and is designed for applications requiring high reliability and cold weather operation.

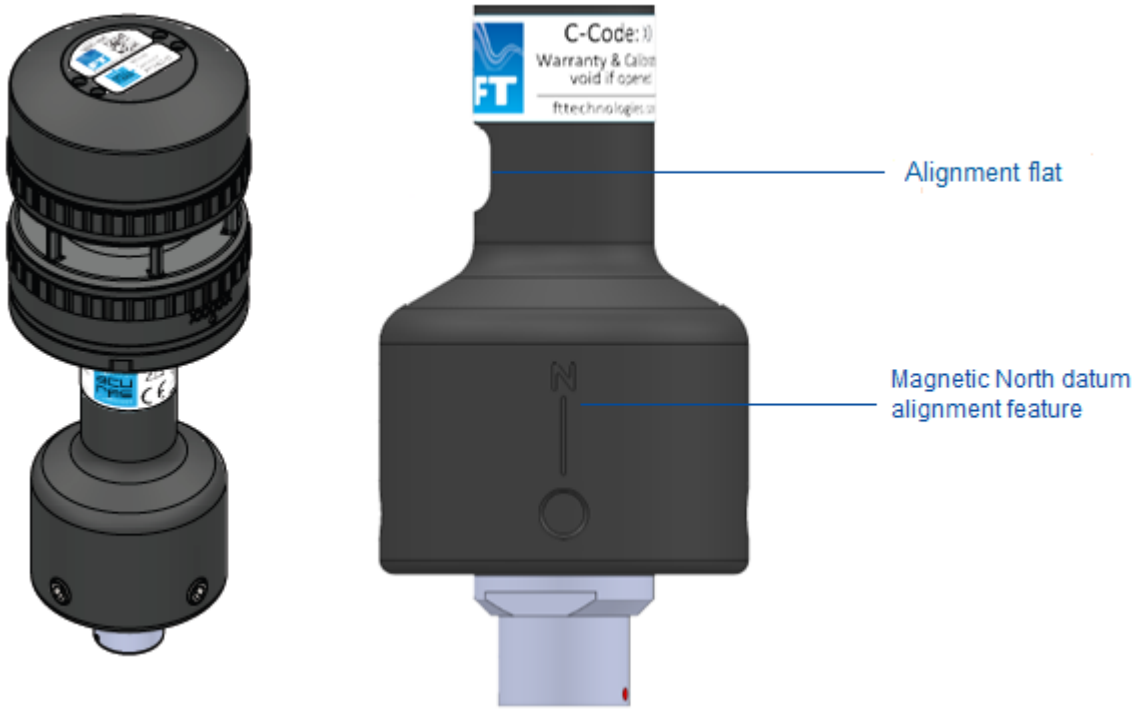


Figure 7: Direct-Mount Wind Sensor

Direct Mount sensors are mounted vertically with the cable connector routed through a 33.7mm (outer diameter) hollow pipe (EN10255 standard sizes). 4 M6 screws are required to secure the sensor onto the pipe (Figure 11). The sensor body is manufactured from hard-anodised aluminium and the cavity has a water-repellent coating.

A suitable compass (not supplied) can be used to align the sensor with magnetic North using the convenient ‘N’ alignment marking and the alignment flat. The magnetic North marking indicates 0° and rotates clockwise when viewed from above (Figure 10). The alignment flat is used with a square-sided compass for rotational alignment. Magnetic North should be lined up to face parallel to the ‘N’ marking feature (Figure 12).

Ensure the airflow into the sensor is not obstructed or influenced by nearby objects.

In order to keep the pressure within the sensor equalised with the atmospheric pressure, a small breather hole is located within the connector housing compartment that should not be blocked.

See safety instruction requirements on pages 4 and 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 are safe and fit for purpose. Please see disclaimer Section 1.4.

The mounting pipe should have a minimum galvanising thickness of 50µm to ensure long-term protection against corrosion (a relevant galvanising design standard should be considered, for example ASTM A123 or ISO 1461-2009). Aluminium components of the appropriate grade could be used as an alternative.

At the base of the sensor the mounting pipe meets the sensor (visible when viewed from below). The contact surface ring (see Figure 8 left image) is hard-anodised and unsuitable for electrical grounding between the sensor body and ground. This connection should be checked as part of the annual inspection of the sensor as detailed in Section 4.2. The FT035 grounding accessory can be fitted within the connector chamber and can provide a low-resistance grounding path to the outer edge of the mounting pipe. The FT035 is comprised of a coiled metallic spring fitted within the circular inner wall, mating with the outer edge of the mounting pipe, it can be viewed from the below viewpoint:

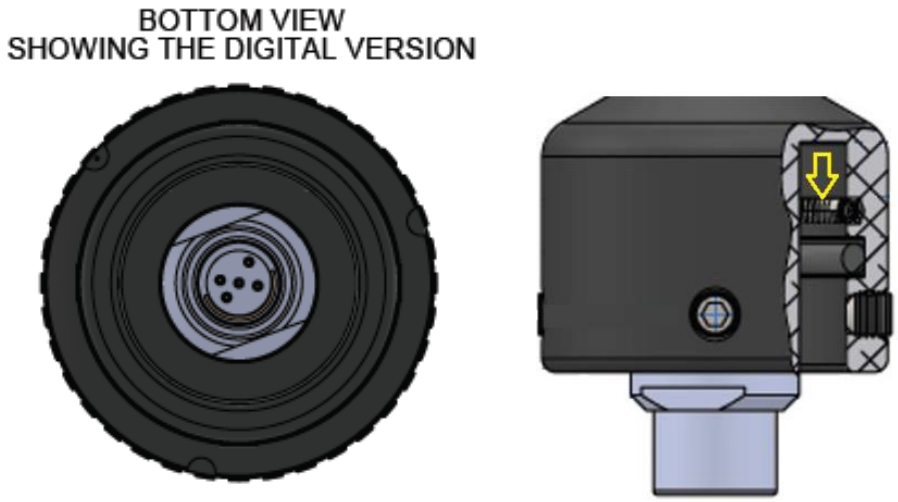
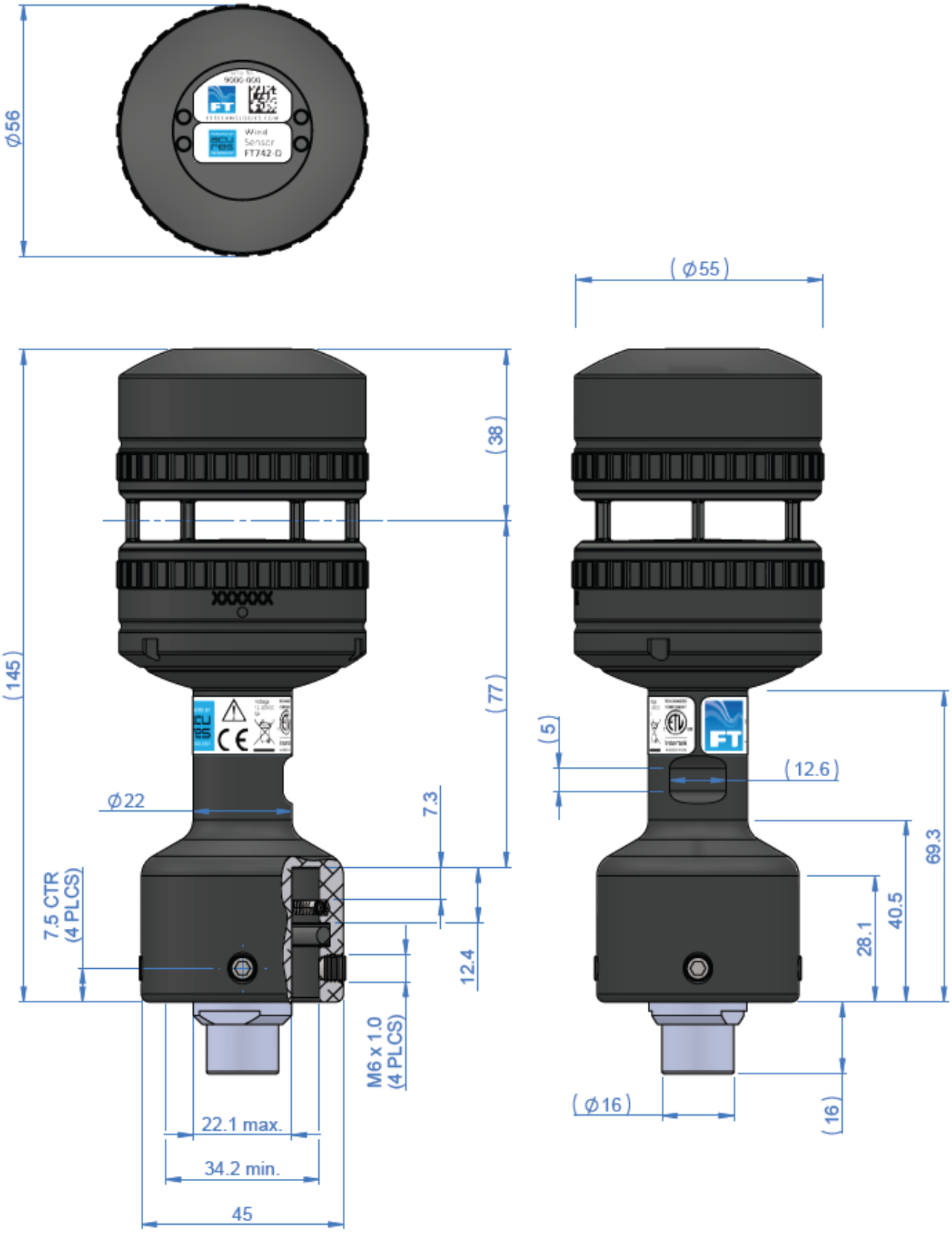


Figure 8: Direct-Mount – Connector (View From Below and FT035 Location)

The following replacement parts are available:

FT027	O-ring (3.53 CS x 32.92 ID)
FT031	Size Adaptor 25mm (1”) for FT742-DM (includes a FT033 tapered pipe insert & 4x FT034 self-locking fasteners)
FT032	Size Adaptor 50mm (2”) for FT742-DM (includes a FT033 tapered pipe insert & 4x FT034 self-locking fasteners)
FT033	Tapered Pipe Insert (33.7mm OD)
FT034	1x Self-locking Fastener
FT035	Grounding Accessory


Ø56
Wind
Sensor
FT742-D
(Ø55)
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(38)
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Ø22
7.3
12.4
7.5 CTR
(4 PLCS)
M6 x 1.0
(4 PLCS)
22.1 max.
34.2 min.
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(12.6)
69.3
40.5
28.1
(Ø16)
(16)

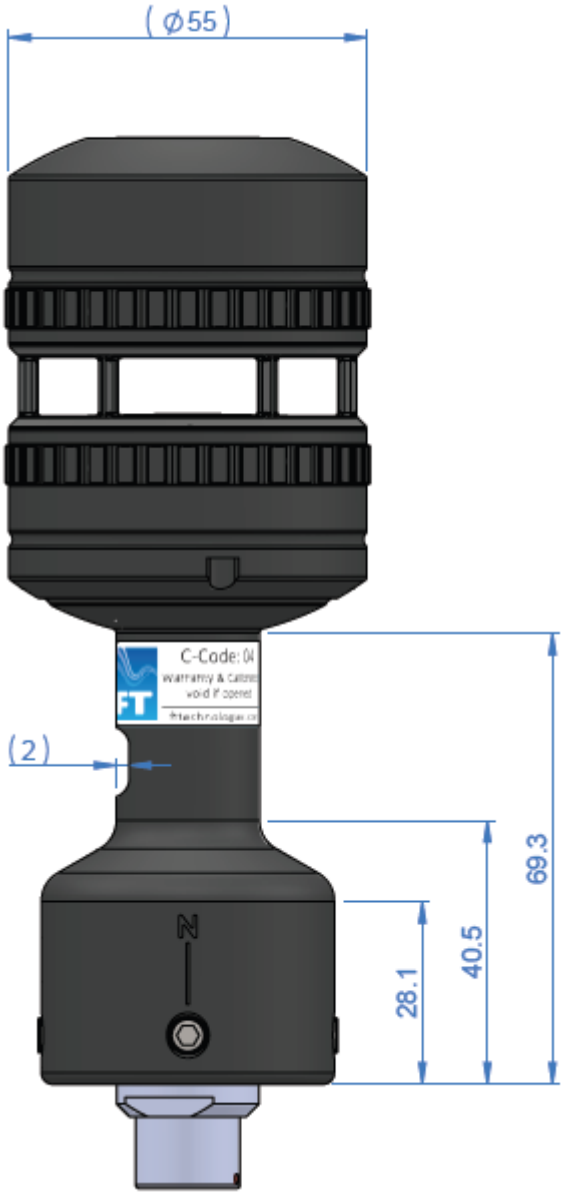


Figure 9: Direct-Mount Wind Sensor (mm)

The sensor measures the wind direction relative to the central datum feature. When the wind sensor is correctly aligned the wind direction measurements will be as shown in
Figure 10.

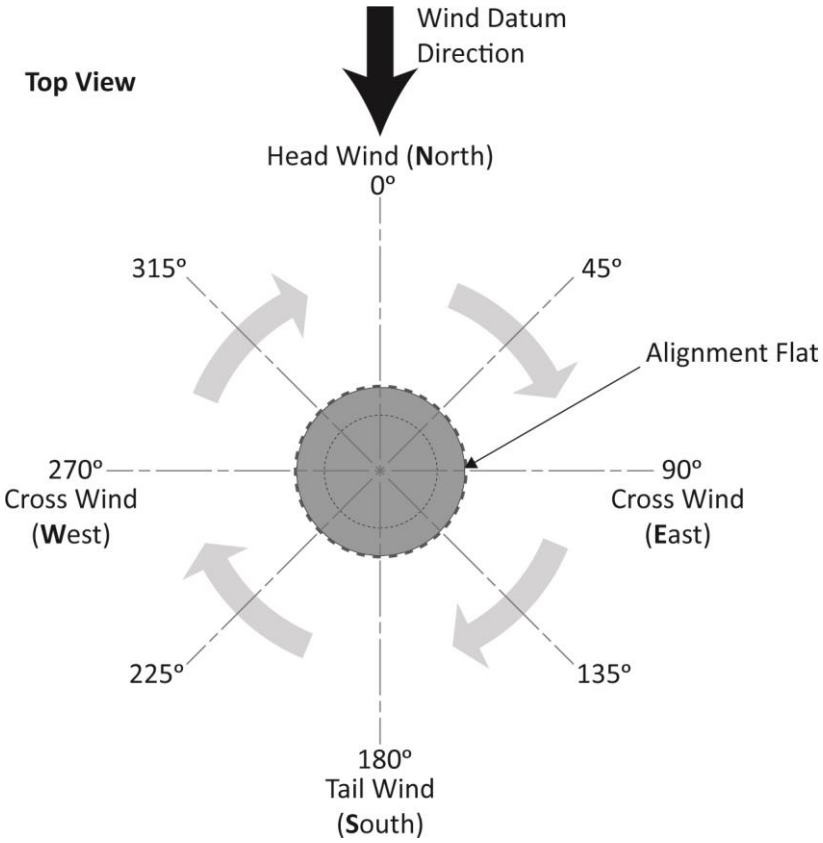
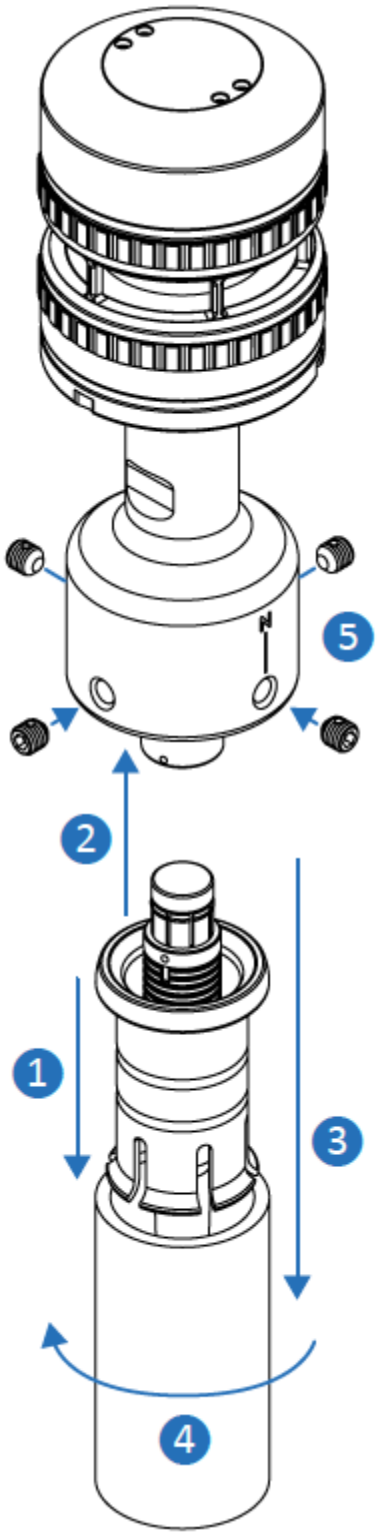


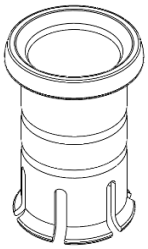
Figure 10: Wind Direction (view from above)

1. Pass the cable through the mounting pipe and pipe insert
2. Push the slotted end of the pipe insert into the mounting pipe. Apply a continuous seam of all-weather adhesive sealant around each of the two channels, before pushing the insert fully into the pipe, ensuring the shoulder is flat and any surplus sealant is wiped away. This insert provides a smooth transition for the sensor O ring to facilitate easy mounting of the DM with no damage to the internal O ring (for alternative pipe sizes use the available size adaptors)
3. Connect the cable to the wind sensor and lower the DM base onto the pipe
4. Rotate the sensor to align the central North ('N' datum, feature) with magnetic North (or an alternative reference)
5. Tighten the four self-locking fasteners (4x part FT034) ensuring an even distribution of pressure and firm contact with the mounting pipe. The fixings use a thread-locking insert and will provide resistance before they are fully engaged. In highly corrosive environments (such as coastal installations) the use of marine grade self-adhesive tape (such as USCGFP by 3M) is recommended to apply over the top of the mounting fasteners to ensure ease of removal. In these environments, it is also beneficial to apply sealant around the base of the sensor at the pipe interface to reduce build-up of corrosion that could make sensor removal difficult.

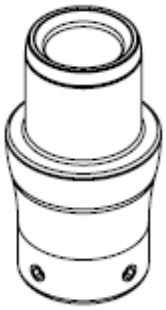
Confirm the installation is safe and appropriate for the environment.

FT provides optional size adaptors to suit mounting diameters of 25mm (FT031) and 50mm (FT032). Ensure the internal diameter allows the interface cable to pass through.

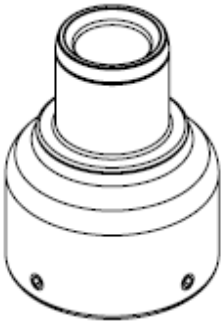




Pipe Insert (FT033)



25mm size adaptor (FT031)



50mm size adaptor (FT032)

Figure 11: Direct-Mount Sensor Pipe Installation – Including tapered pipe insert and size adaptors

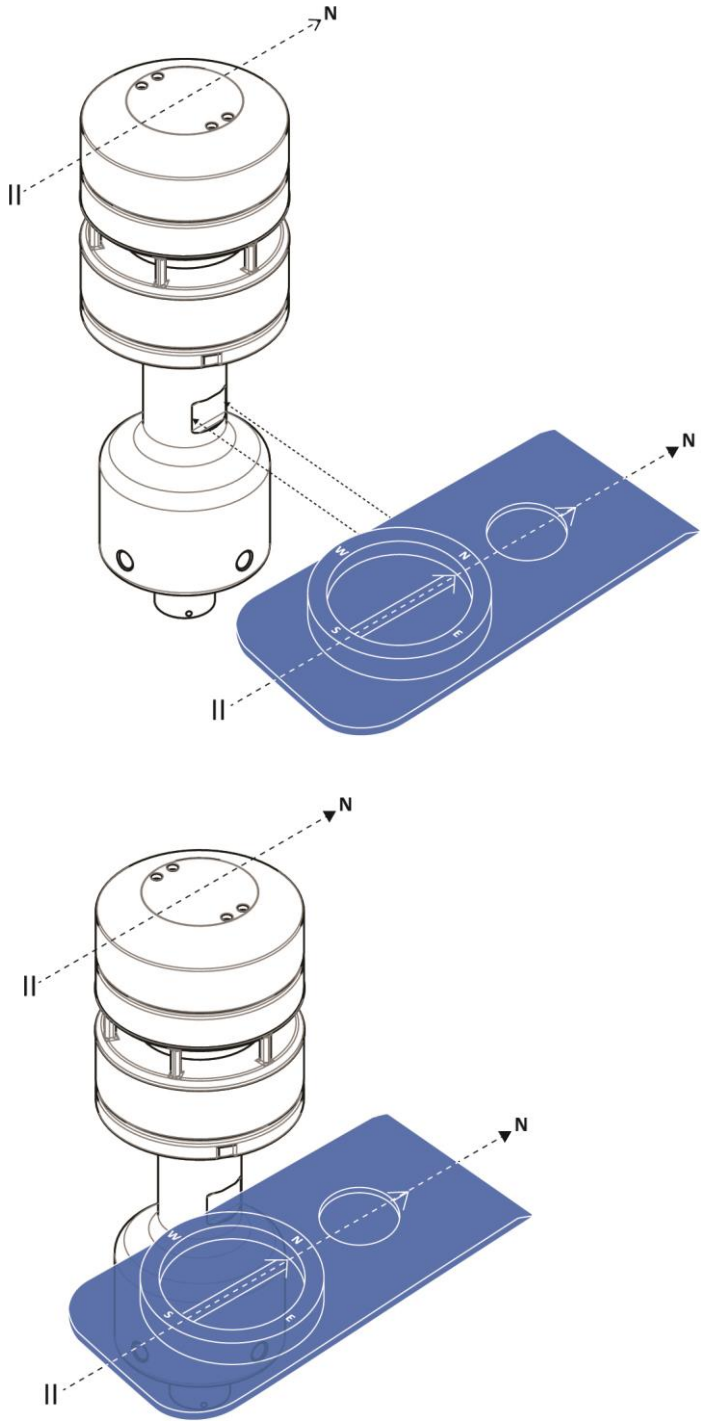


Figure 12: Direct-Mount Compass Alignment

3.1 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 13 and the mating connector manufacturer's part numbers in Figure 14.

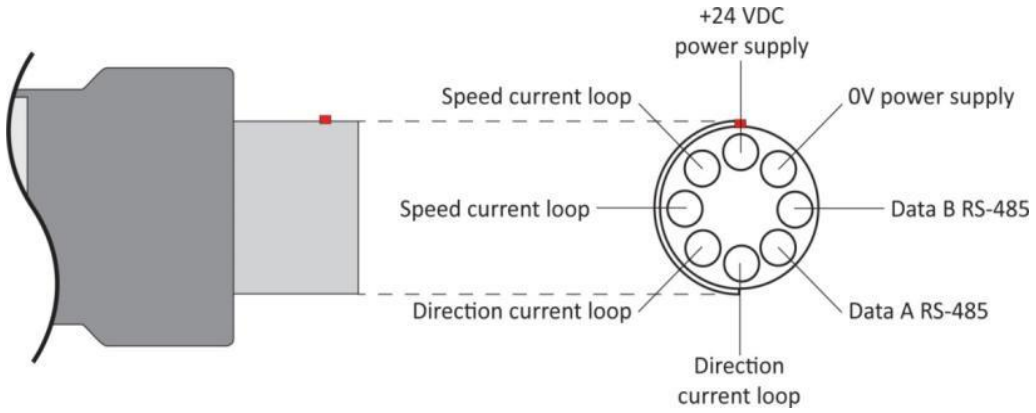


Figure 13: Sensor connector pin out

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 14: Cable Connector Sourcing Options

3.2 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 metal pipe or conduit.

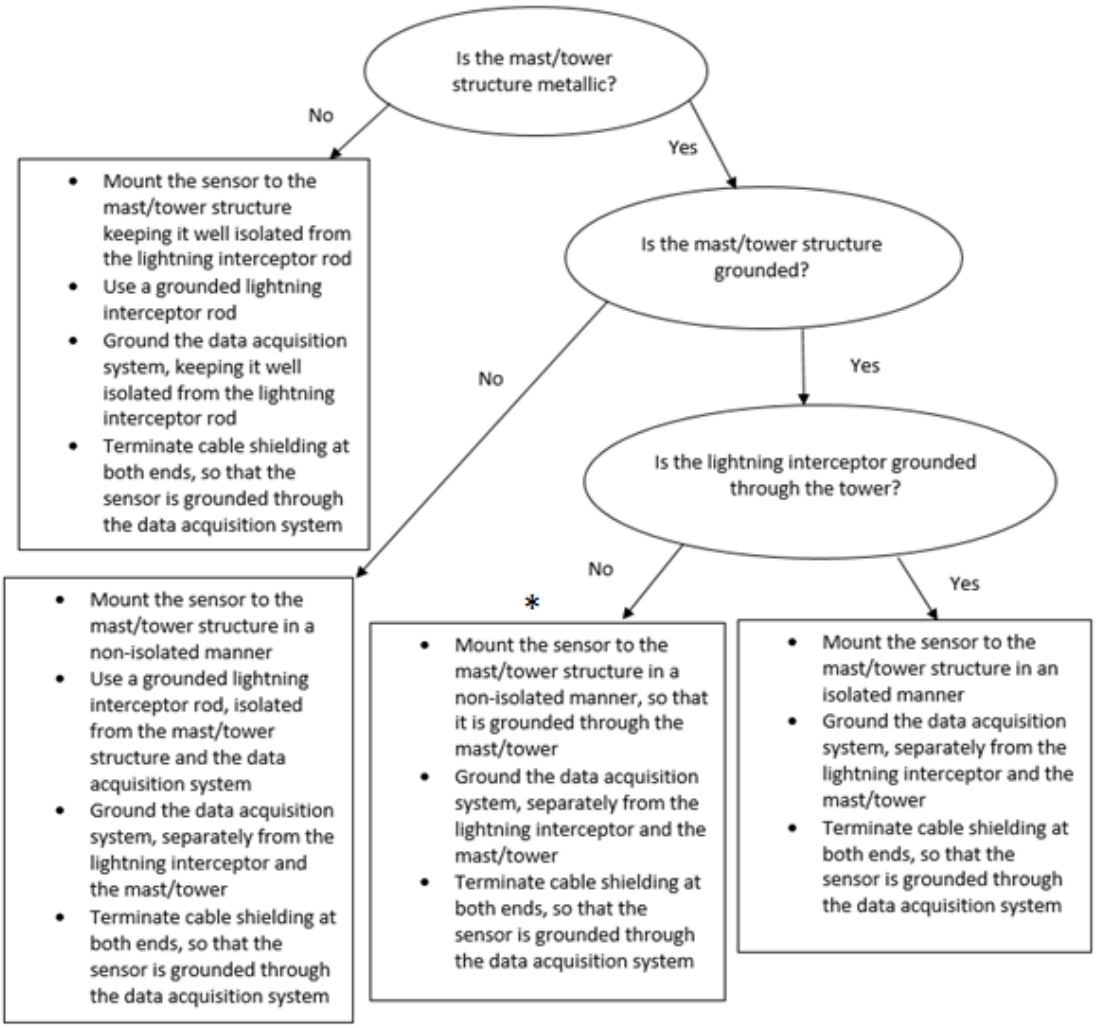
3.3 Lightning, Surge & EMI Protection

The FT742-DM is specifically designed for meteorological use. When installing the sensor, it is essential to do so in a way that protects the sensor in the event of a lightning strike (if the site is deemed to be at risk). Since peak current levels during a lightning strike can be in the order of 200kA, applying the correct grounding technique is critical to ensuring current is diverted to ground in a controlled manner.

The sensor can survive a properly diverted lightning strike, so lightning interceptors and secondary protection should be used. The sensor should be positioned beneath the lighting interceptor rod, within a 45° protection zone. The recommended clearance between sensor and interceptor is a minimum of 30x diameter of the interceptor material.

The standard FT742-DM sensor has a hard-anodised top surface within the connector column housing (see Figure 9). When used with the plastic pipe insert tool this provides a partial non-conductive barrier that prevents electrical surges from striking the sensor via the mounting. This may not provide adequate grounding of induced electrical surge currents. The user should consider the required lightning protection system. The FT035 grounding accessory fits within the connector support column and will provide the sensor with improved lightning grounding/conduction when fitted with an appropriately grounded metallic pipe. The grounding accessory fits between the inner wall of the sensor and the outer wall of the pipe.

The correct grounding method to apply will depends on how the rest of the equipment has been installed. The following flow chart may help determine which sort of grounding should be applied for the application:



* The recommended FT solution.

Ideally the data acquisition system should be enclosed within a grounded metal enclosure and the data acquisition system's ground connected to the enclosure chassis. Where termination of cable shielding at the data acquisition end has been recommended above, it should be done so using 360° termination via EMC cable glands within the wall of the enclosure before the signal wires are allowed to enter. This helps to protect the sensor and data acquisition system against surge currents and voltages, and helps to prevent interference from being induced onto the signal lines.

The use of Surge Protection Devices (SPD's) is recommended. These devices should be located as close as possible to where the signals enter the enclosure (within the metal enclosure) and their ground connections connected to the enclosure chassis. All connections from the sensor to the data acquisition system and to power should pass through the SPD's. This will suppress any unwanted overvoltage transients present on the signal or power lines. The SPD's should be UL 1449 listed and have a minimum surge current rating of 20kA (8/20µs waveform).

All structural grounding connections should have a minimum cross sectional area of 50mm², while mating surfaces should be uncoated and free of corrosion. All cabling should have a minimum bend radius of 57mm to prevent flashover and interference.

Installing the sensor as described in this section can help achieve a lightning protection zone level of LPZ 0B (in accordance with IEC 62305-4).

For non-meteorological applications with a higher risk of lightning exposure, where the sensor is mounted within close proximity of the strike point, we would recommend the Pipe-Mount (PM) range of sensors. In such applications, a different grounding method should be employed and the Pipe Mount variant is a more suitable solution. Please contact FT Technologies for further information.

4 SERVICE, CONFIGURATION & TESTING

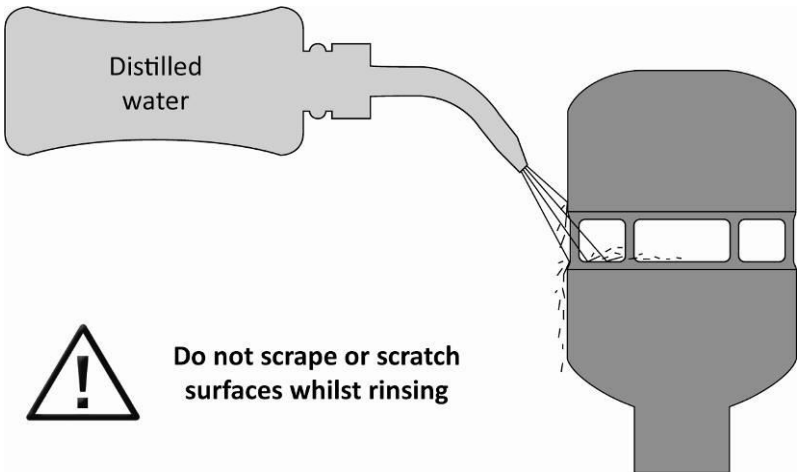
4.1 Inspection

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 any surface, it should be removed using an abrasive cloth. Check that any mechanical fixings 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.



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 reapplied. 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.

The following replacement parts are available:

FT027	O-ring (3.53 CS x 32.92 ID)
FT031	Size Adaptor 25mm (1”) for FT742-DM (includes a FT033 tapered pipe insert & 4x FT034 self-locking fasteners)
FT032	Size Adaptor 50mm (2”) for FT742-DM (includes a FT033 tapered pipe insert & 4x FT034 self-locking fasteners)
FT033	Tapered Pipe Insert (33.7mm OD)
FT034	1x Self-locking Fastener
FT035	Grounding Accessory

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 a suitable method of averaging is applied. Either using the internal filtering on the sensor (see Section 2.2.2) or using an external data controller

- 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.
- 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, 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 opened by the customer cannot typically be repaired, however an inspection fee may still apply.

4.4 The Acu Test Evaluation PC Software

To help users carry out a test bench assessment of the sensors, FT Technologies sells an Acu-Test Evaluation Pack. The Evaluation Pack includes the FT055 cable to connect the sensor to an external power supply. The cable is also fitted with a USB connector to connect the sensor directly to a PC so that its settings can be checked and configured. There are also colour coded wires allowing the current loops to be measured with a multimeter or oscilloscope. (See Figure 15)

The pack also includes the Acu Vis software to allow for reviewing and changing a limited number of sensor settings.

The Acu-Test software is supplied on a CD and will work on PCs running Windows XP, Vista, 7, 8, 8.1 and 10.

The sensors can be easily 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 15 shows how the Evaluation Pack can be quickly set up to evaluate the current loops.

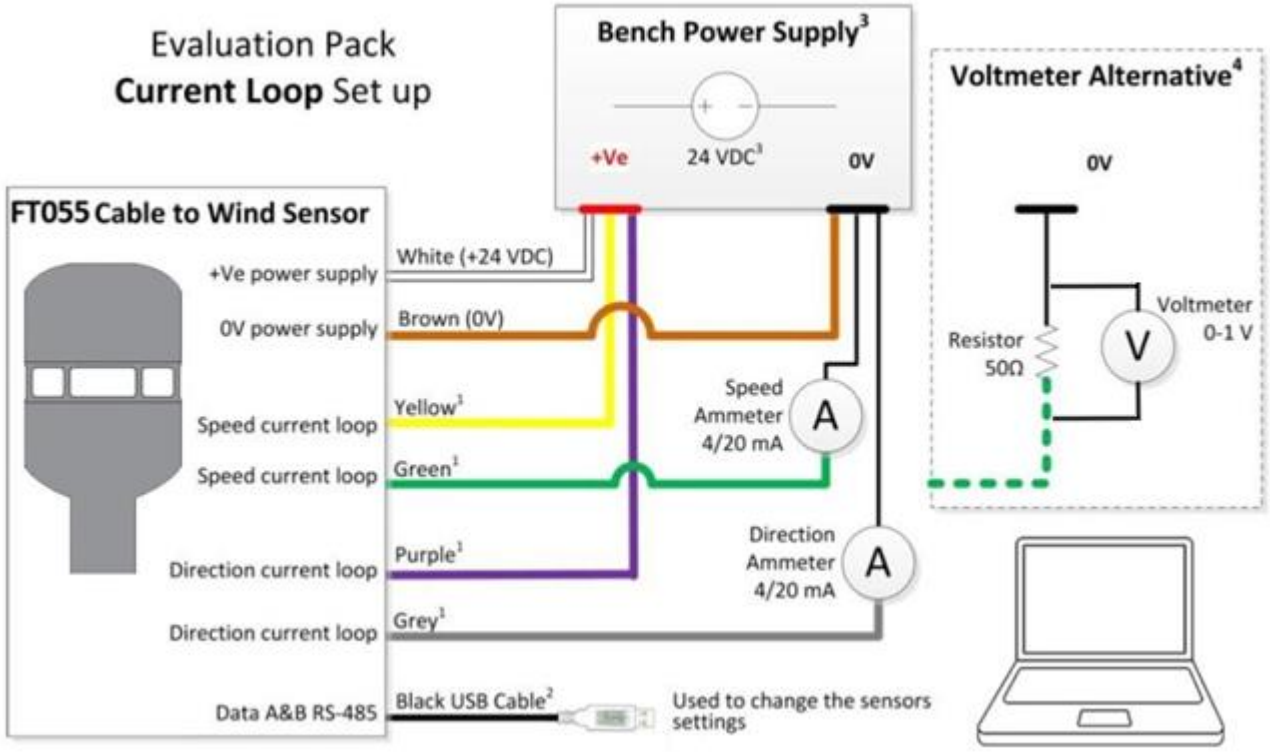


Figure 15: Evaluation Pack Current Loop Set Up

Note 1) The current loops are polarity insensitive so the yellow wire connection can be swapped with green and purple swapped with grey.

Note 2) The USB connection can only be used with the Acu Vis PC software.

Note 3) The DC power supply must be able to supply the full heater current of up to 6A. The heater will automatically turn-on if the ambient temperature is below the programmed set point (the recommended setting is 30°C).

Note 4) Alternatively connect a 50Ω resistor in place of the ammeter and measure the voltage across the resistor with a DC voltmeter or oscilloscope.

Quick Start Steps:

1. Switch off the power supply.
2. Remove the sensor and FT055 cable from its packaging and mate the connectors together.
3. Connect the +24VDC terminal of the power supply (current limit set to 6A) to the white wire and 0V terminal to the brown wire.
4. Connect the yellow wire (wind speed 4-20mA output) to the +24VDC terminal on the power supply.
5. 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.
6. Connect the purple wire (wind direction 4-20mA output) to the +24VDC terminal on the power supply.
7. 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.

Perform a final check all the wires are connected, then switch on the power supply and monitor the air flow measured on the ammeter outputs.

Warning: 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.

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