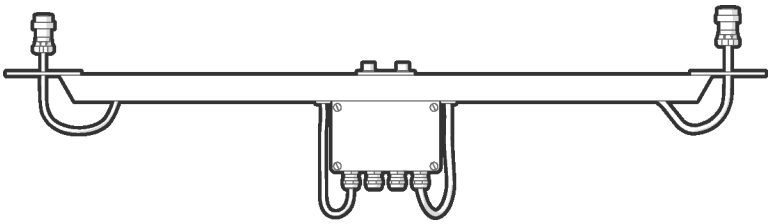
M210822EN-F

User Guide

Vaisala Serial Wind Transmitter

WAC155



VAISALA

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1. About this document

1.1 Version information

Table 1 Document versions

Document code	Date	Description
M210822EN-F	January 2021	Updated WHP151 and WHP25 information.
M210822EN-E	February 2020	Updated WAA252 and WAV252 wiring figures.
M210822EN-D	November 2018	Updated spare part descriptions of ZZ45037 and ZZ45037SPEC.

1.2 Related manuals

Table 2 Related manuals

Document code	Name
M210293EN	*Vaisala Anemometer WAA151 User Guide*
M210294EN	*Vaisala Wind Vane WAV151 User Guide*

1.3 Documentation conventions

WARNING! 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! Caution warns you of 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.

Note highlights important information on using the product.

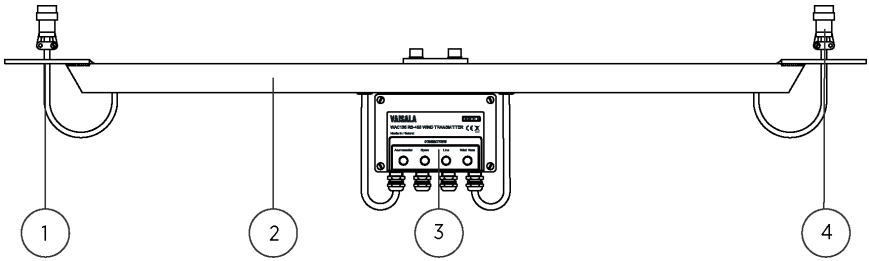
Tip gives information for using the product more efficiently.

Lists tools needed to perform the task.

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

2. Product overview

2.1 Vaisala Serial Wind Transmitter WAC155



1 Flange for mounting Vaisala Anemometer
2 Cross arm
3 Junction box containing the component board
4 Flange for mounting Vaisala Wind Vane

WAC155 converts the digital data that is supplied by Vaisala WA15 series wind sensors into standard serial line messages. The transmitter consists of a component board in a junction box and a cross arm for mounting the wind sensors.

WAC155 communicates with the system through a 2-wire RS-485 cable. The standard electrical and mechanical sensor connections are for WA15 wind set anemometers and wind vanes.

WAC155 also provides electrical input for Thies anemometer (4.3351.00.000) and analog vane (4.3150.00.141). However, these sensors are not directly mountable to the sensor cross arm.

The system supplies power to the wind sensors through the transmitter. The input operating voltage is 9 ... 31.5 VDC. The transmitter also provides the sensors with a throughput for heating power. The unit automatically connects the heating power at a certain temperature.

The main features of WAC155 are:

- Communication with NMEA 0183 -compliant protocol over RS-85 serial bus with configurable ID, baud rate, and turnaround delay
- Measurement of the wind parameters using the instant method according to WMO recommendations
- Computing of wind data average values with adjustable averaging time
- Service connection for configuration and maintenance
- Heating control of sensors with adjustable temperature limits

2.2 Safety

This product has been type-tested for safety. Note the following precautions:

WARNING! Only licensed experts may install electrical components. They must adhere to local and state legislation and regulations.

WARNING! Ground the product and verify outdoor installation grounding periodically. Failure to provide proper grounding can result in injury or death from electrical shock and can severely damage the equipment.

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

2.2.1 ESD protection

Electrostatic Discharge (ESD) can damage electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects in the equipment housing.

To avoid delivering high static voltages to the product:

- Handle ESD-sensitive components on a properly grounded and protected ESD workbench or by grounding yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either precaution, touch a conductive part of the equipment chassis with your other hand before touching ESD-sensitive components.
- Hold component boards by the edges and avoid touching component contacts.

3. Installation

3.1 Selecting location

Finding a suitable site for the product is important for getting representative ambient measurements. Make sure that the site represents the general area of interest.

Allow sufficient clearance for the wind sensors. Do not install wind sensors next to a building or any other object that can affect the flow of air.

CAUTION! Installations on top of high buildings or masts and in sites on open grounds are vulnerable to lightning strikes. A nearby lightning strike may induce a high-voltage surge not tolerable by the internal surge suppressors of the instrument. Additional protection is needed in regions with frequent, severe thunderstorms, especially when long line cables (>30 m (98 ft)) are used. Vaisala recommends using a surge protector, such as WSP150, in all sites with an elevated risk of a lightning strike.

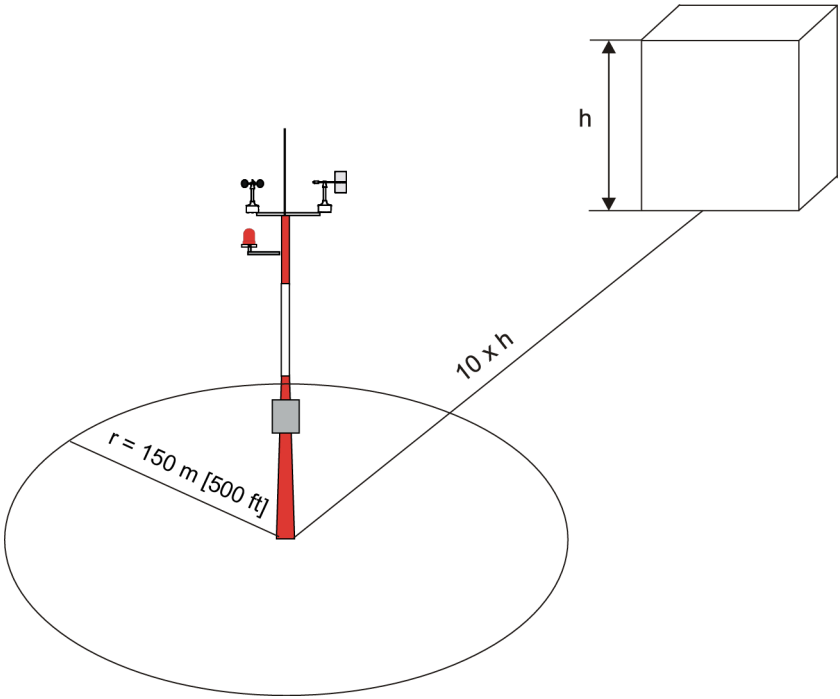


Figure 1 Recommended mast location in open area

Any object of height (h) does not remarkably disturb wind measurement at a minimum distance of 10 × h. There must be at least 150 m (500 ft) open area in all directions from the mast. Minimum distance between the mast and obstacles is ten times the height of an obstacle.

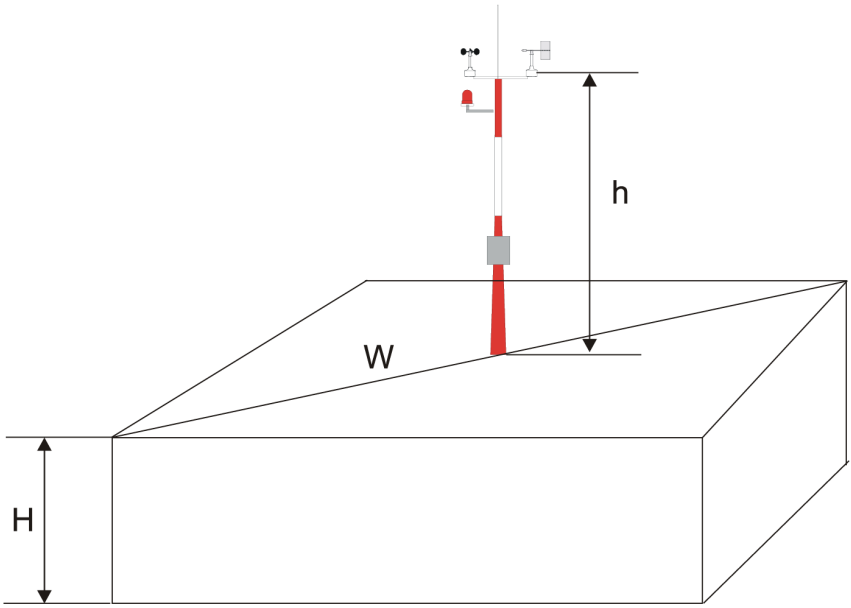
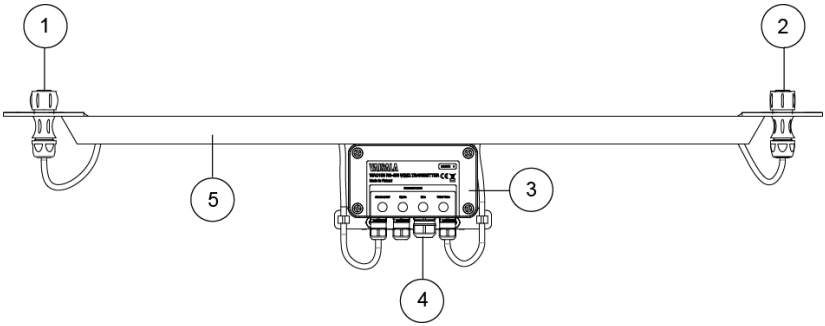


Figure 2 Recommended mast length on top of building

The recommended minimum length (h) for the mast that is installed on the top of a building is 1.5 times the height of the building (H). When the diagonal (W) is less than the height (H) the minimum length of the mast is 1.5 × W.

3.2 Installing Vaisala Serial Wind Transmitter WAC155

1. Remove the four screws holding the cover of the transmitter and remove the cover.

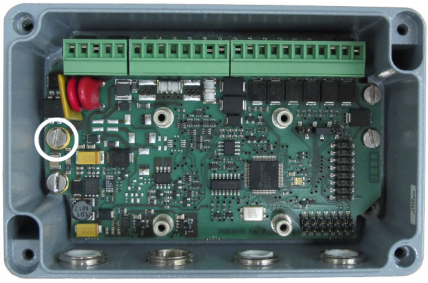


1 Flange for mounting Vaisala Anemometer
2 Flange for mounting Vaisala Wind Vane
3 Transmitter, contains the component board
4 Sensor cable gland
5 Cross arm

2. Select the RS-485 termination.
See Service connector and jumper settings (page 13).

If the data line is shorter than 500 m (547 yd) or if the data rate is slower than 9600 baud, the RS-485 terminator is not normally needed.

3. For marine applications, remove the grounding screw.



4. Enter the power and signal cables through the cable glands. For better protection against RF interference, ground the cable shield.
   See Connections (page 14).
5. Connect the wires to the X2 removable screw terminal block. Tighten the output cable glands.
   See Cable connections (page 16).
6. Reattach the cover with the 4 screws.
7. Attach the unit on the top of a pole mast with the mounting clamp.
   See Mounting WAC155 on top of pole mast (page 27).
8. Mount the sensors to the cross arm.
   See Mounting wind sensors to cross arm (page 29) and the sensor manuals.
9. Before erecting the mast, align the cross arm.
   See Alignment (page 28).

In tower installations you may have to mount and align the sensors on existing structures.

CAUTION! If you have the component board PCB210450B, the maximum operating voltage is 15.5 V instead of 31.5 V.

3.3 Service connector and jumper settings

You can configure and maintain the unit through:

- RS-485 line on terminals X2/7-8
- Service connector X5

If RS-485 is not available, you can use X5. X5 is a 6-terminal pin header with pin 2 removed for polarization. It can be used as a service connector and as a jumper terminal.

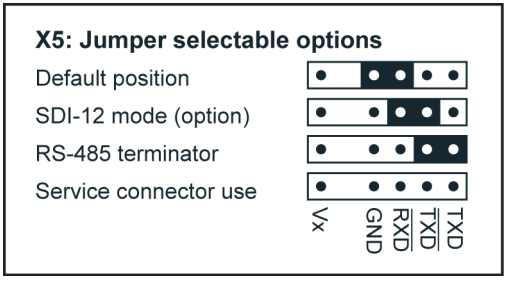


Figure 3 X5 service connector and jumper settings

The following figure shows the location of X5.

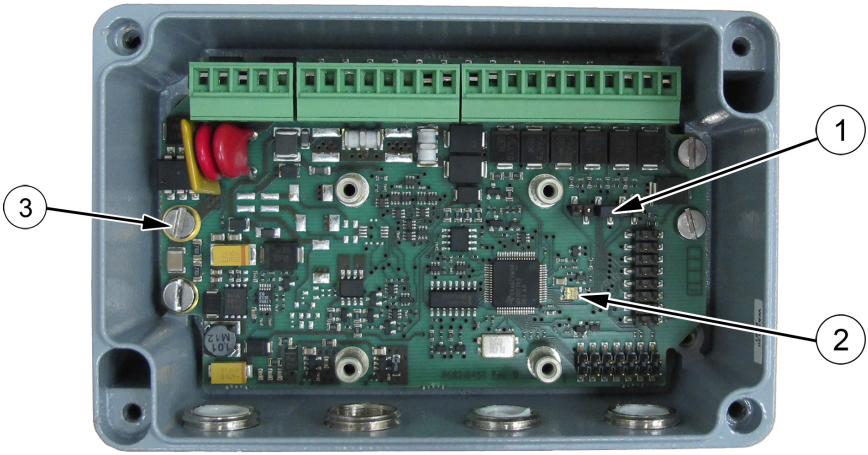


Figure 4 WAC155 component board

1 Service connector X5
2 Status indicator LED
3 Grounding screw

In marine applications, you must remove the grounding screw.

3.4 Connections

WAC155 provides the line cable entry through a gland for a cable with a diameter 7 ... 10 mm. For better protection against RF interference, bend the cable shield.

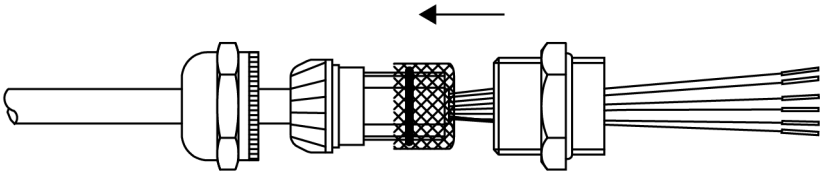


Figure 5 Braided cable shield

WAC155 has 3 plug-in I/O connectors: X1, X2, and X3. The terminals accept wires with maximum cross-section area of 1.5 mm^2.

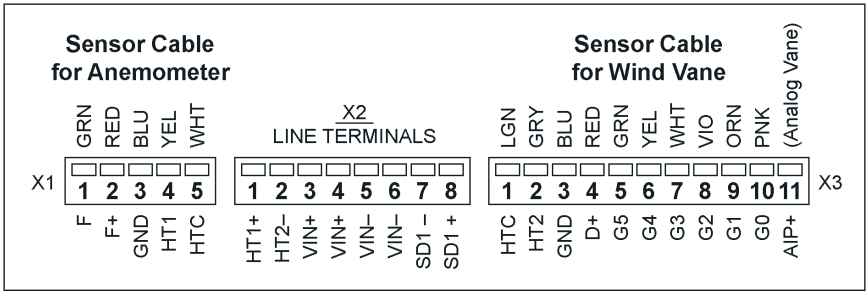


Figure 6 I/O connectors

For the location of the connectors and the cable routing through the cable glands, see Sensor Wiring.

The following tables show the I/O connector pinouts.

Table 3 Anemometer connector (X1) pinout

Pin number	Signal	Description
1	F	Frequency input from sensor
2	F+	Supply voltage output to sensor
3	GND	Sensor ground
4	HT1	Heating supply through control switch from X2
5	HTC	Heating common for heater serial connection

Table 4 Power/Control connector (X2) pinout

Pin number	Signal	Description
1	HT1+	Heating supply input (+)
2	HT2-	Heating supply input (-)
3	Vin+	Supply voltage input
4	Vin+	Supply voltage input
5	Vin-	Supply voltage ground
6	Vin-	Supply voltage ground
7	SD1-	RS-485 inverting I/O

Pin number	Signal	Description
8	SD1+	RS-485 non-inverting I/O

Table 5 Wind direction sensor connector (X3) pinout

Pin number	Signal	Description
1	HTC	Heating common for heater serial connection
2	HT2	Heating supply return to connector X2
3	GND	Sensor ground
4	D+	Supply voltage output to sensor
5	G5	Gray code input from sensor, bit 5
6	G4	Gray code input from sensor, bit 4
7	G3	Gray code input from sensor, bit 3
8	G2	Gray code input from sensor, bit 2
9	G1	Gray code input from sensor, bit 1
10	G0	Gray code input from sensor, bit 0
11	AIP+	Reserved for analog vane

3.4.1 Cable connections

The transmitter connects the wind sensors with the cross arm standard cables through 2 cable glands. Through the cables, the WAC155 transmitter both feeds the sensor power and receives wind data. Plug-in type screw terminal connectors are provided both for the sensor cables and the output line cable.

The following figure shows the standard cable connections with sensor heating elements connected in series.

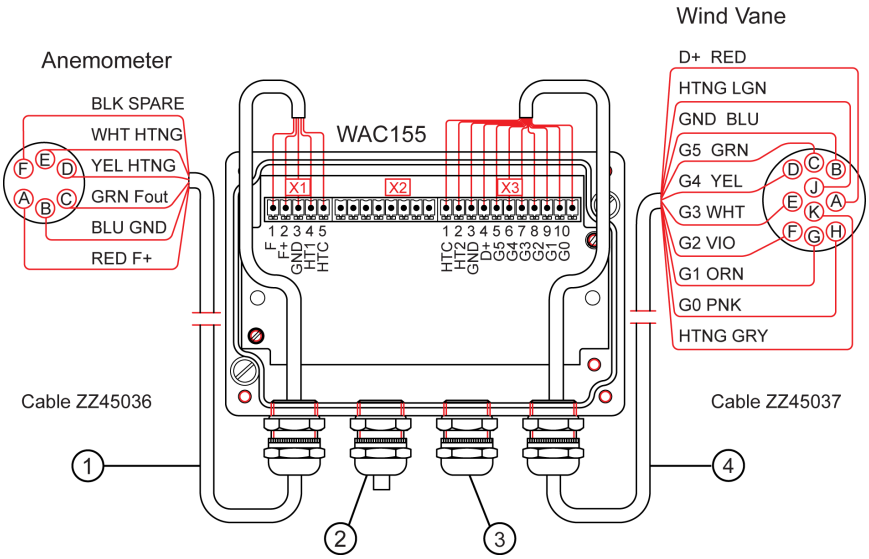


Figure 7 Sensor wiring

1 Anemometer cable ZZ45036
2 Spare gland (for chaining the power and signal wires)
3 Gland for power and signal cables
4 Wind vane cable ZZ45037

3.4.2 Signal output

The serial wind transmitter WAC155 provides a 2-wire half-duplex RS-485 serial bus for data interchange. Wind data is provided in standard NMEA 0183 messages. A service connection is available for configuration and status information.

Several transmitters can share the same RS-485 bus. If there are several transmitters in the same bus, auto-transmission cannot be enabled, and data must be polled from one sensor at a time using NMEA query. If you use only one transmitter, you can configure it to automatically transmit data at selectable intervals.

Each device in the bus has a unique, configurable ID, containing 1 to 5 characters. Alphabetical characters a - z, A - Z (case-sensitive), and numbers 0 - 9 are accepted.

Typically, only a 4-wire shielded cable is required for the line between WAC155 and the host. Two of the four wires provide the operating power for the system. The other two wires are for the RS-485 serial line. Vaisala recommends twisted pair wires for both the power line and the data line.

The recommended maximum length of the RS-485 line is 1200 m (4000 ft). In practice, the achievable line length is affected by the electrical noise and the number of transmitters in the bus. Very long lines may also gather overvoltage transients and surge currents caused by nearby lightning strikes.

WAC155 has on-board surge protection on the RS-485 line, accomplished with discharge tubes and transient zener diodes.

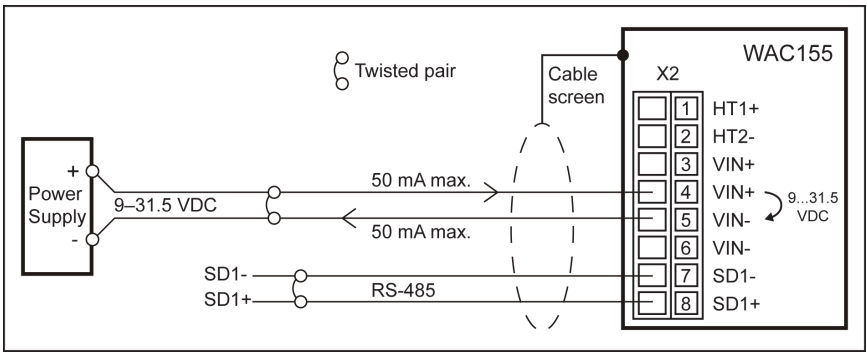


Figure 8 Typical WAC155 system

3.5 Powering

The serial wind transmitter WAC155 transmitter accepts 9 ... 31.5 VDC input power. Typical average power consumption is 120 mW (with WA15 series sensors and powersave mode activated).

The power line is protected against incorrect polarity and overvoltage transients caused by nearby lightning strikes. Transient protection is accomplished with discharge tubes, VDRs, and transient zener diodes.

CAUTION! If you have the revision B of the board (PCB210450B), the maximum operating voltage is 15.5 V instead of 31.5 V. The component board differs in size and outlook. See Service connector and jumper settings (page 13).

3.5.1 Optional heating power

WAC155 also provides the sensors with a throughput and control of heating power, which can be connected if sensor heating is required. The heating power circuit is galvanically isolated from the operating power circuit.

The heating power connection requires an extra pair of wires. Since the required heating current for the WA15 series is typically 0.5 ... 1 A, it is most conveniently supplied from a local power source. WAC155 automatically connects heating power in temperatures below +4 °C (39.2 F).

There are two ways to connect the heating power, depending on the heating power supply available. The default way is to use a 40 V power supply and connect the heating elements of the sensors in series.

When connecting DC heating power, make sure you have the correct polarity of the X2 connector pins 1 and 2 (HT1+ and HT2-). AC heating power wires can be connected either way round.

You can use the 40 V power supply only when both sensors are connected. The sensor heating elements have a 40 Ω resistance each. The typical heating current is 0.5 A in a series-connected system with a 40 V power supply.

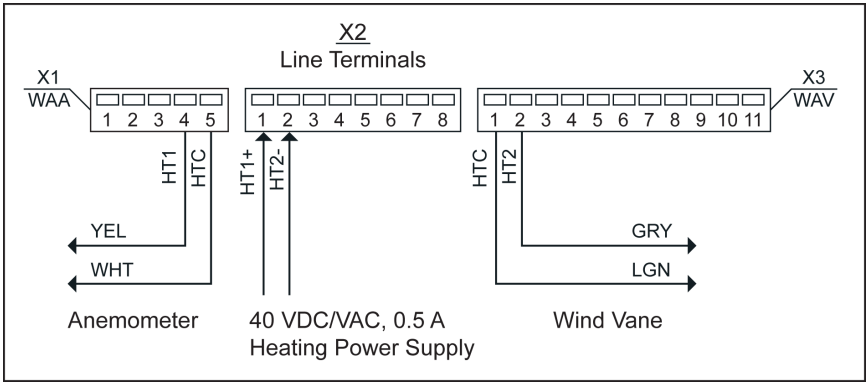


Figure 9 Heating power connection with 40 V power supply

If you use a 20 V power supply, you must connect the sensor heating elements in parallel. The following figure shows the parallel connection. In this case, the typical current demand is 0.5 A + 0.5 A = 1 A.

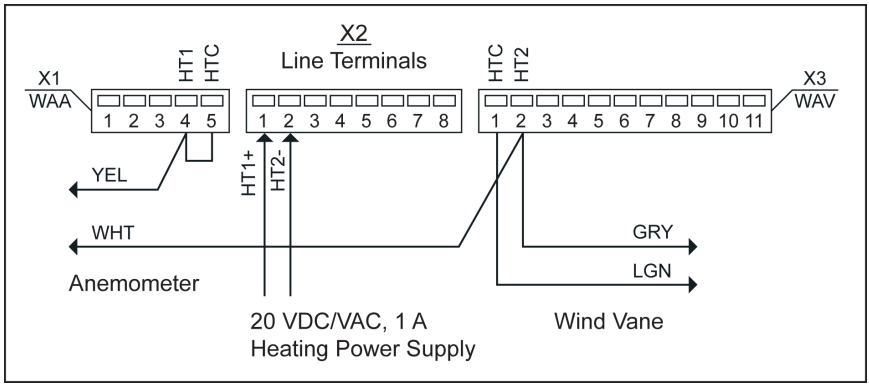


Figure 10 Heating power connection with 20 V power supply

When you only install one sensor, anemometer WAA151 or wind vane WAV151, you must use a 20 V power supply and replace the missing sensor heating element with a jumper wire. In this case, only 0.5 A is typically consumed.

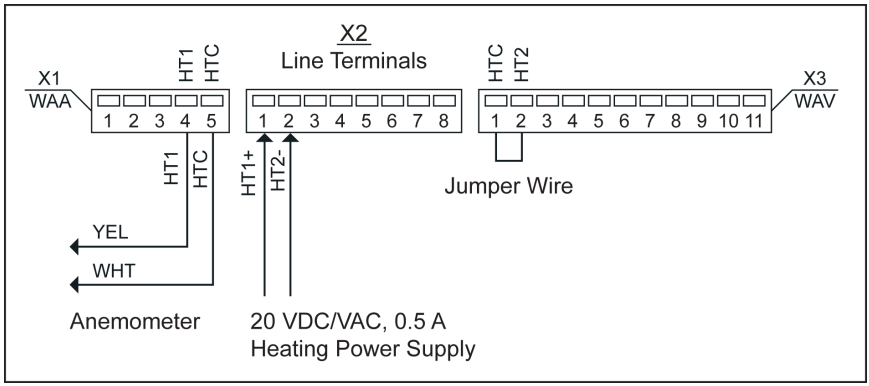


Figure 11 Heating power connection for anemometer only

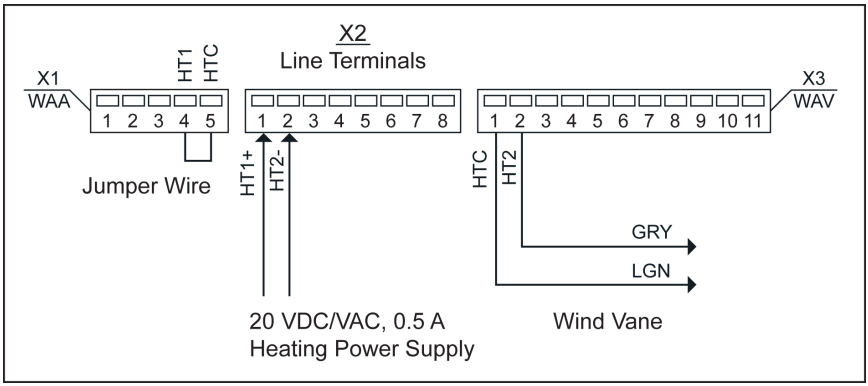


Figure 12 Heating power connection for wind vane only

3.6 Wiring

You can wire WAC155 with:

- WAA151 and WAV151. See Wiring WAA151 and WAV151 with WAC155 (page 21)
- WAA252 and WAV252. See Wiring WAA252 and WAV252 with WAC155 (page 23)

3.6.1 Wiring WAA151 and WAV151 with WAC155

When installing WAC155 on a weather station, see the weather station documentation for installation instructions.

The following wiring diagrams show how to wire the WA15 sensors WAA151 and WAV151 with WAC155:

- If heating power is not connected, see Basic wiring.
- If heating power is connected, see Wiring with WHP151.

Basic wiring

The following figure shows the basic wiring when WAA151 and WAV151 wind sensors are connected to the WAC155 transmitter. Heating power is not connected.

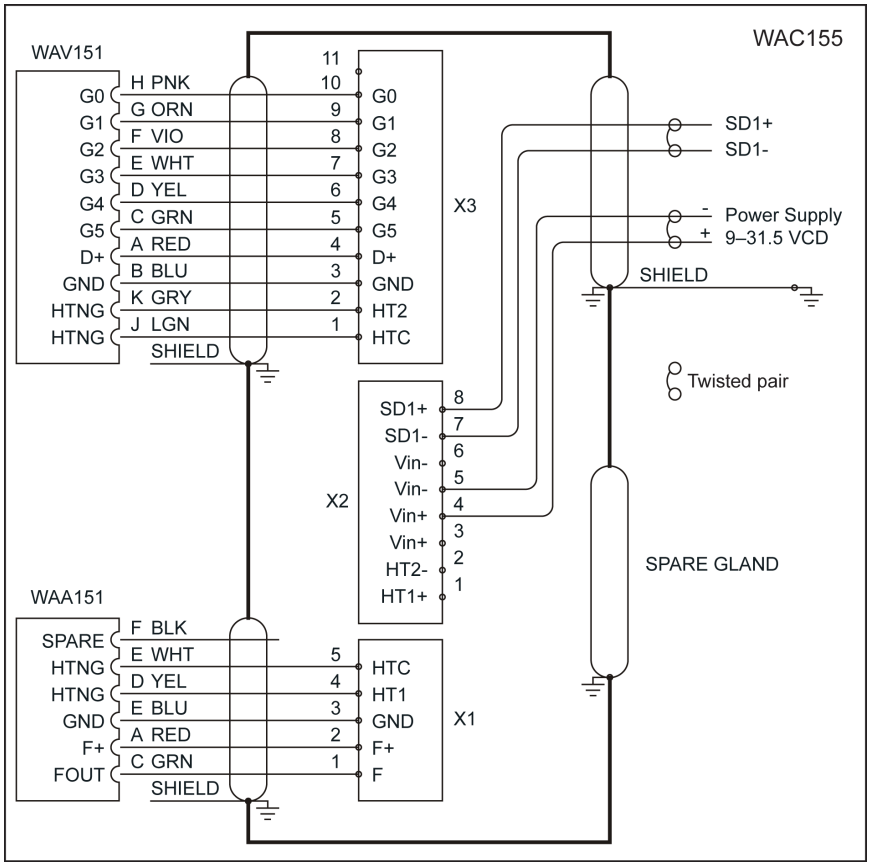


Figure 13 Wiring WAA151 and WAV151 with WAC155

Wiring with WHP151

WHP151 is sold only as a spare part.

The following figure shows WAC155 wiring with Vaisala Mains Power Supply WHP151 with heating power connected.

WHP151 has jumpers for configuring the power output. Connect pins 2 and 3 of X5 to set the correct operating voltage and remove the jumper of X4 to provide continuous heating power. If you connect the heating in series to both sensors as shown in the figure, set the heating power to 38 Vrms 0.5 A by connecting pins 2 and 3 of the X8 jumper.

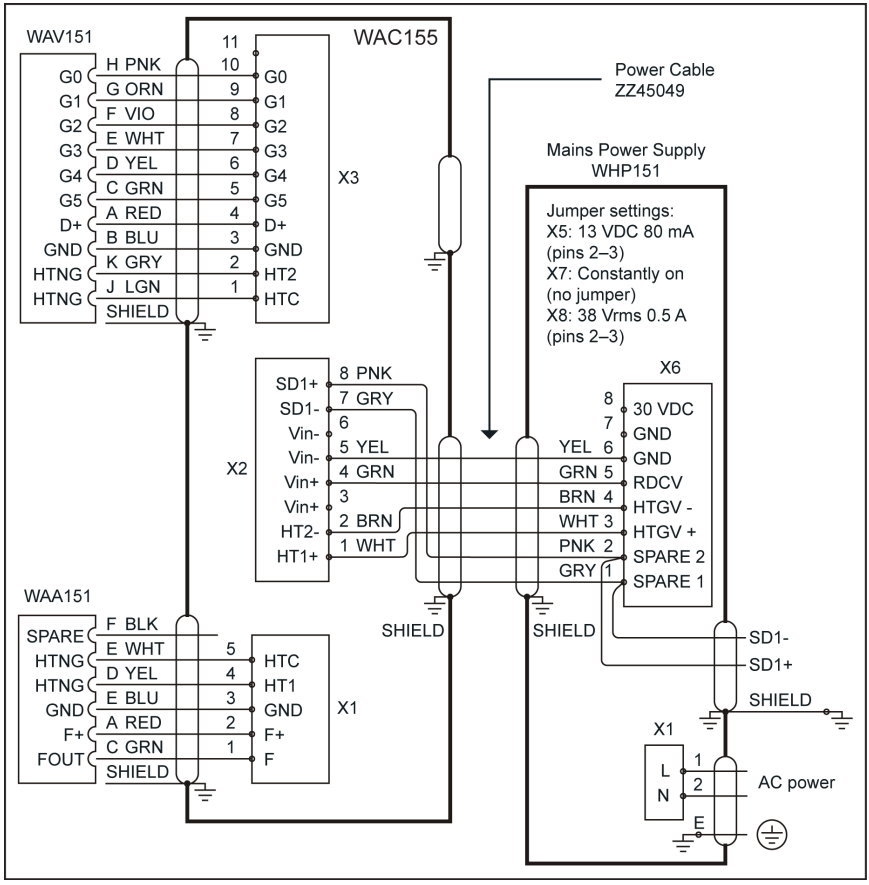


Figure 14 Wiring WAA15 sensors with mains power supply WHP151

3.6.2 Wiring WAA252 and WAV252 with WAC155

The following wiring diagrams show how to wire the WA25 sensors with WAC155:

- No external operating voltage
- Low-current operating power needed

If you have WA25, you configure WAC155. See Configuring WAC155 for WA25 (page 27).

No external operating voltage

The following figure shows the simplest wiring for the WA25 series wind sensors with Vaisala Mains Power Supply WHP25. WAA252 supplies WAC155 with the operating power (+12 Vout to X2/3). No external operating voltage is applied to connector X2. The expansion connector required for high-current wiring is included in the WAA252 accessories.

WHP25 is sold only as a spare part.

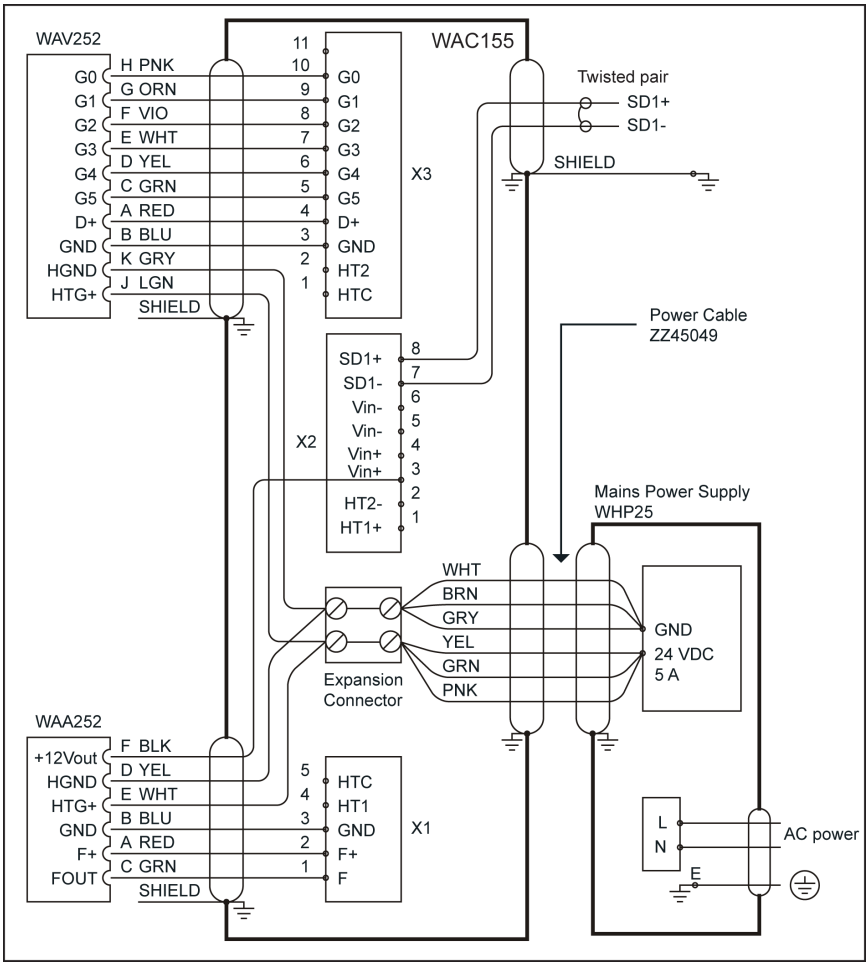


Figure 15 Wiring WA25 series wind sensors without external operating voltage

Low-current operating power needed

The following figure shows the WA25 wiring for applications where low-current operating power is needed also when heating power is not available. The expansion connector required for high-current wiring is included in the WAA252 accessories.

WAA252 accessories include the expansion connector required for the high current wiring.

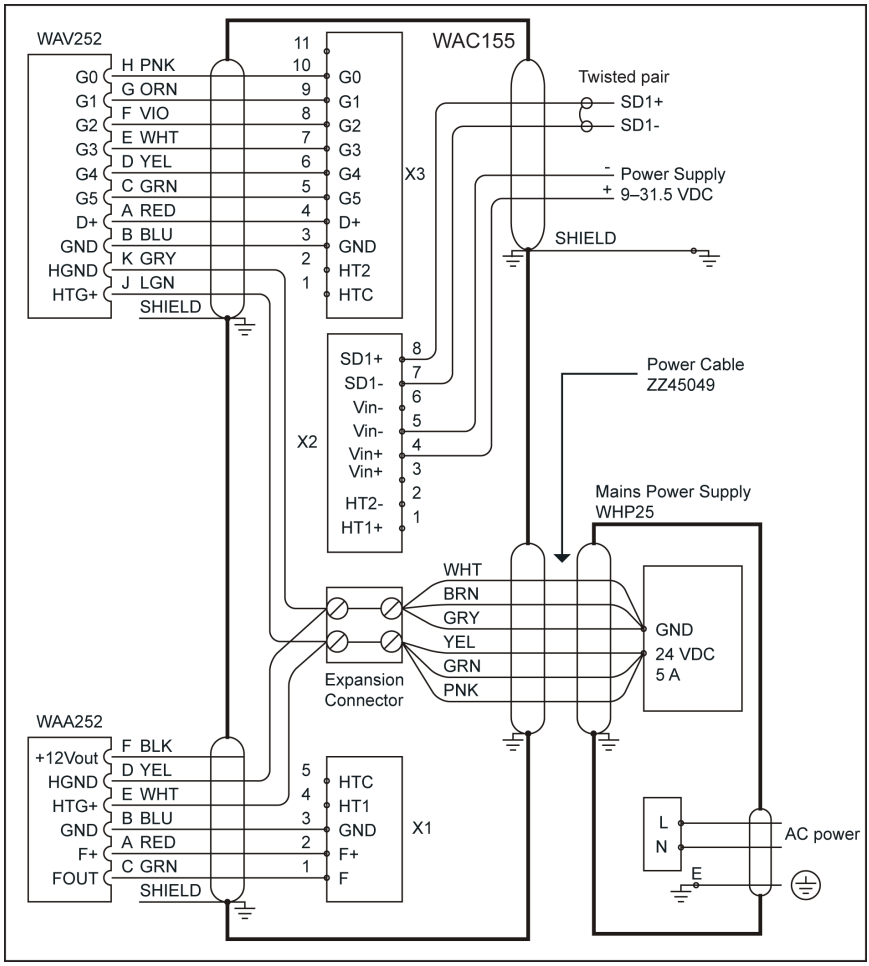


Figure 16 Wiring for WA25 series wind sensors with low-current backup power connection

More information

- SETMEA (page 39)
- SETALR (page 42)

3.7 Configuration

WAC155 default settings are suitable for Vaisala Anemometer WAA151 and Vaisala Wind Vane WAV151. No configuration is needed.

If you have WA25 wind sensors, you must configure WAC155. See Configuring WAC155 for WA25 (page 27).

3.7.1 Configuring WAC155 for WA25

You must configure WAC155 for WA25. With default settings WAC155 and WA25 sensors can return null fields.

Type commands on a single line and terminate them with a line feed <lf> or a carriage return <cr> character. Separate parameters and values by a space.

1. Open a serial connection to WAC155. The default settings are `9600 bps, 8 N 1`.
2. To open a connection for commands, type **`OPEN`** `[id]<cr>`.

   ```
   open $
   ```

3. To set the `spdvoltlimit` parameter, type **`SETALR`** `spdvoltlimit 0`.
4. To set the `dirvoltlimit` parameter, type **`SETALR`** `dirvoltlimit 0`.
5. To set the `powersave` parameter, type **`SETMEA`** `powersave 0`.
6. To get the parameters into use, reset WAC155 by typing **`RESET`**.

More information

- Communication interfaces (page 31)
- Service connection (page 34)

3.8 Mounting WAC155 on top of pole mast

WARNING! A long cable between different units (sensors, transmitters, power supplies, and displays) can cause a lethal surge voltage if a lightning strikes in the vicinity. Always ground the mast equipment case close to the mast with a short low-resistance cable.

The following figure shows how to mount the WAC155 transmitter on top of a Ø 60 mm pole mast using the standard mounting clamp. The arrow on the cover of the junction box must point to the North.

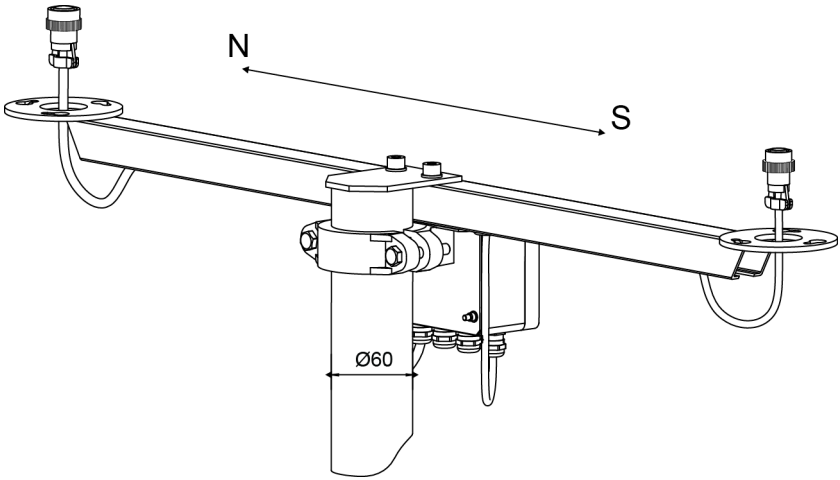


Figure 17 Mounting WAC155 on top of pole mast

3.8.1 Alignment

After mounting the WAC155 transmitter to the mast, make sure that the WAV151 end of the cross arm is pointing to the North.

If you cannot align the cross arm wind vane end directly to the North, you can measure the deviation angle and set the value of wind direction angle offset with the **SETDIR** command. See SETDIR (page 37).

When the cross arm deviates from the North in the clockwise direction, use the plus sign (+) in the **offset** parameter. For counterclockwise deviation, use the minus sign (-).

Wind direction can be referred to true North, which uses the Earth's geographic meridians, or to magnetic North, which is read with a magnetic compass. The magnetic declination is the difference in degrees between the true North and magnetic North.

3.9 Mounting wind sensors to cross arm

You can mount the sensors only one way to the cross arm flanges. This ensures the correct alignment when replacing or reassembling the wind vane.

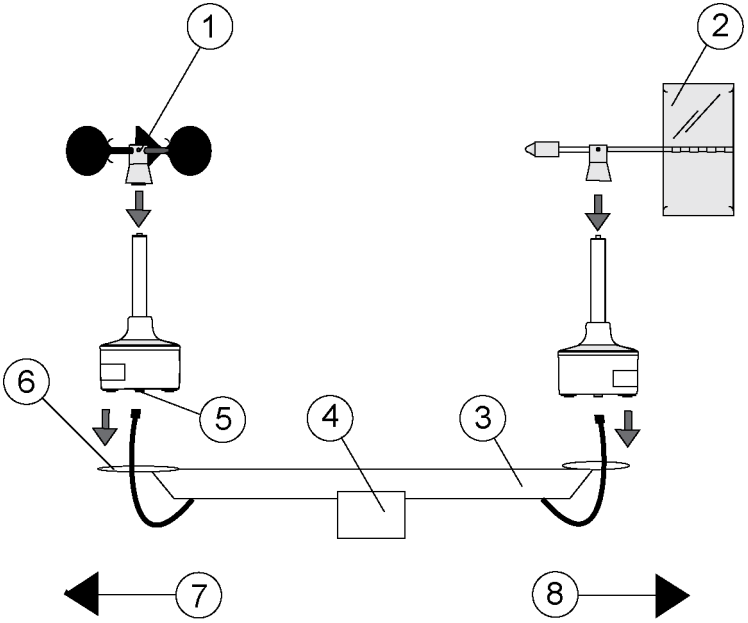


Figure 18 Installing wind sensors WAA151 and WAV151 to WAC155

1 WAA151 cup assembly
2 WAV151 tail assembly
3 Cross arm
4 Junction box
5 Connector
6 Mounting flange
7 South
8 North

3.9.1 Verification

The status indicator LED is located on the component board under the junction box cover.

- The LED flashes green, if the self-diagnostics are completed without errors.
- The LED flashes red, if there is an error.

An error can be caused by a sensor malfunction, an erroneous installation or configuration, or a combination of these. To diagnose the problem, use the service command **ERRS** over the service connection.

If WAC155 signal cable is connected to a data collection system and the system is switched on, make sure that the wind readings react correctly:

- To test the anemometer, rotate the cups manually.
- To test the wind vane, hold the vane at a few fixed angles and verify the data.

4. Operation

4.1 User interface

There is a 2-color status LED on the Vaisala Serial Transmitter WAC155 component board. The LED flashes green when the operational status is OK, and red when there is an error condition. The LED is activated for 5 minutes after the transmitter is switched on. The LED is also activated when the service connection is open.

The red LED does not indicate the error type. You must establish a service connection to find the cause.

Data and service connections are provided over an RS-485 serial bus or service connector X5.

More information

- Error messages (page 50)

4.2 Communication interfaces

Vaisala Serial Wind Transmitter WAC155 communicates through a half-duplex RS-485 interface accessible through terminals X2/7-8.

You can configure the transmitter to send wind data messages at regular intervals (auto-transmit mode) or you can get the data as a response to an MWV query. The data is provided in standard NMEA/MWV wind speed and angle messages. A service interface is available at pin header X5 of the board.

You can connect more than one transmitter to a single RS-485 bus. In case of a single transmitter, you can set the device to transmit data messages at a preconfigured interval. If there are several transmitters in the bus, you can only poll data with the MWV query.

Each device in the same bus has a unique configurable ID, containing 1 ... 5 characters. Alphabetical characters a-z, A-Z (case-sensitive), and numbers 0-9 are accepted.

Table 6 WAC155 default serial communication settings

Property	Description/Value
Baud rate	9600
Data bits	8
Parity	None
Stop bits	1

The service interface at pin header X5 provides the same functionality as the RS-485 interface at X2. Using the service interface affects the RS-485 interface since they share the same data communication port on the WAC155 circuit board.

4.2.1 MWV message format

The NMEA 0183 specification defines wind speed and angle message MWV:

```
$WIMWV,<a.a>,<R>,<s.s>,<U>,<S>*<CS><cr><lf>
```

$WIMWV	Fixed text at the start of the message
<a.a>	Wind angle, 0 ... 359 degrees
<R>	Reference: R = Relative, T = Theoretical
<s.s>	Wind speed
<U>	Units: K = km/h, M = m/s, N = knots (only m/s is provided)
<S>	Status: A = Valid, V = Invalid
*	Asterisk, indicating that the next field is the checksum
<CS>	Two-character checksum for the message

The comma (,) is used as a separator between the fields. Here are some examples of MWV messages:

```
$WIMWV,39,R,1.3,M,A*06
$WIMWV,61,R,1.0,M,A*08
$WIMWV,39,R,0.5,M,A*01
$WIMWV,59,R,1.2,M,A*01
```

To enable the automatic MWV message output, use the **SETMES** command. By default, no automatic messages are enabled.

More information

- SETMES (page 38)

4.2.2 Polling data with MWV query

To poll for an MWV message, type the following query:

```
$WIPKQ,*78<cr>
```

$WIP	Fixed text at the start of the query
K	Default transmitter device ID

Q	Marks the message as a query
*	Asterisk, indicating that the next field is the checksum
78	Two-character checksum for the device ID

The data in the response follows the MWV message format, but the header is different:

```
$P<ID>MWV,<a.a>,<R>,<s.s>,<U>,<S>*<CS><cr><lf>
```

$P	Fixed text at the start of the response
<ID>	Transmitter device ID
MWV	Marks the message as a wind speed and angle message

After receiving a query that uses its device ID, the transmitter replies with an MWV message containing the wind data. An example of a query with device ID "A":

```
$WIPAQ,*72
```

Example of response:

```
$PAMWV,50,R,0.0,M,A*04
```

The following table lists checksums and polling strings for queries with some typical device IDs.

By default, the transmitter does not respond to an MWV query. You can enable the response with the **SETMES** command by naming any of the messages (0 ... 3) MWVQUERY. See SETMES (page 38).

Table 7 Checksum

ID character <id>	Checksum <CS>	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>

ID character <id>	Checksum <CS>	Polling string
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>

4.2.3 Service connection

You can configure the device and view the status information through the service connection. The same interface is used for both the data transmission and the connection. When you open the connection with the **OPEN** command, the data transmission and query are disabled as long as the service connection remains open.

When you change parameter values, you must reset with the **RESET** command or by powering up to get the new parameters into use.

The parameter setting commands are not case-sensitive. The device ID is case-sensitive.

Enter commands on a single line and terminate with a line feed <lf> or a carriage return <cr> character. Separate parameters and values by a space. You can set only one parameter with a single command.

More information

- Configuring WAC155 for WA25 (page 27)

4.3 Configuration commands

The following table lists the commands available in the service connection.

Table 8 Configuration commands

Command	Description
OPEN	Opens the service connection.

Command	Description
CLOSE	Closes the service connection.
HELP	Displays the command list.
SETDEV	Sets the ID of the transmitter.
SETMEA	Configures measurement parameters.
SETSPD	Configures wind speed computation.
SETDIR	Configures wind direction computation.
SETMES	Specifies data transmission mode.
SETCOM	Configures communication parameters.
SETALR	Configures sensor alarm limits.
SETHEA	Configures wind sensor heating control.
GETHEA	Displays the current heating status.
SERVICE TIMEOUT	Configures timeout for service connection.
GETSET	Displays the current settings of the device.
ERRS	Displays the current error status.
INIE	Resets the transmitter to factory default settings.
RESET	Resets the transmitter to new settings.

The following table lists the definitions for various command line elements.

Table 9 Definitions for command line elements

Element	Meaning	Text style used
SAMPLE	Specifies the name of the command or utility.	**UPPER CASE BOLD**
{variable}	Indicates a set of choices from which the user must choose one, several, or all.	lower case enclosed in {braces}
[option]	Indicates optional items.	lower case enclosed in [brackets]
<value>	Specifies the value for the option.	lower case enclosed in <angle brackets>
. , : ;	Punctuation marks are a part of the command and must be included as they are.	lower case
<cr>	Stands for pressing **ENTER**.	lower case

4.3.1 OPEN

The **OPEN** command establishes a service connection with the transmitter. Configuration commands are effective only when the service connection is open.

```
OPEN [id]<cr>
```

id	Case sensitive device ID. Must be used if a device ID has been set for the specific transmitter. The device ID can be 1 to 5 characters (a-z, A-Z, 0-9)

As a factory default, the transmitter ID is "K". If you have not set a device ID for the transmitter with the **SETDEV** command, you can open the service connection with **OPEN K**<cr>.

If you do not know the device ID, open the service connection with the dollar sign "$": **OPEN $**
Use this command only when you have a single transmitter on the bus.

The service connection remains open until it is closed with the **CLOSE** command or the defined service timeout expires. You can configure the timeout with the **SERVICE TIMEOUT** command. When the service connection is closed, the transmitter returns into the normal data transmission mode.

Example

```
>open K
Vaisala Serial Wind Transmitter WAC155
SW version 2.2.1
Service connection opened
>
```

4.3.2 CLOSE

The **CLOSE** command closes all current service connections in the bus.

To take new parameter settings into use when the service connection is closed; reset the transmitter with the **RESET** command or power-cycle the transmitter to validate the new settings.

CLOSE<cr>

Example

```
>close
Service connection closed
>
```

4.3.3 SETDEV

The **SETDEV** command sets the device ID of the transmitter. In a multi-transmitter network, each transmitter must have a unique ID.

```
SETDEV id <value><cr>
```

value	New device ID for the transmitter. The case sensitive ID may contain up to 5 characters, including A-Z, a-z, and 0-9 (default: no ID)

Example

```
>setdev id A1
       ID=A1
>
```

4.3.4 SETSPD

The **SETSPD** command configures the wind speed averaging time.

```
SETSPD average <value><cr>
```

value	Wind speed averaging time in seconds. Range is 0.25 ... 5.00 in 0.25-second increments (default: 3.00).

Example

```
>setspd average 3.00
        AVERAGE=3.00
>
```

4.3.5 SETDIR

The **SETDIR** command configures the wind direction averaging time and angle offset.

```
SETDIR [average] [offset] <value>
```

`average`	Wind direction averaging time in seconds. Range 0.25 ... 5.00 in 0.25-second increments (default: 3.00).
`offset`	Deviation of the sensor alignment from the North in degrees. Range is +180 ... -180° in 1-degree increments (default: 0).
`value`	Value for the option

Example

```
>setdir average 1.00
       AVERAGE=1.00
>setdir offset -30
       OFFSET=-30
>
```

More information

- Alignment (page 28)

4.3.6 SETMES

The **SETMES** command specifies the data transmission mode. The transmitter can support four different messages at a time. Each message has its own settings for the message type and transmit interval.

The supported message types are:

- NONE (no message)
- MWV (auto-transmission of standard wind speed and direction message)
- MWVQUERY (polling of Vaisala extension to MWV message)

```
SETMES {messagenumber} [type] [interval] <value><cr>
```

`messagenumber`	Number of the message to configure. Range: 0 ... 3
`type`	Configures the message type. Possible values: NONE (default) MWV MWVQUERY
`interval`	Configures the transmission interval. Value 0 disables auto-transmission. Possible values: 0 ... 600.00 in 0.25-second increments (default: 0).
`value`	Value for the option

Example

```
>setmes 1 type mwvquery
       0 TYPE=NONE      INTERVAL=0.00
       1 TYPE=MWVQUERY  INTERVAL=0.00
       2 TYPE=NONE      INTERVAL=0.00
       3 TYPE=NONE      INTERVAL=0.00

>setmes 0 type mwv interval 2
       0 TYPE=MWV       INTERVAL=2.00
       1 TYPE=MWVQUERY  INTERVAL=0.00
       2 TYPE=NONE      INTERVAL=0.00
       3 TYPE=NONE      INTERVAL=0.00

>setmes 0 interval 8
       0 TYPE=MWV       INTERVAL=8.00
       1 TYPE=MWVQUERY  INTERVAL=0.00
       2 TYPE=NONE      INTERVAL=0.00
       3 TYPE=NONE      INTERVAL=0.00
```

4.3.7 SETMEA

The **SETMEA** command configures the essential measurement parameters.

```
SETMEA [gaincorr] [offset] [powersave] [allowedspdchange] [maxinvalidspdcount]
[thies] [calibmin] [calibmax] <value><cr>
```

`gaincorr`	Anemometer transfer function gain parameter. Range: 0.0 ... 10.0 (default: 0.101).
`offset`	Anemometer transfer function offset parameter. Range: -10.0 ... 10.0 (default: 0.348).
`powersave`	Defines whether sensor power is pulsed or provided continuously. Pulsing saves power as the sensors are only powered when read. 0 = Continuous power 1 = Pulsed power (default); not used with WA25
`allowedspdchange`	Maximum allowed difference in m/s between two adjacent samples in the sensor data. Range: 0.1 ... 25.0 (default: 10.0).
`maxinvalidspdcount`	Maximum number of adjacent discarded samples in sensor data. Value 0 deactivates the check. Range: 0 ... 15 (default: 2).
`thies`	Defines the sensor type: 0 = Vaisala WA15 or WA25 series (default) 1 = Thies first class anemometer and analog vane (default values for `gaincorr` and `offset` are automatically changed accordingly)
`calibmin`	4 mA calibration value for analog vane (default: 540)

`calibmax`	20 mA calibration value for analog vane (default: 2640)
`value`	Value for the option

For a WA25 system, use the following settings:

- `powersave` = 0
- `spdvoltlimit` = 0
- `dirvoltlimit` = 0

See also SETALR (page 42).

Example

```
>setmea offset 0.318
       GAINCORR                = 0.10100
       OFFSET                  = 0.31800
       POWERSAVE               = 1
       ALLOWEDSPDCHANGE        = 10.0
       MAXINVALIDSPDCOUNT      = 2
       THIES                   = 0
       CALIBMIN                = 540
       CALIBMAX                = 2640
```

More information

- Wiring WAA252 and WAV252 with WAC155 (page 23)

4.3.8 SETCOM

The **`SETCOM`** command configures the data communication parameters.

```
SETCOM [portnumber] [baudrate] [databits] [parity] [stopbits] [txddelay]
<value><cr>
```

In normal use, `portnumber` must always be omitted. The port number 1 is used only for production testing and is not user-accessible.

`portnumber`	Number of the COM port to configure, 0 or 1. If omitted, the configuration applies to the current port in use.
`baudrate`	Baud rate of the port. Possible values: 300, 600, 1200 2400, 4800, 9600, or 19200. Default value: 9600.
`databits`	Number of data bits, 7 or 8. Default value: 8.
`parity`	Parity: ODD, EVEN, or NONE. Default value: NONE.

`stopbits`	Number of stop bits, 1 or 2. Default value : 1.
`txddelay`	RS-485 turnaround delay in milliseconds. Range: 0 ... 200. Default value: 30.
`value`	Value for the option

Example

```
>setcom baudrate 19200
       BAUDRATE  = 19200
       DATABITS  = 8
       PARITY    = NONE
       STOPBITS = 1
       TXDDELAY = 30
>
```

4.3.9 SETHEA

The **SETHEA** command configures the wind sensor heating control. Sensor heating ensures frictionless rotation of sensor bearings in temperatures below -40 °C (-40°F). Heaters are powered by a separate, external power supply. Heating is not enabled by default.

```
SETHEA [active] [tos] [thys] <value><cr>
```

`active`	Enables the wind sensor heating function. Possible values: 0 = Disabled (default), 1 = Enabled, 2 = Forced ON
`tos`	Control limit for heating in Celsius degrees. Range: -55 ... +125 (default: 4)
`thys`	Thermal hysteresis in Celsius degrees. Range: -55 ... +125 (default: 1)
`value`	Value for the option

If heating is enabled, it turns on when the temperature drops below `TOS - THYS`. Heating turns off when the temperature rises above `TOS + THYS`. With the default values of `TOS`=4 and `THYS`=1, heating is enabled at +3 °C and disabled at +5 °C.

CAUTION! `SETHEA ACTIVE 2` is for testing purposes only. Leaving forced heating on for longer periods of time may damage the heating elements of the sensors.

Example

```
>sethea active 1
       ACTIVE = 1
       TOS    = 4.00
       THYS   = 1.00
>
```

4.3.10 GETHEA

The **GETHEA** command displays the current heating status and temperature.

```
GETHEA<cr>
```

Example

```
>gethea
 Heating OFF
 Temperature 14.25
>
```

4.3.11 SETALR

WAC155 monitors wind sensor movement to detect if the sensors appear to be stuck in place. To configure this functionality, use the **SETALR** command.

If **SETALR** is activated and parameters `dir`, `spd`, and `calm` are set to other value than 0, the sensors are cross-checked for movement. If one sensor moves and the other does not for a certain period of time, the motionless sensor is considered stuck.

```
SETALR [active] [dir] [spd] [calm] [dirlimit] [spdlimit] [sdpvoltlimit]
[dirvoltlimit] <value><cr>
```

`active`	Enables the diagnostics for wind sensor movement, 0 or 1. Default value: 0.
`dir`	Timeout for wind direction change in seconds. Range: 0 ... 256. Default value: 60.
`spd`	Timeout for wind speed change in seconds. Range: 0 ... 256. Default value: 60.
`calm`	Calm timeout in minutes. Defines how long both sensors may be static until considered stuck. Range: 0 ... 65535. Default value: 1440.

`dirlimit`	Threshold limit for wind direction change in degrees. If the wind direction change is below the threshold, direction is considered unchanged. Range: 0 ... 180. Default value: 3.
`spdlimit`	Threshold limit for wind speed change in m/s. If the wind speed change is below the threshold, speed is considered unchanged. Range: 0.0 ... 10.0. Default: 0.0.
`sdpvoltlimit`	Threshold limit for minimum current taken by the anemometer (roughly in 50 mA units). Below the limit, the sensor is considered absent and MWV speed value is given as null field („). Setting **`spdvoltlimit`** = 0 deactivates the function. Default value: 0.2.
`dirvoltlimit`	Threshold limit for minimum current taken by the wind vane (roughly in 50 mA units). Below the limit, the sensor is considered absent and MWV direction value is given as null field („). Setting **`dirvoltlimit`** = 0 deactivates the function. Default value: 0.2.
`value`	Value for the option

If you have an old version of WAC155 (L47101 or older) and a new version of WAV151 (L47101 or newer), you must change the **`dirvoltlimit`** value to 0.15.

Typical commands:

SETALR `ACTIVE 1` (activates the alarm functionality)

SETALR `DIR 60` (alarm if wind vane is static for 60 seconds)

SETALR `SPD 60` (alarm if anemometer is static for 60 seconds)

SETALR `CALM 1440` (alarm if both sensors are static for 24 hours)

For WA25 series sensors, you must deactivate the functionality of the following parameters by setting the parameter value to 0:

- **`spdvoltlimit`**
- **`dirvoltlimit`**

Deactivating the **SETALR** command does not deactivate **`sdpvoltlimit`** or **`dirvoltlimit`**. You must deactivate them separately.

Example

```
>setalr active 1
       ACTIVE   = 1
       DIR   = 60
       SPD   = 60
       CALM   = 1440
       DIRLIMIT=   3
       SPDLIMIT=   0.0
       SDPVOLTLIMIT   = 0.2
       DIRVOLTLIMIT   = 0.2
>
```

More information

- Wiring WAA252 and WAV252 with WAC155 (page 23)

4.3.12 SERVICE TIMEOUT

The **SERVICE TIMEOUT** command configures the timeout of the auto-close function of the service connection. If there is no data input within the configured time interval, the device closes the service connection and returns to normal operational state.

Zero value disables the auto-close function, which means that the service connection never closes unless intentionally closed using the **CLOSE** command.

```
SERVICE TIMEOUT <value><cr>
```

value	Value of the service timeout, range 0 ... 30 min. Default value: 5 min.

Example

```
>service timeout 30
       TIMEOUT=30
>
```

4.3.13 GETSET

The **GETSET** command returns the current configuration of the unit.

```
GETSET <cr>
```

The following example uses factory default values.

Example

```
>getset
SETDEV
        ID=
SETSPD
        AVERAGE=3.00
SETDIR
        AVERAGE  = 3.00
        OFFSET   = 0
SETMES
        0       TYPE=NONE       INTERVAL=0.00
        1       TYPE=NONE       INTERVAL=0.00
        2       TYPE=NONE       INTERVAL=0.00
        3       TYPE=NONE       INTERVAL=0.00
SETMEA
        GAINCORR                = 0.10100
        OFFSET                  = 0.32800
        POWERSAVE               = 1
        ALLOWEDSPDCHANGE        = 10.0
        MAXINVALIDSPDCOUNT      = 2
        THIES           = 0
        CALIBMIN        = 540
        CALIBMAX        = 2640
SETCOM
        BAUDRATE = 9600
        DATABITS = 8
        PARITY   = NONE
        STOPBITS = 1
        TXDDELAY = 30
SETHEA
        ACTIVE = 0
        TOS    = 4.00
        THYS   = 1.00
SETALR
        ACTIVE  = 0
        DIR     = 60
        SPD     = 60
        CALM    = 1440
        DIRLIMIT= 3
        SPDLIMIT= 0.0
        SPDVOLTLIMIT= 0.2
        DIRVOLTLIMIT= 0.2
SERVICE
        TIMEOUT = 5
ERRS
        ERRS = 0000
        MASK = 1010
>
```

More information

- INIE (page 46)

4.3.14 HELP

The **HELP** command displays a list of supported commands.

```
HELP<cr>
```

Example

```
>help
CLOSE    Close service connection
SETDEV   Set device
IDSETSPD Speed computation average length
SETDIR   Direction computation average length and offset
...
```

4.3.15 INIE

The **INIE** command resets the transmitter parameter set to factory default. Note that the current configuration settings are lost.

Before using this command, view the current settings with **GETSET** and save the output.

After using this command, you must reset the transmitter with the **RESET** command. This is to ensure that the default values are correctly validated.

The factory default values for all parameters are shown in the **GETSET** message example.

```
INIE <cr>
```

Example

```
>inie
FACTORY DEFAULTS
>
```

4.3.16 RESET

The **RESET** command resets the transmitter and takes any new configuration settings into use. After receiving this command, the transmitter returns into the data transmission mode. To continue with the service connection, enter the **OPEN** command again.

```
RESET <cr>
```

Example

```
>RESET
Wait 5 seconds delay...
```

4.3.17 ERRS

When issued alone without the [mask] option, the **ERRS** command returns the current error status of the transmitter. Possible errors, their codes, and the corresponding hexadecimal values are described in Error messages (page 50).

You can use the [mask] option to define the possible set of errors that causes NMEA messages to be marked as invalid. The error mask is a hexadecimal number formed by combining the hexadecimal values of the desired errors. By default, the mask is 1010, which means that the NMEA data is invalid only if both wind sensors are missing or broken or stuck (presuming the corresponding alarms are activated).

For example, if you want the mask to include errors number 10 and 11 (0400 and 0800 in hex), the desired mask value is 0C00:

```
0400 + 0800 = 0C00
```

```
ERRS [mask] <value><cr>
```

`mask`	Implements an error mask
`value`	Value for the error mask in hexadecimal format (default: 1010)

Example

```
>errs
 Active errors:
 ERROR 3: Wind direction sensor missing or broken
 ERRS = 0008
 MASK = 1010
 >
```

5. Maintenance

5.1 Periodic maintenance

Every 1 to 2 years, make sure that the component board is not corroded. A probable cause for corrosion is that the box cover or cable gland have not been tightened properly.

5.2 Replacing consumables

Before replacing the component board, read ESD protection (page 8).

6. Troubleshooting

6.1 Problem situations

Table 10 Problem situations and their remedies

Problem	Possible cause	Action
The data collecting system does not receive data.	Improper or loose connections	Check the wiring and tighten the screw terminals.
	Incorrect messaging settings	Check and correct the messaging settings through the service connection.
	Power failure	Make sure that the power supply is connected and operational.
Sensor shaft heating is not working.	Heating power is not connected properly.	Check the wiring and tighten the screw terminals.
	Heating is not enabled in the transmitter settings.	Check and correct the transmitter settings using the service connection.
	The heating power supply has a power failure.	Make sure that the power supply is connected and operational.
MWV message returns a null field („) for wind speed or direction reading.	Parameter **spdvoltlimit** or **dirvoltlimit** has too high a value and the sensor is considered absent or faulty.	Set a lower value for the parameter. See SETALR (page 42).
WA25 system returns null fields („) or incorrect values.	Parameter **spdvoltlimit**, **dirvoltlimit**, or **powersave** has a wrong value.	For WA25, set: **spdvoltlimit** = 0 **dirvoltlimit** = 0 **powersave** = 0 See SETMES (page 38) and SETALR (page 42).
Wind vane returns readings with constant deviation from the correct direction.	The cross arm is incorrectly aligned or the **offset** parameter value is wrong.	Check the alignment. If correct mounting is impossible or inconvenient, correct the alignment with the **offset** parameter. See SETDIR (page 37).

6.2 Error messages

The following table describes WAC155 error codes. If you use the **ERRS** command to specify an error mask, use the hexadecimal values. To use the service connection to read the errors and configure WAC155, see Configuration commands (page 34).

Table 11 Error codes

Error number	Hex equivalent	Message	Description
0	0001	`Input voltage too low`	Input voltage below accepted limit, sensor behavior not defined.
1	0002	`Sensor driving voltage too high`	Over-voltage condition.
2	0004	`Wind speed sensor missing or broken`	Self-diagnostics does not detect the proper voltage drop caused by an operational sensor.
3	0008	`Wind direction sensor missing or broken`	Self-diagnostics does not detect the proper voltage drop caused by an operational sensor.
4	0010	`Both sensors missing or broken`	Wind speed and direction sensors are missing or broken.
5	0020	`Internal error`	Reserved for future use.
6	0040	`Erroneous reading from temperature sensor`	Internal temperature sensor gives erroneous readings.
7	0080	`Internal error in non-volatile memory access`	Storing or reading parameters from the internal non-volatile memory has failed.
8	0100	`Internal error`	Reserved for future use.
9	0200	`Temperature sensor not calibrated. Heating control malfunctioning.`	Factory calibration has not been performed or is lost; temperature readings are erroneous.
10	0400	`Wind direction sensor stuck`	The wind vane has not turned for a certain period, but the anemometer has.
11	0800	`Wind speed sensor stuck`	Anemometer has not turned for the configured period of time, but the wind vane has.
12	1000	`Both wind sensors stuck`	Both wind sensors have not turned for a long time.

7. Technical data

7.1 WAC155 specifications

Table 12 WAC155 measurement performance

Property	Description/Value
Averaging interval	3 s (selectable range 0.25 ... 5 s)
Updating interval	0.25 s
Wind speed	
Observation range	0 ... 75 m/s (0 ... 168 mph)
Observation frequency	4 Hz
Resolution	0.1 m/s
Wind direction	
Observation range	0 ... 360°
Observation frequency	32 Hz
Resolution [1)]	2.0°

1) Gained by averaging the eight samples in each 0.25-second period.

Table 13 WAC155 inputs and outputs

Property	Description/Value
Input operating voltage	9 ... 31.5 V
Input operating current (incl. both sensors)	Power-save enabled: 7 mA typically at 24 V Power save disabled: 37 mA typically at 24 V
Heating control, WA15	On at 3 °C (37 °F) / Off at 5 °C (41 °F), adjustable
Input heating voltage, WA15	16 ... 24 V DC or V AC $_{rms}$ with 1 or 2 sensors in parallel 32 ... 48 V DC or 32 ... 43 V AC $_{rms}$ with 2 sensors in series
Input heating current	1.0 A typically at 20 V with 1 or 2 sensors in parallel 0.5 A typically at 40 V with 2 sensors in series
Heating for WA25	Passed by with expansion connector

Property	Description/Value
Sensor operating power	11.5 V / 20 mA typical per sensor (peak current)
Power save duty cycle	510 us wide pulses at 32 Hz to wind vane 75 us wide pulses at 2.5 kHz to anemometer
Signal input	6-bit parallel GRAY code (0.5/10.5 V typical) from wind vane 0 ... 750 Hz square wave (0.5/10.5 V typical) from anemometer
Data output	2-wire half-duplex RS-485, 9600 8N1 [1)]
Service interface	RS-232 or RS-485
Message protocol	NMEA 0183, MWV, and MWV Query

1) Adjustable rate: 300 ... 19200, 7/8, O/E/N, 1/2.

Table 14 WAC155 operating environment

Property	Description/Value
Operating temperature	−55 ... +60 °C (−67 ... +140 °F)
Storage temperature	−60 ... +70 °C (−76 ... +158 °F)
Operating humidity	0 ... 100 %RH
IP rating	IP65

Table 15 WAC155 mechanical specifications

Property	Description/Value
Weight	1.5 kg (3.3 lb)
Material	Aluminum
Dimensions	
Crossarm and junction box (W × H × D)	887 × 165 × 157 mm (34.92 × 6.50 × 6.18 in)
Junction box (W × H × D)	Without cable glands: 127 × 82 × 58 mm (5.00 × 3.23 × 2.28 in) With cable glands: 127 × 110 × 58 mm (5.00 × 4.33 × 2.28 in)
Printed circuit board (W × H)	114 × 68.5 mm (4.49 × 2.70 in)

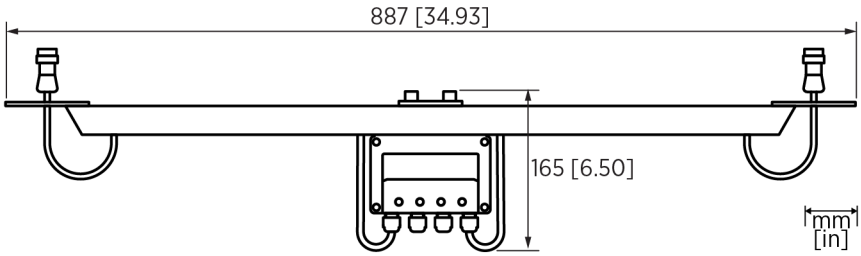


Figure 19 WAC155 dimensions

Table 16 WAC155 compliance

Property	Description/Value
Compliance marks	CE, China RoHS, RCM

Table 17 WAC155 spare parts

Spare part	Order code
Component board for WAC155	WAC155CB
Crossarm and serial RS-485 transmitter	WAC155
Sensor cable for WAA151/252 0.8 m (31.5 in), open lead on one end (6 wires), connector 230118 on other end	ZZ45036
Sensor cable for WAV151/252 0.8 m (31.5 in), open lead on one end (10 wires), connector 230119 on other end	ZZ45037
Special length sensor cable for WAA151/252, open lead on one end (6 wires), connector 230118 on other end	ZZ45036SPEC
Special length sensor cable for WAV151/252, open lead in one side (10 wires) and connector 230119 in another side	ZZ45037SPEC
Connector WAA151, WAA252	230118
Connector WAV151, WAV252	230119

Warranty and product returns

For standard warranty terms and conditions, see www.vaisala.com/warranty.
Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

1. Read the warranty information.
2. Contact Vaisala technical support and request a Return Material Authorization (RMA) and shipping instructions.

> Always request the RMA before returning any faulty material.
> Provide the failure report as requested.

Technical support

Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information 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 on the problem

For more information, see www.vaisala.com/support.

Recycling

Recycle all applicable material.

Follow the statutory regulations for disposing of the product and packaging.

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