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USER GUIDE

WMT700

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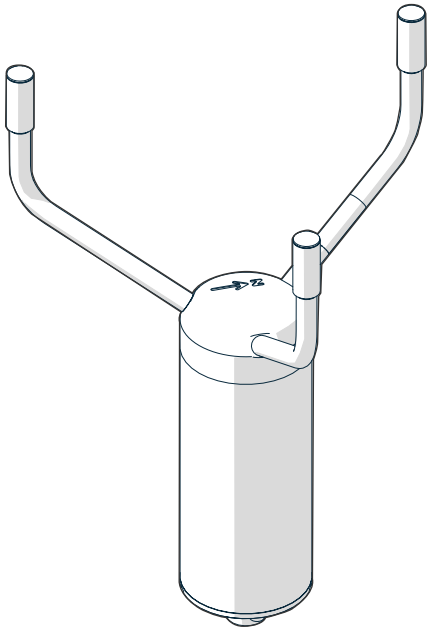


M211095EN-L

User Guide

Vaisala WINDCAP® Ultrasonic Wind Sensor

WMT700 Series



VAISALA

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1. About this document

1.1 Version information

Table 1 Document versions

Document code	Date	Description
M211095EN-L	May 2026	• Added information about the new integrated cable. • Updated information about analog output types. • Updated information about analog output parameter for WMT700 in tunnels and cranes. • Updated operating and heating voltage. • Updated the accessories list.
M211095EN-K	October 2022	• Updated cable information. • Updated heating information. • Updated powering information. • Added fuse size requirements. • Updated accessories list. • FCC/ISED regulatory notices added. • Updated DNV type certificate.
M211095EN-H	April 2017	• Added 3 new commands for WS425 F/G ASOS protocol. • Added information about the new ASOS adapter.

1.2 Documentation conventions

WARNING! Alerts you to a serious hazard. If you do not read and follow instructions carefully at this point, there is a risk of injury or even death.

CAUTION! Alerts you to a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

Highlights important information on using the product.

Gives information for using the product more efficiently.



Lists tools needed to perform the task.



Indicates that you need to take some notes during the task.

1.3 Trademarks

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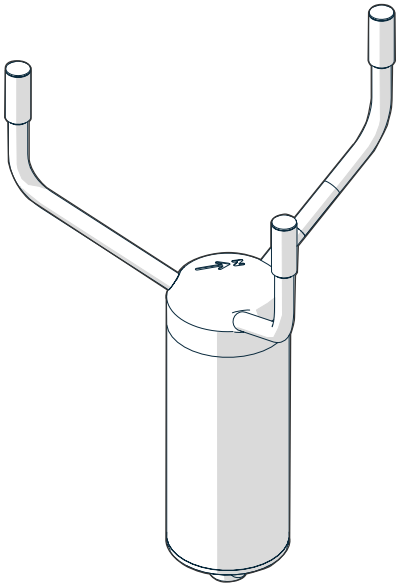
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2. Product overview

2.1 WMT700 overview



The Vaisala WINDCAP WMT700 ultrasonic wind sensor detects the wind speed and direction, and sends the measurement results to the data acquisition systems. WMT700 is a part of Vaisala meteorological data measurement offering, and it is suitable for both system-based and standalone use. In standalone installation WMT700 must be equipped with a PJB480 power junction box.

The WMT700 series consists of 4 product models with different measurement ranges: WMT701, WMT702, WMT703, and WMT704. You can select heating functions that shield the array and/or the transducers and the sensor body from ice and snow buildup in cold climates.

The WMT700 series wind sensors are based on the advanced, patented Vaisala WINDCAP wind measurement technology that ensures accurate results in all wind directions. The effects of temperature, humidity, and pressure are fully compensated.

Since the wind sensors have no moving parts, they are virtually maintenance-free. The performance of the sensors neither degrades with wear nor is it affected by natural contaminants such as salt, dust, or sand.

The WMT700 series wind sensors support a wide range of communication options. You can connect the wind sensors directly to a variety of data acquisition systems without additional converters or adapters.

WMT700 is configured at the factory according to your order, and it is ready for operation directly after the installation. You also have a wide range of configuration options and measurement settings.

WMT700 can be equipped with accessories to tailor the instrument to match different user-specific needs. The accessories include a bird prevention kit, a zero wind verifier, mounting adapters, and cables.

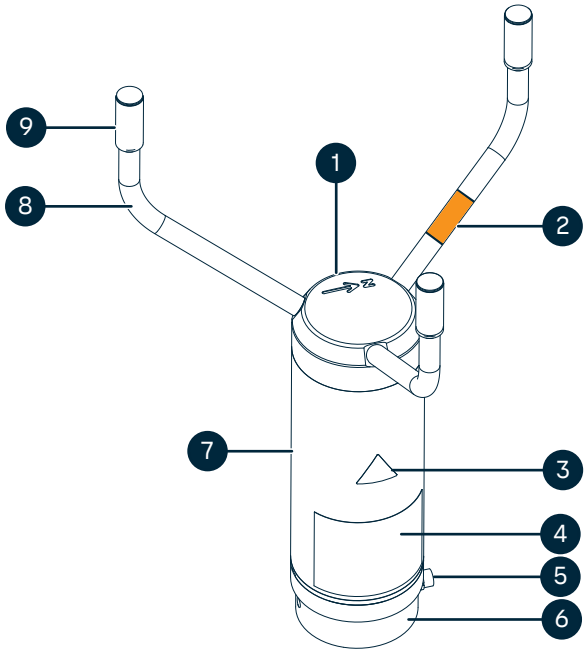


Figure 1 WMT700 wind sensor

1 Top of WMT700 with North arrow
2 Orange sticker marking North arm
3 Hot warning sticker
4 Type label
5 Mounting screw
6 Mounting adapter
7 Body
8 Transducer arms (3 pcs)
9 Transducers (3 pcs)

The array consists of the top, transducer arms, and transducers.

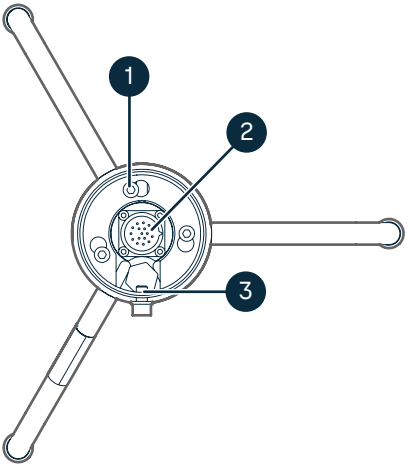


Figure 2 WMT700 from below

1 Mounting adapter screw (3 pcs, 4-mm Allen key)
2 17-pin M23 male connector
3 Waterproof vent

Do not open the sensor. There are no user-serviceable parts inside.

In the integrated cable option, the cable is permanently factory-mounted to the sensor body. This option is available with specific adapter options, like the standard adapter and the maritime adapter. The integrated cable variant is ideal for installations in harsh environments, such as maritime, offshore, and coastal locations. It is also suitable for inverted installations. To order the integrated cable variant, select the integrated hybrid cable 11 m in the *Cable* section of the WMT700 order form and pair it with the appropriate adapter in the Mounting Adapter section. See the WMT700 order form for the latest availability of adapters.

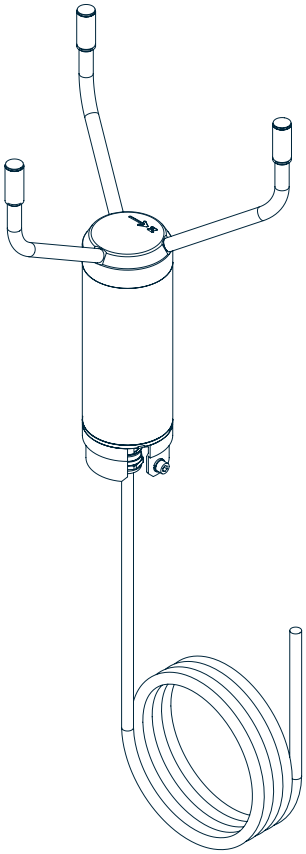


Figure 3 WMT700 with integrated cable

2.1.1 Mounting adapters

The following figures show available mounting kits.

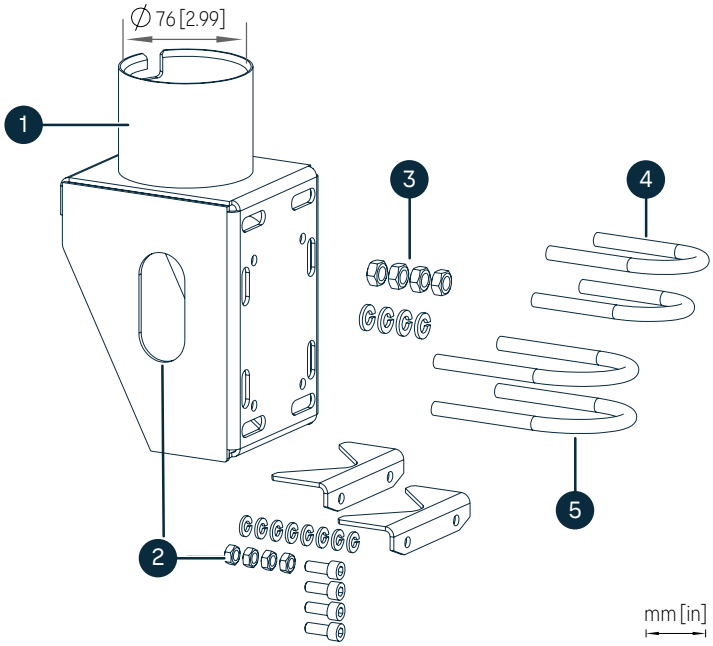


Figure 4 WMT70FIX mounting kit

1 WMT70FIX body
2 Removable mast guide with mounting hardware
3 Mounting hardware (M6 nuts, washers)
4 U bolts for Ø 30 mm mast (2 pcs)
5 U bolts for Ø 60 mm mast (2 pcs)

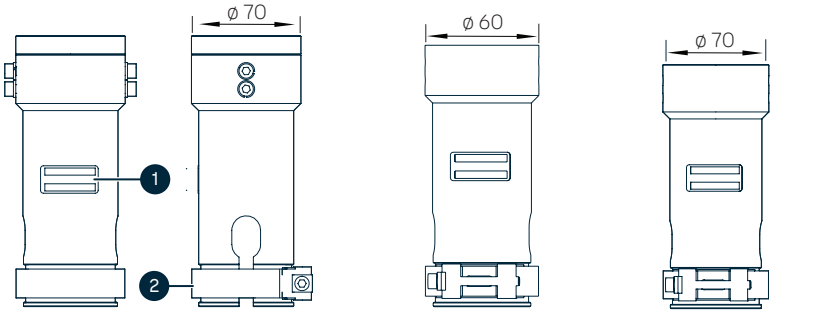


Figure 5 WMT700FIX60-MARINE, WS425FIX60-RST and WS425FIX60, and WMT700FIX60-RST mounting adapters

1 Label
2 Clamp

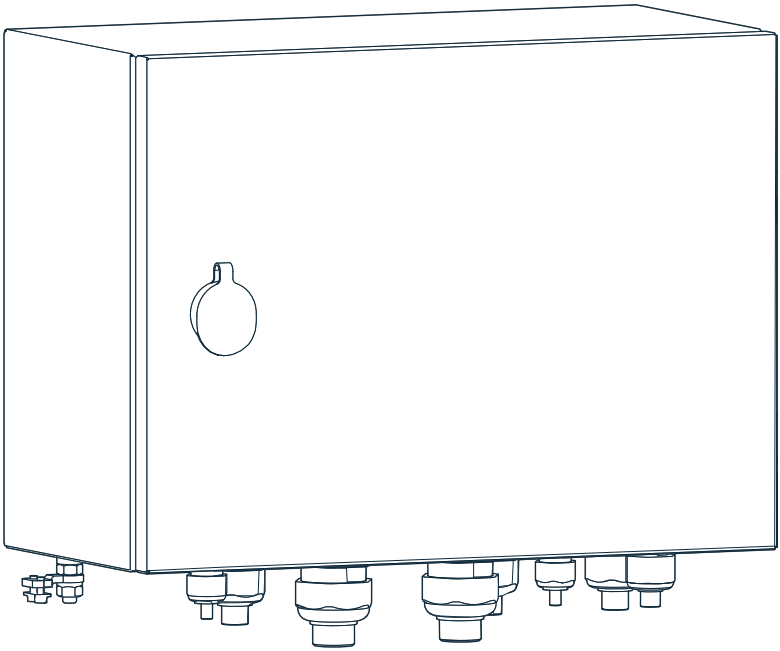
2.1.2 Power unit

If you use your own power supply, make sure that the power supply output voltage, current and power specifications including the tolerance match WMT700 specifications.

More information

- Powering WMT700 (page 81)

2.1.2.1 PJB480 power junction box



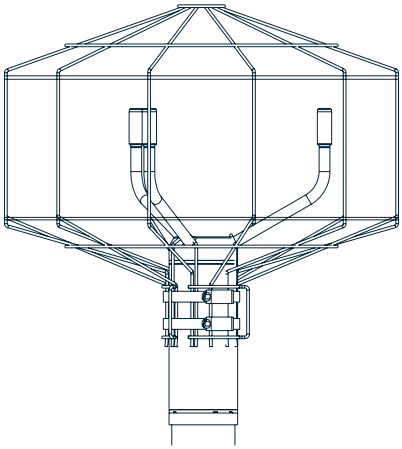
Vaisala Power Junction Box PJB480 provides operational and heating power to WMT700. PJB480 is designed for demanding conditions, such as maritime use and cold climates.

PJB480 is equipped with two 24 V DC power supplies and has a maximum output power of 480 W. It provides power for keeping WMT700 operational and heated, thus preventing buildup of ice and snow. With PJB480, WMT700 can be fully heated (including sensor transducers, arms, and body) to keep the sensor functional in the harshest and coldest environments. PJB480 supports one WMT700.

PJB480 withstands low temperatures, down to −55 °C (−67 °F). Its enclosure is waterproof (IP66) and made of stainless steel. A mounting plate for wall installation is included in the delivery. You can also mount PJB480 on a mast using an optional APPK-SET mounting kit. Install PJB480 directly to a bulkhead without the mounting plate.

PJB480 is a durable solution for cold climates and demanding maritime conditions. It is compliant with IEC 60945 standards. PJB480 can be used with a standalone WMT700 or with a WMT700 that is part of a Vaisala automatic weather station.

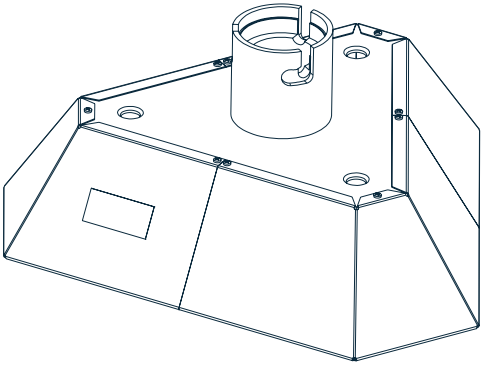
2.1.3 Bird cage



Vaisala recommends using the optional bird cage (WMT70BirdKit) in areas with large bird populations. The cage is designed to prevent large birds from disturbing the wind speed and direction measurements.

You can install the bird cage on a mounted WMT700 without dismounting the wind sensor. In cold climates, accumulated snow or ice on the bird cage can disturb the measurement. In such conditions, perform frequent visual inspections of WMT700 to avoid ice or snow build-ups.

2.1.4 Zero wind verifier



The optional WMT700 zero wind verifier (WMT70Verifier) is a small echo-free chamber for testing the mechanical integrity of WMT700 and performing one-point calibration. The verifier ensures that the array is undamaged and that the transducers are parallel to each other. You can perform the verifier test also in the field.

2.1.5 Cables

Select the cables according to your operating environment.

More information

- Hybrid cables (page 76)
- Standard cables (page 77)
- RS-485 cables (page 78)

2.2 Safety

The WMT700 sensor delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

WARNING! Lightning protection is required to prevent injury and damage to equipment due to direct lightning strikes and lightning-induced current surges.

WARNING! If ice or snow accumulates on the mast, guy wires, or sensors, the ice or snow can fall and cause injury to persons below.

WARNING! Make sure that you prepare or connect only de-energized wires.

WARNING! A long cable between units (sensors, transmitters, power supplies, and displays) can cause a lethal lightning-induced current surge. Always ground the enclosure to a suitable grounded location with a short, low-resistance cable.

WARNING! Do not perform installation or maintenance procedures when there is a risk of thunderstorm or lightning activity in the area.

CAUTION! To prevent equipment damage, install an air terminal so that the tip is as high above the instruments and sensors as possible.

CAUTION! Improper modification can damage the product or lead to malfunction. Any modification voids your warranty.

CAUTION! Handle with care. Any impact on the instrument or sensor array may cause damage and lead to incorrect measurements.

CAUTION! The heating power supply wires are internally connected to each other. If the connection cable has two positive heating supply wires, both must be connected to each other. Leaving one terminal unconnected or connecting it to the ground may cause a malfunction or a short-circuit in the power supply.

CAUTION! Do not modify the unit or use it in ways not described in the documentation. Improper modification may lead to safety hazards, equipment damage, failure to perform according to specification, or decreased equipment lifetime.

Touching a heated sensor may cause injury. Do not touch heated parts when heating is on. The sensor may detect touching as an ice blockage and start the high-power melting mode.

A heated sensor can be hot during normal operation. Wear protective gloves when working with WMT700.
Let WMT700 cool down for 20 minutes after disconnecting the heating power supply.

2.3 Ordering options

Table 2 Measurement range

Sensor type	Measurement range
1	WMT701 up to 40 m/s

Sensor type	Measurement range
2	WMT702 up to 65 m/s
3	WMT703 up to 75 m/s
4	WMT704 up to 90 m/s
A	WMT701 up to 40 m/s + accredited wind calibration
B	WMT702 up to 65 m/s + accredited wind calibration
C	WMT703 up to 75 m/s + accredited wind calibration
D	WMT704 up to 90 m/s + accredited wind calibration

Accredited wind calibration is according to the Measnet procedure.

Table 3 Temperature range

Option	Temperature range
A	–10 ... +60 °C
B	–40 ... +60 °C
C	–55 ... +70 °C

The temperature range option does not include or influence the heating function. Heating is an independent feature and you must order it separately. For environments where ice buildup is possible, Vaisala recommends ordering a heated sensor.

Table 4 Heating

Option	Heating
1	Non-heated
2	Heated transducers (min. 30 W power supply is needed)
3	Heated transducers and arms (min. 150 W needed)
4	Heated transducers, arms, and body (min. 250 W needed)

Power consumption requirement depends on the selected heating option.

Vaisala recommends using heated WMT700 models in conditions where snow and ice accumulation may occur. Full sensor heating is best suited for the most demanding environments.

Table 5 Digital communication interface

Option	Hardware interface
A	RS-485 isolated (1 pair)
B	RS-422 isolated
C	RS-232 isolated
D	SDI-12 isolated

To change the product version characteristics listed in Table 5 (page 22), contact Vaisala Service Center.

Table 6 Digital communication profile

Option	Communication profile		
0	WMT70 - default mode	9600, 8, N, 1	Polled
1	WS425 - ASCII	2400, 8, N, 1	Polled
2	WS425 - NMEA extended (v 0183)	9600, 8, N, 1	Auto send 1/s
3	WS425 - SDI-12 (v 1.3)	1200, 7, E, 1	Polled
4	WS425 - ASOS	2400, 8, N, 1	Polled
5	ROSA - MES 12	9600, 8, N, 1	Polled
6	US AWOS - NMEA standard	2400, 8, N, 1	Auto send 5/s
7	FAA - Federal	9600, 8, N, 1	Polled
8	AWS520 - NMEA extended	4800, 8, N, 1	Auto send 1/s
9	Low power mode for AWS310	9600, 8, N, 1	Polled
A	MARINE 1- NMEA extended (v 0183)	4800, 8, N, 1	Auto send 1/s
B	MARINE 2 - NMEA standard	4800, 8, N, 1	Auto send 1/s

WS425 options are usable and backwards compatible when WS425 is replaced with WMT700.

Other application or customer-specific user profiles are also available.

Table 7 Digital communication units

Option	Unit used
A	Meters per second
B	Knots
C	Miles per hour
D	Kilometers per hour

Table 8 Analog output signal for wind speed channel

Option	Output configuration
0	Disabled
1	Voltage output 100 mV/m/s
3	Current output 4–20 mA

The analog output signal for wind speed channel ordering option can be disabled or factory-configured for 2 different modes.

Table 9 Analog output signal for wind direction channel

Selection	Output configuration
0	Disabled
A	Voltage output 20 mV/degree
E	Current output 4–20 mA (44.444 uA/degree)

Table 10 Cables

Selection	Cable type
1	No cables
2	Cable 2 m, cable connector, open leads on one end
3	Cable 10 m, cable connector, open leads on one end
4	MAWS cable 10 m
8	RS-485 cable 2 m, cable connector, open leads on one end
9	RS-485 cable 10 m, cable connector, open leads on one end
D	Junction box with cable 2 meters
E	Cable 15 m, cable connector, open leads on one end
F	Cable 26 m, cable connector, open leads on one end

Selection	Cable type
G	Hybrid cable 2 m, cable connector, open leads on one end
H	Hybrid cable 10 m, cable connector, open leads on one end
J	Hybrid cable 15 m, cable connector, open leads on one end
K	Hybrid cable 26 m, cable connector, open leads on one end
L	Hybrid cable 11 m integrated to WMT700, no connector

Table 11 Mounting adapters

Option	Adapter type
A	Adapter 228869 only. Standard adapter, no fix
B	Adapter 228869 with WMTFIX70. Standard adapter with general purpose fix suitable for 30-mm and 60-mm pole mast and cross arm installation.
C	WMT700FIX60-MARINE. Maritime adapter with stainless steel fix for 60-mm pole.
D	Adapter 228869 with WMT700FIX60-RST. Standard adapter with stainless steel fix for 60-mm pole.
E	Adapter 228777 only (used for old WS425 FIX30/WS425FIX60), WS425-compatible adapter, no fix.
F	Adapter 228777 with WS425FIX60. WS425-compatible adapter with WS425FIX60.
G	Adapter 228869 with ASM212140 (suitable for mounting 4258057). ASOS mounting adapter.
H	Adapter 228777 with WAC425 (suitable for 30/60 mm pole mast and cross arm installation). Adapter with a sensor arm for 60-mm pole.
J	Adapter 228869 with ASM214411
K	Adapter DRW263005 for integrated cable unit with WMT70FIX70
L	Adapter DRW263005 for integrated cable unit with WMT700FIX60-MARINE

Ordering option 11 is reserved for future.

Table 12 Accessories

Option	Accessories
A	No accessories

Option	Accessories
B	Bird cage (WMT70BirdKit)

Table 13 Manual

Option	Manual
1	No manual
2	English

Ordering options are specified when you place the order. If needed, you can make changes to the following:

- Digital communication interface
- Digital communication profile
- Digital communication units
- Analog output signal for wind speed channel
- Analog output signal for wind direction channel

More information

- Configuration (page 103)

2.3.1 Example of WMT703 configuration

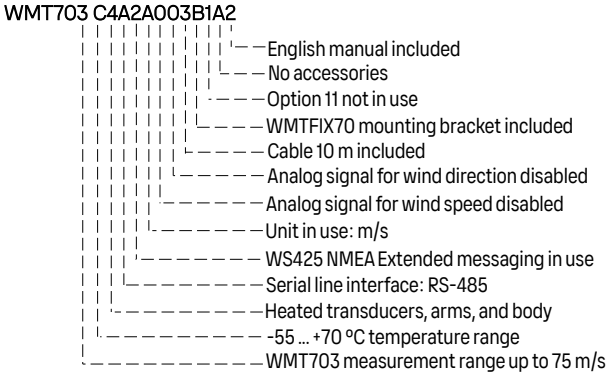


Figure 6 Example of WMT703 configuration

3. Functional description

3.1 Operating principle

WMT700 uses the Vaisala WINDCAP ultrasonic sensor technology in the wind measurement. The sensor has an onboard microcontroller that captures and processes data and communicates over serial interfaces.

WMT700 has an array of 3 equally-spaced ultrasonic transducers on a horizontal plane. Wind speed (WS) and wind direction (WD) are determined by measuring the time it takes the ultrasound to travel from each transducer to the other 2.

WMT700 measures the transit time (in both directions) along the 2 paths established by the array of transducers. The transit time depends on the wind speed along the ultrasonic path. For zero wind speed, both the forward and reverse transit times are the same. With wind along the sound path, the upwind direction transit time increases and the downwind transit time decreases.

The following figure shows how the time shift of the ultrasonic signals is measured and how the tail wind and forward wind affect the measurement.

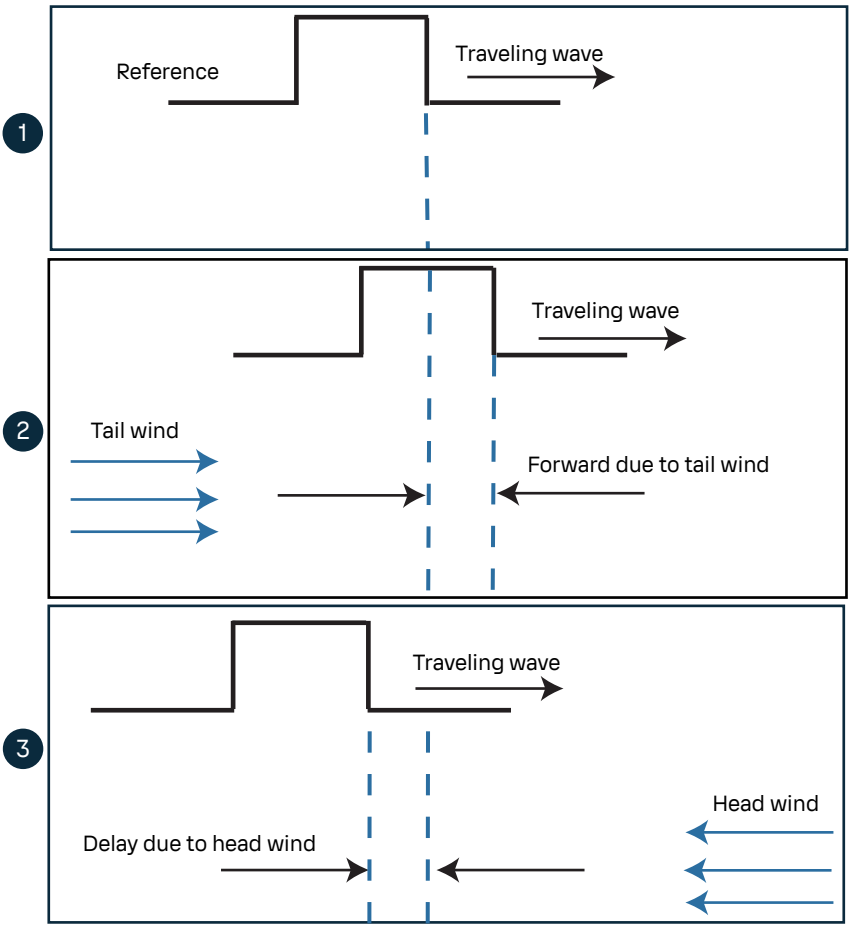


Figure 7 Ultrasonic measurement principle

1 Ultrasonic measurement with zero wind
2 Impact of tail wind on ultrasonic measurement
3 Impact of head wind on ultrasonic measurement

The microcontroller calculates the wind speed from the measured transit times using the following formula:

$$v_w = 0.5 \cdot L \cdot (1/t_f - 1/t_r)$$

V_W	Wind velocity
L	Distance between 2 transducers
t_f	Transit time in the forward direction
t_r	Transit time in the reverse direction

Measuring the 6 transit times allows V_w to be computed for each of the 3 ultrasonic paths. Using V_w values of 2 array paths is enough to compute the wind speed and the wind direction.

The different paths of WMT700 and the vectors provided by the wind sensor:

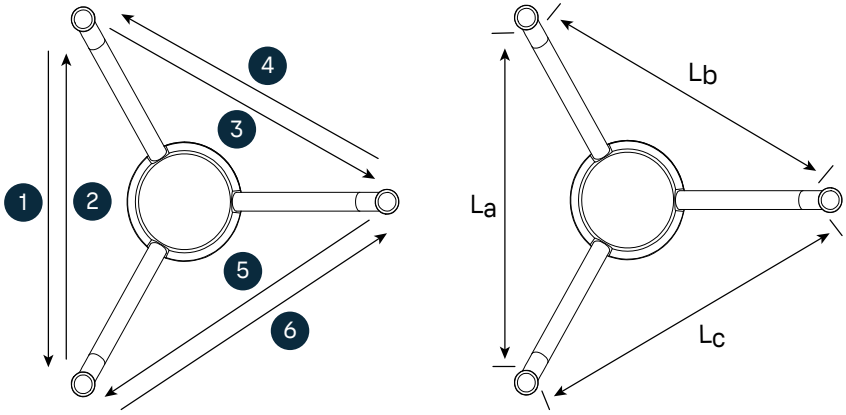


Figure 8 Measurement paths of WMT700

1–6 Measurement paths 1 to 6 of WMT700
L_a, L_b, L_c Distance between 2 transducers

The vectors are calculated as follows:

$$V_a=0.5\cdot L_a\cdot(1/A_1-1/A_2)$$
$$V_b=0.5\cdot L_b\cdot(1/A_3-1/A_4)$$
$$V_c=0.5\cdot L_c\cdot(1/A_5-1/A_6)$$

The equation depends on the accurate distance of the measurement path (L). The computed wind speeds are independent of altitude, temperature, and humidity, which are canceled out when the transit times are measured in both directions, although the individual transit times depend on these parameters.

3.2 Coordinate systems: vector and polar calculations

The triangular geometry of the sensor is converted to orthogonal coordinates to achieve the x and y components. Then the sensor converts the wind vectors into polar coordinates.

The measurement results are reported as follows:

- WMT700 reports WS (x, y) as 2 scalar speeds, one parallel to the N-S direction (x) and the other (y) parallel to the W-E direction.

```
x = -WS × cos (WD)
y = -WS × sin (WD)
```

- WMT700 reports polar wind speed as a scalar speed in selected units (m/s, kt, mph, km/h).

Polar wind direction is expressed in degrees (°). WMT700 indicates the direction that the wind comes from. North is represented as 0°, East as 90°, South as 180°, and West as 270°.

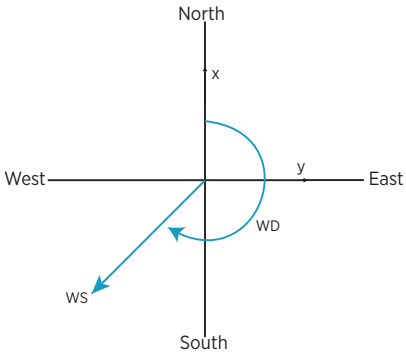


Figure 9 Wind speed and direction presentations (direction offset 0)

3.3 Wind speed and direction averaging

WMT700 provides average values for wind speed and direction using either scalar or vector averaging. With both methods, the average is determined according to the user-configurable averaging time. The averaging time affects serial communication and analog output similarly.

You can also configure the gust averaging time for calculating wind extreme values. The default gust averaging interval is 3 seconds, as recommended by World Meteorological Organization (WMO).

If you select scalar averaging, you can also enable wind direction coasting to ensure consistent direction measurement results at low wind speeds.

3.3.1 Scalar averaging

When you select scalar averaging, WMT700 calculates wind speed and direction averages by adding up each wind measurement from the averaging time and dividing the sum by the number of measurements. The time between each consecutive wind speed and wind direction measurement is 0.25 seconds.

Wind direction is a circular function with a discontinuity at North, where 360° is equal to 0°. For example:

```
359° + 5° = + 4°
0° – 5° = 355°
```

WMT700 translates wind direction to a linear function to determine the wind direction average. For example:

359° + 5° is translated to 364°, which is then further converted to +4° for output.

0° - 5° is translated to 355°.

This ensures that the wind direction average stays representative of the true situation even if individual samples occur on both sides of the zero direction.

If the data acquisition system requests data before the initial averaging time completes, the sensor returns the most recent complete measurement data.

The following figure shows an example of averaging wind direction when the measured wind values are 355° and 10°. The resulting average is 2.5°.

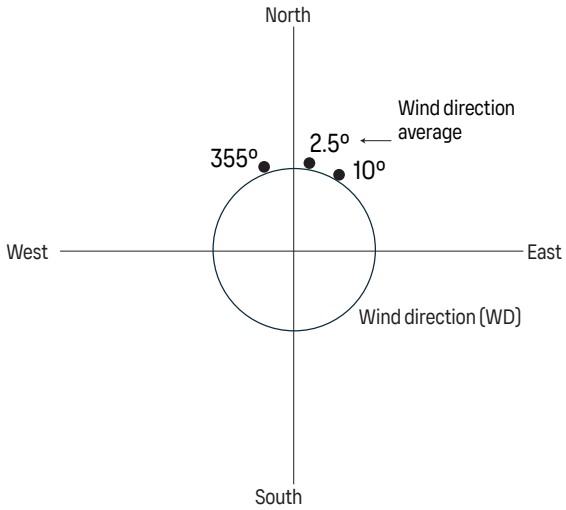


Figure 10 Example of wind direction averaging

3.3.2 Wind direction coasting

Accurate wind direction measurement requires that the wind speed is sufficient. If you enable wind direction coasting, WMT700 does not calculate wind direction when the wind speed drops below the selected wind direction coasting threshold. The last calculated direction output remains until the wind speed increases enough to reach the threshold and WMT700 returns to normal operation.

3.3.3 Vector averaging

When you select vector averaging, WMT700 calculates wind speed and direction averages by adding up each x velocity and y velocity measurement from the averaging time and then dividing the sum by the number of measurements. WMT700 converts the resultant average x velocity and average y velocity to polar direction and magnitude, which returns the wind direction average in degrees and wind speed average in the chosen units.

If the data acquisition system requests data before the initial averaging time completes, the sensor returns the most recent complete measurement data.

3.4 Measurement methods

WMT700 measures wind speed and direction either continuously or for the duration of the user-configurable averaging time. You can select the measurement mode over the serial interface.

3.4.1 Continuous measurement

You can set WMT700 to measure wind data continuously and stop the measurement with the **STOP** command.

The following data communication methods are available:

- Poll mode: You can fetch the most recent data from WMT700 with the **POLL** command. You must specify the data message identification number in the command.
- Automatic message mode: If the automatic message interval is configured, WMT700 sends automatic data messages at selected intervals. The data message is user-configurable.

More information

- Serial interface timing (page 35)
- Configuration parameter descriptions (page 189)
- WMT700 commands (page 182)

3.4.2 Wind measurement on request

You can set WMT700 to measure wind speed and direction for a specified period of time. The duration of the measurement can range from 0.25 seconds to 60 minutes, depending on the configured averaging interval.

You can fetch the required data message from WMT700 in measurement mode with the **POLL** command. You must specify the data message in the command.

More information

- Serial interface timing (page 35)

3.5 Host system connections and interfaces

WMT700 always needs a host device for measurement data collection and presentation. The host device is usually an automatic weather station, but other host devices such as data loggers or personal computers can also be used.

WMT700 performs calculation, quality control, and data format procedures on the measurement data. The processed data is sent to weather stations using serial ports and/or analog output channels. The most commonly used communications interface is RS-485, but WMT700 has a flexible set of interfaces ranging from RS-232 to voltage and current mode analog signals.

You can set WMT700 to send measurement data either as analog output or data messages through a serial port, or you can use both outputs simultaneously. You can send operating and configuring commands to WMT700 through the serial interface.

Operation and heating power is usually provided from one power supply. You can also use separate power supplies for heating and operation to prevent the heating function from consuming the operation power. In a split-supply system there can be a separate backup power supply for the operating power supply.

The following figure shows the main software components and external interfaces of WMT700.

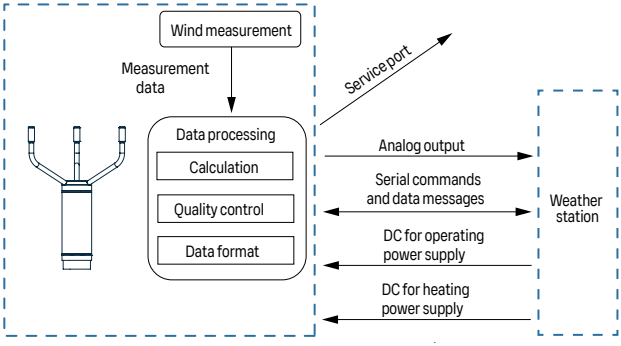


Figure 11 WMT700 external interfaces

More information

- Typical system environments (page 184)

3.6 Serial communication and analog output

The following functionality is preconfigured at the factory according to your order:

- Digital communication interface for COM2
- Digital communication profile for COM2
- Digital communication units
- Analog output signals for wind speed channel (AOUT1)
- Analog output signals for wind direction channel (AOUT2)

3.7 Serial communication

You can use any computer or data logger with a serial port to send commands to WMT700 and to receive measurement data.

In WMT700, there are 2 serial communication ports:

- COM1: Service port (RS-485)
- COM2: Configurable digital communication interface

Both ports support the same commands, protocols, operations, and data messages.

3.7.1 Communication interface

- COM1 is a fixed RS-485 communication interface to be used as a service port.
- COM2 is a flexible digital communication interface that is preconfigured according to your order.

Table 14 Communication interface options

Option	Description
RS-232	Recommended for up to 15-m distance.
RS-485	Recommended for up to 1200-m distance in point-to-point connection.
RS-422	Recommended for up to 1200-m distance.
SDI-12	Recommended for up to 60-m distance.



The recommendations depend on communication speed and cable type. In optimized environments even longer distances can be considered.

Regardless of the factory configuration, you can change the COM2 interface type by using the terminal software.

More information

- Configuration parameter descriptions (page 189)
- Wiring (page 75)

3.7.2 Profiles

You can use the digital communication profile to preconfigure WMT700 according to your order at the factory. Depending on the preconfigured communication profile, the default settings of the following parameters can be:

- Communication protocols
- Communication parameters

The preconfigured communication profiles are:

- WMT700
- WS425 - ASCII
- WS425 - NMEA Extended (version 0183)
- WS425 - SDI-12 (version 1.3)
- WS425 – ASOS
- ROSA - MES 12

Vaisala recommends the WMT700 profile for normal operation.
The profile offers a wide range of predefined and user-configurable data message formats, and it is developed for WMT700.

The ROSA - MES 12 profile is designed for connecting WMT700 to the Vaisala ROSA system. You can use the WS425 profiles when you are upgrading from WS425 to WMT700.

More information

- WMT700 commands (page 182)

3.7.3 Protocols

In addition to the protocols preconfigured under standard profiles, there are additional protocols available:

- WMT700
- WMT700 NMEA MWV
- SDI-12
- WS425 - ASOS
- WS425 - ASCII
- WS425 - NMEA Standard
- WS425 - WAT11
- MES 12

More information

- Parameter handling commands (page 104)

3.7.4 Measurement and configuration modes

The serial ports have 2 operation modes:

- The configuration mode is for configuring WMT700 settings over a serial connection. The selected communication profile does not affect the available configuration commands.
- The measurement mode is for operating WMT700. The available commands depend on the selected profile. The port in the measurement mode can receive polling commands and respond to them with data messages.

The following figure shows the configuration and measurement modes of both serial ports provided by WMT700.

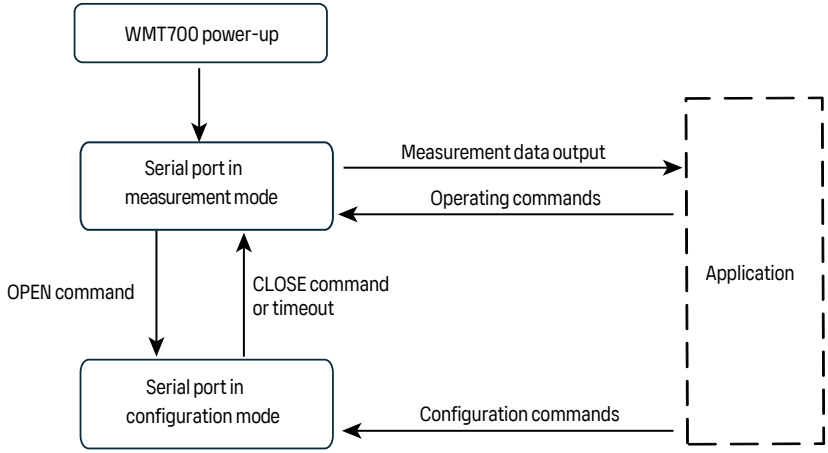


Figure 12 Configuration and measurement modes

After power-up, WMT700 is in measurement mode.

More information

- WMT700 commands (page 182)
- OPEN — entering configuration mode (page 102)
- CLOSE — exiting configuration mode (page 103)

3.7.5 Serial interface timing

Depending on the selected interface, the serial data interface timing is as follows:

- Interfaces RS-232, RS-485, RS-422: The following figure shows timing when WMT700 is polled in the measurement mode.

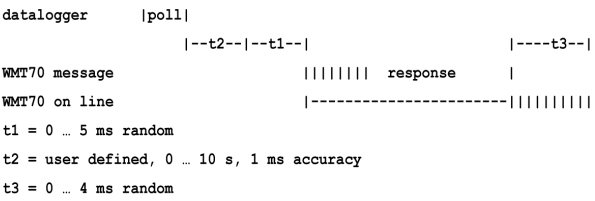


Figure 13 Timing for RS-232, RS-485, and RS-422 interfaces

The response delay **t2** is user-configurable. In the configuration mode, some commands have a longer response delay.

- SDI-12 interface: The timing is compliant with the SDI-12 standard. For the complete SDI-12 standard text, see www.sdi-12.org.

3.8 Analog output

Analog outputs are either enabled or disabled, and the output settings are preconfigured at the factory according to your order. In analog output operation WMT700 takes measurements according to the configured averaging time and synthesizes the analog outputs of wind speed and wind direction with an update interval of 0.25 seconds.

You can use configuration parameters to change the analog output type, WMT700 scaling or save power by disabling the analog output functionality.

WMT700 provides the following analog outputs:

- AOUT1 for wind speed data
- AOUT2 for wind direction data

To emulate the WS425 analog output, choose voltage output, frequency output, and potentiometer.

More information

- Configuration parameter descriptions (page 189)
- Operating WMT700 in WS425 analog output mode (page 130)

3.8.1 Analog output types

Analog output for wind speed (AOUT1) can be configured as:

- Voltage output
- Current output

- Frequency output
  - Push-pull output
  - Pull-down output
  - Pull-up output

Analog output for wind direction (AOUT2) can be configured as:

- Voltage output
- Current output
- Potentiometer output

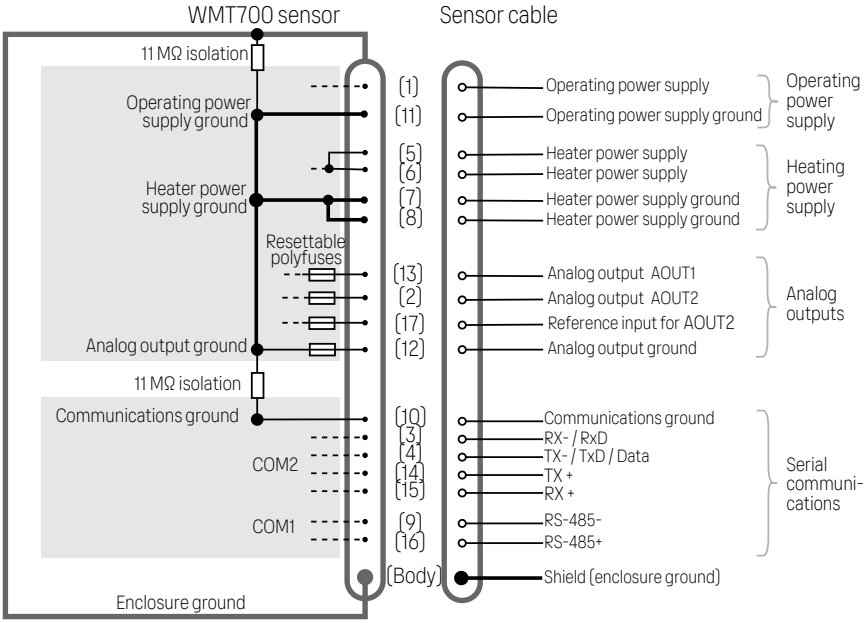


Figure 14 WMT700 isolation and grounding principle

When using current output, isolate analog output ground on the host system side from operating power supply ground and heater power ground.

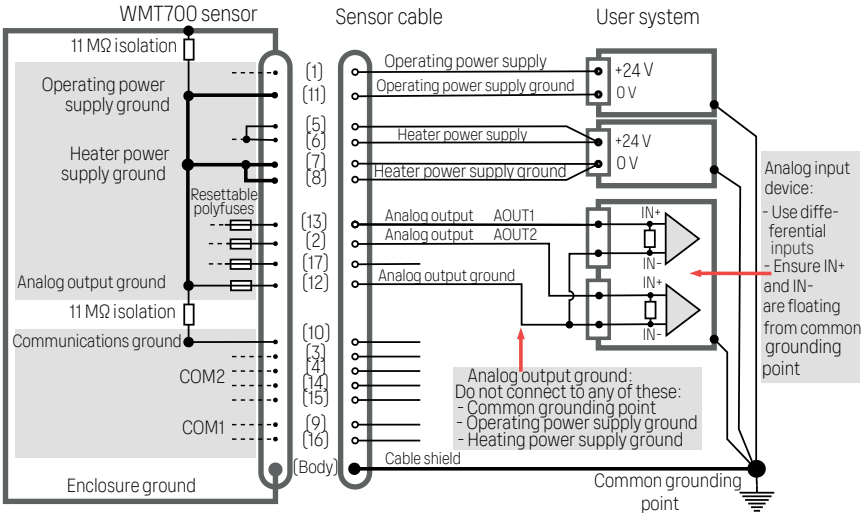


Figure 15 Wiring for 4–20 mA analog output use

Avoid using current and voltage output at the same time. This can lead to faulty readings.

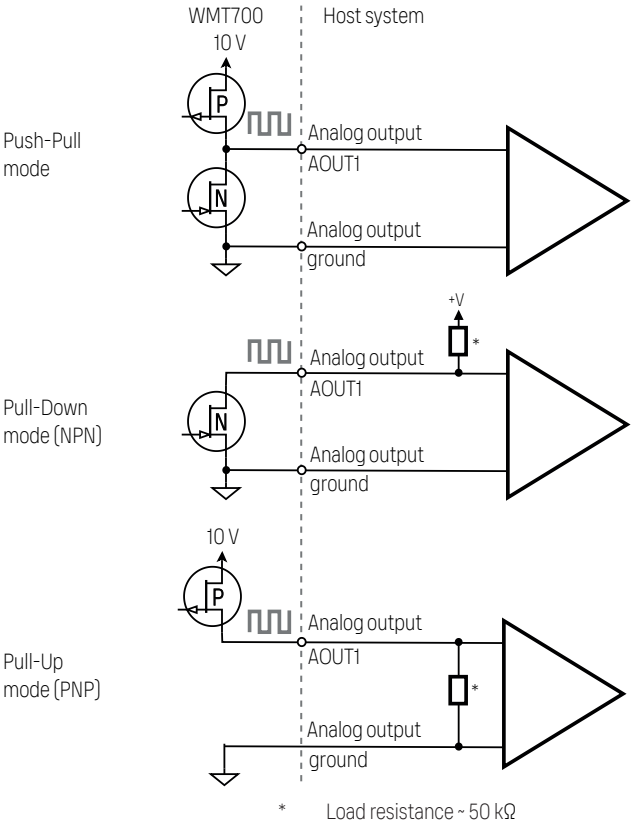


Figure 16 Frequency output

3.8.2 Analog output scaling

You can specify the transfer function between measured values and output analog values. You can select the analog output type as well as the gain and offset used in the transfer function.

Table 15 Factory settings for analog wind speed output

AOUT1 selected option	Scaling/Gain	Offset	Error indication	Example
Voltage	0.1 V/m/s	0 V	10 V	0 V = 0 m/s 7.5 V = 75 m/s

AOUT1 selected option		Scaling/Gain	Offset	Error indication	Example
Current 0–20 mA (Legacy option)		0.0002 A/m/s	0 A	0.022 A	0 mA = 0 m/s 15 mA = 75 m/s
Current 4–20 mA	WMT701	0.00040000 A/m/s	0.004 A	0.002 A	4 mA = 0 m/s 20 mA = 40 m/s
	WMT702	0.00024615 A/m/s	0.004 A	0.002 A	4 mA = 0 m/s 20 mA = 65 m/s
	WMT703	0.00021333 A/m/s	0.004 A	0.002 A	4 mA = 0 m/s 20 mA = 75 m/s
	WMT704	0.00017777777 A/m/s	0.004 A	0.002 A	4 mA = 0 m/s 20 mA = 90 m/s
Frequency push-pull (Legacy option)		10 Hz/m/s	0 Hz	1000 Hz	0 Hz = 0 m/s 750 Hz = 75 m/s
WS425 - voltage (Legacy option)		8 mV/mph (0.017895 V/m/s)	0 mph	2 V	0 mV = 0 mph 1.344 V = 168 mph
WS425 - frequency (Legacy option)		5 Hz/mph (11.185 Hz/m/s)	0 mph	1000 Hz	0 Hz = 0 mph 840 Hz = 168 mph
Frequency push (PNP) (Legacy option)		10 Hz/m/s	0 Hz	1000 Hz	0 Hz = 0 m/s 750 Hz = 75 m/s
Frequency pull (NPN) (Legacy option)		10 Hz/m/s	0 Hz	1000 Hz	0 Hz = 0 m/s 750 Hz = 75 m/s

Table 16 Factory default settings for analog wind direction output

AOUT2 selected option	Scaling/Gain	Offset	Error indication	Example
Voltage	0.02 V/°	0 V	10 V	0 V = 0° 7.2 V = 360°
Current 0–20 mA (Legacy option)	0.00005 A/°	0 A	0.022 A	0 mA = 0° 18 mA = 360°
Current 4–20 mA	0.000044444 A/°	0.004 A	0.002 A	4 mA = 0° 20 mA = 360°
Potentiometer (WS425) (Legacy option)	1/359*Vref /° (0.0027855)	0	Vref (1)	0 V = 0° Vref = 359°

For a different scaling, change the gain and offset settings.

The scaling of the current output 4–20 mA depends on the sensor measurement range (WMT701, WMT702, WMT703, or WMT704), while the 0–20 mA output has 0.2 mA/m/s scaling for all the measurement ranges.

The following tables list the most common settings for different units.

Table 17 Common transfer function settings for AOUT1 (WS)

Output signal	Scaling/Units	Setting for gain	Setting for offset
Voltage	8 mV/mph 100 mV/m/s	0.017895 0.1	0 0
Current	0.2 mA/m/s	0.0002	0
Frequency	5 Hz/mph 10 Hz/m/s	11.185 10	0
WS425 - voltage	8 mV/mph	0.017895	0
WS425 - frequency	5 Hz/mph	11.185	0

Table 18 Common transfer function settings for AOUT2 (WD)

Output signal	Scaling/Units	Setting for gain	Setting for offset
Voltage	4 mV/° 20 mV/°	0.004 0.02	0 0
Current	50 uA/degree	0.00005	0
Potentiometer	359° = AOUT ref	0.0027855	0

You can configure output scaling or transfer function settings in a variety of ways by changing the custom gain and offset. The basic measurement units are m/s and degrees. The physical output units are V, A, and Hz. For the potentiometer, an output of 1 means 100% of the AOUT ref voltage.

The following formula illustrates the impact of gain and offset values on the produced output:

```
o = y0 + k×s
```

Value	Definition
o	Produced analog output (V, A, Hz, 100%)
s	Measured wind speed or direction (in m/s or °)

Value	Definition
k	Selected gain value
y0	Selected offset value

Example

- Output mode: voltage
- Offset: 0.0
- Gain: 0.1

With the above settings, the analog output voltage range is from 0 V (0 m/s) to 7.5 V (75 m/s). When the measured wind speed is 10 m/s, the output voltage is 1.0 V.

```
Output = 0.0 + 10 × 0.1 = 1.0 V
```

Example

- Output mode: current
- Offset: 0.004
- Gain: 0.0002

With the above settings, the analog output current range is 4 mA (0 m/s) … 19 mA (75 m/s). When the measured wind speed is 10 m/s, the output current is 6 mA.

```
Output = 0.004 + 10 × 0.0002 = 6.0 mA
```

3.8.3 Limitations for output signals

You can specify the minimum and maximum values for analog output with the configuration parameters. The output is fixed to the specified values, and the unit depends on the selected analog output mode.

Example

To limit the output 1 in voltage mode to a range of 0.1–5 V, set the analog output minimum value to 0.1 and the analog output maximum value to 5. Type the following commands:

```
S aout1minv,0.1 S aout1maxv,5
```

3.8.4 Missing readings and error indication

If WMT700 is unable to measure the wind, it indicates a missing reading in the output. The most common reasons for measurement problems are foreign objects (such as ice, birds, or other foreign objects) on the line of measurement or sound reflections from nearby objects (such as wind tunnel walls).

The default error indication is an out-of-range signal that is more than 10 V or 20 mA but other error settings can also be configured.

Example

To set the analog output 1 error indication in voltage mode to 1 V, set the analog output error value to 1. Use the following command:

```
S aout1err,1
```

More information

- Configuration parameter descriptions (page 189)

3.9 Heating



Touching a heated sensor may cause injury. Do not touch heated parts when heating is on. The sensor may detect touching as an ice blockage and start the high-power melting mode.



A heated sensor can be hot during normal operation. Wear protective gloves when working with WMT700.
Let WMT700 cool down for 20 minutes after disconnecting the heating power supply.



Heated versions of WMT700 are only intended for outdoor applications.

In addition to the standard non-heated version, WMT700 can include a heating functionality that ensures proper operation in cold environmental conditions or in cases where snow and ice build-up is possible.

WMT700 has the following heating options that can be preconfigured at the factory according to your order:

- Heated transducers (page 44)
- Heated transducers and arms (page 45)
- Heated body, transducers, and arms (page 46)



Make sure that the supply output power capacity is high enough especially when transducers, array arms, and sensor body are equipped with heaters. Note that there are individual connections for applying the heating voltage.

Table 19 Maximum power consumption

Heating	Maximum peak power
Heated transducers	Average 32 W at 24 V Peak 40 W at 24 V
Heated transducers and arms	Average 152 W at 24 V Peak 200 W at 24 V
Heated transducers, arms, body	Average 252 W at 24 V Peak 350 W at 24 V

Heating is controlled with pulse width modulation so that the average power consumption is as in the table above.

- Transducer-and-arm heating has a 1-second timespan. Maximum power peak is always less than 1 s. For the average power of 1 s, see the following figure.
- Body heating has a 10-second timespan. The average power is always limited as shown in the following figure.

If higher heating supply voltages are used, the peak power increases.

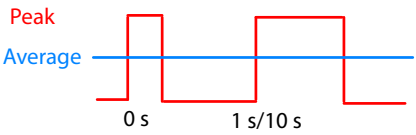


Figure 17 Average power consumption

With a low supply voltage, the power peak gets longer and approaches the average power.

3.9.1 Heated transducers

Touching a heated sensor may cause injury. Do not touch heated parts when heating is on. The sensor may detect touching as an ice blockage and start the high-power melting mode.

A heated sensor can be hot during normal operation. Wear protective gloves when working with WMT700.
Let WMT700 cool down for 20 minutes after disconnecting the heating power supply.

The heating functionality has a thermostatic control with temperature sensors in each transducer. The control function keeps the transducer temperature at 20 °C (68 °F) and adds heating power when necessary. If the sensor is blocked, WMT700 increases the heating power to melt the ice and returns to lower power after a period of time. The heating mode can also be activated at higher temperatures to distract birds or insects if the sensor detects a blockage.

You cannot change the heating parameters, but you can enable or disable the heating functionality with configuration parameters. When heating voltage falls below 18 V DC, an alarm is raised. Heating is automatically disabled if heating voltage falls below 15 V DC.

Regardless of heating voltage, the maximum heating power is limited to 40 W and the average heating power is limited to 32 W. The maximum power control is achieved by automatically sequencing the transducer heaters depending on a heating voltage.

- At low heating voltages, all the transducers are heated simultaneously.
- At mid-range, 2 of the transducers are heated.
- At high voltage end, a single transducer is heated at a time.

A pulse width modulation (PWM) scheme is used to control the average heating power.

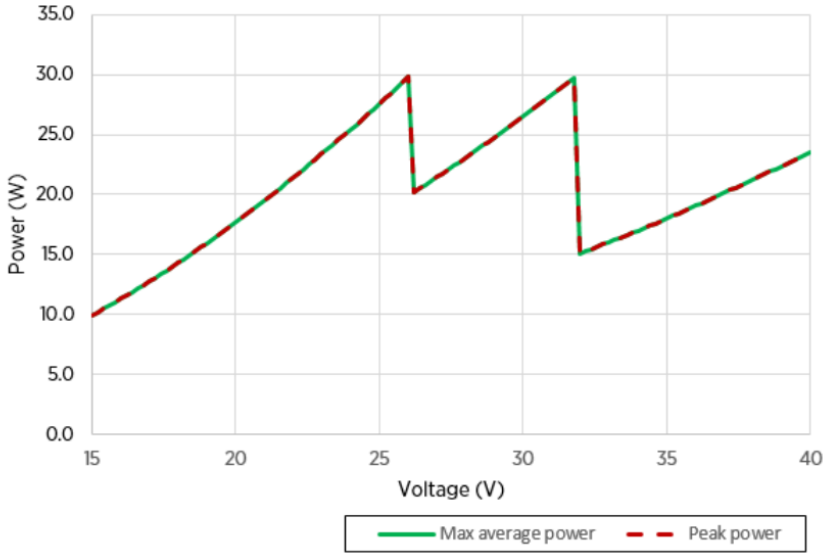


Figure 18 Heated transducers peak and average power

3.9.2 Heated transducers and arms

Touching a heated sensor may cause injury. Do not touch heated parts when heating is on. The sensor may detect touching as an ice blockage and start the high-power melting mode.

A heated sensor can be hot during normal operation. Wear protective gloves when working with WMT700.
Let WMT700 cool down for 20 minutes after disconnecting the heating power supply.

In addition to heated transducers, the array arms can also be heated to prevent ice build-up on the arms.

The functional principle is the same as with the heated transducers only, but the maximum heating power is limited to 200 W and the average heating power is limited to 152 W.

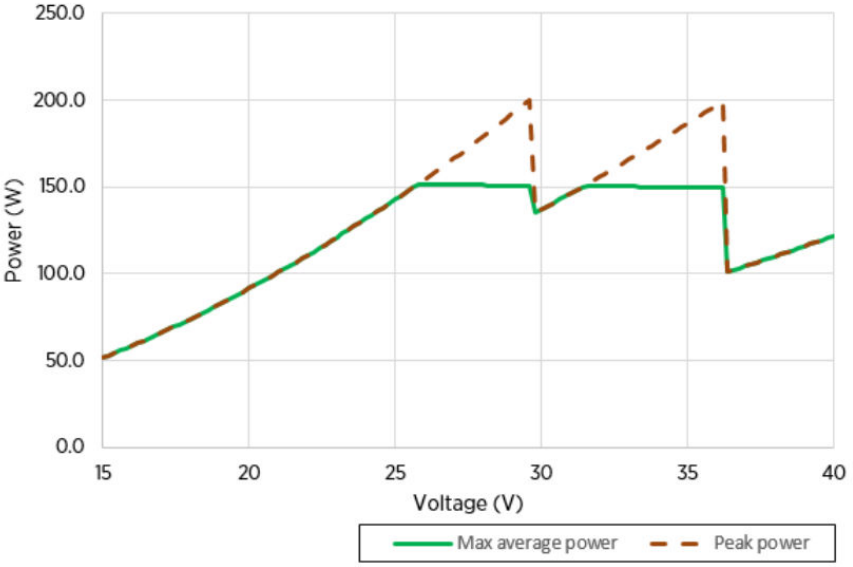


Figure 19 Heated transducers and arms peak and average power

3.9.3 Heated body, transducers, and arms

Touching a heated sensor may cause injury. Do not touch heated parts when heating is on. The sensor may detect touching as an ice blockage and start the high-power melting mode.

A heated sensor can be hot during normal operation. Wear protective gloves when working with WMT700.
Let WMT700 cool down for 20 minutes after disconnecting the heating power supply.

The fully heated version of WMT700 is suitable for harsh weather conditions. It provides heating for the sensor body, transducers, and arms.

The functional principle is the same with the heated transducers and arms. Body heating is controlled independently of transducer and arm heating. The maximum heating power for the fully heated WMT700 is 350 W at 24 V and the average heating power is 252 W in harsh weather conditions. The inner temperature of the unit is measured continuously. If the inner temperature starts rising, body heating power automatically reduces to retain the optimum inner temperature of WMT700.

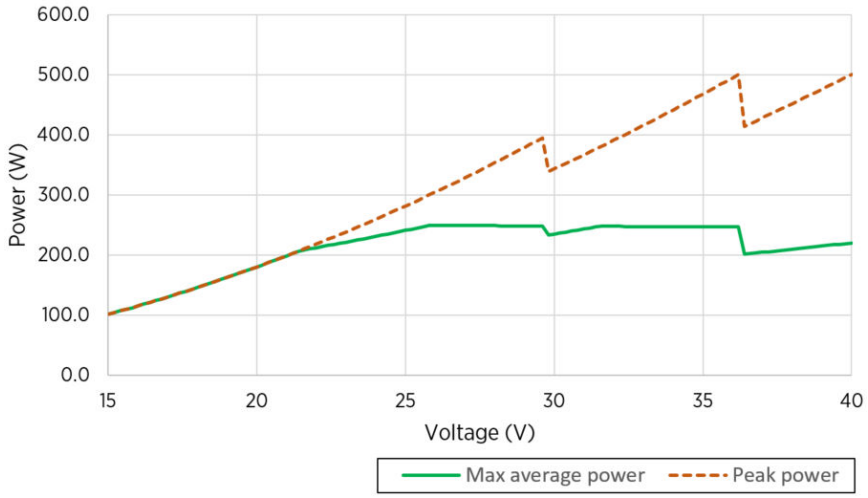


Figure 20 Fully heated WMT700 peak and average power

4. Installation

4.1 Installing WMT700

WARNING! Do not perform installation or maintenance procedures when there is a risk of thunderstorm or lightning activity in the area.

CAUTION! To prevent equipment damage, install an air terminal so that the tip is as high above the instruments and sensors as possible.

To prevent corrosion, oxidation, and seizing, use a non-conductive, non-water-soluble, non-silicone-based grease, such as ceramic or Teflon paste, between different kinds of metal.

4.1.1 Maritime installations

In maritime installations according to IEC 60945, WMT700 belongs to installation category C, which means that it is exposed to weather.

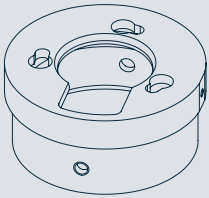
Vaisala recommends using the WMT700FIX60-MARINE adapter in marine installations. It is a stainless steel mounting adapter for a 60-mm tube with a plastic insulator. It is designed for marine installations and the cable is outside the mast.

When making maritime installations, note the following:
- Do not install WMT700 near a magnetic compass. The compass safe distance is 5 m.
- Do not place WMT700 directly in front of a radar.
- Do not install WMT700 next to a powerful RF-transmitter antenna.

4.1.1.1 Mounting WMT700 marine adapter

- Allen key 4.0 x 200 mm with T-handle
- Screws (3 pcs)

If there is a connector cover in your WMT700, remove it before installing the marine adapter (WMT700FIX60-MARINE).

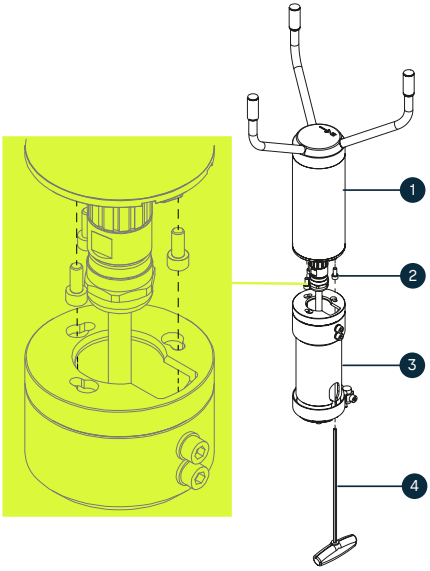


1. Connect the WMT700 cable firmly to WMT700.

If you have the integrated cable option, the cable is permanently mounted to the sensor body at the factory.

CAUTION! Make sure that you tighten the connector properly to avoid water leakage and damage to the sensor. Failure to tighten the connector properly voids the warranty.

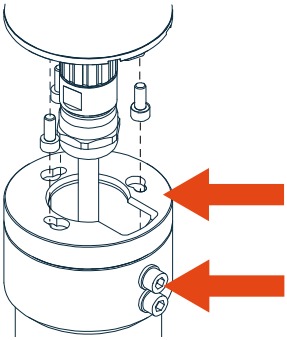
2. Lead the WMT700 cable through the marine adapter (WMT700FIX60-MARINE).



1 WMT700
2 Screws (3 pcs)
3 Marine adapter (WMT700FIX60-MARINE)
4 Allen key 4.0 x 200 mm with T-handle

3. Attach the mounting adapter with the 3 screws provided with the marine adapter. Tighten the screws with the Allen key.

CAUTION! Do not try to remove the plastic part of the marine adapter or open the screws.



4.2 Selecting location

Finding a suitable site for WMT700 is important for getting representative ambient measurements. Select a site that represents the general area of interest. Follow the WMO Guide to Meteorological Instruments and Methods of Observation WMO-No. 8, or other application-specific requirements set by various organizations, like the International Civil Aviation Organization (ICAO).

It is important to take into account the geography and surrounding area to achieve optimum performance. Trees, buildings, or other objects near WMT700 disturb free air flow and affect the accuracy of the measurement results.

Vaisala recommends installing WMT700 higher than any other object within a horizontal radius of 300 m. In general, any object of height (h) does not remarkably disturb wind measurement at a minimum distance of 10 × h.

When mounting WMT700 on top of a building, the recommended minimum height (h) for the mast is 1.5 × the height of the building (H). When the diagonal (W) is less than the height (H), the minimum height of the mast is 1.5 × W.

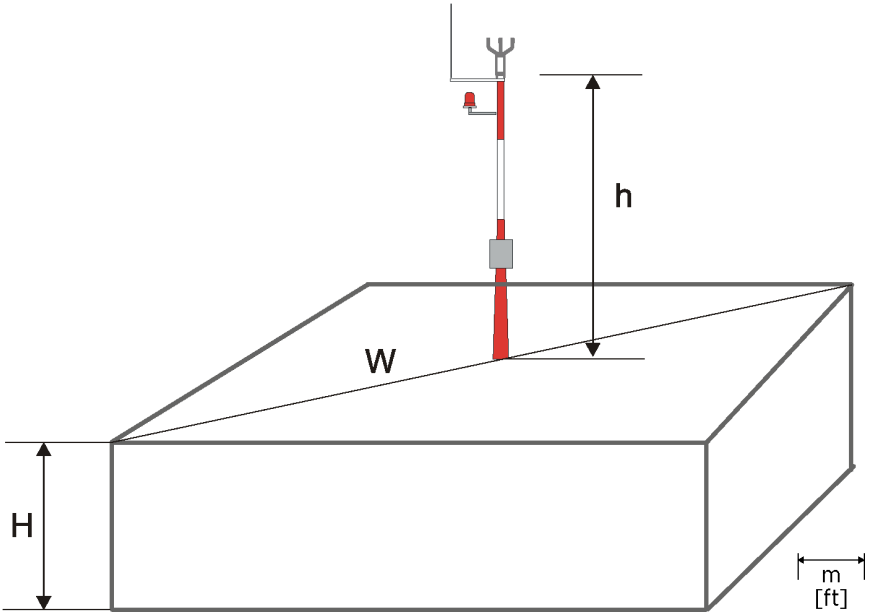


Figure 21 Recommended mast length on top of building

h Recommended minimum height for the vertical mast
H Height of the building
W Diagonal of the building

When there is a need to ensure free air flow with a cross arm installation, the distance (y) between WMT700 and the mast must be more than 20 × the diameter of the vertical mast (z). See the following figure and follow application-specific installation guidelines.

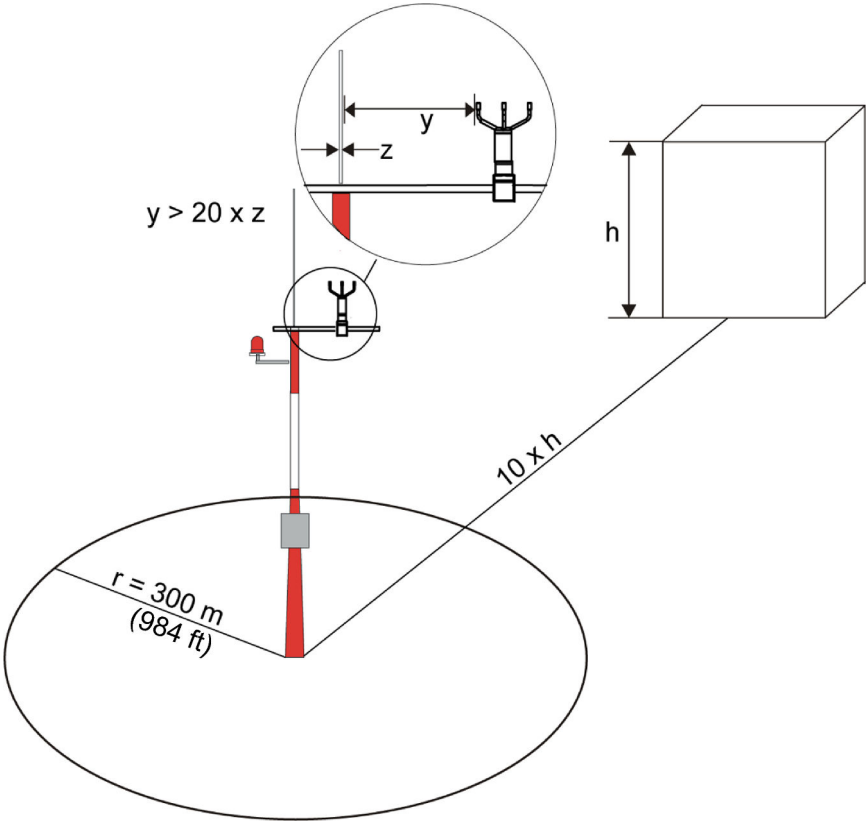
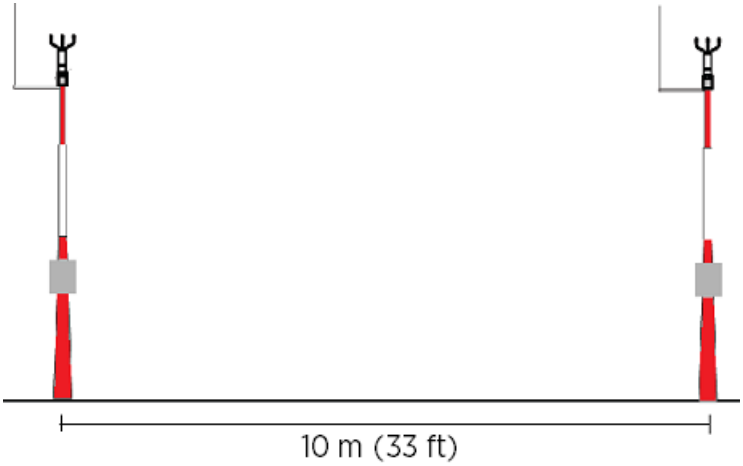


Figure 22 Recommended location in open area

h Height of a building or other high structure
r Distance from a building or other high structure
y Distance from the vertical mast
z Diameter of the vertical mast

When mounting 2 WMT700 wind sensors at the same height, make sure that there is a minimum of 10 m of distance between the 2 sensors. If the difference in the height of the sensors is at least 0.5 m, it is enough to have a minimum distance of 2 m between the 2 sensors to avoid possible acoustical interference between them.



WARNING! To protect personnel and the wind sensor, install an air terminal with the tip at least 1 m above WMT700. The rod must be properly grounded, compliant with all local applicable safety regulations. Do not install the wind sensor above the top of the air terminal.

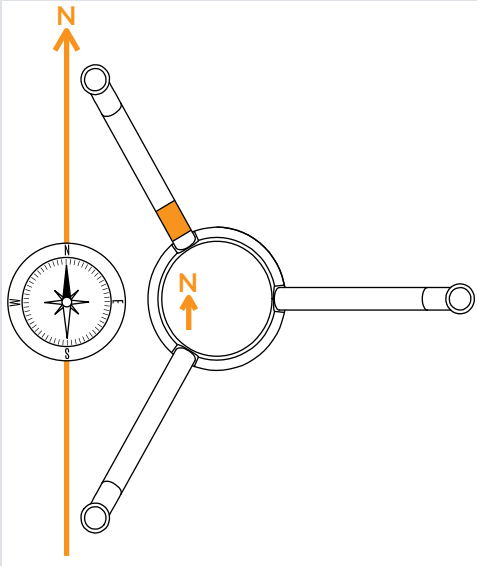
4.3 Placing WMT700

Install WMT700 on one of the following:

- Side of the mast
- Top of the mast
- Support arm

When selecting the mounting position and routing the cable, take into account the other equipment installed on the mast (for instance, air terminals).

When you are installing the sensor, pay attention to the North arrow printed on top of the sensor. The North arm is marked with an orange sticker. Align the North arm with the arm below the North arrow.



4.4 Unpacking and handling WMT700

CAUTION! Always transport the device in the original package. Transporting the device without the package voids the warranty.

CAUTION! Do not remove the upper protective packaging until you have installed the sensor. It protects the transducers during installation.

CAUTION! Handle with care. Any impact on the instrument or sensor array may cause damage and lead to incorrect measurements.

WMT700 is shipped in a custom cardboard container with 2 × plastic protective packaging. When unpacking WMT700, remove only the lower protective packaging that protects the sensor body.

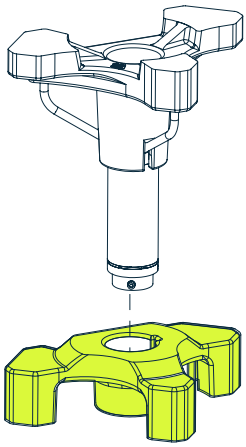


Figure 23 Removing WMT700 lower protective packaging

4.5 Connecting WMT700 cables

If you have the integrated cable option, the cable is already permanently mounted to the sensor body at the factory and you do not need to connect the cable to your WMT700.

WARNING! Make sure that you prepare or connect only de-energized wires.

WARNING! A long cable between units (sensors, transmitters, power supplies, and displays) can cause a lethal lightning-induced current surge. Always ground the enclosure to a suitable grounded location with a short, low-resistance cable.

CAUTION! Make sure that the cable is properly attached to the mast or cross arm before starting the installation. Otherwise, it may slip and fall down.

CAUTION! To avoid strain on the connector, make sure you connect the cable properly. Too much strain may cause the cable to fall off, damage the cable or connector, or make the cable or connector susceptible to water leakage.

CAUTION! WMT700 cables have an easy-to-use cable connector. Tighten the connector by hand. Do not use tools. If you have a cable tightening tool supplied by Vaisala in the past, do not use it with the current cable connector.

4-mm Allen key

The recommended minimum bending radius for the cable is 80 mm (3.15 in).

When installing WMT700, route the cable according to the mounting option. When mounting on a mast, you can route the cable either outside or inside the mast. Cable routing depends on the mast type and other equipment, such as air terminals, installed on the mast.

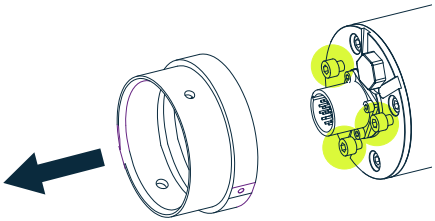
There are 3 WMT700 cable types:

- The hybrid cable designed for the fully heated WMT700. You can use it with all versions.
- The standard cable for non-heated, transducer-heated, and transducer-and-arm-heated WMT700.
- The RS-485 cable for RS-485 connections only. You can use it for non-heated, transducer-heated, and transducer-and-arm-heated WMT700.

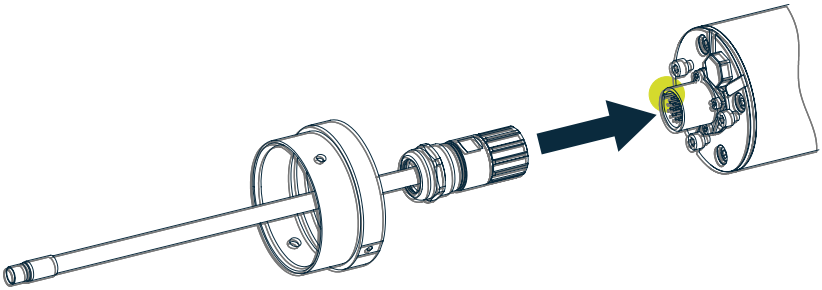
Table 20 WMT700 cable types

Cable type	Fully-heated WMT700	Transducer-and-arm-heated WMT700	Transducer-heated WMT700	Non-heated WMT700
Hybrid cable	✓	✓	✓	✓
Standard cable		✓	✓	✓
RS-485 cable		✓	✓	✓

1. Loosen the M5 screws (3 pcs) with a 4-mm Allen key and rotate the connector cover to remove it.

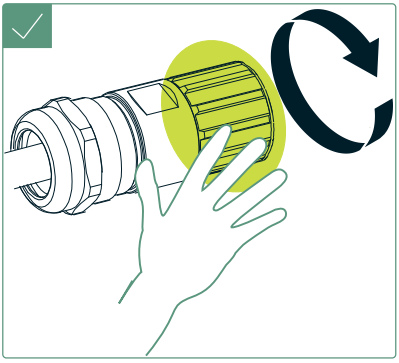


2. To attach the connector, guide it to the connector slot.



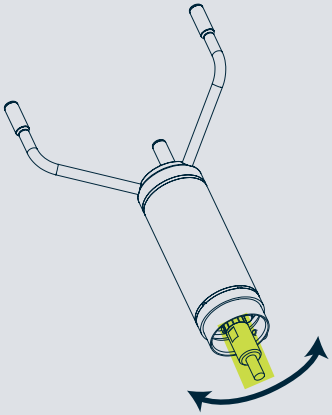
3. Align the male and female connectors.

4. To tighten the connector, turn the locking ring. Turning the connector body may break the connector.



5. Reattach the connector cover and tighten the M5 screws (3 pcs) with a 4-mm Allen key. Tightening torque 3 Nm.

To verify that the cable is tight, wiggle the cable and make sure the locking ring is tight. Wiggling makes the connector tightening sleeve loose. Tighten the cable again. Repeat until firmly tight.



6. Connect the wires.

More information

- Cable wiring (page 79)

4.6 Mounting WMT700 on vertical pole mast using WMT70FIX

- 5-mm Allen key
- 13-mm wrench

You can mount WMT700 on a 30-mm (1.18-in) or a 60-mm (2.36-in) pole mast. The WMT70FIX mounting kit contains U bolts for both kinds of pole masts (2 pcs each).

You can place WMT700 either on the side or on top of the mast. When selecting the mounting position, take into account:

- Other equipment installed on the mast (for example, air terminal)
- Cable routing (inside or outside the mast)

1. Make sure that the cable is firmly connected to the sensor.

2. Assemble the WMT70FIX mounting kit, and attach it to the mast with the U bolts.

> When mounting the sensor on the side of the mast, make sure that the mounting kit is positioned at the top level of the mast.

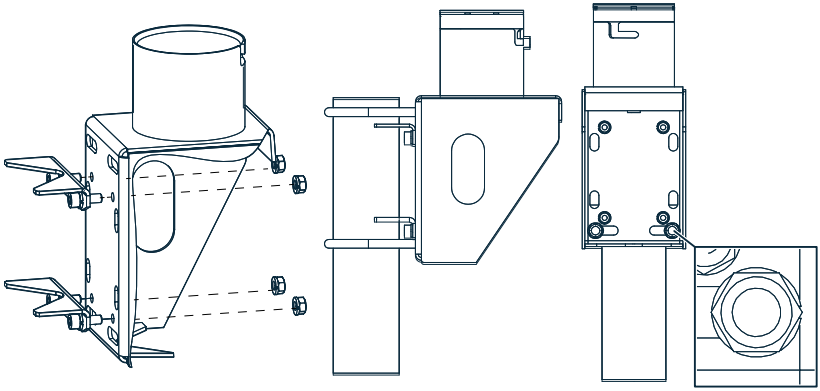


Figure 24 Option 1: Mounting WMT70FIX on side of mast

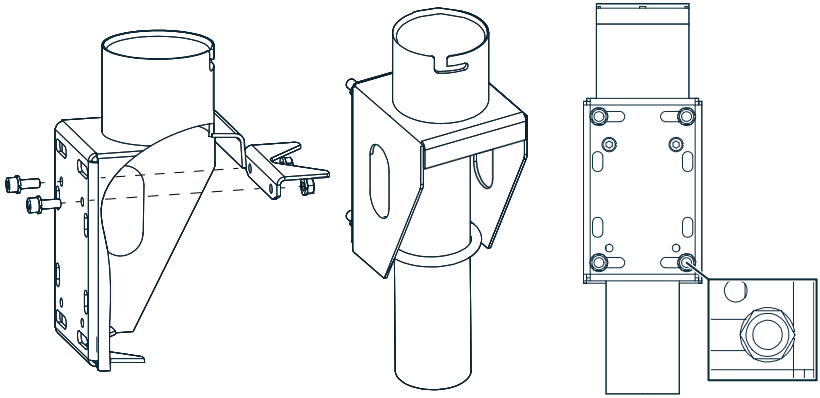
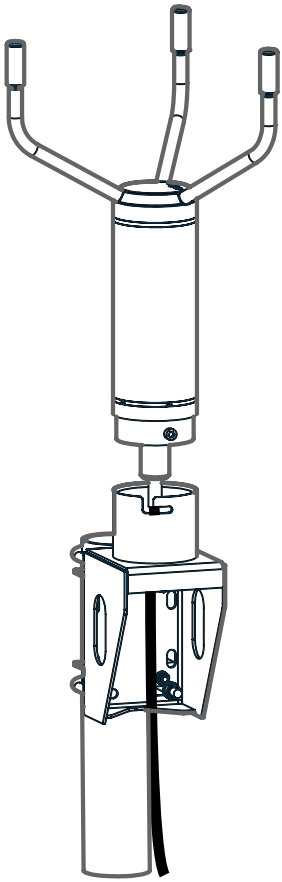


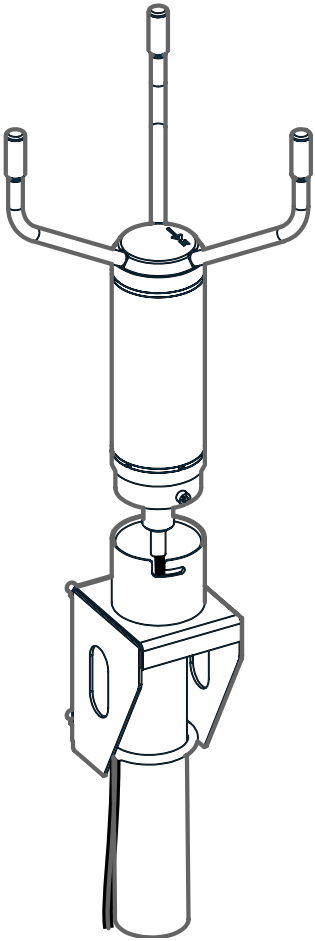
Figure 25 Option 2: Mounting WMT70FIX on top of mast

3. Check that the mounting kit is level, and tighten the U-bolts slightly.

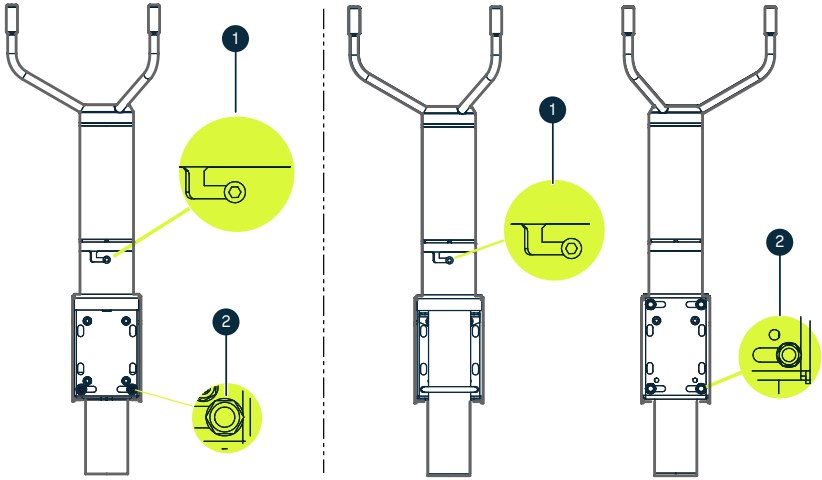
> Do not tighten the bolts too much at this stage. You still need to rotate the mounting kit to align the sensor after the installation.

4. Lift the sensor up.
5. Holding the sensor from its body, run the cable through the WMT70FIX mounting kit, and slide the sensor into the mounting kit.





6. To avoid misalignment, turn the sensor until the mounting screw reaches the far end of the slot, and tighten the screw. Tightening torque 5 Nm.



1 WMT700 mounting screw
2 U-bolt and nut (M8 DIN934 A4) in horizontal slot

7. To align the sensor, rotate the mounting bracket.

More information

- Aligning WMT700 (page 66)

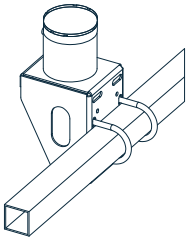
4.7 Mounting WMT700 on support arm using WMT70FIX

- 5-mm Allen key
- 13-mm wrench

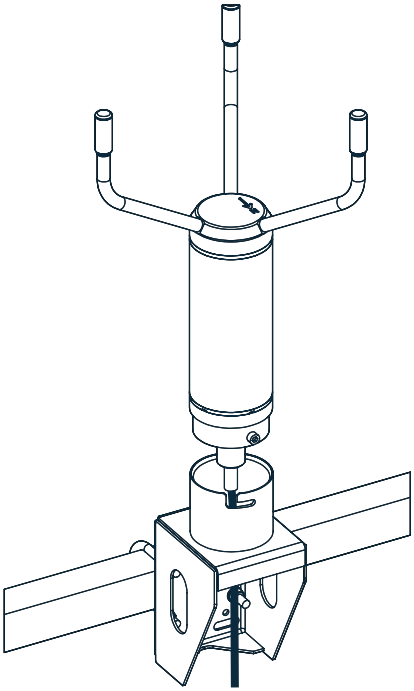
When you mount WMT700 on a horizontal support arm using the WMT70FIX mounting kit, place WMT700 with the array facing up.

1. Make sure that the cable is firmly connected to the sensor.

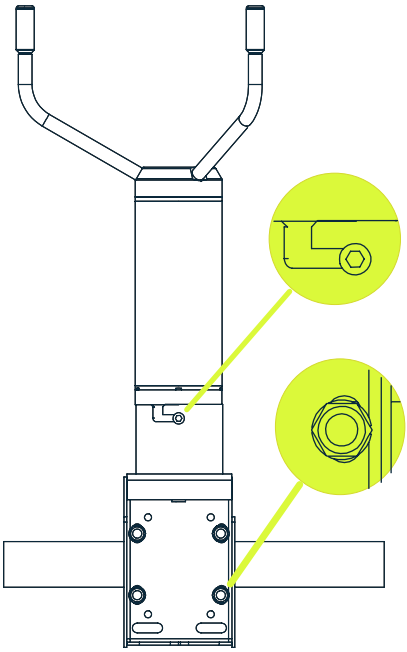
2. Attach the WMT70FIX mounting kit to the support arm with the U-bolts and insert the U-bolts in the slots of the mounting kit.



3. Check that the mounting kit is not tilted to either side and tighten the U-bolts firmly.
4. Lift the sensor up.
5. Holding the sensor from its body, run the cable through the mounting kit, and slide the sensor into the mounting kit.



6. To avoid misalignment, turn the sensor until the screw reaches the far end of the slot, and tighten the screw. Tightening torque 5 Nm.



1 WMT700 mounting screw
2 U-bolt and nut (M8 DIN934 A4) in horizontal slot

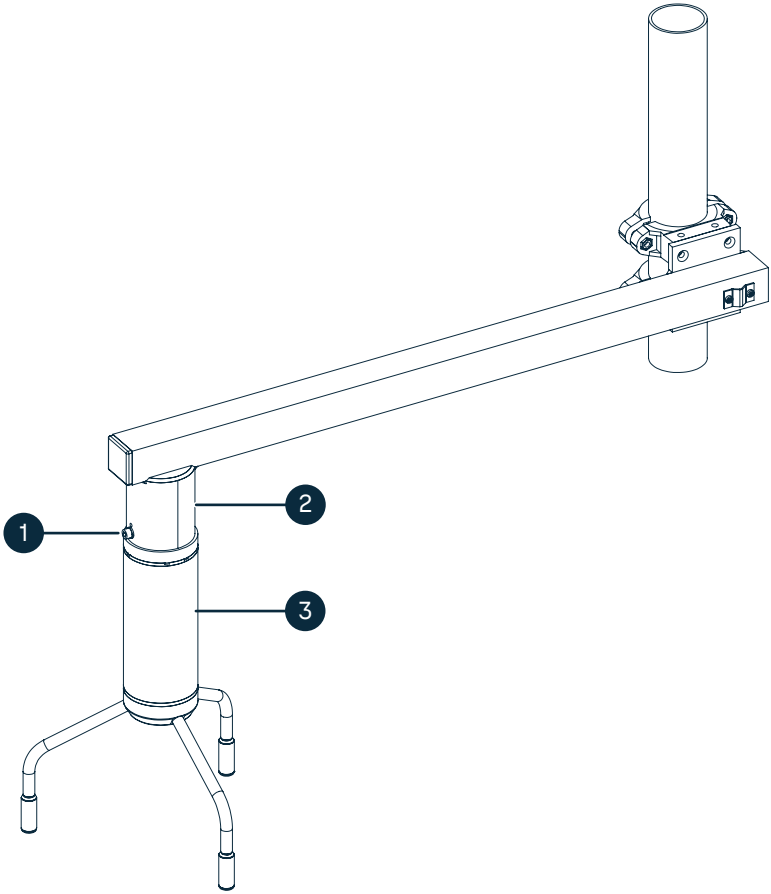
7. Align the sensor.

More information

- Aligning WMT700 (page 66)

4.8 Inverted mounting

You can mount WMT700 with the array facing down. Inverted mounting may be suitable, for example, for extremely cold environments where massive ice build-up is a problem. If you mount WMT700 with the array facing down, use the WAC425 support arm.



1 Mounting adapter for FIX30/60 (228777)
2 WAC425 support arm (WAC425)
3 WMT700

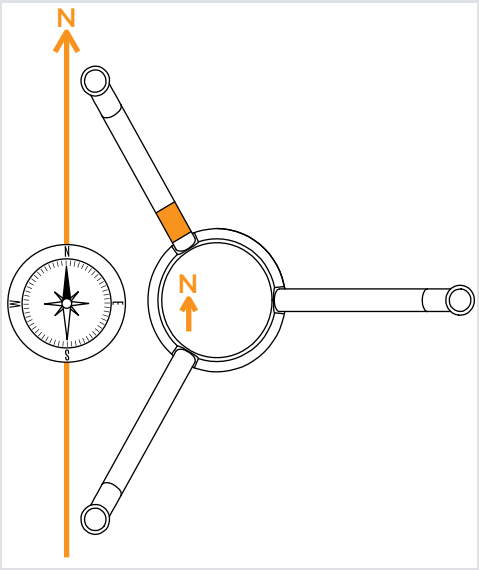
If you mount WMT700 with the array facing down, you must set the `wndOrientation` parameter value to `1`, array facing down. The default value is `0`.

4.9 Aligning WMT700

- 5-mm Allen key
- Compass

When you align the wind sensor, Vaisala recommends using compass binoculars (such as Minox B 7×50DCM).

When you are installing the sensor, pay attention to the North arrow printed on top of the sensor. The North arm is marked with an orange sticker. Align the North arm with the arm below the North arrow.



Do not remove the instrument or sensor from the mounting kit during alignment.

1. Remove the protective packaging that protects the transducers and store it for future use.
2. To align the sensor, use a compass or other similar method and rotate the sensor so that the arrow points North.
3. Tighten the bolts of the mounting kit. Tightening torque 5 Nm.

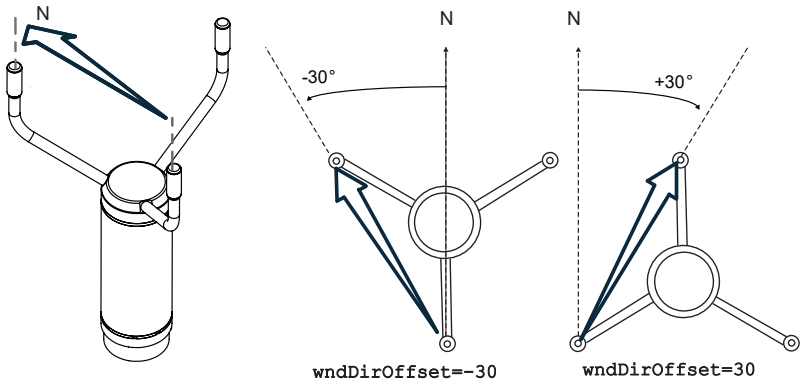
4. If you cannot align WMT700, measure the deviation angle from North and configure the wind direction offset error.

Connect the cable to the data acquisition system and power supply.

4.9.1 Configuring wind direction offset

If you cannot align the sensor so that the arrow points North, make a wind direction offset by configuring the deviation angle in the sensor.

1. Mount the sensor to the desired position.
2. Define the deviation angle from the North (zero) alignment.



3. Type the wind message formatting command and the deviation angle **`S wndDirOffset,(angle)`**. Indicate the direction from the North line with **+** or **−**.

When the deviation angle is set, the sensor transmits the wind direction data by using the changed zero alignment.

More information

- Configuration parameter descriptions (page 189)

4.9.2 Analog output parameter for WMT700 in tunnels and cranes

Analog outputs can be used in road and rail tunnel applications as well as crane applications.

You can get horizontal and direction data with the parameter **`aout_map`**. The **`aout_map`** parameter defines how analog output signals are used. WMT700 provides the following analog outputs:

- **aout1** for wind speed data
- **aout2** for wind direction data

Table 21 **aout_map** values

Parameter	Definition
0	**aout1**, wind speed **aout2**, wind direction (default)
1	**aout1**, North-South, x component **aout2**, East-West, y component Typically, only the component x is used.
2	**aout1**, wind speed **aout2**, wind speed alarm A digital output: hi when wind speed > **aout2_0**

With parameters

- **s aout_map,1**
- **s wndOrientation,0**

The x and y components of the wind vector are defined as:

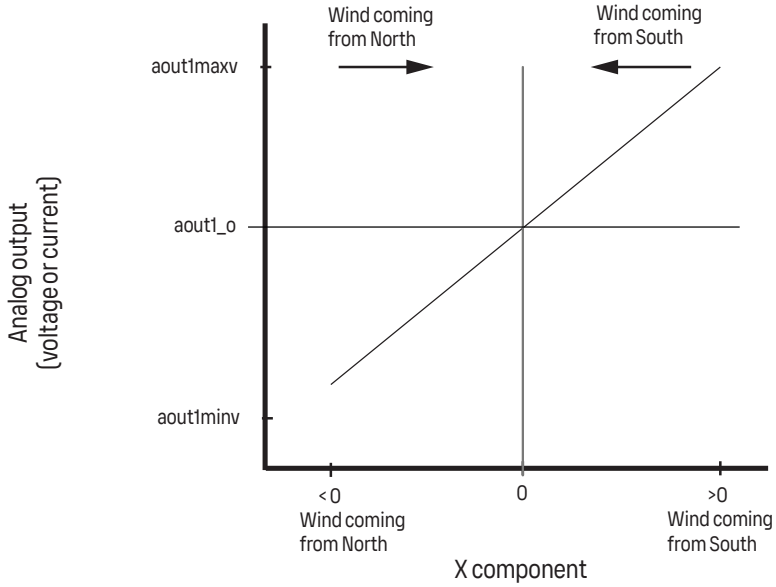


Figure 26 Analog output (voltage or current) X component

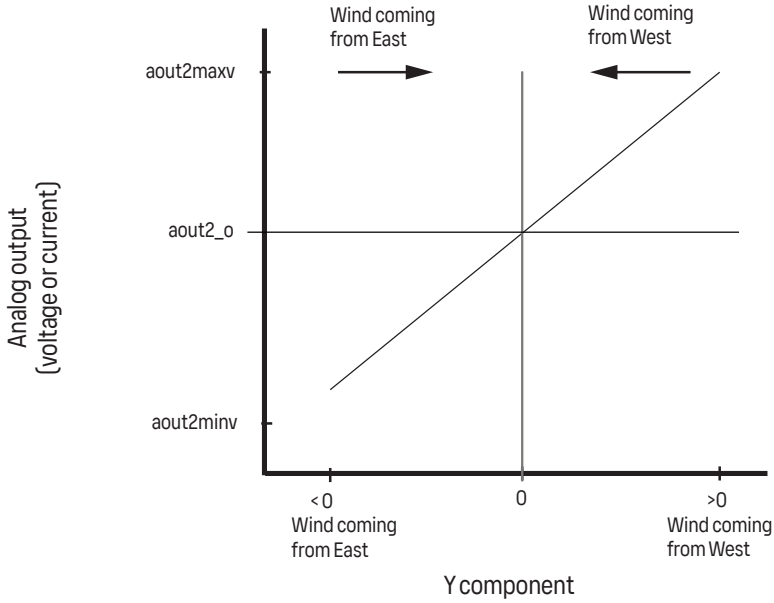


Figure 27 Analog output (voltage or current) Y component

Minimum and maximum values for the x and y components:

- X_min = (Aout1min - aout1_o)/aout1_g
- X_max =(Aout1max - aout1_o)/aout1_g
- Y_min = (Aout2min - aout2_o)/aout2_g
- Y_max =(Aout2max - aout2_o)/aout2_g

Direction of the wind vector is from the measured point to the origin.

Changing **`wndOrientation`** to 1 changes the sign of the y component.

The following table shows the relationship between polar representation and the x and y vector components.

Table 22 Wind y and x components at different wind direction angles

Wind speed	Wind direction	X component	Y component
1	0	-1	0
1	90	0	-1

Wind speed	Wind direction	X component	Y component
1	180	1	0
1	270	0	1

4.9.2.1 Tunnel application

In the tunnel application, airflow can be presented with one mA output channel, because airflow goes along the tunnel. Typically, a relatively long average time (time constant) for wind speed parameter is applied.

The sensor must be installed in a tunnel so that the sensor's North is aligned with the tunnel. The AOUT1 channel (x component) provides the airflow in the tunnel. The following figure shows a typical WMT700 installation in a tunnel.

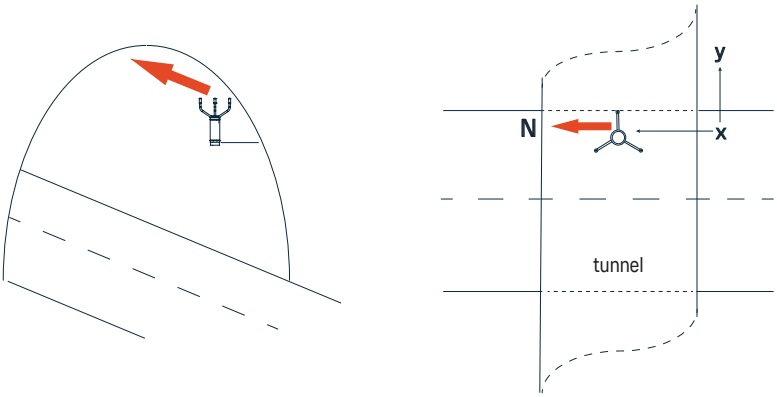


Figure 28 WMT700 in tunnels

The following figure shows the 4–20 mA output as a function of airflow. The zero value is in the middle of the output scale (12 mA). When airflow increases from 0 m/s towards North, mA output reduces from 12 mA linearly resulting in 4 mA with 20 m/s wind. Similarly, when airflow increases from 0 m/s towards South, mA output increases from 12 mA linearly resulting in 20 mA with 20 m/s wind.

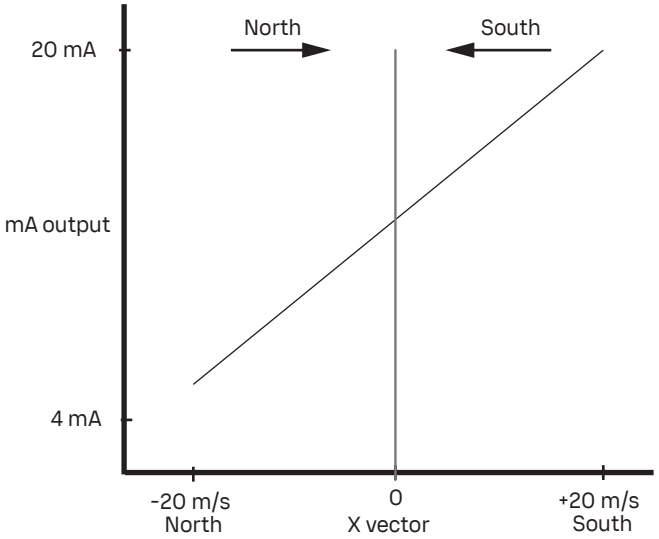


Figure 29 mA output in tunnels

The parameter **aout_map** with setting 1 is used to get the North-South component of wind.

```
s aout_map,1
```

The North-South component to AOUT1, the current output, -20 ... 20m/s to 4 ... 20mA, AOUT2 disabled:

```
s aout1_g,0.0004
s aout1_o,0.012 s
aout1maxv,0.020
s aout1minv,0.004
s aout1mode,0
s aout1err ,0.002 s
aout2mode,7
```

4.9.2.2 Crane application

In the crane application, WMT700 can provide wind speed value and drive alarm signals with 2 mA output channels. The WMT00 alarm output signal can be connected to external audible or visible devices to trigger wind speed alarm for user-defined limits.

Two analog channels are required for this application:

- Channel 1 provides the wind speed value
- Channel 2 provides the alarm signal

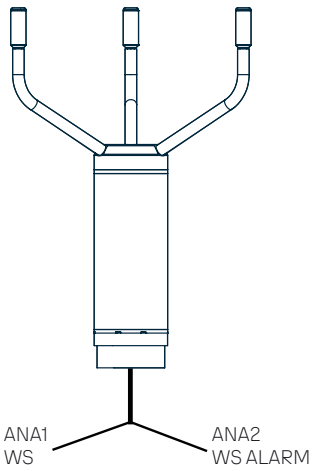


Figure 30 Analog output for wind speed and wind speed alarm

The wind speed value can be scaled according to the sensor's measurement range. The alarm signal operates with on/off-mode. The alarm threshold can be adjusted. The following figure shows the relation of outputs.

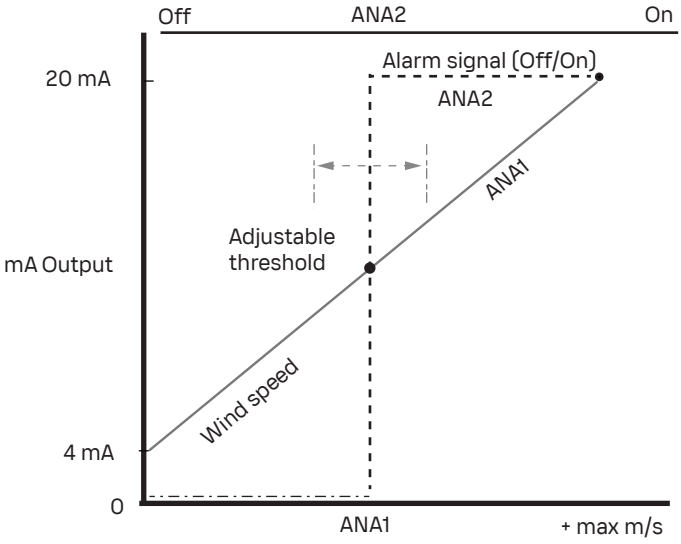


Figure 31 mA output in cranes

The **aout_map** with setting 2 is for getting the wind speed value and the alarm signal. The wind speed value in the Aout1 channel activates the wind speed alarm when the wind speed value exceeds the set limit value.

```
s aout_map,2
```

The analog output 2 works as digital output. **aout2_o** sets the threshold wind speed (**ws_tresh, unit [m/s]**) to 20 m/s:

```
s aout2_o,20
```

```
s aout2_g,1
```

To invert the logic signal, type:

```
s aout2_g,-1.
```

aout1 gives wind speed 4–20 mA output.

aout2 gives 0 mA when the wind speed is < 20m/s, otherwise 20 mA.

```
s aout_map,2
s aout1_g,0.000044444
s aout1_o,0.004
s aout1maxv,0.020
s aout1minv,0.004
s aout1mode,0
s aout1err ,0.002
s aout2_g,1
s aout2_o,20
s aout2maxv,0.020
s aout2minv,0.000
s aout2mode,4
s aout2err ,0.00
```

4.10 Installing bird cage

Install the optional bird cage on top of the wind sensor.

CAUTION! Make sure that you do not damage the WMT700 array when installing the bird cage.

In cold climates, take into account that accumulated snow or ice on the bird cage can disturb the measurement. In such conditions, visit the site frequently to clear ice and snow build-up.

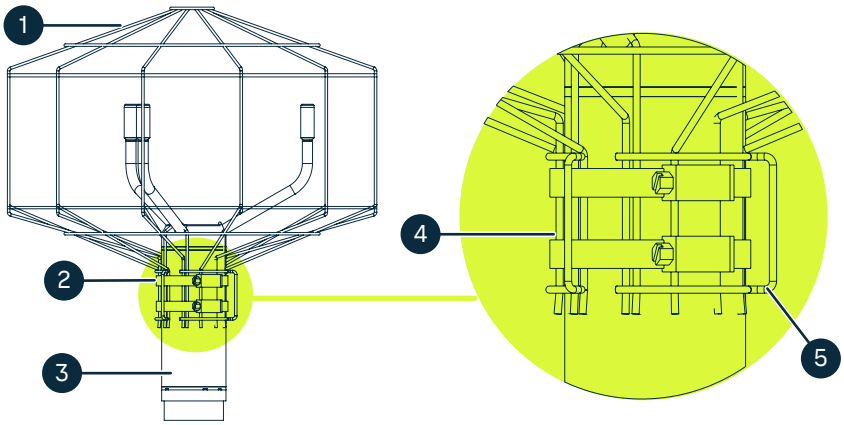


Figure 32 WMT700 bird cage and bird cage straps

1 Bird cage
2 Bird cage straps
3 Wind sensor
4 Guide for attaching the straps
5 Latch for attaching the straps

1. Unpack the bird cage and the straps.
2. Position the bird cage on top of the wind sensor and press the kit down until the three hooks are in contact with the transducer arms.
3. Run the lower strap through the 3 guides in the kit.
4. Lift the latch screw, insert the strap to the latch, and press down the latch screw.
5. To tighten the screw, turn it clockwise with a screwdriver or a socket. Do not overtighten.
6. Run the upper strap through the 3 guides in the kit, and repeat step 4 and step 5 for it.

The WMT700 bird cage protects the wind sensor from many bird species. In challenging environments, additional bird-proofing may be required. To enhance protection, you can install mesh sized appropriately for the conditions and the bird species observed at the site. After installing any additional mesh, make sure that you verify that the WMT700 wind measurements are reported normally.

4.11 Wiring

There are 3 cable sets for WMT700:
- Hybrid cables (page 76) required for a fully heated WMT700.
  You can use the hybrid cable with all WMT700 heating options. The integrated cable option also includes a hybrid cable.
- Standard cables (page 77) for non-heated, transducer-heated, and transducer-and-arms-heated WMT700.
- RS-485 cables (page 78)

4.11.1 M23 connector signals

The 17-pin M23 male connector is located at the bottom of WMT700. The connector is used for power supply, digital communications, and analog outputs. The signals related to digital communications are galvanically separated from the ground.

The following figure and table show the pin-out of the 17-pin M23 connector. The COM2 serial output type depends on the sensor configuration. Analog outputs are always available from the connector.

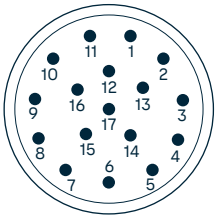


Figure 33 Pin-out of M23 connector

Table 23 M23 connector pins

Pin	Description	RS-232	RS-422	RS-485	SDI-12
1	Operating power supply				
2	Analog output AOUT2, wind direction				
3	COM2	RS-232Rx	Rx–	Rx–	-
4		RS-232Tx	Tx–	Tx–	Data
5	Heater power supply				
6					
7	Heater power supply ground				
8					
9	COM1 (service port)	RS-485–			

Pin	Description	RS-232	RS-422	RS-485	SDI-12
10	COM1 and COM2 communication ports ground				
11	Operating power supply ground				
12	Analog output ground				
13	Analog output AOUT1, wind speed				
14	COM2	-	Tx+	Tx+	-
15		-	Rx+	Rx+	-
16	COM1 (service port)	RS-485+			
17	Reference input for AOUT2 (simulated potentiometer)				
Shield	Enclosure ground				

4.11.2 Hybrid cables

A hybrid cable is required for the fully-heated WMT700. It can be used with all WMT700 heating options.

Vaisala provides the following open-lead hybrid cables for connections to other host systems:

Table 24 Hybrid cables

Cable	Product code	Description
Cable 2 m	CBL210706-2MSP	Cable carries through all signals from WMT700.
Cable 10 m	CBL210706-10MSP	
Cable 15 m	CBL210706-15MSP	
Cable 26 m	CBL210706-26MSP	
Cable with custom length	CBL210706-SPEC	Cable carries through all signals from WMT700. Define the length when you order WMT700.
Integrated cable 11 m	-	Cable carries through all signals from WMT700. Integrated to the sensor body.

Long cables may decrease WMT700 capabilities, see Power and cable recommendations (page 85).

WMT700 cables are shielded hybrid cables with several different wires. The cable contains 2 x 2 x 0.14 mm^2 + 7 x 0.14 mm^2 + 2 x 0.25 mm^2 + 4 x 1.0 mm^2 wires with screen.

The sensor and the cabling must be protected with a fuse or a circuit breaker. The maximum sizes of the fuses or circuit breakers protecting the power lines:
- 13 A with type B, C, or D (IEC/EN 60898-1 or UL 1077) tripping characteristics and specified for at least 40 V DC voltage operation for heating power supply.
- 1 A with type B (IEC/EN 60898-1) tripping characteristics and specified for at least 40 V DC voltage operation for operating power supply.

The circuit breaker can be either 2-pole (on both positive and negative/ground) or 1-pole (positive wires). You can also replace the circuit breaker with a cartridge fuse with T (slow acting) tripping characteristics.

4.11.3 Standard cables

The standard cables are for non-heated, transducer-heated, and transducer-and-arms-heated WMT700.

The following standard cables are available:
- Cable 2 m (227567SP)
- Cable 10 m (227568SP)
- Cable 15 m (237890SP)
- Cable 26 m (237889SP)

Table 25 Standard cables

Order code	Description	Purpose
227567SP	Standard cable 2 m, cable connector, open leads on one end	Used for analog output or serial communication with 2 serial ports.
227568SP	Standard cable 10 m, cable connector, open leads on one end	
237890SP	Standard cable 15 m, cable connector, open leads on one end	
237889SP	Standard cable 26 m, cable connector, open leads on one end	
228259SP	RS-485 cable 2 m, cable connector, open leads on one end	Used for serial communication with RS-485 interface. See RS-485 cables (page 78).
228260SP	RS-485 cable 10 m, cable connector, open leads on one end	
ASM210719SP	Junction box with cable 2 m	Used when a cable longer than 10 meters is needed. Junction box contains terminal blocks that extend the 2-meter cable to a needed length.

If there are unused wires, make sure that they are unconnected and protected. Do not cut off any wires.

4.11.4 RS-485 cables

In the RS-485 mode, the same signals as in the RS-422 mode are available at the end of cables 2 m, 10 m, 15 m, and 26 m. Make 2-wire loop-backs at the end of the cable or connect the wires to the same terminal.

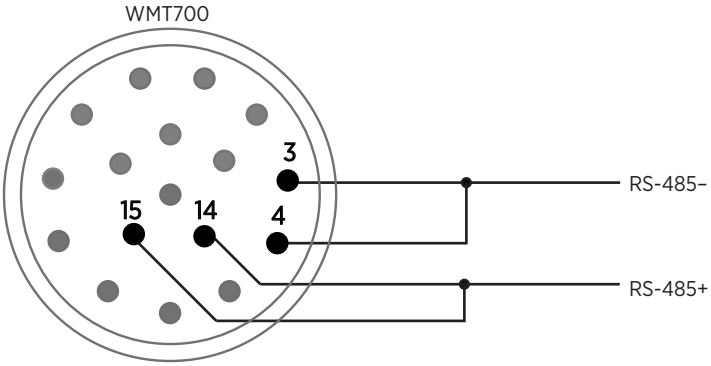


Figure 34 COM2 RS-485 wiring

Table 26 RS-485 wiring

WMT700 signals	Wire colors	WMT700 M23 connector pin	RS-485 signals
RxA / RX–	Green	3	–
TxA / TX–	Orange	4	
TxB / TX+	White/orange	14	+
RxB / RX+	White/green	15	

To avoid confusion, the RS-485 and RS-422 signals of WMT700 are named as follows:
- Inverting: –
- Non-inverting: +

According to the EIA-485 standard, the lines are named as follows:
- Inverting: – <=> A
- Non-inverting: + <=> B

The A/B naming used by some manufacturers is in conflict with the standard. To ensure proper operation, verify the polarity of the signals when using the device on the bus with signals named as A/B. Opposite polarity causes data inversion on the bus, but it does not damage the device.

4.11.5 Cable wiring

Connect the wires according to the following table.

Table 27 WMT700 cables 2 m, 10 m, 15 m and 26 m

Pin	Description	Hybrid/ Integrated cable	Standard cable	RS-485 cable
1	Operating power supply	Brown 0.25 mm^2	White 0.25 mm^2	White 0.25 mm^2
11	Operating power supply ground	Blue 0.25 mm^2	Gray/pink 0.25 mm^2	Gray/pink 0.25 mm^2
5	Heater power supply	White/red 1.0 mm^2	Gray 0.25 mm^2	Gray 0.25 mm^2 Green 0.25 mm^2
6		Red 1.0 mm^2	Pink 0.25 mm^2	Pink 0.25 mm^2
7	Heater power supply ground	Black 1.0 mm^2	Blue 0.25 mm^2	Blue 0.25 mm^2 Black 0.25 mm^2
8		White/ black 1.0 mm^2	Red 0.25 mm^2	Red 0.25 mm^2 Yellow 0.25 mm^2
Shield	Enclosure ground			
	Analog outputs			

Pin	Description					Hybrid/ Integrated cable	Standard cable	RS-485 cable
2	Analog output AOUT2, wind direction					White/ violet 0.14 mm^2	Brown 0.25 mm^2	-
13	Analog output AOUT1, wind speed					Violet 0.14 mm^2	White/ green 0.25 mm^2	-
17	Reference input for AOUT2 (simulated potentiometer)					White/gray 0.14 mm^2	White/gray 0.25 mm^2	-
12	Analog output ground					Gray 0.14 mm^2	Red/blue 0.25 mm^2	-
	COM port	**RS-232**	**RS-422**	**RS-485**	**SDI-12**			
3	COM2	RS232 Rx	RX-	RX-	-	Green 0.14 mm^2	Green 0.25 mm^2	Brown 0.25 mm^2 (pins 3 and 4 connected inside the cable)
4		RS232 Tx	TX-	TX-	Data	Orange 0.14 mm^2	Yellow 0.25 mm^2	
14		-	TX+	TX+	-	White/ orange 0.14 mm^2	Brown/ green 0.25 mm^2	Red/blue 0.25 mm^2 (pins 14 and 15 connected inside the cable)
15		-	RX+	RX+	-	White/ green 0.14 mm^2	White/ yellow 0.25 mm^2	
10	COM1 and COM2 communication ports ground					White/blue 0.14 mm^2	Violet 0.25 mm^2	Violet 0.25 mm^2
9	COM1 service port	RS-485 –				White/pink 0.14 mm^2	Black 0.25 mm^2	-
16		RS-485 +				Pink 0.14 mm^2	Yellow/ brown 0.25 mm^2	-

The wire colors in the tables are not applicable to other cables.

If there are unused wires, make sure that they are unconnected and protected. Do not cut off any wires.

More information

- Connecting WMT700 cables (page 55)

4.12 Powering WMT700

WMT700 has separate power supply inputs for:
- Operating power
- Heating power

The inputs are usually connected to the same 24 V DC power supply unit. Special applications, such as battery operation or battery backup, may require separate supplies.

The operating power has 1 supply terminal and 1 ground terminal, while the heating power has 2 supply terminals and 2 ground terminals allowing a higher supply current. All supply ground terminals are internally connected to each other inside WMT700.

Make sure that the power supply output voltage, current, and power specifications including the tolerance match the WMT700 specifications.

In a system setup with 2 separate power supplies, avoid ground potential differences between the supplies. Connect the negative terminals together if necessary.

Do not use a DC power supply based on a chopper circuit that operates at 100 kHz. The ripple in the DC output can distort the measurement.

The sensor and the cabling must be protected with a fuse or a circuit breaker. The maximum sizes of the fuses or circuit breakers protecting the power lines:

- 13 A with type B, C, or D (IEC/EN 60898-1 or UL 1077) tripping characteristics and specified for at least 40 V DC voltage operation for heating power supply.
- 1 A with type B (IEC/EN 60898-1) tripping characteristics and specified for at least 40 V DC voltage operation for operating power supply.

The circuit breaker can be either 2-pole (on both positive and negative/ground) or 1-pole (positive wires). You can also replace the circuit breaker with a cartridge fuse with T (slow acting) tripping characteristics.

More information

‣ Power unit (page 16)

4.12.1 Operating power

WMT700 can use any 9–36 V (nominal voltage 24 V) minimum 2 W DC power supply that meets applicable safety regulations.

Connect heating supply wires to the ground if heating is not used. The following figures show the typical current and power consumptions vs. operating voltage.

The selected heating option affects the needed operation voltage when separate powering for operation and heating is used.

Do not use a DC power supply based on a chopper circuit that operates at 100 kHz. The ripple in the DC output can distort the measurement.

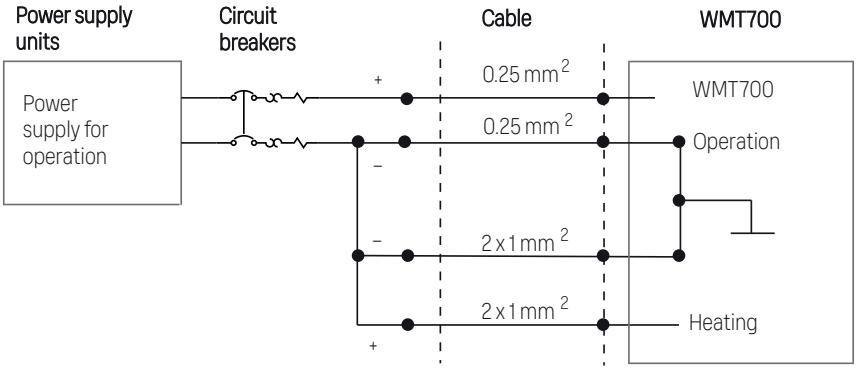


Figure 35 Wiring of non-heated WMT700 versions

In maritime environments, the normal input voltage ranges are: operating voltage 12–30 V DC (-25 ... +30%) and heating voltage 24–30 V DC (-25 ... +30%), as defined in the maritime standard IEC 60945.

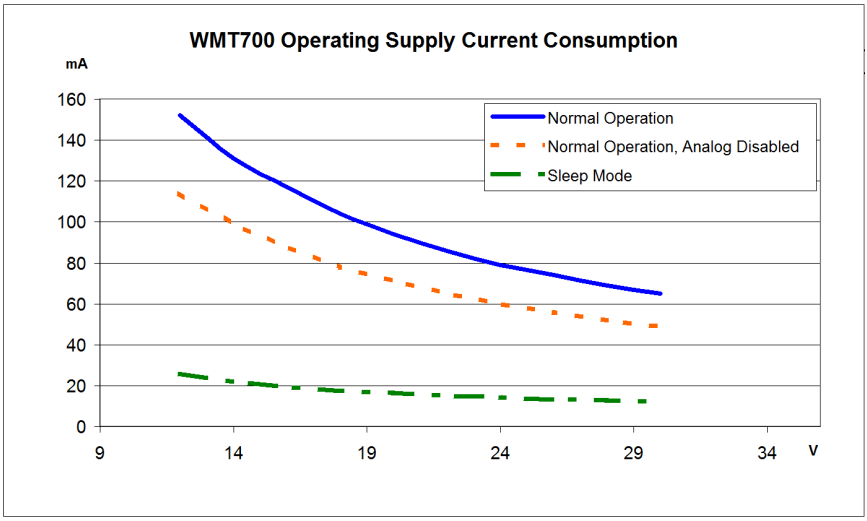


Figure 36 Operating supply current consumption

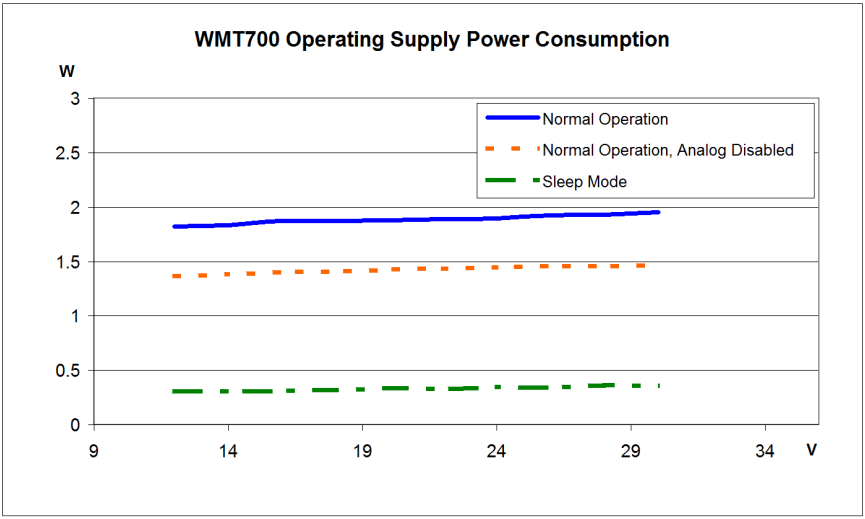


Figure 37 Operating supply power consumption

More information

- SLEEP — enter low-power mode (page 129)

4.12.2 Heating power

The following table shows the minimum power supply requirements of the WMT700 heating options.

In maritime environments, the normal input voltage ranges are: operating voltage 12–30 V DC (-25 … +30%) and heating voltage 24–30 V DC (-25 … +30%), as defined in the maritime standard IEC 60945.

Table 28 Heating power supply requirements

Heating option	Heating voltage	Required heating power supply
None	-	-
Transducers	24–36 V DC	40 W
Transducers and arms	24–36 V DC	200 W
Transducers, arms, and body	24–36 V DC	350 W (2 m cable)

4.12.2.1 Power and cable recommendations

This applies to hybrid cables (CBL210706-2M, CBL210706-10M, CBL210706-15M, CBL210706-26M, CBL210706-SPEC).

The hybrid cable ambient temperature can be up to 60 °C (140 °F). Cable installation is limited to up to 3 cables in contact with each other horizontally (on tray) or vertically (on wall).

- For the fully heated WMT700, if you need a hybrid cable longer than 26 m, Vaisala recommends ordering a special length cable (CBL210706-SPEC).
  To extend the cable length, you can also use the connector, your own cable, or the 2 m hybrid cable (CBL210706-2M), a junction box, and your own cable.
  To wire WMT700 with your own cable and a connector, the minimum requirements are
  - 2 parallel 1 mm^2 wires for the heating power supply
  - 2 parallel 1 mm^2 for return (ground) because of high current need
- The operating power supply must be at least 0.25 mm^2 for supply and return (ground). The temperature specification for the cable is 80 °C (176 °F). This allows the cable ambient temperature to be up to 60 °C (140 °F).
- For the other versions (non-heated, transducer-heated, and transducer-and-arms-heated), the installation ambient temperatures are lower.
  For your own cable, the maximum temperature is higher than 80 °C (176 °F). Refer to the cable standard DIN VDE 0298-4, or equivalent standard, to define the correct number of parallel wires and cross section areas for the 13 A circuit breaker for heating power supply and for the 1 A circuit breaker for operating power supply.

The minimum operation voltage for a fully heated WMT700 (heated transducers, arms, and body) is 16 V, including the cable losses, if a separate power supply unit is used for operation.

Connect both heating power supply wires to the same ferrule if the cable is shortened.

The following figures illustrate the wiring of heated WMT700 instruments.

The following figures illustrate the wiring of heated WMT700 instruments.

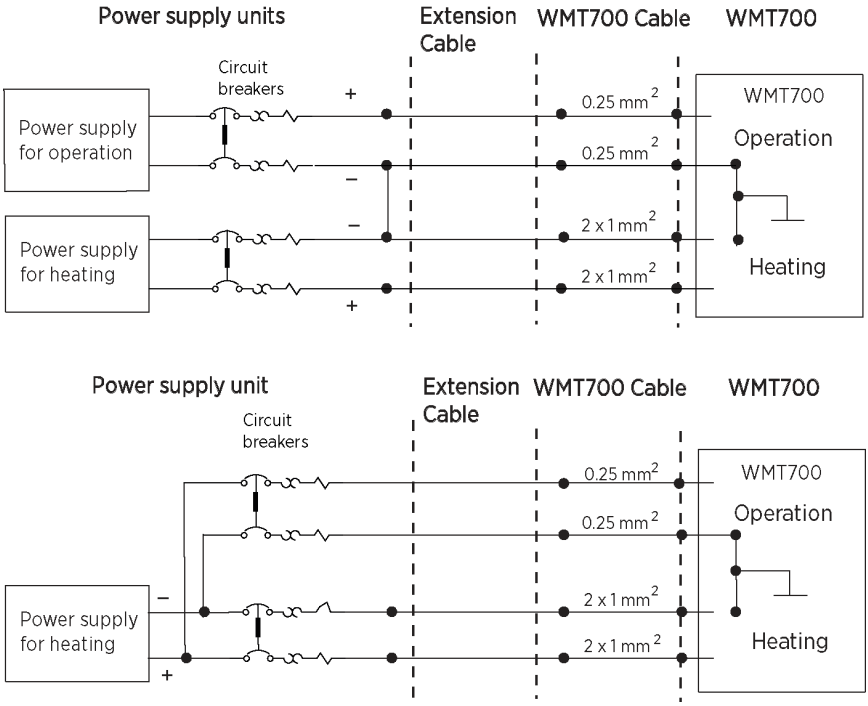


Figure 38 Wiring of heated WMT700 versions

When you use separate power supplies for operating and heating, the minus (-) terminals of the power supplies are connected together by an additional wire. Use a minimum 0.75 mm^2 wire for connecting the (-) terminals together.

CAUTION! There are 2 terminals connected in parallel for both positive and negative rails of the heating voltage for the maximum current capacity. If the connection cable has parallel supply wires, they all must be connected to ensure current capacity. Leaving one terminal unconnected or connecting it to the ground may cause a WMT700 malfunction or a short circuit in the power supply.

Always use cables that meet the minimum dimension requirements. Long cables with thin wires cause power loss in the cable and significantly decrease WMT700 heating capabilities. Loop resistance of 0.15 Ω results in an approximately 1 V drop in heating voltage with 200 W heating. The loop resistance of a 10-m cable (CBL210706-10M) is 0.2 Ω resulting in an approximately 1.3 V drop. Vaisala recommends using at least a 28 V supply for the maximum heating capability.

Table 29 Power supply requirements with hybrid cable

Hybrid cable length	Hybrid cable (CBL210706-2M) with 2 x 1 mm^2 for supply 2 x 1 mm^2 for return current	2 m hybrid cable (CBL210706-2M) with 2 x 1 mm^2 for supply 2 x 1 mm^2 for return current extension with 2.5 mm^2 cable	2 m hybrid cable (CBL210706-2M) with 2 x 1 mm^2 for supply 2 x 1 mm^2 for return current and extension with 4 mm^2 cable
2 m	24 V DC 400 W	24 V DC 400 W	24 V DC 400 W
10 m	24 V DC 400 W	24 V DC 400 W	24 V DC 400 W
15 m	26 V DC 400 W	26 V DC 400 W	24 V DC 400 W
26 m	28 V DC 400 W	27 V DC 400 W	24 V DC 400 W
30 m	29 V DC 400 W	28 V DC 400 W	24 V DC 400 W
40 m	31 V DC 400 W	30 V DC 400 W	24 V DC 400 W
50 m	33 V DC 400 W	32 V DC 400 W	25 V DC 400 W
60 m	35 V DC 400 W	33 V DC 400 W	25 V DC 400 W
70 m	-	35 V DC 400 W	26 V DC 400 W
80 m	-	-	26 V DC 400 W
90 m	-	-	27 V DC 400 W
100 m	-	-	27 V DC 400 W

4.12.2.2 Maximum peak power

The **heaPeakPwr** parameter sets WMT700 maximum peak power (in Watt). WMT700 has 3 heater resistors for each arm. The **heaPeakPwr** parameter determines how many resistors are on at the same time. WMT700 measures the supply voltage and calculates the maximum allowed number of heaters from the supply voltage and heater resistance. The **heaPeakPwr** parameter does not limit the power in the body heater of a heated version of WMT700.

Make sure the WMT700 power peak limit is lower than the power supply rating. Setting **heaPeakPwr** value too low reduces heating performance.

Use a power supply that has enough power for WMT700. Part of the power is dissipated in the cables.

Table 30 Sensor power of different heating options

Heating option	Required sensor power	Default value of `heaPeakPwr`	Allowed parameter values
Transducers	40 W	30	0–40
Transducers and arms	200 W	200	0–200
Transducers, arms, and body	350 W	200	0–350

4.12.2.3 Body heating power adjustment

The **`heaBMaxPower`** parameter sets WMT700 maximum body heater power (in Watt).

You can disable WMT700 body heating by setting the **`heaBMaxPower`** parameter value to 0. The default value is 100.

Table 31 `heaBMaxPower` parameter values

Body heating	Parameter value
Off	`0`
On	`100`

The parameter affects the maximum average power, not the maximum peak power.

4.12.3 Power unit

If you use your own power supply, make sure that the power supply output voltage, current and power specifications including the tolerance match WMT700 specifications.

More information

- Powering WMT700 (page 81)

4.13 Upgrade from WS425 to WMT700

When upgrading to WMT700, you have the following installation options:

- Basic installation: mounting WMT700 with the WMT70FIX mounting kit and the WMT700 mounting adapter. Uninstall the WS425 wind sensor and mounting kit. See Installing WMT700 (page 48).
- Retrofit installation: mounting WMT700 with a WS425 mounting kit and the WMT700 mounting adapter for FIX30/60.

At the measurement site, mount WMT700 and connect it to the power source and data acquisition system.

After upgrading to WMT700, you can install the optional bird prevention kit available for the wind sensor.

WARNING! To protect personnel and the wind sensor, install an air terminal with the tip at least 1 meter above WMT700. The air terminal must be properly grounded, compliant with all local applicable safety regulations. Do not install the wind sensor above the top of the air terminal.

WARNING! Do not perform installation or maintenance procedures when there is a risk of thunderstorm or lightning activity in the area.

CAUTION! Handle with care. Any impact on the instrument or sensor array may cause damage and lead to incorrect measurements.

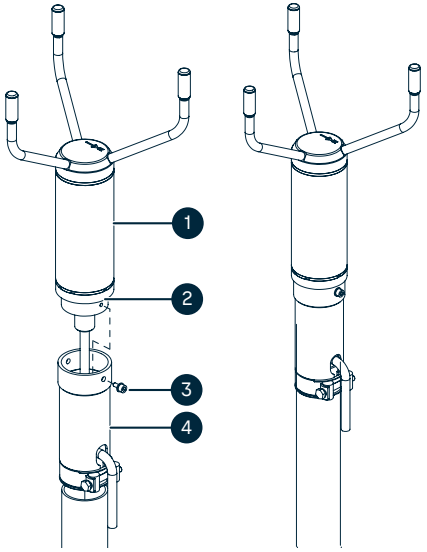
Save the container and all the packaging materials for future transporting or shipping.

4.13.1 Mounting with WS425 mounting kit

You can mount WMT700 on a vertical pole mast or a horizontal cross arm using the WS425 mounting kit. The mounting procedure is the same. Typically, you can upgrade from WS425 to WMT700 without removing the mounting kit.

If you remove the mounting kit, you must align the wind sensor after mounting. Mark both the wind sensor and the mounting kit with a marker pen before removing the mounting kit. You can use the mark as a rough reference when starting the aligning process described in Aligning WMT700 (page 66).

When mounting WMT700 to a cross arm, you can place the wind sensor with the array facing up or down. If the wind sensor is installed with the array facing down, configure WMT700 accordingly. See Configuration (page 103).



The following figure shows the mounting procedure to a vertical pole mast.

Figure 39 Retrofit installation to pole mast

1 WMT700
2 Mounting adapter for FIX30/60 (228777)
3 Mounting screw
4 WS425 mounting kit (WS425FIX60)

The following figure shows the mounting procedure to a horizontal cross arm.

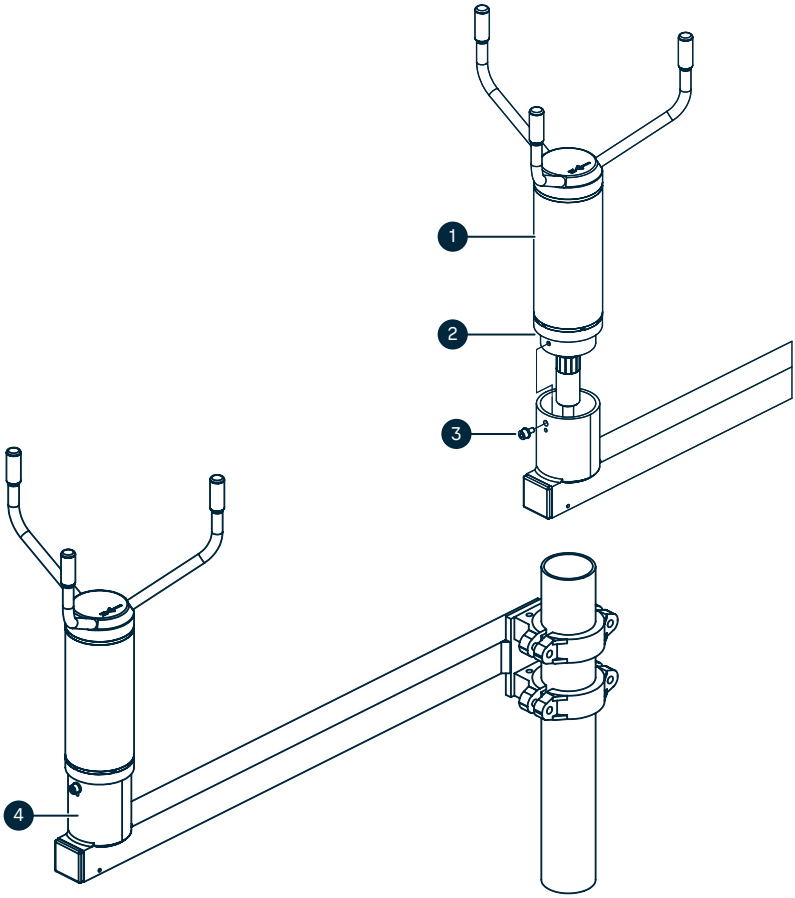


Figure 40 Retrofit installation to cross arm with array facing up

1 WMT700
2 Mounting adapter for FIX30/60 (228777)
3 Mounting screw
4 WAC425 sensor support arm (WAC425)

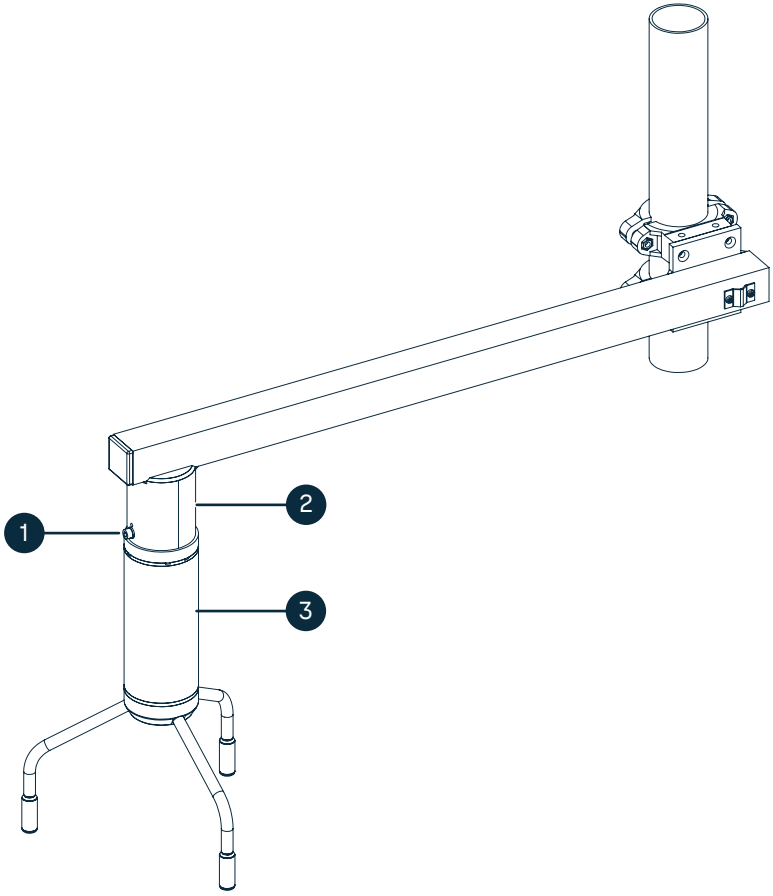


Figure 41 Retrofit installation to cross arm with array facing down

1 Mounting adapter for FIX30/60 (228777)
2 WAC425 sensor support arm (WAC425)
3 WMT700

4.13.2 Upgrade prerequisites

You need the following components:

- Correct mounting kit (already attached to the mast) for a retrofit installation. The following figure shows the available options.

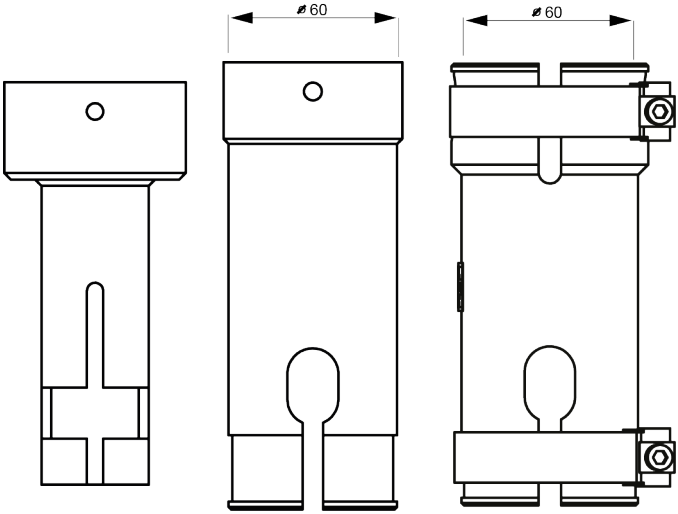


Figure 42 FIX30, WS425FIX60-RST, and WMT700FIX60-MARINE

- Correct mounting adapter for your installation, The diameter of the mounting adapter for the adapters is 61 mm. Change the mounting adapter if necessary. If you are not sure that you have the correct mounting adapter, contact Vaisala.

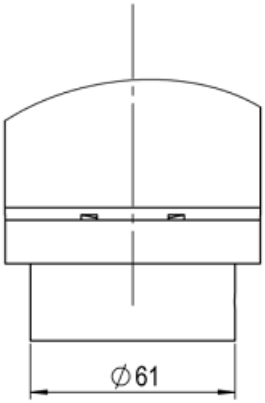


Figure 43 Mounting adapter for FIX30, WS425FIX60 (228777)

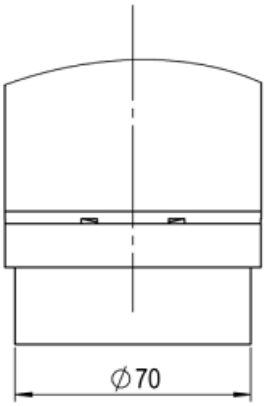


Figure 44 Mounting adapter for WMT700FIX60-RST, WMT700FIX60-MARINE, and WMT70FIX (228869)

- Correct cables for the mounting kit and analog output/serial communication. The following table lists the available cables for a retrofit installation. The In/Out stands for the possibility to route the cable either inside or outside of the mast.

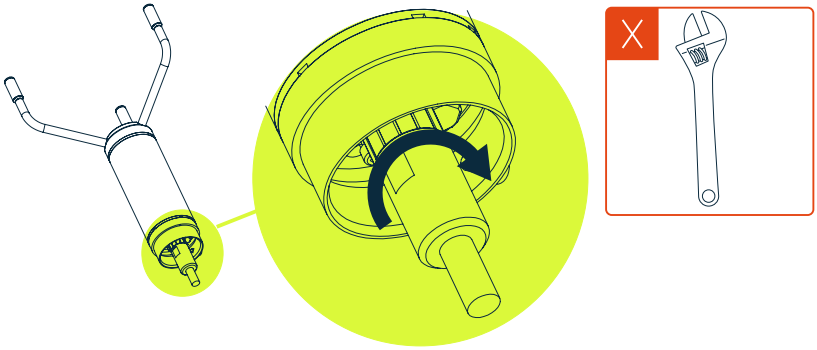
If you have FIX30, do not use the adapter cables but order the appropriate WMT700 cable. The adapter cable does not fit inside the mast.

Table 32 Mounting kits and cable codes

Description	Spare part item	FIX70		FIX30		WS425FIX60	
		In	Out	In	Out	In	Out
WMT700 cables with connector and open leads on one end	CBL210706 all models	✓	✓	✓		✓	✓

4.13.3 Upgrading from WS425 to WMT700

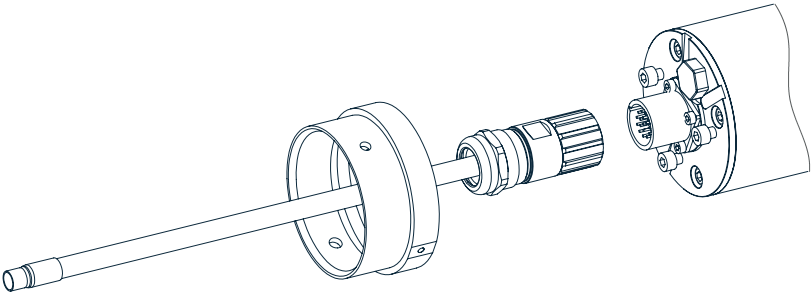
1. Uninstall WS425.
2. Run WMT700 cable through the WS425 mounting kit and connect it to WMT700.
3. Tighten the connector by rotating the connector by hand clockwise.



Make sure that the connector is properly tightened before proceeding to the next step. If you cannot tighten the connector, loosen the mounting adapter fixing screws, remove the mounting adapter, and connect the cable. Reattach the mounting adapter.

4. Attach the WMT700 sensor body to the WS425 mounting kit and tighten the bolt.
5. Remove the transportation damper protecting the array and store it for future use.

6. Connect the cable to the data acquisition system and power supply.



7. Connect the wires.

   WMT700 is now ready for operation.

4.13.4 Mounting WMT700 with ASOS mounting adapter

You can mount WMT700 on your existing 425NWS installation kit (4258057) by using the ASOS mounting adapter (ASM212140).

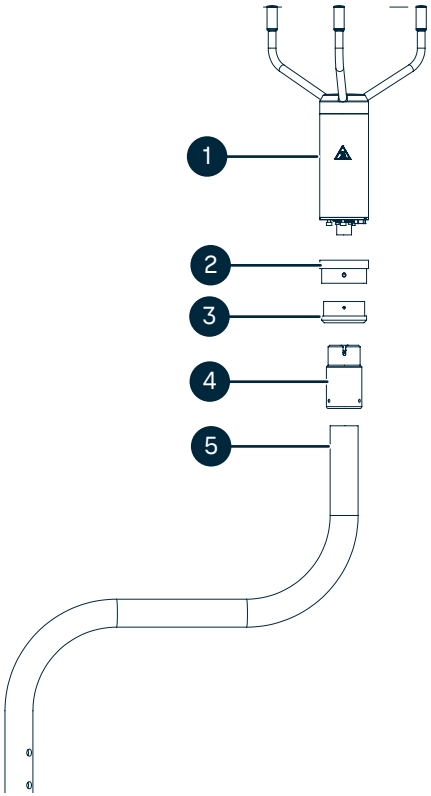
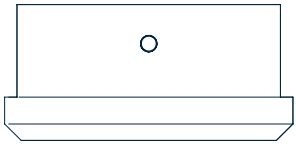


Figure 45 Installation with ASOS mounting adapter

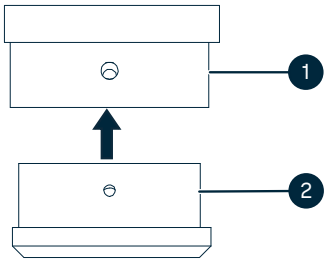
1 WMT700
2 Adapter for WMT700FIX, WMT700FIX60-MARINE, and WMT700FIX60-RST (228869)
3 ASOS mounting adapter (ASM212140)
4 425NWS sensor alignment adapter
5 425NWS mounting tube

1. Remove the screw from the ASOS mounting adapter.



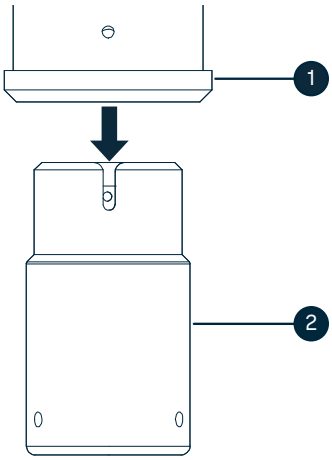
2. Insert the ASOS mounting adapter into the WMT700 adapter (228869).

   The ASOS adapter slides into position.



1 Adapter for WMT700FIX, WMT700FIX-MARINE, and WMT700FIX60-RST (228869)
2 ASOS mounting adapter (ASM212140)

3. Rotate the adapter until the screw holes are aligned. Insert the screw and tighten it.
4. Mount WMT700 with the ASOS mounting adapter on the existing sensor alignment adapter.



1 WMT700 mounting adapter
2 Existing 425NWS alignment adapter

5. Align the screw holes, insert the screw, and tighten it.

4.13.5 Connection cable prerequisites

When you install WMT700, pay attention to the following issues.

Pay attention to how you route the cables in your mounting option. When you mount WMT700 on a mast, you can route the cable either outside or inside the mast depending on the mast type and other equipment, such as air terminals, installed to the mast.

CAUTION! To avoid strain on the connector, make sure you connect the cable properly. Too much strain may cause the cable to fall off, damage the cable or connector, or make the cable or connector susceptible to water leakage.

The recommended minimum bending radius for the cable is 80 mm (3.15 in).

WARNING! Make sure that you prepare or connect only de-energized wires.

WARNING! Do not perform installation or maintenance procedures when there is a risk of thunderstorm or lightning activity in the area.

WARNING! A long cable between units (sensors, transmitters, power supplies, and displays) can cause a lethal lightning-induced current surge. Always ground the enclosure to a suitable grounded location with a short, low-resistance cable.

4.13.6 Wiring in retrofit installations

Replace the existing cables with the WMT700 cable when replacing WS425 with WMT700.

4.13.6.1 Using standard WMT700 cables

This is the recommended way for the retrofit installation. The cables available for the installation:

- CBL210706-2M
- CBL210706-10M
- CBL210706-15M
- CBL210706-26M
- CBL210706-SPEC

4.13.6.2 WMT700 and WS425 analog output signals

WMT700 pin connections differ from the connections of WS425 in that wind speed signal output, both voltage and frequency signals, appears on WMT700 pin 13.

WMT700 analog outputs must be configured according to the appropriate analog output mode, which is either voltage, frequency, or potentiometer.

Table 33 WMT700 and WS425 analog output connections

WMT700 connector pin	WMT700 signal	Voltage output	WS425 connector pin, wire color
13	Analog output AOUT1, wind speed	Voltage	15, violet (connect pin 14 to ground)
		Current	Not available
		Frequency	14, pink
2	Analog output AOUT2, wind direction	Voltage	13, gray
		Current	Not available
		Potentiometer	13, gray
17	Reference input for AOUT2	Potentiometer	12, white
12	Analog output ground	All modes	1, black (common with supply ground)

4.13.7 Powering in retrofit installations

WMT700 is designed to operate with the same supply voltages as WS425 and no connection changes are necessary. The power consumption depends on the selected heating options. WMT700 with heated transducers can be used to replace similar WS425 models. When upgrading from WS425 to WMT700 with heated transducers and arms, more capacity is required from the power supply unit.

When WMT700 is in operation, the power consumption is higher than with WS425. This can affect system performance in power-critical applications such as solar-powered or battery-powered systems. Use solar-power or battery backup only to secure operating voltage. Make sure that the solar-powered system has a sufficient power reserve available.

5. Operation

5.1 Communicating with terminal software

- Computer with a serial port
- Cables for the serial connection
- Any terminal software, such as Tera Term or HyperTerminal for Windows.

1. Connect a cable between your terminal computer, power supply, and WMT700.
2. Open the HyperTerminal program.
3. Cancel the new connection.
4. Select **File > Properties**.
5. Select the correct COM port and select **Configure**.
6. Set the communication parameters according to the configured port settings of WMT700. The default values for WMT700 are:

Communication parameter	Default value
Bits per second	9600
Data bits	8
Parity	None
Stop bits	1
Flow control	None

7. Select **Apply > OK**.
8. Select **Settings > ASCII setup > ASCII sending - Send line ends with line feed (optional) > OK**. Close the **New Connection Properties** window.
9. Select **View > Font** and in the **Font** list, select **Terminal**.
10. Select **Call > Call**. Type a name and select an icon for the connection. Select **OK**.

    When a serial line cable is connected to the computer and the terminal setup is correct, switch the sensor power supply on. The following information is displayed:

```
WMT700 v<version number>
```

    The sensor goes to measurement mode after 4 seconds and it is ready to receive measurement mode commands.

At the end of each command, press **ENTER** to execute the command. The following combinations of carriage return <CR> and line feed <LF> are accepted: <CR>, <LF>, and <CR><LF>.

The communication baud rate can be 300–115200 baud.

More information

- Configuration parameter descriptions (page 189)

5.2 Entering and exiting configuration mode

You can toggle between the configuration and measurement modes with the **OPEN** and **CLOSE** commands.

- In the measurement mode, **OPEN** changes the mode to the configuration mode.
- In the configuration mode, **CLOSE** changes the mode to the measurement mode.

The configuration mode does not recognize the **OPEN** command and the measurement mode does not recognize the **CLOSE** command.

5.2.1 OPEN — entering configuration mode

To switch WMT700 from the measurement mode to the configuration mode, use the **OPEN** command.

```
$0OPEN<enter>
```

Name	Description
$	Fixed $ character starts the command.
0	Sensor address. All sensors answer 0 address.
OPEN	The **OPEN** command
<enter>	To activate the command, press **ENTER**.

After the **OPEN** command the sensor switches from measurement mode to configuration mode. The following symbol is displayed:

```
>
```

If the port protocol is SDI-12, ("`s comX_protocol,1`"), type **0OPEN** <ENTER>.

5.2.2 CLOSE — exiting configuration mode

To switch from the configuration mode to the measurement mode, use the **CLOSE** command.

```
>CLOSE<enter>
```

Name	Description
>	Configuration mode prompt
CLOSE	The **CLOSE** command.
<enter>	To activate the command, press **ENTER**.

5.3 Configuration

The initial settings are configured at the factory according to your order. You can start using WMT700 directly after installation unless you want to check and/or change the settings.

You can configure WMT700 settings for serial communication or analog output with configuration commands over the serial port. Before configuration, set the port to the configuration mode.

You can configure WMT700 by sending individual commands or by loading a configuration file to the sensor.

You can use one serial port in the configuration mode and operate WMT700 from the other serial port.

WMT700 provides:

- Parameter handling commands (page 104)
- Wind measurement control commands (page 108)
- Diagnostics and support commands (page 109)
- Information commands (page 110)

If the **messages** parameter value is 1, enabled, WMT700 responds to an invalid command with an error message. If the **messages** value is 0, disabled, WMT700 does not respond to the commands. You can fetch the most recent error data in the configuration mode with the **ERRORS** command.

Table 34 Configuration mode commands

Command	Description
?	Displays a list of configuration commands.
BAUD	Changes or displays serial port settings.
CLEARERR	Resets error counters.
CLOSE	Switches the serial port to measurement mode.
ERRORS	Fetches the error codes and counter information from WMT700.
G	Displays either all or specified parameters.
H	Displays a list of data messages and available values for measurement unit, profile, baud rate, interface, and analog output mode.
MEAS	Starts wind measurement based on the user-configurable averaging time. WMT700 does not send data messages automatically.
POLL	Tests data polling.
RESET	Resets WMT700.
S	Changes selected parameters or defines new data messages.
START	Starts continuous measurement.
STOP	Stops continuous measurement.
VERSION	Displays the software version.
WIND_GET	Fetches wind calibration information.

More information

- ERRORS — get error codes and counts (page 109)
- Ordering options (page 20)
- Restoring serial port settings (page 170)

5.4 Parameter handling commands

All the commands in the configuration mode are in the following form:

```
>CMD x,y<enter>
```

Name	Description
>	Configuration mode prompt
CMD	Command

Name	Description
	Space
x	Any parameter in Table 69 (page 189)
,	Comma
y	Value of the parameter
<enter>	Press **ENTER** to activate the command.

The parameter name and allowed parameter values depend on the command. For certain commands they are optional. In the command descriptions, WMT700 configuration mode prompt and **ENTER** are left out for clarity.

5.4.1 S — set parameter

With the **S** command you can define new data messages, configure data messages, and change parameter values.

If the **messages** parameter value is 1, enabled, WMT700 responds to an invalid command with an error message. If the **messages** value is 0, disabled, WMT700 does not respond to the commands. You can fetch the most recent error data in the configuration mode with the **ERRORS** command.



Do not switch the power supply off immediately after the **S** command. To save the updated parameters, power must be on for at least 5 seconds after the **S** command.

```
S x,y
```

Name	Description
x	Any parameter in Configuration parameter descriptions (page 189).
y	Value of the parameter

Example 1

The baud rate is set to 2400 bps, parity to even, data bits to 8 bits, and stop bits to 1 bit. You must reset WMT700 before the communication settings take place.

```
S com1_baud,2 S com1_parity,1 S com1_data,8 S com1_stop,1
```

You can also change or view the serial port settings with the **BAUD** command. With the **BAUD** command the communication settings take place immediately.

Example 2

The analog output 1 is set to send measurement data as a current signal, the gain is set to 1 mA/m/s and the offset to 4 mA.

```
S aout1_o,0.004 S aout1_g,0.001 S aout1mode,0
```

Example 3

Both analog outputs are disabled to reduce power consumption.

```
S aout1mode,3 S aout2mode,7
```

More information

- Configuration parameter descriptions (page 189)
- ERRORS — get error codes and counts (page 109)

5.4.2 G — get parameter

The **G** command shows the values of the configuration parameters. You can either display all parameter values or only certain values.

You can view all parameter values with the **G** command if you do not specify any parameters in the command.

```
G
```

To view specified parameter values with the **G** command.

```
G x
```

Name	Description
x	Any parameter in Configuration parameter descriptions (page 189).

Example

The averaging time is 4 seconds:

```
G wndAvg
wndAvg ,4
```

More information

- Configuration parameter descriptions (page 189)

5.4.3 BAUD — display or set port settings

This command shows or changes values of the serial port settings.

More information

- Restoring serial port settings (page 170)

5.4.3.1 Set port settings

You can use the **BAUD** command to change the bit rate, parity bit, data bits, stop bit, and communication profile of the selected serial port.

There is a 100 ms delay after which WMT700 takes the settings into use. Do not send commands to WMT700 during this time.

```
BAUD x,y,z,w
```

Name	Description
x	Bit rate (300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200)
y	Data bits (7 or 8)
z	Parity (n = none, e = even, o = odd)
w	Stop bits (1 or 2)

Example

The bit rate is set to 115200, data bits to 8, parity to none, and stop bits to 1:

```
BAUD 115200,8,n,1
```

5.4.3.2 Display port settings

You can use the **BAUD** command to display the current serial port settings.

```
BAUD
```

5.5 Wind measurement control commands

5.5.1 MEAS — single wind measurement

The **MEAS** command starts wind measurement based on the user-configurable averaging time. WMT700 does not send the data message automatically. Use the polling command to fetch measurement data in the required data message format.

```
MEAS
```

5.5.2 START — start continuous measurement

The **START** command starts continuous wind measurement. Continuous measurement starts when you exit the configuration mode or restart WMT700.

```
START
```

You can retrieve data with a polling command or configure WMT700 to send data messages at selected intervals. You can set the interval for automatic messages with the **autoInt** parameter.

5.5.3 STOP — stop wind measurement

The **STOP** command stops continuous wind measurement.

```
STOP
```

To restart measurement, use the **MEAS** or **START** command. You can fetch the most recent measurement data at any time with the polling command.

5.6 Diagnostics and support commands

5.6.1 ERRORS — get error codes and counts

The **ERRORS** command fetches error information from WMT700.

```
ERRORS
```

The response:

```
a,b,c,d,e,f
```

Name	Description
a	Number of events since latest reset
b	Code for the first event since latest reset
c	Code for the most recent event
d	Number of errors since latest reset
e	Code for the first error since latest reset
f	Code for the most recent error

Example

```
1,3,3,10,13,13
```

- Number of events since latest reset: 1
- Code for the first event since latest reset: 3
- Code for the most recent event: 3
- Number of errors since latest reset: 10
- Code for the first error since latest reset: 13
- Code for the most recent error: 13

If no errors or events have occurred yet, the response is the following:

```
0,0,0,0,0,0
```

More information

- Error and event messages (page 169)

5.6.2 CLEARERR — reset error codes and counts

The **CLEARERR** command resets the error counters of WMT700.

```
CLEARERR
```

5.6.3 POLL — get message

The **POLL** command fetches the latest measurement data from WMT700. You must specify the data message format in the command.

Vaisala recommends using the **POLL** command only for testing data connections. To fetch measurement data for other purposes, switch the serial port to the measurement mode. The polling command in the measurement mode depends on the selected profile.

```
POLL y
```

Name	Description
y	Identification number for the data message format.

More information

- Data messages (page 120)

5.6.4 RESET — reset CPU

This command resets WMT700.

```
RESET
```

5.7 Information commands

5.7.1 ? — display command set

This command displays a list of available configuration commands.

```
?
```

5.7.2 H — display help and messages

This command displays a list of supported data messages and their identification numbers as well as the available values for wind speed measurement unit, profile, baud rate, interface, and analog output.

```
H
```

5.7.3 VERSION — show firmware version

This command displays the label and version of the WMT700 software.

```
VERSION
```

5.7.4 WIND_GET — get calibration data

This command fetches the WMT700 calibration date and other calibration data. This information is mostly intended for Vaisala technical support.

```
WIND_GET
```

5.8 Configuration parameters

A number of parameters affect WMT700 functionality.

To view and set parameter values, use the **G** and **S** commands.

You can configure WMT700 by sending individual commands or by loading a configuration file to the sensor.

In the automatic message mode, to initiate continuous measurement, use the **START** command.

More information

- Configuration parameter descriptions (page 189)
- Upgrading from WS425 to WMT700 (page 95)
- Loading settings from configuration files (page 116)
- START — start continuous measurement (page 108)

5.9 Configurable data messages

You can define new data messages for automatic messaging or polling with the WMT700 profile. Each item in a user-configurable data message string consists of 2 characters after the \ character. For example, the item for wind speed is **\ws**. The maximum number of characters for a string is 80.

The characters are passed to messages as they are. All visible ASCII characters are allowed, except the available items for data message strings listed in Table 35 (page 112).



You can only use the user-configurable data messages with the WMT700 protocol.

More information

- Data messages (page 120)

5.9.1 Data message configuration

After you have defined the new data message, you can test the message by polling it in the configuration mode.

More information

- POLL — get message (page 110)
- START — start continuous measurement (page 108)

5.9.1.1 Items for data messages

The user-configurable data messages can contain wind measurement, control character, check sum, and monitoring items. Configure new data messages with the **msg1**, **msg2**, **msg3**, and **msg4** parameters. All available items are listed in the following tables.

Table 35 Wind measurement items for data messages

Item	Description
\ad	Address
\dm	Wind direction minimum calculated over the averaging period
\dx	Wind direction maximum calculated over the averaging period
\gu	Wind gust speed
\lu	Wind lull speed
\rg	Signal quality
\st	Speed of sound

Item	Description
\Ts	Sonic temperature
\Tz	10 s average of sonic temperature
\va	Validity of the measurement data. The available values are:1 = Valid wind measurement data0 = Unable to measure
\w1	Wind direction when the peak speed (\wp) occurred
\wd	Wind direction, average
\wm	Wind speed minimum calculated over the averaging period
\wp	Wind speed maximum calculated over the averaging period
\ws	Wind speed, average
\wx	Wind speed average, x component
\wy	Wind speed average, y component

Table 36 Control character

Item	Description
\01	SOH (start of heading)
\02	STX (start of text)
\03	ETX (end of text)
\04	EOT (end of transmission)
\cr	CR (carriage return)
\lf	LF (line feed)
\se	Checksum calculation end point
\sp	Print checksum
\ss	Checksum calculation start point

Table 37 Monitoring items for data messages

Item	Description
\er	Status code. The code is a decimal number. Each bit corresponds to a status flag. For a list of the bits, see Status flags (page 115)
\fb	0 = No error 1 = Blocked sensor
\fh	0 = No error 1 = Heater failure. Incorrect heater resistance.

Item	Description
\fs	0 = No error 1 = Wind speed exceeds operating limits 2 = Sonic temperature exceeds operating limits 3 = Wind speed and sonic temperature exceed operating limits
\ft	This value indicates temperature sensor failures when converted to binary format: Bit 0 = Temperature sensor 1 failure Bit 1 = Temperature sensor 2 failure Bit 2 = Temperature sensor 3 failure
\fv	0 = No error 1 = Supply voltage (Vh or Vi) too high 2 = Supply voltage (Vh or Vi) too low
\pa	Average heating power
\ra	Heater resistance
\ta	Transducer temperature
\ti	Internal temperature
\vh	Heater voltage
\vi	Supply voltage

Example

In this example a new data message with identification number 1 is defined. The items included in the message are average wind speed, average wind direction, and supply voltage. `S msg1,$\ws,\wd,\vi\cr\lf`

When the above message is polled, WMT700 sends the following data if the average wind speed is 5 m/s, the average wind direction is 128 degrees, and the supply voltage is 23.4: `$05.00,128,23.4<CR><LF>`

Example

In this example the data message 2 is set to include the following items:

- SOH
- Checksum calculation start point
- Wind speed, average
- Wind direction, average
- Wind gust speed
- Wind lull speed
- Wind direction minimum
- Wind direction maximum
- Wind direction during the peak speed (wp) occurred
- Checksum calculation end point
- EOT
- Print checksum
- CR
- LF

```
S msg2,\01\ss$\ws,\wd,\gu,\lu,\dm,\dx,\w1\se\04\sp\cr\lf
```

WMT700 sends the following message that starts with the SOH character which is excluded from the checksum. The checksum ends before the EOT character. The checksum (in this case, D8) is printed after the EOT character.

```
┌_$02.66,98.21,02.66,02.60,95.68,99.53,99.34_D8<CR><LF>
```

The non-printable characters are shown above as ┌┘ and <CR><LF>.

5.9.2 Status flags

The following list describes the status flags included in the data message when the status code item `\er` has been added to the message. Each bit corresponds to a specific status.

Status flags are coded in decimal number format. To extract each bit from the status code, the decimal number must be converted to binary format.

Table 38 Status

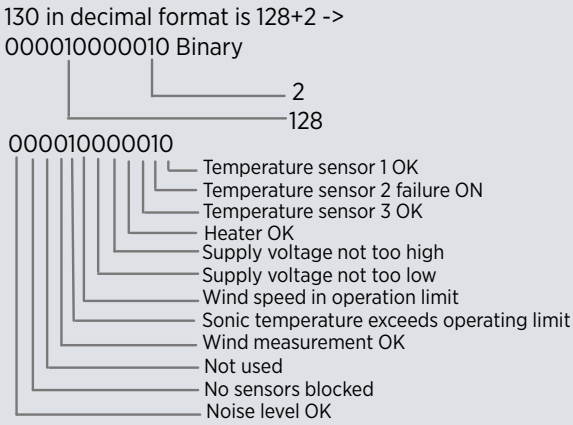
Bit	Description
0	Temperature sensor failure on north transducer
1	Temperature sensor failure on east transducer
2	Temperature sensor failure on south transducer
3	Heater failure. Incorrect heater element resistance.
4	Too high (Vh >40 V or Vi 40 V) supply voltage.
5	Too low (Vh <18 V or Vi <10 V) supply voltage.
6	Wind speed exceeds operating limits.

Bit	Description
7	Sonic temperature exceeds operating limits.
8	Wind measurement fails over 80% of the averaging time. Reported wind is still correct.
9	Not used.
10	Blocked sensor. Reported wind is still correct.
11	High noise level.
12	Not used.

The status flags are set when an event is detected. The flags are cleared when a status message is reported. To get the current situation, you must read the status message twice. The first status message shows all events since the last read. The second status message shows the current situation.

Example

The diagnostics has recognized the following concurrent failures: temperature sensor failure on east transducer (bit 1) and sonic temperature exceeds operating limits (bit 7). A binary value representing this combination (bit 1 and bit 7 => "1") in decimal format is 130.



5.9.3 Loading settings from configuration files

You can configure WMT700 settings over the RS-485, RS-422, or RS-232 interface using configuration files. Send a text file containing the configuration settings to the sensor with a terminal program, such as Tera Term or Windows HyperTerminal.

1. In the terminal program, to fetch the current WMT700 parameters, type **G**.
2. To disable error messages, type **S messages,0**
3. Copy the values from the terminal program to a file. Remove the parameters you do not want to change and the **messages** parameter to avoid switching on messaging during the transfer.
4. To clear the error counters, type **CLEARERR**.
5. To change the settings, send the file to WMT700.
6. To verify that the parameters are in the allowed range and valid, type **ERRORS**.

   If all values are valid, WMT700 sends the following response:

   ```
   0,0,0,0
   ```

   If the response for parameter setting is not disabled but the messages parameter is set to 1 instead, WMT700 responds to each **S** command confirming the new parameter values. If an error occurs during the configuration, WMT700 sends a response containing the error messages.

   RS-485 is a half-duplex interface. If the RS-485 interface is used and response for parameter setting is enabled (messages parameter is set to 1), a simple terminal program cannot be used for loading parameters from file.

Example

This configuration file contains all user-configurable WMT700 parameters.

```
S wndAvg,1.00000
S wndUnit,0
S wndDirOffset, 0.00000
S wndOrientation,0
S wndGustTime,3.00000
S wndCover,4
S wndVector,1
S wndCoast,0.00000
S autoInt,1.00000
S autoSend,0
S autoPort,1
S com1_baud,4
S com1_parity,0
S com1_data,8
S com1_stop,1
S com1_protocol,0
S com1_delay,20
S com2_baud,4
S com2_parity,0
S com2_data,8
S com2_stop,1
S com2_protocol,0
S com2_delay,20
S com2_interf,0
S sleepTime,5
S startDelay,5
S heaterOn,1.00000
S freqType,0
S aout1_o,0.00000
S aout1_g,1.00000
S aout1minv,0.00000
S aout1maxv,32000.0
S aout1err,1000.00
S aout1mode,3
S aout2_g,1.00000
S aout2_o,0.00000
S aout2minv,0.00000
S aout2maxv,32000.0
S aout2err,1000.00
S aout2mode,7
S msg1,\ss$\ws,\wd,\se\sp\cr\lf
S msg2,2
S msg3,3
S msg4,4
S address,A
S messages,1
```

More information

- Configuration parameter descriptions (page 189)

5.10 Operating WMT700

When WMT700 is installed and configured, you can start operating the wind sensor:

- To receive wind measurement data through a serial connection as data messages, use serial communication.
  - If you use the WMT700 profile, see the following operating instructions.
  - If you use WS425 or SDI-12 profiles, see Operating WMT700 with WS425 and SDI-12 profiles (page 133)
- To receive wind measurement data as current, potentiometer, voltage, or frequency output, use analog output.

For a complete list of the serial commands available for the WMT700 series wind sensors, see WMT700 commands (page 182).

More information

- Analog output (page 36)
- Operating WMT700 in WS425 analog output mode (page 130)

5.10.1 Operating WMT700 with terminal program

- Computer with a serial port.
- Required cables for serial connection. See Cables (page 19).
- Any terminal program, such as Tera Term or HyperTerminal for Windows.

1. Connect a cable between your terminal computer, power supply, and WMT700.
2. Open the HyperTerminal program.
3. Cancel the new connection.
4. Select **File > Properties**.
5. Select the correct COM port and select **Configure**.
6. Set the communication parameters according to the configured port settings of WMT700. The default values for WMT700 are:

Communication parameter	Default value
Bits per second	9600
Data bits	8
Parity	None
Stop bits	1
Flow control	None

7. Select **Apply > OK**.

8. Select **Settings > ASCII setup > ASCII sending - Send line ends with line feed (optional) > OK**. Close the **New Connection Properties** window.
9. Select **View > Font > Terminal**.
10. Select **Call > Call**. Type a name and select an icon for the connection. Select **OK**.
11. Switch the sensor power supply on. The following information is displayed: `WMT700 v<version number>`
12. Wait for 4 seconds. WMT700 enters measurement mode automatically.
13. To test the connection, enter configuration mode with the following command: `$0OPEN<CR><LF>`
14. Use the following command to return to measurement mode: `CLOSE<CR><LF>`

You can now start operating WMT700. Note that WMT700 does not send data messages automatically unless configured to do so.

More information

- Measurement mode commands (page 127)
- Communicating with terminal software (page 101)
- Data messages (page 120)

5.10.2 Data messages

The data messages can contain measurement data calculated by WMT700 and information on the status and properties of the wind sensor.

For the automatic message mode, you must set the following parameters:

- `autoInt` (defines the message send interval in seconds, 0.125 s resolution)
- `autoSend` (0 = automatic message mode disabled, for available messages, see the following table.
- `autoPort` (defines where the message is sent: 1 = COM1, 2 = COM2)

When the WMT700 protocol is used, you can use either one of the predefined message formats or user-configurable data message format.

The following table lists the data messages supported by WMT700. You need the data message numbers when you use the WMT700 protocol **`POLL`** command or the automatic message mode with any protocol.

Table 39 Data messages

Data message number	Description
WMT700 data messages	
20	WMT700 NMEA MWV profile message that reports average wind speed and direction.
21	WMT700 profile message that reports average wind speed and direction.

Data message number	Description
22	WMT700 profile message that reports wind speed in x and y components.
23	WMT700 profile message that reports wind speed and direction and self-diagnostics information.
24	WMT700 profile message that reports wind speed and direction and self-diagnostics information, and includes the checksum.
25	WMT700 profile message that reports wind measurement, sonic temperature, and status data, and includes the checksum.
27	ROSA - MES 12 Standard profile message
WS425 and SDI-12 messages	
15	WS425 A/B NMEA Extended profile message
16	WS425 A/B ASCII profile message
17	WS425 A/B SDI-12 profile message for **M** command
18	WS425 A/B SDI-12 profile message for **V** command
19	WS425 A/B NMEA Standard profile message
32	WS425 A/B WAT11 profile message
User-configurable data messages	
1	Items defined by the user.
2	
3	
4	

To select a data message when using polling, specify the corresponding data message identification number in the polling command.

To select a data message when using automatic messages, use the configuration parameters.

More information

- Configuration parameters (page 111)
- POLL — poll data (page 129)

5.10.2.1 WMT700 data message 21

WMT700 data message 21 reports the wind speed and direction in the following format:

```
$\ws,\wd\cr\lf
```

Name	Description
$	Fixed text
\ws	Wind speed, average
\wd	Wind direction, average
\cr	CR (carriage return)
\lf	LF (line feed)

Example

```
$00.08,299.20<cr><lf>
```

- Wind speed, average: 0.08 m/s
- Wind direction, average: 299.2°

5.10.2.2 WMT700 data message 22

WMT700 data message 22 reports the wind speed in x and y components in the following format:

```
$\wx,\wy\cr\lf
```

Name	Description
$	Fixed text
\wx	Wind speed average, x component
\wy	Wind speed average, y component
\cr	CR (carriage return)
\lf	LF (line feed)

Example

```
$-00.04,00.07<cr><lf>
```

Interpretation of the example message:
- Wind speed, average, x component: -0.04
- Wind speed, average, y component: 0.07

5.10.2.3 WMT700 data message 23

WMT700 data message 23 reports wind measurement and self-diagnostics data in the following format:

```
$\ws,\wd,\wp,\wm,\Ts,\vh,\vi,\ta,\er\cr\lf
```

Name	Description
$	Fixed text
\ws	Wind speed, average
\wd	Wind direction, average
\wp	Wind speed, maximum
\wm	Wind speed, minimum
\Ts	Sonic temperature
\vh	Heater voltage
\vi	Supply voltage
\ta	Transducer temperature
\er	Status code. The code is a decimal number. Each bit corresponds to a status flag. See Status flags (page 115).
\cr	CR (carriage return)
\lf	LF (line feed)

```
$03.21,75.83,03.34,03.15,22.37,12.2,23.5,20.0,32<cr><lf>
```

5.10.2.4 WMT700 data message 24

WMT700 data message 24 can be used to receive wind measurement and self-diagnostics data. The checksum is included in the message. WMT700 calculates the checksum by applying 8-bit XOR for all bytes between checksum calculation start point and end point. The result is printed as a 2-digit hexadecimal value.

```
\ss$\ws,\wd,\wp,\wm,\Ts,\vh,\vi,\ta,\er,\se\sp\cr\lf
```

Name	Description
\ss	Checksum calculation start point, not shown in the message
$	Fixed text
\ws	Wind speed, average
\wd	Wind direction, average
\wp	Wind speed, maximum
\wm	Wind speed, minimum

Name	Description
\Ts	Sonic temperature
\vh	Heater voltage
\vi	Supply voltage
\ta	Transducer temperature
\er	Status code. The code is a decimal number. Each bit corresponds to a status flag.
\se	Checksum calculation end point, not shown in the message
\sp	Print checksum (to verify message integrity)

WMT700 data message 24 does not include a device ID and therefore does not support polling.

Example

```
$03.45,76.03,03.58,03.37,21.97,23.8,23.6,23.8,0,D4<cr><lf>
```

Name	Description
Wind speed, average	3.45 m/s
Wind direction, average	76.03°
Wind speed, maximum	3.58 m/s
Wind speed, minimum	3.37 m/s
Sonic temperature	21.97 °C
Heater voltage	23.8 V
Supply voltage	23.6 V
Transducer temperature	23.8 °C
Status code	0
Checksum	D4

More information

- Status flags (page 115)

5.10.2.5 WMT700 data message 25

WMT700 data message 25 reports wind measurement, sonic temperature, and status data. The checksum is included in the message. WMT700 calculates the checksum by applying 8-bit XOR for all bytes between checksum calculation start point and end point. The result is printed as a 2-digit hexadecimal value. The message is in the following format:

```
\ss$\ws,\wd,\wp,\wm,\Ts,\er,\se\sp\cr\lf
```

Name	Description
\ss	Checksum calculation start point, not shown in the message
$	Fixed text
\ws	Wind speed, average
\wd	Wind direction, average
\wp	Wind speed, maximum
\wm	Wind speed, minimum
\Ts	Sonic temperature
\er	Status code. The code is a decimal number. Each bit corresponds to a status flag. See Status flags (page 115).
\se	Checksum calculation end point, not shown in the message
\sp	Print checksum (to verify message integrity)
\cr	CR (carriage return)
\lf	LF (line feed)

Example

```
$03.22,75.29,03.38,03.07,22.13,0,3E<cr><lf>
```

Table 40

Name	Description
Wind speed, average	3.22 m/s
Wind direction, average	75.29°
Wind speed, maximum	3.38 m/s
Wind speed, minimum	3.07 m/s
Sonic temperature	22.13 °C
Status code	0
Checksum	A4

5.10.2.6 ROSA - MES 12 data message

The MES 12 data message 12 is used in the ROSA Surface Analyzer for Roads and Runways system. You can use this data message when WMT700 is connected to the Vaisala ROSA system.

This message contains sensor identifications (sids), corresponding data items, and the synchronization characters SOH, STX, and ETX. The lines are ended by CR and LF characters.

5.10.3 Missing readings

If WMT700 is not able to measure the wind, it indicates a missing reading in the output. The most common reasons for measurement problems are ice, birds, or other foreign objects on the line of measurement.

When the WMT700 profile is used, WMT700 indicates missing readings by showing 999 in the data messages.

When the WMT700 data message 22 is polled, missing readings are indicated with the following response:

```
$999.00,999.00<cr><lf>
```

5.10.4 Error indication

WMT700 provides advanced self-diagnostics for monitoring the status of the wind sensor and the validity of the measurement data. You can use the diagnostics as follows:

- WMT700 checks the status of the internal operational software at each reset by verifying the CRC checksum of the software. The software check is not made periodically; it is only made at each reset. If the checksum is incorrect, WMT700 does not start up. If the checksum is correct, WMT700 continues by calculating the CRC checksum of the parameter memory. In case the parameter memory is corrupted, the sensor replies with the text `Parameters crc error` upon startup. In case the parameter memory checksum is correct, WMT700 replies with the text `ready` as shown in the following example.

```
>$WMT700 v<version number>
ready.
```

- To check the status of the wind sensor, include the status code item `\er` in the data message. You need to convert the status code to a binary number to verify the status. An error code does not indicate that the wind data is invalid.
- To check that the wind data is valid, include the `\va` item in the data message.
- To check other diagnostics-related data, include the required items in the data message.

More information

- Status flags (page 115)
- Items for data messages (page 112)
- WMT700 commands (page 182)

5.11 Measurement mode commands

In the measurement mode, the available commands depend on the selected profile.



For a complete list of serial commands available for all the communication profiles supported by WMT700, see WMT700 commands (page 182).

More information

- WMT700 commands (page 182)
- Operating WMT700 with WS425 and SDI-12 profiles (page 133)

5.11.1 WMT700 profile commands

When you select the WMT700 profile, you can operate WMT700 with these commands. In the command descriptions, `<CR>` is an ASCII carriage return control character and `<LF>` is an ASCII line feed control character. You can send commands at any speed. The command is executed when end-of-line character is received.

Each measurement mode command must start with the user-configurable WMT700 address. It can be any string of printable ASCII characters with the maximum length of 30 characters. Characters `<CR>`, `<LF>`, and `$` are not allowed. If you use `0` as the address in the command, WMT700 responds regardless of the configured address.

If you have enabled response for parameter setting (messages parameter is set to 1), WMT700 responds to an invalid command with an error message.

Table 41 Measurement mode commands

Command	Description
$aMEAS	Starts wind measurement in single measurement mode. The duration of the measurement is based on the user-configurable averaging time.
$aOPEN	Switches the serial port to configuration mode.
$aPOLL,y	Fetches latest measurement data from WMT700.
$aSLEEP	Switches WMT700 from normal operating mode to low-power mode.

$	Fixed text
a	WMT700 address. If the value is **0**, it refers to any WMT700 address.
y	Identification number for the data message format.

5.11.1.1 MEAS — start measurement

The **MEAS** command starts wind measurement in single measurement mode based on the user-configurable averaging time. WMT700 does not send the data message automatically. Use the polling command to fetch the measurement data in the required format.

```
$aMEAS<CR><LF>
```

Name	Description
$	Fixed text
a	WMT700 address. If the value is **0**, it refers to any WMT700 address

5.11.1.2 OPEN — enter configuration mode

The **OPEN** command switches the serial port to the configuration mode.

```
$aOPEN<CR><LF>
```

Name	Description
$	Fixed text
a	WMT700 address. If the value is **0**, it refers to any WMT700 address

WMT700 automatically returns to normal operating mode, if it does not receive commands in 2 minutes, or if it detects multiple unrecognized commands.

5.11.1.3 POLL — poll data

The **POLL** command fetches data from WMT700. You must specify the data message number in the polling command.

When WMT700 is in the low-power mode, it does not receive the first character in the command. You must send an extra character (space) before the polling command to receive data.

```
$aPOLL,y<CR><LF>
```

Name	Description
$	Fixed text
a	WMT700 address. If the value is `0`, it refers to any WMT700 address.
y	Identification number for the data message format.

Example

In this example WMT700 custom data message 1 is polled from WMT700.

```
$0POLL,1<CR><LF>
```

More information

- Data messages (page 120)

5.11.1.4 SLEEP — enter low-power mode

This command switches WMT700 from the normal operating mode to the low-power mode. WMT700 resumes normal operation after sleep period determined by the `sleepTime` parameter has elapsed, or when a character is received on data port COM2. For more information on the `sleepTime` parameter.

```
$aSLEEP<CR><LF>
```

Name	Description
$	Fixed text

Name	Description
a	WMT700 address. If the value is **0**, it refers to any WMT700 address.

More information

- Configuration parameters (page 111)

5.11.2 ROSA - MES 12 profile commands

When the ROSA - MES 12 profile is selected, you can poll data in the MES12 data message format. This data message is used in the ROSA Surface Analyzer for Roads and Runways system. You can use this data message when WMT700 is connected to the Vaisala ROSA system.

5.11.2.1 M 12 — poll MES 12 data message

This command fetches data from WMT700 in the MES 12 data message format.

```
@a M 12<CR><LF>
```

Name	Description
@	Fixed text
a	WMT700 address. The allowed range is from 0 to 99.

More information

- ROSA - MES 12 data message (page 126)

5.12 Operating WMT700 in WS425 analog output mode

5.12.1 Analog output settings

In analog output operation WMT700 takes measurements according to the configured averaging time and synthesizes the analog outputs of wind speed and wind direction with an update interval of 0.25 seconds. The analog output signal type and range depend on the configured settings.

Normally, analog output is enabled and the output settings are preconfigured at the factory according to your order. WMT700 can be operated using these settings directly after the installation. However, the analog output settings of WMT700 can be changed or the analog output functionality can be disabled at any time to save power over the serial interface.

When operating WMT700 in a system configured for WS425, you must configure the analog output settings according to the following table using the **S** command.

Table 42 Required parameters for WS425 analog output operation mode

Parameter name	Default value	Allowed values	Description of how to emulate WS425
`aout1err`	1000	0–32000	Set 1 for voltage output and 625 for frequency output for similar operation as with WS425.
`aout1_g`	1	0–100	Gain for AOUT1. Set 0.017895 for compatibility with WS425 voltage output. Set 11.18 for compatibility with WS425 frequency output.
`aout2_g`	1	0–100	Gain for AOUT2. Set 0.0027855 for compatibility with WS425 potentiometer output.
`aout1mode`	3	0 = Current 1 = Voltage 2 = Frequency 3 = Disabled	Analog output mode for AOUT1. Set 1 for WS425 voltage output compatibility. 2 for WS425 frequency output compatibility.
`aout2mode`	7	4 = Current 5 = Voltage 6 = Potentiometer 7 = Disabled	Analog output mode for AOUT2.Set 6 WS425 potentiometer output compatibility.
`aout1_oaout2_o`	0	-10000 ... 10000	Offset for AOUT1 and AOUT2.Set output offset to 0.

More information

- S — set parameter (page 105)

5.13 Wind speed output

In a system configured for WS425, you can set WMT700 to measure wind speed and send analog output as frequency or voltage.

These sections describe WMT700 analog output:

- Settings are configured according to Analog output settings (page 130).
- Wires are connected according to WMT700 and WS425 analog output signals (page 100) .

5.13.1 Frequency

When frequency is selected as the wind speed analog output, WMT700 sends a pulsed signal of 0 to 10 V with a frequency proportional to wind speed through AOUT1. Every mile per hour adds 5 Hz (WS425) to the frequency. In SI units, a change of 0.894 meters per second adds 10 Hz to the frequency. A frequency counter is required to count the output in Hz and the calculation that scales the result to appropriate units.

5.13.2 Voltage

When voltage is selected as the wind speed analog output, the output from WMT700 varies linearly from 0 VDC at 0 mph to 1 VDC at 125 mph. In SI units, the voltage varies linearly from 0 VDC at 0 m/s to 1 VDC at 55.88 m/s.

5.14 Wind direction output

When wind direction is measured, WMT700 sends analog output as simulated potentiometer output voltage referred to as external reference voltage. The output is a proportional signal 0–100 % of the reference voltage representing the wind direction. The reference voltage must be in the range of 1.0–4.0 V DC (WMS425) or 0–10 V DC (WMT700). The output is 0 V DC at 0 degrees and increases to the reference voltage at 359 degrees.

5.15 Limitations for output signals

You can specify the minimum and maximum values for analog output with the configuration parameters. The output is fixed to the specified values, and the unit depends on the selected analog output mode.

Example

To limit the output 1 in voltage mode to a range of 0.1–5 V, set the analog output minimum value to 0.1 and the analog output maximum value to 5. Type the following commands:

```
S aout1minv,0.1 S aout1maxv,5
```

5.16 Missing readings and error indication

If WMT700 is unable to measure the wind, it indicates a missing reading in the output. The most common reasons for measurement problems are foreign objects (such as ice, birds, or other foreign objects) on the line of measurement or sound reflections from nearby objects (such as wind tunnel walls).

The default error indication is an out-of-range signal that is more than 10 V or 20 mA but other error settings can also be configured.

Example

To set the analog output 1 error indication in voltage mode to 1 V, set the analog output error value to 1. Use the following command:

```
S aout1err,1
```

More information

- Configuration parameter descriptions (page 189)

5.17 Operating WMT700 with WS425 and SDI-12 profiles

Each communication profile has its own section listing the configurable parameters and the available commands and data messages.

5.18 Communication profiles

WMT700 supports the following communication profiles:

- WMT700
- ROSA - MES 12
- WS425 - ASCII
- WS425 - NMEA Extended (version 0183)
- WS425 - SDI-12 (version 1.3)
- WS425 - ASOS

The profile has been preconfigured at the factory according to your requirements specified when ordering WMT700. You can change the profile through the serial interface, if necessary.

5.18.1 Changing communication profile

The communication profile and other settings have been configured at the factory according your specifications. You can start using WMT700 directly after the installation with these settings.

If you want to change the communication profile, you must change all parameters to match the new profile.

5.19 Entering configuration mode

This command switches the serial port to configuration mode. The command works with any communication profile supported by WMT700.

```
$aOPEN<CR><LF>
```

Name	Description
$	Fixed text
a	Value of the **address** parameter. If the value is 0, it refers to any WMT700 address
<CR>	Carriage return
<LF>	Line feed

5.20 F/G ASOS profile

The following table lists the configurable parameters and their allowed and default values for the WS425 F/G ASOS profile.

Table 43 Configurable parameters for WS425 F/G ASOS profile

Parameter	Default value	Profile-specific allowed values	Description
autoSend	0	0 = Automatic messages disabled	Automatic data message number. Selects the data message format for automatic messages
com1_protocol	0 [1)]	2 = WS425 F/G ASOS	Profile for serial port COM1
com2_protocol	2	2 = WS425 F/G ASOS	Profile for serial port COM2
com2_interf	N/A [2)]	0 = RS-485 1 = RS-422 3 = RS-232	Interface for serial port COM2
wndAvg	5	0.125–3600 Resolution: 0.125	Averaging time for wind measurement in seconds
wndGustTime	3	0.25–3600 Resolution: 0.25	Averaging time for wind minimum and maximum in seconds
wndOrientation	0	0 = Array facing up 1 = Array facing down	Orientation of the array of WMT700
wndUnit	0 [2)]	0 = Meters per second (m/s) 1 = Miles per hour (mph) 2 = Kilometers per hour (km/h) 3 = Knots (knot)	Wind speed unit

Parameter	Default value	Profile-specific allowed values	Description
`wndVector`	0	0 = Scalar averaging	Wind averaging method

1) *The parameter has no protocol-specific default value. It is determined separately in the configuration code.*
2) *Wind speed unit and COM2 digital communication interface are defined in the order form. Default setting may be any of the allowed options, and it can be verified from the unit's configuration code.*

To start continuous measurement, use the **START** command.

To stop measurement, use the **STOP** command.

5.20.1 WS425 F/G ASOS commands

WMT700 responds to each command with a fixed-length message. In the command descriptions, <CR> is an ASCII carriage return control character and <LF> is an ASCII line feed control character.

When the WS425 F/G ASOS profile is selected, WMT700 only responds to upper case characters.

The following commands are available for operating WMT700 with the WS425 F/G ASOS profile.

Table 44 WS425 F/G ASOS commands

Command	Description
WA	Requests average wind speed and direction message.
WS	Requests the verbose built-in test (BIT) results.
WT	Requests the short response BIT results and status.
WD	Reports the BIT status.
WF	Returns a fixed pattern of data

The **WA** command is executed by the ASOS at an interval that ranges from 1 to 30 seconds. For the **WA** command, WMT700 responds to the ASOS interrogation poll within 250 milliseconds of receiving the request.

The following WS425 F/G ASOS commands cannot be used with WMT700: **WB**, **WFIRMWARE**, **WJ**, **WR**, **WCAL**, **WH**, **WCDV**, **WSTK**, **WL**, **WM**, **WN**, **WSST**, and **WATE**. You can only configure WMT700 in the configuration mode. For a list of configuration commands for WMT700, see Configuration (page 103).

5.20.1.1 WA — fetch averaged wind speed and direction

This command requests the averaged wind speed and direction message with peak winds.

```
WA <CR><LF>
```

The response to the **WA** command consists of the averaged wind speed and direction data, peak wind speed, and associated direction. The average wind speed is a scalar running average of the fundamental 1-second interval wind speed measurement made by WMT700.

You can set the wind averaging time and gust time with the **wndAvg** and **wndGustTime** parameters. Set the **wndVector** parameter to **0** to use scalar averaging.

The command also fetches the WMT700 status, the averaging time for average and peak wind speed and wind direction, and signal quality.

More information

- WS425 F/G ASOS data message (page 140)

5.20.1.2 WS — fetch internal diagnostics information

The **WS** command requests the verbose built-in test (BIT) results.

```
WS<CR><LF>
```

The command gives a textual run down of the results of all built-in tests. In every line, except the bad reading counter, the pass/fail indication is given with the single character P or F. This is followed by the description of the measured parameter, which is followed by the actual measured value.

The Bad 1 second readings counter is a running total of the number of fundamental 1-second readings that the sensor flagged as bad. This number rolls over to zero after reaching the count value of 65535. It is initialized to zero on each power-up or any other activity that performs a re-initialization of the sensor. The time measurement quality indices are given for path numbers as follows:

- Path 0 is from south transducer to north transducer
- Path 1 is from north transducer to south transducer
- Path 2 is from north transducer to east transducer
- Path 3 is from east transducer to north transducer
- Path 4 is from east transducer to south transducer
- Path 5 is from south transducer to east transducer

The response:

```
<CR><LF>
P Heater voltage 22.3 Volts <CR><LF>
P Array heater resistance 12.0 Ohms <CR><LF>
P Heaters off voltage 0.00 Volts <CR><LF>
P Thermistor temperature 30.3 C <CR><LF>
F Incoming supply voltage 11.5 Volts <CR><LF>
P 5.0 volt supply 5.00 Volts <CR><LF>
P 10 volt supply 10.00 Volts <CR><LF>
- Bad 1 second reading counter 0 <CR><LF>
P Path 0 signal quality index 99 <CR><LF>
P Path 1 signal quality index 99 <CR><LF>
P Path 2 signal quality index 99 <CR><LF>
P Path 3 signal quality index 99 <CR><LF>
P Path 4 signal quality index 99 <CR><LF>
P Path 5 signal quality index 99 <CR><LF>
```

The test limits are listed in the following table.

Test		Limit
Heater voltage		18.0–40.0 V
Array heater resistance range		
Heating option		
	Non-heated	Not applicable
	Heated transducers	46.5–77.5 Ohm
	Heated transducers and arms	9–15 Ohm
	Heated transducers, arms and body	9–15 Ohm
Incoming supply voltage		18.0–40.0 V
5.0 V supply		4.5–5.5 V
10 V supply		9.0–11.0 V
Signal quality index		Above 50

5.20.1.3 WT - request short response BIT results and status

The **WT** command requests the short response built-in test (BIT) results and status. The command format:

```
WT CR LF
```

The response:

Name	Description
Byte 1	STX start of text ASCII control character
Byte 2	W sensor ID
Byte 3	T command identifier
Byte 4	P or F for heater voltage pass or fail
Byte 5-8	XX.X format heater voltage (volts RMS)
Byte 9	P or F for array heater resistance pass or fail
Byte 10-12	X.X or XX. (format as required) for array heater resistance (ohms)
Byte 13	P or F for pass or fail on heater off voltage
Byte 14-16	X.X format heater off voltage (volts RMS)
Byte 17	P or F for pass or fail thermistor temperature
Bytes 18-20	Thermistor temperature (degrees Celsius)
Byte 21	P or F for incoming supply voltage pass or fail
Byte 22-25	XX.X format incoming supply voltage (volts DC)
Byte 26	P or F for 5 volt supply pass or fail
Bytes 26-29	X.XX format 5 volt supply voltage (volts DC)
Byte 30	P or F for 10 volt supply pass or fail
Bytes 31-34	XX.X format 10 volt supply voltage (volts DC)
Byte 35	ASCII hyphen character (-)
Bytes 36-40	XXXXX format bad 1 second reading counter
Byte 41	P or F for path 0 Signal Quality Index pass or fail
Bytes 42-43	XX format path 0 Signal Quality Index
Byte 44	P or F for path 1 Signal Quality Index pass or fail
Bytes 45-46	XX format path 1 Signal Quality Index
Byte 47	P or F for path 2 Signal Quality Index pass or fail
Bytes 48-49	XX format path 2 Signal Quality Index
Byte 50	P or F for path 3 Signal Quality Index pass or fail
Bytes 51-52	XX format path 3 Signal Quality Index
Byte 53	P or F for path 4 Signal Quality Index pass or fail
Bytes 54-55	XX format path 4 Signal Quality Index
Byte 56	P or F for path 5 Signal Quality Index pass or fail
Bytes 57-58	XX format path 5 Signal Quality Index

Name	Description
Bytes 59-60	XX hexadecimal ASCII for modulo 256 checksum for Character positions 2 through 58
Byte 61	ETX end of text ASCII control character
Byte 62	ASCII carriage return control character
Byte 63	ASCII line feed control character

5.20.1.4 WD - report status of built-in tests

The **WD** command reports the status of the built-in tests (BIT). The command offers a concise report on the pass/fail status of all BITs. The command format is:

```
WD CR LF
```

The response:

```
STX WD PPPPPPPPPPP CS ETX CR LF
```

Name	Description
STX	ASCII start of test control character (position 1)
WD	Command identifier (positions 2,3)
P or F	Pass/Fail for 12 built in tests specified in WS command above in the order shown in the WS command text (positions 4-15) except Thermistor temperature.
CS	Modulo 256 hexadecimal checksum of all characters from position 2 through the last P or F (positions 16,17)
EXT	ASCII end of text control character (position 18)
CR	ASCII carriage return control character (position 19)
LF	ASCII line feed control character (position 20)

5.20.1.5 WF - return fixed pattern of data

The **WF** command returns a fixed pattern of data. This command can be used to verify the communications link. The command format is:

```
WF CR LF
```

The data fields are fixed at the following values:

Name	Description
Status	F
Wind direction	678
Peak wind direction	567
Wind averaging time	21
Peak wind averaging time	09
Wind speed	876.5
Peak wind speed	432.1

Example of **WF** output:

```
WFF6785672109876.5432.1K99xx
```

5.20.2 WS425 F/G ASOS data message

WMT700 responds to the **WA** command with a data message.

- The sensor status (byte 4) indicates the following:
  - P (Pass) indicates that all diagnostic tests have passed and WMT700 is functioning normally.
  - F (Fail) indicates that one or more of the diagnostic tests have failed. You can then request diagnostics and extended tests (WS) to further isolate the problem.
  - H (Heater failure) indicates that the wind reading is valid but one or more built-in heater diagnostic tests have failed.
- When the status byte is F, the wind direction fields are set to 999 and the wind speed fields are set to 999.9 in the applicable sensor response messages.
- The signal quality (bytes 26-27) is a numeric value from 0 to 99 representing the data quality of processed data samples during the averaging time.
  For example, a value of 99 signifies that all data samples were determined to be valid and processed during the averaging time. If some samples were determined to be "missing", these samples were not processed and the reported signal quality is a proportional value less than 99.
- Bytes 28-29 are the modulo 256 hexadecimal checksum of the ASCII values calculated for bytes from 2 to 27.

Table 45 WS425 F/G ASOS data message

Byte	Description
1	Start of text
2	Sensor ID
3	Command identifier

Byte	Description
4	Sensor status: [1) 2)] • P = Pass • F = Fail • H = Heater failure
5-7	Averaged wind direction (degrees)
8-10	Wind direction (degrees) @ peak wind speed
11-12	Averaging time for wind speed and direction
13-14	Averaging time for peak wind speed and direction (seconds)
15-19	Averaged wind speed
20-24	Peak wind speed since last WA command
25	Wind speed unit: • M = Miles per hour • K = Knots • L = Kilometers per hour • T = Meters per second
26-27	Signal quality [3)]
28-29	Hex checksum [4)]
30	End of text
31	Carriage return
32	Line feed

1) The sensor status (byte 4) indicates the following:

- *P (Pass) indicates that all diagnostic tests have passed and WMT700 is functioning normally.*
- *F (Fail) indicates that one or more of the diagnostic tests have failed. You can then request diagnostics and extended tests (WS) to further isolate the problem.*
- *H (Heater failure) indicates that the wind reading is valid but one or more built-in heater diagnostic tests have failed.*

2) When the status byte is F, the wind direction fields are set to 999 and the wind speed fields are set to 999.9 in the applicable sensor response message.

3) The signal quality (bytes 26-27) is a numeric value from 0 to 99 representing the data quality of processed data samples during the averaging time. For example, a value of 99 signifies that all data samples were determined to be valid and processed during the averaging time. If some samples were determined to be "missing", these samples were not processed and the reported signal quality is a proportional value less than 99.

4) Bytes 28-29 are the modulo 256 hexadecimal checksum of the ASCII values calculated for bytes from 2 to 27.

Example

```
WAP2131870503012.6014.7K99xx
```

Interpretation of the example message:

- Sensor ID: W
- Command identifier: A
- Sensor status: P = pass
- Averaged wind direction (degrees): 213
- Wind direction (degrees) @ peak wind speed: 187
- Averaging time for wind speed and direction: 05
- Averaging time for peak wind speed and direction (seconds): 03
- Averaged wind speed: 012.6
- Peak wind speed since last WA command: 014.7
- Wind speed units: K = knots
- Signal quality: 99
- Hex checksum (refer to note 4): xx

5.21 WS425 A/B NMEA Standard profile

When the WS425 A/B NMEA Standard profile is configured, WMT700 sends messages based on the configured automatic message interval. There are no operating commands available for the user.

The following table lists configurable parameters and their allowed and default values for the WS425 A/B NMEA Standard profile

Table 46 Configurable parameters for WS425 A/B NMEA Standard profile

Parameter	Default value	Profile-specific allowed values	Description
`address`	1	String with 1 character	Address for WMT700
`autoInt`	1	0.125–1000 Resolution: 0.125	Automatic message interval in seconds. Do not select a message interval that is shorter than the time it takes to send a data message
`autoPort`	1	1 = COM1 port 2 = COM2 port	Serial port to which WMT700 sends automatic data messages
`autoSend`	0	0 = Automatic messages disabled 19 = NMEA automatic data message	Automatic data message number. Selects the data message format for automatic messages

Parameter	Default value	Profile-specific allowed values	Description
com1_protocol	0 [1)]	4 = WS425 A/B NMEA Standard	Profile for serial port COM1
com2_protocol	0	4 = WS425 A/B NMEA Standard	Profile for serial port COM2
com2_interf	N/A [2)]	0 = RS-485 1 = RS-422 3 = RS-232	Interface for serial port COM2
wndAvg	1	0.125–3600 Resolution: 0.125	Averaging time for wind measurement in seconds
wndOrientation	0	0 = Array facing up 1 = Array facing down	Orientation of the array of WMT700
wndUnit	0 [2)]	0 = Meters per second 1 = Miles per hour 2 = Kilometers per hour 3 = Knots	Wind speed unit
wndVector	1	0 = Scalar averaging	Wind averaging method

1) *The parameter has no protocol-specific default value. It is determined separately in the configuration code.*
2) *Wind speed unit and COM2 digital communication interface are defined in the order form. Default setting may be any of the allowed options, and it can be verified from the unit's configuration code.*

5.21.1 WS425 A/B NMEA Standard data message

The standard variable length, comma-separated, MWV wind message is defined by NMEA 0183 V2.20 as follows:

```
$WIMWV,<dir>,<ref>,<spd>,<uni>,<sta>*<chk><CR><LF>
```

Name	Description
$WIMWV	Fixed text
<dir>	Wind angle: 0 to 359 degrees
<ref>	Reference: R = Relative
<spd>	Wind speed

Name	Description
<uni>	Wind speed unit: • K = Kilometers per hour • M = Meters per second • N = Knots
<sta>	Status: • A = Data valid • V = Invalid data
*	Fixed text
<chk>	Checksum (8-bit XOR, excluding $ and *)
<CR>	Carriage return code, ASCII 0DH
<LF>	Line feed code, ASCII 0AH

When the NMEA Standard profile is selected, the **autoInt** parameter must have a non-zero value since no polling command is defined for this profile.

Missing readings

If data is missing due to a measurement problem, the NMEA messages show V in the status field. Wind speed and wind direction fields are left empty.

5.22 WS425 NMEA extended profile (v. 0183)

When you have selected WS425 A/B NMEA Extended profile, you can set WMT700 to send messages based on the configured automatic message interval or poll data using the **$WIP** command.

Table 47 WS425 NMEA extended profile parameter descriptions

Parameter	Default value	Profile-specific allowed values	Description
address	A	String with 1 character	Address for WMT700
autoInt	1	0.125–1000 Resolution: 0.125	Automatic message interval in seconds. Do not select a message interval that is shorter than the time it takes to send a data message

Parameter	Default value	Profile-specific allowed values	Description
autoPort	2	1 = COM1 port 2 = COM2 port	Serial port to which WMT700 sends automatic data messages
autoSend	15	0 = Automatic messages disabled 15 = NMEA automatic data message	Automatic data message number. Selects the data message format for automatic messages.
com1_protocol	0 [1)]	5 = WS425 A/B NMEA Extended	Profile for serial port COM1
com2_protocol	5	5 = WS425 A/B NMEA Extended	Profile for serial port COM2
com2_interf	N/A [2)]	0 = RS-485 1 = RS-422 3 = RS-232	Interface for serial port COM2
wndAvg	3	0.125–3600 Resolution: 0.125	Averaging time for wind measurement in seconds
wndOrientation	0	0 = Array facing up 1 = Array facing down	Orientation of the array of WMT700
wndUnit	0 [2)]	0 = Meters per second 1 = Miles per hour 2 = Kilometers per hour 3 = Knots	Wind speed unit
wndVector	0	0 = Scalar averaging	Wind averaging method

1) *COM1 service port is always by default 0 - WMT700 protocol. This can be changed using serial commands if COM1 is needed for protocol-specific communication*
2) *Wind speed unit and COM2 digital communication interface are defined in the order form. Default setting may be any of the allowed options, and it can be verified from the unit's configuration code.*

5.22.1 WS425 A/B NMEA extended commands

This command polls data from WMT700.

```
$WIP<id>Q,*<chk><CR><LF>
```

Name	Description
`$WIP`	Fixed text
`<id>`	Data ID; A–Z
`Q`	Fixed text
*	Fixed text
`<chk>`	Checksum (8-bit XOR, excluding $ and *)
`<CR>`	Carriage return code, ASCII 0DH
`<LF>`	Line feed code, ASCII 0AH

To use WMT700 with the NMEA Extended profile, either set the **`autoSend`** parameter to **`0`** to enable polling or define a fixed output interval with the **`autoInt`** parameter. If you are using automatic messages, the value for the **`autoSend`** parameter must be set to **`15`**.

Table 48 Checksum table

ID character <id>	Checksum <chk>	Polling string
A	72	**`$WIPAQ,*72<CR><LF>`**
B	71	**`$WIPBQ,*71<CR><LF>`**
C	70	**`$WIPCQ,*70<CR><LF>`**
D	77	**`$WIPDQ,*77<CR><LF>`**
E	76	**`$WIPEQ,*76<CR><LF>`**
F	75	**`$WIPFQ,*75<CR><LF>`**
G	74	**`$WIPGQ,*74<CR><LF>`**
H	7B	**`$WIPHQ,*7B<CR><LF>`**
I	7A	**`$WIPIQ,*7A<CR><LF>`**
J	79	**`$WIPJQ,*79<CR><LF>`**
K	78	**`$WIPKQ,*78<CR><LF>`**
L	7F	**`$WIPLQ,*7F<CR><LF>`**
M	7E	**`$WIPMQ,*7E<CR><LF>`**
N	7D	**`$WIPNQ,*7D<CR><LF>`**
O	7C	**`$WIPOQ,*7C<CR><LF>`**

5.22.2 WS425 A/B NMEA Extended data message

WS425 A/B NMEA Extended data message is as follows:

```
$P<id>MWV,<dir>,<ref>,<spd>,<uni>,<sta>*<chk><CR><LF>
```

Name	Description
$P	Fixed text
<id>	Data ID, A–Z
MWV	Fixed text
<dir>	Wind angle: 0–359 degrees
<ref>	Reference: R = relative
<spd>	Wind speed
<uni>	Wind speed unit: K = Kilometers per hour M = Meters per second N = Knots
<sta>	Status: A = Valid data V = Invalid data
*	Fixed text
<chk>	Checksum (8-bit XOR, excluding $ and *)
<CR>	Carriage return code, ASCII 0DH
<LF>	Line feed code, ASCII 0AH

Missing readings

If data is missing due to a measurement problem, the NMEA messages show V in the status field. Wind speed and wind direction fields are left empty.

5.23 WS425 A/B ASCII profile

In Vaisala WINDCAP Ultrasonic Wind Sensor WS425 User's Guide, this profile was called the Handar mode.

The following table lists the configurable parameters and their allowed and default values for the WS425 A/B ASCII profile.

Table 49 Configurable parameters for WS425 A/B ASCII

Parameter	Default value	Profile-specific allowed values	Description
`autoInt`	1	0.125–1000 Resolution: 0.125	Automatic message interval in seconds. Do not select a message interval that is shorter than the time it takes to send a data message.
`autoPort`	1	• 1 = COM1 port • 2 = COM2 port	Serial port to which WMT700 sends automatic data messages.
`autoSend`	0	0 = Automatic messages disabled	Automatic data message number. Selects the data message format for automatic messages.
`com1_protocol`	0 [1)]	3 = WS425 A/B ASCII	Profile for serial port COM1
`com2_protocol`	3	3 = WS425 A/B ASCII	Profile for serial port COM2
`com2_interf`	N/A [2)]	• 0 = RS-485 • 1 = RS-422 • 3 = RS-232	Interface for serial port COM2
`wndOrientation`	0	• 0 = Array facing up • 1 = Array facing down	Orientation of the array of WMT700
`wndUnit`	0 [2)]	• 0 = Meters per second • 1 = Miles per hour • 2 = Kilometers per hour • 3 = Knots	Wind speed unit
`wndVector`	0	0 = Scalar averaging	Wind averaging method

1) *The parameter has no protocol-specific default value. It is determined separately in the configuration code.*
2) *Wind speed unit and COM2 digital communication interface are defined in the order form. Default setting may be any of the allowed options, and it can be verified from the unit's configuration code.*

5.23.1 WS425 A/B ASCII commands

Use the following commands to operate WMT700 with the WS425 A/B ASCII profile.

Table 50 WS425 A/B ASCII commands

Command	Description
`I`	Requests identification information for WMT700.

Command	Description
Wx	Starts measurement based on averaging time and fetches the data.

You cannot use the WS425 A/B ASCII command Measurement Unit Change **Ux** with WMT700.

More information

- WMT700 commands (page 182)

5.23.1.1 I — identify sensor

The **I** command shows the vendor, model number, and version information of WMT700.

```
VAISALA WMT700 200
```

5.23.1.2 Wx — start measurement

This command starts wind measurement based on averaging time and fetches the data automatically when the measurement has finished. You must specify the averaging time in the command.

The averaging time supplied in the command (**x**) sets the averaging time for WMT700. When you change the averaging time, it applies to the next new wind value.

```
Wx
```

Name	Description
x	Time for averaging wind speed and wind direction. The range is from 1 to 9

WMT700 responds to the **Wx** command with a 19-character fixed-length data message.

Character	Description
1	┐02H (<STX>, start of transmission)
2	W
3	Averaging in seconds
4	Status: P = Pass F = Fail
5	Wind direction (most significant digit)
6	Wind direction (middle digit)

Character	Description
7	Wind direction (least significant digit)
8	Wind speed (most significant digit)
9	Wind speed (next digit)
10	Wind speed (next digit)
11	Wind speed (least significant digit)
12	. (dot character)
13	Wind speed (tenth digit)
14	Wind speed unit: M = Miles per hour K = Knots L = Kilometers per hour T = Meters per second
15	Checksum (most significant digit). For more information, see the note below.
16	Checksum (least significant digit)
17	┗ 03H (<ETX>, end of transmission)
18	CR (carriage return)
19	LF (line feed)

The checksum is calculated from the characters from position 2 to 14. The accumulator initializes at 0 with the addition of the byte value. The checksum has a range of 0H–FFH.

Example

```
W5 W5P1200013.2TDE
```

Interpretation of the example message:

- ┐ 02H (<STX>, start of transmission)
- Sensor ID: W
- Averaging in seconds: 5
- Sensor status: P = pass
- Wind direction: 120
- Wind speed: 0013
- . (dot character)
- Wind speed unit: T = meters per second
- Checksum (most significant digit): D
- Checksum (least significant digit): E
- ┗ 03H (<ETX>, end of transmission)

Missing readings

If data is missing due to a measurement problem, the WS425 A/B ASCII message reports 999.9 for wind speed.

5.24 WS425 A/B WAT11 profile

The following table lists the configurable parameters and their allowed and default values for the WS425 A/B WAT11 profile.

Table 51 Configurable parameters for WS425 A/B WAT11 profile

Parameter	Default value	Profile-specific allowed values	Description
`com1_protocol`	0 [1)]	6 = WS425 A/B WAT11	Profile for serial port COM1
`com2_protocol`	0	6 = WS425 A/B WAT11	Profile for serial port COM2

1) *The parameter has no protocol-specific default value. It is determined separately in the configuration code.*

5.24.1 WS425 A/B WAT11 commands

If you have selected the WS425 A/B WAT11 profile, you can poll data with the following command:

```
<esc><id>
```

Name	Description
`<esc>`	Escape character ASCII 27H
`<id>`	WMT700 ID, for example, A

Response:

```
<stx><id><spd><dir>
```

Name	Description
`<stx>`	Start of text character (1 digit)
`<id>`	WMT700 identification character, for example, A (1 digit)
`<spd>`	Wind speed (in meters per second) multiplied by 10. For example, `045` is 4.5 meters per second (3 digits).
`<dir>`	Wind direction with two octal numbers for 6-bit binary data, for example, `73` corresponds to (7×8+3)/64×360 = 332 degrees

Missing reading

The WS425 A/B WAT11 message reports missing data as slashes (/////).

5.25 SDI-12 profile (v 1.3)

SDI-12 is a standard for interfacing data recorders with microprocessor-based sensors. The name stands for serial/digital interface at 1200 baud.

The SDI-12 Support Group is an association of companies that produce and use SDI-12 products with the purpose of reviewing requests to enhance, clarify, or modify the SDI-12 architecture and that votes on proposed changes to SDI-12.

For the complete SDI-12 standard text and information on the SDI-12 Support Group, see the SDI-12 website: www.sdi-12.org.

SDI-12 sub-modes A and B are not supported by WMT700.

When establishing the terminal connection to WMT700, set the following communication settings for the SDI-12 profile:

- `Bits per second: 1200`
- `Data bits: 7`
- `Parity: 1`
- `Stop bits: 1`
- `Flow Control: None`

The following table lists the configurable parameters and their allowed and default values for the SDI-12 profile.

Table 52 Configurable parameters

Parameter	Default value	Profile-specific allowed values	Description
`address`	1	1, 2, 3, 4, 5, 6, 7, 8, 9	Address for WMT700
`autoPort`	1	1 = COM1 port 2 = COM2 port	Serial port to which WMT700 sends automatic data messages
`autoSend`	0	0 = Automatic messages disabled	Automatic data message number. Selects the data message format for automatic messages.
`com1_protocol`	0 [1)]	1 = SDI-12	Profile for serial port COM1

Parameter	Default value	Profile-specific allowed values	Description
com2_baud	1	1 = 1200	Baud rate for serial port COM2. Changes take effect only after reset or the **RESET** command. Note that low bit rate can affect measurement timing, if WMT700 cannot send the data message before new measurement starts.
com2_data	7	7 = 7 data bits	Data bits for serial port COM2. Changes take effect only after reset or the **RESET** command.
com2_interf	0 [2)]	2 = SDI-12	Interface for serial port COM2
com2_parity	1	1 = Even	Parity for serial port COM2. Changes take effect only after reset or the **RESET** command. .
com2_protocol	1	1 = SDI-12	Profile for serial port COM2
com2_stop	1	1 = 1 bit	Stop bits for serial port COM2. Changes take effect only after reset or the **RESET** command .
wndAvg	1	0.125–3600 Resolution: 0.125	Averaging time for wind measurement in seconds
wndOrientation	0	0 = Array facing up 1 = Array facing down	Orientation of the array of WMT700
wndUnit	0 [2)]	0 = Meters per second 1 = Miles per hour 2 = Kilometers per hour 3 = Knots	Wind speed unit
wndVector	0	0 = Scalar averaging	Wind averaging method

1) *The parameter has no protocol-specific default value. It is determined separately in the configuration code.*
2) *Wind speed unit and COM2 digital communication interface are defined in the order form. Default setting may be any of the allowed options, and it can be verified from the unit's configuration code.*

To start continuous measurement, use the **START** command. To stop measurement, use the **STOP** command.

5.25.1 SDI-12 commands

You can only use COM2 serial port for sending commands and receiving data messages with the SDI-12 profile.

The following table lists the available commands for operating WMT700 with SDI-12 profile.

Table 53 SDI-12 commands

Command	Description
?!	Queries WMT700 for its address.
a!	Ensures that WMT700 is responding.
aI!	Queries WMT700 for its SDI-12 compatibility level, model number, and firmware version number.
aAb!	Changes WMT700 address.
aC!	Starts concurrent measurement.
aCC!	Starts concurrent measurement with CRC calculation.
aD0!	Fetches instant data from WMT700.
aM!	Starts measurement.
aMC!	Starts measurement with CRC calculation.
aV!	Starts verification.

The following SDI-12 commands cannot be used with WMT700:
- Measurement unit change command **aXUx!**
- Heater control command **aXHx!**
- Check current sub mode **aX?!**
- Place sensor in sub mode B command **aXQx;c.c;n;yyyy!**
- Reset the sensor to sub mode A command **aXS!**
- Check current measurement unit command **aX*!**
- Continuous measurement **aR0!**

More information

- WMT700 commands (page 182)

5.25.1.1 ?! — address query

The **?!** command queries for the WMT700 address.

When you use a question mark (?) as the address character with the **a!** command, WMT700 responds as if it was being addressed on the SDI-12 bus. Regardless of its address, WMT700 responds to the command, which allows you to determine the address for the wind sensor.



If more than one WMT700 is connected to the bus, they all respond, causing a bus contention.

```
?!
```

Name	Description
?	Wildcard
!	Terminates the command

The response:

```
a<CR><LF>
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the `address` value
<CR><LF>	Terminates the response

5.25.1.2 a! — acknowledge active

The **a!** command ensures that WMT700 is responding to a data recorder or another SDI-12 device. It asks WMT700 to acknowledge its presence on the SDI-12 bus.

```
a!
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the address value
!	Terminates the command

The response:

```
a<CR><LF>
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the address value
<CR><LF>	Terminates the response

```
1!1<CR><LF>
```

5.25.1.3 aAb! — change address

The **aAb!** command changes the WMT700 address. After sending a response to the command WMT700 does not respond to any other command for 1 second. WMT700 writes the new address to the non-volatile memory.



You can also change the WMT700 address by entering configuration mode and changing the `address` parameter.

```
aAb!
```

Name	Description
a	Current single-digit WMT700 address that corresponds to the first character of the `address` value
A	Change address command
b	New address
!	Terminates the command

The response:

```
b<CR><LF>
```

Name	Description
b	New single-digit WMT700 address (or the original address if WMT700 is unable to change the address)
<CR><LF>	Terminates the response

5.25.1.4 aC! — start concurrent measurement

The **aC!** command starts concurrent measurement. WMT700 does not return measurement data after this command. It sends a response that indicates when the measurement result can be retrieved using the **aD0!** command and the number of parameters.

```
aC!
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the `address` value
C	Start concurrent measurement command
!	Terminates the command.

The response:

```
atttnn<CR><LF>
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the `address` value
ttt	Period of time, in seconds, after which WMT700 has the measurement ready
nn	Number of measurement values WMT700 calculates and returns as a response to one or more subsequent **aD0!** commands
<CR><LF>	Terminates the response.

```
1C! 100205<CR><LF>
```

Interpretation of the example message:

- Time after which the measurement is ready: 2 seconds
- Number of returned measurement values: 5

To fetch the measurement results, use the **aD0!** command.

5.25.1.5 aD0! — send data

The **aD0!** command fetches instant data from WMT700. **aD0!** must be preceded by a **C!**, **M!**, or **V!** command. WMT700 responds by sending measurement data (after **C!** or **M!**) or verification data (after **V!**).

In a SDI-12 system compliant with the standard, if the expected number of measurements is not returned in response to an **aD0!** command, a data recorder issues **D1!**, **D2!**, and so on, until all measurement values are received. The expected number of measurements is included in the message that WMT700 sends in response to an **aC!**, **aM!** or **aV!** command. Multiple data requests are not needed with WMT700, since all return values fit in one response string.

```
aD0!
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the **address** value
D0	Send data command
!	Terminates the command

More information

- SDI-12 data messages (page 161)

5.25.1.6 aI! — send identification

The **aI!** command queries WMT700 for its SDI-12 compatibility level, model number, and firmware version number.

```
aI!
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the address value
I	Send identification command
!	Terminates the command

The response:

```
allccccccccmmmmmmvvvxxx . . . xxx<CR><LF>
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the address value
11	SDI-12 version number, indicating SDI-12 version compatibility; for example, version 1.1 is encoded as 11

Name	Description
cccccccc	8-character vendor identification Vaisala
mmmmmm	6 characters specifying the model number of WMT700
vvv	3 characters specifying the firmware version 604
xxx ... xxx	Optional field, up to 13 characters, used for a serial number or other specific WMT700 information that is not relevant for operation of the data recorder (not used)
<CR><LF>	Terminates the response

5.25.1.7 aM! — start measurement

This command starts measurement. WMT700 does not return measurement data after this command. It sends a response that indicates when the measurement result can be retrieved using the **aD0!** command and the number of parameters.

```
aM!
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the **address** value
M	Start measurement command
!	Terminates the command.

The response:

```
atttn<CR><LF>
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the **address** value
ttt	Period of time, in seconds, after which WMT700 has the measurement ready
n	Number of measurement values WMT700 calculates and returns as a response to one or more subsequent **aD0!** commands
<CR><LF>	Terminates the response.

Example

```
1M! 10025<CR><LF>
```

Interpretation of the example message:

- Time after which the measurement is ready: 2 seconds
- Number of returned measurement values: 5

To fetch the measurement results, use the **aD0!** command.

5.25.1.8 aV! — start verification

The **aV!** command starts verification. However, WMT700 does not return verification data directly after this command. It sends a response that specifies when the verification results can be retrieved using the **aD0!** command and the number of parameters. The WMT700 verification data includes a watchdog count, sensor measurement unit settings, and the current SDI mode setting.

The command:

```
aV!
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the address value
V	Starts verification command
!	Terminates the command

The response:

```
atttn<CR><LF>
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the address value
ttt	Period of time, in seconds, after which WMT700 has the verification data ready
n	Number of returned verification data fields
<CR><LF>	Terminates the response

Example

```
1V! 10014<CR><LF>
```

Interpretation of the example message:

- Time when the measurement is ready: 1 second
- Number of returned measurement values: 4

To fetch the measurement results, use the **aD0!** command.

5.26 SDI-12 data messages

When the SDI-12 profile is selected, the data message sent by WMT700 depends on the command that you use before fetching the data with the **aD0!** command.

5.26.1 WS425 A/B SDI-12 message for C and M command

When you give the commands **aC!** or **aM!** followed by **aD0!**, the response is:

```
a<WS><WD><x><y><s><CR><LF>
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the `address` value
<WS>	Polar wind speed in selected units Format: +(ss)s.s
<WD>	Polar wind direction in degrees Format: +(dd)d.d
<x>	x component of wind speed in selected units Format: ±(ss)s.s
<y>	y component of wind speed in selected units Format: ±(ss)s.s
<s>	Static speed of sound in miles per hour Format: ±(ss)s.s
<CR><LF>	Terminates the response.

The above are measurement data fields.

Missing readings

If data is missing due to a measurement problem (for example, blocked paths between transducers), the measurement data is replaced with 999.9.

Example

Example of the command and response when data is missing:

```
7D0! 7+999.9+999.9+999.9+999.9+999.9 <CR><LF>
```

5.26.2 WS425 A/B SDI-12 message for V command

When you type the commands **aV!** and **aD0!**, the response is the following:

```
a<watchdog><WS_unit><SDI-mode><spare><CR><LF>
```

Name	Description
a	Single-digit WMT700 address that corresponds to the first character of the **address** value
<watchdog>	Number of times the watchdog has triggered. Ideally zero. Format: +(c)c
<WS_unit>	Wind speed unit. The options are: • +0 = mph • +1 = kt • +2 = km/h • +3 = m/s
<SDI-mode>	Current sub mode setting. The options are: • +0 = SDI-12 sub mode A • +1 = SDI-12 sub mode B
<spare>	1 digit for factory use, format: +c
<CR><LF>	Terminates the response

The above are verification data fields.

5.26.3 Requesting cyclic redundancy check

Error detection capability can be enhanced by using the **aCC!** or **aMC!** command to start the measurement. These commands have the same function and send the same response as commands **aC!** and **aM!** respectively. The difference is that cyclic redundancy check is appended to the data returned by the **aD0!** command.

The 16-bit cyclic redundancy check value is appended to the response of the **aD0!** command before <CR><LF>. It is encoded as 3 ASCII characters using the following algorithm:

```
1st character=0x40 OR (CRC shifted right 12 bits)
2nd character=0x40 OR ((CRC shifted right 6 bits) AND 0x3F)
3rd character=0x40 OR (CRC AND 0x3F)
```

Example

```
1MC! 10025<CR><LF> 1D0! 1+2.7+85.2-0.2-2.7+770.5CAH<CR><LF>
```

6. Maintenance

6.1 WMT700 maintenance

WMT700 is a very reliable and rugged sensor. Since no moving or consumable parts are used, only minimal maintenance is required.

Preventive maintenance for WMT700 includes:

- Checking that the transducers are not bent, twisted, or rotated. All transducers must be parallel to each other. A damaged array may cause inaccurate readings.
- Checking that the transducers have not been scraped or touched with sharp objects. The silicon rubber coating must be undamaged. If the transducers or the coating is damaged, send the sensor to Vaisala for repair.
- Verifying functionality by using the optional verifier to check the distance between the transducers.

WMT700 is calibrated at the factory and recalibration is not required.

Periodic calibration of WMT700 is not required for technical reasons but some quality management systems may require regular calibration of the measuring instruments. To fulfill the requirements, Vaisala recommends recalibrating the sensor every 24 months. For more information, contact Vaisala Services. Vaisala offers optional accredited wind tunnel calibration services.

If the sensor becomes contaminated, clean it carefully using mild detergent and a soft, lint-free cloth. Do not use solvents or a pressure washer to clean the sensor, since they may damage the silicon rubber transducer sleeve.



Touching a heated sensor may cause injury. Do not touch heated parts when heating is on. The sensor may detect touching as an ice blockage and start the high-power melting mode.



A heated sensor can be hot during normal operation. Wear protective gloves when working with WMT700.
Let WMT700 cool down for 20 minutes after disconnecting the heating power supply.



CAUTION! Do not clean the instrument or sensor unless it is clearly contaminated.



CAUTION! Handle with care. Any impact on the instrument or sensor array may cause damage and lead to incorrect measurements.

CAUTION! Any temporary object, such as snow, ice, or a bird, that blocks the observation path between the ultrasonic transducer heads may lead to inaccurate measurements.

CAUTION! Do not open the instrument or sensor. There are no user-serviceable parts inside.

In maritime environments, it is not possible to perform WMT700 software updates.

6.2 Testing operation

Optional verifier (WMT70VERIFIER)

WMT700 measures the time it takes for an ultrasonic signal to travel from one transducer to another. Therefore, the accuracy of the sensor depends on the distance between the transducers and the time-of-flight measurement circuit, which uses a crystal oscillator for its time reference.

If necessary, you can verify the distance between the transducer arms with an optional verifier. You can order the verifier from Vaisala as an accessory.

Vaisala recommends that you test the proper operation once a year or if you suspect that the transducers may have been damaged. The sensor arms may be bent or the rubber on the transducers may be damaged. Make a visual check to verify if there is physical damage.

You can perform the test either in the field or in a laboratory.

CAUTION! Do not perform the test when the wind speed is more than 10 m/s (22 mph) or when there is a risk of thunderstorm in the area.

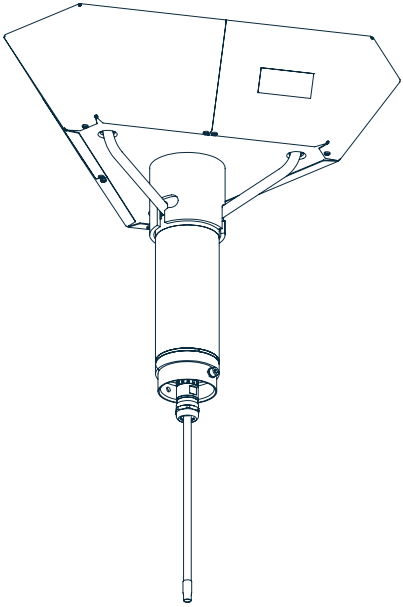
Some individual data samples may be lost during the verifier test. This does not indicate that the sensor or instrument is faulty.

The verifier cannot be used to test the accuracy of wind direction measurement. During zero wind calibration, the wind direction data is missing. This does not indicate that the sensor is faulty.

Disable heating before performing the verifier test.

You can disable heating by disconnecting the heater supply voltage or by setting the `heaterOn` parameter to `0`.

1. Slip the verifier over the 3 transducers.



2. Start wind measurement.

   The command depends on the selected communication profile.
3. Make sure that the reading does not exceed 0.22 m/s (0.5 mph) with the verifier in place.
4. Remove the verifier.

7. Troubleshooting

7.1 Troubleshooting checklist

When troubleshooting, check the questions listed in Technical support (page 180) before contacting Vaisala technical support.

7.2 Problem situations

Problem	Probable cause	Action
Wind measurement failure. WMT700 is sending irregular data values.	The installation site is causing measurement problems.	Check that the installation site matches the requirements listed in Placing WMT700 (page 53).
	Snow, ice, a bird, or other objects are blocking the measurement path between the ultrasonic transducers.	Remove the blockage and check that the wind transducers are not damaged. If the blockage is ice or snow, it melts after some time if you use a heated version of WMT700. Duration of the blockage depends on the severity of the weather event. If birds are causing the blockage, consider installing a bird cage. See Bird cage (page 18).
Reported wind direction is not correct.	WMT700 is misaligned, which causes an offset error.	Realign WMT700 according to Aligning WMT700 (page 66).
Wind direction indication acts erratically.	Orientation of the sensor does not match the **`wndOrientation`** parameter value.	Set the **`wndOrientation`** parameter value according to the actual orientation of the sensor. See Configuration parameter descriptions (page 189).
There is no response when you try to switch to configuration mode with the **`OPEN`** command.	The WMT700 settings are unknown or they have been accidentally changed.	Reset the serial communication settings to default values. See Restoring serial port settings (page 170).

Problem	Probable cause	Action
WMT700 does not respond to any commands.	The communication profile is not correct.	Configure the communication profile to match the host communication profile. See Changing communication profile (page 133).
	The wiring might be incorrect.	Check the wiring, see Wiring (page 75).
Connection works but data messages are not available.	You have mistyped the command.	Use the **ERRORS** command to fetch the error messages from WMT700. See ERRORS — get error codes and counts (page 109).
Data messages are not in the expected format.	The selected data message is not correct.	If you use automatic messages: check the selected data message with the **G** command. If necessary, set a new value for the **autoSend** parameter. If you use polling: check that you are using the correct data message number in the polling command, see Table 39 (page 120).
Some items are missing from the data messages.	The configured data message does not contain all the required items.	Define the data message again with the required items. See Parameter handling commands (page 104).
Configuration commands do not work.	WMT700 is in measurement mode.	Switch from measurement mode to configuration mode. See Communicating with terminal software (page 101).
WMT700 sends an error message as a response to a command.	For probable causes, see Error and event messages (page 169).	For remedies, see Error and event messages (page 169).
No signal is present on analog outputs.	Analog output has been disabled.	Enable analog output with the **aout1mode** and **aout2mode** parameters. See Configuration parameter descriptions (page 189).
Automatic data messages are not received although parameters are correct.	WMT700 is not in continuous measurement mode.	Initiate continuous measurement with the **START** command. See START — start continuous measurement (page 108).

Problem	Probable cause	Action
Data from WMT700 is temporarily lost.	The data logger and wind sensor are not in the same operating mode (polling or automatic transmission mode).	Make sure that the data logger and wind sensor are both in either polling or automatic transmission mode.
Data messages are not received.	Baud rates of the data logger and wind sensor do not match.	Change the baud rate so that it is the same in the data logger and wind sensor.
Parameter does not change after typing the **S** command.	The parameter requires reset before it becomes valid.	Check Configuration parameter descriptions (page 189) if you must reset before the parameter is changed.
Inconsistent serial communication or missing data.	Pin contacts of the connector have become oxidized or the connector is not firmly attached.	Change the WMT700 cable.
Retrofit installation cannot be completed.	You do not have the correct mounting kit for the retrofit installation.	Check that you are using the correct mounting adapter with your mounting kit. See WMT700 accessories (page 198).
WMT700 does not work properly after retrofit installation.	Incorrect cables are used in the retrofit installation.	Check that you have used cables listed in Connection cable prerequisites (page 98). If you do not have the correct cables, contact Vaisala technical support.
Connection to WMT700 is lost.	The power supply is not sufficient, especially if you are using a heated version of WMT700.	Check that the power supply matches the requirements in Powering WMT700 (page 81).

7.3 Error and event messages

If the `messages` parameter is set to `1`, WMT700 sends error and event messages. The following table lists the available messages.

Table 54 Error and event messages

Error/Event code	Probable cause	Remedy
2	Event. Parameters are set to factory defaults.	To change the default settings in configuration mode; see Communicating with terminal software (page 101).

Error/Event code	Probable cause	Remedy
3	Event. Wind calibration data has been lost. WMT700 must be calibrated.	Contact Vaisala technical support.
10	Error. You get an invalid value when using the **S** command.	Check the allowed parameter values, see Configurable parameters (page 195).
11	Error. Parameter used with the **S** command is unknown.	Check that you are using the correct parameter names, see Configurable parameters (page 195).
12	Error. Unknown command.	Check the allowed commands in WMT700 commands (page 182).
13	Error. The string before the end of the command character is too long.	Check the command and parameter names you are using.

To troubleshoot WMT700, you can also:
- Fetch the error and event messages with the **ERRORS** command.
- Include diagnostics-related items in the data message.

More information

- Parameter handling commands (page 104)
- ERRORS — get error codes and counts (page 109)

7.4 Restoring serial port settings

If you do not know the configured settings of WMT700, or the settings have been accidentally changed, you may not get any response when you type the **OPEN** command. In that case, restore the serial port settings to known values.

1. Connect a cable between your terminal computer, power supply, and WMT700.
2. Open a terminal program, such as HyperTerminal or Tera Term.
3. Cancel the new connection.
4. Select **File > Properties**.
5. Select the correct COM port and then **Configure**.

6. Regardless of the configured port settings of WMT700, select the following communication settings:
   - Bits per second: 19200
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow Control: None
7. Close the **New Connection Properties** window.
8. Connect to WMT700 using the RS-485 interface.
9. Switch the sensor power supply off and back on.
10. Press # on your keyboard and hold down the key for at least 5 seconds. WMT700 responds with the following string:

    ```
    Ok
    Restoring COM1 and COM2 settings…
    ```

    Updating the settings is completed in a few seconds. When the operation is done, WMT700 sends the following response:

    ```
    Done. Rebooting…
    ```

    WMT700 has applied the settings and reboots using the new settings. For the restored settings, see the following table.
11. Before you start configuring new values to WMT700, apply the new settings to HyperTerminal. To close the connection, select **Call > Disconnect**.
12. Select **File > Properties**.
13. Select **Properties > Configure**.
14. In **Bits per second**, select **9600**.
15. Close the **Properties** window.

16. Select **Call > Call**.

Table 55 Restored serial port settings

Parameter name	Default value	Description
`com1_baud` `com2_baud`	4	4 = 9600 bauds per second
`com1_data` `com2_data`	8	Number of data bits
`com1_delay` `com2_delay`	20	Response delay in milliseconds
`com2_interf`	0	0 = RS-485
`com1_parity` `com2_parity`	0	0 = None
`com1_protocol` `com2_protocol`	0	WMT700 protocol
`com1_stop` `com2_stop`	1	Number of stop bits

The serial port settings are now restored to known values. You can type the **OPEN** command and start configuring WMT700.

More information

- Configuration (page 103)

8. Technical data

8.1 WMT700 specifications

Table 56 Wind speed measurement performance

Property	Description/Value
Observation range	WMT701: 0–40 m/s (89 mph) WMT702: 0–65 m/s (145 mph) WMT703: 0–75 m/s (168 mph) WMT704: 0–90 m/s (201 mph)
Starting threshold	0.01 m/s (0.0223 mph)
Resolution	0.01 m/s (0.0223 mph)
Response time	250 ms
Accuracy	0–75 m/s (168 mph): ±0.1 m/s (0.2 mph) or 2 % of reading, whichever is greater 75–90 m/s (201 mph): ±5 % of reading
Available variables	Instant, peak, average, maximum, minimum, gust, lull

Table 57 Wind direction measurement performance

Property	Description/Value
Observation range	0–360°
Starting threshold	0.1 m/s (0.2 mph)
Resolution	0.01°
Response time	250 ms
Accuracy	±2°
Available variables	Instant, average, maximum, minimum

CAUTION! Any temporary object, such as snow, ice, or a bird, that blocks the observation path between the ultrasonic transducer heads may lead to inaccurate measurements.

In extreme weather conditions, ice or snow accumulation may cause a temporary wind observation blackout even when heating is enabled.

Table 58 Operating environment

Property	Description/Value
Operating temperature	–10 … +60 °C (+14 … +140 °F) –40 … +60 °C (–40 … +140 °F) –55 …+70 °C (–67 …+158 °F)
Storage temperature	–60 … +80 °C (–76 … +176 °F)
Operating humidity	0–100 %RH
IP rating	IP66: Dust-tight. Protected from powerful water jets from any direction. IP67: Dust-tight. Protected from the effects of temporary immersion in water under standardized conditions of pressure and time.

Table 59 Powering specifications

Property	Description/Value
Operating voltage	9–36 V DC (absolute max. 40 V DC) [1]
Heating voltage	24–36 V DC (absolute max. 40 V DC) [1]
Heating power supply requirement [2]	
Heated transducers	Average 32 W Peak 40 W
Heated transducers and arms	Average 152 W Peak 200 W
Heated transducers, arms, and body	Average 252 W Peak 350 W at 24 V DC

1) *In maritime environments, the normal input voltage ranges are: operating voltage 12–30 V DC (–25 … +30 %) and heating voltage 24–30 V DC (–25 … +30 %), as defined in the maritime standard IEC 60945.*
2) *The actual power consumption depends on the temperature.*

Table 60 Messaging specifications

Property	Description/Value
Readout update interval	4 Hz (default) and 8 Hz (optional)
Units available	m/s, knots, mph, km/h, V, mA, Hz
Operating mode	Automatic message or poll mode
Sonic temperature	Celsius degrees
Data format outputs	Polar coordinates and vectors

Table 61 Digital outputs

Property	Description/Value
Communication interfaces	COM1: RS-485 COM2: RS-485, RS-422, RS-232, SDI-12
Communication profiles	WMT700, WS425 ASCII, NMEA Standard and Extended (version 0183), SDI-12 (version 1.3), WS425 ASOS, ROSA MES 12, customized
Bit rate	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200
Available averages	Max. 3600 s

Table 62 Analog outputs

Property	Description/Value
Wind speed	
Frequency push-pull	Pulse 0 V/10 V: 0–2 kHz (f = 10 Hz/m/s) (load > 10 kΩ)
Frequency pull-down	Pulse 0.5 V/V_{in}–2 V (11 V minimum) 0–750 Hz (load 50 kΩ ±20 %)
Frequency pull-up	Pulse 1.5 V/V_{in}–4 V (8 V minimum)
Voltage	0–10 V (U = 100 mV / m/s)
Current	0–20 mA (I = 0.2 mA / m/s)
Wind direction	
Voltage	0–10 V (U = 20 mV/°)
Current	0–20 mA (I = 50 uA/°)
Potentiometer	Reference voltage 1–10 V DC, 0–V_{ref} represents 0–359°

Table 63 Compliance

Property	Description/Value
EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) as amended by 2015/863 REACH Regulation (EC 1907/2006)
EMC immunity	IEC 61326-1:2013, IEC 60945
EMC emissions	CISPR 32 / EN 55032, Class B
Environmental	IEC 60068-2-1, 2, 6/34, 30, 31, 67, 78, IEC 60529 VDA 621-415
Maritime	IEC 60945:2002 + IEC 60945/Cor1:2008, DNVGL-CG-0339
Safety	UL 61010-1 CAN/CSA C22.2 No. 61010-1-12
Application standards	EN 15518-3:2023, Winter maintenance equipment - Road weather information systems - Part 3: Requirements on measured values of stationary equipment
Compliance marks	CE, China RoHS, RCM, UKCA
Listing marks	SGS (USA and Canada) [1)]

1) Not applicable to the integrated cable.

Table 64 Environmental tests

Test	Setup according to
Wind	ISO16622; MEASNET
Wind driven rain	MIL-STD 810G Method 506.5
Salt fog	IEC 60068-2-52, VDA 621 - 415
Leak test (ingression protection)	IEC 60529 class IP67
Vibration	IEC 60068-2-6
Shock	MIL-STD-202G, Method 213B, cond. J
Dry heat	IEC 60068-2-2
Damp heat cyclic	IEC 60068-2-30
Damp heat	IEC 60068-2-78
Low temperature	IEC 60068-2-1

Test	Setup according to
Free fall (rough handling)	IEC 60068-2-31
Change of temperature	IEC 60068-2-14

Wind tunnel tests have been performed according to Sonic anemometers/thermometers - Acceptance test methods for mean wind measurements ISO 16622:2002 and Measnet Anemometer Calibration Procedure Version 2, October 2009.

Vaisala WINDCAP® Ultrasonic Wind Sensor Series WMT700 is safety listed for United States and Canadian markets by SGS. SGS is Nationally Recognized Test Laboratory (NRTL) officially recognized by the American Occupational Safety and Health Administration (OSHA).

Table 65 Mechanical specifications

Property	Description/Value
Dimensions (H × W × Ø [1)])	348 × 250 × 285 mm (13.70 × 9.84 × 11.22 in)
Weight	1.8 kg (4.0 lb)
Weight	
WMT700 wind sensor	1.8 kg (4.0 lb)
Mounting adapter	0.3 kg (0.7 lb)
WMT70FIX mounting kit	1.4 kg (2.2 lb)
Materials	
Body and arms, mounting kit	Stainless steel AISI 316
Transducers	Silicone
Connector housing surface	Nickel-plated brass

1) *Diameter of area covered by transducers.*

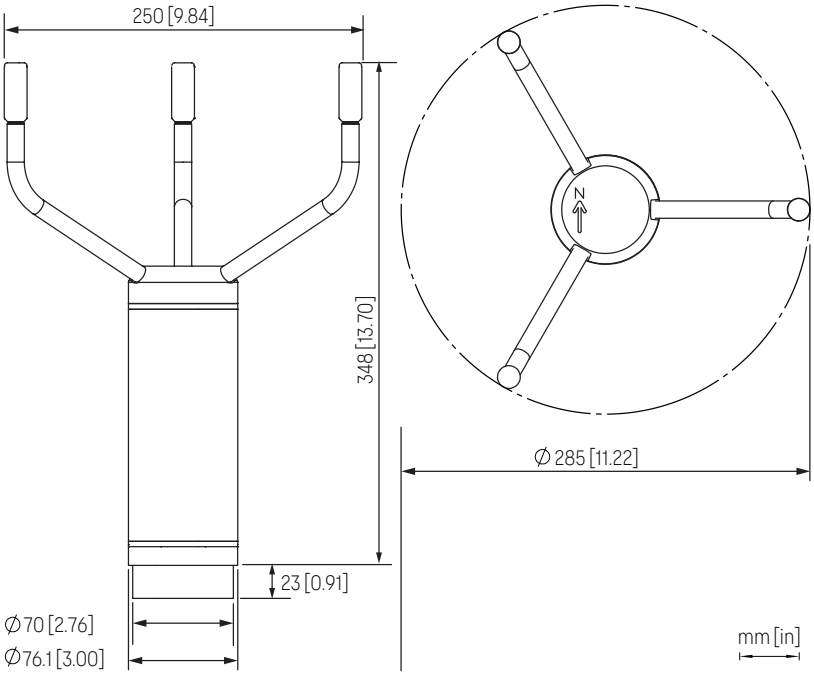


Figure 46 WMT700 dimensions

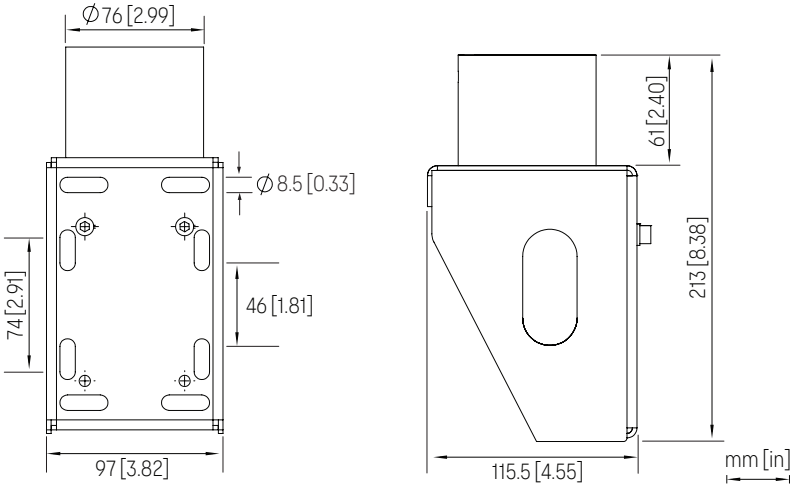


Figure 47 WMT70FIX mounting kit dimensions

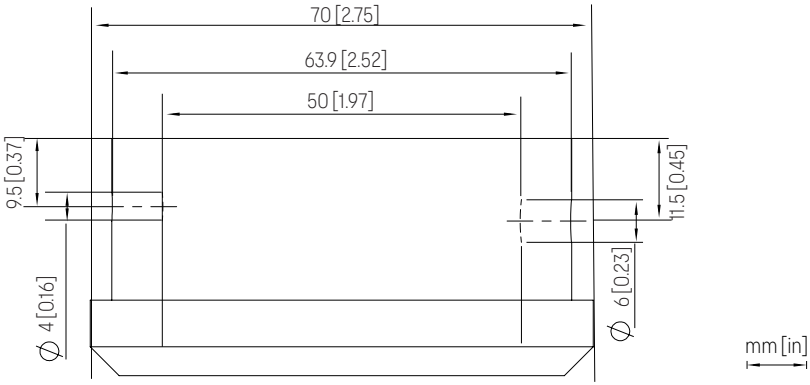


Figure 48 ASOS mounting adapter dimensions

9. Vaisala services

9.1 Service centers

Vaisala offers comprehensive customer care throughout the life cycle of our products. Our service centers offer maintenance, calibration, upgrade, and repair services. All the services are provided worldwide with fast deliveries. For more information, go to vaisala.com/services.

The services are available from:

- Vaisala Online Store, store.vaisala.com
- Vaisala Services, helpdesk@vaisala.com

The provided services vary product by product.

9.2 Technical support



You can contact Vaisala technical support at vaisala.my.site.com/myvaisala or helpdesk@vaisala.com. You can find all our support channels at vaisala.com/support.

When contacting technical support, provide the following as applicable:

- Product name, model, and serial number
- Software/Firmware version
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information
- Diagnostics package for the application

If applicable, also provide the following details:

- What failed (what worked / did not work)?
- Where did it fail (location and environment)?
- When did it fail (date, immediately / after a while / periodically / randomly)?
- How many failed (only one defect / other same or similar defects / several failures in one unit)?
- What was done when the failure was noticed?
- What was connected to the product and to which connectors?
- What is the input power source type, voltage, and what else (such as lighting, heaters, and motors) was connected to the same power output?
- Are all parts connected and grounded properly? Take a photo to help the troubleshooting.

9.3 Warranty

For warranty terms and conditions and the warranty claim process, see vaisala.com/warranty.

Note that warranty coverage may not apply if the product is damaged due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. See the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Appendix A. WMT700 commands

The following table lists all WMT700 commands.

Table 66 WMT700 commands

Command	Description	Mode/Profile
?	Displays a list of configuration commands.	Configuration mode
BAUD	Changes or displays serial port settings.	
CLEARERR	Resets error counters.	
CLOSE	Switches the serial port to measurement mode.	
ERRORS	Displays error codes and counts.	
G	Displays either all or specified parameters.	
H	Displays a list of data messages and available values for measurement unit, profile, baud rate, interface, and analog output mode.	
MEAS	Starts wind measurement based on the user-configurable averaging time. WMT700 does not send data messages automatically.	
POLL	Tests data polling.	
RESET	Resets WMT700.	
S	Changes selected parameters or defines new data messages.	
START	Starts continuous measurement.	
STOP	Stops continuous measurement.	
VERSION	Displays the software version.	
WIND_GET	Fetches wind calibration information.	
MEAS	Starts wind measurement. The duration is based on the user-configurable averaging time.	Measurement mode WMT700 profile
OPEN	Switches the serial port to configuration mode.	
POLL	Fetches data from WMT700.	
SLEEP	Switches WMT700 from normal operating mode to low-power mode.	
@a M 12	Polls data from WMT700 in the MES 12 data message format.	Measurement mode MES12 profile

Command	Description	Mode/Profile
WA	Requests average wind speed and direction message.	Measurement mode WS425 ASOS F/G profile
WS	Requests the verbose built-in test (BIT) results.	
WT	Requests the short response BIT results and status.	
WD	Reports the BIT status.	
WF	Returns a fixed pattern of data.	
$WIP	Polls data from WMT700.	Measurement mode WS425 A/B NMEA Extended profile
$aabbQ,MWV	Polls NMEA MWV message from WMT700.	Measurement mode WMT700 NMEA MWV profile
I	Requests identification information from WMT700.	Measurement mode WS425 A/B ASCII profile
Wx	Starts measurement based on averaging time and fetches the data.	
<esc><id>	Polls data from WMT700.	
?!	Queries WMT700 for its address.	Measurement mode SDI-12 profile
a!	Ensures that WMT700 is responding.	
aI!	Queries WMT700 for its SDI-12 compatibility level, model number, and firmware version number.	
aAb!	Changes WMT700 address.	
aC!	Starts concurrent measurement.	
aCC!	Starts concurrent measurement. CRC is included in the response.	
aD0!	Fetches instant data from WMT700.	
aM!	Starts measurement.	
aMC!	Starts measurement. CRC is included in the response.	
aV!	Starts verification.	

Appendix B. Typical system environments

The following figure shows a system in which the weather station is connected to COM2, while COM1 is left for service and maintenance purposes only. This is the recommended setup for WMT700 serial communications.

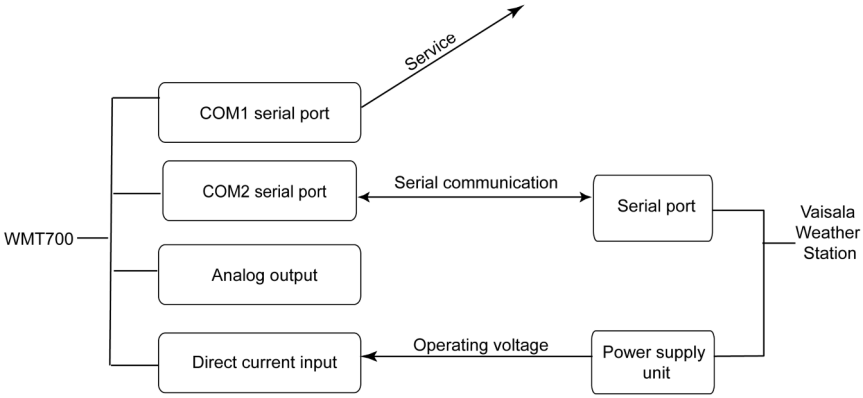


Figure 49 System environment with serial port COM1 only

The following figure shows a system in which the weather station is only connected to the analog output channel. Serial port COM1 is used for maintenance purposes.

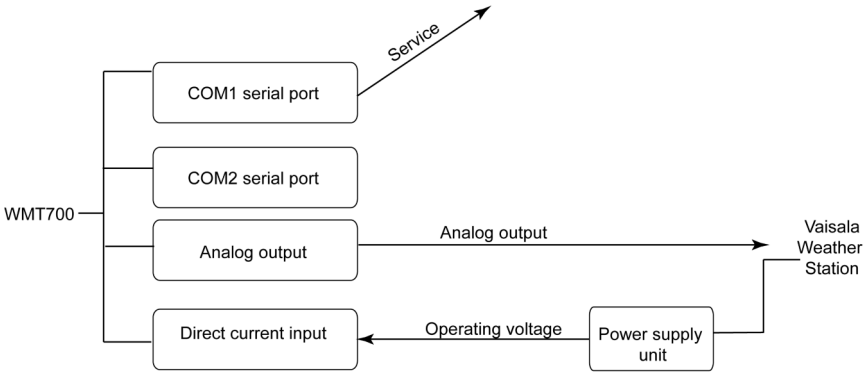


Figure 50 System environment with analog output only

The following figure shows a system in which serial ports COM1 and COM2 operate independently. Serial port COM1 is used for maintaining WMT700 and monitoring the wind sensor in mission-critical applications while COM2 provides continuous measurement data.

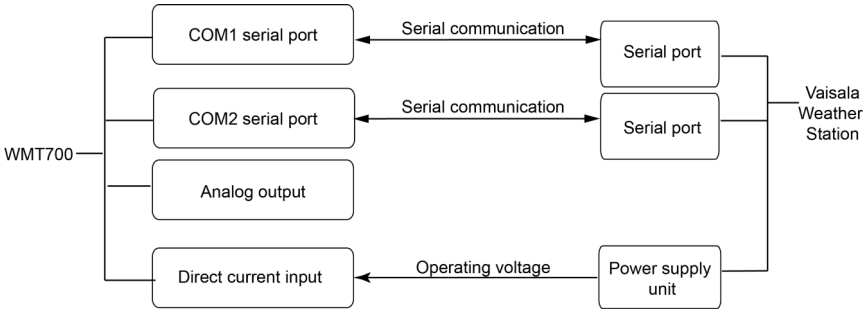


Figure 51 System environment with serial ports COM1 and COM2

The following figure shows a system with a separate back-up battery for operating power. The heating power is supplied with a direct power supply unit that prevents the heating function from consuming the power supply for the operations. This setup is suitable for WMT700 product types that provide heating for the wind sensor.

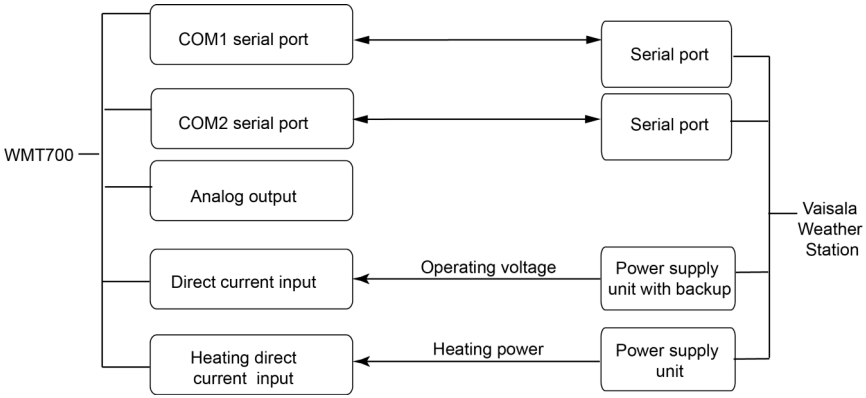


Figure 52 System environment with backup battery

Appendix C. Default settings for different communication profiles

Table 67 Default settings for different digital communication profiles

Setting	Parameter	WMT700	WS425 ASCII	WS425 NMEA Ext	WS425 SDI-12	WS425 F/G ASOS	ROSA MES 12
Service port							
Protocol	com1_protocol	WMT700					
Baud rate	com1_baud	9600	9600	9600	9600	9600	9600
Data bits	com1_data	8	8	8	8	8	8
Parity	com1_parity	0 (None)	0 (None)	0 (None)	0 (None)	0 (None)	0 (None)
Stop bits	com1_stop	1	1	1	1	1	1
Response delay	com1_delay	20 ms	20 ms	20 ms	20 ms	20 ms	20 ms
Data port							
Protocol	com2_protocol	WMT700	WS425 ASCII	WS425 NMEA Ext	SDI-12	WS425 F/G ASOS	ROSA MES12
Baud rate	com2_baud	9600	2400	9600	1200	2400	9600
Data bits	com2_data	8	8	8	7	8	8
Parity	com2_parity	0 (None)	0 (None)	0 (None)	1 (Even)	0 (None)	0 (None)
Stop bits	com2_stop	1	1	1	1	1	1
Response delay	com2_delay	20 ms	20 ms	20 ms	N/A	20 ms	20 ms
Other parameters							
Address	address	A	A	A	0	1	12
Automatic message number	autoSend	Disabled (0)	Disabled	15	Disabled	Disabled	Disabled
Automatic message port	autoPort	COM1	COM1	COM2	COM1	COM1	COM1

Setting	Parameter	WMT700	WS425 ASCII	WS425 NMEA Ext	WS425 SDI-12	WS425 F/G ASOS	ROSA MES 12
Automatic data message interval	`autoInt`	1 s	1 s	1 s	1 s	1 s	1 s
Wind averaging time	`wndAvg`	1 s	1 s	3 s	1 s	5 s	600 s
Gust averaging time	`wndGustTime`	3 s	3 s	3 s	3 s	3 s	3 s
Installation orientation of WMT700	`wndOrientation`	Array facing up					
Wind measurement averaging method	`wndVector`	Scalar averaging					

The parameters in the following table do not have a protocol-specific default value. They are defined in the configuration code.

Table 68 Parameters with no protocol-specific default value

Setting	Parameter	WMT700	WS425 ASCII	WS425 NMEA Ext	WS425 SDI-12	WS425 F/G ASOS	ROSA MES 12
Interface type	`com2Interf`	N/A	N/A	N/A	N/A	N/A	N/A
Wind speed unit	`wndUnit`	N/A	N/A	N/A	N/A	N/A	N/A

Appendix D. Configuration parameter descriptions

Table 69 Configuration parameter descriptions

Parameter	Default value	Allowed values	Units	Description
address	A	String with a maximum of 40 characters.	-	Address for WMT700. Note that the SDI12, ASCII, NMEA Extended, ASOS, and MES 12 profiles use the first character only. SDI-12 only uses digits 1–9.
aout1err aout2err	1000	0–32000	V, A, Hz, %	Value for AOUT1 and AOUT2 analog output if wind measurement fails.
aout1_g	0.1	0–100	-	Gain for AOUT1 (wind speed).
aout2_g	0.02	0–100	-	Gain for AOUT2 (wind direction).
aout1_o aout2_o	0	-10000 ... 10000	-	Offset for AOUT1 and AOUT2.
aout1maxv aout2maxv	32000	0–32000	V, A, Hz, %	Analog output maximum value for AOUT1 and AOUT2. The output is fixed to this value. The unit depends on analog output mode.
aout1minv aout2minv	0	0–32000	V, A, Hz, %	Analog output minimum value for AOUT1 and AOUT2. The output is fixed to this value. The unit depends on the analog output mode.
aout1mode	3	0 = Current 1 = Voltage 2 = Frequency 3 = Disabled	-	Analog output mode for AOUT1.
aout2mode	7	4 = Current 5 = Voltage 6 = Potentiometer 7 = Disabled	-	Analog output mode for AOUT2.

Parameter	Default value	Allowed values	Units	Description
`autoInt`	1	0.125–1000 Resolution: 0.125	s	Automatic message interval in seconds. Do not select a message interval that is shorter than the time it takes to send a data message.
`aout_map`	0	0 = AOUT1, wind speed AOUT 2, wind direction 1 = AOUT1, North-South, x component AOUT2, East-West, y component 2 = AOUT1, wind speed AOUT2, wind speed alarm A digital output: hi when wind speed > aout2_o	-	Parameter for analog outputs in road and rail tunnel applications and crane applications. This parameter provides horizontal and direction data.
`autoPort`	1	1 = COM1 port 2 = COM2 port	-	Serial port to which WMT700 sends automatic data messages.
`autoSend`	0	0 = Automatic messages disabled 1–99	-	Automatic data message number. Selects the data message format for automatic messages.
`cal_date`			-	Wind calibration date. This is a read-only parameter.

Parameter	Default value	Allowed values	Units	Description
com1_baud com2_baud	4	0 = 300 1 = 1200 2 = 2400 3 = 4800 4 = 9600 5 = 19200 6 = 38400 7 = 57600 8 = 115200	-	Baud rates for serial ports COM1 and COM2. Changes take effect only after reset or the **RESET** command. Note that a low bit rate can affect measurement timing, if WMT700 cannot send the data message before a new measurement starts.
com1_data com2_data	8	7 8	-	Data bits for serial ports COM1 and COM2. Changes take effect only after reset or the **RESET** command.
com1_delay com2_delay	20	0–10000	ms	COM1 and COM2 response delay in milliseconds.
com2_interf	0	0 = RS-485 1 = RS-422 2 = SDI-12 3 = RS-232	-	Interface for serial port COM2. (The interface for serial port COM1 cannot be changed.)
com1_parity com2_parity	0	0 = None 1 = Even 2 = Odd	-	Parity for serial ports COM1 and COM2.Changes take effect only after reset or the **RESET** command.
com1_protocol	0	0–11 • 0 = WMT700 • 2 = WS425 F/G ASOS • 3 = WS425 A/B ASCII • 4 = WS425 A/B NMEA Standard • 5 = WS425 A/B NMEA Extended • 6 = WS425 A/B WAT11 • 8 = MES 12 • 11 = WMT700 NMEA MWV	-	Protocol for serial port COM1.

Parameter	Default value	Allowed values	Units	Description
`com2_protocol`	0	0–11 • 0 = WMT700 • 1 = SDI-12 • 2 = WS425 F/G ASOS • 3 = WS425 A/B ASCII • 4 = WS425 A/B NMEA Standard • 5 = WS425 A/B NMEA Extended • 6 = WS425 A/B WAT11 • 8 = MES 12 • 11 = WMT700 NMEA MWV	-	Protocol for serial port COM2.
`com1_stop` `com2_stop`	1	1 2	-	Stop bits for serial ports COM1 and COM2. Changes take effect only after reset or the **RESET** command.
`freqType`	0	0 = Push-pull 1 = Active pull-down 2 = Active pull-up	-	AOUT1 frequency output type. Setting 1 requires external pull-up resistor. Setting 2 requires external pull-down resistor.
`heaBMaxPower`	100	0 = Off 100 = On	W	`heaBMaxPower` sets maximum body heater power. Setting the parameter value to `0` disables WMT700 body heating.
`heaPeakPwr`	200	Min–max = 0–350 W	-	`heaPeakPwr` determines how many resistors are on at the same time. WMT700 has 3 heater resistors for each arm. `heaPeakPwr` does not limit the power in the body heater of a heated version.
`heaterOn`	1	0 = Heater off 1 = Automatic	-	Heater control. When the value is set to `1`, WMT700 controls the heaters based on the temperature and other conditions.
`messages`	1	0 = Disabled 1 = Enabled	-	Response for parameter setting.

Parameter	Default value	Allowed values	Units	Description
`msg1, msg2, msg3, msg4`		String with a maximum of 80 characters.	-	User-configurable data message formats. Parameters correspond to the message identification numbers from 1 to 4.
`serial_n`			-	Serial number for WMT700. This is a read-only parameter
`serial_pcb`			-	Circuit board serial number. This is a read-only parameter.
`sleepTime`	5	0 = Disabled 1–32000	s	Duration of the low-power mode in seconds. WMT700 returns automatically to normal state after this period of time has elapsed. You can also return to normal state by sending an extra space before the polling command.
`startDelay`	5	0–30	s	WMT700 waiting time before activating automatic messages at startup.
`wndAvg`	1	0.125–3600 Resolution: 0.125	s	Averaging time for wind measurement. This parameter affects both serial communication and analog output.
`wndCoast`	0	0–100 0 = Disabled	m/s	Wind direction coasting threshold. When wind speed drops below the limit, wind direction coasting is performed. Only affects the scalar averaging mode.
`wndCover`	4	0–20	s	Defines how long WMT700 continues to report the last valid wind value if wind measurement fails (for example due to snow or birds). **`0`** means that if measurement fails, WMT700 reports missing measurement data immediately.
`wndDirOffset`	0	-180 ... 180	°	User-defined wind direction offset.

Parameter	Default value	Allowed values	Units	Description
`wndGainLo`	1		%	Wind tunnel tests show that the bird cage systematically lowers the wind speed reading by 1.5 % (cage) or 2.5 % (cage and net). The `wndGainLo` parameter can be used to compensate for wind speed gain correction for the bird cage. `S wndGainLo,1.015`
`wndGustTime`	3	0.25–3600, resolution: 0.25	s	Averaging time for wind minimum and maximum in seconds.
`wndOrientation`	0	0 = Array facing up 1 = Array facing down	-	Orientation of the transducer arms of WMT700.
`wndRate`	1	1 = 4 2 = 8	Hz	Wind vector update rate. For best performance in wind speeds over 50 m/s, Vaisala recommends the 4 Hz rate.
`wndUnit`	0	0 = m/s 1 = mph 2 = km/h 3 = knots	-	Wind speed unit. This parameter affects data messages sent through serial interfaces but has no impact on analog output.
`wndVector`	0	0 = Scalar averaging 1 = Vector averaging	-	Wind averaging method

Appendix E. WMT700 NMEA MWV profile

E.1 Configurable parameters

When the WMT700 NMEA MWV profile is selected, you can set WMT700 to send messages based on the configured automatic message interval or poll MWV message using the NMEA **`Query`** command.

Table 70 Configurable parameters for WMT700 NMEA MWV profile

Parameter	Default value	Profile-specific allowed values	Description
`address`	N/A	String with 2 characters, for example **`WI`**	Address for WMT700. The address must consist of 2 capital letters A–Z.
`autoInt`	1	0.125–1000 Resolution: 0.125	Automatic message interval in seconds. Do not select a message interval that is shorter than the time it takes to send a data message.
`autoPort`	1	1 = COM1 port 2 = COM2 port	Serial port to which WMT700 sends automatic data messages
`autoSend`	0	0 = Automatic messages disabled 20 = WMT700 NMEA MWV automatic data message	Automatic data message number. Selects the data message format for automatic messages.
`com1_protocol`	0 [1)]	11 = WMT700 NMEA MWV protocol	Profile for serial port COM1
`com2_protocol`	0	11 = WMT700 NMEA MWV protocol	Profile for serial port COM2
`com2_interf`	N/A [2)]	0 = RS-485 1 = RS-422 3 = RS-232	Interface for serial port COM2
`wndAvg`	1	0.125–3600 Resolution: 0.125	Averaging time for wind measurement in seconds
`wndOrientation`	0	0 = Array facing up 1 = Array facing down	Orientation of WMT700 array

Parameter	Default value	Profile-specific allowed values	Description
`wndUnit`	0 [2)]	0 = Meters per second 1 = Miles per hour 2 = Kilometers per hour 3 = Knots	Wind speed unit
`wndVector`	0	0 = Scalar averaging	Wind averaging method

1) *COM1 service port is always by default 0 - WMT700 protocol. You can change this using serial commands if COM1 is needed for protocol-specific communication.*
2) *Wind speed unit and COM2 digital communication interface are defined in the order form. Default setting may be any of the allowed options , and it can be verified from the unit's configuration code.*

To start continuous measurement, use the **START** command. Stop the measurement with the **STOP** command.

E.2 WMT700 NMEA MWV commands

This command polls data from WMT700 when the WMT700 NMEA MWV protocol is selected.

```
$--<id>Q,MWV*<chk><CR><LF>
```

Name	Description
`$`	Message header
`--`	2-character talker ID of the polling unit
`<id>`	2-character WMT700 sensor ID; AA–ZZ
`Q`	Query command
`,`	Field delimiter
`MWV`	Sentence formatter
`*<chk>`	Checksum field(8-bit XOR, excluding $ and *)
`<CR>`	Carriage return code, ASCII 0DH
`<LF>`	Line feed code, ASCII 0AH

To use WMT700 with the WMT700 NMEA MWV profile, set the **`autoSend`** parameter to **`0`** to enable polling or define a fixed output interval with the **`autoInt`** parameter. If you use automatic messages, set the **`autoSend`** parameter to **`20`**.

E.3 WMT700 NMEA MWV data message

WMT700 NMEA MWV data message is as follows:

```
$<id>MWV,<dir>,<ref>,<spd>,<uni>,<sta>*<chk><CR><LF>
```

Name	Description
$	Message header
<id>	Two character sensor ID; AA–ZZ
MWV	Fixed text
<dir>	Wind angle: 0 to 359°
<ref>	Reference: R = relative
<spd>	Wind speed
<uni>	Wind speed unit: K = km/h M = m/s N = knots
<sta>	Status: A = Valid data V = Invalid data
*	Fixed text
<chk>	Checksum (8-bit XOR, excluding $ and *)
<CR>	Carriage return code, ASCII 0DH
<LF>	Line feed code, ASCII 0AH

Example of the command and response:

```
$IIWIQ,MWV*2F<CR><LF>
$WIMWV,045,R,011.63,N,A*09<CR><LF>
```

Interpretation of the example message:

- Talker ID "II" queries the WMT700 NMEA MWV message from sensor which has address parameter set to "WI".
- WMT700 responds with talker ID "WI" and the requested MWV message. The reported relative wind direction is 045 degrees and the wind speed is 11.63 knots.

Missing readings

If data is missing due to a measurement problem, the NMEA messages show V in the status field. Wind speed and wind direction fields are left empty.

Appendix F. WMT700 accessories

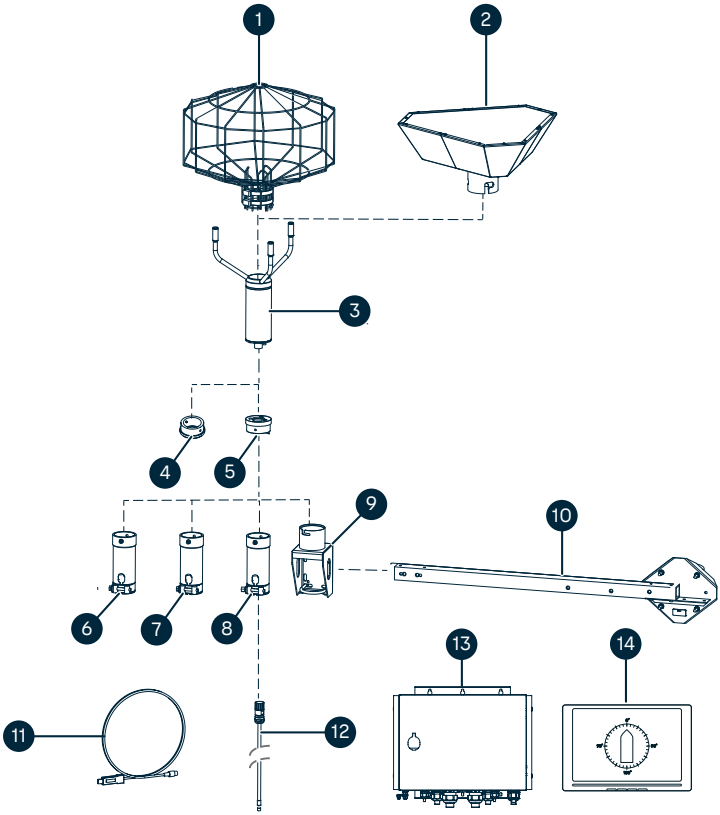


Figure 53 WMT700 accessories

Number	Accessory	Order code
1	Bird cage	WMT70BIRDKIT
2	Zero wind verifier	WMT70VERIFIER
3	WMT700	
4	Mounting adapter between 228869 and 4258057 (ASOS mounting adapter)	ASM212140
5	Adapter for WMTFIX70	228869

Number	Accessory	Order code
6	Stainless steel mounting adapter for 60-mm (2.36 in) tube with plastic insulator (for marine installation and cable outside mast)	WMT700FIX60-MARINE
7	Stainless steel mounting adapter for 60-mm (2.36 in) tube	WMT700FIX60-RSTSP
8	Mounting adapter (RST) for 50-mm (1.97 in) pole	ASM214411
9	General purpose mounting adapter for WMT700, WMT70FIX	WMT70FIXSP
10	Cross arm (40 x 40 x 850 mm)	WMT70CROSSARM
11	WMT700 USB service cable	240855
	Universal USB service cable with screw terminal for RS-485 or RS-232	240884
12	Hybrid cable 2 m	CBL210706-2MSP
	Hybrid cable 10 m	CBL210706-10MSP
	Hybrid cable 15 m	CBL210706-15MSP
	Hybrid cable 26 m	CBL210706-26MSP
	Cable 2 m	227567SP
	Cable 10 m	227568SP
	Cable 15 m	237890SP
	Cable 26 m	237889SP
	RS-485 cable 2 m, cable connector, open leads on one end	228259SP
	RS-485 cable 10 m, cable connector, open leads on one end	228260SP
	MAWS cable 10 m	227565SP
	Adapter cable for WS425 serial	227569SP
	Adapter cable for analog frequency output	227570SP
	Junction box with 2-m hybrid cable (extension diameter 8–13 mm)	ASM210719SP
13	Outdoor AC (mains) power supply for arm-heated and fully heated WMT700	PJB480
14	Wind display XDi-N 144 (5″ display) for ship navigation	252307
	Wind display XDi-N 192 (7″ display) for ship navigation	252321

Appendix G. Certificate

DNV

TYPE APPROVAL CERTIFICATE

Certificate No:
TAA00000U5
Revision No:
1

This is to certify:

That the Bridge instrumentation

with type designation(s)
WMT 700 SERIES ULTRASONIC WIND SENSORS WMT701, WMT702, WMT703 and WMT704

Issued to
Vaisala Oyj
Vantaa, Finland

is found to comply with
IEC 60945 Ed. 4 (2002-08) Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results

Application :

See page 2.

Issued at **Høvik** on **2022-02-10**
This Certificate is valid until **2027-02-09** .
DNV local unit: **Helsinki FIS**

Approval Engineer: **Frederik Tore Elter**

for **DNV**

.....
Trond Sjåvåg
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

Appendix H. Regulatory statements

H.1 FCC/ISED regulatory notices

Modification statement

Vaisala Oyj has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

Vaisala Oyj n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.

Interference statement

This device complies with Part 15 of the FCC Rules and Innovation, Science and Economic Development Canada (ISED) licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR Innovation, Sciences et Développement économique Canada (ISDE) applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

FCC Class B digital device notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAN ICES-3 (B) / NMB-3 (B)

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de classe B est conforme à la norme canadienne NMB-003.

Recycling



Recycle all applicable material according to local regulations.

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