

Features and Advantages ARCO SDI-12

- More than 150 years of experience in classical meteorology
- Frictionless data acquisition using non-contact measuring principle
- Highest reliability and longevity due to double high-performance bearings and special alloys
- Corrosion resistant surfaces for long service life
- Particularly low starting value (0.3 m/s)
- Measuring range from 0.3...55 m/s
- Quick and easy installation thanks to pipe mounting and M12 plug connection
- Wind vane and 3-arm cup rotor exchangeable
- Increased water tightness due to water traps integrated in the sensor
- SDI-12 Protocol, Version 1.4
- Low current consumption (< 4 mA at 12 VDC)
- The compact design of the sensor reduces the effort required for components and their assembly times compared to individual devices.



Content

1	Introduction	3
2	Start-up · General	3
2.1	Tools and installation material	3
2.2	Unpacking the sensor	3
2.3	Receiving inspection	3
2.4	Power supply	3
2.5	Mounting the cup rotor	4
2.6	Mounting the wind vane	4
2.7	Installation procedure (brief description)	4
2.7.1	Mounting the sensor	4
2.7.2	Power supply and signal cables	5
2.7.3	Safety regulations	5
3	Maintenance	5
3.1	Regular maintenance and calibration	5
3.2	Visual inspections and cleaning	5
4	Transport	5
5	Dimensioned drawing ARCO SDI-12	6
6	Electrical connection ARCO SDI-12	7
7	SDI-12 Interface	8
8	Technical data	14
9	Warranty	14
10	Disposal	14



1 Introduction

The sensors of the ARCO series are very robust, compact and extremely reliable. During their development, special care was taken to ensure compliance with meteorological requirements. The sensors represent the experience of more than 150 years of development and production of wind sensors at Lambrecht meteo.

The system records the horizontal air flow and processes the measured values into the meteorological parameters wind speed and wind direction.

The sensors and other system components are mounted in a splash-proof and dustproof metal housing.

The housing and the measuring elements are made of corrosion-resistant aluminium alloys. Sensor housing, cup rotor and wind vane are anodized.

2 Start-up · General

Wind can be represented by a vector size. For a complete description, wind speed and wind direction must be specified. Both components are subject to spatial and temporal variations, so that strictly speaking they apply only to the location where the measuring instrument is installed. Therefore, special attention should be paid to the choice of installation location.

For wind measurements according to the meteorological standards (for example VDI 3786, Part 2), the measuring height and measuring location are decisive criteria for representative and error-free measurements. Ideally, a measuring height of 10 m above the ground is recommended for professional measurements. Furthermore, there should be no obstacles such as buildings, vehicles, airplanes or anything similar within a radius of 150 m of the station. In cases of mobile measurements on vehicles or on measuring containers, the above conditions are not always achievable. Therefore, acceptable compromises have to be found and, if necessary, documented.

In general, wind measuring instruments should not measure the specific wind conditions of a limited area, but indicate the typical wind conditions in a wider area. The values measured at different places must be comparable. Therefore, when mounting the sensor, make sure that the installation site is not located in the slipstream of larger obstacles. The distance between the obstacles and the sensor should be at least 10 times the height of the obstacles (corresponds to the definition of an undisturbed terrain). If there is no undisturbed terrain, the sensor must be positioned at a height that is at least 5 m higher than the obstacle height.

If the sensor is installed on a roof, the installation location should be in the middle of the roof so that preferential directions are avoided. If both wind direction and wind speed are measured, the sensors should, if possible, be mounted at the same measuring point, whereby any mutual influence of the sensors should be avoided. These requirements can be advantageously achieved with the ARCO-SERIAL, ARCO SDI-12 and ARCO-NAV sensors.



The sensor must not be mounted on or near transmitters or antennas. A minimum distance of 2 m must be kept for interference-free signal transmission.

2.1 Tools and installation material

No special tools are required for the pending assembly and maintenance work. All work can be carried out with standard tools such as screwdrivers, open-end spanners and Allen keys.

2.2 Unpacking the sensor

The sensor is delivered in a separate packaging, carefully protected against mechanical influences, in order to avoid damage during transport.

The packaging includes the following items:

- 1 Sensor ARCO SDI-12
- 1 Operating Instructions

Accessories: (depending on order scope, packed separately)

Connection cable with cable plug

2.3 Receiving inspection

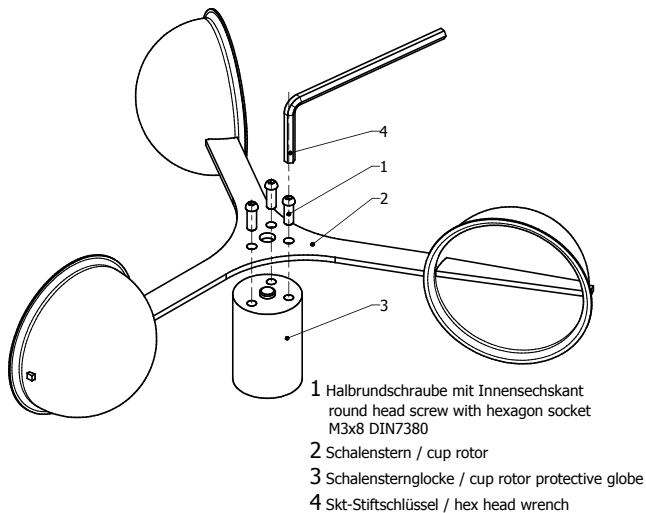
Please check the scope of delivery for completeness and any possible transport damage. Please report any complaints immediately in writing.

2.4 Power supply

The compact sensor requires 12 VDC as power supply for the electronics.

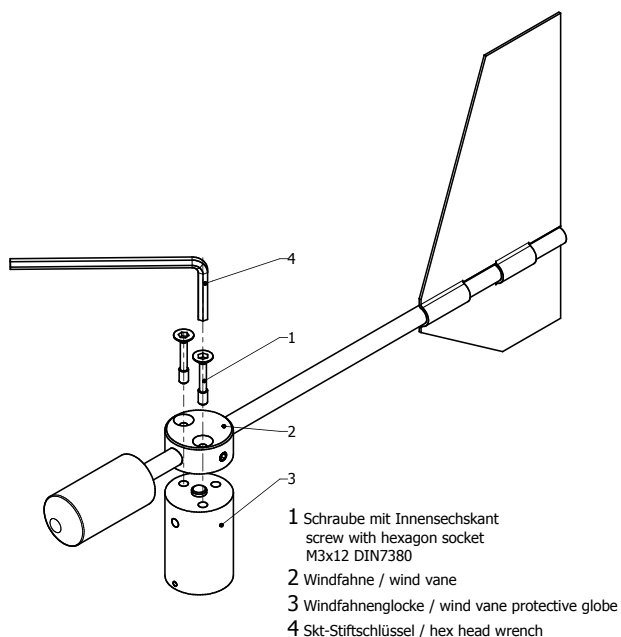
2.5 Mounting the cup rotor

The drill holes on the cup rotor are arranged in such a way that it can only be mounted in a specific, unambiguous position. All screws have to be used and the cup rotor or the wind vane have to be fixed with them. This ensures the correct direction of rotation. The required Allen key is included in the scope of delivery.



2.6 Mounting the wind vane

The wind vane can only be mounted in a specific position. Use all 2 screws to attach the wind vane to the sensor head. This is the only way to ensure a correct measurement of the wind direction.



Please mount the wind vane on the upper part and the cup rotor on the lower part of the sensor!

2.7 Installation procedure (brief description)

The sensor is installed in three steps:

- (1) Attach the cable plug to the sensor and pull the cable through the mast if necessary.
- (2) Install the sensor on the mast, but before tightening the screws you must align the sensor to the North.
- (3) Connect the sensor connections for power supply and signal output.

2.7.1 Mounting the sensor

The sensor is mounted on a mast piece (tube) with an outside diameter of 50 mm and an inside diameter of at least 40 mm. Before attaching the instrument with the two grub screws M8 x 12, connect the cable, lead it through the pipe and align the sensor to the north.

For this purpose, an appropriate marking is attached to the instrument housing (see dimensioned drawing). Align the sensor to the North before tightening the screws.

Please make sure that the sensor is firmly attached to the mast!

Alignment of wind vane

To measure the wind direction, the sensor must be aligned to the geographical North direction. In order to align the wind sensor perfectly and firmly to the North, the device has an integrated mounting aid. In the lower part of the sensor shaft there is a grub screw with pin which can be turned inwards, points to the North and is countersunk into the corresponding slot of the mast (if present), so that the sensor is aligned correctly and in a non-rotating manner. If necessary, the grub screw can be turned in or out using an Allen key (see dimensioned drawing).

Turn the mark on the wind vane exactly over the mark on the sensor housing shaft. Fix this position of the wind vane, e.g. with an adhesive strip. After alignment, remove the adhesive strips again.

Now you can target the reference point via the axis of the wind vane. The housing of the sensor must be turned on the mounting tube so that the tip of the wind vane points to the Northern reference point.

For the alignment, a point in the terrain is defined which is as far North as possible in relation to the final position of the wind direction sensor.

The position of the reference point can first be selected using a topographic map (1:25000). The exact position of the reference point is determined with a compass, which can be adjusted horizontally on a tripod.



Pay attention to compass misalignments!



When the tip of the vane points to the reference point, the sensor can finally be attached with the two grub screws.

A functional test in three directions shifted each 90° is recommended.



Observe all relevant safety instructions when mounting a sensor on a mast.

2.7.2 Power supply and signal cables

As soon as the sensor is correctly mounted and connected to the pre-assembled cable (accessory), the wires for the power supply and the signal output can be connected.

A 4-pin M12 cable connector is required for the electrical connection of the sensor. The shielding of the cable must be clamped at both ends to the protective conductor (PE).



To reduce the risk of inductive irradiation, the sensor must be grounded correctly.

The external connection is made by means of a central plug connector, which is protected in the device socket. Further details on the electrical connection of the sensor are shown in the sections "Dimensioned drawing" and "Electrical connection".

The typical power supply of the sensors is 12 VDC with a current consumption of 4 mA. The input voltage range can be 9...15 VDC.

In case of possible icing or ice formation on the moving sensor element, the function is limited for the duration of the icing.

The output signal of the sensor corresponds to the SDI-12 standard.

The sensor is ready for use 5 seconds after connection to the power supply.

2.7.3 Safety regulations



Since the sensor is often mounted at great heights, the relevant safety regulations must be followed during installation. During the electrical installation work, the relevant circuits must be disconnected from the power supply.

The housing must only be opened by authorized persons!

3 Maintenance

3.1 Regular maintenance and calibration

The sensors are designed to be very low-maintenance and for a long service life. It is recommended that you carry out regular visual inspections for weather-related surface contamination and cleaning if necessary. A regular visual and functional check of the wind sensors is recommended.



If reference measurements are required, it is essential to ensure that the measured values can only be compared if the measurements are carried out under the same conditions. This means that the reference instrument must be used close to the sensor!

The sensor is a measuring instrument and is therefore subject to the user's own recalibration cycle.

Manufacturer recommendation: 2 years.

We are pleased to offer you our qualified maintenance and calibration services to ensure the long-term function and precision of the offered components.

3.2 Visual inspections and cleaning

The use of the sensor under the respective environmental conditions requires appropriate actions. It is advisable to clean the housing and the shelter at regular intervals. The intervals depend on the ambient conditions and the degree of contamination. A regular visual inspection and functional test is recommended.

If problems arise during the tests which you cannot solve, please contact Lambrecht meteo service:

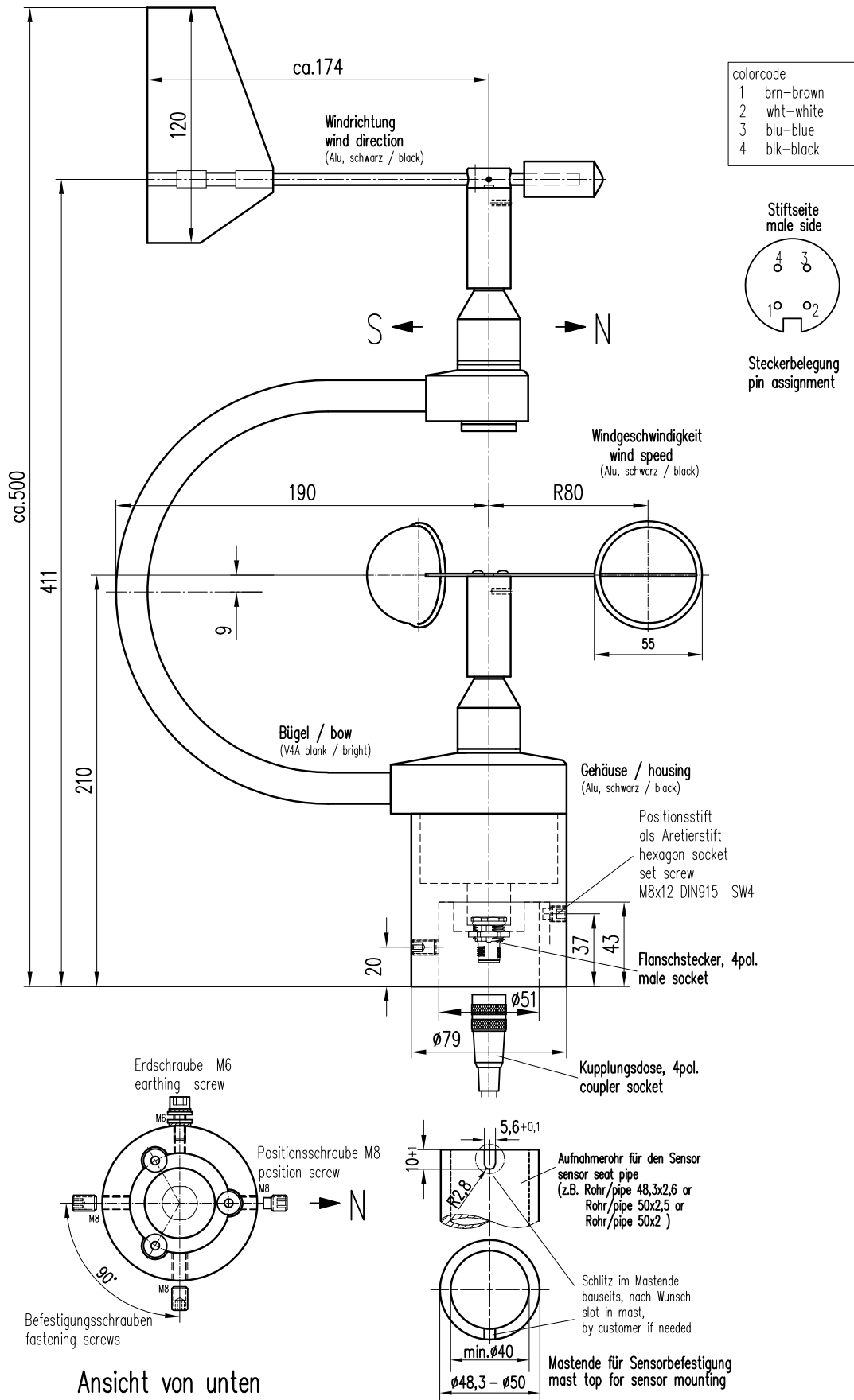
Tel.: +49-(0)551-4958-0

E-Mail: support@lambrecht.net

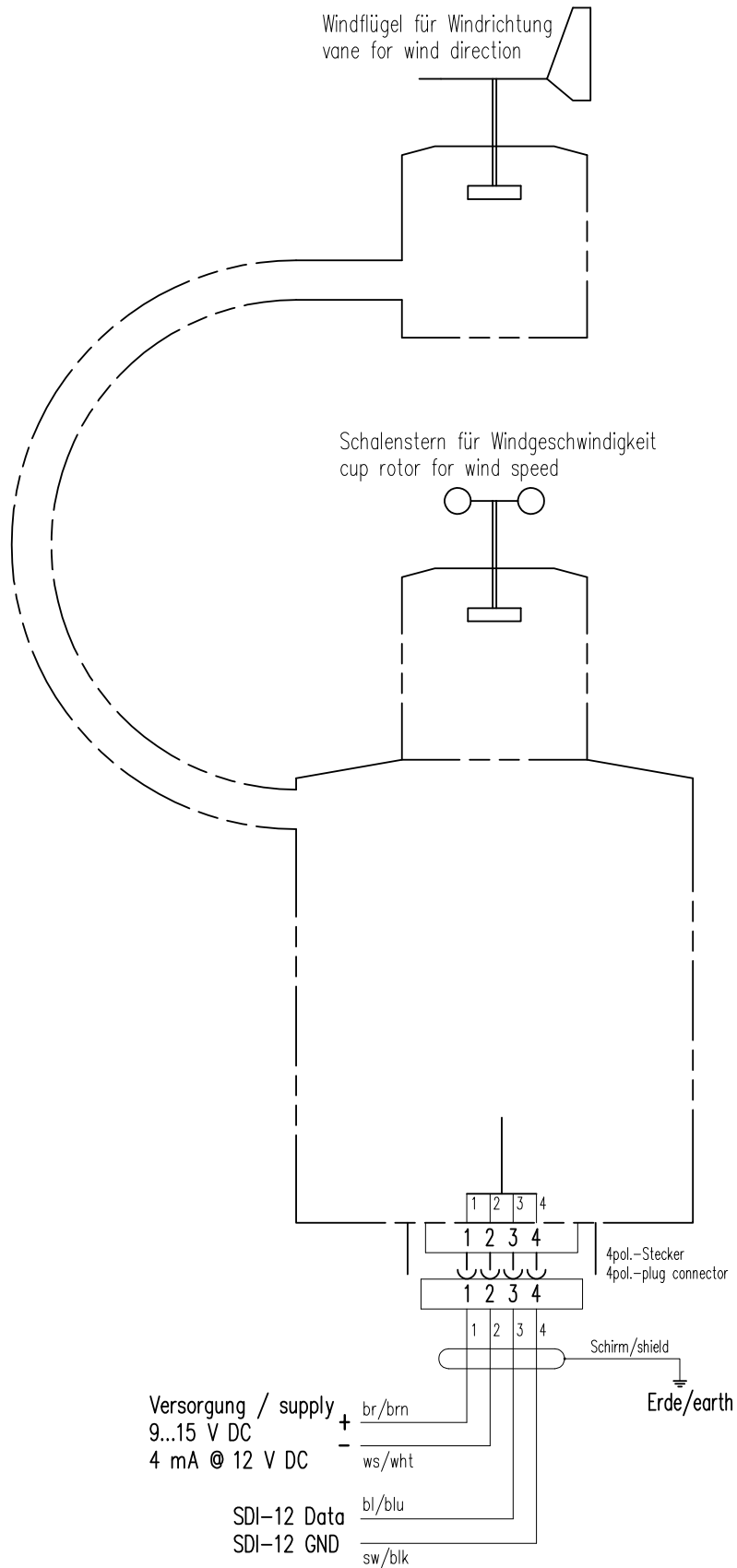
4 Transport

In the event that the sensor is to be shipped or transported by you, it must be securely packed to avoid mechanical impact or other damage.

5 Dimensioned drawing ARCO SDI-12



6 Electrical connection ARCO SDI-12



PUR/PVC colorcode	
1	br - brn
2	ws - wht
3	bl - blu
4	sw - blk



7 SDI-12 Interface

The communication using SDI-12 protocol via SDI-12 interface is based on the ‘SDI-12 A Serial-Digital Interface Standard for Microprocessor-Based Sensors, Version 1.4, 2017’. The ARCO SDI-12 can be used in bus mode parallel to other ARCO SDI-12.



The combined wind sensor behaves like two individual bus participants with their own addresses for wind speed and wind direction.

The following subset of SDI-12 commands were implemented into the ARCO SDI-12.

For more information on the SDI-12 protocol, please refer to the standard documentation mentioned above or the website www.SDI-12.org.

Implemented SDI-12 commands:

Command	Function	Answer of the sensor
a!	Acknowledge Active	a<CR><LF>
al!	Send Identification	allccccccmmmmmmvvvxx...xx<CR><LF>
aAb!	Change Address	b<CR><LF>
aM!	Start Measurement	atttn<CR><LF>
aMC!	Start Measurement and Request CRC	atttn<CR><LF>
aC!	Start Concurrent Measurement	atttnn<CR><LF>
aCC!	Start Concurrent Measurement and Request CRC checksum	atttnn<CR><LF>
aD0!	Send Data (Buffer 0)	a<data><CR><LF> a<data><CRC><CR><LF>
aV!	Start Verification	atttn<CR><LF>
aX!	Resetting the Addresses	a<CR><LF>

a = address of the respective sensor;

Standard sensor address: Wind speed = 0; Wind direction = 1

SDI-12 commands always start with the address of the appropriate sensor. Therefore all other sensors on the same bus will ignore these commands. SDI-12 commands end with ‘!’. All answers from sensors start with its address, too, but end with the ASCII characters ‘Carriage Return’ <CR> and ‘Line Feed’ <LF>.

The SDI-12 protocol is based on the ASCII character set. The baud rate of the SDI-12 protocol is 1200 Bd and has the byte frame format:

- 1 start bit
- 7 data bits (least significant bit transmitted first)
- 1 parity bit (even parity)
- 1 stop bit.

Acknowledge Active - a!

This command ensures that the sensor responds to requests. Basically it asks the sensor to confirm that it is connected to the bus.

The sensor returns its address and <CR><LF>.



Syntax

Command	Answer
a! a – Sensor address ! – End of command	a<CR><LF> a – Sensor address <CR><LF> – End of answer

Example:

Command	Answer
0!	0<CR><LF>
1!	1<CR><LF>

Send Identification - a!

The command **a!** is used to ask the sensor for its model number and firmware version.

Syntax

Command	Answer
a! a – Sensor address ! – Command "Send Identification"	a14LMGmbH1514582x1.1<CR><LF> a – Sensor address a14LMGmbH1514582x1.1 14 – 2 characters SDI-12 version-No. 14 = version 1.4 LMGmbH15 – 8 characters manufacturer's (= Lambrecht meteo GmbH) 14582x – 6 characters sensor type 14582S – Wind speed 14582D – Wind direction 1.1 – Firmware version <CR><LF> – End of answer
! – End of command	

Example:

Command	Answer
0!	014LMGmbH1514582S1.1<CR><LF>
1!	114LMGmbH1514582D1.1<CR><LF>

Change address - aAb!

The factory setting for the address of the wind speed is "0", for the wind direction "1".

If there are several sensors connected to one bus, the sensor address can be changed with the command **aAb!**. The address is always a single ASCII character. Standard for addresses are the ASCII characters "0" to "9" (decimal 48 to 57). If there are more than 10 sensors connected to one bus, using the characters "A" to "Z" (decimal 65 to 90) and "a" to "z" (decimal 97 to 122) is allowed. The sensor answers with its new address and <CR><LF>.

After the address is changed, one should not send further commands to the sensor for a period of one second (see also "SDI-12 Standard, Version 1.4, 2017").



Syntax

Command	Answer
aAb! a – Old sensor address A – Command 'Change Address' b – New sensor address ! – End of command	b<CR><LF> b – New sensor address <CR><LF> – End of answer

Example:

Command	Answer
0A1!	1<CR><LF>

Start Measurement - aM!

The "**aM!**" command requests the sensor to process the available measurement data and write them to an output string. Unlike the standard sensors described in the SDI-12 documentation, the ARCO SDI-12 measures continuously. This is why the ARCO SDI-12 always responds with "**a000**". The data is therefore immediately available. This is also the reason why the ARCO SDI-12 does not send a "service request" and ignores measurement interruption commands. The data can be retrieved with the command "**aD0!**" (see below under "Send data"). The data is not overwritten until the next "**C**" or "**M**" command and can be retrieved several times.

Syntax

Befehl	Antwort
aM! a – Sensor address M – Command "Start Measurement" ! – End of command	a0004<CR><LF> a – Sensor address 000 – Seconds the sensor needs until the measured data can be returned (= 0 s – Data immediately available) 04 – Number of provided measured data <CR><LF> – End of answer

Example:

Command	Answer
1M!	10004<CR><LF>mos

The measured data can be requested with the commands **aD0!** and **aD1!** (see **Send Data**).



Start Measurement and Request CRC - aMC!

Same command as "aM!" but in addition to the generated data the sensor returns a 3-digit CRC checksum. For information on how the CRC checksum is generated, please consult 'SDI-12 Standard, Version 1.4, 2017, chapter 4.4.12'.

Syntax

Command	Answer
aMC! a – Sensor address M – Command 'Start Measurement and Request CRC' C – Request for transmission of the CRC checksum ! – End of command	a0004<CR><LF> a – Sensor address 000 – Seconds the sensor needs until the measured data can be returned with "CRC" (= 0 s – Data immediately available) 4 – Number of provided measured data <CR><LF> – end of answer

Example:

Command	Answer
1MC!	10004<CR><LF>

Start Concurrent Measurement - aC!

The "Concurrent Measurement" enables the data logger to measure simultaneously with multiple sensors on the same bus.

The "aC!" command requests the sensor to process the available measurement data and write them to an output string. Unlike the standard sensors described in the SDI-12 documentation, the ARCO SDI-12 measures continuously. This is why the ARCO SDI-12 always responds with "a000". The data is therefore immediately available. This is also the reason why the ARCO SDI-12 does not send a "service request" and ignores measurement interruption commands. The data can be retrieved with the command "aD0!" (see below under "Send data"). The data is not overwritten until the next "C" or "M" command and can be retrieved several times.

Syntax

Command	Answer
aC! a – Sensor address C – Command 'Start Concurrent Measurement' ! – End of command	a00004<CR><LF> a – Sensor address 000 – Seconds the sensor needs until the measured data can be returned (= 0 s – Data immediately available) 4 – Number of provided measured data <CR><LF> – end of answer

Example:

Command	Answer
1C!	100004<CR><LF>

The measured data can be requested with the command **aD0!** (see "Send Data").



Start Concurrent Measurement and Request - CRC aCC!

Same command as "aC!" but in addition to the generated data the sensor returns a 3-digit checksum. For information on how the CRC checksum gets generated, please consult 'SDI-12 Standard Version 1.4, 2017, chapter 4.4.12'.

Syntax

Command	Answer
aCC!	a00004<CR><LF>
a – Sensor address	a – Sensor address
C – Command 'Start Concurrent Measurement'	000 – Seconds the sensor needs until the measured data can be returned with "CRC" (= 0 s – Data immediately available)
C – Request for transmission of the CRC checksum	04 – Number of provided measured data
! – End of command	<CR><LF> – End of answer

Example:

Command	Answer
1CC!	100004<CR><LF>

Send Data - aD0!

The data requested by the sensor with the commands "C" or "M" can be retrieved with the command "aD0!". The sensor uses the corresponding signs ("+" or "-") as field separators. If the data was requested with a "CC" or "MC" command, a CRC checksum is also returned. For more information on how to generate this CRC checksum, see "SDI-12 Standard, Version 1.4, 2017, chapter 4.4.12".

After the measurement, the data is stored in the buffer "D0" and retrieved with the command "aD0!".

Wind speed (address = 0)

Measured data	Unit
Buffer 0	
Momentary value since last measurement	m/s
Minimum value since last measurement	m/s
Maximum value since last measurement	m/s
Average value since last measurement	m/s

Wind direction (address = 1)

Measured data	Unit
Buffer 0	
Momentary value since last measurement	°
Minimum value since last measurement	°
Maximum value since last measurement	°
Average value since last measurement	°



Syntax for measurements with command "aC!" or "aM!"

Command	Answer
aD0! a – Sensor address D – Command 'Send Data' 0 – Request for the data in buffer 0 or 1 = buffer 1 ! – End of command	a<values><CR><LF> a – Sensor address <values> – Requested data separated by resp. sign ("+" or "-") <CR><LF> – End of answer

Example:

Command	Answer
0C!	000004<CR><LF>
0D0!	0+0.1+0.1+0.1+0.1<CR><LF>

Syntax for measurements with command "aCC!" or "aMC!"

Command	Answer
aD0! a – Sensor address D – Command 'Send Data' 0 – Request for the data in buffer 0 or 1 = buffer 1 ! – End of command	a<values><CRC><CR><LF> a – Sensor address <values> – Requested data separated by resp sign ("+" or "-") <CRC> – 3-digit CRC checksum <CR><LF> – End of answer

Reset addresses - aX!

If inadvertently the same address has been assigned to wind direction and wind speed, the sensor can be reset to address 0 for wind speed and address 1 for wind direction with the command "**aX!**".



8 Technical data

ARCO SDI-12	Id-No. 00.14582.070470
Range of application:	Temperatures -40...+70 °C Wind speed 0...55 m/s 0...100 % r. h.
Protocol:	SDI-12
Supply voltage:	Sensor 9...15 VDC · 4 mA at 12 VDC
Housing:	Seawater resistant aluminium specially coated IP 65 in vertical position of use
Dimensions:	See dimensioned drawing
Weight:	Approx. 1.7 kg

Parameter wind direction

Measuring range:	0...360°
Accuracy:	± 1 %
Resolution:	< 1°
Starting value:	0.3 m/s
Damping ratio:	0.5...0.6

Parameter wind speed

Measuring range:	0.3...55 m/s
Accuracy:	± 2 % FS at 0.3...55 m/s
Resolution:	< 0.1 m/s
Starting value:	0.3 m/s
Distance constant:	4 m

Accessories: (please order separately)

Sensor connection cable with plug connector M12, 4-pin	
Length:	12 m
Id-No:	32.14567.060000

Sensor connection cable with plug connector M12, 4-pin	
Length:	15 m
Id-No:	32.14567.060010

(Other lengths available on request.)

Options:

(9340)	Visualisation and evaluation software MeteoWare-CS-3 Basic
	Id-No. 36.09340.000000

Standards

- EMC/EMI: EN 60945
- Low voltage guideline 73/23/EWG and VDE 0100
- WMO No. 8
- VDI 3786 part 2
- SDI12, 1.4, 2017

9 Warranty

Please note the loss that unauthorised manipulation of the system shall result in the loss of warranty and non-liability. Changes to system components require express written permission from LAMBRECHT meteo GmbH. These activities must be performed by a qualified technician.

The warranty does not cover:

1. Mechanical damage caused by external impacts (e. g. icefall, rockfall, vandalism).
2. Impacts or damage caused by over-voltage or electromagnetic fields which are beyond the standards and specifications of the device.
3. Damage caused by improper handling, e. g. by using the wrong tools, incorrect installation, incorrect electrical installation (incorrect polarity) etc.
4. Damage caused by using the device outside the specified operation conditions.

10 Disposal

LAMBRECHT meteo GmbH is listed and registered at the Stiftung Elektro-Altgeräte Register ear under:

WEEE-Reg.-No. DE 45445814

In the category of monitoring and control instruments, device type: "Monitoring and control instruments for exclusively commercial use".

Within the EU



The device has to be disposed according to the European Directives 2002/96/EC and 2003/108/EC (Waste Electrical and Electronic Equipment). Do not dispose the old device in the household waste! For an environmentally friendly recycling and disposal of your old device, contact a certified disposal company for electronic waste.

Outside the EU

Please follow the regulations in your country regarding the appropriate disposal of waste electronic equipment.

Subject to change without notice.

14582_ARCO_SDI-12_b-de.indd 21.22

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Quality System certified by DQS according to DIN EN ISO 9001:2015, Reg. No. 003748 QM15