Wind Direction Transmitter
>>First Class<<
Instruction for Use

4.3151.xx.40x

- Device with digital output (THIES / MODBUS RTU), RS 485
- Wind velocity signal acquisition

THE WORLD OF WEATHER DATA

Safety Instructions

- Before operating with or at the device/product, read through the operating instructions.
  This manual contains instructions which should be followed on mounting, start-up, and operation.
  A non-observance might cause:
  - failure of important functions
  - endangerment of persons by electrical or mechanical effect
  - damage to objects

- Mounting, electrical connection and wiring of the device/product must be carried out only by a qualified technician who is familiar with and observes the engineering regulations, provisions and standards applicable in each case.

- Repairs and maintenance may only be carried out by trained staff or **Adolf Thies GmbH & Co. KG**. Only components and spare parts supplied and/or recommended by **Adolf Thies GmbH & Co. KG** should be used for repairs.

- Electrical devices/products must be mounted and wired only in a voltage-free state.

- **Adolf Thies GmbH & Co KG** guarantees proper functioning of the device/products provided that no modifications have been made to the mechanics, electronics or software, and that the following points are observed:

- All information, warnings and instructions for use included in these operating instructions must be taken into account and observed as this is essential to ensure trouble-free operation and a safe condition of the measuring system / device / product.

- The device / product is designed for a specific application as described in these operating instructions.

- The device / product should be operated with the accessories and consumables supplied and/or recommended by **Adolf Thies GmbH & Co KG** .

- Recommendation: As it is possible that each measuring system / device / product may, under certain conditions, and in rare cases, may also output erroneous measuring values, it is recommended using redundant systems with plausibility checks for **security-relevant applications**.

Environment

- As a longstanding manufacturer of sensors Adolf Thies GmbH & Co KG is committed to the objectives of environmental protection and is therefore willing to take back all supplied products governed by the provisions of "*ElektroG*" (German Electrical and Electronic Equipment Act) and to perform environmentally compatible disposal and recycling. We are prepared to take back all Thies products concerned free of charge if returned to Thies by our customers carriage-paid.

- Make sure you retain packaging for storage or transport of products. Should packaging however no longer be required, please arrange for recycling as the packaging materials are designed to be recycled.

Documentation

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- Although these operating instructions have been drawn up with due care, **Adolf Thies GmbH & Co KG** can accept no liability whatsoever for any technical and typographical errors or omissions in this document that might remain.

- We can accept no liability whatsoever for any losses arising from the information contained in this document.

- Subject to modification in terms of content.

- The device / product should not be passed on without the/these operating instructions.

Table of contents

Table overview

1   Available Models

Order - No.	Wind direction Meas. range	Wind velocity Input [Hz]	Interface / Data output	Supply	Heating	South-bore[2]
4.3151.00.400[1]	0 ... 360 °	1082Hz @ 50m/s	RS 485 / Thies		with	
4.3151.00.401			RS 485 / Modbus RTU			
4.3151.01.400	0 ... 360 °	1082Hz @ 50m/s	RS 485 / Thies		with	with
4.3151.01.401			RS 485 / Modbus RTU	3,3 … 42V DC		
4.3151.10.400	0 ... 360 °	1082Hz @ 50m/s	RS 485 / Thies			
4.3151.10.401			RS 485 / Modbus RTU			
4.3151.11.400	0 ... 360 °	1082Hz @ 50m/s	RS 485 / Thies			with
4.3151.11.401			RS 485 / Modbus RTU			

[1] same design 4.3151.90.400

[2] see chapter 5.2 mechanical mounting and alignment or 15. dimensional drawing

The following parts are included in delivery:

1 Instrument

1 Terminal plug

1 Instruction for Use

The instructions for use are available for download under the following link:

https://www.thiesclima.com/db/dnl/4.3151.xx.40x_WR-Geber-FirstClass_deu.pdf

2 Application

The wind direction transmitter serves for the detection of the horizontal **wind direction** in the field of meteorology and the technology of environmental protection.

The measuring value is available in binary format on request as a serial data telegram via an RS485 interface. The data telegram is able to operate, for e.g., wind displays, dataloggers, process control systems.

The wind direction transmitter can also record the pulse signals from an anemometer and can complete its serial data telegram by the parameter **wind velocity**.

Special characteristics:

- High level of measuring accuracy and resolution.

- High damping ratio at a small delay distance.

- Low starting threshold.

- Low current consumption (1,0mA @ 3,3 … 42V).

- Option for connecting an anemometer "First Class 4.335x.x0.000".

- Data telegram additionally with wind velocity. (WV = 0,0462*f+0,21).

For wintertime use the wind direction transmitter (see chapter 1 models available) is optionally equipped with an electronically regulated heating, which guarantees the smooth running of the ball bearing, and prevents ice forming in the space between the external rotation parts.

3 Mode of Operation

Wind direction

The dynamic characteristics of the wind vane is achieved by the aluminum lightweight construction. The co-action of wind vane and balance weight results in a high damping ratio with small delay distance as excellent characteristic of the complete vane.

The axis of the wind vane is running in ball bearings and carries a diametrically magnetized magnet at the inner end. The angle position of the axis is scanned contact-free by a magnetic angle sensor (TMR-Sensor, Tunnel Magneto Resistance) through the position of the magnet field. As the sensor is operated in magnetic saturation, effects by external magnetic fields can almost be eliminated. The connected electronics calculates the angle position of the axis and provides the respective serial output signal.

Note:

The wind direction is recorded 4 times per second.

Acquisition of Wind Velocity

Additionally to the wind direction acquisition the wind direction transmitter offers the option of supplying the wind velocity signal from the *Wind transmitter First Class 4.335x.x0.000*. The wind velocity signal is acquired and analyzed and is available in the output register along with the acquired wind direction.

The measured frequency is converted into the wind speed using the following straight line equation

$$WG = 0,0462 * f + 0,21 \qquad WG: Windgeschwindigkeit \; \frac{m}{s}$$

$$f: Frequenz \; in \; Hz$$

With frequency of 0Hz the wind speed is set to 0m / s.

> **Note:**
>
> *The wind speed (frequency) is recorded by means of a period duration measurement (internal reference clock: 4MHz).*

General

An AC- or DC-voltage of 24V is intended for the separate supply of the optional heating. In all probability, the heating guarantees a trouble-free function of the Wind Direction Transmitter First Class even under extreme meteorological icing-conditions.

The outer parts of the instrument are made of corrosion-resistant anodized aluminum and stainless steel. Highly effective labyrinth gaskets and O-rings protect the sensitive parts inside the instrument against humidity and dust.

4 Recommendation Site Selection / Standard Installation

In general wind measurement instruments should be able to detect the wind conditions of a large area. In order to obtain comparable values when determining the surface wind, measurements should be taken at a height of 10 meters over an even area with no obstacles. An area with no obstacles means that the distance between the wind direction transmitter and an obstacle should be at least 10 times the height of the obstacle (s. VDI 3786 Part 2). If it is not possible to fulfill this condition then the wind direction transmitter should be set up a height where local obstacles do not influence the measured values to any significant extent (approx. 6 … 10m above the obstacle). The wind direction transmitter should be set up in the center of flat roofs and not on the edge in order to avoid any preferential directions.

5 Installation

Attention:

Storing, mounting and operation under weather conditions is permissible only in vertical position, as otherwise water can get into the instrument.

Remark:

When using fastening adapters (angle, traverses, etc.) please take a possible effect on the measurements by turbulences into consideration.

Caution:

The device may only be supplied with a power supply of the "Class 2, limited power".

5.1 Wind Vane Mounting

Before the wind direction transmitter can be installed at its selected site, the wind vane must be mounted on the housing.

Tool:

    Not required.

Process

1. Remove wind transmitter shaft and wind vane from the packing.
2. Remove cap❶ by left-hand rotation of upper part❷ of wind transmitter shaft.
3. Put the wind vane onto the upper part of the wind transmitter shaft.

    Remark:
    The longer part of the wind vane blade must indicate upwards.

4. Keep hold of the wind vane by hand to avoid twist movement, and turn the upper part of the wind transmitter shaft until the vane locks into the forcible control❸.

    Remark:
    The marking lines❹ at the bottom of wind vane counter weight, and at the upper part of the wind transmitter shaft, must be aligned.

5. Put the cap onto the thread, and seize strongly by clockwise rotation by hand ... ready
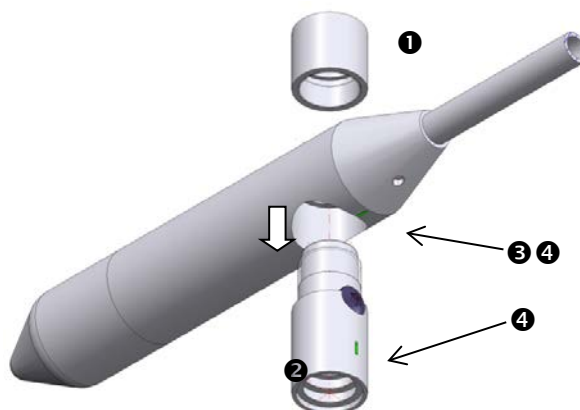
5.2 Mechanical Mounting and Alignment

Remark:

The wiring must be prepared so far, that plug and cable have been pushed through instrument carrier, mast, traverse etc., and can be connected to the wind direction transmitter at the moment of the "Mechanical Mounting", described in the following (**please refer to chapter 5.3**.).

The wind direction transmitter must be mounted on an instrument carrier, which is suited for the measurement. For dimensions of wind direction transmitter please refer to **chapter 15 Dimension diagram.**

Suitable instrument carriers are masts, tubes, traverses, arms, adapters, adapters of POM for isolated mounting, which correspond to the mounting dimensions of the wind transmitter, and to the static requirements.

The inner diameter of the instrument carrier should be ≥ 20mm based on plug- and cable feed-through.

If the north alignment is carried out by compass, please consider the local declination (= deviation of direction of the magnetic needle from the true north), and local magnetic interferences (e.g. hardware, electric cable).

For alignment aid and for easy changing / replacement without readjustment:

With the help of the north-ring (accessory 509619):
The optional north ring part. no. 509619 can be used to mount the wind transmitter. The north ring serves as an alignment aid and for easy changing / replacement without having to re-adjustment of the north direction of wind direction indicators. The north ring uses the north borehole of the mast holder for this. **See chapter 15 Dimension diagram.**

With the help of the south borehole:
The south borehole is used for alignment in the north / south direction. It serves as an alignment aid and for easy changing / replacement without readjustment. For north orientation using the south hole, you have to construct your mounting mast specifically**. See chapter 15 Dimension diagram.**

When aligning the wind direction transmitter on a moving object (e.g. vehicle, wind wheel, ship etc) please consider that the "north point" to be determined, might possibly be located on the object.

Tools:

Hexagon socket wrench size 3 (Allen key).

Procedure:

1. Push cable/ plug connector of the wind direction transmitter through the borehole of the mast, tube, arm etc.

2. Put wind direction transmitter on mast, tube, arm etc.

3. For the precise determination of the wind direction the wind direction transmitter must be aligned **northwards** (geographical north).

   The north point (0 °) is at the point where the output signal jumps from the maximum value to the minimum value.

4. Rotate north marking (**I**) at the housing and wind vane axially one above the other, acc. to figure.

5. Determine a prominent spot in the surrounding area (tree, building etc.) in northward direction, by means of a compass.

6. Locate the prominent spot over wind vane and balance weight of the wind direction transmitter.

7. Align wind direction transmitter. The north marking must indicate the *geographical north*.

8. In case of conformity, safeguard the wind direction transmitter by two M6-Allen head screws.
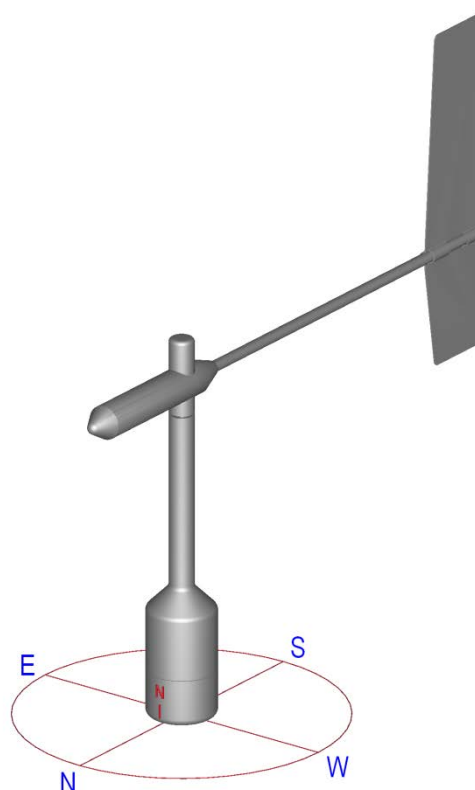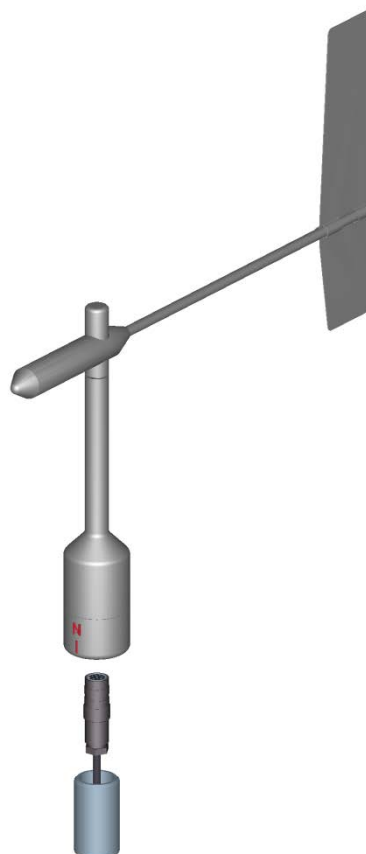
5.3 Electrical Mounting

5.3.1 Cable

Solder a shielded cable with diameter 7 … 8mm and a core cross-section of 0.5 ... 0.75mm²
to the enclosed coupling socket.

- The number of necessary wires is given in the connection diagram (chapter 7).

5.3.1.1 Cable Recommendation

No. of wires/ diameter / type / cable diameter
CABLE 8 x 0.5mm² LIYCY   BLACK, UV- resistant, Ø 7.6mm

5.3.2 Cable Shield

The connection of the cable shield between sensor and data acquisition device should be se-
lected in way, that in case of over-voltages no equalizing currents will flow that might destroy
the electronic components.
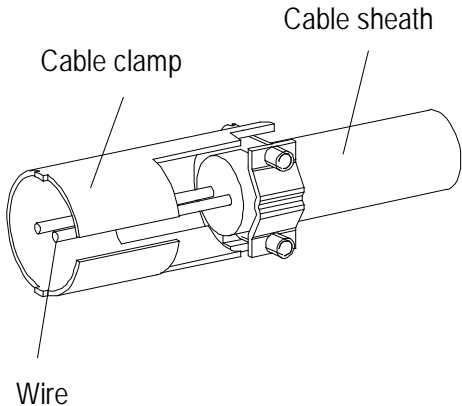
The connection of the cable shield should depend on the selected isolated, or respectively,
non-isolated mounting of the sensors.

5.3.2.1 Connecting Recommendation for the Cable Shield

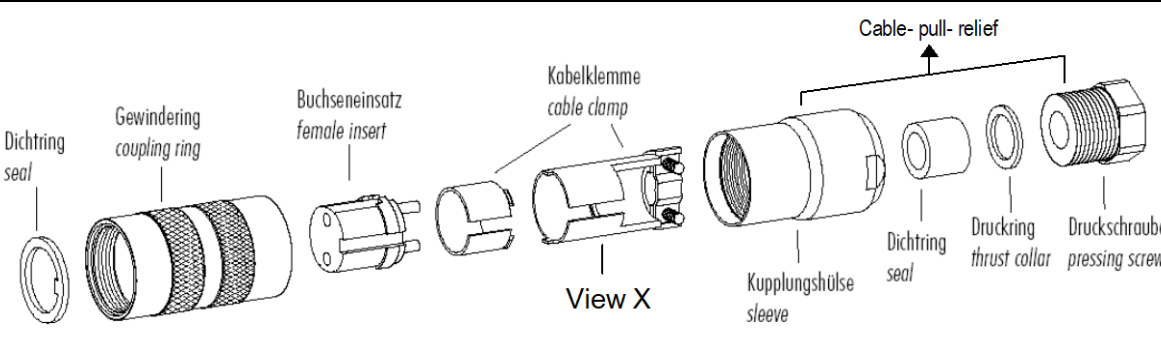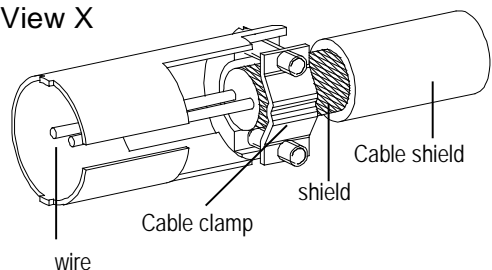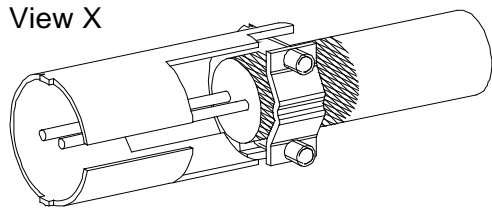|	Sensor Carrier	Sensor	Shielding / Ground	Lightning Protection
1.	Metallic measurement mast, grounded	**Isolated** mounting at the measuring mast (e.g. by non-metallic brackets, holder etc. or by metallic brackets, holder etc. with isolated plastic adaptors).	Apply the cable shield between sensor and data acquisition device (e.g. datalogger) both-sided. Ground data acquisition device.	Mount metallic lightning protection rod on the mast. Alternatively: Install separate lightning protection rod beside the measurement mast.
2.	Metallic measurement mast, grounded	**Non-isolated** mounting at the measurement mast (e.g. by metallic brackets, holders etc.).	Apply cable shield between sensor and data acquisition device (e.g. datalogger) only one-sided at the acquisition device.. Ground data acquisition device.	Mount metallic lightning protection rod on the mast in **isolated condition**, and ground lightning protection rod. Alternatively: Install separate lightning protection rod beside the measurement mast.
3.	Metallic measurement mast, not grounded (mounted in isolated condition, e.g. on the attic)	**Non-isolated** mounting at the measurement mast. (e.g. by metallic brackets, holders etc.).	Apply the cable shield between sensor and data acquisition device (e.g. datalogger) both-sided. Ground data acquisition device.	Mount metallic lightning protection rod on the mast in **isolated condition**, and ground lightning protection rod. Alternatively: Install separate lightning protection rod beside the measurement mast.
4.	Non-metallic measuring mast (=isolated)	Mounting at the measurement mast. (e.g. by metallic brackets, holders etc.).	Apply the cable shield between sensor and data acquisition device (e.g. datalogger) both-sided. Ground data acquisition. device.	Mount metallic lightning protection rod on the mast, and ground lightning protection rod. Alternatively: Install separate lightning protection rod beside the measurement mast.

5.3.3 Plug and Cable Mounting

Coupling socket, Type: Binder, Serial 423, EMC with cable clamp

Cable- pull- relief

Dichtring *seal*
Gewindering *coupling ring*
Buchseneinsatz *female insert*
Kabelklemme *cable clamp*
View X
Kupplungshülse *sleeve*
Dichtring *seal*
Druckring *thrust collar*
Druckschraube *pressing screw*

Cable connection: **with** cable shield

1. Stringing parts on cable acc. to plan given above.
2. Stripping cable sheath 20mm
   Cutting uncovered shield 15mm
   Stripping wire 5mm.

   Cable mounting 1:
   Putting shrink hose or insolating tape between wire and shield.

   Cable mounting 2:
   If cable diameter permits, put the shield backward on the cable sheath.
3. Soldering wire to the insert, positioning shield in cable clamp.
4. Screwing-on cable clamp.
5. Assembling remaining parts acc. to upper plan.
6. Tightening pull-relief of cable by screw-wrench (SW16 und 17).

Cable mounting 1
View X

Cable shield
shield
Cable clamp
wire

Cable mounting 2

View X

Cable connection: **without** cable shield

1. Stringing parts on cable acc. to plan given above.
2. Stripping cable sheath 20mm.
3. Cutting uncovered shield 20mm.
4. Stripping wire 5mm.
5. Soldering wire to the insert.
6. Positioning shield in cable clamp.
7. Screwing-on cable clamp.
8. Assembling remaining parts acc. to upper plan.
9. Tightening pull-relief of cable by screw-wrench (SW16 und 17).

Cable clamp
Cable sheath
Wire

6 Connecting Diagram

Connection diagram acc. to chapter 5.3.2.1 no. 1, 3 and 4:

Order-No. 4.3151.0X.401 4.3151.1X.401*		View on the soldered joint of the counter plug

• *Order-no 4.3151.10.xxx (w/o heating) PIN 7 and 8 are not connected.
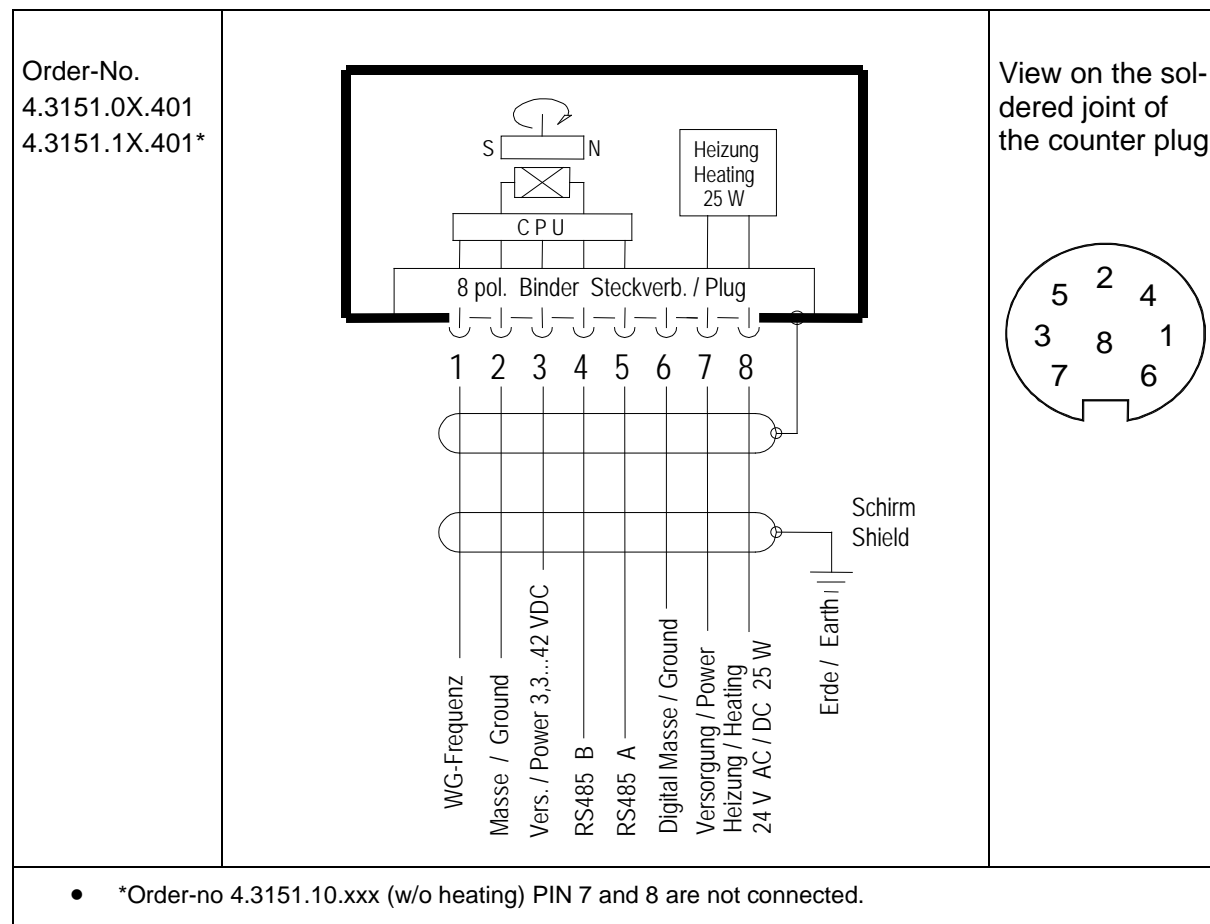
Pin	Name	Function
1	WV-frequency	Input wind velocity
2	GND	Supply ground
3	+Vcc	Supply 3.3 ... 42V DC
4	Serial B	RS 485 (B)
5	Serial A	RS 485 (A)
6	DGND	Digital ground / ground wind velocity
7	HZG	Heating supply: Voltage: 24V AC/DC Power: 25W
8		
*Order-no 4.3151.10.xxx (w/o heating) PIN 7 and 8 are not connected.		

6.1 Example Connection Diagram
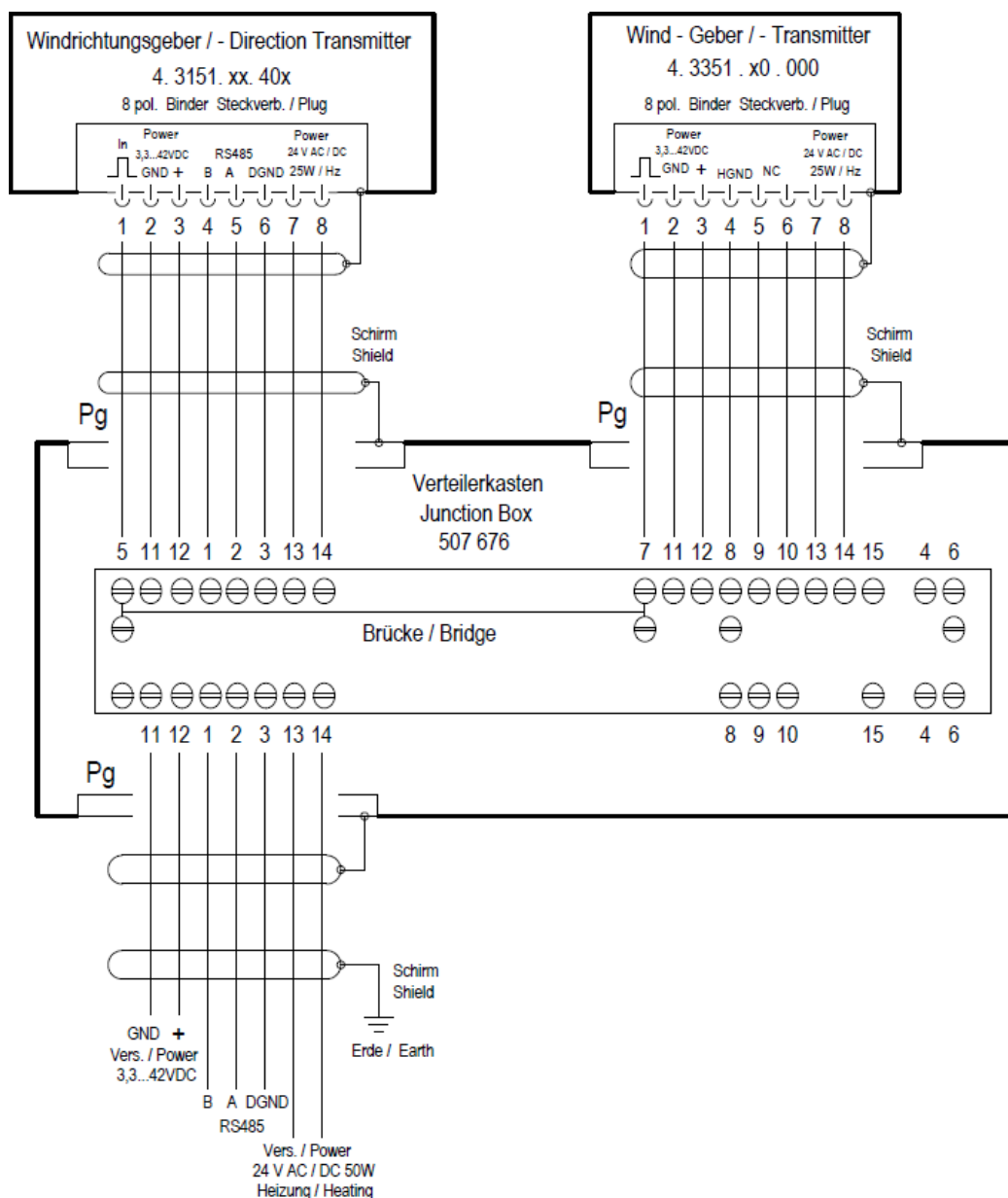
7 Serial Interface (RS485)

The wind direction transmitter has an RS485 interface, which is operated in half-duplex mode. For a respective termination (terminating resistance) of the connecting cable must be provided externally (no termination in the wind direction transmitter).

Master — Slave #1 (RS485 connection diagram: Data Out, Tx Enable, Data In, Bus A (-), Bus B (+))
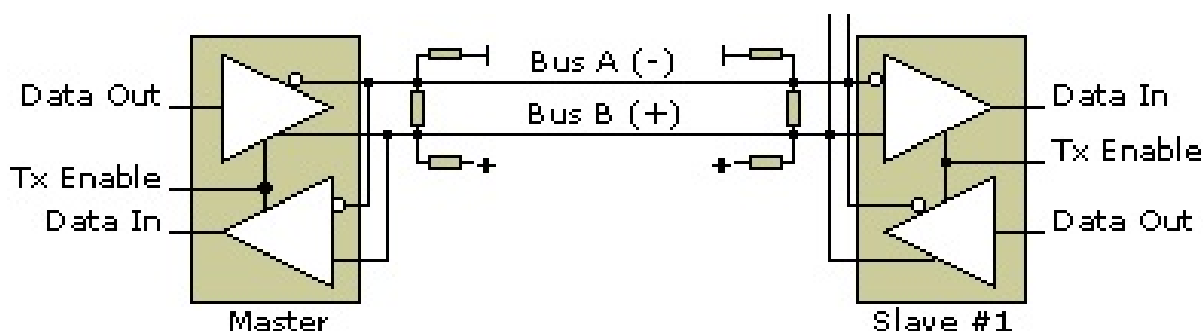
8 Placing into Operation

The wind direction transmitter is to be connected to a power supply and a RS485 interface, as given in the connection diagram. With the connection of the supply voltage, and after a delay of 5sec, the output of serial data starts automatically with the following setting/or the MODBUS register are accessible:

Setting of interface:

Baud rate	9600 baud
Data bits	8 bit
Parity bit	no
Stop bit	1

9 Serial Communication

The communication from the wind direction sensor has a command interpreter, which supports the following 2 modes (see **Command CI**):

- THIES

- MODBUS RTU

With the command interpreter can be read measurements and the behavior of the device can be changed. This includes e.g. baud rate, framing, device ID and startup behavior.

Basically, the commands in "THIES mode" has the following structure:

- <id><Command><CR> (no parameter: used to query the set parameter).
- <id><Command><Parameter><CR> (with parameter: used to set new parameter).

id: Identification number („00" bis „99")
Command: 2-character broad command (siehe Commandsliste)
Parameter: Parameter value with 1 up to 10 point (decimal value at ASCII)
<CR>:   Carriage Return (13_{dec}; 0x0D)

With help of the identification number (ID) several devices can be operated together on the BUS-group. This purpose, each device is set to an individual id (please see commend **Command** ID).

A sent command confirm with an echo telegram. The echo telegram begins with a "!" Followed by the id, the command and the value set. Finally, the character "carriage return" follows.

Commands can be sent with or without parameter. Without specifying a parameter, only the value is output.

Sample: 00BR<CR>
              !00BR00005<CR>

If a command with parameter is sent, the parameter is checked. If the parameter is valid, it is saved and specified in the "echo telegram". If the parameter is invalid, the parameter is ignored and the set value is output in the "echo telegram".

Sample:

00ID00005<CR>	Send Command.
!05ID00005<CR>	Echo telegramm (parameter valid and password right).
00ID00004<CR>	SendeCommand.
!00ID00000<CR>	Echo telegramm (parameter invalid and password wrong).

Note:

With command TR, the sensor measured values can be queried. The wind transmitter does not respond with the echo telegram but with the requested data telegram!

In order to avoid an unwanted parameter adjustment some Commande (see Commandsliste) are secured by a password. This password must be sent before the actual command.

Sample: Chance the baud rate

00KY1<CR>	Command open to the user level
00BR4<CR>	Baud rate set to 4800
!00BR00004<CR>	Echo of command. Baud rate was set to 4800

The wind direction sensor supports 1 password level.

• User-level (Password „1").

Attention:

The password-protected commands are released until one of the following conditions is met:

- switch the supply voltage

- the command 00KY0 <CR> is sent

The register addresses of the command interpreter in MODBUS-RTU mode of the supported commands are listed in Table 1.

10 Commands and Description

For the wind direction transmitter the following commands are available:

Command	Initial value factory setting	MODBUS Register-adress	Description	Password read[1] / write[2]	
Command BR	5	40005	Set the baudrate	Without	User
Command CI	0	40013	Selection of the command inter-preter	Without	User
Command FB	1	40001	Quick start mode	Without	User
Command ID	0 (THIES) 1 (MODBUS)	40003	Set wind sensor ID	Without	User
Command KY	0	40009	Key / Password	Without	Without
Command NC	0	-	Northcorrection	Without	User
Command MI	10	40027	Averaging interval	Without	User
Command OR	100	-	Output interval	Without	User
Command RS	0	40021	Check reset source or perform reset	Without	User
Command SF	0	40019	Frame format	Without	User
Command SN	0	40007	Serial number	Without	-
Command SV	-	45005	Software-version.	Without	-
Command TR	-	-	Telegram request	Without	Without
Command TT	0	-	Automatic telegram output	Without	User

Table 1: Commands

10.1 Command BR

<id>BR<parameter><CR>   Set the baudrate

Access: Read / write

Description: With command BR get/set the baudrate.

Parameter Description:

Parameter	Description
2	1200baud
3	2400baud
4	4800baud
5	9600baud
6	19200baud
7	38400baud
8	57600baud

Value range: 2 / 3 / 4 / 5 / 6 / 7 / 8

Initial value: 5

10.2 Command CI

<id>CI<parameter><CR>   Selection of the command interpreter

Access: Read / write

Description: With Command CI get set the command interpreter.

Note:

Is the ID number higher then 98 and switch in the THIES Interpreter, the ID will automatically set to range 0.

Note:

If the identification number ID 0, switching to the MODBUS RTU interpreter is not possible!

Parameter Description:

Parameter	Description
0	THIES
1	MODBUS RTU

Value range: 0 bis 1

Initial value: 0

10.3 Command FB

<id>FB<parameter><CR>	Quick start mode
Access:	Read / write
Description:	With command "FB" get set the quick start mode
Parameter Description:	0: quick start modus off 1: quick start modus on
Value range:	0...1
Initial value:	1

10.4 Command ID

<id>ID<parameter><CR>	Identification Number
Access:	Read / write
Description:	This command sets the identification number (THIES Interpreter) or the slave address (MODBUS RTU Interpreter).
	Only if the 'id' contained in the command matches the one set in the weather station will an answer telegram be sent. An exception is the generic, id ', where all weather stations respond (THIES interpreter). After the 'id' has been changed, the device immediately responds with the new
'id'.Parameter Description:	99 generic id' (THIES Interpreter)
	0 Broadcast Slave-Adresse (MODBUS RTU Interpreter)
Value range:	0 … 99 (THIES Interpreter) 1 … 247 (MODBUS RTU Interpreter)
Initial value:	0 (THIES Interpreter) 1 (MODBUS RTU Interpreter)

10.5 Command KY

<id>KY<parameter><CR>	Key / Password
Access:	Read / write
Description:	With command "KY" get set the value of the key / password. To chance parameters, the required password must be set.
Parameter Description:	0 no password 1 key / password at user level
Value range:	0 / 1
Initial value:	0

10.6 Command MI

<id>MI<parameter><CR>	Averaging intervall
Access:	Read / write
Description:	With this command, the averaging interval for the sliding averaging of the wind direction is set in seconds. The wind direction is vectorially averaged with the unit vector (i.e., the magnitude of the vector is 1).
Parameter Description:	Averaging interval in seconds
Value range:	0...360
Initial value:	10

10.7 Command NC

<id>MI<parameter><CR>	North correction
Access:	Read / write
Description:	With this command the offset for the calculation of the wind direction is set or queried. The offset is added to the measured wind direction in the device.
Parameter Description:	Offset in degrees
Value range:	0...600
Initial value:	10

10.8 Command OR

<id>OR<parameter><CR>	Output interval
Access:	Read / write
Description:	With command "OR" you set or query the output interval for the automatic telegram output.
Parameter Description:	Output interval in milliseconds
Value range:	100...60000
Initial value:	100

10.9 Command RD

<id>RD<parameter><CR>	Response delay
Access:	Read / write
Description:	With command "RD" you set and query the response delay between receiving and command.
Parameter Description:	Delay in milliseconds
Wertebereich:	0…50
Initialwert:	20

10.10 Command RS

<id>RS<parameter><CR>	Reset
Access:	Read / write
Description:	Command "RS" queries the reset source (reading without parameter) or performs a reset (writing with any parameter).

The following reset sources can be output

Output	Meaning
POR	Power on reset
BODCORE	Brownout reset (µC core voltage)
BODVDD	Brownout reset (µC Vdd voltage)
EXT	External reset
WDT	Watchdog reset
SYST	System reset

Parameter Description:	1	Software Reset run
	2	Watchdog Reset run
Value range:	1…2	
Initial value:	-	

10.11 Command SF

<id>SF<parameter><CR>	Frame format
Access:	Read / write
Description:	With command "SF" set the frame format of the interface
Parameter Description:	0: 8N1 (8 data bits, no parity, 1 Stop bit)
	1: 8N2 (8 data bits, no parity, 2 Stop bits)
	2: 8E1 (8 data bits, straight parity, 1 Stop bit)
	3: 8E2 (8 data bits, straight parity, 2 Stop bits)
	4: 8O1 (8 data bits, uneven parity, 1 Stop bit)
	5: 8O2 (8 data bits, uneven parity, 2 Stop bits)
Value range:	0…5
Initial value:	0

10.12 Command SN

<id>SN<CR>	Serial number
Access:	Reading
Description:	With command "SN" could read the serial number.
Parameter Description:	-
Value range:	-
Initial value:	0

10.13 Command SV

<id>SV<CR>	Software-version
Access:	Reading
Description:	Command "SV" can read out the software version.
Parameter Description:	-
Reply telegram:	-
Value range:	-
Initial value:	-

10.14 Command TR

<id>TR<parameter><CR>	Telegram request
Access:	Reading
Description:	This command can requested on the available telegrams.
Parameter Description:	3 query the data telegram 3 4 query the data telegram 4
Value range:	3 / 4
Initial value:	-

10.15 Command TT

<id>TT<parameter><CR>	Automatic telegram output
Access:	Read / write
Description:	With command "TT" the automatic output of the available telegram can be activated/specified. The output interval is set with the command "OR".
Parameter Description:	3 Output data telegram 3
	4 Output data telegram 4
Value range:	0 / 3 / 4
Initial value:	0

11 Command Interpreter MODBUS RTU

If the command interpreter MODBUS RTU is selected, the transmitted bytes are interpreted according to the MODBUS specification (http://www.modbus.org/). The wind direction sensor represents a MODBUS slave. The data transmission takes place in packets, so-called frames, of a maximum size of 256 bytes. Each package includes a 16-bit CRC checksum (initial value: 0xffff).

Slave-Adress	Function code	Data	CRC	
1Byte	1Byte	0 ... 252Byte(s)	2Bytes	
			CRC low-Byte	CRC high-Byte

Table 2: MODBUS Frame

Following MODBUS functions are supported:

- 0x04 (Read Input Register).

- 0x03 (Read Holding Registers).

- 0x10 (Write Multiple Registers).

The wind direction sensor supports write access for the slave address 0 ("Broadcast").

All received MODBUS requests are checked for validity before execution. In case of an error, the wind direction sensor responds with one of the following exceptions (MODBUS Exception Responses):

Code	Name	Description
0x01	ILLEGAL FUNCTION	Functioncode in the request a registry address is not allowed.
0x02	ILLEGAL DATA ADDRESS	The register address in the request is not valid.
0x03	ILLEGAL DATA VALUE	The specified data in the request is not allowed.

Table 3: MODBUS Exceptions

11.1 Messwerte (Input Register)

All measured values of the wind direction sensor cover 32 bits, e.g. 2 MODBUS register addresses. The following table shows the assignment of measured value to register addres with the measured values sorted as follows:

- by measurement type (30001 bis 34999).

- sequence without free gaps (35001 bis 39999).

Register-address	Parameter name	Unit	Multiplier	Description	Data typ
30001	Instantaneous value-wind speed (35001)[1]	m/s	10	Value / 10 (1 decimal place, e.g. 101=10.1m/s)	U32
30201	Instantaneous value-wind direction	°	10	Value / 10 (1 decimal place, e.g. 1010=101.0°)	U32
30203	Average wind direction	°	10	Value / 10 (1 decimal place, e.g 1010=101.0°)	U32
35001	Instantaneous value-wind speed (30001)[1]	m/s	10	Value / 10 (1 decimal place, e.g. 101=10.1m/s)	U32
35003	Instantaneous value-wind direction	°	10	Value / 10 (1 decimal place, e.g. 1010=101.0°)	U32
35005	Avarage wind direction	°	10	Value / 10 (1 decimal place, e.g. 1010=101.0°)	U32
35007	Wind speed	Hz	10	Value / 10 (1 decimal place, e.g. 1010=101.0Hz)	U32

Table 4: MODBUS Input Register

[1]: The numbers in clip indicate the register addresses which represent the same measurements. E.g. the wind speed is at address 30001 and at address 35001.

> *Note:*
> **Due to the complete arrangement of the measured values from address 35001, the MODBUS master can read out all measured values with one request!**

11.2 Commands (Holding Register)

All commands of the sensor cover 32 bits, e.g. 2 MODBUS register addresses and represent unsigned integers. The following example shows how to change the baud rate to 19200 baud.

1. Set the password for user level (KY=1)

Slave-address	Functions-code	Start-address	Number of Register	Number of Byte(s)	Data	CRC	
0x01	0x10	0x9C 49	0x00 02	0x04	0x00 00 00 01	0x0F 33	
						CRC low-Byte	CRC high-Byte

2. Set the baud rate at 19200 Baud (BR=6)

Slave-address	Functions-code	Start-address	Number of Register	Number of Byte(s)	Data	CRC	
0x01	0x10	0x9C 45	0x00 02	0x04	0x00 00 00 06	0x4E A4	
						CRC low-Byte	CRC high-Byte

The available commands for parameter setting are listed in the section **10. Commands and Description**.

12 Data Telegram

The parameters in the data telegrams are output with leading zeros:
e.g. 01.4 008.7

The delivery state of the data output is as follows:
| Dataouput | automatically |
| Output interval | 100ms |

The checksum is formed by the XOR function from the characters between <STX> and "*" (starting with Hex00). Then the 8-bit checksum is divided into two ASCII characters (high and low nibble) with a value range of 0 ... F (hex).

12.1 Telegram 3

Posi-tion	Length	Sample	Description
1	1	STX	Start character (start of text).
2	4	xx.x	Instantaneous value of the wind speed; Unit: m / s; Resolution: 0.1m / s.
6	1	spaces	Seperator sign (' ')
7	5	xxx.x	Instantaneous value of the wind direction; Unit: °; Resolution: 0.1 °.
12	1	*	Separator sign ('*')
13	2	xy	Checksum (exclusive or linked) hexadecimal representation x: high nibble, checksum in HEX y: low nibble, checksum in HEX
15	1	CR	Carriage Return
16	1	ETX	End of text

12.2 Telegram 4

Posi-tion	Length	Sample	Description
1	1	STX	Start character (start of text).
2	4	xx.x	Instantaneous value of the wind speed; Unit: m / s; Resolution: 0.1m / s.
6	1	spaces	Separator sign (' ')
7	5	xxx.x	Instantaneous value of the wind direction; Unit: °; Resolution: 0.1 °.
12	1	spaces	Separator sign (' ')
13	5	xxx.x	Average value of the wind direction; Unit: °; Resolution: 0.1 °.
18	1	spaces	Separator sign (' ')
19	6	xxxx.x	Instantaneous value of the wind speed; Unit: Hz; Resolution: 0.1Hz.
25	1	*	Separator sign ('*')
26	2	xy	Checksum (exclusive or linked)

Posi-tion	Length	Sample	Description
			hexadecimal representation x: high nibble, checksum in HEX y: low nibble, checksum in HEX
28	1	CR	Carriage Return
29	1	ETX	End of text

12.3 Telegram 5

Posi-tion	Length	Sample	Description
1	1	STX	Start character (start of text).
2	5	xxx.x	Instantaneous value of the wind direction; Unit: °; Resolu-tion: 0,1°.
7	1	*	Separator sign ('*')
8	2	xy	Checksum (exclusive or linked) hexadecimal representation x: high nibble, checksum in HEX y: low nibble, checksum in HEX
10	1	CR	Carriage Return
11	1	ETX	End of text

13 Maintenance

If properly installed, the instrument requires no maintenance.

The ball bearings of the wind direction transmitter are prone to wear, and with a prolonged use they might change the dynamic behavior of the wind vane. Therefore, we recommend to check the instru-ment in regular intervals.

Cleaning
For the cleaning of the device you should use a damp cloth without chemical cleaning agents are used.

Remark:

For transport of instrument please use original packing.

We recommend the threads of the plugs with a suitable corrosion inhibitor to protect them against corrosion.

14 Technical Data

Characteristic	Description
Measuring range	0 ... 360 °
Measuring Accuracy	±1 °
Resolution of measuring value	0.1 °
Output telegram	**Telegram 3; Telegram 4; Telegram 5**
Measuring time	Approx. 10ms / WD-measurement.
Operating speed	Up to 75m/s.
Survival speed	85 m/s up to 0.5h.
Electric input of wind velocity	0 ... 1082Hz @ 0 ... 50m/s $U_{PPmax} = 0 ... 15V$, $U_{PPmin} = 0 ... 3V$
Permissible ambient conditions for operation	-50 ... +80 °C All occurring situations of rel. humidity incl. dew moistening.
Wind load (Wind power)	64,5N
Electrical output	RS 485 half duplex: 1200; 2400; 4800; 9600; 19200; 38400; 57600Baud 8 Bit; no/even/odd parity; 1/2 Stopbit(s)
Starting threshold	< 0.5m/s at 10 ° amplitude (acc. to ASTM D 5366-96). < 0.2m/s at 90 ° amplitude (acc. to VDI 3786 Part 2).
Delay distance	< 1.8m (acc. to ASTM D 5366-6).
Damping ratio	D > 0.3 (acc. to ASTM D 5366-96).
Quality factor	K > 1 $$K = \frac{4 \cdot D \cdot \omega_0}{\rho \cdot u}$$ D damping ratio, ω_0 angular frequency of undamped oscillation, ρ air density u wind speed.
Heating	Surface temperature of housing neck > 0 °C at 20m/s up to -10 °C air temperature, at 10m/s up to -20 °C using the Thies icing standard 012002 on the housing neck heating regulated with temperature sensor.
Power supply	3,3 … 42V
Power consumption	Serial communication: 0,5mA @ 3,3 … 42V With one data query/sec: 1,0mA @ 3,3 … 42V

Characteristic	Description
Power supply for heating	Current: 24V AC/DC +- 20%, 45…65Hz (galvanic isolation from housing) Idling voltage: max. 32V AC and max. 48V DC Power: 25W
Connection	8-pole plug connection for shielded cable in the shaft (see connecting diagram).
Mounting	Mounting on mast Outer diameter ≤ 34mm Inner diameter ≥ 22mm Remark: mounting on mast is possible with separate adapter (option).
Dimensions	See dimensional drawing.
Weight	Approx. 0.7kg
Protection	IP 55 (DIN 40050)
Material: Housing, vane Mast-adaptor	Aluminium Stainless steel (V4A)

15 Dimensional Drawing

Nordbohrung
North borehole

Z (2:1)

Ø50

105   345

245

Ø25

Ø18

410

250

25

M6

Ø35

Südbohrung
South borehole

Nordmarkierung
Northmark

N

16 Accessories

Traverse 0,6m For mounting the wind speed and wind direction transmitter jointly onto a mast	4.3174.00.000	Horizontal sensor distance: 0.6m Vertical sensor distance: 0.2m Mast receptacle: 48 … 50mm Material: Aluminum, anodized Dimensions: tube Ø 34 x 4mm, 668mm long, 756mm high
Hanger –FIRST CLASS- 1m For the lateral mounting of a wind speed and wind direction transmitter onto a mast tube..	4.3184.01.000	Sensor distance to mast: 1m Mast clamp: 40 … 80mm Tube diameter: 34mm Material: Aluminum
Lightning rod For mounting the a/m traverse or hanger.	4.3100.98.000	Dimension: Ø 12mm, 500mm long, 1050mm high Material: Aluminum
Wind – Junction box Serves for the connection of several measuring value transmitters. Minimizes the number of cable cores.	507 676	Dimension: 125 x 80 x 57mm Material: Aluminium
Adaptor For isolated mounting of each wind transmitter and wind direction transmitter on the traverse (4.3174.0.000).	509077	Dimension: A:Ø 34mm, outside 25mm high B:Ø 35mm, inside 45mm high Material: POM
Adapter "north ring" The "north ring" serves is an alignment aid, and for the easy change/replacement without re-adjustment of the northern direction of wind direction transmitters. .	509619	Material: Aluminium, anodized Dimension: A: Ø 50mm, outside 75mm high B: Ø 35mm

Please contact us for other accessories such as cables, power supply units, masts, as well as for additional mast- or system-constructions.

Example: Wind transmitter with traverse and lightning rod.

17 More Information / Documents as download

Following documents are available for download via the link.

Instruction for use

https://www.thiesclima.com/db/dnl/4.3151.xx.40x_WR-Geber-FirstClass_deu.pdf

18 EC-Declaration of Conformity

Manufacturer: Adolf Thies GmbH & Co. KG

Hauptstraße 76

37083 Göttingen, Germany

http://www.thiesclima.com

Product: WR firstclass, akt, Poti

Doc. Nr. 1585-44784_CE

Article Overview:

4.3151.00.000	4.3151.00.001	4.3151.00.012	4.3151.00.020	4.3151.00.110	4.3151.00.140	4.3151.00.141	4.3151.00.161	4.3151.00.173	4.3151.00.210	
4.3151.00.212	4.3151.00.400	4.3151.00.401	4.3151.00.901	4.3151.01.400	4.3151.01.401	4.3151.10.000	4.3151.10.001	4.3151.10.012	4.3151.10.020	
4.3151.10.110	4.3151.10.140	4.3151.10.141	4.3151.10.161	4.3151.10.173	4.3151.10.210	4.3151.10.212	4.3151.10.400	4.3151.10.401	4.3151.11.400	
4.3151.11.401	4.3151.90.000	4.3151.90.001	4.3151.90.141	4.3151.90.400						

The indicated products correspond to the essential requirement of the following European Directives and Regulations:

2014/30/EU	26.02.2014	DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility.
2017/2102/EU	15.11.2017	DIRECTIVE (EU) 2017/2102 of the European Parliament and of the Council of November 15, 2017 amending Directive 2011/65 / EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
2012/19/EU	13.08.2012	DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012 on waste electrical and electronic equipment (WEEE).
2018/1139/EU	04.07.2018	Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency.

The indicated products comply with the regulations of the directives. This is proved by the compliance with the following standards:

DIN EN 61000-6-2	2019-11	Electromagnetic compatibility Immunity for industrial environment
DIN EN 61000-6-3:2007 + A1:2011	2011-09	Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments
DIN EN 61010-1	2020-03	Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements
DIN EN 63000	2019-05	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

Legally binding signature:

General Manager - Dr. Christoph Peper

Legally binding signature:

Development Manager - ppa. Jörg Petereit

This declaration certifies the compliance with the mentioned directives, however does not include any warranty of characteristics.

Please pay attention to the security advises of the provided instructions for use.

19 UK-CA-Declaration of Conformity

Manufacturer: Adolf Thies GmbH & Co. KG

Hauptstraße 76

37083 Göttingen, Germany

http://www.thiesclima.com

Product: WR firstclass, akt, Poti

Doc. Nr. 1585-44784_CA

Article Overview:

4.3151.00.000	4.3151.00.001	4.3151.00.012	4.3151.00.020	4.3151.00.110	4.3151.00.140	4.3151.00.141	4.3151.00.161	4.3151.00.173	4.3151.00.210
4.3151.00.212	4.3151.00.400	4.3151.00.401	4.3151.00.901	4.3151.01.400	4.3151.01.401	4.3151.10.000	4.3151.10.001	4.3151.10.012	4.3151.10.020
4.3151.10.110	4.3151.10.140	4.3151.10.141	4.3151.10.161	4.3151.10.173	4.3151.10.210	4.3151.10.212	4.3151.10.400	4.3151.10.401	4.3151.11.400
4.3151.11.401	4.3151.90.000	4.3151.90.001	4.3151.90.141	4.3151.90.400					

The indicated products correspond to the essential requirement of the following Directives and Regulations:

1091	08.12.2016	The Electromagnetic Compatibility Regulations 2016
RoHS Regulations 2012	01.01.2021	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
3113	01.01.2021	Regulations: waste electrical and electronic equipment (WEEE)
2018/1139/EU	04.07.2018	Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency.

The indicated products comply with the regulations of the directives. This is proved by the compliance with the following standards:

BS EN IEC 61000-6-2	25.02.2019	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments
BS EN IEC 61000-6-3	30.03.2021	Electromagnetic compatibility (EMC). Generic standards. Emission standard for equipment in residential environments
BS EN 61010-1+A1	31.03.2017	Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements
BS EN IEC 63000	10.12.2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Legally binding signature:

Legally binding signature:

General Manager - Dr. Christoph Peper

Development Manager - ppa. Jörg Petereit

This declaration certificates the compliance with the mentioned directives, however does not include any warranty of characteristics.

Please pay attention to the security advises of the provided instructions for use.

Please contact us for your system requirements.
We advise you gladly.

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