

VAISALA

USER'S GUIDE

Vaisala Serial Wind Transmitter WAC155



M210822EN-A

PUBLISHED BY

Vaisala Oyj	Phone (int.):	+358 9 8949 1
P.O. Box 26	Fax:	+358 9 8949 2227
FIN-00421 Helsinki		
Finland		

Visit our Internet pages at <http://www.vaisala.com/>

© Vaisala 2007

No part of this manual may be reproduced in any form or by any means, electronic or mechanical (including photocopying), nor may its contents be communicated to a third party without prior written permission of the copyright holder.

The contents are subject to change without prior notice.

Please observe that this manual does not create any legally binding obligations for Vaisala towards the customer or end user. All legally binding commitments and agreements are included exclusively in the applicable supply contract or Conditions of Sale.

Table of Contents

CHAPTER 1	
GENERAL INFORMATION	7
About This Manual	7
Contents of This Manual	7
General Safety Considerations	8
Feedback	8
Product Related Safety Precautions	8
ESD Protection	9
Recycling	9
Warranty	10
CHAPTER 2	
PRODUCT OVERVIEW	11
Introduction to Vaisala Serial Wind Transmitter WAC155	11
CHAPTER 3	
INSTALLATION	13
Selecting Location	13
Installation Procedure	15
Jumper Settings	16
Connections	17
Sensor Wiring	19
Signal Output	20
Powering	21
Optional Heating Power	22
Wiring Examples	24
Mounting	28
Mounting WAC155 to the Top of a Pole Mast	28
Mounting Wind Sensors to WAC155	29
Alignment	29
Verification	30
CHAPTER 4	
OPERATION	31
User Interface	31
Communication Interfaces	31
NMEA Message Format	32
Polling Data using a Query	33
Service Connection	34
List of Serial Commands	35

OPEN	36
CLOSE	37
SETDEV	38
SETSPD	38
SETDIR	38
SETMES	39
SETMEA	40
SETCOM	41
SETHEA	42
GETHEA	42
SETALR	43
SERVICE TIMEOUT	44
GETSET	45
HELP	45
INIE	45
RESET	46
ERRS	46
CHAPTER 5	
MAINTENANCE	49
Periodic Maintenance	49
Visual Checking	49
Replacing Consumables	49
Parts List for Consumables	49
CHAPTER 6	
TROUBLESHOOTING	51
Problem Situations	51
Error Messages	52
Technical Support	53
Return Instructions	53
Vaisala Service Centers	54
CHAPTER 7	
TECHNICAL DATA	55
Specifications	55
Dimensions in mm (inches)	57

List of Figures

Figure 1	Vaisala Serial Wind Transmitter WAC155	12
Figure 2	Recommended Mast Location in Open Area	14
Figure 3	Recommended Mast Length on Top of a Building	15
Figure 4	RS-485 Termination	16
Figure 5	WAC155 Component Board	17
Figure 6	Cable Shield Bent over the Plastic Sleeve and O-ring	17
Figure 7	I/O Connectors	18
Figure 8	Wiring of the Sensors	20
Figure 9	Typical System with 12 VDC Power Supply	21
Figure 10	Heating Power Connection with 40 V Power Supply	22
Figure 11	Heating Power Connection with 20 V Power Supply	23
Figure 12	Heating Power Connection for Anemometer Only	23
Figure 13	Heating Power Connection for Wind Vane Only	24
Figure 14	Basic Wiring with WAA151 and WAV151 Sensors	25
Figure 15	Wiring with WHP151 Mains Power Supply	26
Figure 16	Wiring with WHP25 Mains Power Supply and the WA252 Series Wind Sensors	27
Figure 17	Mounting WAC155 to the Top of a Pole Mast	28
Figure 18	Installation of the Wind Sensors WAA151 and WAV151 to WAC155	29
Figure 19	WAC155 Dimensions	57

List of Tables

Table 1	Anemometer Connector (X1) Pinout	18
Table 2	Power/Control Connector (X2) Pinout	19
Table 3	Wind Direction Sensor Connector (X3) Pinout.	19
Table 4	WAC155 Default Serial Communication Settings	32
Table 5	Checksum table	34
Table 6	List of Serial Commands	35
Table 7	Meaning of the Command Line Elements	36
Table 8	Available Spare Parts	49
Table 9	Problem Situations and Corrective Actions	51
Table 10	Self-diagnostics Error Codes	52
Table 11	Performance	55
Table 12	Inputs and Outputs	56
Table 13	Operating Conditions	56
Table 14	Dimensions and Mechanics	56

CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

About This Manual

This manual provides information for installing and maintaining the Vaisala Serial Wind Transmitter WAC155.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information: This chapter provides general notes for the manual and the product.
- Chapter 2, Product Overview: This chapter introduces the features of the Vaisala Serial Wind Transmitter WAC155.
- Chapter 3, Installation: This chapter provides you with information that is intended to help you install this product.
- Chapter 4, Operation: This chapter contains information that is needed to operate the Vaisala Serial Wind Transmitter WAC155.
- Chapter 5, Maintenance: This chapter provides information that is needed in basic maintenance of the Vaisala Serial Wind Transmitter WAC155.

- Chapter 6, Troubleshooting: This chapter describes common problems, their probable causes and remedies, and contact information.
- Chapter 7, Technical Data: This chapter provides technical data of the Vaisala Serial Wind Transmitter WAC155.

General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

WARNING

Warning alerts you to a serious hazard. If you do not read and follow instructions very 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

Note highlights important information on using the product.

Feedback

Vaisala Customer Documentation Team welcomes your comments and suggestions on the quality and usefulness of this publication. If you find errors or have other suggestions for improvement, please indicate the chapter, section, and page number. You can send comments to us by e-mail: manuals@vaisala.com.

Product Related Safety Precautions

The Vaisala Serial Wind Transmitter WAC155 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

WARNING Ground the product, and verify outdoor installation grounding periodically to minimize shock hazard.

CAUTION Do not modify the unit. Improper modification can damage the product or lead to malfunction.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to 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 inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself with a wrist strap and a resistive connection cord to the equipment chassis before touching the boards. When neither of the above is possible, at least touch a conductive part of the equipment chassis with your other hand before touching the boards.
- Always hold the boards by the edges and avoid touching the component contacts.

Recycling



Recycle all applicable material.



Dispose of batteries and the unit according to statutory regulations. Do not dispose of with regular household refuse.

Warranty

Vaisala hereby represents and warrants all Products manufactured by Vaisala and sold hereunder to be free from defects in workmanship or material during a period of twelve (12) months from the date of delivery save for products for which a special warranty is given. If any Product proves however to be defective in workmanship or material within the period herein provided Vaisala undertakes to the exclusion of any other remedy to repair or at its own option replace the defective Product or part thereof free of charge and otherwise on the same conditions as for the original Product or part without extension to original warranty time. Defective parts replaced in accordance with this clause shall be placed at the disposal of Vaisala.

Vaisala also warrants the quality of all repair and service works performed by its employees to products sold by it. In case the repair or service works should appear inadequate or faulty and should this cause malfunction or nonfunction of the product to which the service was performed Vaisala shall at its free option either repair or have repaired or replace the product in question. The working hours used by employees of Vaisala for such repair or replacement shall be free of charge to the client. This service warranty shall be valid for a period of six (6) months from the date the service measures were completed.

This warranty is however subject to following conditions:

- a) A substantiated written claim as to any alleged defects shall have been received by Vaisala within thirty (30) days after the defect or fault became known or occurred, and
- b) The allegedly defective Product or part shall, should Vaisala so require, be sent to the works of Vaisala or to such other place as Vaisala may indicate in writing, freight and insurance prepaid and properly packed and labelled, unless Vaisala agrees to inspect and repair the Product or replace it on site.

This warranty does not however apply when the defect has been caused through

- a) normal wear and tear or accident;
- b) misuse or other unsuitable or unauthorized use of the Product or negligence or error in storing, maintaining or in handling the Product or any equipment thereof;
- c) wrong installation or assembly or failure to service the Product or otherwise follow Vaisala's service instructions including any repairs or installation or assembly or service made by unauthorized personnel not approved by Vaisala or replacements with parts not manufactured or supplied by Vaisala;
- d) modifications or changes of the Product as well as any adding to it without Vaisala's prior authorization;
- e) other factors depending on the Customer or a third party.

Notwithstanding the aforesaid Vaisala's liability under this clause shall not apply to any defects arising out of materials, designs or instructions provided by the Customer.

This warranty is expressly in lieu of and excludes all other conditions, warranties and liabilities, express or implied, whether under law, statute or otherwise, including without limitation any implied warranties of merchantability or fitness for a particular purpose and all other obligations and liabilities of Vaisala or its representatives with respect to any defect or deficiency applicable to or resulting directly or indirectly from the Products supplied hereunder, which obligations and liabilities are hereby expressly cancelled and waived. Vaisala's liability shall under no circumstances exceed the invoice price of any Product for which a warranty claim is made, nor shall Vaisala in any circumstances be liable for lost profits or other consequential loss whether direct or indirect or for special damages.

CHAPTER 2

PRODUCT OVERVIEW

This chapter introduces the features of the Vaisala Serial Wind Transmitter WAC155.

Introduction to Vaisala Serial Wind Transmitter WAC155

The Vaisala Serial Wind Transmitter WAC155 converts the digital data supplied by the Vaisala 151 and 252 Series wind sensors for use in the RS-485 bus. The WAC155 transmitter consists of a component board in a junction box and a cross arm for mounting the wind sensors; see [Figure 1 on page 12](#).

The WAC155 unit is installed underneath the cross arm, and it communicates with the controlling system via a twisted pair RS-485 cable. The electrical connections to the sensors are 6-bit parallel gray-code for the direction measurement and up to 750Hz digital pulse for the wind speed measurement (anemometer).

The power to the sensors is supplied through the WAC155 transmitter. The transmitter accepts 9 ... 15.5 VDC as input power. The WAC155 transmitter also provides the sensors with a throughput for optional heating power. The unit automatically connects the heating power in temperatures below +3 °C (default setting).

The main features of the WAC155 are as follows:

- Communication with NMEA 0183 compliant protocol over RS-485 electrical interface (half-duplex)
- Capable of measuring the wind parameters at a configurable interval using the instant method according to the WMO standard
- Fail-safe RS-485 operation with configurable baud rate and turnaround delay
- Configurable RS-485 bus termination and ID setting
- Service connection via the RS-485 interface for configuration and maintenance
- Adjustable heating control of the sensors
- Automatic detection of sensor failure conditions

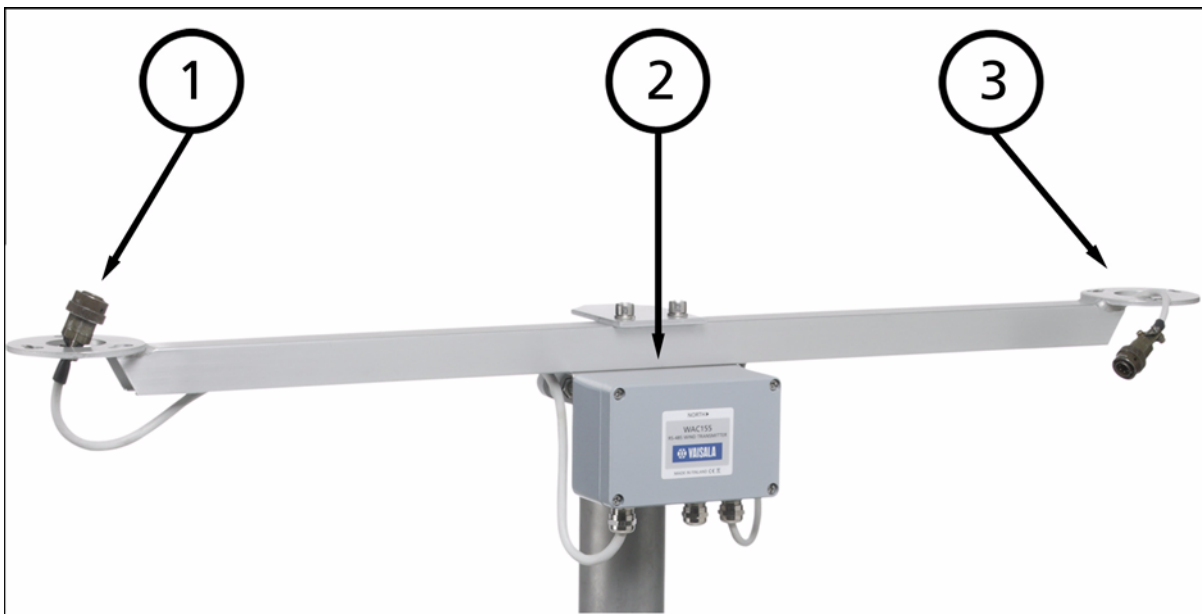


Figure 1 Vaisala Serial Wind Transmitter WAC155

The following numbers refer to [Figure 1 on page 12](#).

- 1 = Flange for mounting a Vaisala anemometer
- 2 = Junction box, containing the component board
- 3 = Flange for mounting a Vaisala wind vane

CHAPTER 3

INSTALLATION

This chapter provides you with information that is intended to help you install this product.

Selecting Location

Finding a suitable site for the product is important for getting representative ambient measurements. The site should represent the general area of interest.

Allow sufficient clearance for the wind sensors. Wind sensors should not be located next to a building or any other object that might 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 (> 30m) are used. Vaisala recommends using a surge protector such as the WSP150 in all sites where there is an elevated risk of lightning strike.

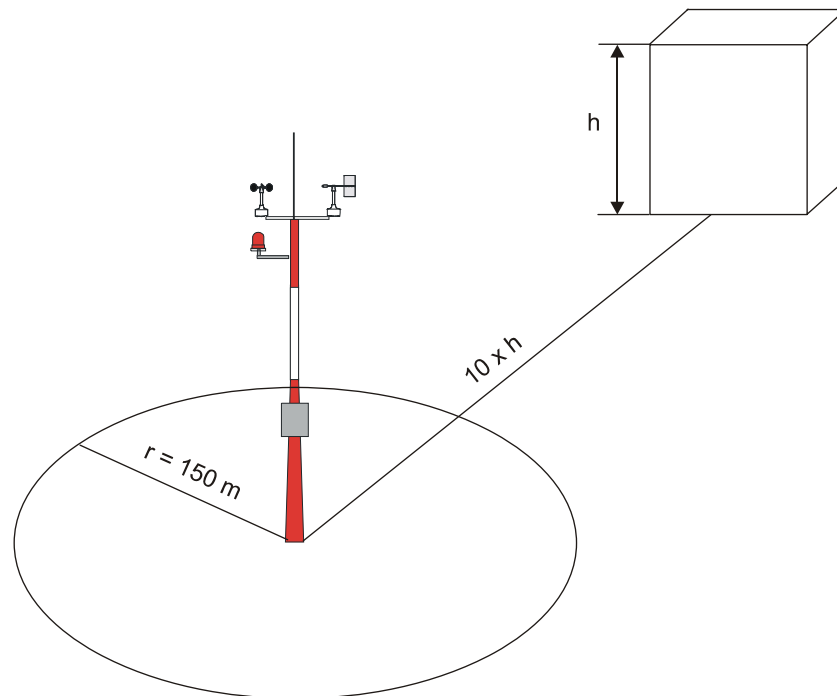


Figure 2 Recommended Mast Location in Open Area

In general, any object of height (h) will not remarkably disturb wind measurement at a minimum distance of $10 h$. There should be at least 150 m open area in all directions from the mast. Refer to [Figure 2 on page 14](#).

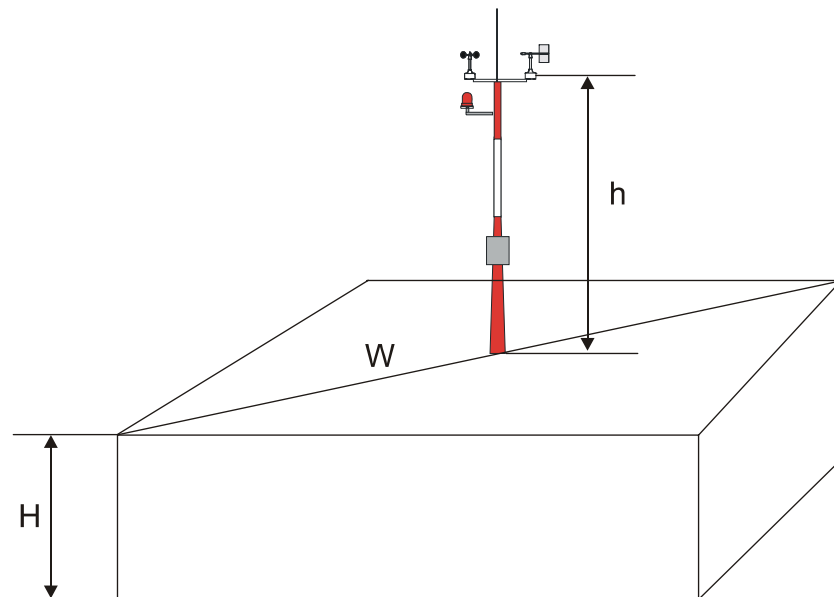


Figure 3 Recommended Mast Length on Top of a Building

The recommended minimum length (marked with the letter h in [Figure 3 on page 15](#)) for the mast that is installed on 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 $1.5 W$.

Installation Procedure

For installation, follow the procedure below and refer to corresponding sections for details.

1. Remove the four screws holding the cover of the WAC155 transmitter. Remove the cover.
2. Select the RS-485 termination according to the instructions in section [Jumper Settings on page 16](#).
3. Enter the power and signal cables through the cable glands(s). For better protection against RF interference, ground the cable shield as shown in [Figure 6 on page 17](#).
4. Connect the wires to the X2 removable screw terminal block according to [Figure 8 on page 20](#) and [Figure 9 on page 21](#). Tighten the output cable gland(s).
5. Carefully reattach the enclosure cover with the four screws.

6. Attach the unit on the top of a pole mast with the mounting clamp as shown in [Figure 17 on page 28](#).
7. Mount the sensors onto the cross arm. Refer to [Figure 18 on page 29](#) and the sensors' manuals.
8. Align the cross arm as instructed in section [Alignment on page 29](#) before erecting the mast.

Jumper Settings

RS-485 serial bus termination can be selected with the on-board jumper. Termination is on when pins 1 and 2 are shorted, and termination is off when pins 2 and 3 are shorted or when the jumper plug is fully disconnected. Termination is implemented by a 120 Ω resistor on the component board.

In a simple point-to-point configuration where only one WAC155 transmitter is used the jumper is always in ON position. In a multidrop configuration where several WAC155 transmitters share the single RS-485 communication line, the termination jumper is in ON position only at the physically farthest transmitter (i.e. at the end of the communication line), and in OFF position at the other transmitters.

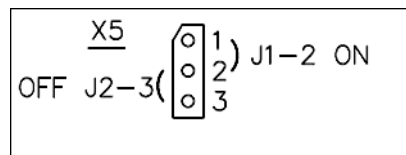


Figure 4 RS-485 Termination

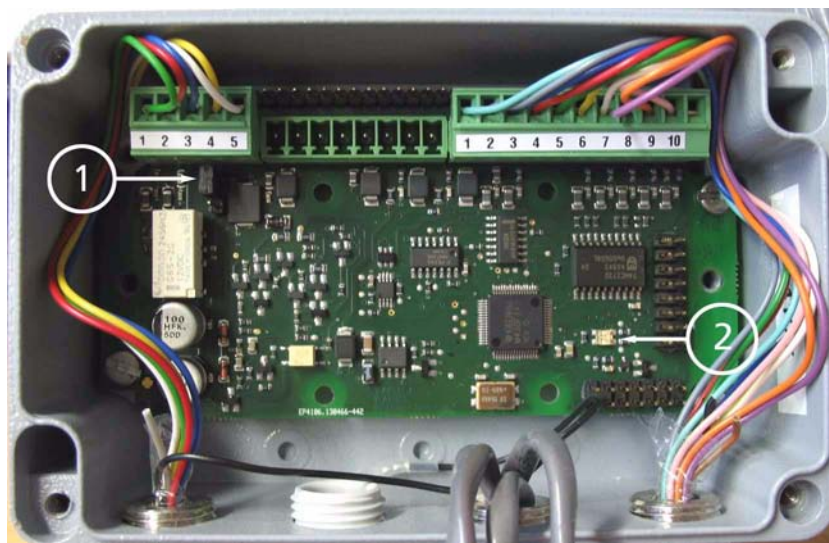


Figure 5 WAC155 Component Board

The following numbers refer to [Figure 5 on page 17](#).

- 1 = RS-485 termination jumper
- 2 = Status indicator LED

Connections

The WAC155 transmitter provides the line cable entry through a gland for a cable with a diameter from 7 to 10 mm. For better protection against RF interference, bend the cable shield as illustrated in [Figure 6 on page 17](#).

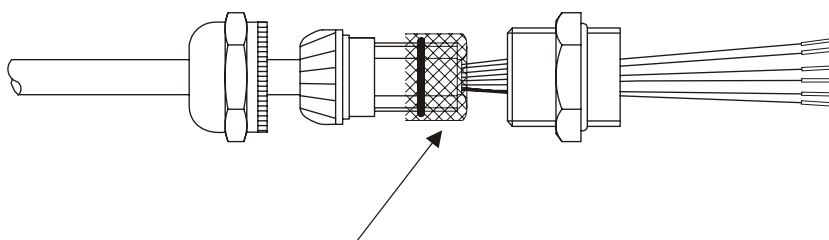


Figure 6 Cable Shield Bent over the Plastic Sleeve and O-ring

The WAC155 transmitter has three I/O connectors as shown in [Figure 7 on page 18](#). For the location of the connectors and the routing of the cables through the cable glands, refer to [Figure 8 on page 20](#).

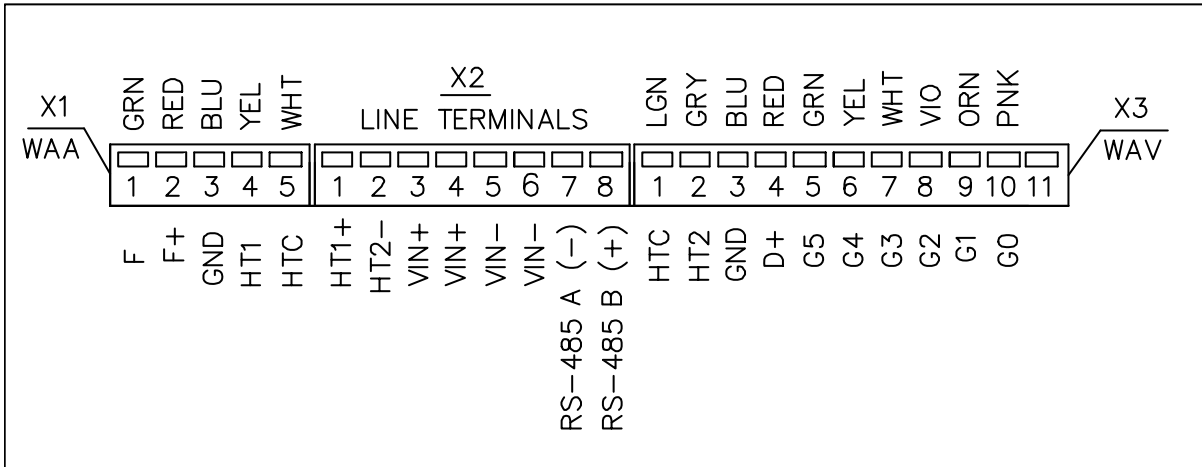


Figure 7 I/O Connectors

The following numbers refer to [Figure 7 on page 18](#).

- X1 = Plug-in connector with screw terminals (5 pcs) for the anemometer cable. Maximum wire cross section area is 1.5 mm².
- X2 = Plug-in connector with screw terminals (8 pcs) for the power and signal cable. Maximum wire cross section area is 1.5 mm².
- X3 = Plug-in connector with screw terminals (11 pcs) for the wind vane cable. Maximum wire cross section area is 1.5 mm².

I/O connector X1-X3 pinouts are shown in following tables.

Table 1 Anemometer Connector (X1) Pinout

Pin #	Signal	Description
1	F	Pulse input from sensor
2	F+	Supply voltage output to sensor
3	GND	Sensor ground
4	HT1	Heating supply-1 from connector X2
5	HTC	Heating common for heater serial connection

Table 2 Power/Control Connector (X2) Pinout

Pin #	Signal	Description
1	HT1+	Heating supply-1 input
2	HT2-	Heating supply-2 input
3	Vin+	Supply voltage input
4	Vin+	Supply voltage input
5	Vin-	Ground
6	Vin-	Ground
7	RS-485 A(-)	RS-485 inverting I/O
8	RS-485 B(+)	RS-485 noninverting I/O

Table 3 Wind Direction Sensor Connector (X3) Pinout

Pin #	Signal	Description
1	HTC	Heating common for heater serial connection
2	HT2	Heating supply-2 from 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	n.c.	Not connected

Sensor Wiring

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

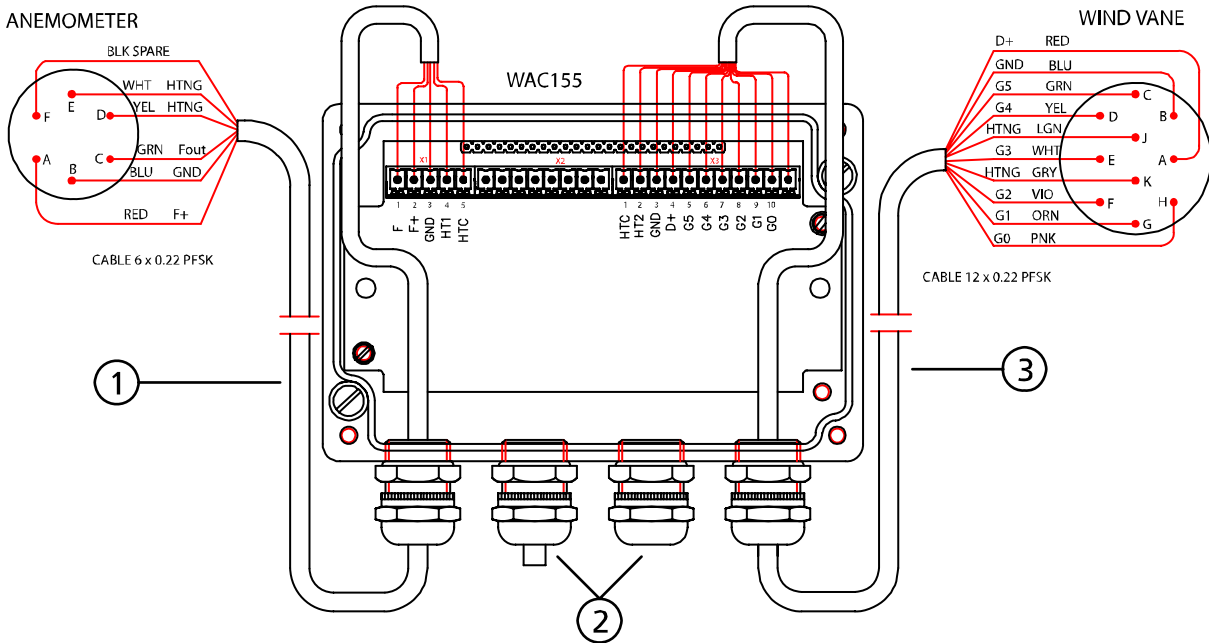


Figure 8 Wiring of the Sensors

The following numbers refer to [Figure 8 on page 20](#).

- 1 = Anemometer cable
- 2 = Glands for power and signal cables
- 3 = Wind vane cable

Signal Output

The WAC155 transmitter provides a half-duplex RS-485 serial bus connection. Wind data is provided in standard NMEA messages. In addition, a service connection is available for configuration and status information. The service connection is available through the same RS-485 interface. When the service connection is in use, data transmission and query are disabled.

Several transmitters can be connected to the same RS-485 bus. If only a single transmitter is connected, the transmitter can be configured in auto-transmit mode, i.e. the device transmits data messages at configured intervals. If there are several transmitters in the same bus, auto-transmission may not be enabled, and data must be polled using a query.

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

Typically, only a 4-wire shielded cable is required for the line between the WAC155 transmitter and the receiving end. Two of the four wires provide the operating power for the system. A twisted pair can be used for the power wires to reduce interference. The other two wires are for the RS-485 serial bus connection from the WAC155 transmitter.

The maximum length of an unisolated RS-485 line is 1200m (4000ft). The cable used should be at least a twisted pair AWG 24 cable. The achievable line length is affected by electrical noise and the number of transmitters on the bus.

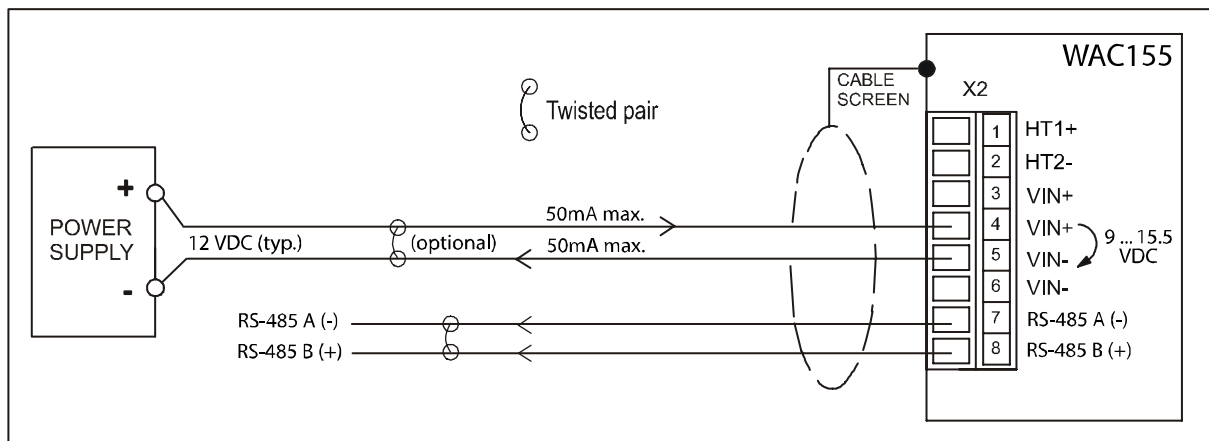


Figure 9 Typical System with 12 VDC Power Supply

Powering

The WAC155 transmitter accepts 9 ... 15.5 VDC as input power.

The power line is protected against incorrect polarity. Transient protection is accomplished with VDRs, series inductors and resistors, and transient zener diodes on both the power line and each I/O line.

Optional Heating Power

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

The heating power connection requires an extra pair of wires. Since the heating elements in the shafts of the WAA151 and WAV151 sensors typically consume some 500 mA each, the heating power is most conveniently supplied from a local power source. Unit can automatically connect heating power in temperatures below +3 °C (default setting).

There are two ways to connect the heating power, depending on the heating power supply available. The default way is to connect a 40 VAC or VDC power supply in series; see [Figure 10 on page 22](#). When a 40 V power supply is used, 500 mA is required. The 40 V power supply can only be used when both sensors are connected.

NOTE If you connect DC heating power, observe the correct polarity of the X2 connector pins 1 and 2 (HT1+ and HT2-).

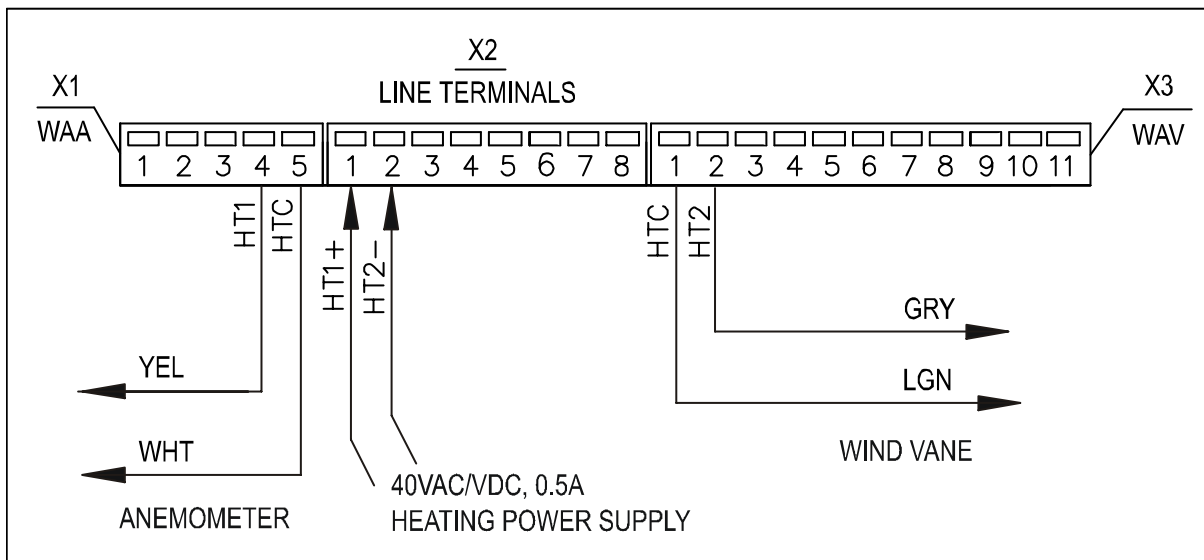


Figure 10 Heating Power Connection with 40 V Power Supply

If a 20 VAC or VDC power supply is used, the heating power should be connected in parallel. The power supply must provide 500 mA for each connected WAV151 and WAA151 sensor; 1 A is required when both

sensors are connected. The parallel connection is illustrated in [Figure 11 on page 23](#).

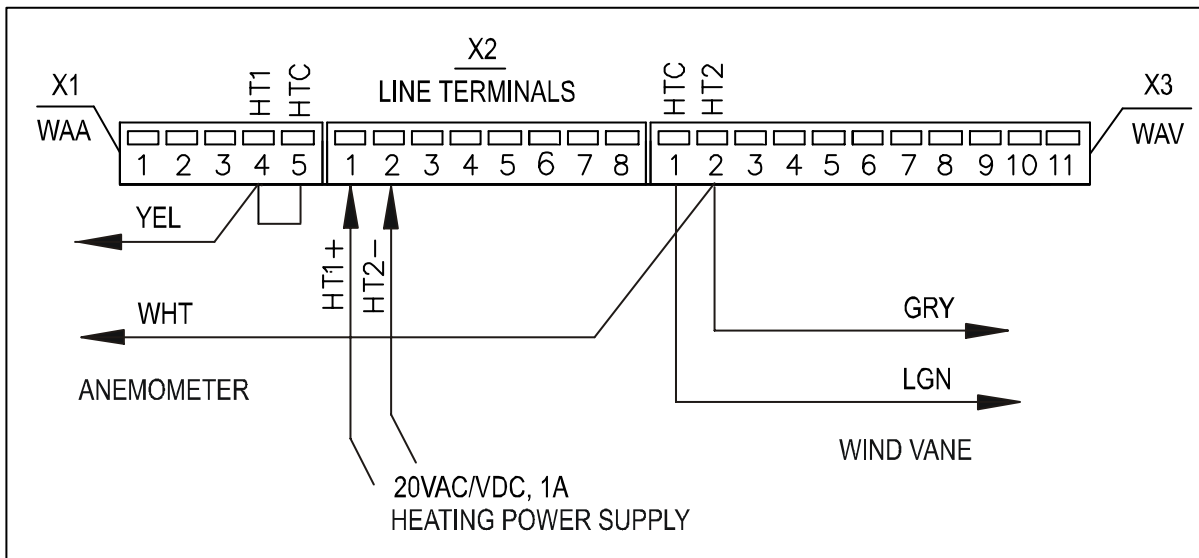


Figure 11 Heating Power Connection with 20 V Power Supply

When a 20 V power supply is used, the heating power can also be connected to a single sensor. Refer to [Figure 12 on page 23](#) and [Figure 13 on page 24](#).

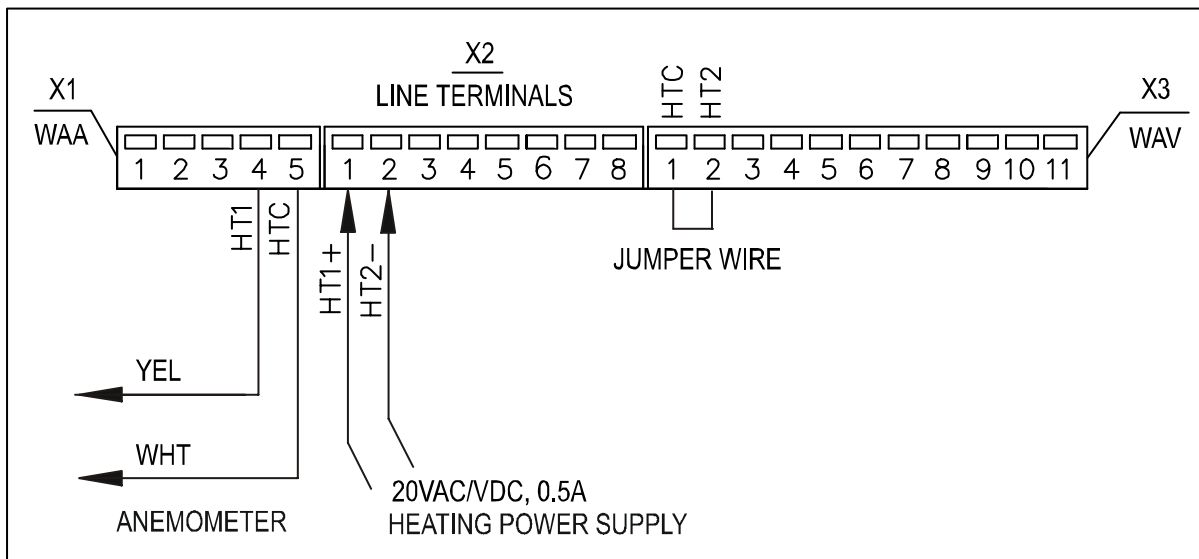


Figure 12 Heating Power Connection for Anemometer Only

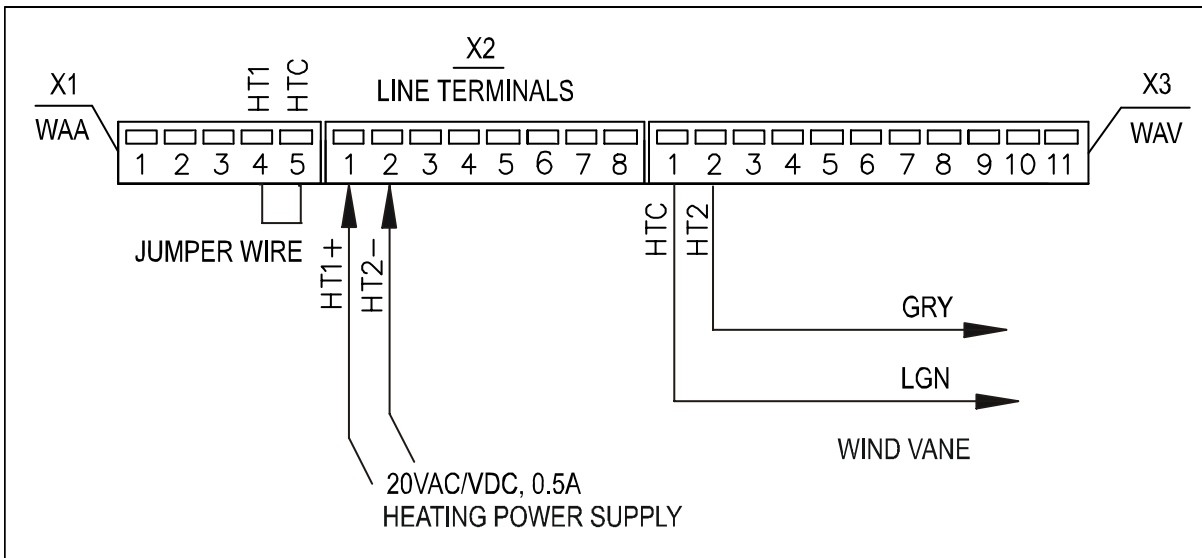


Figure 13 Heating Power Connection for Wind Vane Only

Wiring Examples

[Figure 14 on page 25](#) illustrates the basic wiring when the WAA151 and WAV151 wind sensors are connected to the WAC155 transmitter. Heating power is not connected in the figure.

[Figure 15 on page 26](#) illustrates wiring with the WHP151 Mains Power Supply, with heating power connected. Note that the WHP151 has jumpers for configuring the power output. Connect pins 2-3 of the X5 jumper to set the correct voltage, and remove the X4 jumper 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 2-3 of the X8 jumper.

[Figure 16 on page 27](#) illustrates the wiring with the WHP25 Mains Power Supply and the WA252 series wind sensors. The WAC155 operating power is supplied from the WAA252 (+12Vout, F -> X2/3). Thus no external operating voltage shall be applied to the connector X2.

NOTE

The expansion connector required for the high current wiring in [Figure 16 on page 27](#) is included in the WAA252 accessories

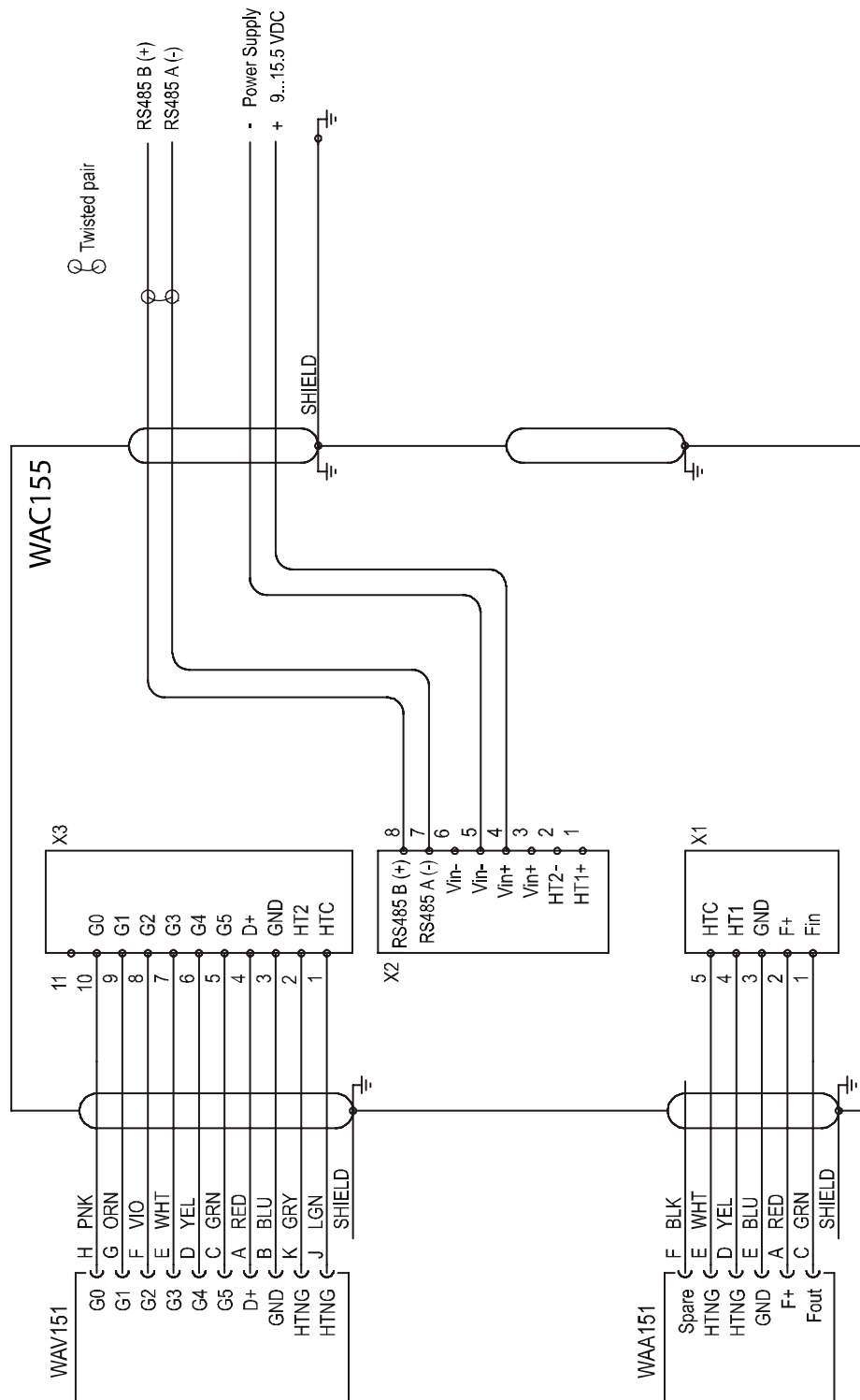


Figure 14 Basic Wiring with WAA151 and WAV151 Sensors

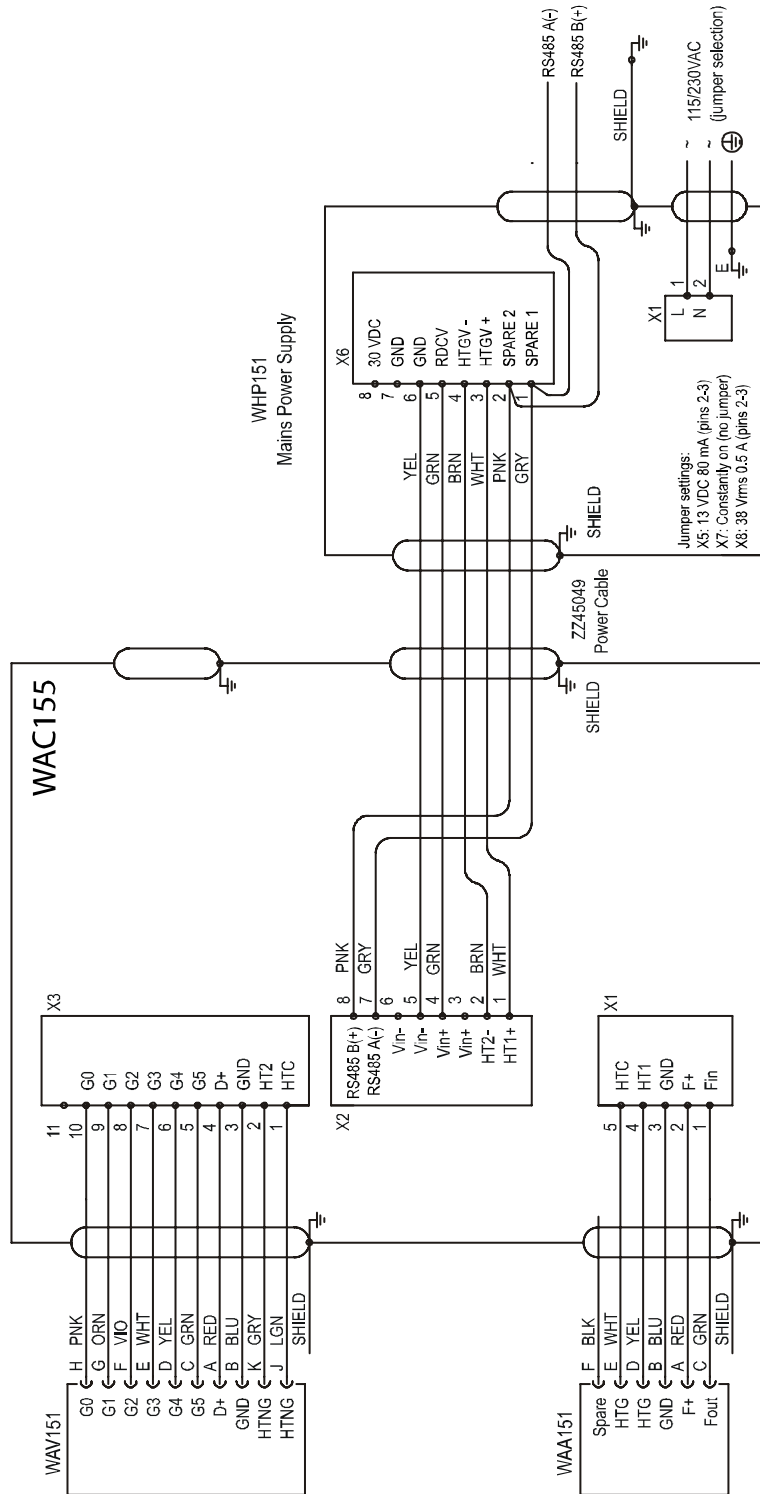


Figure 15 Wiring with WHP151 Mains Power Supply

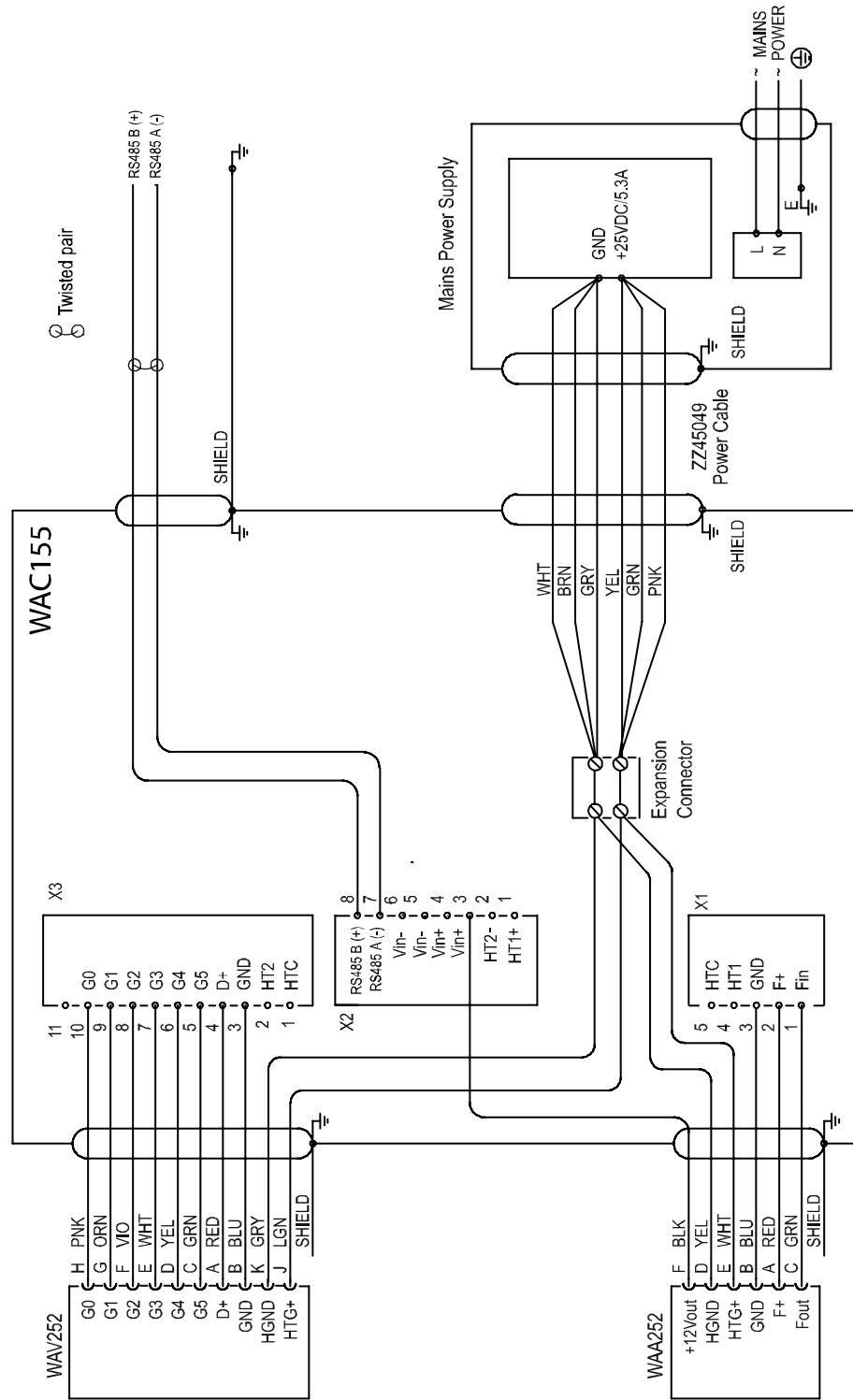


Figure 16 Wiring with WHP25 Mains Power Supply and the WA252 Series Wind Sensors

Mounting

Mounting WAC155 to the Top of a Pole Mast

Figure 17 on page 28 illustrates mounting of the WAC155 transmitter to the top of a $\varnothing 60$ mm pole mast using the standard mounting clamp. The arrow on the cover of the junction box must point to north.

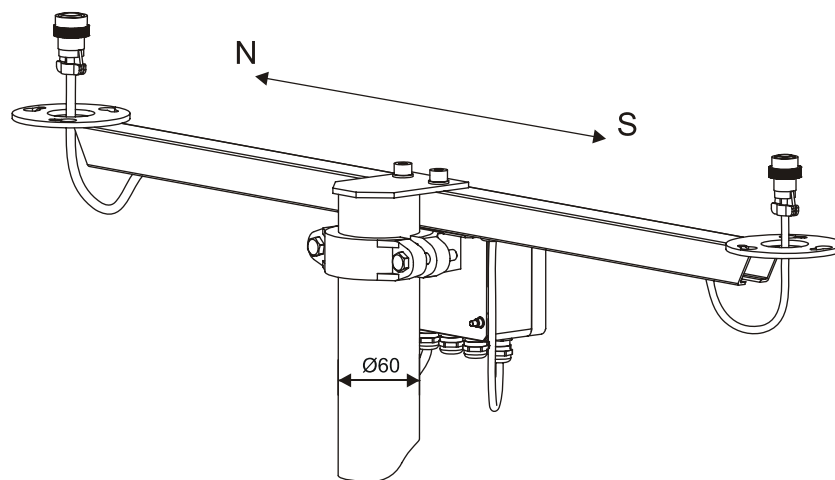


Figure 17 Mounting WAC155 to the Top of a Pole Mast

NOTE

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.

Mounting Wind Sensors to WAC155

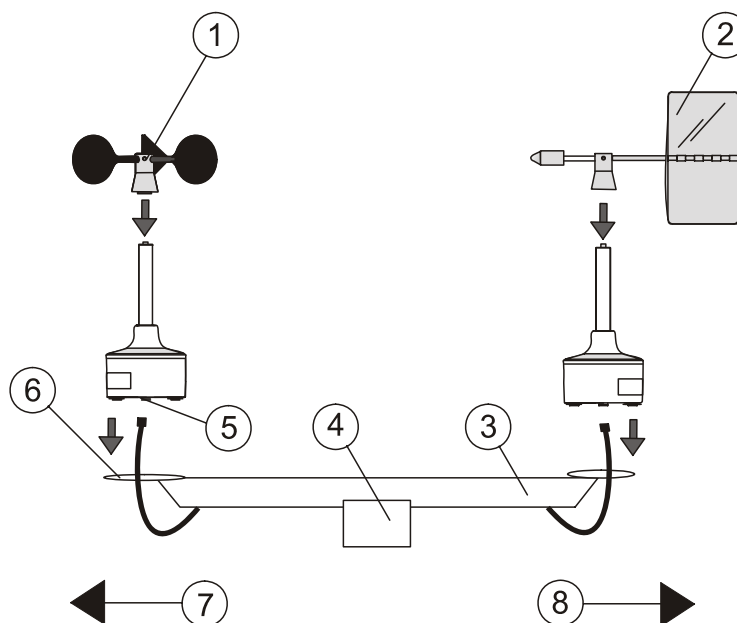


Figure 18 Installation of the Wind Sensors WAA151 and WAV151 to WAC155

The following numbers refer to [Figure 18 on page 29](#).

- 1 = WAA151 Cup assembly
- 2 = WAV151 Tail assembly
- 3 = Cross arm
- 4 = WAC155
- 5 = Connector
- 6 = Mounting flange
- 7 = South
- 8 = North

Alignment

After mounting the WAC155 transmitter to the mast, check that the WAV151 end of the cross arm is pointing to north with the required accuracy, see [Figure 17 on page 28](#). To ensure a correct assembly after aligning the WAC155, you can mount the sensors on it only in one way.

Verification

Monitor the status indicator LED when powering up the WAC155 transmitter. The LED will flash green if the self-diagnostics are completed without errors, and red if there is an error condition.

An error condition may be caused by an erroneous installation, configuration, or a combination of both. For example, enabling sensor heating without connecting the heating power will cause an error state. You may be able to diagnose the problem using the service connection. However, if the problem is with the operating power, the service connection may not be available even if the LED is flashing.

If the signal cable from the WAC155 transmitter is connected to a data collection system and the system is powered up, check that the wind readings react correctly. For testing the anemometer, rotate the cups manually. For testing the wind vane, hold the vane in a few fixed angles and verify the data.

CHAPTER 4

OPERATION

This chapter contains information that is needed to operate the Vaisala Serial Wind Transmitter WAC155.

User Interface

The WAC155 does not provide a direct user interface, except for a status indicator LED on the component board. The LED will flash green when the operational status is OK, and red when there is an error condition. The LED is activated for five minutes after the transmitter is powered up. The LED is also activated when the service connection is open.

The red LED does not indicate the type of the error. Service personnel must connect to the service connection to resolve the problem.

Data and service connections are provided over the RS-485 interface. These connections are described in the next section.

Communication Interfaces

The WAC155 transmitter communicates over a half-duplex RS-485 interface. The WAC155 can be configured to send wind data messages at regular intervals (auto-transmit mode), and it can provide the data as a response to an MWV query. The data is provided in standard NMEA wind speed and angle messages. In addition, a service interface is available for configuration and status information.

More than one transmitter can be connected to a single RS-485 bus. In the case of single transmitter, the auto-transmit mode can be used (the device transmits data messages with configured interval). If there are several transmitters in the same bus, auto-transmission may not be enabled, and data can be only polled by query.

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

Table 4 WAC155 Default Serial Communication Settings

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

NMEA Message Format

The NMEA specification defines wind speed and angle message MWV as follows:

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

where

- \$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
- <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 output by the WAC155:

```

$WIMWV,39,R,1.3,M,A*06
$WIMWV,39,R,0.5,M,A*01
$WIMWV,61,R,1.0,M,A*08
$WIMWV,59,R,1.2,M,A*01
$WIMWV,53,R,1.5,M,A*0c
$WIMWV,46,R,1.2,M,A*0f
$WIMWV,70,R,1.1,M,A*09

```

Polling Data using a Query

Polling for the MWV messages can be done using the following command:

```
$WIP<ID>Q,*<CS><cr><lf>
```

where

\$WIP= Fixed text at the start of the query
 <ID>= Transmitter device ID
 Q = Marks the message as a query
 * = Asterisk, indicating that the next field is the checksum
 <CS>= Two character checksum for the device ID

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

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

where

\$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 will reply with an MWV message containing the wind data. However, if you have not defined any messages of the type `mwvmessage` using the **SETMES** command, the transmitter will not respond.

Example polling command for transmitter with device ID "A":

```
$WIPAQ,*72
```

Example response:

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

[Table 5 on page 34](#) provides checksums and polling strings for some typical device IDs.

Table 5 Checksum table

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>
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>

Service Connection

The service connection allows you to configure the device and gather status information. The same physical RS-485 interface connection is used for both the data transmission and the service connection. When the service connection is opened (using the **OPEN** command), the data transmission and query are disabled as long as the service connection remains open.

When you change any parameters using the service connection, remember that a reset (or a power-up) is required to take the new parameters into use.

The commands are not case-sensitive; formats 'COMMAND', 'command', 'Command' and all other combinations of upper and lower case letters are accepted. However, the device ID is case-sensitive. Commands are entered on a single line, terminated by a line feed <lf> or carriage-return <cr> characters. If the terminal provides both characters as the line end marker, the second EOL character is silently

discarded. Commands may include parameters and values which are separated by a space ' '. Only one parameter can be set with a single command; multiple parameters require multiple commands.

You can repeat the previous command by typing CTRL+P. The previous command will be brought to the console, but it will not be automatically executed. You can delete characters with the backspace key [\leftarrow]. Arrow keys are not available for data editing, and tabulator completion is not supported.

A list of the supported commands is provided in section [List of Serial Commands on page 35](#).

List of Serial Commands

The following table provides a list of the serial commands that are available in the service connection.

Table 6 List of Serial Commands

Command	Description
OPEN	Open the service connection
CLOSE	Close the service connection
HELP	Display the command list
SETDEV	Set the ID of the transmitter
SETMEA	Configure measurement parameters
SETSPD	Configure wind speed computation time period
SETDIR	Configure wind direction computation time period
SETMES	Specify data transmission mode
SETCOM	Configure communication ports
SETALR	Configure sensor stuck supervision functionality
SETHEA	Configure wind sensor heating control
GETHEA	Display the current heating status
SERVICE TIMEOUT	Configure timeout for service connection
GETSET	Display the current settings of the device
ERRS	Display the current error status
INIE	Reset the transmitter to factory default settings
RESET	Reset the transmitter to new settings

The sections below contain a description of each command. The meaning of the command line elements is presented in the table below.

Table 7 Meaning of the 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 considered as part of the command and should be included as they are.	lower case
<cr>	Stands for pressing ENTER (on your computer keyboard)	lower case

OPEN

The **OPEN** command establishes service communication with the transmitter. Transmitter configuration commands are effective only when the service connection is open.

OPEN [id]<cr>

where

id = Case-sensitive device ID that specifies the transmitter where the service connection is opened. Must be specified if a device ID has been set for the transmitter, or if there are multiple transmitters on the same RS-485 bus.

If there is only one transmitter on the RS-485 bus, and no device ID has been set for the transmitter using the **SETDEV** command, you can open the service connection without specifying the ID. The device ID can be 1..5 characters (a-z, A-Z, 0-9).

If there are multiple transmitters on the same bus, you should always open the service connection so that you specify the device ID. Do not install multiple transmitters on the same bus without assigning a different device ID for each transmitter.

NOTE

If you do not know the device ID of a transmitter, you can open the service connection by using the dollar sign "\$" as the device ID:

OPEN \$

Only use this command when you have a single transmitter on the bus.

The service connection will remain open until it is closed by the **CLOSE** command, or until the defined service timeout expires (i.e., no commands have been given within the defined timeout period). The timeout period is configured using the **SERVICETIMEOUT** command. Once the service connection is closed, the transmitter will return into the operation state it had prior to opening the connection, either auto-transmitting or polling mode.

Example:

```
>open
```

```
Vaisala Serial Wind Transmitter WAC155  
SW version 2.0.7
```

```
Service connection opened  
>
```

CLOSE

The **CLOSE** command closes all current service connections. It is not necessary to define the device ID. Note that new parameters are not automatically taken into use when the service connection is closed; you must reset or power cycle the transmitter to do that.

CLOSE<cr>

Example:

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

SETDEV

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

SETDEV id <value><cr>

where

value = Specifies the new device ID for the transmitter. The ID may contain up to 5 characters, including A-Z, a-z, and 0-9. The ID is case-sensitive.

Example:

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

SETSPD

The **SETSPD** command configures the wind speed computation time period.

SETSPD average <value><cr>

where

value = Wind speed computation time period in seconds. Range 0.25 ... 5.00 in 0.25 second increments (default 3.00)

Example:

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

SETDIR

The **SETDIR** command configures the wind direction computation time period.

SETDIR average <value>

where

value = Wind direction computation time period in seconds. Range 0.25 ... 5.00 in 0.25 second increments (default 3.00)

Example:

```
>setdir average 3.00
  AVERAGE=3.00
>
```

SETMES

The **SETMES** command specifies the data transmission mode. The transmitter can support four (4) different messages at a time. Each message has its own settings for the message type and transmit interval.

Three message types are supported:

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

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

where

messagenumber = The number of the message to configure. Range 0 ... 3

type = Configures the message type. Possible values:
NONE
MWV
MWVQUERY

interval = Configures the transmit interval. Zero value disables data auto-transmission. Possible values: 0 ... 600.00 in 0.25 second increments

value = The value for the option.

Example:

```
>setmes 1 type mwvquery
0 TYPE=NONE INTERVAL=0.00
1 TYPE=MWVQUERY INTERVAL=1.00
2 TYPE=NONE INTERVAL=0.00
3 TYPE=NONE INTERVAL=0.00
>
```

SETMEA

The **SETMEA** command configures measurement parameters. The configurable parameters include anemometer transfer function parameters *gain* and *offset*.

SETMEA [allowedspdchange] [maxinvalidspdcount] [gaincorr]
[offset] [powersave] <value><cr>

where

- | | | |
|--------------------|---|--|
| allowedspdchange | = | Maximum allowed difference between two adjacent samples in the sensor data, range 0.1 ... 25.0 (default 10.0) |
| maxinvalidspdcount | = | Maximum number of adjacent discarded samples in the sensor data. Sensor data sanity check functionality is enabled if this value is not zero. Range 0 ... 15 (default 2) |
| gaincorr | = | Anemometer transfer function gain parameter. Range 0.0 ... 10.0 (default 0.09853) |
| offset | = | Anemometer transfer function offset parameter. Range -10.0 ... 10.0 (default 0.4054) |
| powersave | = | Defines whether sensor power is pulsed or provided continuously. Pulsing saves power, since the sensors are only powered when they are being read.
0 = continuous power
1 = pulsed power (default) |
| value | = | Defines the value for the option. |

Example:

```
>setmea offset 0.318
  GAIN = 0.09853
  OFFSET = 0.31800
  POWERSAVE = 1
  ALLOWEDSPDCHANGE = 10.0
  MAXINVALIDSPDCOUNT = 2
>
```

SETCOM

The **SETCOM** command configures the communication ports. Default communication port settings are 9600-n-8-1.

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

where

- portnumber= The number of the COM port to configure, 0 or 1. If omitted, the configuration will apply to the current port in use.
- baudrate = The baud rate of the port. Possible values: 300 600 1200 2400 4800 9600 19200
- databits = The number of data bits, 7 or 8
- stopbits = The number of stop bits, 1 or 2
- parity = The parity to be used. Possible values: ODD EVEN NONE
- txddelay = The RS-485 half-duplex transmission turn-around delay in milliseconds, range 0 .. 200
- value = The value for the option.

Example:

```
>setcom baudrate 9600
  BAUDRATE = 9600
  DATABITS = 8
  PARITY = NONE
  STOPBITS = 1
  TXDDELAY = 30
>
```

SETHEA

The **SETHEA** command configures the wind sensor heating control. Sensor heating is provided to prevent frost in sensor bearings. Heaters are powered by an external power supply, which is not the same as the sensor system power supply. Heating is not enabled by default. If necessary, heating can also be forced.

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

where

active = Enables the wind sensor heating functionality. Possible values: 0 = disabled (default) 1 = enabled 2 = forced

tos = Control limit for heating in degrees Celcius, range -55...+125 (default 4)

thys = Thermal hysteresis in degrees Celcius, range -55...+125 (default 1)

value = The value for the option

If heating is enabled, it is turned on when temperature drops below TOS-THYS. Heating is turned off when 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.

Typical commands:

SETHEA ACTIVE 1 (enable sensor heating)

SETHEA TOS 3 (set heating control limit to 3 degrees Celcius)

Example:

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

GETHEA

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

GETHEA<cr>

Example:

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

SETALR

The WAC155 can monitor the wind sensor movement to detect if the sensors appear to be stuck in place. The **SETALR** command is used to configure this functionality.

If the functionality is enabled and timeouts are not zero, sensors are cross-checked for changes, i.e. if the reading of the other sensor changes, but the other one does not for certain period of time, the sensor is considered stuck.

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

where

- active = Enables the wind sensor stuck supervision functionality. 0 or 1 (default 0)
- dir = Timeout for wind direction change, range 0 ... 256 (default 60)
- spd = Timeout for wind speed change, range 0 ... 256 (default 60)
- calm = The calm timeout. Defines how long both sensors may be unchanged until both sensors are considered being stuck. Range 0 ... 65535 (default 1440)
- dirlimit = Threshold limit for wind direction change. If the wind direction change is below the threshold, it is considered unchanged from the wind sensor stuck functionality point of view. Range 0 ... 180 (default 3)
- spdlimit = Threshold limit for wind speed change. If the wind speed change is below the threshold, it is considered unchanged from the wind sensor stuck functionality point of view. Range 0.0 ... 10.0 (default 0.0)
- value = The value for the option

Typical commands:

SETALR ACTIVE 1 (activate the alarm functionality)

SETALR DIR 60 (alarm if wind vane stuck for 60 seconds)

SETALR SPD 60 (alarm if anemometer stuck for 60 seconds)

SETALR CALM 1440 (alarm if both sensors stuck for 1440 minutes)

Example:

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

SERVICE TIMEOUT

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

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

SERVICE TIMEOUT <value><cr>

where

value = The value of the service timeout, range 0 ... 30 min (default 5 min).

Example:

```
>service timeout 5
TIMEOUT=5
>
```

GETSET

The GETSET command will return the current configuration of the current unit.

GETSET <cr>

Example:

```
>getset
SETDEV
      ID=A1
SETSPD
      AVERAGE=3.00
SETDIR
      AVERAGE=3.00
...
```

HELP

The HELP command displays a list of the supported commands.

HELP<cr>

Example:

```
>help
CLOSE Close service connection
SETDEV Set device ID
SETSPD Speed computation average length
SETDIR Direction computation average length
...
```

INIE

The **INIE** command resets the transmitter to factory defaults. Note that the current configuration settings will be lost. Before using the **INIE** command, it may be a good idea to view the current settings using the **GETSET** command, and record the output.

After using this command, you have to use the **RESET** command to take the factory defaults into use, and re-open the service connection with the **OPEN** command.

INIE <cr>

Example:

```
>inie  
FACTORY DEFAULTS  
>
```

RESET

The RESET command resets the transmitter, and takes any new configuration settings into use. After using this command, you have to re-open the service connection with the **OPEN** command.

RESET <cr>

Example:

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

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 [Table 10 on page 52](#).

You can use the [mask] option to define the 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 0010 which means that only if both wind sensors are missing or broken, the NMEA data is invalid.

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

0400 + 0800 = 0C00

ERRS [mask] <value><cr>

where

mask = Implements an error mask.

value = The value for the error mask in hexadecimal format
(default 0010).

Example:

```
>errs
```

```
Active errors:
```

```
ERROR 5: Heating control broken or heating power missing
```

```
ERRS = 0020
```

```
MASK = 0010
```

```
>
```


CHAPTER 5

MAINTENANCE

This chapter provides information that is needed in basic maintenance of the Vaisala Serial Wind Transmitter WAC155.

Periodic Maintenance

Visual Checking

Check every 1 to 2 years that the component board is not corroded.

Replacing Consumables

When replacing the component board, read carefully the section [ESD Protection on page 9](#).

Parts List for Consumables

Table 8 Available Spare Parts

Spare Part	Order Code
Component Board for WAC155	WAC155CB
Sensor Cable for Anemometer (0.8m)	ZZ45036
Sensor Cable for Wind Vane (0.8m)	ZZ45037

CHAPTER 6

TROUBLESHOOTING

This chapter describes common problems, their probable causes and remedies, and contact information.

Problem Situations

Table 9 Problem Situations and Corrective Actions

Problem	Possible cause	Action
Data is not received by the data collecting system	Improper or loose connections.	Check wiring and tighten the screw terminals.
	Incorrect messaging settings.	Check and correct using the service connection.
	Power failure.	Check that the power supply is online.
Shaft heating of the sensors is not working.	Heating power is not connected properly.	Check wiring and tighten the screw terminals.
	Heating is not enabled in the transmitter settings.	Check and correct using the service connection.
	Power failure of the heating power supply.	Check that the power supply is online.

Error Messages

The table below describes the error codes defined in the WAC155. If you use the **ERRS** command to specify an error mask, use the hexadecimal values that are provided in the table. For help in using the service connection to read the errors and configure the WAC155, refer to section [List of Serial Commands on page 35](#).

Table 10 Self-diagnostics Error Codes

Error #	Hex equivalent	Message	Description
0	0001	Input voltage too low	Input voltage below accepted limit, sensor behaviour not defined
1	0002	Input 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 operational sensor
4	0010	Both sensors missing or broken	Wind speed and direction sensors are both missing or broken
5	0020	Heating control malfunction or heating power missing	Heating power control mechanism malfunctioning or heating power is not connected
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 failed
8	0100	Internal error	This error code is reserved for future use
9	0200	Temperature sensor not calibrated. Heating control malfunctioning.	Production time calibration not performed, 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

Technical Support

For technical questions, contact the Vaisala technical support:

E-mail helpdesk@vaisala.com

Fax +358 9 8949 2790

Return Instructions

If the product needs repair, please follow the instructions below to speed up the process and to avoid extra costs to you.

1. Read the section [Warranty on page 10](#).
2. Contact a Vaisala Service Center or a local Vaisala representative. The latest contact information and instructions are available from www.vaisala.com. Addresses of the Service Centers are provided in section [Vaisala Service Centers on page 54](#).

Please have the following information on hand:

- serial number of the unit
 - date and place of purchase or last calibration
 - description of the fault
 - circumstances in which the fault occurs/occurred
 - name and contact information of a technically competent person who can provide further information on the problem
3. Pack the faulty product in a strong box of adequate size, with proper cushioning material to avoid damage.
 4. Include the information specified in step 2 in the box with the faulty product. Also include a detailed return address.
 5. Ship the box to the address specified by your Vaisala contact.

Vaisala Service Centers

Vaisala Service Centers perform calibrations and adjustments as well as repair and spare part services. See contact information below.

Vaisala Service Centers also offer accredited calibrations, maintenance contracts, and a calibration reminder program. Do not hesitate to contact them to get further information.

NORTH AMERICAN SERVICE CENTER

Vaisala Inc., 10-D Gill Street, Woburn, MA 01801-1068, USA.

Phone: +1 781 933 4500, Fax: +1 781 933 8029

E-mail: us-customersupport@vaisala.com

EUROPEAN SERVICE CENTER

Vaisala Instruments Service, Vanha Nurmijärventie 21 FIN-01670 Vantaa, FINLAND.

Phone: +358 9 8949 2658, Fax: +358 9 8949 2295

E-mail: instruments.service@vaisala.com

TOKYO SERVICE CENTER

Vaisala KK, 42 Kagurazaka 6-Chome, Shinjuku-Ku, Tokyo 162-0825, JAPAN.

Phone: +81 3 3266 9617, Fax: +81 3 3266 9655

E-mail: aftersales.asia@vaisala.com

BEIJING SERVICE CENTER

Vaisala China Ltd., Floor 2 EAS Building, No. 21 Xiao Yun Road, Dongsanhuan Beilu, Chaoyang District, Beijing, P.R. CHINA 100027.

Phone: +86 10 8526 1199, Fax: +86 10 8526 1155

E-mail: china.service@vaisala.com

www.vaisala.com

CHAPTER 7

TECHNICAL DATA

This chapter provides technical data of the Vaisala Serial Wind Transmitter WAC155.

Specifications

Table 11 Performance

Property	Description/Value
Equipment type	Digital-to-RS-485 serial bus converter for Vaisala wind sensors
Full scale: for direction for speed	0 ... 360° 0 ... 75 m/s
Resolution: for direction for speed	5.625° (1.4° achieved by calculation) 0.1 m/s
Updating interval: for direction for speed	3 s (default) 3 s (default)
Pulse-mode power feed: to the vane to the anemometer	500 µs / 4 Hz Nominal 50 µs / 2400 Hz Nominal

Table 12 Inputs and Outputs

Property	Description/Value
Signal input: wind direction wind speed	6-bit parallel GRAY code Pulse frequency 0 ... 750 Hz
Input operating power	9 ... 15.5 VDC, 8 mA typical incl. sensors (when power-save mode is enabled)
Maximum operating power	50 mA (when power-save mode is disabled)
Input heating power	16 ... 24 VAC or VDC 32 ... 48 VAC or VDC can be used when heating power is connected in series to both sensors
Typical heating power	500 mA per sensor
Output signals	RS-485 serial bus
Signal cable	4 wires minimum: VIN+, VIN-, RS-485 A(-), RS-485 B(+)

Table 13 Operating Conditions

Property	Description/Value
Temperature range: operating storage	-55 ... +55 °C -60 ... +70 °C
Humidity	0 ... 100 %RH

Table 14 Dimensions and Mechanics

Property	Description/Value
Dimensions: printed circuit board junction box	115 x 58 mm ² 125 (w) x 80 (h) x 57 (d) mm
Cross arm length	800 mm
Ingress protection	IP65
Mounting	To a Ø 60 mm pole mast
Weight	1.5 kg
Material: cross arm junction box	Al anodized Al painted gray

Dimensions in mm (inches)

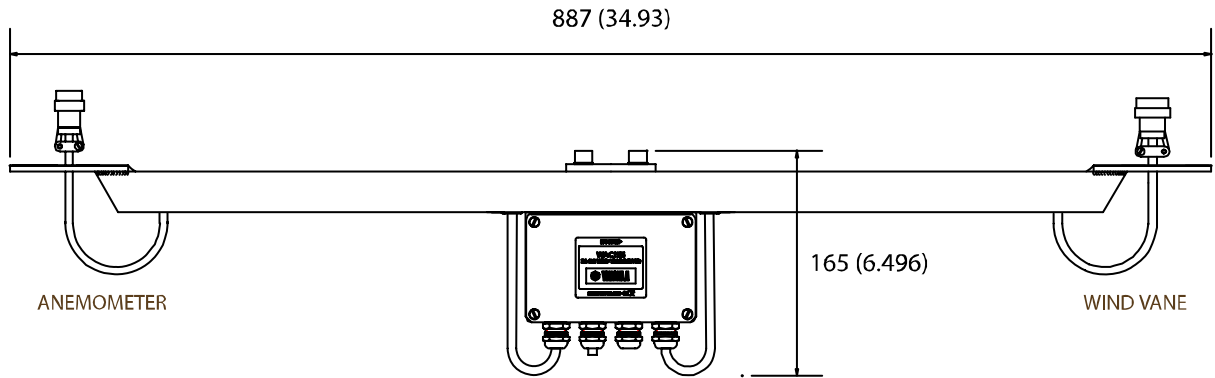
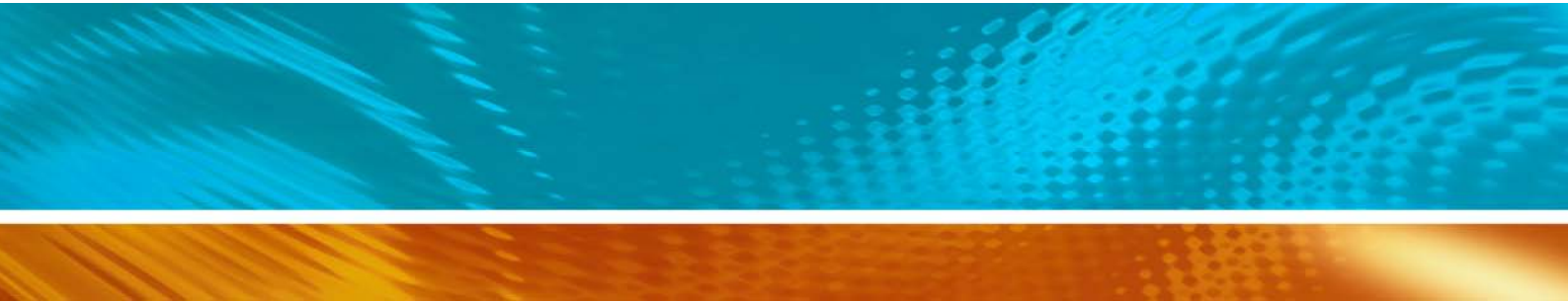


Figure 19 WAC155 Dimensions



www.vaisala.com

