

Wind Direction Transmitter >>First Class<<

Instruction for Use

4.3151.x0.001

Low Power Device with digital output, 10 Bit serial-synchronous



Dok. No. 021744/08/21

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

- © Copyright **Adolf Thies GmbH & Co. KG**, Göttingen / Germany
- Although these operating instruction has 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.

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1 Models available

Order - No.	Measuring range	Electrical Output	Supply	Heating	Features
4.3151.00.001	0 ... 360°	Digital: 10 Bit Serial Synchronous	3.3 ... 42V DC	ja (24V AC / DC)	
4.3151.10.001	0 ... 360°	Digital: 10 Bit Serial Synchronous	3.3 ... 42V DC	nein	
4.3151.90.001	0 ... 360°	Digital: 10 Bit Serial Synchronous	3.3 ... 42V DC	yes (24V AC / DC)	Mast- Adaptor from stainless steel (V4A)

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.

Special characteristics:

- High level of measuring accuracy and resolution.
- High damping ratio at a small delay distance.
- Low starting threshold.
- Low current consumption (3.3 V @ 1.4mA).

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

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-synchronous output signal.

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 cap ❶ by left-hand rotation of upper part ❷ of wind transmitter shaft.
3. Put the wind vane onto the upper part of the wind transmitter shaft.

Remark:

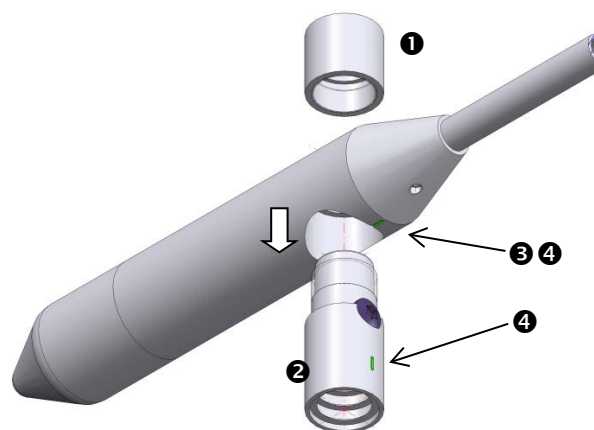
The longer part of the wind vane blade must indicate upwards.

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 control ❸.

Remark:

The marking lines ❹ 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

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 also 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 10 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 $\geq 20\text{mm}$ 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 10 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:

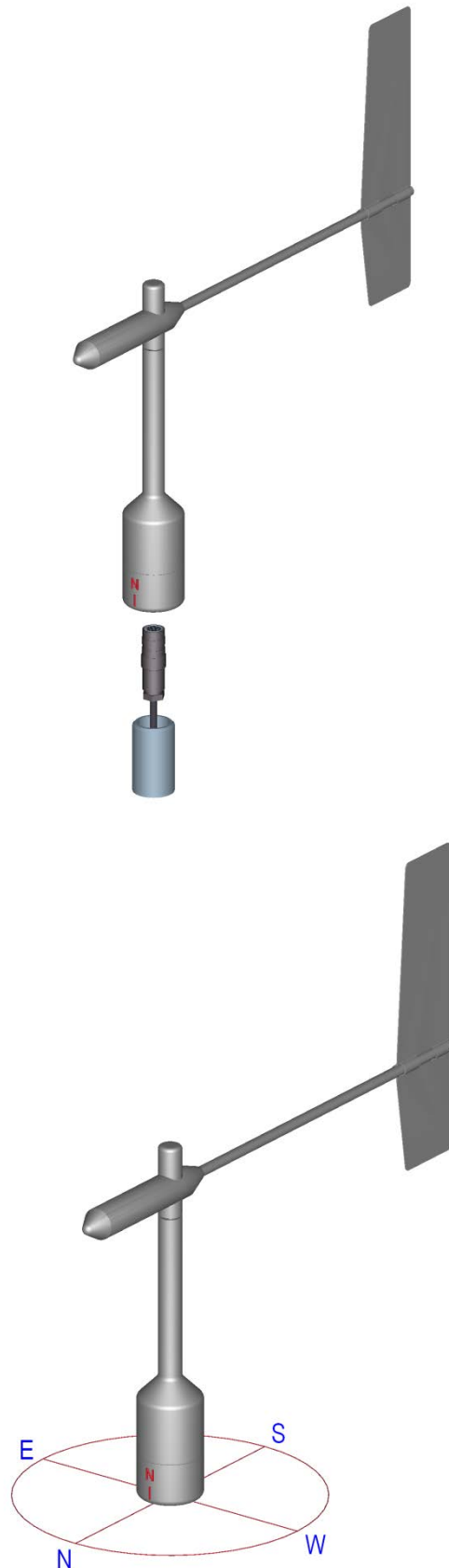
Hexagon socket wrench size 3 (Allen key).

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 5.4).

5.3.1.1 Cable Recommendation

No. of wires/ diameter / type / cable diameter
CABLE 8 x 0.5mm ² LIYCY BLACK, UV- resistant, Ø 7.6mm

5.3.2 Cable Shield

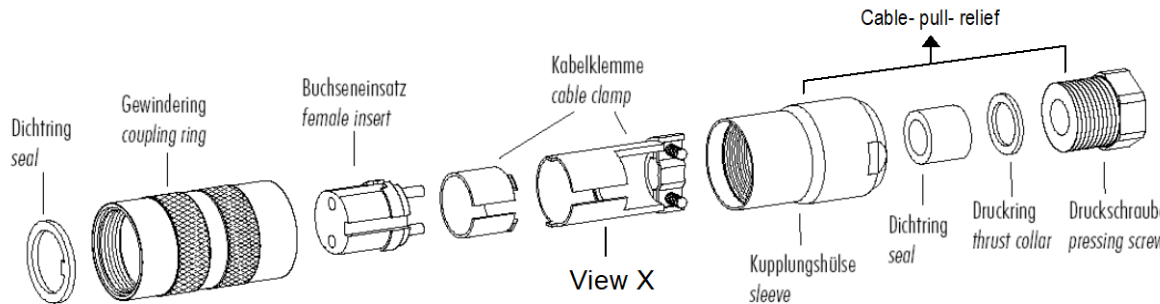
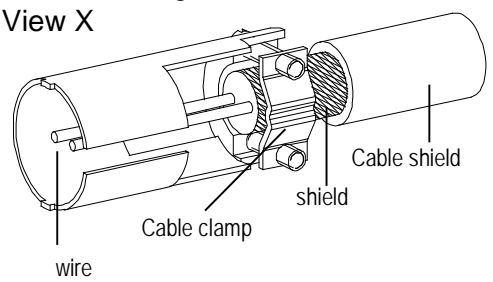
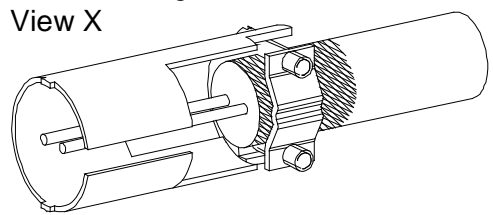
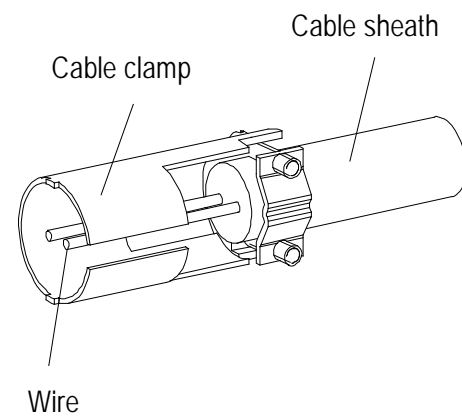
The connection of the cable shield between sensor and data acquisition device should be selected in way, that in case of over-voltages no equalizing currents will flow that might destroy the electronic components.

The connection of the cable shield should depend on the selected isolated, or respectively, non-isolated mounting of the sensors.

5.3.3 Connecting Recommendation for the Cable Shield

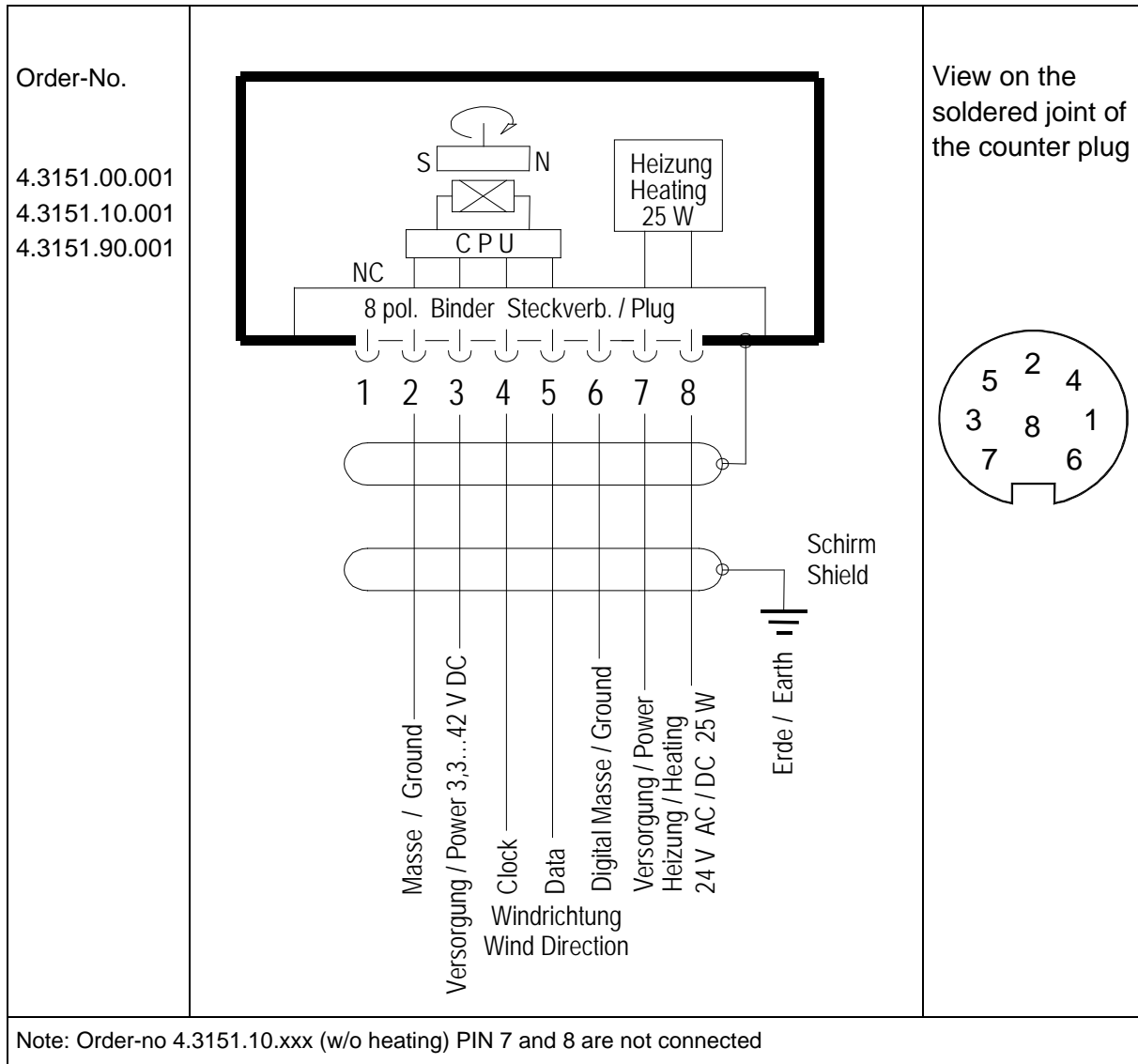
	Sensor Carrier	Sensor	Shielding / Ground	Lightning Protection
1.	Metallic measurement mast, grounded	Isolated mounting at the measuring mast (e.g. by non-metallic brackets, holder etc. or by metallic brackets, holder etc. with isolated plastic adaptors).	Apply the cable shield between sensor and data 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.

5.3.4 Plug and Cable Mounting

Coupling socket, Type: Binder, Serial 423, EMC with cable clamp	
	
Cable connection: with cable shield	
<ol style="list-style-type: none"> Stringing parts on cable acc. to plan given above. Stripping cable sheath 20mm Cutting uncovered shield 15mm Stripping wire 5mm. <p><i>Cable mounting 1:</i> Putting shrink hose or insulating tape between wire and shield.</p> <p><i>Cable mounting 2:</i> If cable diameter permits, put the shield backward on the cable sheath.</p> <ol style="list-style-type: none"> Soldering wire to the insert, positioning shield in cable clamp. Screwing-on cable clamp. Assembling remaining parts acc. to upper plan. Tightening pull-relief of cable by screw-wrench (SW16 und 17). 	<p><i>Cable mounting 1</i> View X</p> 
<ol style="list-style-type: none"> Soldering wire to the insert, positioning shield in cable clamp. Screwing-on cable clamp. Assembling remaining parts acc. to upper plan. Tightening pull-relief of cable by screw-wrench (SW16 und 17). 	<p><i>Cable mounting 2</i> View X</p> 
Cable connection: without cable shield	
<ol style="list-style-type: none"> Stringing parts on cable acc. to plan given above. Stripping cable sheath 20mm Cutting uncovered shield 20mm Stripping wire 5mm. Soldering wire to the insert. Positioning shield in cable clamp. Screwing-on cable clamp. Assembling remaining parts acc. to upper plan. Tightening pull-relief of cable by screw-wrench (SW16 und 17). 	

5.4 Connecting Diagram

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



Contact	Name	Function
1	-----	Not connected
2	GND	Supply ground
3	+Vcc	Supply 3.3 ... 42V DC
4	Clock	Serial-synchron Clock
5	Data	Serial-synchron Data
6	DIG-GND	Digital ground
7	HZG	Heating supply:
8		Voltage: 24V AC/DC Power: 25W

6 Serial-synchronous Interface

The serial-synchronous interface has a unidirectional two-leads-interface. When no data query is carried out the wind transmitter is in standby-mode. On the first received clock pulse the 10bit measuring value of the wind direction plus status bit is accepted in a shift register, and the LSB is connected to the data output. In parallel, the new measuring process is starting.

After 16 clock pulses the WD-code plus status bit is output (see figure 2). The identification as 10bit word is carried out through the characteristic bit, and the control of transmission errors is done by the parity bit.

The simultaneous data output and the starting of a measuring process mean that always the last measuring value is output (see figure 1).

The parity is formed over all 16bit. Parity bit = 1 when the sum of bit0 – bit15 is even.

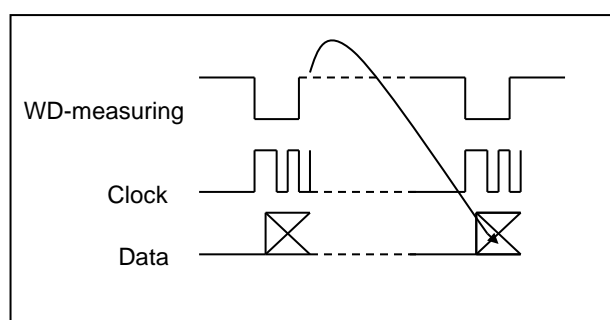


Figure 1: Wind-Direction Transmission

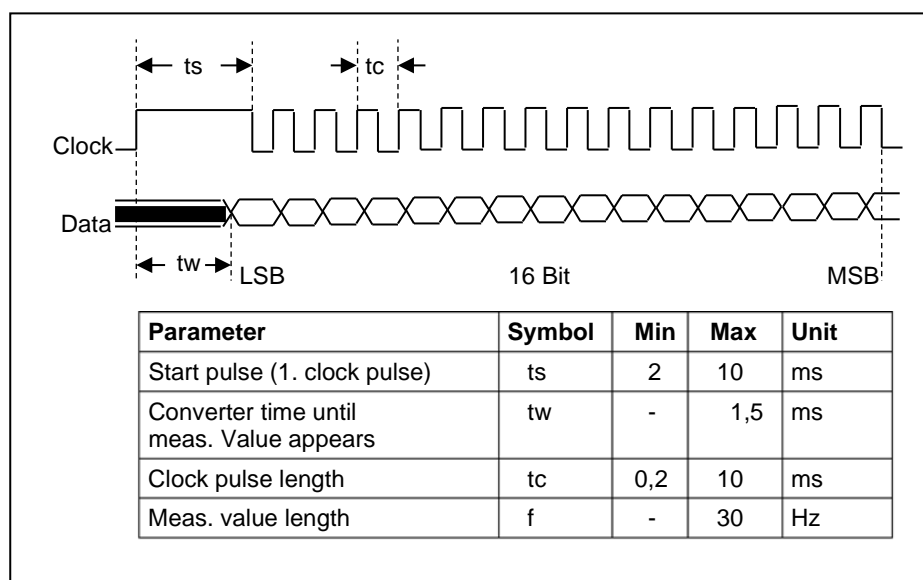


Figure 2: Interface specification "serial- synchron."

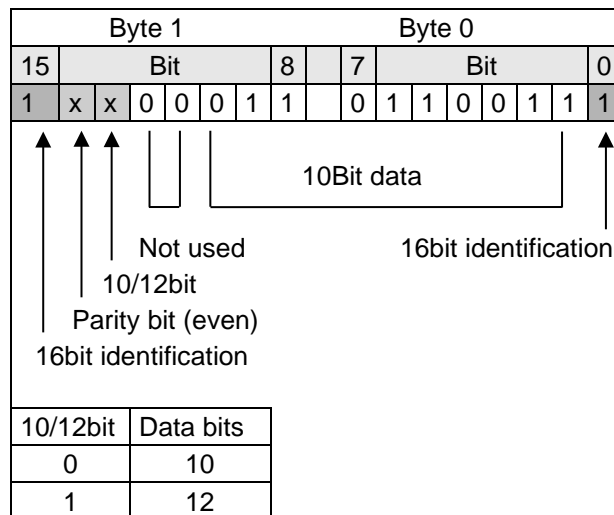


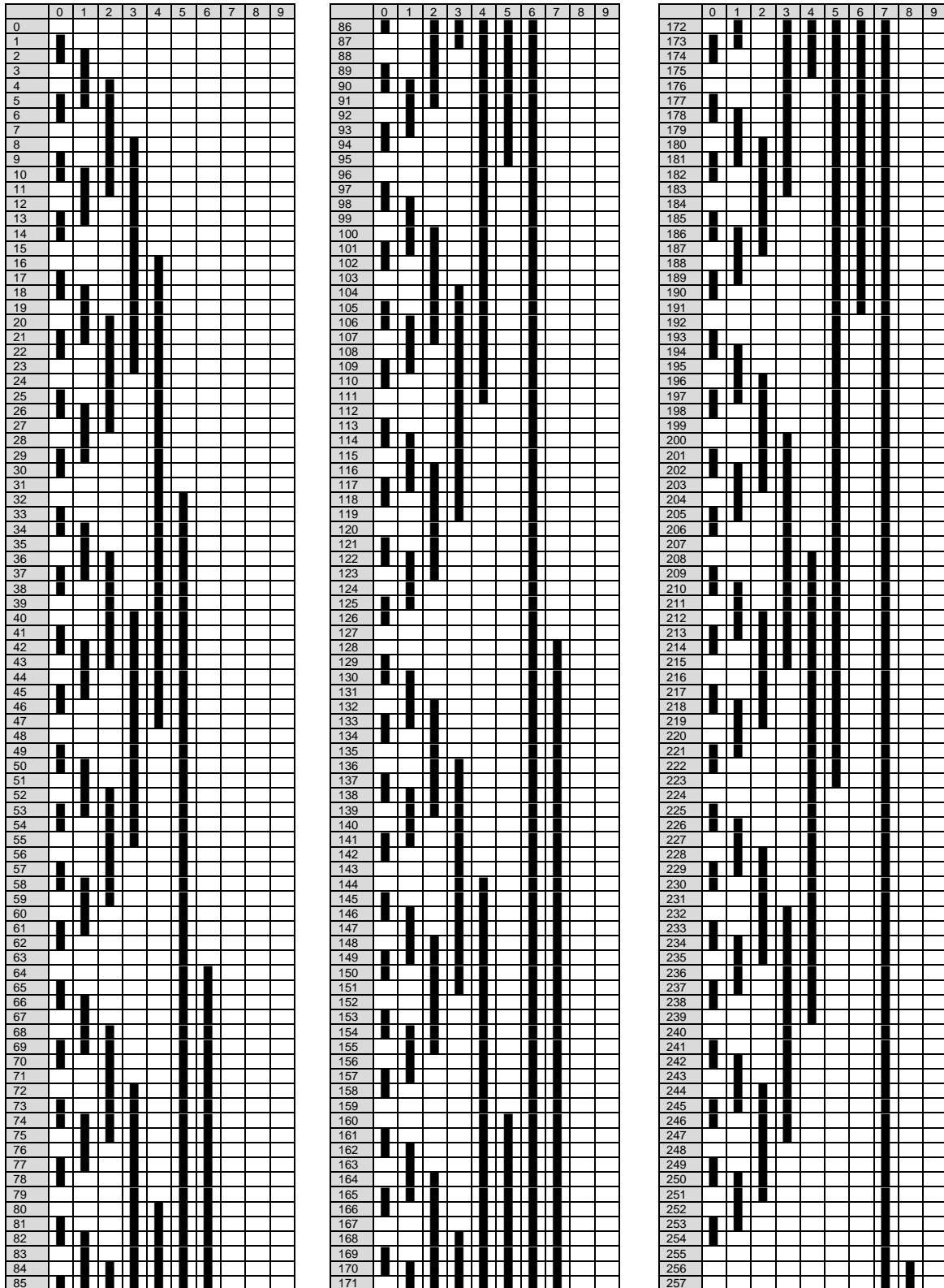
Figure 3: Protocol

Figure 4: 10bit Wind Direction Gray Code

The wind direction (0 ... 360°) is transformed into a 10 bit Gray-code, and then output. The resolution is 0,35°. 1024 increments per revolution.

Increment 0 = 0° = North and corresponds to the sector 0 ... 0,35°

Increment 1023 = 359.6° corresponds to the sector 359.6 ... 0°



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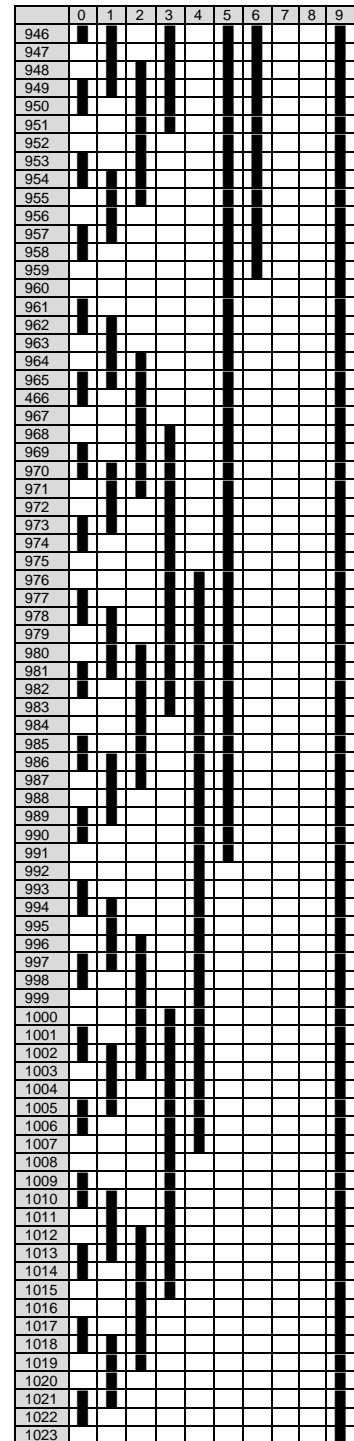
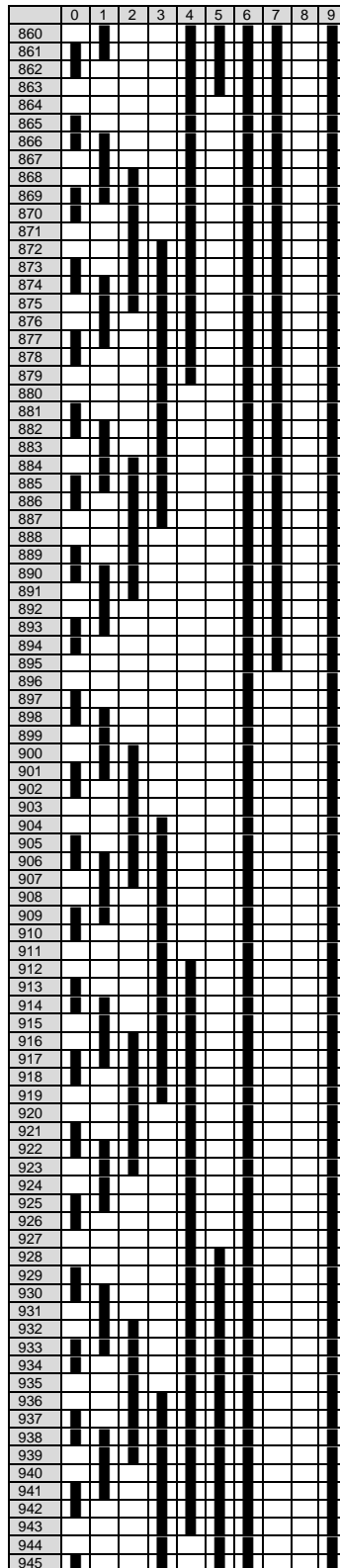
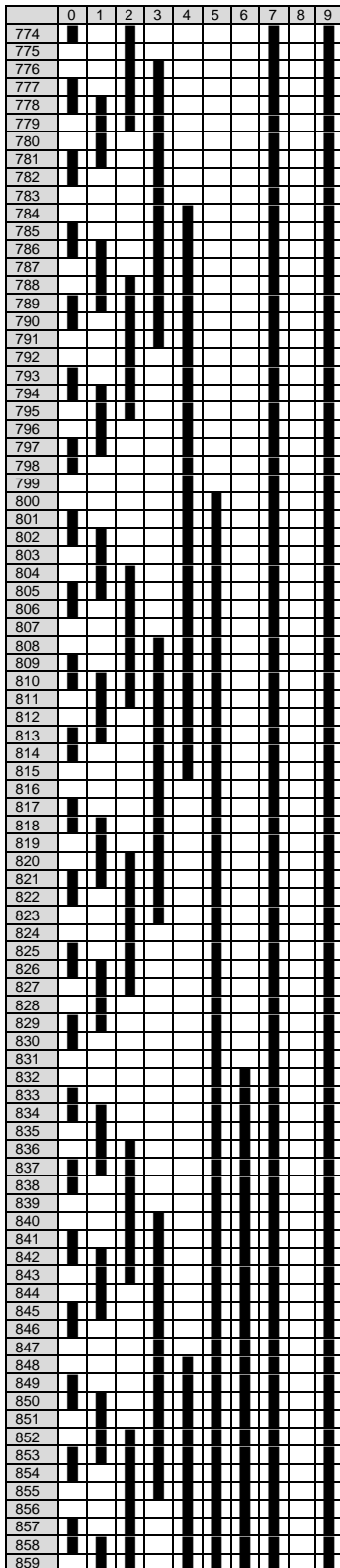
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7 Placing into Operation

Connect the wind transmitter to a power supply unit and a serial-synchronous interface, as described in the connection diagram. After connection of the supply voltage, and after a delay of $t(v) = 5\text{sec}$, while the interface is inactive, the wind direction data can be recalled via the interface.

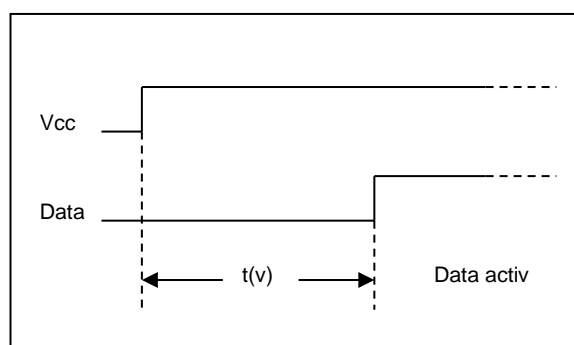


Figure5: Data- out activation

8 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 instrument in regular intervals.

Cleaning

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

Remark:

For transport of instrument please use original packing.

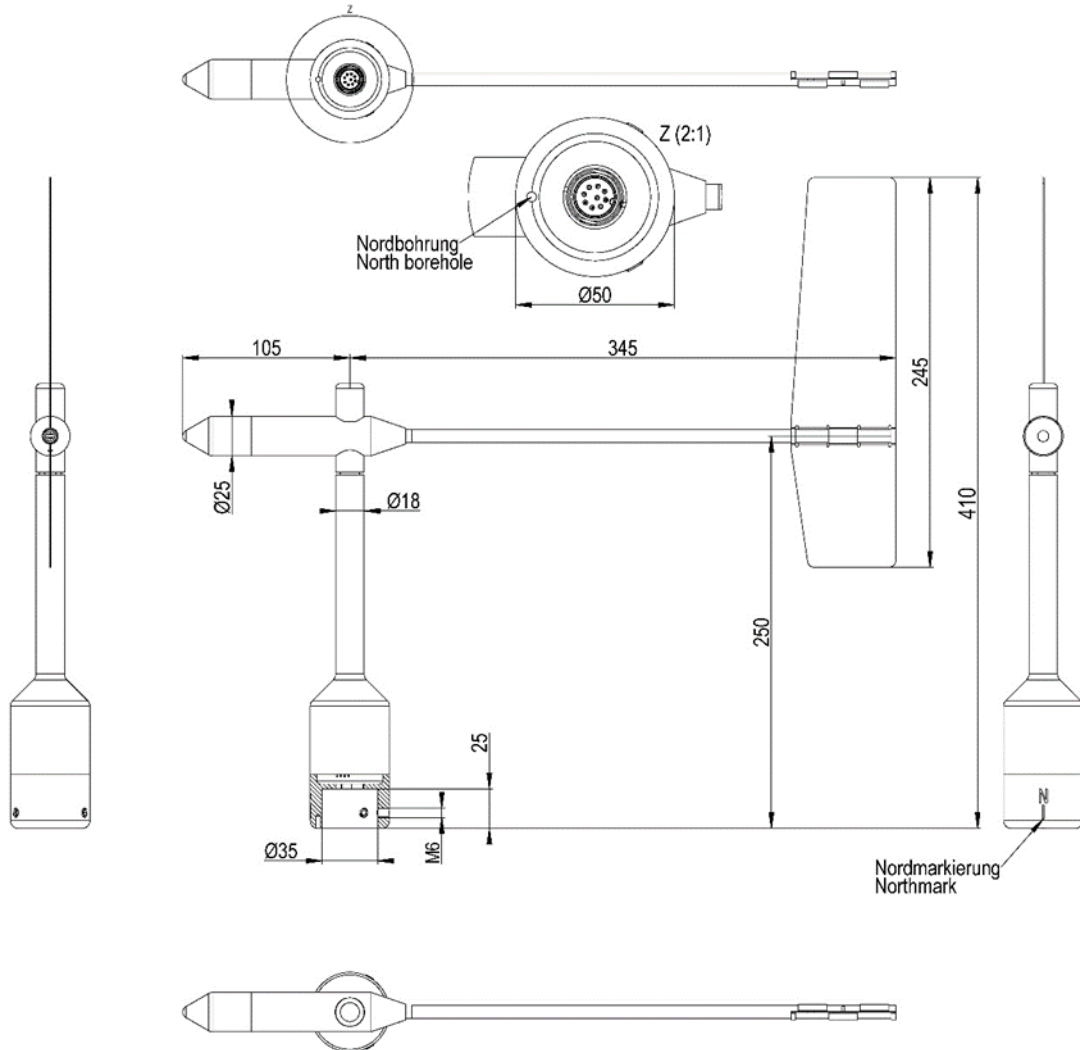
We recommend the threads of the plugs with a suitable corrosion inhibitor to protect against corrosion.

9 Technical Data

Characteristic	Description
Measuring range	0 ... 360°
Measuring Accuracy	±0.75°
Resolution of measuring value	0.35°
Operating speed	Up to 75m/s.
Survival speed	85m/s up to 0.5h.
Permissible ambient conditions for operation	-50 ... +80°C All occurring situations of rel. humidity incl. dew moistening.
Wind load (Wind power)	64,5N
Output	16bit serial synchronous (see figure 2).
Output-Code	Thies Gray Code 10bit (see figure 4).
Electrical output	Data (out), Clock I (Data (out) max. = 10mA Clock (in) see table 2 Power- On delay 5sec
Data-Out (Amplitude)	V _{cc} (max = 15V)
Clock-IN (Amplitude)	3.3V ... V _{cc}
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 5366-96).
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.
Electrical supply (V _{cc})	V _{cc} 3.3 ... 42V DC I _{cc} = 0.88 mA in standby I _{cc} ≈ 1.2 mA 10Hz query rate
Electrical supply for heating	Current: 24V AC/DC +- 20%, 45...65 Hz (galvanic isolation from housing) Idling voltage: max. 32V AC and max. 48V DC Power: 25W

Characteristic	Description
Connection	8-pole plug connection for shielded cable in the shaft (see connecting diagram).
Mounting	Mounting on mast Outer diameter $\leq 34\text{mm}$ Inner diameter $\geq 20\text{mm}$ Remark: mounting on other mast is possible with separate adapter (option).
Dimensions	See dimensional drawing.
Weight	Approx. 0.7kg
Protection	IP 55 (DIN 40050)
4.3151.x0.001 Material: Housing, vane Mast-adaptor	Aluminium (AlMgSi1) Aluminium (AlMgSi1)
4.3151.90.001 Material: Housing, vane Mast-adaptor	Aluminium (AlMgSi1) Stainless steel (V4A)

10 Dimensional drawing



11 Accessories

<p>Traverse 0,6m</p> <p>For mounting the wind speed and wind direction transmitter jointly onto a mast</p>	4.3174.00.000	<p>Horizontal sensor distance: 0.6m</p> <p>Vertical sensor distance: 0.2m</p> <p>Mast receptacle: 48 ... 50mm</p> <p>Material: Aluminum, anodised</p> <p>Dimensions: tube Ø 34 x 4mm, 668 mm long, 756mm high</p>
<p>Hanger –FIRST CLASS- 1m</p> <p>For the lateral mounting of a wind speed and wind direction transmitter onto a mast tube.</p>	4.3184.01.000	<p>Sensor distance to mast: 1m</p> <p>Mast clamp: 40 ... 80mm</p> <p>Tube diameter: 34mm</p> <p>Material: Aluminum</p>
<p>Lightning rod</p> <p>For mounting the a/m traverse or hanger.</p>	4.3100.98.000	<p>Dimension: Ø 12mm, 500mm long, 1050mm high</p> <p>Material: Aluminum</p>
<p>Adaptor</p> <p>For isolated mounting of each wind transmitter and wind direction transmitter on the traverse (4.3174.0.000).</p>	509077	<p>Dimension: A:Ø 34mm, outside 25mm high B:Ø 35mm, inside 45mm high</p> <p>Material: POM</p>
<p>Adapter „north ring“</p> <p>The „north ring“ serves as alignment aid, and for the easy change/replacement without re-adjustment of the northern direction of wind direction transmitters.</p>	509619	<p>Material: Aluminium, anodized</p> <p>Dimension: A: Ø 50mm, outside 75mm high B: Ø 35mm</p>

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.



12 EC-Declaration of Conformity

Document-No.: 001585

Month: 08 Year: 21

Manufacturer: **A D O L F T H I E S G m b H & C o. K G**

Hauptstr. 76
D-37083 Göttingen
Tel.: (0551) 79001-0
Fax: (0551) 79001-65
email: Info@ThiesClima.com

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

Description of Product: **Wind Direction Transmitter FIRST CLASS**

Article No.	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	4.3151.00.312	4.3151.10.312	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			

specified technical data in the document: **021741/08/21; 021743/08/21; 021746/03/20; 021750/08/21; 021753/10/20; 021755/05/20; 021779/05/20; 021860/06/21; 021886/08/21; 021905/03/21; 021780/08/21**

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

2014/30/EU	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
2014/35/EU	DIRECTIVE 2014/35/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 the making available on the market of electrical equipment designed for use within certain voltage limits
552/2004/EC	Regulation (EC) No 552/2004 of the European Parliament and the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation)
2011/65/EU	DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
2012/19/EU	DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012 on waste electrical and electronic equipment (WEEE)

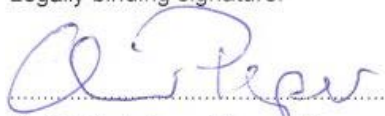
The indicated products comply with the regulations of the directives. This is proved by the compliance with the following standards:

EN 61000-6-2	Electromagnetic compatibility Immunity for industrial environment
EN 61000-6-3	Electromagnetic compatibility Emission standard for residential, commercial and light industrial environments
EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1: General requirements
EN 50581	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Place: Göttingen
Signed for and on behalf of:

Date: 03.08.2021

Legally binding signature:



Dr. Christoph Peper, General Manager

issuer:



ppa. Jörg Petereit, Development Manager

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.

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

ADOLF THIES GMBH & CO. KG

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