FT742 – Digital (RS485) Wind Sensor Manual

Direct-Mount Variant

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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 conforme à la 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.	RECOGNIZED COMPONENT C ETL US LISTED Intertek 4000105	**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.	CE	**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 FT742-D-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 3). 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 or contact FT Technologies for further information.

1.2 Build Versions and Labelling

Figure 1 shows how to identify a sensor, the serial number and calibration code (if applicable):

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 sensor is designed, manufactured and optimised for high availability.

No promise in part or full can be given to guarantee a 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

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) Knots and km/h options available.
Wind Direction Measurement	
Range	0 to 360°
Accuracy	4° RMS
Resolution	1°
Environment	
Temperature Range	-40 to +85°C (operating and storage)
Humidity	0-100%
Altitude	0-4000m

Data I/O

RS485 Interface	Digital RS485, galvanically isolated from power supply lines and case
Format	ASCII data, polled or continuous output modes
Data Update Rate	Up to 10 measurements per second (10Hz)

Power Requirements[3]

Supply Voltage	24VDC nominal (12-30VDC range)
Supply Current (Heater off)	31mA (typical)
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 [4] by the default software settings (the heater current and voltage limits can be modified, see Sections 6.4.11 & 6.4.13 for further details or contact FT Technologies).

Physical

Weight	380g (without size adaptors)
Material	Aluminium alloy (hard anodised)
I/O Connector	5 way (RS485 option)
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 the default settings and filters enabled.
3. See safety instruction requirements (page 5 and 6).
4. The heater set point, current limit and maximum power limits can be pre-configured in the factory or adjusted using the FT Acu-Test Digital kit.

2.2 Wind Speed Calibration

All FT742-DM wind sensors get calibrated in the FT production wind tunnel before dispatch. As the sensor has no moving parts, there is no need to recalibrate a sensor over its lifetime as no measurement degradation will occur. The sensor's compact strong monolithic shape is designed to prevent accidental transducer movement or damage. FT Technologies' calibration procedure and wind tunnels are designed to give a calibration profile that is within the accuracy limits set in the product technical specification (see Section 2.1). Periodically the accuracy of FT's wind tunnels are compared with the accuracy of an independent wind tunnel to ensure that no drift has occurred.

In exceptional circumstances users may wish to apply additional calibration factors. The sensor has an option to set a User Calibration Table, which can modify the wind sensor's wind speed output (see Section 6.4.21).

The User Calibration Table can be programmed with up to 64 correction factors which are maintained in non-volatile memory. When enabled, the uncorrected wind speed output is adjusted according to the stored User Calibration Table records using linear interpolation. The adjustments are applied to wind speed readings regardless of wind direction.

2.3 Wind Speed and Direction Filtering

It is important that the system does not rely exclusively on a single wind reading for any control decision. A single reading may be inaccurate due to measurement error, turbulence, corruption or interference. It is recommended that an average of wind readings is used. In addition if 100% data availability is required then a second FT sensor or alternative wind sensors should be fitted in addition.

The sensor has optional internal filtering available. This is a digital finite impulse response (FIR) filter, which works by calculating the moving average of a fixed number of previous readings. If filtering is being applied externally, the sensor's output filters can be disabled. If filtering inside the sensor is preferred, the length of the averaging for both wind speed and direction can be independently set (see Sections 6.4.8 and 6.4.9).

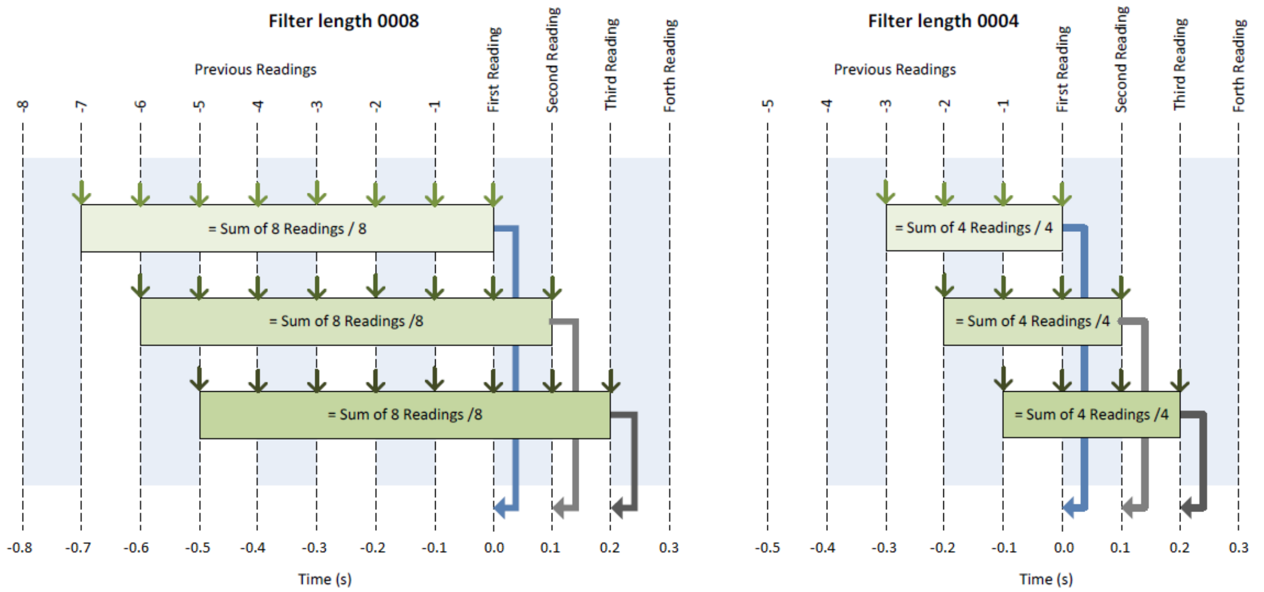


Figure 2: Examples of FIR Filtering

It is recommended to use average readings to reduce the effects of air turbulence.

2.4 Electronic Rotation of the Datum Direction

The datum direction of the sensor can be offset electronically by using the CF command (Section 6.4.2). This facility can be used to adjust the datum direction in case of any mechanical misalignment within the mounting arrangement. To offset the datum direction, in either the clockwise or anticlockwise direction, use the CF command (Section 6.4.2). Once the offset has been set it will be retained in the sensor Flash memory.

2.5 Selective Filter Scheme

In addition to the averaging filter described in Section 2.3, the sensor has a feature called the Selective Filter. The scheme allows the user to set a "validity period", during which the sensor will exclude invalid readings from entering the averaging filter (see Section 6.4.8). The output will freeze on the last previous "good" reading and only raise an error flag once the number of bad readings exceeds the validity period. This scheme can be enabled by factory configuration or using the FL command (see Section 6.4.10). The filter is turned off by default to match legacy behaviour.

2.6 Error Detection

The sensor has a self-checking mechanism which can detect if a reading is invalid. On very rare occasions where an invalid reading may have been detected, this is signalled to the computer or data logger by setting an error flag character within the wind velocity output message (see Sections 6.4.27 and 6.4.28).

When an error is detected, the error flag character is set to a value of: 1.

Note: An optional Overspeed Warning Scheme can be enabled (but is disabled by default). See Section 6.4.16 for further details.

It is important that error flags are not ignored. Data associated with an error flag should **not** be processed as valid wind data. 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 (see Section 6.4.18 for instructions on sending an RSU command).

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).

2.7 Overspeed Warning Scheme

During periods where the sensor detects wind speed beyond the rating of the sensor, the sensor will (by default) indicate a general error flag status.

An additional overspeed warning scheme can be enabled where in the event of wind speeds beyond the rating of the sensor, the error flag character will be set to 2 (see Sections 6.4.27 and 6.4.28) unless a general error condition is also detected and the flag will be set to 1.

To comply with legacy behaviour, this scheme is disabled by default.

The Overspeed Warning Scheme can be enabled by software commands (see Section 6.4.16), using the Acu-Test Digital kit (see Section 4.4) or enabled in the factory before despatch.

2.8 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.

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, by using the Acu Vis Test software (see Section 4.4) or the heater software commands (see Section 6.4.11).

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 and the cable length should not exceed 15m. If longer cables runs are required, consider the use of a junction box and heavy-gauge cable.

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, modified using the Acu-Test PC software (see Section 4.4), or by using the software command (see Section 6.4.13). By default, the heater requires a minimum of 11VDC for operation, see Section 6.4.13 for further details.

2.9 Low Power Operation

The sensor is designed for typical operation at 24VDC, however the sensor can operate below this (12-30VDC) with reduced performance. 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, see Sections 6.4.11, 6.4.12 and 6.4.13, or 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.

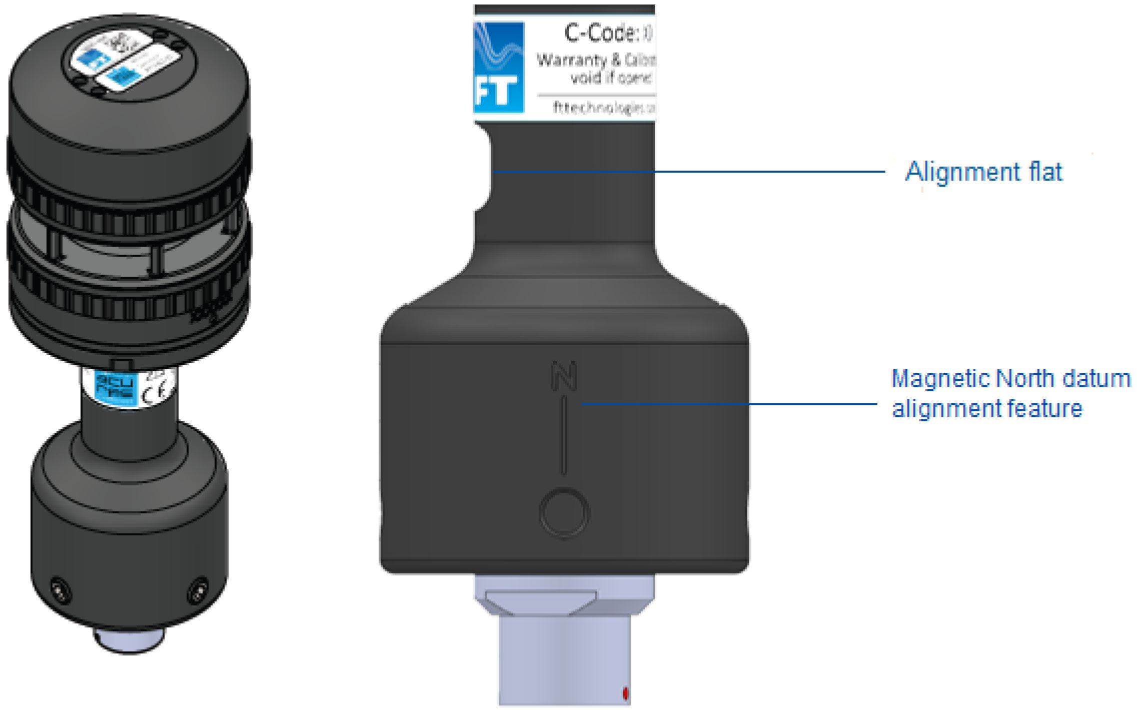


Figure 3: The Direct Mount Sensor

Direct Mount sensors are mounted vertically with the cable connector routed down through a 33.7mm (outer diameter) hollow pipe (EN10255 standard sizes). 4 M6 screws can be used to secure the sensor onto the pipe (Figure 7). 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 (see Figure 6). 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.

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 5 and 6.
- 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 1.4.

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 4) at the top 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 (see 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:

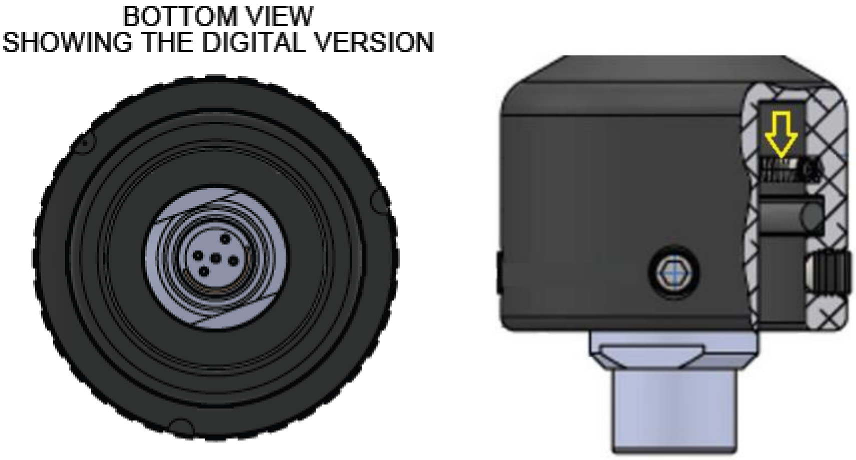
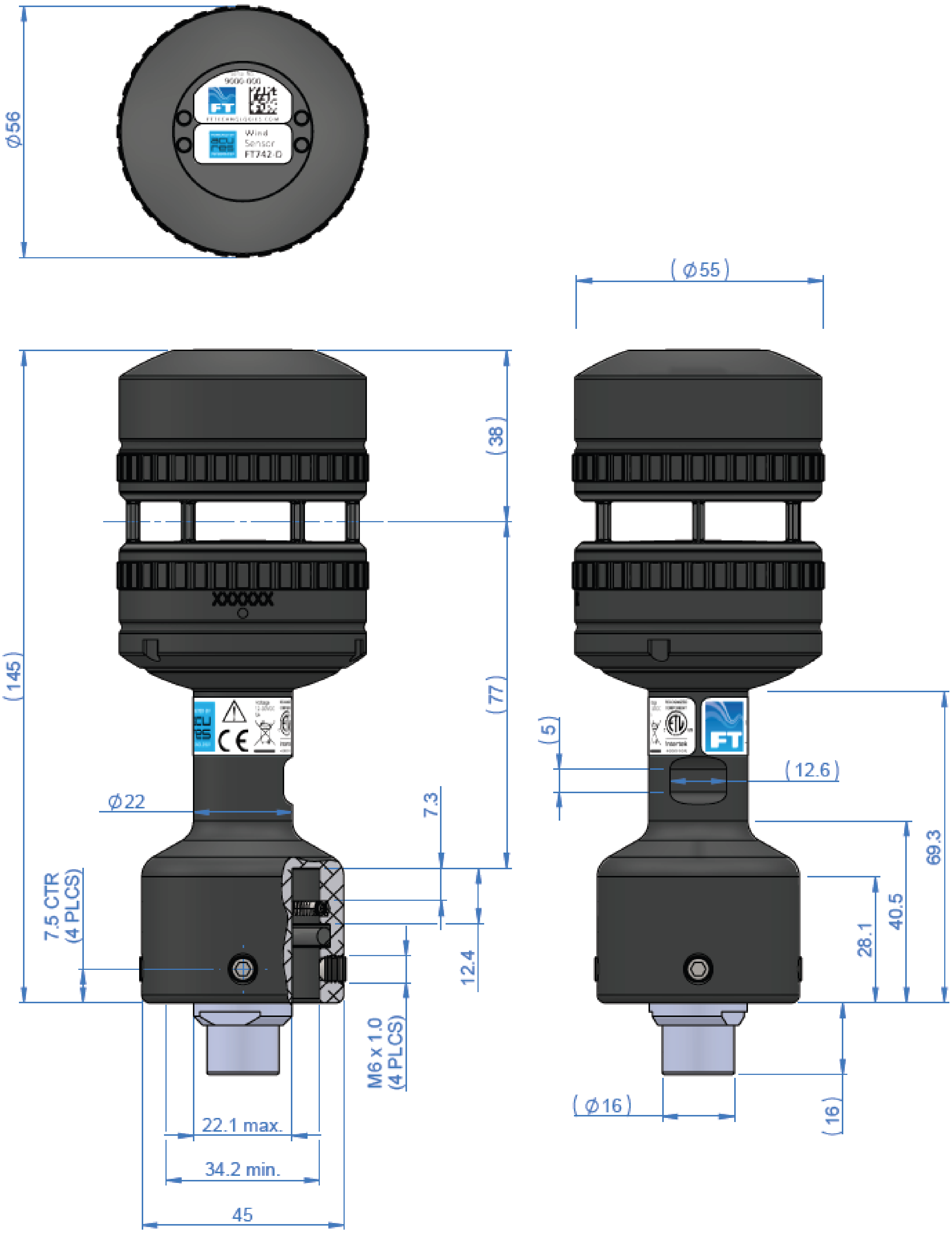


Figure 4: Direct-Mount – Connector (View From Below and FT035 Location)

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
(Ø55)
(38)
(145)
(77)
(5)
(12.6)
Ø22
7.3
69.3
40.5
28.1
7.5 CTR
(4 PLCS)
12.4
M6 x 1.0
(4 PLCS)
22.1 max.
34.2 min.
45
(Ø16)
(16)

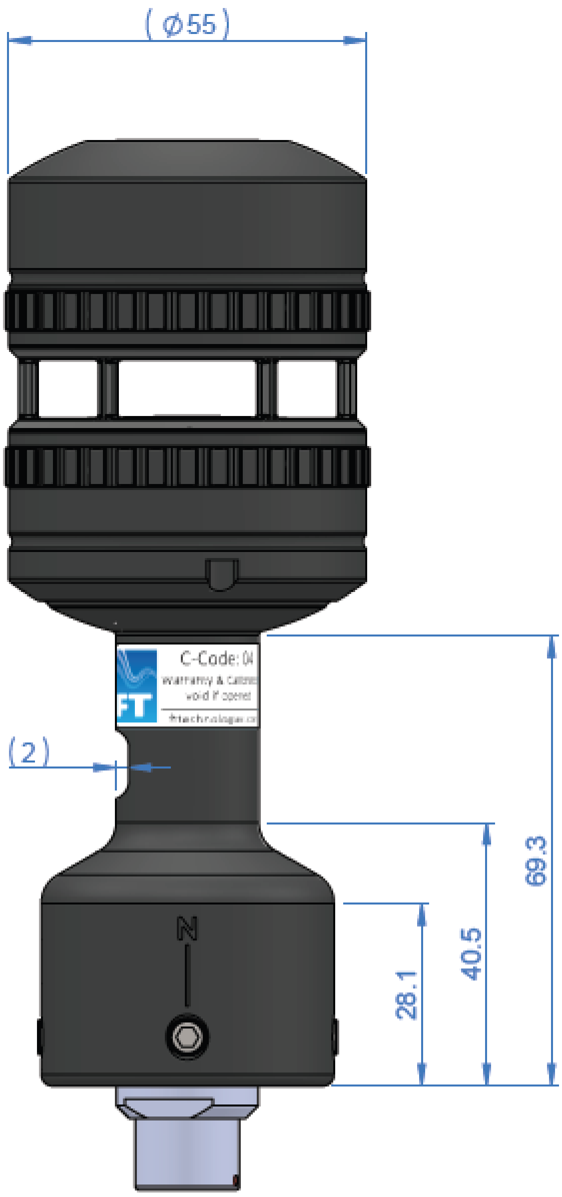


Figure 5: Direct Mount Sensor (mm)

The sensor measures the wind direction relative to the alignment flat and the central datum feature. When the wind sensor is correctly aligned the wind direction measurements will be as shown in Figure 6.

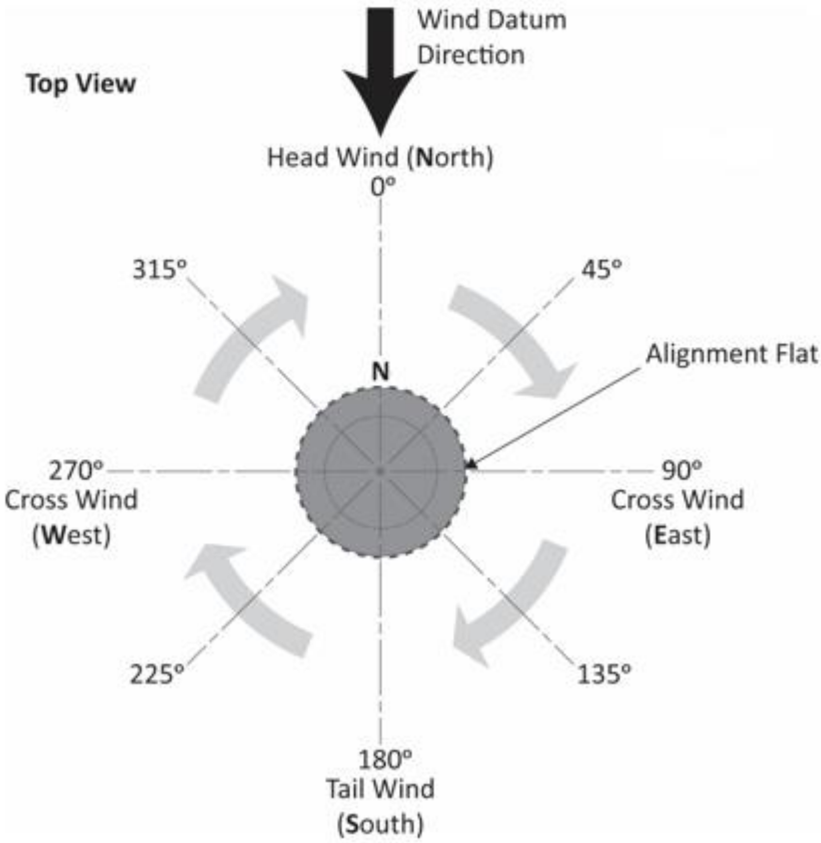


Figure 6: Wind Direction (view from above)

1. 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)

2. Pass the cable through the mounting pipe and pipe insert

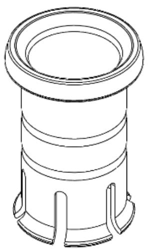
3. Connect the cable to the wind sensor and lower the DM base onto the pipe

4. Rotate the sensor to align the central North ('N' datum, feature) with magnetic North (or an alternative reference)

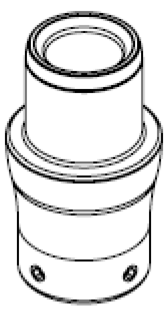
5. Tighten four self-locking fasteners (4x part FT034) ensuring an even distribution of pressure and firm contact with the mounting pipe. The fixings use a thread-locking insert and will provide resistance before they are fully engaged. In highly corrosive environments (such as coastal installations) 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.

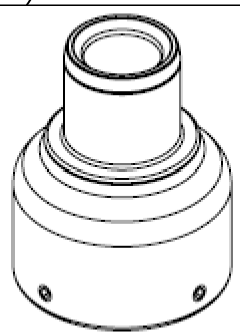
FT provides optional size adaptors to suit mounting diameters of 25mm (FT031) and 50mm (FT032). Ensure the internal diameter allows the interface cable to pass through.



Pipe Insert (FT033)



25mm size adaptor (FT031)



50mm size adaptor (FT032)

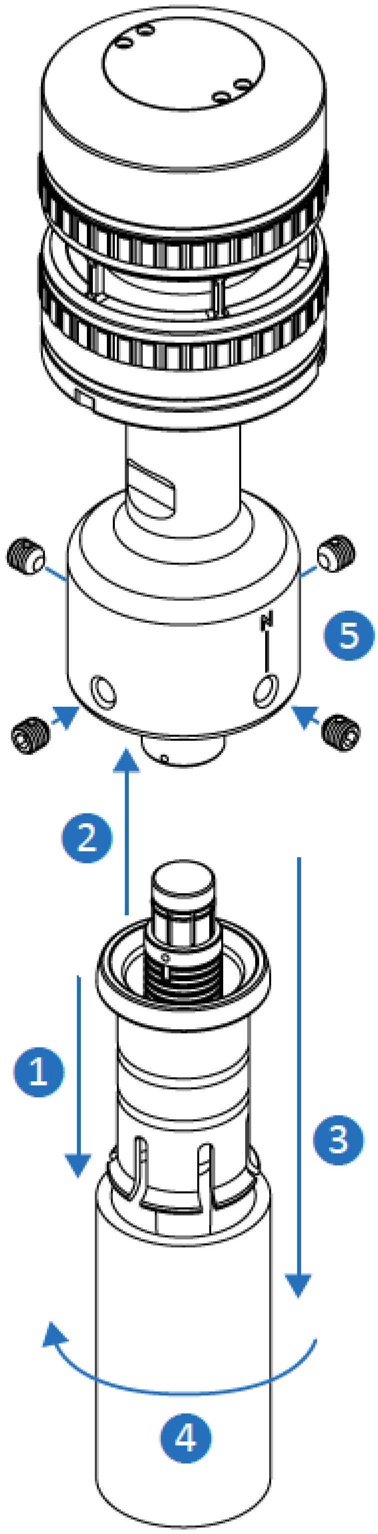


Figure 7: Direct-Mount Sensor Pipe Installation – Including tapered pipe insert and size adaptors

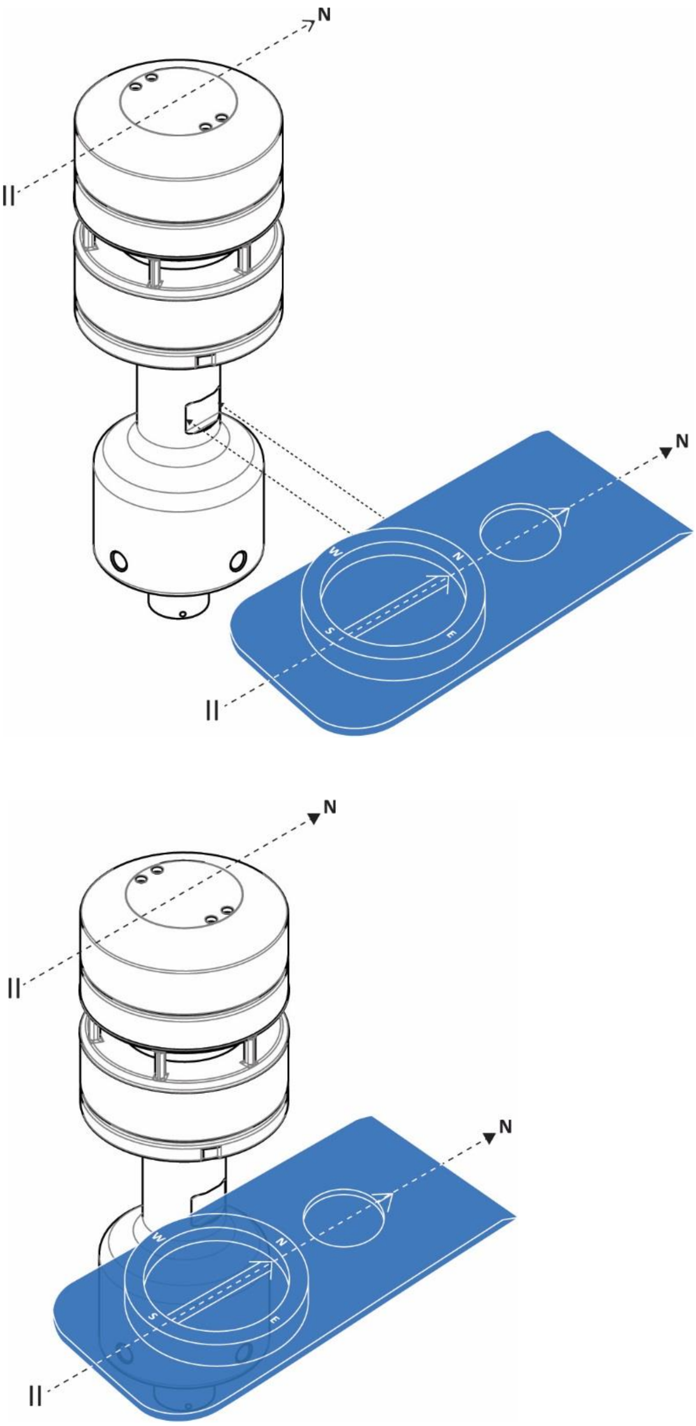


Figure 8: Direct-Mount Compass Alignment

3.1 Connector Details

All electrical connections are made to the sensor via a 5-way multipole connector located in the base of the wind sensor housing. The connector pin designations are shown in Figure 9 and the connector/mating connector manufacturer's part numbers in Figure 10.

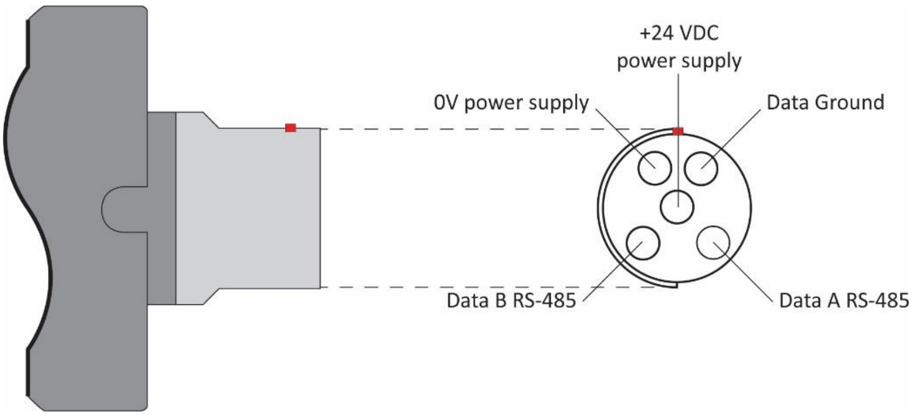


Figure 9: Sensor Connector Pins

Manufacturer	Connector Type	Connector Description	Manufacturers Part Number	Maximum Outer Cable Diameter
W.W.Fischer	Cable Side Connector	5 way plug	SE104Z053-130/8.7	8.0mm
ODU	Cable Side Connector	5 way plug	SX2F1C-P05NJH9-0001	9.2mm

Figure 10: Connector Sourcing Options

3.2 Cable Details

The mating connectors for the sensor are suitable for use with cables with overall diameters as described in the table 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

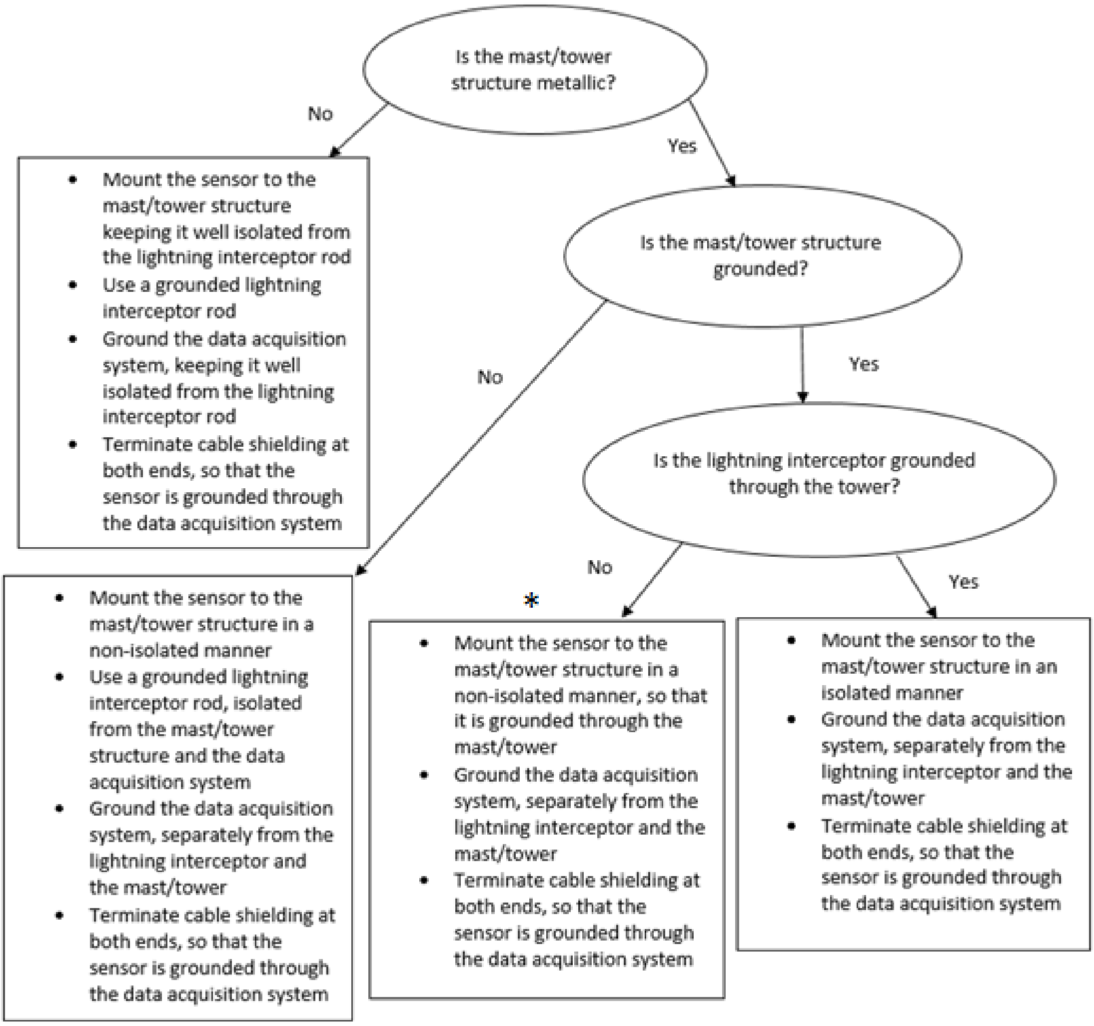
The FT742-DM is specifically designed for meteorological use. When installing the sensor it is essential to do so in a way that protects the sensor in the event of a lightning strike, if the site is deemed to be at risk. Since current levels during lightning strike can be in the order of 200kA, applying the correct grounding technique is critical, so that the 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 FT742-DM sensor has a hard-anodised top surface within the connector column housing (see Figure 4). 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. It 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 depend on how the rest of the equipment has been installed. The following flow chart can 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) 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

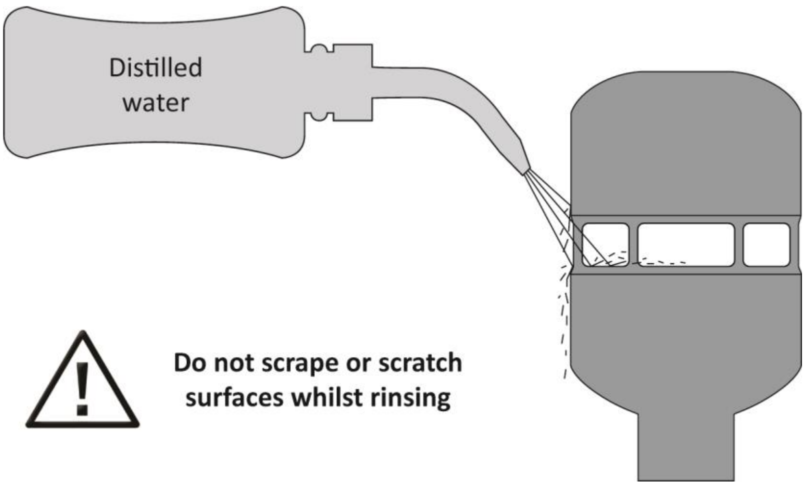
4.1 Inspection

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. Confirm the intended network component values.



Cleaning: The measurement cavity has a special hydrophobic coating (water repelling) 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.
- Reset the sensor (RSU command or power-cycle).
- 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. Sensors may be returned to FT Technologies for further analysis if required (see Section 4.3).

⚠ **Warning – The sensor contains 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:
  - 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
  - Ensure that a suitable method of averaging is applied. Either using the internal filtering on the sensor (see Section 6.4.8) or using an external data controller

  Check that the wind sensor data and status flag errors are being processed as per the advice in Sections 6.4.27 and 6.4.28.

- Check that the measurement cavity's special coating is in a satisfactory condition and no debris is present. 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.

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 Pack

To help users carry out a test bench assessment of the digital sensors, FT Technologies sells an Evaluation test Pack. This includes Acu-Vis software and the FT054 digital test cable. The test cable allows for connection between the sensor, an external supply and PC via a Type A USB connection. The sensor's communication settings can then be checked, the heater set point configured and the wind speed and wind direction displayed.

4.4.1 The Acu Vis PC Software

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

The Acu Vis software automatically detects the FT054 USB test cable and wind sensor. The program will detect the wind sensor as long as it is powered up and functional. The dials then show the real-time wind speed and direction from the wind sensor as shown in Figure 11.

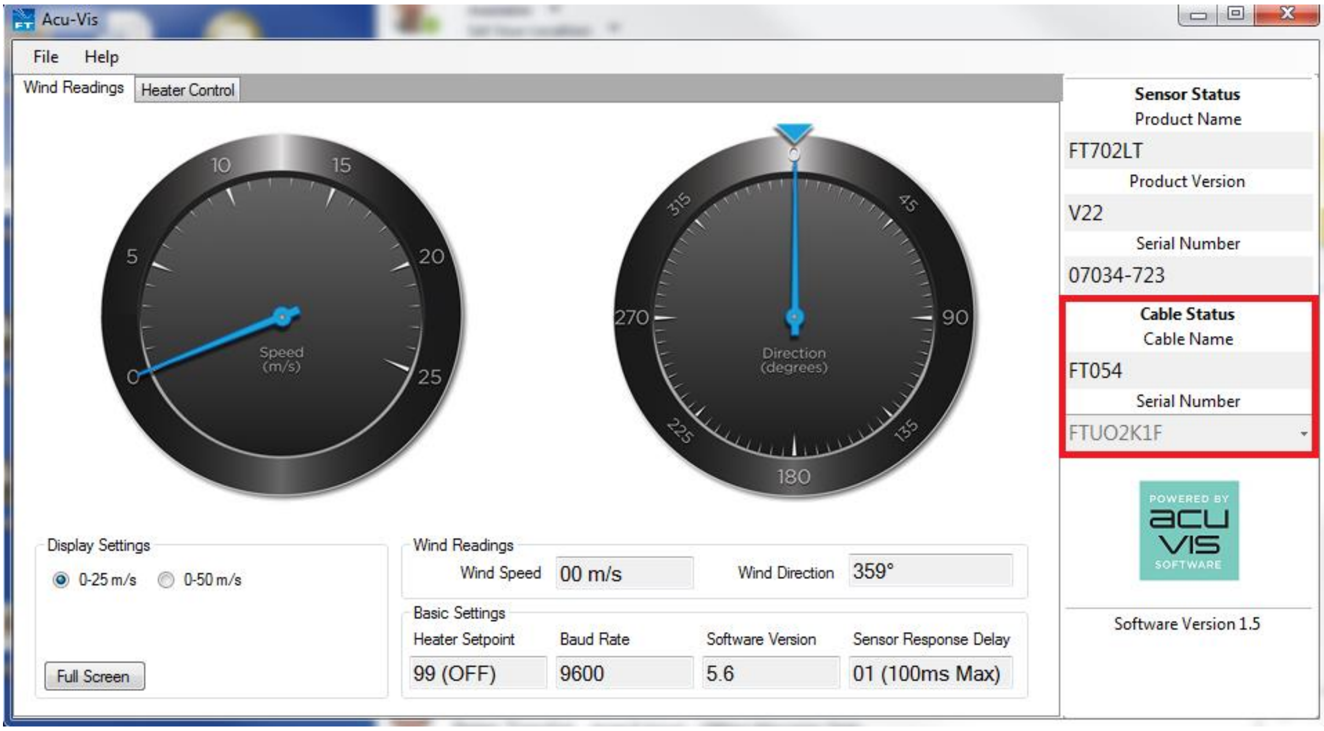


Figure 11: Acu-Vis Dials

The program also shows the communication settings that the sensor is using, as well as its software version and serial number.

The Heater Control tab can be used to monitor the sensor's heaters and to change the sensor's heater set point temperature as shown in Figure 13.

4.4.2 FT054 Evaluation Cable

The digital sensors can be tested by connecting it to a computer. Figure 12 shows how the Evaluation Pack can be quickly set up to evaluate the sensor using Acu Vis.

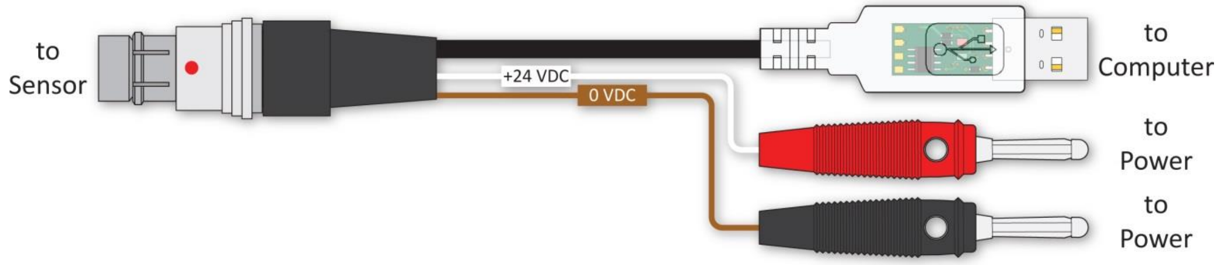


Figure 12: Electronic diagram

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.

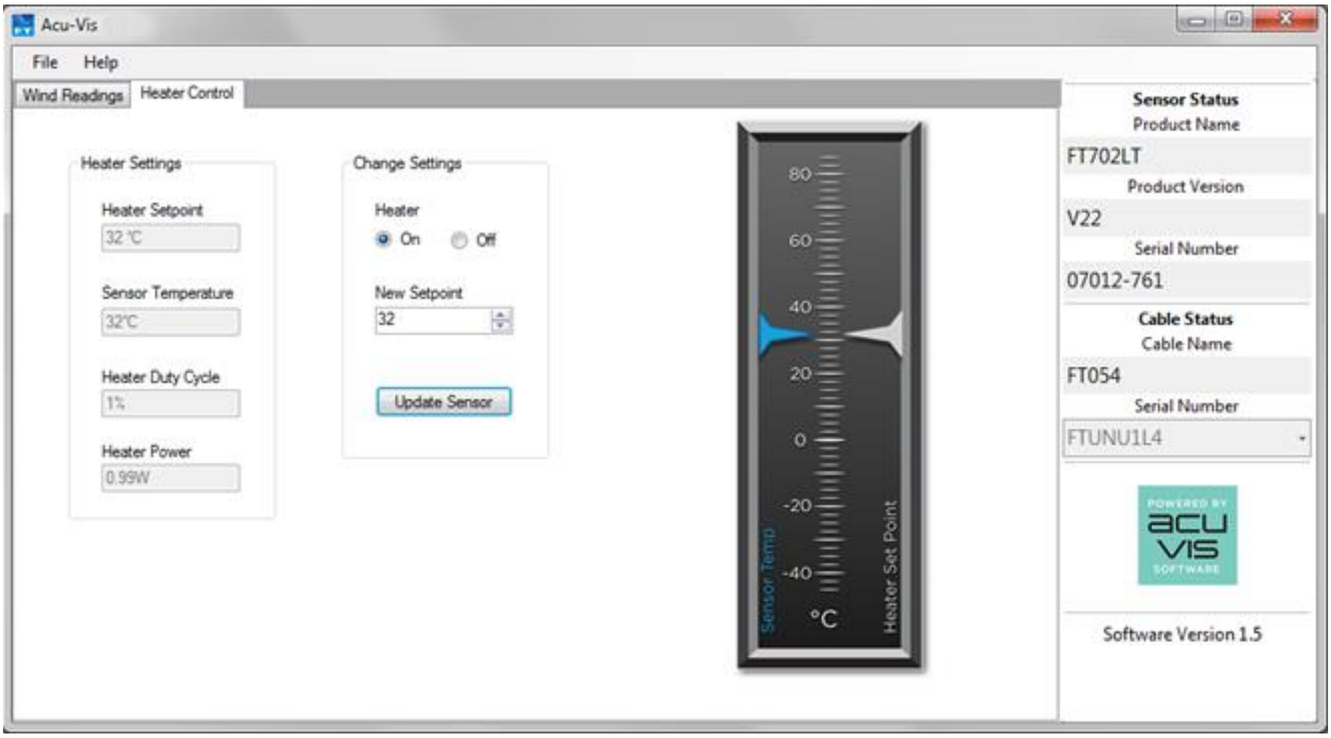


Figure 13: Acu-Vis Heater Controls

Heater Settings: Displays the Heater setpoint value (°C).
Sensor Temperature: Displays the actual reported temperature (inside the sensor).
Heater Duty Cycle: Displays the percentage of full scale power used by the heater.
Heater Power: Displays the dynamic power consumption of the heater.

Change Settings: Permits activation, deactivation and modification of the heater setpoint.

Quick Start Steps

1. Insert the Acu-Vis CD into the PC and install Acu-Vis, by running the setup.exe file.

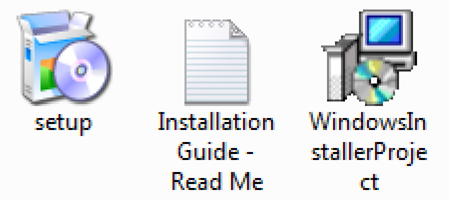


Figure 14: Acu-Vis Install Files

2. Remove the sensor and FT054 cable from their packaging and mate the connectors together.

3. Connect the +24VDC terminal of the power supply (current limit set to 6A) to the white wire (Red test plug) and 0V terminal to the brown wire (black test plug). Then switch on the power supply.

4. Connect the USB cable to the Computer and allow Windows to detect the cable and install any drivers.

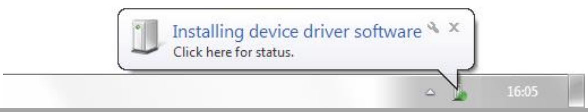
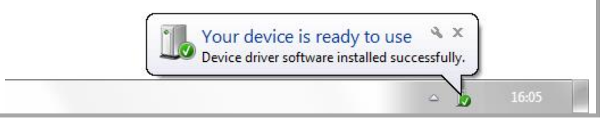
Please wait for Windows to install the hardware	Ready for use
	

Figure 15: Windows driver installation sequence

5. Once the above sequence is complete, wait approximately 10 seconds and then run Acu-Vis by selecting the shortcut icon on the desktop or from the start menu in the FT Technologies folder.

Figure 16: Acu-Vis Shortcut Icon

6. If you need to change over the evaluation cable it is recommended to firstly close the program, replace the cable and allow enough time for Windows to recognise the new cable and install its drivers. Then restart Acu-Vis.

5 SENSOR COMMUNICATION

5.1 Introduction

The sensor features an easy to use ASCII-based communication protocol transmitted over an RS485 serial link. The protocol incorporates checksum validation to ensure the integrity of all data transmissions. In addition to the FT Technologies proprietary protocol the sensor can output the common NMEA 0183 MWV (Wind Speed and Angle) sentence.

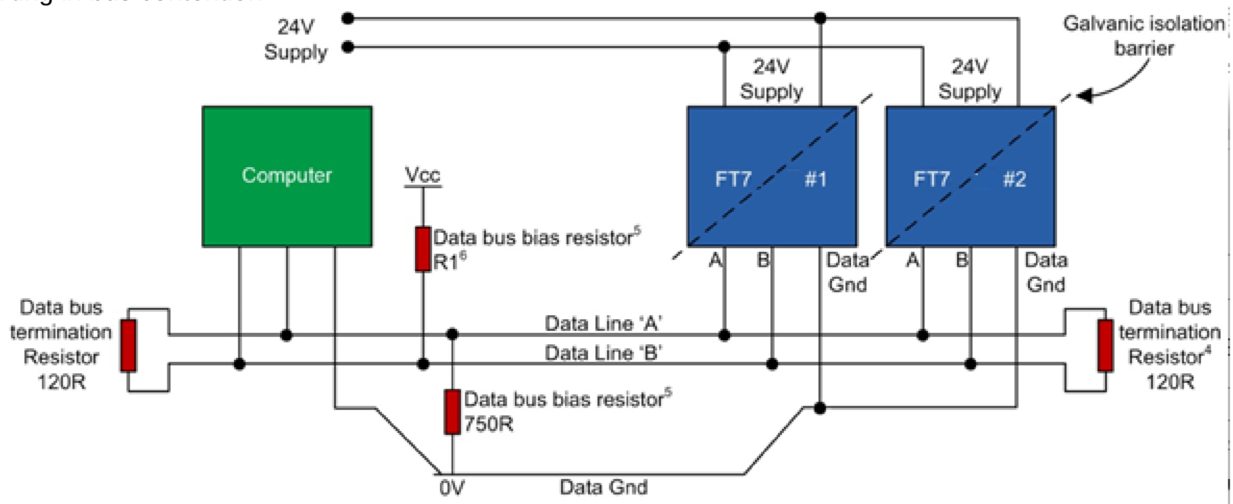
5.2 RS485 Protocol

The sensor is fitted with an RS485 half-duplex serial interface. Slew-rate limited drivers are used to reduce EMI, and minimize reflections from improperly terminated transmission lines and stubs. The signal state definitions for the serial interface data lines are as follows:

- The idle, marking, logical “1”, OFF or stop bit state is defined by a negative voltage on line A with respect to line B.
- The active, spacing, logical “0”, ON or start bit state is defined by a positive voltage on line A with respect to line B.
-

The circuit below (Figure 17) shows the recommended wiring diagram for connecting the sensor to the PC.
If two or more wind sensors are to be installed it is possible to use the same 2-wire data link to connect all the sensor units to the computer.

Before using a sensor in a multi-device system, the Listener identifier of each sensor must be set to a unique value. Use the ID command (Section 6.4.14) to set the Listener identifier for each sensor. If the Listener identifiers are being set in the final host system, then it is important that only one sensor be connected at a time to the RS485 bus until all devices have been assigned a unique Listener ID. Great care should be exercised when using the ‘//’ characters for addressing. The ‘//’ address characters can be used to send a SET command simultaneously to all sensor units (for example, to enable or disable filtering). Under no circumstances should the ‘//’ characters be used with any QUERY commands since this will cause all sensor units to transmit data resulting in bus contention.



Notes:
1. Data lines A & B should be twisted pair type. Cable should incorporate overall screening braid which should be connected to chassis at each circuit node.
2. All resistors should be anti-surge type, such as Tyco CCR resistors rated at 1W or similar.
3. Surge protection not shown.
4. Subject to testing, one or both termination resistors may be omitted, if computer makes use of slew-rate limited RS485 drivers.
5. Subject to testing, the bias resistors may be omitted, if computer makes use of fail-safe RS485 receivers.
6. For Vcc = 5V use 750R for R1, For Vcc = 24V use 6800R for R1.

Figure 17: RS-485 Connection Diagram for 2 Wind Sensors

5.3 Configuring the Sensor

All user parameter settings are stored in non-volatile memory and are retained when the sensor is switched off. When the sensor is next switched on (or a user reset command is sent) the sensor will revert to these settings. The sensor can therefore be configured prior to final installation if required.

The sensor settings can be returned to the factory values (see Figure 22 for factory default settings) at any time by sending the factory reset command.

5.4 Communication

5.4.1 Conventions used in this manual

All examples of sensor transmitted and received messages are printed in italic courier monospace font, e.g.

`$<listenerID>,DFP*<checksum><cr><lf>`

Angle brackets are used as placeholders for data (e.g. <wind speed>) or for non-printable ASCII characters (e.g. <cr> for carriage return).

Figure 18 lists the various special characters and symbols which are used in the examples given in this Handbook.

Symbol	Valid Characters	HEX Values	Definition
a	{A to Z} {0 to 9} {/}	41-5A, 30-39, 2F	Talker/listener address field characters
c	{A to Z} {0 to 9}	41-5A, 30-39	Fixed length field of alpha (upper case only) and numeric characters
h	{A to F} {0 to 9} {/}	30-39, 41-46, 2F	Checksum field validation characters
s	{ }	20	Space
x	0 to 9	30-39	Fixed length field of numeric characters
x.x	{0 to 9} {.}	30-39, 2E	Fixed point numeric field (i.e. always with leading and trailing zeros)
±	{+ -}	2B, 2D	Polarity indicator. Where a value can take on both positive and negative values a polarity indicator (either + or -) is always sent as the first character in the field. The field length therefore remains fixed for both positive and negative values.
	{$}	24	Start of message delimiter
	{*}	2A	Checksum field delimiter
	{,}	2C	Field delimiter
-	{-}	2D	Dash
<cr>		0D	Carriage return Line feed — End of message delimiter
<lf>		0A	
<name>			Placeholder for data

Figure 18: Symbols used in this Handbook

5.4.2 Data Transmission

Data is transmitted and received via an asynchronous serial communication interface using ASCII characters. The interface operates with the following parameters:

Parameter	Setting
Baud Rate	1200, 2400, 4800, 9600 (factory default), 19200, 38400
Data Bits	8
Start Bits	1
Stop Bits	1
Parity	None

Figure 19: Data Transmission Parameters

To set the sensor baud rate use the BR command (Section 6.4.1)

The sensor does not use handshaking (either hardware or software) to control the flow of data to and from the host computer. It is important, therefore, that the serial interface of the host computer is set with handshaking/flow control disabled.

5.4.3 Message Format

Data communication between the sensor and the host computer is performed by the transmission of ASCII messages. Figure 20 shows the composition of the message. The same message format is used for both received and transmitted messages.

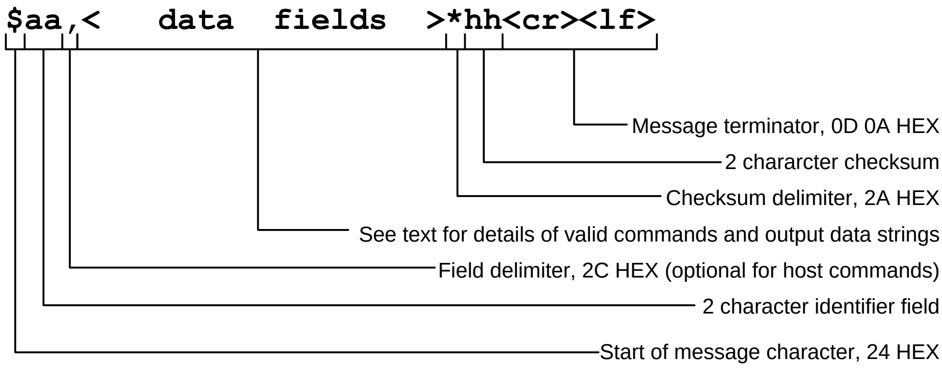


Figure 20: Message Format

All messages start with the '$' start of message character, followed by the 2 character talker/listener identifier (Section 5.4.4) field.

Following the first delimiter is the main body of the message which comprises a variable number of data fields (dependent on the message being transmitted), each separated by the field delimiter character (','). Data fields may contain alpha, numeric, or alphanumeric data depending on the information content of the field.

Messages sent to the sensor will contain a command in <data fields> and messages transmitted from the sensor will contain output data in <data fields>.

The data field section of the message is terminated by the checksum delimiter character '*'. Following the checksum delimiter is the two-character checksum field. See Section 5.4.5 for information on how to compute the checksum and Section 5.4.6 if checksum message validation is not required.

All messages are terminated with a carriage return <cr> and line feed <lf>.

5.4.4 Listener and Talker Identifiers

The sensor is assigned with both a Listener and Talker identifier address that allows an individual sensor to be uniquely identified in a system comprising more than one sensor.

Whenever a message is sent to the sensor, the identifier field of the message (the 2 characters immediately following the ‘$’ start of message character) must correspond to the sensor Listener identifier address, otherwise the sensor will ignore the message. In applications where more than one sensor is connected to the RS485 bus, you should assign each sensor in the system a unique Listener ID. The host computer will then be able to address individually each sensor. If you do not wish to use the Listener ID in messages sent from the host computer, you can replace the Listener ID with ‘//’. Sending ‘//’ in place of the Listener ID will allow any sensor, irrespective of its Listener ID setting, to respond to the message.

Whenever a message is transmitted from the sensor, the identifier field of the message (the 2 characters immediately following the ‘$’ start of message character) will contain the Talker ID. The Talker ID is used as a message tag to identify which sensor has transmitted the message.

The factory default value for the Listener ID is 01 and for the Talker ID it is WI (Weather Instrument). To change the Listener and/or Talker ID use the ID Command, Section 6.4.14.

5.4.5 Calculating the Message Checksum

All messages sent to, or received from, the sensor include a checksum field. Messages that are transmitted from the sensor always include a checksum value in the checksum field. Messages sent to the sensor by the host computer can either contain a checksum value or an ‘ignore checksum identifier’ in the checksum field.

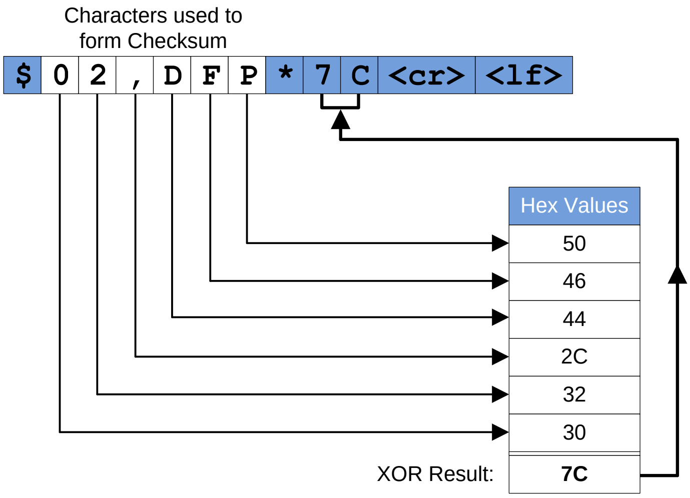


Figure 21: Checksum Example

The checksum value is calculated by Exclusive OR’ing (XOR’ing) all the bytes between (but not including) the ‘$’ and the ‘*’ characters of the message. The resulting single byte value is then represented by 2 HEX characters in the message string. The most significant character is transmitted first.

Note: Since a message only contains ASCII characters (which have values in the range 0-7F) the checksum value will always be between 0 and 7F.

5.4.6 Disabling the Checksum

All messages which are sent to the sensor must contain a valid checksum value in the checksum field, otherwise the sensor will not process the incoming message. Although it is recommended that a checksum value be computed for all messages which are sent to the sensor, in some cases this may not be convenient (i.e. when communicating with the sensor with a terminal). To prevent the sensor from performing checksum validation of incoming messages, send the ASCII characters ‘//’ in place of the checksum value.

Example:

Send a message to set the data output format to Polar using the DFP command (the sensor Listener ID in this example is set to 02)

With a checksum (sensor checksum validation automatically enabled):

*$02DFP*50<cr><lf>*

Without a checksum (sensor checksum validation automatically disabled):

$02DFP//<cr><lf>*

A checksum value is always transmitted by the sensor with every outgoing message. However the checksum field can be ignored by the host computer if checksum validation for received messages is not required.

6 PARAMETER SETTINGS

FT sensors are configurable. The factory default settings can be modified on despatch to the required customer settings.

6.1 Command Types

6.1.1 Set Commands

Figure 22 lists the commands that may be sent to the sensor from the host computer that are used to SET configuration options for the wind sensor.

Command	Mnemonic	Configuration Options	Factory Default	Section
Serial interface baud rate	BR	1200, 2400, 4800, 9600, 19200, 38400	9600	6.4.1
Datum offset	CF	000.0° to 359.9°	000.0°	6.4.2
Continuous Update	CU	Enable or Disable Update interval, 0.1-6000 seconds	Disabled	6.4.3
Wind velocity data format	DF	Polar or NMEA	Polar	6.4.4
Command delay interval	DL	00 to 20	01	6.4.6
Clear Error Report	ER	Reset	000000000000	6.4.7
Wind velocity filter	FL	Enable or Disable, Speed filter length Direction filter length	Enabled 0016 0016	6.4.8 6.4.9
Selective Filter	FL	Enable or Disable Selective filter length	Disabled 010	6.4.10
Heater settings	HT	Setpoint Temperature Heater Start Delay Time Current Limit Undervoltage limit	Heater Disabled 4 seconds delay 4A 11V	6.4.11 6.4.12 6.4.13
Listener and talker identifiers	ID	Listener ID = xx Talker ID = xx	Listener ID = 01 Talker ID = WI	6.4.14
Min/Max wind speed	MM	Reset	999.9,000.0	6.4.15
Overspeed Warning Scheme	OS	Enabled or disable	Disabled	6.4.16
Reset	RS	Load Factory Default, Load Current Settings, Load Saved Parameters	NA	6.4.18
User Calibration Table	UC	Enable or Disable Clear Wind speed table record Save wind speed table Table label	Disabled NA NA NA	6.4.21 6.4.22 6.4.23 6.4.24 6.4.25
Save User Parameters	US	Copies current Parameters	NA	6.4.26

Figure 22: Set Commands

When a valid message is recognised by the sensor, the sensor will carry out the command contained in the message. To verify that the command has been successfully carried out, an associated QUERY command can be sent after most SET commands (see Section 6.1.2 for the list of parameters which may be queried).

6.1.2 Query Commands

Figure 23 lists the commands that may be sent to the sensor from the host computer that are used to QUERY the wind sensor's latest readings or configuration.

Command	Mnemonic	Sensor Data Returned	Section
Serial interface baud rate	BR	1200, 2400, 4800, 9600, 19200, 38400	6.4.1
Datum offset	CF	000.0° to 359.9°	6.4.2
Continuous update	CU	Enabled or Disabled Update interval (0.1 - 6000 seconds)	6.4.3
Wind velocity data format	DF	Polar or NMEA	6.4.4
Runtime Counter	DG	Number of hours of runtime	6.4.5
Command delay interval	DL	00 to 20	6.4.6
Error report	ER	Factory Report	6.4.7
Wind velocity filter	FL	Enabled or Disabled Speed filter length, 1-64 Direction filter length, 1-64	6.4.8 6.4.9
Selective Filter	FL	Enabled or Disabled Validity Period	6.4.10
Heater settings	HT	Setpoint Temperature, 0°C to 55°C. Percentage of heater current, 0% to 100% Internal sensor temperature, 00°C to ±99°C, Heater Delay Time, 4s to 999s Current Limit, 0.1A to 6.0A Undervoltage Limit, 11V to 17V	6.4.11 6.4.12 6.4.13
Listener and talker identifiers	ID	Listener ID = xx Talker ID = xx	6.4.14
Min/Max wind speed	MM	Min & Max Speeds Recorded	6.4.15
Overspeed Warning Status	OS	Enabled or Disabled	6.4.16
Parameter Report	PR	Factory Report	6.4.17
Serial Number	SN	Serial Number	6.4.19
Software Version	SV	Software Version	6.4.20
User Calibration Table	UC	Enabled or Disabled Wind speed table record Table label	6.4.21 6.4.22 6.4.23 6.4.24 6.4.25
Saved User Parameters	US	Matches Saved to Current User Parameters	6.4.26
Wind velocity reading	WV	Wind Speed, Direction and Sensor Status	6.4.27 6.4.28

Figure 23: Query Commands

6.2 User Calibration Table

The User Calibration Table includes up to 64 user programmable records. Each record comprises a pair of values representing the corrected speed (wind tunnel speed) and the corresponding uncorrected wind sensor speed. In addition to the calibration table, there is provision for a user-defined text string of up to 32 characters which is stored together with the table.

The User Calibration Table records must be entered in ascending order of wind sensor speed. The minimum allowable difference between wind sensor speed values in consecutive records is 0.5m/s.

To load the User Calibration Table with data, the following steps need to be taken:

1. The Table must first be cleared (See Section 6.4.22).
2. Each pair of table row values is entered into a RAM copy of the User Calibration Table (See Section 6.4.23)
3. A text string linked to the table may be entered if desired. This can be entered at any point after the table is cleared and before the RAM copy of the table is saved into Flash memory. (See section 6.4.25)
4. The RAM copy of the User Calibration Table is saved into Flash memory (See Section 6.4.24

At any point in the above procedure (or at any other time) commands can be sent to the wind sensor to:

- Verify that the table has been cleared;
- Verify the last row of data written to the table;
- Read the number of table entries and the table checksum;
- Read out a selected row of table data,
- Read out the User Calibration Table label.

See Sections 6.4.21 - 6.4.25 for further details.

6.3 Timing Constraints

When a valid command is received by the sensor input buffer, there will be a time delay whist the command is being processed. The actual command latency depends on exactly when the last character of the command is received within the sensor internal processing cycle. The sensor can process only one SET or QUERY command at a time.

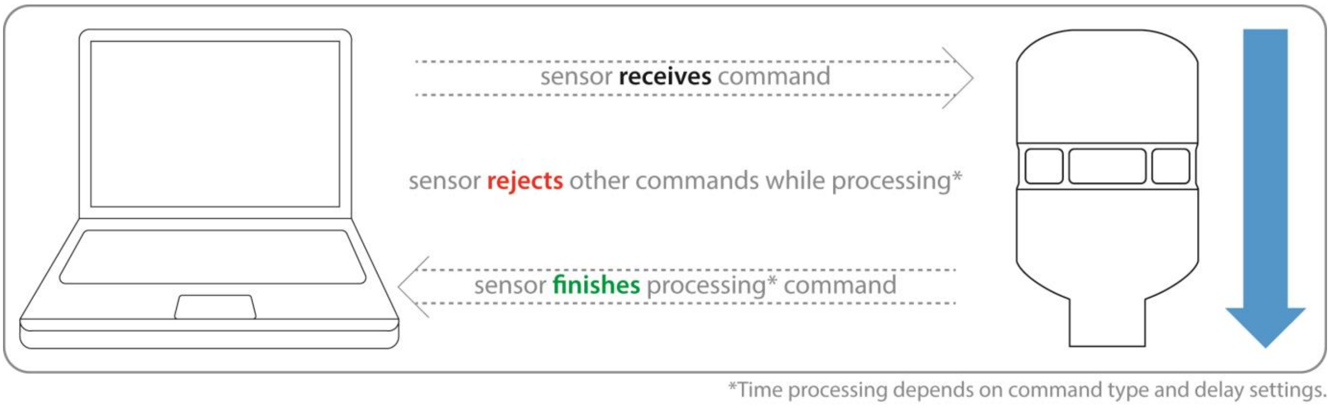


Figure 24: Command Processing

Once a SET command has been received by the sensor, it can take approximately 400ms for the command to be processed and any setting change implemented. If other commands are sent during this period, they may be ignored by the wind sensor. Therefore all SET commands must be separated by a period of at least 500ms before further commands are sent. (Or longer in the case of a Reset command being sent See Section 6.4.18).

Once a QUERY command has been received by the sensor, it takes up to 50ms for the command to be processed. The sensor will then wait for a predefined delay before sending a response. This delay time is programmable in increments of 50ms.

See Section 6.4.6 for details of how the delay between the sensor receiving a command and transmitting a reply can be adjusted. An additional latency is recommended depending on the time taken for the computer to switch between transmit and receive modes.

If the delay time has been extended using the DL command, then the next QUERY command sent to the wind sensor must be separated by the maximum QUERY command processing time (50ms) and at least the DL interval (50ms default.) It is therefore recommended that the frequency of any QUERY command does not exceed 10Hz, i.e. 10 commands per second.

Message Example:

For example, to set the wind velocity output to Polar format and verify that the command has been accepted, send the following commands:

Set the wind reading format to polar:

$//DFP//<cr><lf>*

Then wait 500ms for the SET command to be implemented by the sensor.

A QUERY can then be sent to confirm command has been carried out:

$//DF?//<cr><lf>*

Then wait 50-100ms for the sensor to send a response:

*$WI,DF=P*5D<cr><lf>*

Please note the above example assumes the sensor has a factory default time delay of 50-100ms (DL01).

6.4 Command Parameters

Each command, and its usage, is described in the following Sections. All examples, other than where stated, assume that the sensor Listener ID is set to 01, and the sensor TalkerID is set to WI, (Weather Instrument).

6.4.1 BR: Set or Query the Serial Interface Baud Rate

Command Parameter	BR

Command Syntax	SET Sensor:	*$<listenerID>,BR<baudrate>*<checksum><cr><lf>* *$aa,BRx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,BR?*<checksum><cr><lf>* *$aa,BR?*hh<cr><lf>*
	Sensor Output:	*$<talkerID>,BR=<baudrate>*<checksum><cr><lf>* *$aa,BR=x*hh<cr><lf>*

Parameters	<baudrate>	
	0	Set the baud rate to 38400 baud
	1	Set the baud rate to 19200 baud
	2	Set the baud rate to 9600 baud (Factory Default Setting)
	3	Set the baud rate to 4800 baud
	4	Set the baud rate to 2400 baud
	5	Set the baud rate to 1200 baud

Examples	<u>Example 1</u> Set the baud rate to 19200 baud, verify the new setting and send a user reset command to activate the new baud rate	
	<u>Message</u>	<u>Comment</u>
	$01,BR1//<cr><lf>*	Set baud rate to 19200
	$01,BR?//<cr><lf>*	Query baud rate setting
	*$WI,BR=1*2E<cr><lf>*	Sensor Output
	$01,RSU//<cr><lf>*	Send user reset

Description	Use the BR command to change the sensor serial interface baud rate. The new baud rate setting will only come into effect when the sensor is next powered-up or after a Reset command (RSU) has been received. If the baud rate is changed, you will only be able to communicate with the sensor if the host computer’s baud rate is set to the same baud rate. If you do not know what the current setting of the sensor baud rate is you will need to try each baud rate in turn until you establish communication.

6.4.2 CF: Set or Query the Wind Datum Offset Angle

Command Parameter	CF

Command Syntax		
	SET Sensor:	*$<listenerID>,CF<offset>*<checksum><cr><lf>* *$aa,CFxxx.x*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,CF?*<checksum><cr><lf>* *$aa,CF?*hh<cr><lf>*
	Sensor Output:	*$<talkerID>,CF=<mode>,<status>,<offset>,<offset>*<checksum><cr><lf>* *$aa,CF=c,c,xxx.x,xxx.x*hh<cr><lf>*

Parameters		
	<offset> *000.0 to 359.9*	Applying an offset electronically rotates the datum direction of the sensor in a counter clockwise direction (when looking down from above). (000.00 is Factory Default Setting)
	<mode> *D*	Always returns D
	<status> *D*	Always returns D

Examples		
	Example 1 The datum direction of the sensor is rotated by 5° to the left with respect to the sensor's mounting surface (as per Section 3).	
	Message	Comment
	$01,CF355.0//<cr><lf>*	Set offset angle to 5°
	$01,CF?//<cr><lf>*	Query parameters
	*$WI,CF=D,D,355.0,355.0*26<cr><lf>*	Sensor output
	Example 2 The datum direction of the sensor is rotated 5° to the right with respect to the sensor's mounting surface (as per Section 3).	
	Message	Comment
	$01,CF005.0//<cr><lf>*	Set offset angle to 5°
	$01,CF?//<cr><lf>*	Query parameters
	*$WI,CF=D,D,005.0,005.0*26<cr><lf>*	Sensor output

Description	Use the CF command to set the sensor wind datum direction offset.

WARNING: Once set, the offset value is retained within the non-volatile memory. If the sensor's location is changed then the offset value must be changed to suit the new installation or set to zero otherwise incorrect wind direction readings will be obtained.

6.4.3 CU: Set or Query the Continuous Update Setting

Command Parameter	CU	

Command Syntax	SET Sensor:	*$<listenerID>,CU<cont.update>,<interval>*<checksum><cr> <lf>* *$aa,CUcxxxxx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,CU?*<checksum><cr><lf>* *$aa,CU?*hh<cr><lf>*
	Sensor Output:	*$<talkerID>,CU=<cont.update>,<interval>*<checksum><cr> <lf>* *$aa,CU=c,xxxxx*hh<cr><lf>*

Parameters	<continuous update>	
	E	Enabled
	D	Disabled (Factory Default Setting)
	<interval>	
	1 to 59999	interval, in 0.1s increments, between outputs in continuous mode

Examples	Example 1 Set the sensor to output readings automatically every 10 seconds. Verify that the command has been accepted.	
	Message	Comment
	$01,CUE00100//<cr><lf>*	Enable CU mode, rate = 0.1Hz
	Example 2 Disable the continuous updating. Verify that the command has been accepted. (Note: This command must only be sent during the first four seconds after power-up – for more information see below).	
	Message	Comment
	$01,CUD//<cr><lf>*	Disable CU mode
	$01,CU?//<cr><lf>*	Query CU mode setting
	*$WI,CU=D,00100*40<cr><lf>*	Sensor response

Description	Use the CU command to enable or disable the continuous update mode of operation. When continuous update is enabled, the sensor will output wind velocity readings at a rate determined by the <interval> setting. Each time the continuous update mode is enabled, the required <interval> setting must be sent (even if this has been sent to the sensor previously). When the continuous update mode is enabled, if the sensor is switched-off, when power is reapplied the sensor will automatically resume outputting readings. Once the sensor has been put into continuous update mode then it becomes a talker only and will not respond to any further commands. To be able to send commands again the continuous mode must be disabled. To achieve this, the CUD (disable continuous update mode) command must be sent within the first four seconds of the power being applied to the sensor.

WARNING: Do not use the continuous update mode if there are other talkers connected to the data bus. Only one active talker is allowed on the data bus at any one time otherwise bus contention will occur

6.4.4 DF: Set or Query the Wind Velocity Data Format

Command Parameter	DF

Command Syntax		
	SET Sensor:	*$<listenerID>,DF<format>*<checksum><cr><lf>* *$aa,DFc*hh<cr><lf>* or *$aa,DFcc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,DF?*<checksum><cr><lf>* *$aa,DF?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,DF=<format>*<checksum><cr><lf>* *$aa,DF=c*hh<cr><lf>*

Parameters	<format>	
	P	Set the data format to Polar (wind speed and direction) (Factory Default Setting)
	N	Set the data format to NMEA 0183 with wind speed in m/s
	NN	Set the data format to NMEA 0183 with wind speed in knots
	NK	Set the data format to NMEA 0183 with wind speed in km/h

Examples

Example 1

Set the wind velocity output data format to NMEA with wind speed in m/s and verify the new setting.

Message	Comment
$01,DFN//<cr><lf>*	Set format to NMEA (m/s)
$01,DF?//<cr><lf>*	Query format setting
*$WI,DF=N*43<cr><lf>*	Sensor response

Example 2

Set the wind velocity output data format to NMEA with wind speed in knots and verify the new setting.

Message	Comment
$01,DFNN//<cr><lf>*	Set format to NMEA (knots)
$01,DF?//<cr><lf>*	Query format setting
*$WI,DF=NN*0D<cr><lf>*	Sensor response

Description

Use the DF command to set the required format of the wind velocity readings. See command WV (Sections 6.4.27 and 6.4.28) for a description of the sensor output for each of the format types.

When a DF Set command is sent to the sensor, a reset of the minimum and maximum readings to their default values is automatically performed.

Polar Format: The sensor returns the magnitude of the wind speed (m/s only) and the wind direction (0-359 degrees).

NMEA 0183 Format: The sensor returns the wind angle (0-359 degrees, Relative) and wind speed (m/s, knots or km/h). The sensor TalkerID is always set to WI when NMEA format is selected irrespective of any value that may have been set with the ID command.

6.4.5 DG: Query the Run-time Counter

Command Parameter	DG	
Command Syntax	SET Sensor:	*N/A*
	QUERY Sensor:	*$<listenerID>,DG?T*<checksum><cr><lf>* *$aa,DG?T*hh<cr><lf>*
	Sensor output:	*$<talkerID>,DG=<counter>*<checksum><cr><lf>* *$aa,DG=xxxxxx*hh<cr><lf>*
Parameters	<counter> *000000 to 999999*	Holds the number of hours that the anemometer has been in operation during its lifetime.
Examples	<u>Example 1</u> Query the Run-Time Counter. <u>Message</u> *$01,DG?T*//<cr><lf>* *$WI,DG=012897*CF<cr><lf>*	<u>Comment</u> Query Run-Time Counter Sensor response (12897 hours = 1 year, 5 months, 21 days and 9 hours)
Description	Use the DG command to query the number of operational hours that the anemometer has been in use. The Run-Time Counter is incremented on completion of each full hour that the anemometer has been in use.	

6.4.6 DL: Set or Query the Command Delay Interval

Command Parameter	DL	
Command Syntax	SET Sensor:	*$<listenerID>,DL<delay>*<checksum><cr><lf>* *$aa,DLxx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,DL?*<checksum><cr><lf>* *$aa,DL?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,DL=<delay>*<checksum><cr><lf>* *$aa,DL=xx*hh<cr><lf>*
Parameters	<delay> *00 to 20*	(delay interval, in 50ms increments) (Factory Default Setting = 01)

Examples

<u>Example 1</u>
Set the command delay interval to 250ms and verify the new setting.

<u>Message</u>	<u>Comment</u>
$01,DL05//<cr><lf>*	Set delay to 250ms
$01,DL?//<cr><lf>*	Query delay setting
*$WI,DL=05*02<cr><lf>*	Sensor response

Description

Use the DL command to set the delay interval from when the sensor receives a command to when the command is executed. The DL command is primarily intended for use where a time delay may be required to allow the RS485 interface to switch from transmit to receive mode.

For example, if the delay interval is set to 250ms then the sensor will commence outputting the wind velocity data between 250-300ms after receiving a WV query command.

If any further commands are sent to the sensor before the delay interval has elapsed they will be discarded.

6.4.7 ER: Query or Reset the Error Report

Command Parameter	ER

Command Syntax	SET Sensor:	*$<listenerID>,ER<reset>*<checksum><cr><lf>* *$aa,ERc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,ER?*<checksum><cr><lf>* *$aa,ER?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,ER=<error report>*<checksum><cr><lf>* *$aa,ER=xxxxxxxxxxxxxxx*hh<cr><lf>*

Parameters	<reset> *R*	 Resets the historical log section of the error report to all 0’s
	<error report> *<error report>*	 Sensor error report string

Examples	<u>Example 1</u> Query the error report <u>Message</u> *$01,ER?*//<cr><lf>* *$WI,ER=000000000000000*28<cr><lf>*	 <u>Comment</u> Query error report Sensor response

Description	The error report contains information on errors that have occurred during the operation of the sensor. The output string is always comprised of 15 ASCII characters (all shown as ‘0’, ASCII 30(HEX) in the above example). 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 Error Report Locations Most recent Least recent Current Status The first character in the data field represents the current operational status of the sensor. ‘0’ (ASCII 30(HEX)) indicates that the sensor is functioning correctly any other character indicates that an error condition exists. The status is cleared once the ER command is executed. The next 14 locations contain an historical log of the last 14 errors with the most recent error being recorded in the leftmost position. Each error condition is assigned an ASCII character. The historical log is stored in Flash and is retained when the power is switched off or the sensor software reset. This report can be sent back to the FT factory for analysis if there are problems with the sensor.

Currently the historical error log is only used for factory diagnostic purposes.

6.4.8 FL.1: General Filter Settings

Command Parameter	FL (enable/ disable)

Command Syntax		
	SET Sensor:	*$<listenerID>,FL<filter>*<checksum><cr><lf>* *$aa,FLc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,FL?*<checksum><cr><lf>* *$aa,FL?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,FL=<filter>*<checksum><cr><lf>* *$aa,FL=c*hh<cr><lf>*

Parameters	<filter>	
	E	Filter enabled (Factory Default Setting)
	D	Filter disabled

Examples		
	Example 1 Enable the filter. Verify that the command has been accepted.	
	Message	Comment
	$01,FLE//<cr><lf>*	Enable filtering
	$01,FL?//<cr><lf>*	Query filter setting
	*$WI,FL=E*40<cr><lf>*	Sensor response
	Example 2 Disable the filter. Verify that the command has been accepted.	
	Message	Comment
	$01,FLD//<cr><lf>*	Disable filtering
	$01,FL?//<cr><lf>*	Query filter setting
	*$WI,FL=D*41<cr><lf>*	Sensor response

Description	Use the FL command to enable or disable moving average filtering of the wind speed and wind direction readings (see Section 2.3).

6.4.9 FL.2: Set or Query Filter Lengths

Command Parameter	FL (lengths)	
Command Syntax	SET Sensor:	*$<listenerID>,FLL<speedLen>,<dirLen>*<checksum><cr><lf>* *$aa,FLLxxxx,xxxx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,FL?L*<checksum><cr><lf>* *$aa,FL?L*hh<cr><lf>*
	Sensor output:	*$<talkerID>,FL=<speedLen>,<dirLen>*<checksum><cr><lf>* *$aa,FL=xxxx,xxxx*hh<cr><lf>*
Parameters	<speedLen> *0001 to 0064*	Sample size of the wind speed filter. Number of previous readings[#] used to calculate the latest wind speed reading, 0001 is equivalent to disabling the filter (Factory Default Setting = 0016)
	<dirLen> *0001 to 0064*	Sample size of the wind direction filter. Number of previous readings[#] used to calculate the latest wind direction reading, 0001 is equivalent to disabling the filter; (Factory Default Setting = 0016)
Examples	Example 3 Modify the filter's dimensions. Verify that the command has been accepted.	
	Message	Comment
	$01,FLL0001,0032//<cr><lf>*	Set speed filter length to 1 and direction filter length to 32.
	$01,FL?L//<cr><lf>*	Query filter's length settings.
	*$WI,FL=0001,0032*29<cr><lf>*	Sensor response.
Description	Use this command to modify the speed and direction filter lengths. When the filter is enabled, speed and direction readings are independently averaged by calculating the mean of the previous number of readings[#] set by the filter lengths <speedLen> and <dirLen>. # Please note the previous readings filter length by definition includes the most up to date wind reading at position 1. So setting a filter to a length of 0001 gives just the current reading (see Section 2.3). The sensor's internal memory is large enough to retain 64 previous speed and direction readings, allowing for maximum filter length of 6.4 seconds.	

6.4.10 FL.3: Set or Query the Selective Filter

Command Parameter	FL (selective filter)

Command Syntax	SET Sensor:	*$<listenerID>,FLS<FilterStatus><period>*<checksum><cr><lf>* *$aa,FLScxxx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,FL?S*<checksum><cr><lf>* *$aa,FL?S*hh<cr><lf>*
	Sensor output:	*$<talkerID>,FL=<FilterStatus>,<period>*<checksum><cr><lf>* *$aa,FL=c,xxx*hh<cr><lf>*

Parameters	<FilterStatus> *E* *D*	 Enabled Disabled
	<Period> *000 to 255*	 Length of validity period (in increments of 0.1 seconds): 000 A single error will trigger the error flag 001 2 consecutive errors will trigger the error flag (0.2 seconds)

Examples	Example 1 Query the Selective Filter Status. Message *$01,FL?S*//<cr><lf>* *$WI,FL=E,005*hh<cr><lf>*	 Comment Query the Selective Filter status. Sensor reports it is enabled with a 5 reading (0.5 second) filter.
	Example 2 Enable or Disable the Selective Filter Status. *$01,FLSE010*//<cr><lf>* *$01,FLSD*//<cr><lf>*	 Enable the Selective Filter for up to 10 readings (1 second). Disable the Selective Filter.

Description	In addition to the averaging filter described in Section 2.5, the sensor has a feature called the Selective Filter. 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 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. Depending on the control system used, this may improve data quality.

6.4.11 HT.1: General Heater Settings

Command Parameter	HT (enable/ disable)

Command Syntax	SET Sensor:	`$<listenerID>,HT<tsp>*<checksum><cr><lf>` `$aa,HTxx*hh<cr><lf>`
	QUERY Sensor:	`$<listenerID>,HT?*<checksum><cr><lf>` `$aa,HT?*hh<cr><lf>`
	Sensor output:	`$<talkerID>,HT=<tsp>,<%>,<temp>*<checksum><cr><lf>` `$aa,HT=xx,xx,±xx*hh<cr><lf>`

Parameters	<tsp> *00-55* *99*	 Heater control circuit set point temperature (degrees Celsius) Disables the heater (factory default setting)
	<%> *00-99*	 Read only parameter that returns the % of full scale heater current limit 0% (heater off) to 99% (heater fully on)
	<temp> *-99 to +99*	 Read only parameter that returns the current internal temperature of the sensor, In ºC, in range 00 to ±99ºC

Examples	Example 1
	Set the sensor set point temperature to 5°C. Verify that the command has been accepted.
	Message
	`$01,HT05*//<cr><lf>`
	`$01,HT?*//<cr><lf>`
	`$WI,HT=05,00,+24*3B<cr><lf>`
		
		Comment
		Set heater set point temp
		Query heater setting
		Sensor response

	Example 2
	Turn off the sensor heater. Verify that the command has been accepted.
	Message
	`$01,HT99*//<cr><lf>`
	
	`$01,HT?*//<cr><lf>`
	`$WI,HT=99,00,+24*3E<cr><lf>`
		
		Comment
		Disable heater
		
		Query heater setting
		Sensor response

Description	Use the HT command to set the sensor heater parameters, including switching the heater on or off and configuring the heater set point. It is possible to query the sensor's internal temperature. It is also possible to query the duty cycle of the heater, which specifies the percentage of the current being drawn by the heaters. By default the heater requires a minimum voltage of 11VDC, see Section 6.4.13 for further details.

6.4.12 HT.2: Delay Heater Settings

Command Parameter	HT (delay)

Command Syntax	SET Sensor:	*$<listenerID>,HTD<delay>*<checksum><cr><lf>* *$aa,HTDxxx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,HT?D*<checksum><cr><lf>* *$aa,HT?D*hh<cr><lf>*
	Sensor output:	*$<talkerID>,HT=<delay>*<checksum><cr><lf>* *$aa,HT=xxx*hh<cr><lf>*

Parameters	<delay>	
	004 to 999	Heater Delay in seconds. This is the period after sensor power on before the heater will be enabled. (Factory Default is 004 = 4 seconds)

Examples	<u>Example 3</u> Set the sensor heater delay to 010. Verify that the command has been accepted.	
	<u>Message</u>	<u>Comment</u>
	$01,HTD010//<cr><lf>*	Set heater delay to 010
	$01,HT?D//<cr><lf>*	Query heater delay setting
	*$WI,HT=010*22<cr><lf>*	Sensor response

Description	Use the HT command to set the sensor heater parameters, including setting a delay time which specifies how many seconds will elapse after powering on the sensor before the heater is enabled.

6.4.13 HT.3: Limit Heater Settings

Command Parameter	HT (current and under-voltage limit)	
Command Syntax	SET Sensor:	*$<listenerID>,HTL<CurrentLimit>,<UVoltLimit>*<checksum><cr><lf>* *$aa,HTLxx,xx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,HT?L*<checksum><cr><lf>* *$aa,HT?L*hh<cr><lf>*
	Sensor output:	*$<talkerID>,HT=<CurrentLimit>,<UVoltLimit>*<checksum> <cr><lf>* *$aa,HT=x.x,xx*hh<cr><lf>*
Parameters	<CurrentLimit> *01 to 60*	Heater Current Limit in steps of 100mA. Valid values of the current limit are in the range 01 to 60. That is, 100mA to 6.0A. (Factory default is 40 = 4.0A)
	<UVoltLimit> *11 to 17*	Heater Under Voltage Limit in Volts. If the supply voltage falls below the under voltage limit, the heater will be turned off, until the supply returns above the limit. (Factory default 11 = 11VDC.)

Examples		
	Example 4 Set the sensor heater current limit to 3.3A and set the under voltage limit to 12VDC. Verify that the command has accepted.	
	Message	Comment
	$01,HTL33,12//<cr><lf>*	Set current and voltage Limit
	$01,HT?L//<cr><lf>*	Query heater settings
	*$WI,HT=3.3,12*12<cr><lf>*	Sensor response

Description	
	The HT command may be used to set the sensor heater parameters such as the maximum current and under voltage limit of the heaters.

6.4.14 ID: Set or Query the Listener & Talker Identifiers

Command Parameter	ID

Command Syntax	SET Sensor:	*$<listenerID>,ID<RxID><TxID>*<checksum><cr><lf>* *$aa,ID=cccc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,ID?*<checksum><cr><lf>* *$aa,ID?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,ID=<RxID><TxID>*<checksum><cr><lf>* *$aa,ID=cccc*hh<cr><lf>*

Parameters	<RxID> *00 to ZZ*	The sensor 2 digit listener address identifier (Factory Default RxID = 01)
	<TxID> *00 to ZZ*	The sensor 2 digit talker address identifier (Factory Default TxID = WI)

Examples	<u>Example 1</u> Set the sensor listener address identifier to A1 and the talker address identifier to B1. Verify that the command has been accepted.	
	<u>Message</u>	<u>Comment</u>
	$01,IDA1B1//<cr><lf>*	Set address ID's
	$A1,ID?//<cr><lf>*	Query ID settings
	*$B1,ID=A1B1*6C<cr><lf>*	Sensor response
	Note: the ID? command must use the new listener ID otherwise the command will not be recognised.	

Description	Use the ID command to set the listener and talker address identifiers. See Section 5.4.4 for information on listener and talker address identifiers.

6.4.15 MM: Reset or Query the Min/Max Recorded Wind Speed

Command Parameter	MM

Command Syntax	SET Sensor:	*$<listenerID>,MM<setting>*<checksum><cr><lf>* *$aa,MMc*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,MM?*<checksum><cr><lf>* *$aa,MM?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,MM=<MinSpeed>,<MaxSpeed>*<checksum><cr><lf>* *$aa,MM=xxx.x,xxx.x*hh<cr><lf>*

Parameters	<setting> *R*	Resets the min/max readings to their default (<MinSpeed> to 999.9 and <MaxSpeed> to 000.0) until the first reading
	<MinSpeed> *000.0 to 999.9*	Minimum detected wind speed in current unit (m/s, knots or km/h)
	<MaxSpeed> *000.0 to 999.9*	Maximum detected wind speed in current unit (m/s, knots or km/h)

Examples	Example 1 Query the min/max wind speed readings	
	Message	Comment
	$01,MM?//<cr><lf>*	Query the min/max readings
	*$WI,MM=005.1,034.2*22<cr><lf>*	Sensor response

Description	Use the MM command to query the minimum and maximum wind speed readings that the sensor has recorded since it was last switched on. The minimum and maximum readings are set to their default values when an MMR, an RS or a DF set command is executed.

6.4.16 OS: Overspeed Warning Scheme

Command Parameter	OS

Command Syntax	SET Sensor:	*$<listenderID>,OS<mode>*<checksum><cr><lf>* *$aa,OSm*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,OS?*<checksum><cr><lf>* *$aa,OS?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,OS=<mode>*<checksum><cr><lf>* *$aa,OS=m*hh*

Parameters	<Mode>	
	D	Overspeed Warning Disabled
	E	Overspeed Warning Enabled

Examples	Example 1	
	Enable the Overspeed Warning scheme. Verify that the command has been accepted.	
	Message	Comment
	$01,OSE//<cr><lf>*	Enable the scheme
	$01,OS?//<cr><lf>*	Query Overspeed Warning scheme
	*$WI,OS=E*56<cr><lf>*	Sensor response
	Example 2	
	Disable the Overspeed Warning scheme. Verify that the command has been accepted.	
	Message	Comment
	$01,OSD//<cr><lf>*	Disable the scheme
	$01,OS?//<cr><lf>*	Query Overspeed Warning scheme
	*$WI,OS=D*57<cr><lf>*	Sensor response

Description	Use this command to query, enable or disable the Overspeed Warning Scheme (See Section 2.7).

6.4.17 PR: Query the Parameter Report

Command Parameter	PR

Command Syntax		
	SET Sensor:	`NA`
	QUERY Sensor:	`$<listenerID>,PR?*<checksum><cr><lf>` *`$aa,PR?*hh<cr><lf>`*
	Sensor output:	`$<talker id>,PR=<RFU>,<diagnostic flags>,<material temperature>,<RFU>,<RFU>*<checksum><cr><lf>` `$aa,PR=xxxxxx,xxxx,xx,xx,xx*hh<cr><lf>`

Parameters		
	<RFU> *NA*	Reserved for Factory Use
	<diagnostic flags > *NA*	These flags should normally be 0000
	<material temperature> *00 to FF*	The material temperature is given as a hexadecimal value. The HT Query command is the recommended method for obtaining material temperature readings.

Examples		
	Example 1 Query the parameter report	
	Message	Comment
	`$01,PR?*//<cr><lf>`	Get the parameter report
	`$WI,PR=076B63,0000,19,29,BF*7C<cr><lf>`	Sensor response

Description	
	Use the PR command to generate a sensor report. This report can be sent back to the FT factory for analysis if there are problems with the sensor.

> Currently the parameter report is only used for factory diagnostic purposes.

6.4.18 RS: Reset the Sensor

Command Parameter	RS

Command Syntax		
	SET Sensor:	*$<listenerID>,RS<mode>*<checksum><cr><lf>* *$aa,RSc*hh<cr><lf>*
	QUERY Sensor:	*NA*
	Sensor output:	*None*

Parameters	<mode>	
	F	Reset the sensor, loading the Factory Default settings
	S	Reset the sensor, loading saved parameters settings
	U	Reset the sensor, reloading the user parameter settings

Examples		
	Example 1 Reset the sensor, reloading the last parameter settings	
	Message	Comment
	$01,RSU//<cr><lf>*	Reset sensor, reloading last settings

Description	
	Use the RS command to reset the sensor software. The sensor will be ready to receive new commands or take readings from a maximum of 2 seconds after any reset command is sent. To restart the software, but continue to use the previous user parameter settings use the RSU command To restart the software, but load the saved parameter settings use the RSS command. To restart the software, but load the factory default parameter settings use the RSF command. See command US (Section 6.4.26) for a description for setting or querying these Saved Parameters.

6.4.19 SN: Query the Serial Number and Platform Version

Command Parameter	SN

Command Syntax	SET Sensor:	NA
	QUERY Sensor:	*$<listenerID>,SN?*<checksum><cr><lf>* *$aa,SN?*hh<cr><lf>*
	Sensor Output:	*$<talkerID>,SN=<SerialNumber>,<PlatformVersion>*<checksum><cr><lf>* *$aa,SN=xxxxx-xxx,xxsss*hh<cr><lf>*

Parameters	<SerialNumber> *00000-000 to 99999-999*	Unique serial number of the sensor
	<PlatformVersion> *00-99*	Platform version (issue) of the sensor design. The 3 spaces after the 2 digit number are reserved for future use.

Examples	Example 1 Read the sensor serial number and platform version	
	Message	Comment
	$01,SN?//<cr><lf>*	Query serial number
	*$WI,SN=09000-130,24 *3E<cr><lf>*	Sensor response

Description	The SN command returns the serial number of the sensor and also the platform version of the sensor. The serial number format starts with a 5 digit batch code, followed by a 3 digit number which identifies a sensor within a particular batch. The overall number is the unique serial number identifier for the sensor.

6.4.20 SV: Query the Software Version

Command Parameter	SV	
Command Syntax	SET Sensor:	*NA*
	QUERY Sensor:	*$<listenerID>,SV?*<checksum><cr><lf>* *$aa,SV?*hh<cr><lf>*
	Sensor Output:	*$<talkerID>,SV=<SoftwareVersion>*<checksum><cr><lf>* *$aa,SV=sssx.xss*hh<cr><lf>*
Parameters	<SoftwareVersion> *1.0 to 9.9*	Software version of the sensor. The spaces are reserved for future use.
Examples	Example 1 Read the software version number Message *$01,SV?*//<cr><lf>* *$WI,SV= 7.3 *00<cr><lf>*	Comment Query software version Sensor response
Description	The SV command returns the software version of the sensor.	

6.4.21 UC.1: General User Calibration Settings

Command Parameter	UC (enable/ disable)

Command Syntax	SET Sensor:	*$<listenerID>,UC<table>*<checksum><cr><lf>* *$aa,UCx*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,UC?*<checksum><cr><lf>* *$aa,UC?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,UC=<entries>,<table>,<UCRAMChecksum>, <UCFlashChecksum>*<checksum><cr><lf>* *$aa,UC=nn,x,yyyy,zzzz*hh<cr><lf>*

Parameters	*<table>*	
	E	User Calibration Table enabled
	D	User Calibration Table disabled (Factory Default Setting)
	<entries>	
	nn	Number of calibrated table entries
	<UCRAMChecksum>	
	yyyy	User calibration table RAM copy checksum
	<UCFlashChecksum>	
	zzzz	Saved user calibration table Flash copy checksum

Examples	<u>Example 1</u> Enable the user calibration table and verify new setting	
	<u>Message</u>	<u>Comment</u>
	*$01,UCE*7E<cr><lf>*	Enable calibration table
	*$01,UC?*04<cr><lf>*	Query user calibration table status
	*$WI,UC=55,E,5174,5174*70<cr><lf>*	Typical sensor response

Description	Use the UC command to enable or disable the implementation of the user calibration table for calibrating wind speed readings. The four-digit user calibration table checksum is calculated by summing all table entries over the number of table rows present. The least significant 4 digits of the resulting sum are retained as the table checksum. The user-defined text string is not included in the checksum. Each xx.xx speed value is treated as an integer by ignoring the decimal point. For example, the table row: 15.00, 14.97 is summed as 1500 + 1497 = 2997. A table sum of 55174 results in the checksum 5174. If the user calibration table has not been loaded, the number of calibrated table entries (nn) will be 00 and the saved user calibration table Flash copy checksum (zzzz) will be 5535.

When the User Calibration facility is enabled, the uncorrected wind speed indication of the sensor is calibrated according to the stored calibration records, using linear interpolation.

6.4.22 UC.2: Clear User Calibration Table Record

Command Parameter	UC (Erase table)
Command Syntax	SET Sensor: *$<listenerID>,UC<erase>*<checksum><cr><lf>* *$aa,UCCLEAR*hh<cr><lf>*
Parameters	`<erase>` *CLEAR* Erases both Flash and RAM copies of user calibration table
Examples	Example 1 Erase the user calibration tables and verify Message / Comment *$01,UCCLEAR*62<cr><lf>* Erase calibration tables *$01,UC?*04<cr><lf>* Query user calibration table status *$WI,UC=00,D,0000,0000*71<cr><lf>* Sensor response
Description	Use the UCCLEAR command to erase the RAM and saved FLASH copies of the user calibration table. A UCCLEAR is performed before a new user calibration table is loaded (see Section 6.4.23). The user calibration table label is also cleared to 32 ASCII spaces when the UCCLEAR command is sent (see Section 6.4.25).

6.4.23 UC.3: Set User Calibration Table Record

Command Parameter	UC (set & verify record)

Command Syntax		
	SET Sensor Calibration Record:	*$<listenerID>,UCW<Cspeed>,<Uspeed>*<checksum><cr><lf>* *$aa,UCWxx.xx,yy.yy*hh<cr><lf>*
	Verify Last Record:	*$<listenerID>,UC?W*<checksum><cr><lf>* $aa,UC?W*hh<cr><lf>
	Sensor output:	*$<talkerID>,UC=<error code>*<checksum><cr><lf>* *$aa,UC=n*hh<cr><lf>*

Parameters		
	<Cspeed> *xx.xx*	Corrected speed
	<Uspeed> *yy.yy*	Uncorrected speed
	<error code>	
	0	Table entry accepted
	1	Error: Sensor speed out of order (latest row speed <previous row speed)
	2	Error: Sensor speed increment less than 0.5ms than previous record
	3	Error: Data entry not allowed (table has not been cleared first)
	4	Error: Bad argument (data format not valid)
	5	Error: User calibration table is full (all 64 rows have been entered)

Examples		
	<u>Example 1</u> Enter user calibration table record and verify	
	<u>Message</u>	<u>Comment</u>
	*$01,UCW00.90,01.11*48<cr><lf>*	Set a wind speed correction
	*$01,UC?W*53<cr><lf>*	Query if table entry was accepted
	*$WI,UC=0*29<cr><lf>*	Sensor response

Description	
	Use the UCW command to set and verify individual user calibration table records. New records can only be entered if the Calibration table is cleared first (see Section 6.4.22) Up to 64 records can be entered sequentially into the sensor’s RAM and verified. Once sufficient records have been loaded, these can be saved to the Flash using the user calibration save command (see Section 6.4.24).

6.4.24 UC.4: Save and Read User Calibration Table

Command Parameter	UC (save and read)

Command Syntax	Save Sensor Calibration Record:	*$<listenerID>,UCS*<checksum><cr><lf>* *$aa,UCS*hh<cr><lf>*
	QUERY Saved Sensor Calibration Record:	*$<listenerID>,UC?R<row>*<checksum><cr><lf>* $aa,UC?Rnn*hh<cr><lf>
	Sensor output:	*$<talkerID>,UC=<row>,<Cspeed>,<Uspeed>*<checksum><cr><lf>* *$aa,UC=nn,xx.xx,yy.yy*<cr><lf>*

Parameters	*<row>* *01 – 64*	Calibration table row number
	<Cspeed> *xx.xx*	Corrected speed
	<Uspeed> *yy.yy*	Uncorrected speed

Examples	Example 1 Save a new user calibration table from RAM into Flash memory and verify	
	Message	Comment
	*$01,UCS*68<cr><lf>*	Save calibration table
	*$01,UC?*04<cr><lf>*	Query user calibration table status
	*$WI,UC=55,E,5174,5174*70<cr><lf>*	Typical sensor response
	Example 2 Read calibration data stored in row 5 of the Flash calibration table	
	Message	Comment
	*$01,UC?R05*53<cr><lf>*	Query Flash user calibration record
	*$WI,UC=05,06.00,06.03*1F<cr><lf>*	Typical sensor response

Description	Use the UCS command to save a new user calibration table into Flash memory. A user calibration query (see Section 6.4.21) command can then be used to verify that the checksum of the RAM and Flash copies are equal. This demonstrates that the table has been saved without error. Use the UC?R command to verify the data stored in an individual Flash calibration record.

Once the table has been saved into Flash memory, new data and the text string can only be written to it by first clearing the table.

6.4.25 UC.5: Set & Query User Calibration Table Label

Command Parameter	UC (label)

Command Syntax	SET Sensor label:	*$<listenerID>,UCT<text string>*<checksum><cr><lf>* *$aa,UCTxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx*hh<cr><lf>*
	QUERY Sensor label:	*$<listenerID>,UC?T*<checksum><cr><lf>* $aa,UC?T*hh<cr><lf>
	Sensor output:	*$<talkerID>,UC=<label32>*<checksum><cr><lf>* *$aa,UC=xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx*hh<cr><lf>*

Parameters	*<text string>* *xxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxx*	Up to 32 upper or lower case alphanumeric ASCII characters (can also include ASCII space, underscore and hyphen characters). Factory default is 32 ASCII spaces.
	<label32> *xxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxx*	32 ASCII characters, Note: ASCII spaces will be added to entered ASCII string if it is less than 32 characters to form a string of 32 characters.

Examples

Example 1

Set the User Calibration label to “speed offset V03” and verify

Message	Comment
*$01,UCTspeed offset V03*50<cr><lf>*	Set Calibration table label
*$01,UC?T*0C<cr><lf>*	Query Calibration table label
*$WI,UC=speed offset V03 *26<cr><lf>*	Sensor response

Description

Use the UCT command to set a User calibration table label. The label can be up to 32 ASCII characters long and include ASCII space, underscore and hyphen characters.

The user calibration table label can be cleared by using the UCCLEAR command. (see Section 6.4.22) This resets the label to 32 ASCII spaces.

UC?T query command will only return a response after the user calibration table has been initialised.

6.4.26 US: Set or Query Saved Parameters

Command Parameter	US

Command Syntax	SET Sensor:	*$<listenerID>,US<setting>*<checksum><cr><lf>* *$aa,USS*hh<cr><lf>*
	QUERY Sensor:	*$<listenerID>,US?*<checksum><cr><lf>* *$aa,US?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,US=<match>*<checksum><cr><lf>* *$aa,US=c*hh<cr><lf>*

Parameters	<setting>	
	S	Copies the User Parameters and saves them as the Saved Parameters.
	<match>	
	P	indicates the User Parameters are the same as the Saved Parameters
	F	indicates the User Parameters are not the same as the Saved Parameters

Examples	Example 1 Set and Verify new user saved parameters	
	Message	Comment
	$01,USS//<cr><lf>*	Set saved parameters
	$01,US?//<cr><lf>*	Query the saved parameters
	*$WI,US=F*4F<cr><lf>*	Sensor response

Description

There are three copies of Parameters stored in Flash memory namely, User Parameters, Factory Parameters, Saved Parameters respectively. All three copies are initially loaded with the same default settings.

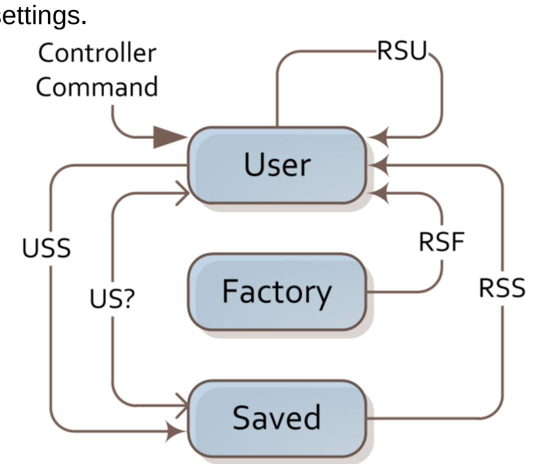


Figure 25: Relationship between the 3 flash copies of Parameter Settings

The User Parameters is the copy that the sensor operates from, at all times. When sending a command to the sensor, it is the User Parameter copy which is updated. The user parameters copy is non volatile so the sensor will keep the last settings when it is powered up again.

The Factory Parameters retain the original default settings and cannot be modified, but can be used to replace the User Parameter, by using the RSF command (see Section 6.4.18)

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Description continued	The Saved Parameters are created by means of the USS command. This command copies the User Parameters and saves them into a separate area in Flash reserved for the Saved Parameters. The query US command compares item by item the Saved Parameters against the User Parameters and reports any discrepancy; this command could be used after USS to confirm that all of User Parameters have been copied correctly in Saved Parameters. A reset command can be used to load the Saved Parameters back to the User Parameters. See command RSS (Section 6.4.18) for the details of the RSS command. After RSF and RSS commands are executed the restored parameters are loaded into RAM, so it is imperative to execute any one of the Set Commands described in Section 6.1.1; executing any one of these commands instructs the sensor to make a non-volatile copy of the newly created User Parameters.

> The Command USS should never be done outside of a laboratory or controlled environment. This then ensures that the Saved Parameters copy is not corrupted. Then in the field when changing a User parameter, if a lightning strike occurs exactly at the same time as an attempted change and the User version becomes corrupt there is always a ‘clean’ back up Saved copy of the parameters that can be used to recover the sensor.

6.4.27 WV Polar: Query the Wind Velocity Reading

Command Parameter	WV (Polar)	
Command Syntax	SET Sensor:	N/A
	QUERY Sensor:	*$<listenerID>,WV?*<checksum><cr><lf>* *$aa,WV?*hh<cr><lf>*
	Sensor output:	*$<talkerID>,WVP=<speed>,<angle>,<status>*<checksum><cr><lf>* *$aa,WVP=xxx.x,xxx,x*hh<cr><lf>*

Parameters	<speed> *000.0 to 075.0*	Measured wind speed in metres per second
	<angle> *000 to 359*	Measured wind direction in degrees relative to sensor datum
	< status > *0 to Z*	Indicates whether an error condition was detected by the sensor operating system. A status value of 0 indicates no issues have been detected (ASCII 30(HEX)). If the sensor detects an error condition, the status character will be set to 1. If the Overspeed Warning Scheme (see Section 2.7) is enabled and if the sensor detects wind speed above the maximum range, the status flag will be set to 2.

Examples	Example 1 The following example illustrates the polar wind velocity data format. The example shows the sensor output with a wind speed of 20m/s and a wind angle of 45°.	
	Message	Comment
	$01,WV?//<cr><lf>*	Query the wind velocity
	*$WI,WVP=020.0,045,0*73<cr><lf>*	Sensor polar response

Description	The WV command returns the wind velocity value in the currently selected format. Polar or NMEA formats are available. Use the DF command, Section 6.4.4, to select the required output format. Polar Format: The sensor returns the magnitude of the wind speed (m/s) and the wind direction (0-359°). NMEA 0183 Format: The sensor returns the NMEA 0183 Wind Speed and Angle sentence MWV (see WV NMEA, Section 6.4.28).

It is important that the status is always monitored. Readings associated with errors should not be treated as valid. It is important that the host computer is able to cope with occasional periods when valid data may be temporarily unavailable.

The status is cleared once the WV command is executed, provided that the error condition does not persist.

6.4.28 WV NMEA: Query the Wind Velocity Reading

Command Parameter	WV (NMEA)

Command Syntax	SET Sensor:	N/A
	QUERY Sensor:	*$<listenerID>,WV?*<checksum><cr><lf>* *$aa,WV?*hh<cr><lf>*
	Sensor output:	*$WIMWV,<angle>,R,<speed>,<units>,<status>*<checksum><cr><lf>* *$WIMWV,xxx,R,xxx.x,c,A*hh<cr><lf>*

Parameters	<angle> *000 to 359*	Measured wind direction in degrees relative to sensor datum
	<speed> *000.0 to 075.0* *000.0 to 145.8* *000.0 to 270.0*	Measured wind speed (in metres per second). Measured wind speed (in knots). Measured wind speed (in km per hour).
	<units> *M* *N* *K*	Indicates the wind speed is presented in metres/second Indicates the wind speed is presented in knots Indicates the wind speed is presented in kilometres/hour
	< status > *0 to Z*	Indicates whether an error condition was detected by the operating system, such as out of range wind speed or incorrect signal level. Any character other than 'A' (ASCII 41(HEX)) = error.

Examples

Example 1

The following example illustrates the NMEA wind velocity data format. The example shows the sensor output in m/s with a wind speed of 20m/s and a wind angle of 45°.

Message	Comment
$01,WV?//<cr><lf>*	Query the wind velocity
*$WIMWV,045,R,020.0,M,A*3D<cr><lf>*	Sensor NMEA response

Example 2

The following example illustrates the NMEA wind velocity data format. The example shows the sensor output in knots with a wind speed of 30.6 knots and a wind angle of 9°.

Message	Comment
$01,WV?//<cr><lf>*	Query the wind velocity
*$WIMWV,009,R,030.6,N,A*31<cr><lf>*	Sensor NMEA response

Description

The WV command returns the wind velocity value in the currently selected format and units. Polar or NMEA formats are available. Use the DF command, Section 6.4.4, to select the required output format and units.

Polar Format: The sensor returns the magnitude of the wind speed (m/s) and the wind direction (0-359°) (see WV Polar, Section 6.4.27).

NMEA 0183 Format: The sensor returns the NMEA 0183 Wind Speed and Angle sentence MWV. The sensor returns the wind direction (0-359°) and wind speed (m/s, knots or km/h) using the MWV Wind Speed and Angle sentence. The sensor Talker ID is always set to WI when NMEA format is selected, irrespective of any setting that may have been set with the ID command.

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