Analog Wind Transmitter WAT12

USER'S GUIDE

M210309EN-A
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VAISALA

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CHAPTER 1

GENERAL INFORMATION

About This Manual

This manual provides information for installing and maintaining WAT12 Analog Wind Transmitter.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides important safety, revision history, and warranty information for the product.
- Chapter 2, Product Overview, introduces WAT12 Analog Wind Transmitter features.
- Chapter 3, Installation, provides you with information that is intended to help you install this product.
- Chapter 4, Maintenance, provides information that is needed in basic maintenance of WAT12 Analog Wind Transmitter.
- Chapter 5, Troubleshooting, describes common problems, their probable causes and remedies, and provides contact information.
- Chapter 6, Technical Data, provides technical data of WAT12 Analog Wind Transmitter.

Version Information

Table 1 Manual Revisions

Manual Code	Description
T649en-1.1	WAT12 Analog Wind Transmitter - Technical Reference.
M210309EN-A	This manual, the first version of WAT12 Analog Wind Transmitter User's Guide. Supersedes the above mentioned Technical Reference.

Related Manuals

Table 2 Related Manuals

Manual Code	Manual Name
M210293en	WAA151 Anemometer - User's Guide
M210294en	WAV151 Wind Vane - User's Guide

Safety

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.

Product Related Safety Precautions

WAT12 Analog Wind Transmitter 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 the grounding of the outdoor installation 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 to the equipment chassis

before touching the boards. Ground yourself with a wrist strap and a resistive connection cord. When neither of the above is possible, 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.

Regulatory Compliances

WAT12 Analog Wind Transmitter is a CE compliant product.

Warranty

For certain products Vaisala normally gives a limited one year 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.

CHAPTER 2

PRODUCT OVERVIEW

This chapter introduces WAT12 Analog Wind Transmitter features.

Introduction to WAT12 Analog Wind Transmitter

The WAT12 transmitter converts the digital data supplied by the Vaisala 151 and 252 Series wind sensors, into two industry standard analog current loops; one representing the wind speed and the other the wind direction. The current loops are suitable for connection to, for example, chart recorders, analog or digital panel meters, analog inputs of computers, or other instruments with an analog input interface. The power to the sensors is also supplied through the WAT12 transmitter. The transmitter accepts a wide range of input power, from 12 to 28 VDC.

The WAT12 transmitter consists of a printed circuit board unit in a junction box and a cross arm for mounting the wind sensors, see Figure 1 on page 10. A 4-wire cable for the wind speed and direction signals and power supply is needed between the transmitter and the receiving end.

The loop current is user selectable. The loops are supplied by high-side drivers with a return to the signal and power ground; thus nearly any input type can be driven.

The WAT12 transmitter provides the sensors with a throughput for optional heating power. A thermostat switch is available as an option to automatically connect the heating power in temperatures below +4 °C.

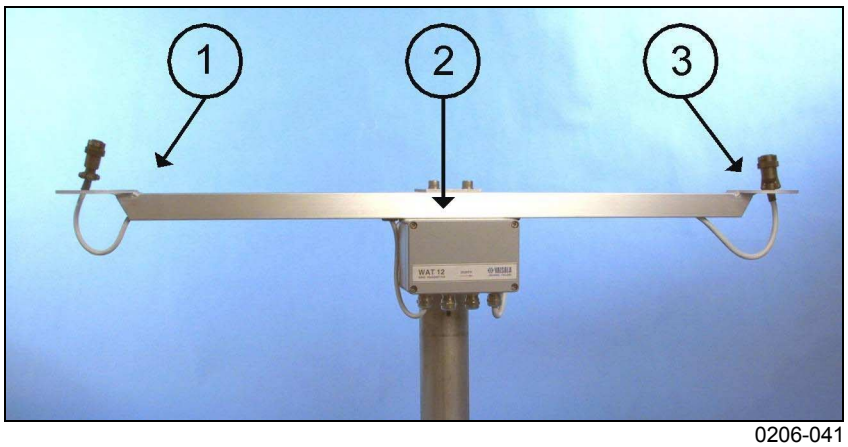

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Figure 1 WAT12 Analog Wind Transmitter

The following numbers refer to Figure 1 above:

1 = Flange for mounting a Vaisala anemometer
2 = Junction box, containing the circuit 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

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.

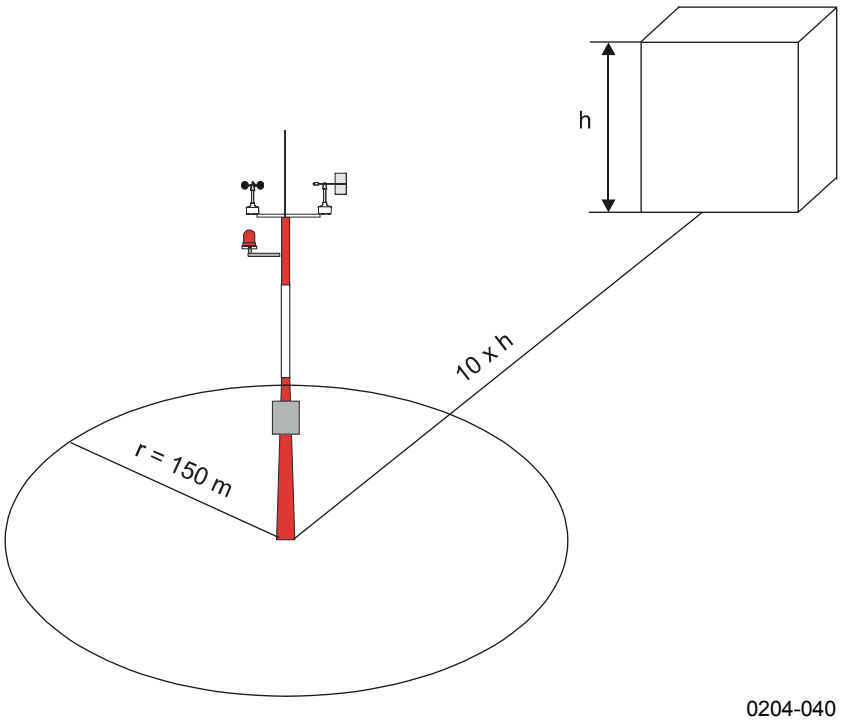

Figure 2 Recommended Mast Location in Open Area

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 11.

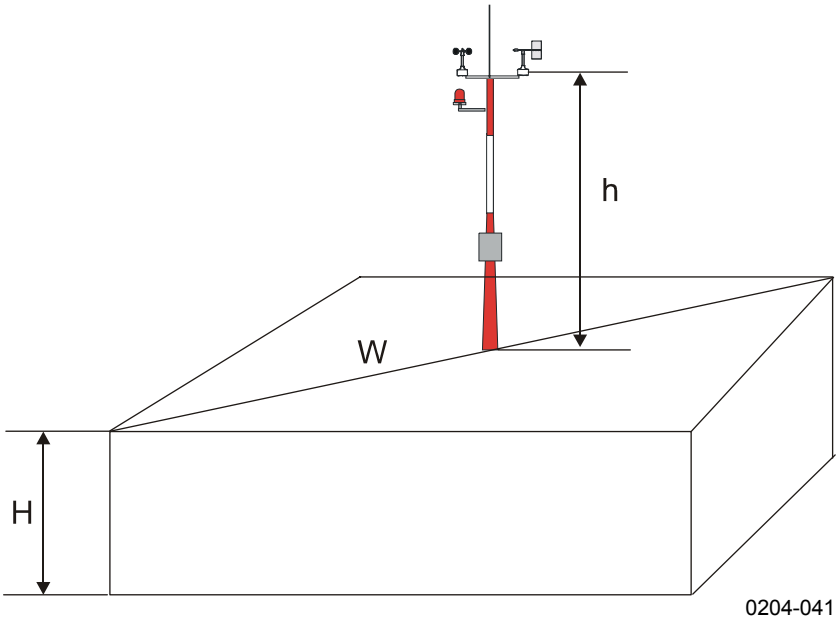

Figure 3 Recommended Mast Length on Top of a Building

The recommended minimum length (marked with the letter h in Figure 3 above) 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 WAT12 transmitter. Remove the cover.
2. Select the current output span, as well as direction and speed scaling according to the instructions in section Jumper Settings on page 14. Some examples of selecting scales and ranges are shown in Figure 5 on page 15, Figure 6 on page 16, and Figure 7 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 8 on page 17.
4. Connect the wires to the X2 removable screw terminal block according to Figure 11 on page 19, Figure 12 on page 20, Figure 13 on page 20, or Figure 14 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 21 on page 27.
7. Mount the sensors onto the cross arm. Refer to Figure 22 on page 28 and the sensors' manuals.
8. Align the cross arm as instructed in section Alignment on page 29 before erecting the mast.

Jumper Settings

The loop current can be selected with the on-board jumper plugs. Several output ranges, such as 0 to 20 mA, 4 to 20 mA, 0 to 10 mA, 2 to 10 mA, 0 to 5 mA, and 1 to 5 mA, are available as user configurable options, each with factory-adjusted zero and span levels. The voltage-mode signals are easily obtained by connecting a suitable resistor across the readout device's terminals. Signal full scale options are also available. For instance, a directional scale of 540° (0-360-180°), which is convenient for analog panel meters or chart recorders, can be chosen to prevent the needle or pen from oscillating across the scale with northerly winds.

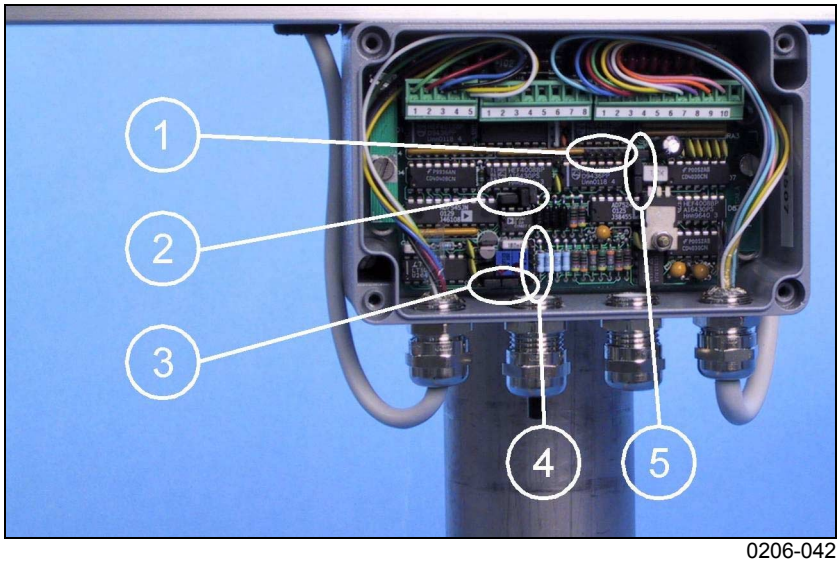

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Figure 4 Location of the Jumpers

The following numbers refer to Figure 4 above.

1 = X4: Test and operation
2 = X5: Output zero
3 = X7: Scaling together with X6
4 = X8: Output span
5 = X6: Scaling together with X7

For example, you can set the wind speed output from 1 to 5 mA which corresponds to speed values from 0 to 51.2 m/s and to direction values from 0 to 540 degrees. This range does not change the scaling of 360 degrees corresponding to one full turn, rather it allows to calculate the average direction during northerly winds. These settings are carried out by the jumpers of the WAT12 transmitter as described in Table 3 below.

Table 3 Jumper Settings for the 1 to 5 mA Current Loop

Jumper		Description
X4	J5 ON	Normal operation
X5	J1 ON	1 / 2 / 4 mA for 51.2 m/s
X6	J1 ON J3 ON	0 ... 540°
X7	J5 ON	
X7	J6 ON	0 ... 51.2 m/s
X8	ALL OFF	1 ... 5 mA

Some examples for selecting scales and ranges are shown in Figure 5 below, Figure 6 on page 16, and Figure 7 on page 16.

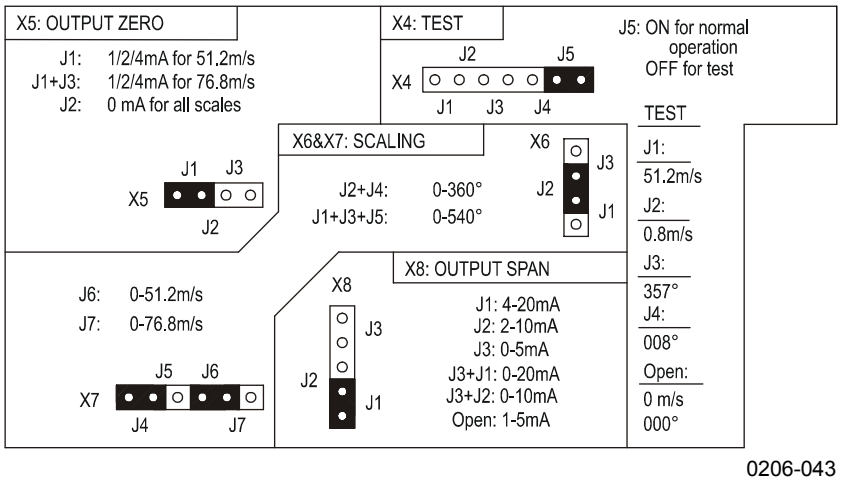

Figure 5 Jumpers for the Setting: 4 ... 20 mA, 0° ... 360°, 0 ... 51.2 m/s

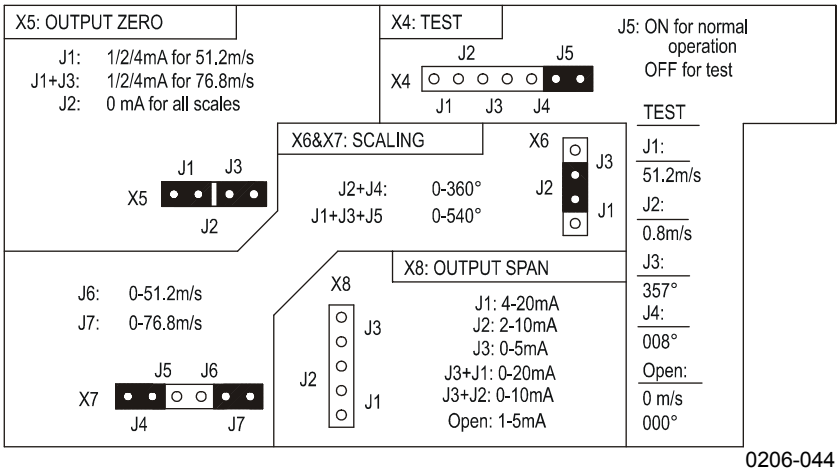

Figure 6 Jumpers for the Setting: 1 ... 5 mA, 0° ... 360°, 0 ... 76.8 m/s

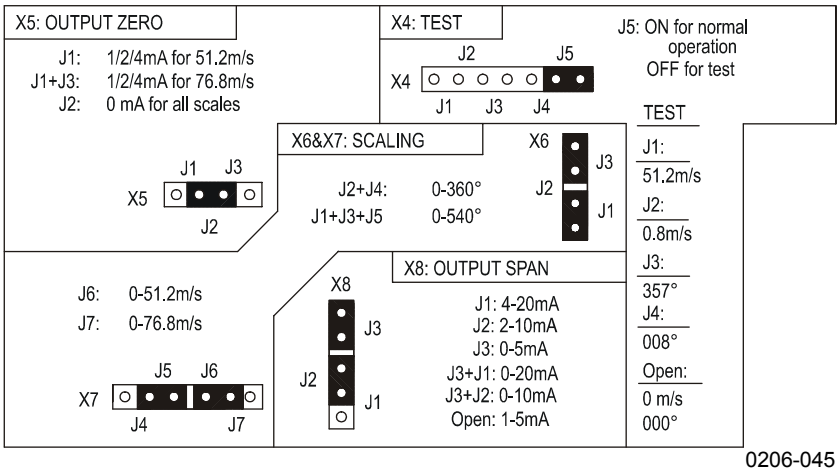

Figure 7 Jumpers for the Setting: 0 ... 10 mA, 0° ... 540°, 0 ... 51.2 m/s

Connections

The WAT12 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 8 on page 17.

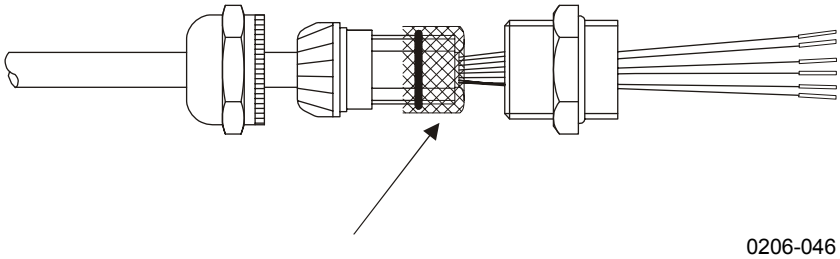

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Figure 8 Cable Shield Bent over the Plastic Sleeve and O-ring

The WAT12 transmitter has three I/O connectors as listed in Table 4 on page 18. For the location of the connectors, refer to Figure 9 below.

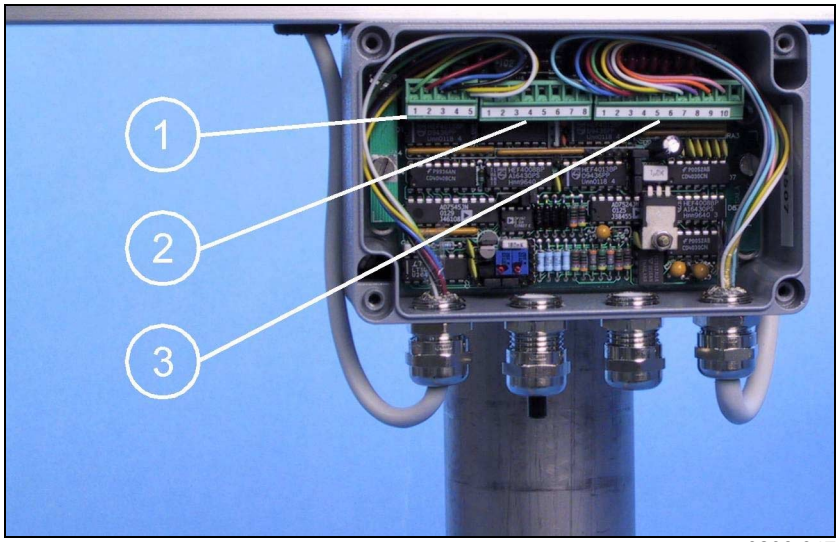

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Figure 9 I/O Connectors

The following numbers refer to Figure 9 above.

1 = X1: For the anemometer cable
2 = X2: For the power and signal cable
3 = X3: For the wind vane cable

Table 4 I/O Connectors

Connector	Description
X1	Plug-in connector with screw terminals (5 pcs) for the anemometer cable. Maximum wire cross section area is 1.5 mm^2.
X2	Plug-in connector with screw terminals (8 pcs) for the power and signal cable. Maximum wire cross section area is 1.5 mm^2.
X3	Plug-in connector with screw terminals (11 pcs) for the wind vane cable. Maximum wire cross section area is 1.5 mm^2.

Sensor Wiring

The transmitter connects to the wind sensors with the cross-arm's standard cables through two cable glands. Through these cables the WAT12 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.

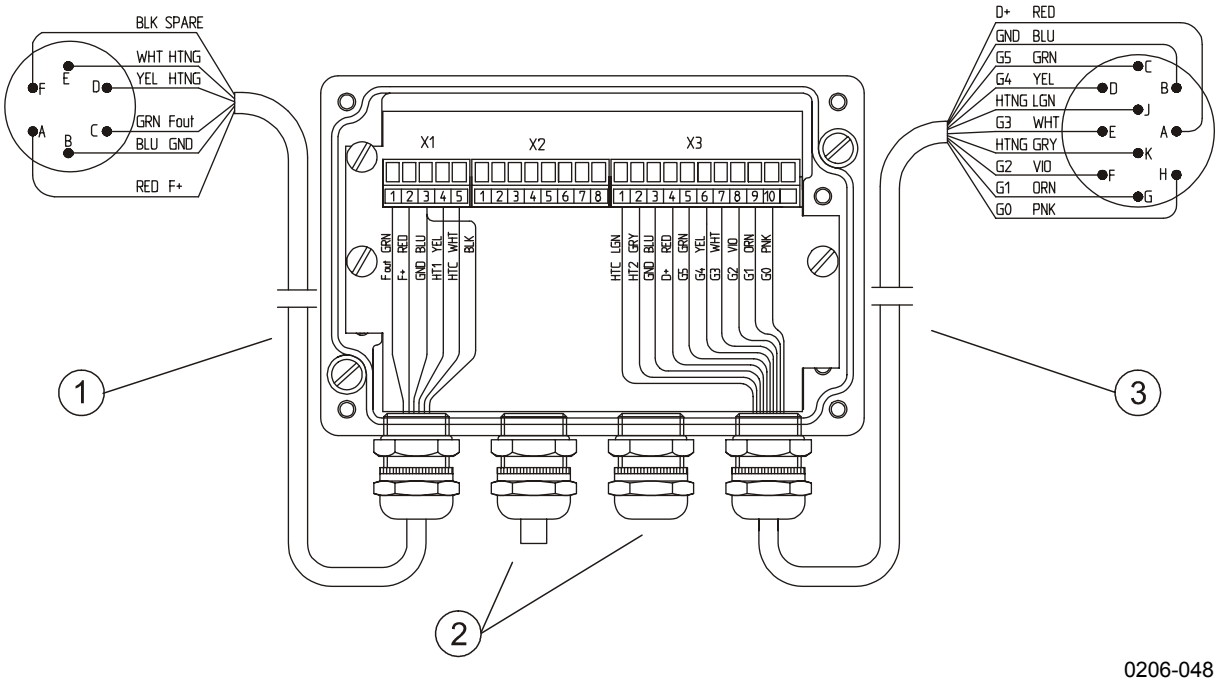

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Figure 10 Wiring of the Sensors

The following numbers refer to Figure 10 on page 18.

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

Signal Output

The signal output provides two analog current loops, direction and speed, with sourcing drivers with an o/p driving voltage 10.5 V typically and an o/p resistance of 57 Ω. The loops return to the common ground for power and signal. The signal and sensor power outputs are also current limited.

Typically, only a 4-wire shielded cable is required for the line between the WAT12 transmitter and the receiving end. Two of the four wires provide the operating power for the system. The other two are for the current source outputs from the WAT12 transmitter; one delivering the speed signal and the other the direction signal. The two readout devices are wired each across the respective current source terminal (+) and the negative terminal of the power supply (-). Refer to Figure 11 below for a typical system with a 24 VDC power supply and the 5 mA signal currents.

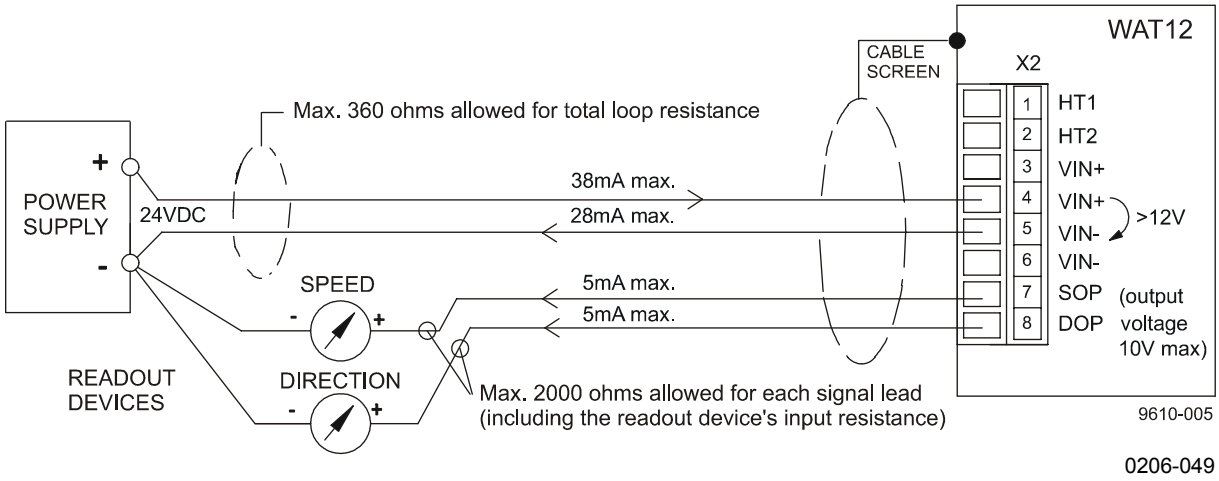

Figure 11 Typical System with 24 VDC Power Supply and 5 mA Signal Currents

Figure 12 below illustrates wiring for high noise environment. It is essential to ground the cable also at the power supply.

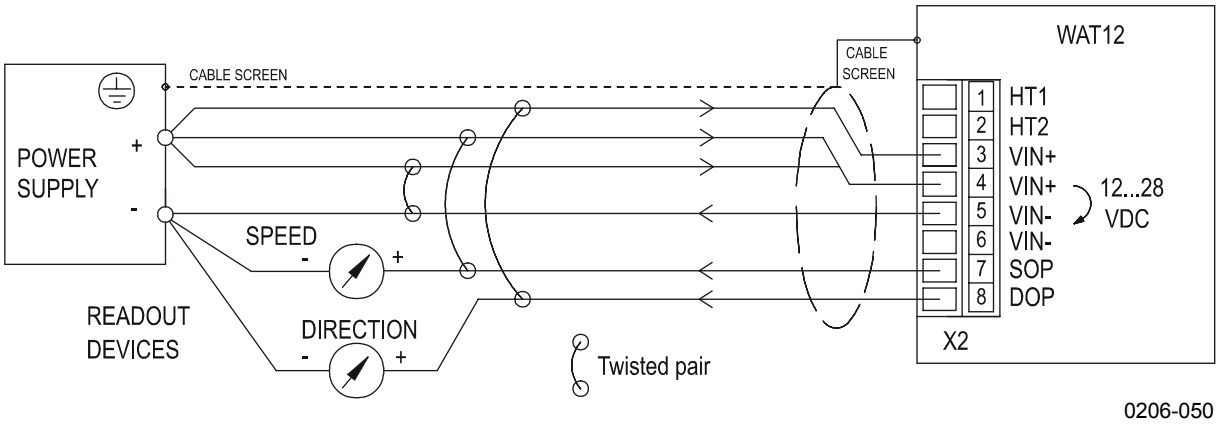

Figure 12 Wiring for High Noise Environment

Figure 13 below illustrates wiring for long distance with the 5 mA loop current. Note the maximum resistance values for both the power and signal leads.

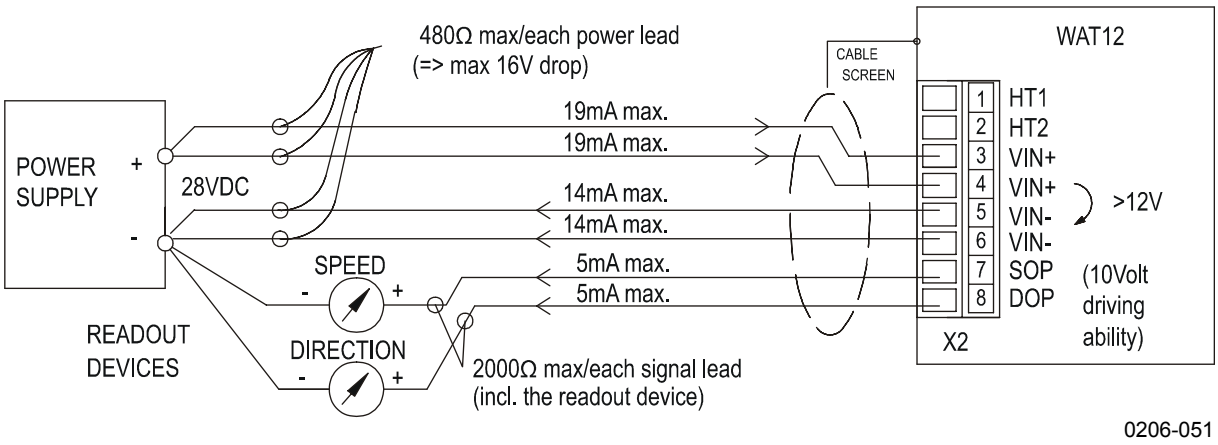

Figure 13 Long Distance Wiring

Figure 14 on page 21 illustrates 4-wire wiring for long distance with a 48 VDC power supply.

CAUTION A source resistance, over 1000Ω, must be used for dropping VIN to an acceptable level, because if VIN exceeds 28 VDC, the transmitter may be damaged permanently.

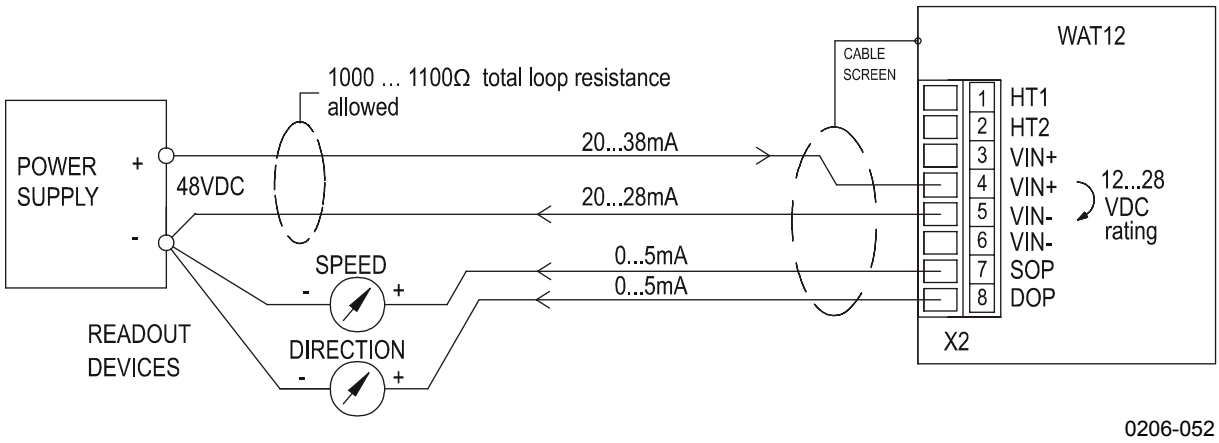

Figure 14 Long Distance Wiring with Four Wires

Powering

The WAT12 transmitter accepts a wide range of input power, from 12 to 28 VDC. When the 5 mA loop current is selected, the total current consumption is less than 40 mA including the sensors and the loop current. The low current consumption enables to remotely supply the operating power from a distance of several kilometers, even through private or leased telephone lines.

The maximum power line resistance depends on the supply voltage and the loop current selection. For an example with an 24 VDC power supply, refer to and to Figure 11 on page 19.

Table 5 Power Line Resistance with an 24 VDC Power Supply

Loop Current, mA	Power Line Resistance, Ω
5	360
10	310
20	250

For other powering options, refer to Figure 12 on page 20, Figure 13 on page 20, and Figure 14 above.

The power line is protected against the wrong 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 WAT12 transmitter also provides the sensors with a throughput for optional heating 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, the heating power is most conveniently supplied from a local power source. A thermostat switch is available for automatic connection of the heating power in temperatures below +4 °C.

The optional heating power requirement is 20 VAC or VDC, and 500 mA for both WAV151 and WAA151 sensors. The sensors can be connected in series, when a 40 V power supply providing 500 mA is required. Alternatively, the sensors can be connected in parallel, when a 20 V power supply providing 1 A is required. For the default connection, refer to Figure 15 below.

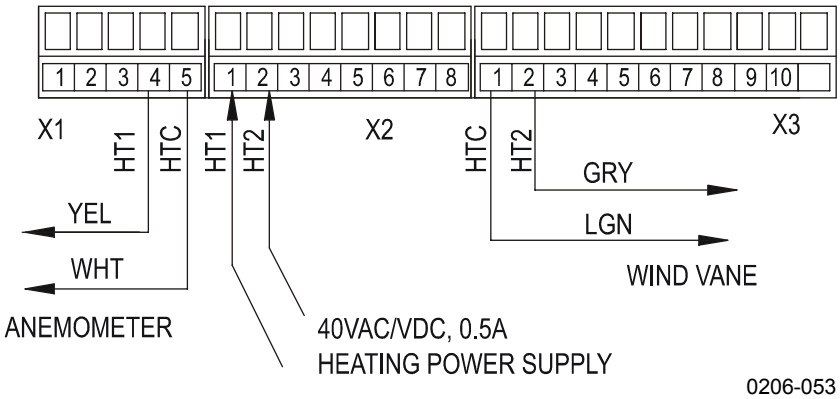

Figure 15 Default Heating Power Connection with both Sensors

Wiring Examples

Refer to Figure 16 below for the basic wiring, when the WAA151 and WAV151 wind sensors are connected to the WAT12 transmitter.

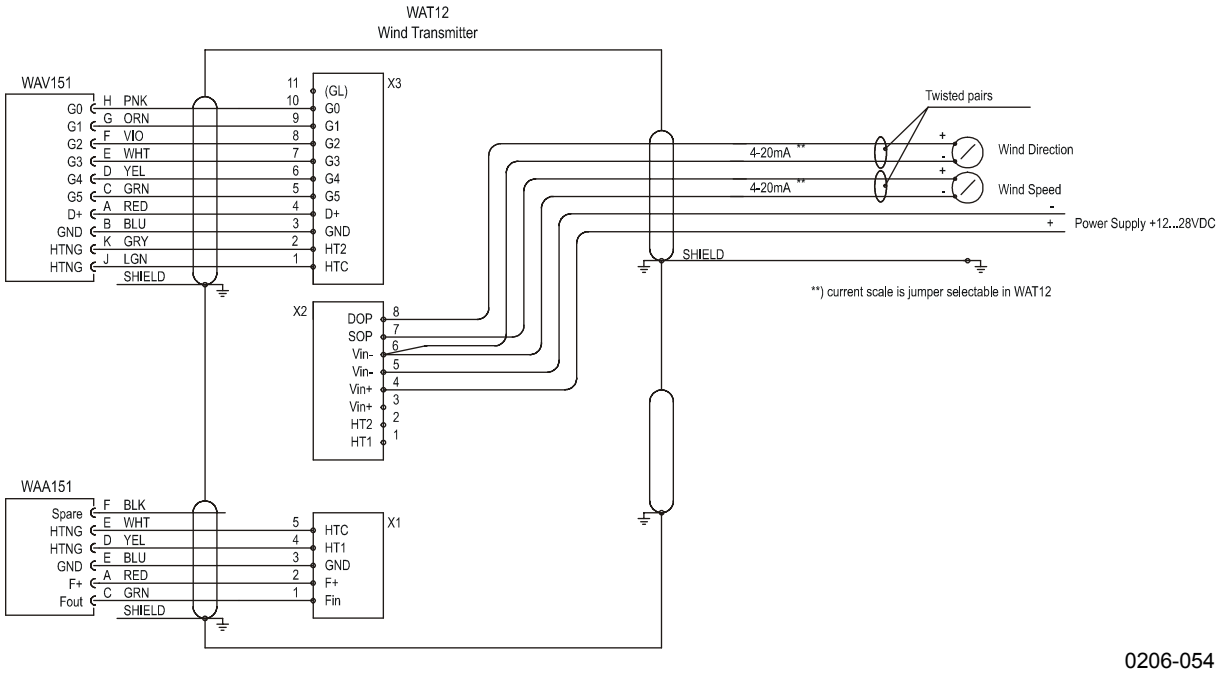

Figure 16 Basic Wiring with WAA151 and WAV151 Sensors

Figure 17 on page 24 illustrates the wiring with WHP151 Mains Power Supply.

Figure 18 on page 25 illustrates the wiring with WHP25 Mains Power Supply and the 252 series wind sensors.

NOTE	An expansion connector and discrete joining wires are included in the WAA252 accessories.

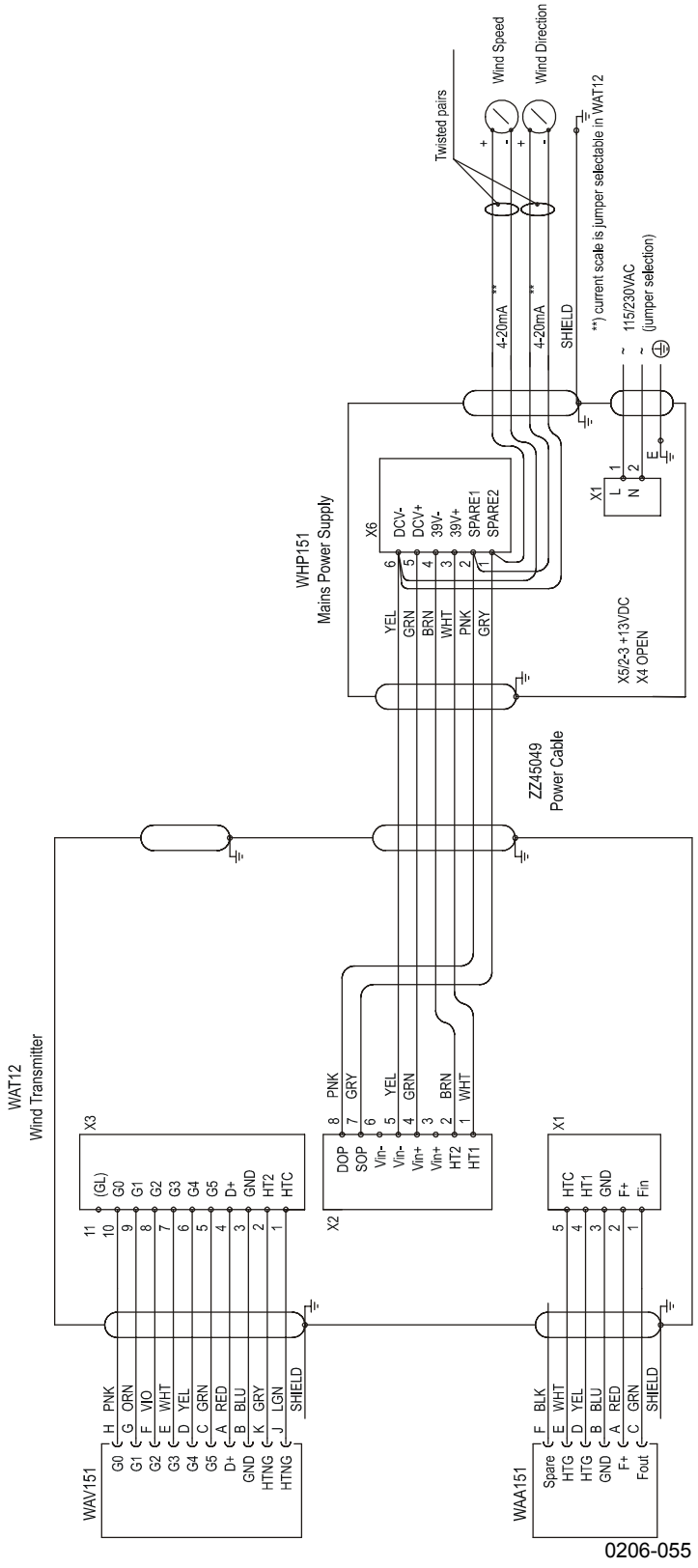

Figure 17 Wiring with WHP151 Mains Power Supply

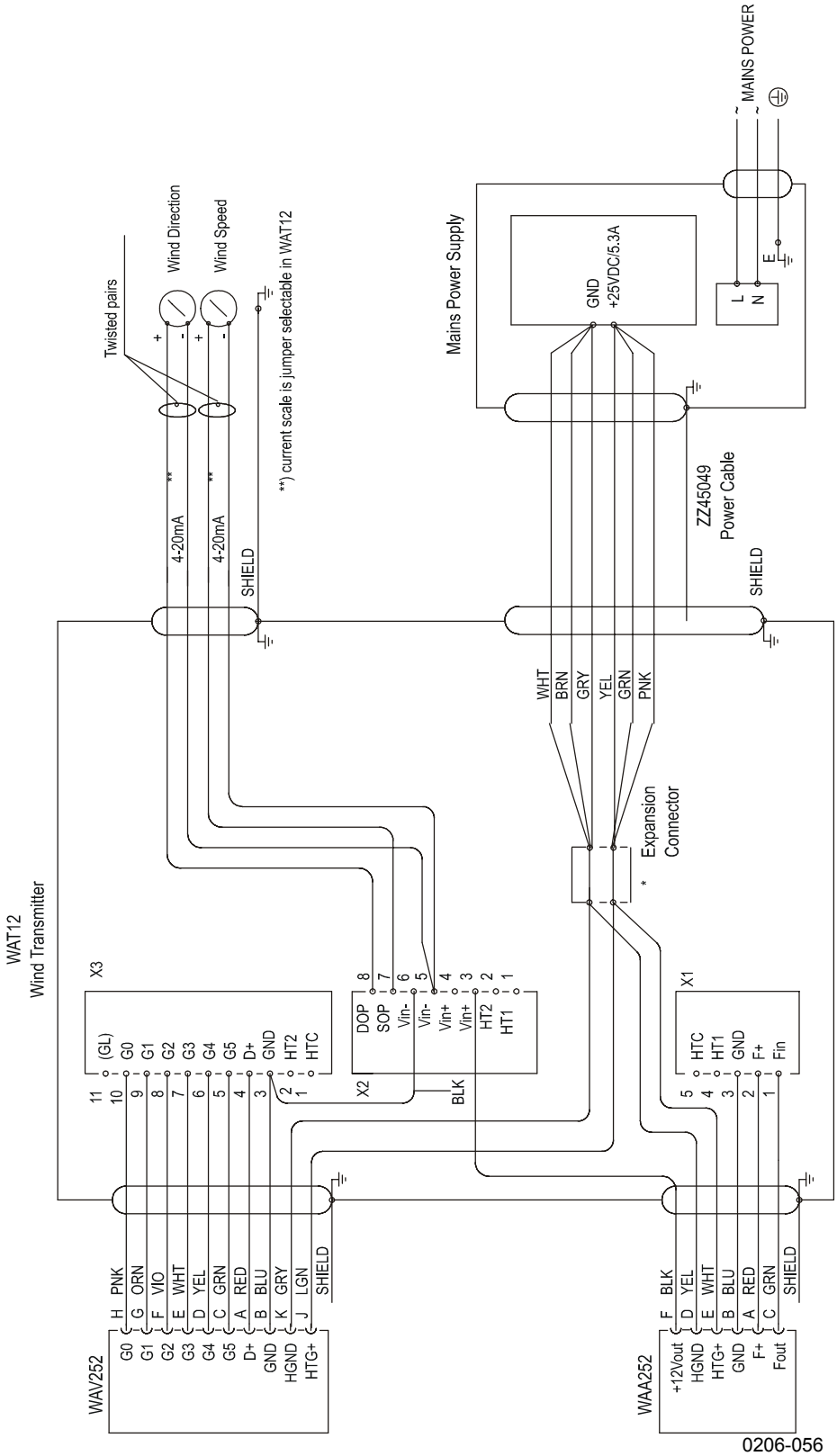

Figure 18 Wiring with WHP25 Mains Power Supply and the 252 Series Wind Sensors

Mounting the Thermostat Switch

The thermostat switch connects at +4 °C (±3 °C) and disconnects at +11 °C (±3 °C). For mounting, refer to Figure 19 below. For standard wiring, refer to Figure 20 on page 27.

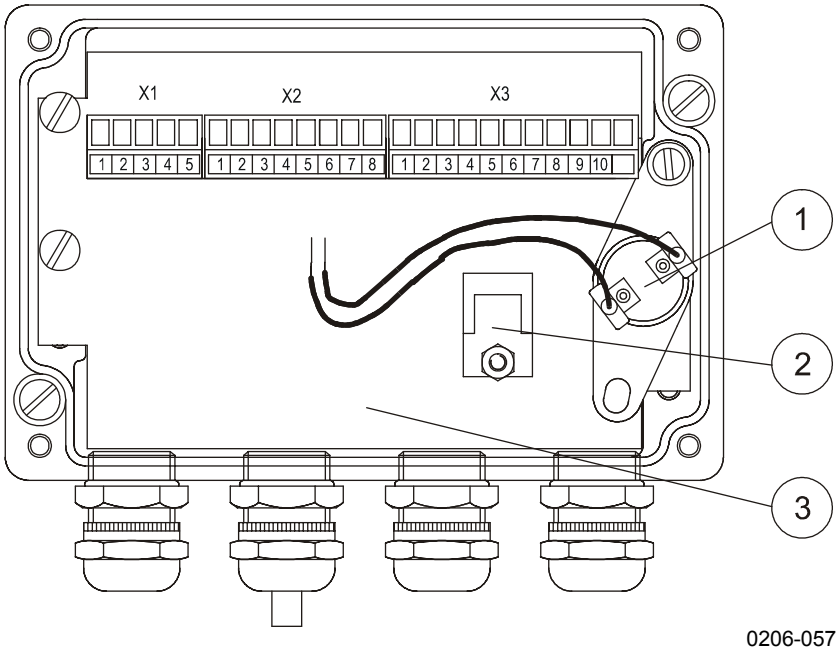

Figure 19 Mounting the Thermostat Switch inside the WAT12 Junction Box

The following numbers refer to Figure 19 above.

1 = Thermostat switch
2 = Regulator
3 = Wires

CAUTION	The thermostat switch (number 1 in Figure 19 above) must not touch the regulator (2).

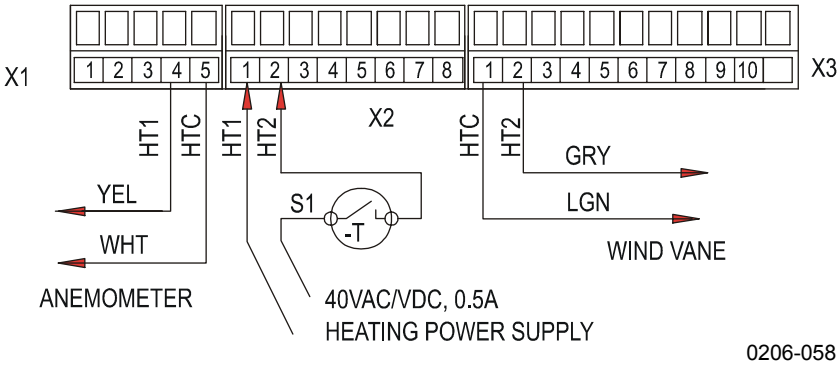

Figure 20 Standard Connection for Thermostat Switch

Mounting

Mounting WAT12 to the Top of a Pole Mast

Figure 21 below illustrates mounting of the WAT12 transmitter to the top of a Ø 60 mm pole mast, with the standard mounting clamp. The arrow on the cover of the junction box must point to north.

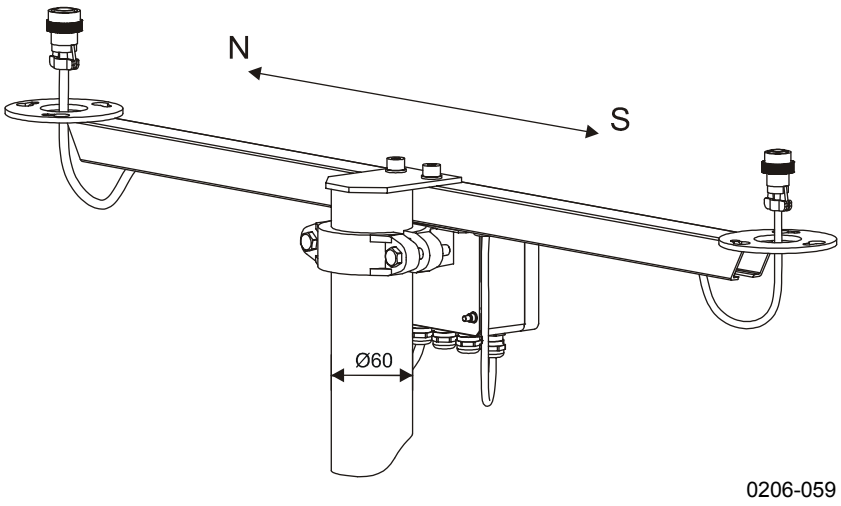

Figure 21 Mounting WAT12 to the Top of a Pole Mast

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 and low-resistance cable.

Mounting Wind Sensors to WAT12

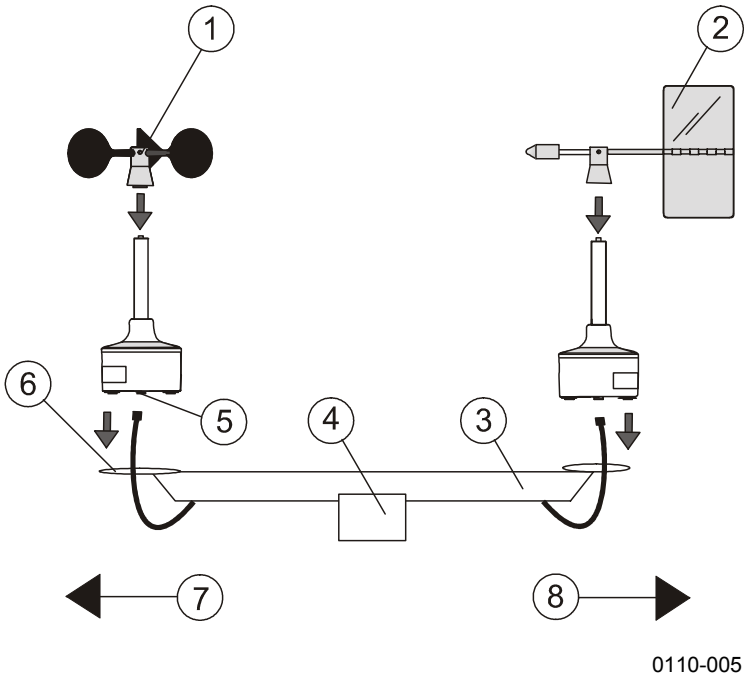

Figure 22 Installation of the Wind Sensors WAA151 and WAV151 to WAT12

The following numbers refer to Figure 22 above:

1 = WAA151 Cup assembly
2 = WAV151 Tail assembly
3 = Cross arm
4 = WAT12
5 = Connector
6 = Mounting flange
7 = SOUTH
8 = NORTH

Alignment

After mounting the WAT12 transmitter to the mast, check that the WAV151 end of the cross arm is pointing to north with the required accuracy, see Figure 21 on page 27. For ensuring correct assemblage after aligning the WAT12, you can mount the sensors on it only in one way.

Verification

If the signal cable from the WAT12 transmitter is connected to the 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 data.

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CHAPTER 4

MAINTENANCE

This chapter provides information that is needed in basic maintenance of WAT12 Analog Wind Transmitter.

Periodic Maintenance

Visual Checking

Check every 1 to 2 years that the printed circuit board is not corrored.

Testing Proper Operation

For easy testing and adjustment, reference signals are provided for the two output channels. For instance, by inserting a jumper plug, an output can be forced to the full scale or zero level. Hence a readout device can be easily adjusted to comply with the transmitter output. Inside the transmitter box there is an instruction label, showing all the useful jumper combinations for output scale, measurement range, and testing.

Table 6 Jumper Selectable Reference Sources for Testing

Variable	Reference Signal Alternatives
Direction	000° / 008° / 357°
Speed	0.0 m/s / 0.8 m/s / 51.2 m/s

Follow the procedure below to test the WAT12 transmitter functionality with the reference signals:

1. Remove the four screws holding the cover of the WAT12 transmitter. Remove the cover.
2. Remove the jumper J5 from the jumper block X4 to enable the test stage.
3. Select one of the direction and speed alternatives with jumpers J1, J2, J3, and J4, refer to Table 7 below. For the location of the jumper block X4, see Figure 4 on page 14.

Table 7 Output Values for the Jumpers in the Test Mode

Jumper	Output Value
J1 ON	51.2 m/s
J2 ON	0.8 m/s
J3 ON	357°
J4 ON	008°
All open	0 m/s and 000°

4. Verify the readings with the data collecting system at the receiving end.
5. To end the test stage, reattach the jumper J5 to the jumper block X4.
6. After a successful test, carefully reattach the enclosure cover with the four screws.

CAUTION Do not try to adjust the transmitter scaling from the sealed potentiometers of the transmitter.

Replacing Consumables

When replacing the component board, read carefully section ESD Protection on page 7.

When replacing the thermostat switch, refer to section Mounting the Thermostat Switch on page 26.

Parts List for Consumables

Table 8 Available Spare Parts

Spare Part	Order Code
Component Board for WAT12	16637WA
Thermostat switch	16923WA

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CHAPTER 5
TROUBLESHOOTING

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

Common Problems

Table 9 Some Common Problems and their Remedies

Problem	Probable Cause	Remedy
Data is not received by the data collecting system.	Improper or loose connections	Check wiring and tighten the screw terminals.
Shaft heating of the sensors is not working.	Improper or loose connections	Check wiring and tighten the screw terminals.
	Heating is not connected.	Check the connections.
	The thermostat switch is failing.	Replace the thermostat switch.

Error Messages

If the wind speed or direction sensor is removed (output current is 0), the values in the messages are replaced by slashes and the I/O error bit of status is set to 1.

Getting Help

For technical questions or for comments on the manuals, contact the Vaisala technical support:

E-mail	helpdesk@vaisala.com
Telephone	+358 9 8949 2789
Fax	+358 9 8949 2790

Return Instructions

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

1. Read the warranty information.
2. Write a Problem Report with the name and contact information of a technically competent person who can provide further information on the problem.
3. On the Problem Report, please explain:
   - What failed (what worked / did not work)?
   - Where did it fail (location and environment)?
   - When did it fail (date, immediately / after a while / periodically / randomly)?
   - How many failed (only one defect / other same or similar defects / several failures in one unit)?
   - What was connected to the product and to which connectors?
   - Input power source type, voltage and list of other items (lighting, heaters, motors etc.) that were connected to the same power output.
   - What was done when the failure was noticed?
4. Include a detailed return address with your preferred shipping method on the Problem Report.
5. Pack the faulty product using an ESD protection bag of good quality with proper cushioning material in a strong box of adequate size. Please include the Problem Report in the same box.
6. Send the box to:
   Vaisala Oyj
   SSD Service
   Vanha Nurmijärventie 21
   FIN-01670 Vantaa
   Finland

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CHAPTER 6

TECHNICAL DATA

This chapter provides technical data of WAT12 Analog Wind Transmitter.

Specifications

Table 10 WAT12 Analog Wind Transmitter Specifications

Property	Description / Value
Equipment type	Digital-to-analog current loop converter for Vaisala wind sensors
Signal input: wind direction wind speed	 6-bit parallel GRAY code (optionally 7 bits) Pulse frequency 0 ... 750 Hz
Input operating power	12 ... 28 VDC, 30 mA
Output sensor power on-board regulated to	10.7 VDC typically
Output signals	Two analog current loops, one for direction, one for speed. High-side drivers; the loops return to the common signal and power ground. Loop driving voltage 10 V typically.
Loop current options, jumper selectable and common for both channels	0 ... 5 mA 1 ... 5 mA 0 ... 10 mA 2 ... 10 mA 0 ... 20 mA 4 ... 20 mA

Property	Description / Value
Signal cable	4 wires minimum (VIN+, VIN-, DOP, SOP)
Max. loop resistance (incl. cable and receiver's input resistance)	1800 ohm for 5 mA loop 900 ohm for 10 mA loop 450 ohm for 20 mA loop
Full scale options: for direction for speed	 0 ... 360° / 0 ... 540° 0 ... 51.2 m/s / 0 ... 76.8 m/s
Resolution: for direction for speed	 ±2.8° 0.1 m/s
Updating interval: for direction for speed	 8 times a second (with no averaging) Once a second (averaged over previous 1 s period)
Output accuracy	Better than 1 % of full scale
Accuracy with loop resistance: R_L = 100 Ω R_L = 20 ... 2000 Ω	 ±0.2 % of full scale at +25 °C ±0.8 % of full scale at full temp. range
Pulse-mode power feed: to the vane to the anemometer	 Nominally 490 µs wide pulse, applied every 125 ms Nominally 70 µs wide pulse, applied every 0.49 ms .
Testing references: for direction for speed	 000° / 008° / 357° 0.0 m/s / 0.8 m/s / 51.2 m/s
Dimensions: printed circuit board junction box	 114 × 69 mm^2 125 (w) × 80 (h) × 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
Temperature range: operating storage	 -55 ... +55 °C -60 ... +70 °C
Humidity	0 ... 100 %RH