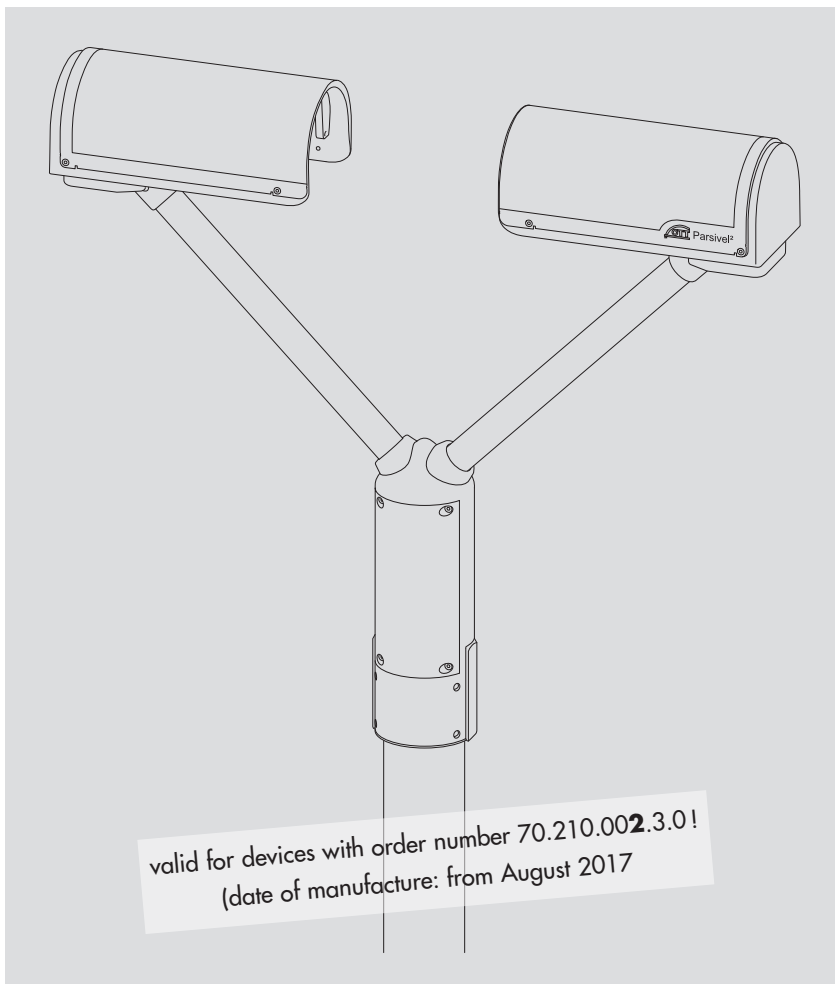


Operating instructions  
**Present Weather Sensor**  
**OTT Parsivel<sup>2</sup>**



English

We reserve the right to make technical changes and improvements without notice.

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## 1 Scope of supply

- ▶ **OTT Parsivel<sup>2</sup>**
  - 1 laser-optical disdrometer consisting of: two sensor heads with splash protection unit grid, tunnel housing with 30 mm wide and 180 mm long light strip, base holder with integrated electronics and 8-pin panel jack for connecting the supply voltage and electrical ports
  - 1 installation set, consisting of
    - 1 x cable lug for grounding
    - 1 x flat washer
    - 6 x grub screws M 8 x 16 mm
    - 7 x grub screws M 8 x 25 mm
    - 1 x hex nut M 8
    - 2 x lock washers
    - 1 x Allen key, 4 mm
  - 1 USB connection cable. USB connector type A to USB type B, 3 m
  - 1 OTT Parsivel PC software "ASDO", basic version
  - 1 set of operating instructions

## 2 Order numbers

- |                                   |  |                |
|-----------------------------------|--|----------------|
| ▶ <b>OTT Parsivel<sup>2</sup></b> | <b>Laser-optical disdrometer</b>   | 70.210.002.3.0 |
| ▶ <b>Accessories</b>              | <b>Connection cable, assembled</b>   | 70.210.409.4.1 |
|                                   | - 8-core, wire cross section 0.25/0.75 mm <sup>2</sup>                       |                |
|                                   | - one end prepared with plug   |                |
|                                   | - one open cable end, insulation removed and provided with end sleeves       |                |
|                                   | - Length 1 m, 13 m (available on request according to customer requirements) |                |
|                                   | <b>Power supply 24 V DC/100 W; control cabinet version</b>                   | 65.030.003.9.2 |
|                                   | - Protection class IP 20   |                |
|                                   | - for top hat rail installation (TS 35)                                      |                |
|                                   | - Input voltage: 100 ... 240 V AC  |                |
|                                   | <b>Power supply 24 V DC/100 W; protective housing version</b>                | 97.850.029.9.5 |
|                                   | - Protection class IP 65   |                |
|                                   | - in aluminum protective housing   |                |
|                                   | - Input voltage: 100 ... 240 V AC  |                |
|                                   | <b>Interface converter</b>   | 97.961.091.9.5 |
|                                   | - RS-485 / USB; galvanically isolated; electrical supply via USB interface   |                |
|                                   | <b>Pedestal 2"</b>   |                |
|                                   | - with bottom plate for attachment to a concrete base                        |                |
|                                   | - with mounting plate for mains adapter (protective housing version)         |                |
|                                   | - Laser strip installation height: 1 m (length: 0.53 m)                      | 70.210.420.3.1 |
|                                   | - Laser strip installation height: 2 m (length: 1.53 m)                      | 70.210.421.3.1 |
|                                   | - Laser strip installation height: 3 m (length: 2.53 m)                      | 70.210.422.3.1 |
|                                   | <b>Attachment set for pedestal</b>   | 99.020.050.9.2 |
|                                   | - for attachment of the pedestal on a concrete base                          |                |
|                                   | - 4 x anchor rods  |                |
|                                   | - 4 x anchor bolt glue cartridges  |                |
|                                   | <b>OTT Parsivel PC software "ASDO", full version</b>                         | 56.551.001.9.7 |
| ▶ <b>Spare parts</b>              | <b>Splash protection unit grid (1 piece)</b>                                 | 70.210.410.3.1 |

### 3 OTT Parsivel<sup>2</sup> factory settings

The OTT Parsivel<sup>2</sup> is a flexibly configurable device with respect to interface activation and parameters and the heating settings, and is supplied with the following factory settings:

Operating mode:	RS-485 2-wire <sup>1)</sup>
Baudrate RS-485:	19,200 baud
RS-485 bus mode:	disabled
Bus address RS-485:	0
SDI-12 interface:	disabled
SDI-12 bus address:	0
Pulse output:	0.1 mm enabled
Sensor head heating	
Operating mode	automatic operation
Minimum temperature:	+10 °C
Screen heating	
Status:	enabled
Threshold temperature:	+10 °C
Minimum heating power:	25 %
Maximum heating power:	100 %
Data telegram:	OTT telegram (see Chapter 11.4)
Measurement interval:	60 s

The parameters can be set with the OTT Parsivel software ASDO, or alternatively using a terminal software. Notes on setting these parameters can be found in Appendix A "CS command set" or in the "OTT Parsivel software ASDO" Operating instructions.

<sup>1)</sup> the green and yellow wires in the connection cable are configured as an RS-485 interface (alternatively: SDI-12)

## 4 Safety information

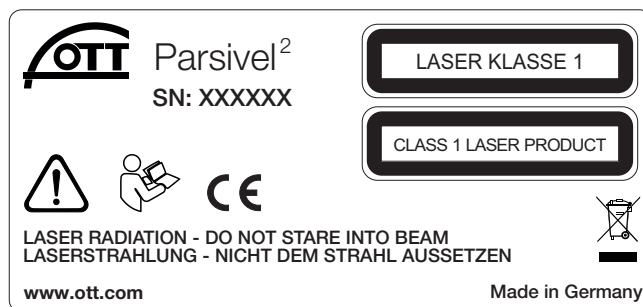


- ▶ These operating instructions contain basic instructions that must be followed during installation, operation and maintenance. Therefore, it is absolutely necessary that they be read by the assembler and by the responsible technical personnel/operator prior to installation and startup!
- ▶ These operating instructions must be accessible at the point of use of the measurement device.
- ▶ Personnel responsible for installation, operation and maintenance must have the appropriate qualifications for this work! Responsibilities, competency and the monitoring of personnel must be closely controlled by the owner. If personnel do not have the required knowledge, it must be provided through training and instruction. If necessary, OTT HydroMet can provide this service on a contractual basis for the owner.
- ▶ Non-adherence to these safety instructions can have dangerous consequences for persons as well as for the measurement device!
- ▶ Non-adherence to these safety instructions can result in the loss of any indemnity claims!
- ▶ Please adhere to the safety instructions listed in these operating instructions, to all existing national accident prevention regulations and to any internal work, operating and safety rules as set forth by the owner!
- ▶ The operating safety of the delivered measuring device is only guaranteed when it is used properly! Retrofitting or changing the measuring device is only allowed if authorized by the manufacturer.
- ▶ To ensure safety, buy only original replacement parts and accessories authorized by the manufacturer. Use of other parts can void liability for any consequences arising therefrom!
- ▶ The OTT Parsivel<sup>2</sup> is a **class 1 laser product** which complies with IEC/EN 60825-1:2014.

Wavelength: **650 nm**; output power: max. **0,2 mW**.  
(visible laser beam; colour: red)

Under reasonably foreseeable conditions (i.e. proper use of the device), the available laser radiation is not harmful to the eyes (and skin). Nevertheless, glare, impaired colour vision and visual disturbances, for example, cannot be ruled out. Do not look at the laser beam with the naked eye nor view it directly using optical instruments!

The position of the laser beam is shown in figure 2 (coloured red).



## 5 Introduction

The OTT Parsivel<sup>2</sup> is a laser-based optical system for complete and reliable measurement of all types of precipitation. The size range of measurable liquid precipitation particles is from 0.2 ... 8 mm, for solid precipitation particles it is from 0.2 ... 25 mm. In the process, precipitation particles can have a particle speed (rate of fall) of from 0.2 ... 20 m/s. The precipitation particles are categorized as follows:

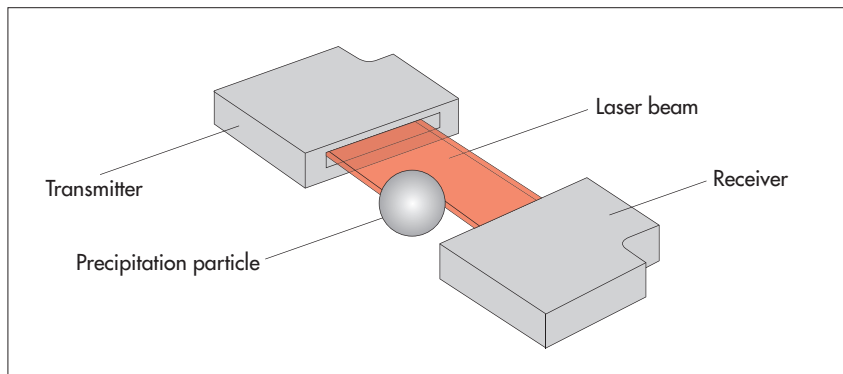
- ▶ Drizzle
- ▶ Drizzle with rain
- ▶ Rain
- ▶ Rain, drizzle with snow
- ▶ Snow
- ▶ Snow grains
- ▶ Soft hail
- ▶ Hail

The precipitation measurements are carried out using a special sensor head that was developed for this particular purpose. It detects precipitation optically. The data thus determined are processed and stored by a fast digital signal processor. The OTT Parsivel<sup>2</sup> issues one data telegram every 60 seconds.

### 5.1 Functional principle

The theory behind the OTT Parsivel<sup>2</sup> is a laser sensor that produces a horizontal strip of light. The emitter and the receiver are integrated into a single protective housing.

Fig. 1: Functional principle of the OTT Parsivel<sup>2</sup>.



#### Measurement of particle size

If there are no particles in the laser beam, the maximum voltage is output at the receiver. Precipitation particles passing through the laser beam block off a portion of the beam corresponding to their diameter, thus reducing the output voltage; this determines the particle size.

#### Measurement of particle speed

To determine the particle speed, the duration of the signal is measured. A signal begins as soon as a precipitation particle enters the light strip and ends when it has completely left the light strip.



The following parameters can be derived from these two determined quantities:

- ▶ Size spectrum
- ▶ Type of precipitation
- ▶ Kinetic energy
- ▶ Intensity of the precipitation
- ▶ Radar reflectivity
- ▶ Visibility

The splash protection attached to the sensor head prevents precipitation particles from deflecting off the housing, falling into the laser beam and thus falsifying the measurements.

## 5.2 Connection options for the OTT Parsivel<sup>2</sup>

The OTT Parsivel<sup>2</sup> can be connected to various devices as shown in the illustration below. Refer to the respective chapters in this regard.

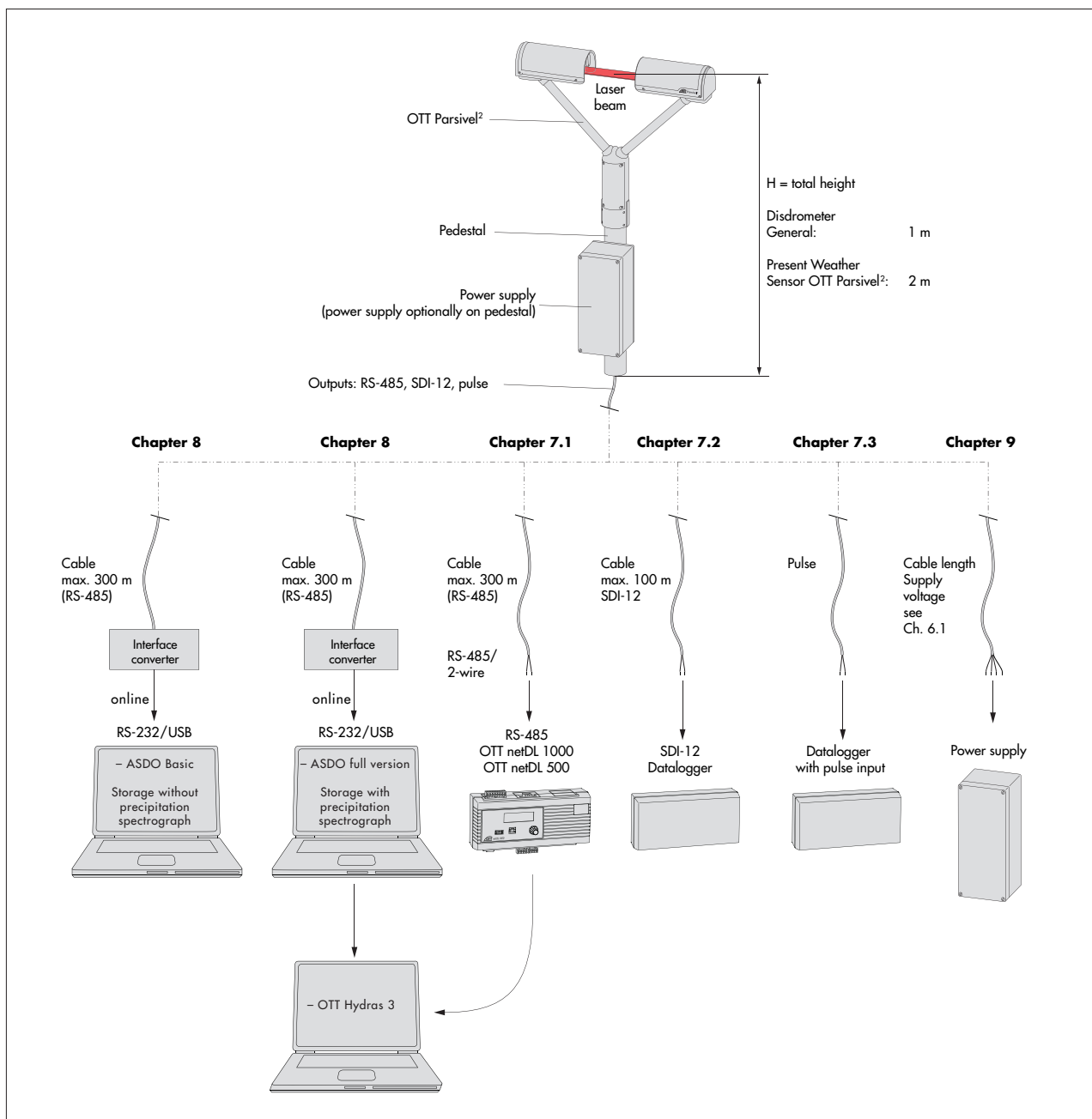


Fig. 2: Connection options for the OTT Parsivel<sup>2</sup>.

## 6 Installing the OTT Parsivel<sup>2</sup>

! **Please follow Safety instructions (see chapter 4) when installing the OTT Parsivel<sup>2</sup>!**

It is of critical importance to the quality of the measurements that the setup location be selected carefully. Here, wind and vibrations must be minimized (see chapter 13.2 "Disruptions due to convection and vibrations"). If the protection against these influences is not sufficient, virtual drops can be detected.

### Prerequisites

The OTT Parsivel<sup>2</sup> is mounted on a pedestal. The pedestal must have the following specifications:

- ▶ Pedestal diameter 50 ... 62 mm
- ▶ Pedestal consists of an electrically conducting material and is grounded
- ▶ The concrete foundation of the pedestal must have minimum dimensions of 40 x 40 x 80 cm (L x W x H).

Before the OTT Parsivel<sup>2</sup> can be fastened to the pedestal, the data transmission cable and power supply must be installed.

### 6.1 Cable selection

The electrical connection of the OTT Parsivel<sup>2</sup> is made with an 8-core cable, prepared with a plug at the factory (accessory). This connection cable can be supplied with a length of one or 13 meters. The wire cross section is 0.25 mm<sup>2</sup> (sensor head heating power supply: 0.75 mm<sup>2</sup>). If required, you can extend the cable keeping to the following criteria:

#### Data transmission cable

The OTT Parsivel<sup>2</sup> has the following interfaces:

- ▶ RS-485
- ▶ SDI-12
- ▶ Pulse output

A total of two wires are available in the connection cable for the RS-485 and SDI-12 interfaces. The assignment of these wires with the RS-485 or SDI-12 interface is carried out by the OTT Parsivel user software ASDO or with a terminal program (factory setting: RS-485 interface).

We recommend that the data transmission cable has the following characteristics:

- ▶ Twisted-pair cable; unshielded
- ▶ Usage length with RS-485 interface: max. 300 m
- ▶ Usage length with SDI-12 interface: max. 100 m
- ▶ Usage length with pulse output: max. 100 m
- ▶ Wire cross section from a cable length of 25 meter  $\geq 0.5$  mm<sup>2</sup> (below that: 0.25 mm<sup>2</sup>)

#### Power supply cable

Power supply for electronics: Wire cross section up to a cable length of 25 meter 0.25 mm<sup>2</sup>, above that 0.5 mm<sup>2</sup>. Maximum cable length 250 meter (when using an OTT power supply).

Power supply for sensor head heating: Maximum resistance of cable: 2  $\Omega$ .

The length of the cable is dependent on the wire cross section:

Wire cross section	max. cable length
0,75 mm <sup>2</sup>	21 m
1,0 mm <sup>2</sup>	28 m
1,5 mm <sup>2</sup>	42 m
2,5 mm <sup>2</sup>	70 m
4,0 mm <sup>2</sup>	112,5 m

## 6.2 Connecting ground to OTT Parsivel<sup>2</sup> (recommendation)

To ground the OTT Parsivel<sup>2</sup>, you will need the following parts from the installation set provided:

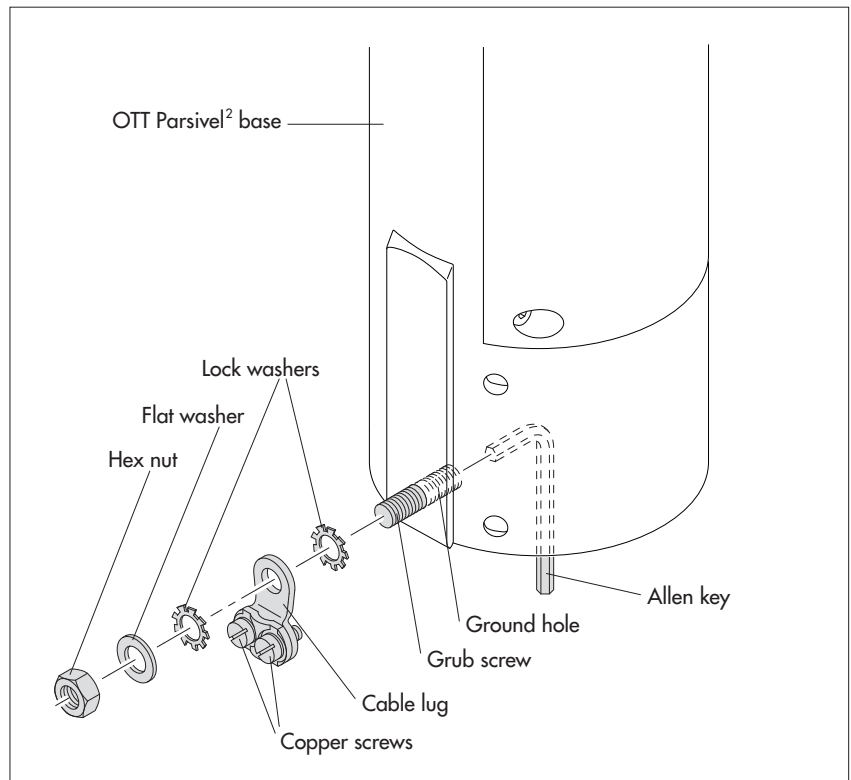
- ▶ 1 hex key 4 mm
- ▶ 1 M 8 x 25 grub screw
- ▶ 2 lock washers
- ▶ 1 cable lug
- ▶ 1 flat washer
- ▶ 1 M 8 hex nut

Also, you will need a grounding cable with a wire cross section of 16 mm<sup>2</sup>.

In order to ground the OTT Parsivel<sup>2</sup>, proceed as follows:

- Rotate the grub screw using the hex key from inside into the grounding hole (see Fig. 3) until the grub screw is flush with the inner wall inside the socket.
- Place the lock washers, cable lug and flat washer as shown in Fig. 3 onto the grub screw from the outside.
- Likewise, screw the hex nut from outside onto the grub screw and tighten it. Hold the grub screw from the inside using the hex key while doing so so that it does not rotate during tightening.
- Loosen the two copper screws of the cable lug by rotating them a few turns.
- Remove the insulation from one end of the grounding cable approximately 2 cm.
- Insert the uninsulated end of the grounding cable between the two plates of the cable lug and retighten the two copper screws. The other end of the cable must be properly grounded near the OTT Parsivel<sup>2</sup>.

Fig. 3: Grounding the OTT Parsivel<sup>2</sup>.  
The individual parts to fasten the cable lug are included in the installation kit.

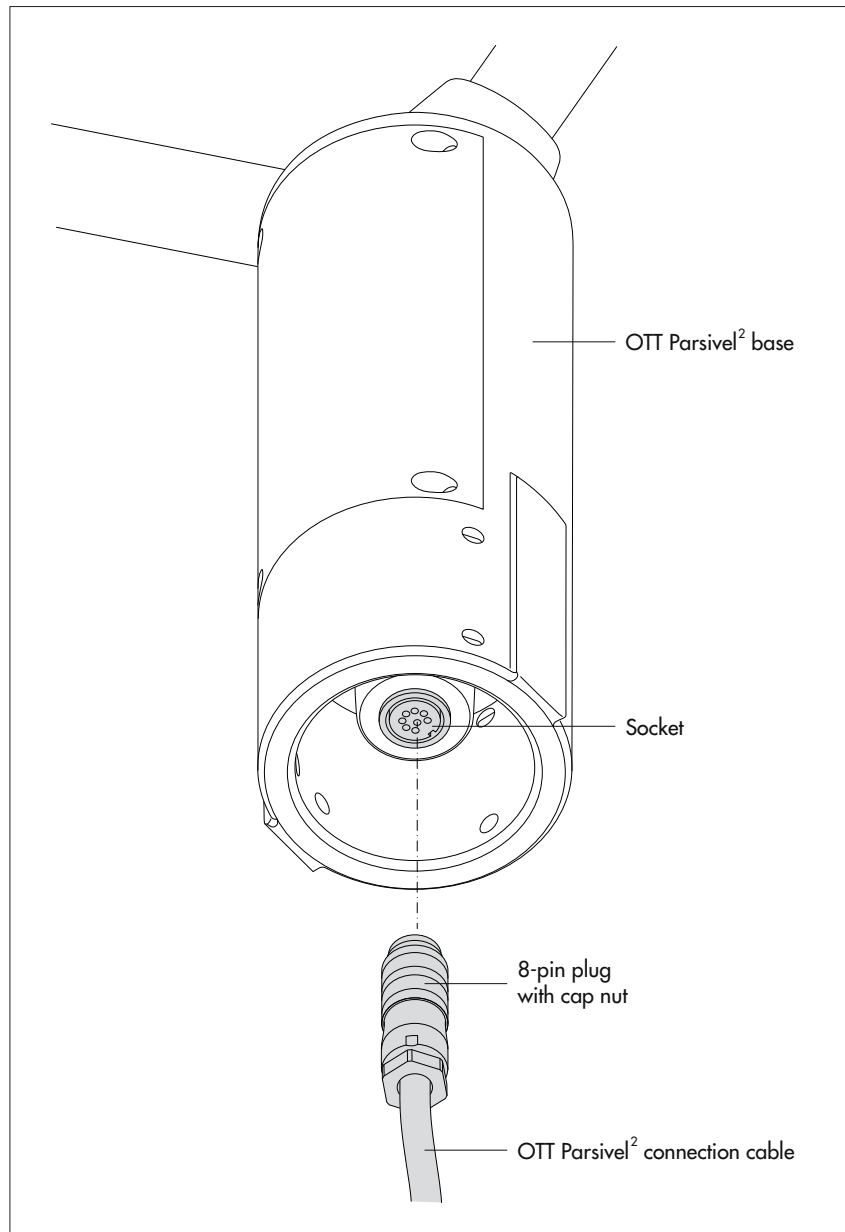


### 6.3 Installing the OTT Parsivel<sup>2</sup> on a pedestal

Proceed as follows to install the OTT Parsivel<sup>2</sup>:

- If necessary: Attach the power supply (protective housing version) to the mounting plate of the pedestal using the bolts and nuts supplied.
- Feed the connection cable with the 8-pin plug from the power supply on the leg or from a control cabinet upwards through the pedestal.
- Connect the plug to the socket in the base of the OTT Parsivel<sup>2</sup>. Tighten the cap nut for the plug by hand.

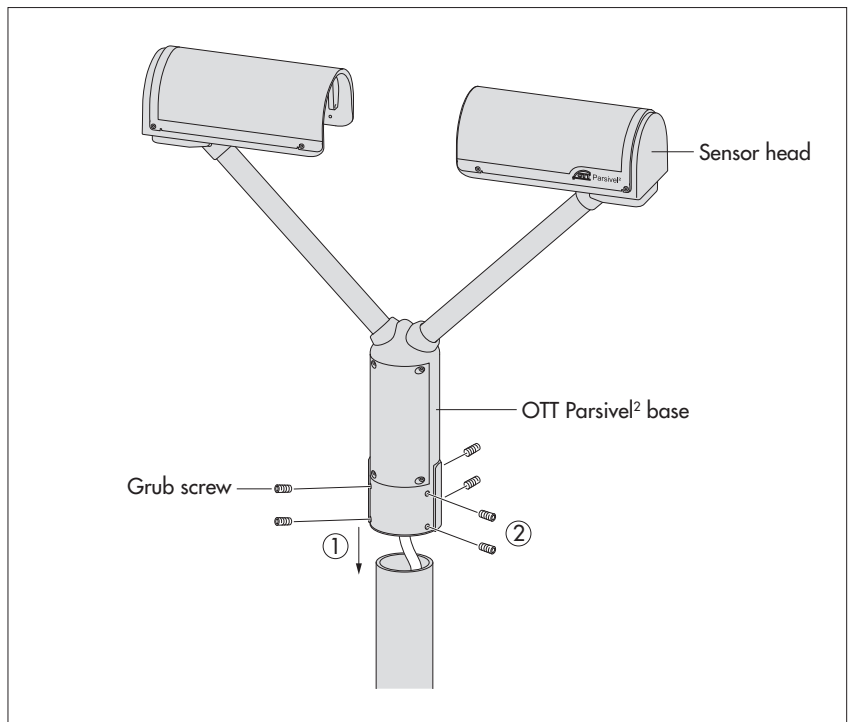
Fig. 4: Connecting the connection cable to the OTT Parsivel<sup>2</sup> base.



- Slide the connected and grounded OTT Parsivel<sup>2</sup> onto the pedestal.

- Orient the OTT Parsivel<sup>2</sup> such that the laser beam is perpendicular to the local main wind direction.
- Evenly tighten the 6 M 8 x 16 grub screws, or M 8 x 25 depending on the diameter of the pedestal, using the 4 mm hex key provided (installation set) so that the sensor heads are horizontal as much as possible.

Fig. 5: Installing the OTT Parsivel<sup>2</sup> on the pedestal.



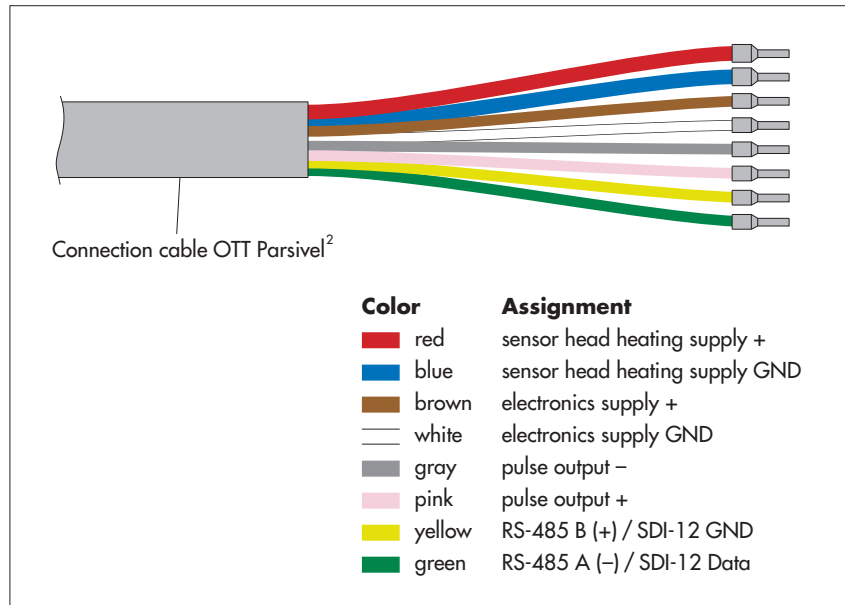
## 7 Connecting the OTT Parsivel<sup>2</sup> to a datalogger

The OTT Parsivel<sup>2</sup> can be connected to the following dataloggers:

- ▶ OTT netDL with RS-485 interface
- ▶ OTT netDL with SDI-12 interface
- ▶ Any datalogger with an SDI-12 interface
- ▶ Datalogger with pulse input

The connection to a datalogger is made with a prepared, 8-core connection cable (accessory). This cable also has 2 wires for the electrical power supply for the electronics and two for the sensor head heating of the OTT Parsivel<sup>2</sup>.

Fig. 6: Wiring assignment of the connection cable.



The green and yellow cable is assigned either to the RS-485 or SDI-12 interface. The selection is carried out during setup via the OTT Parsivel user software ASDO or a terminal program. Both of these wires are assigned to the RS-485 interface at the factory.

Parallel operation of the pulse output with either the RS-485 or the SDI-12 interface is possible to a limited extent. With this operating type, the OTT Parsivel<sup>2</sup> does not send the pulse at intervals of one minute but at the time interval set for sample intervals on the datalogger or PC.

## 7.1 Connecting the OTT Parsivel<sup>2</sup> to an OTT netDL IP datalogger using the RS-485 interface

The measured values determined by the OTT Parsivel<sup>2</sup> can be called and stored via the OTT netDL IP datalogger.

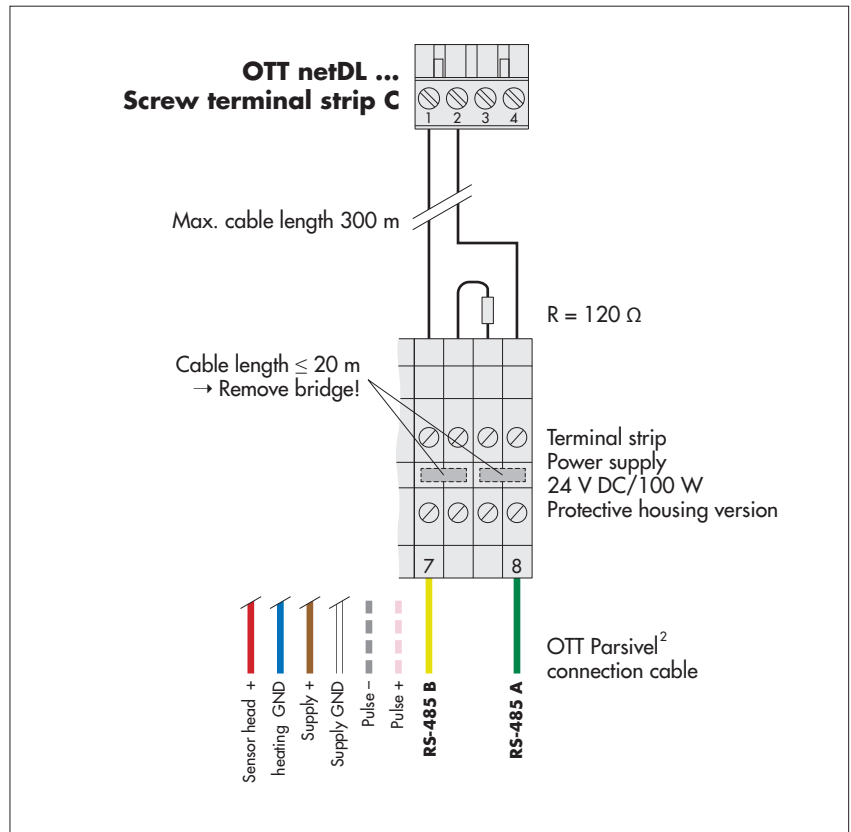
- To do so, connect the OTT Parsivel<sup>2</sup> as shown in Fig. 7 to the OTT netDL using the RS-485 interface.

Fig. 7: Connecting the OTT Parsivel<sup>2</sup> to the OTT netDL via the RS-485 interface.

The figure shows the example connection using the terminal strip of an OTT power supply (accessory).

In addition, the four wires of the voltage supply (sensor head heating: red + blue; electronics: brown + white) must be connected to the power supply; see Chapter 9.

Likewise connect the two wires of the pulse output to the terminal strip. For this application, however, they are not connected further.

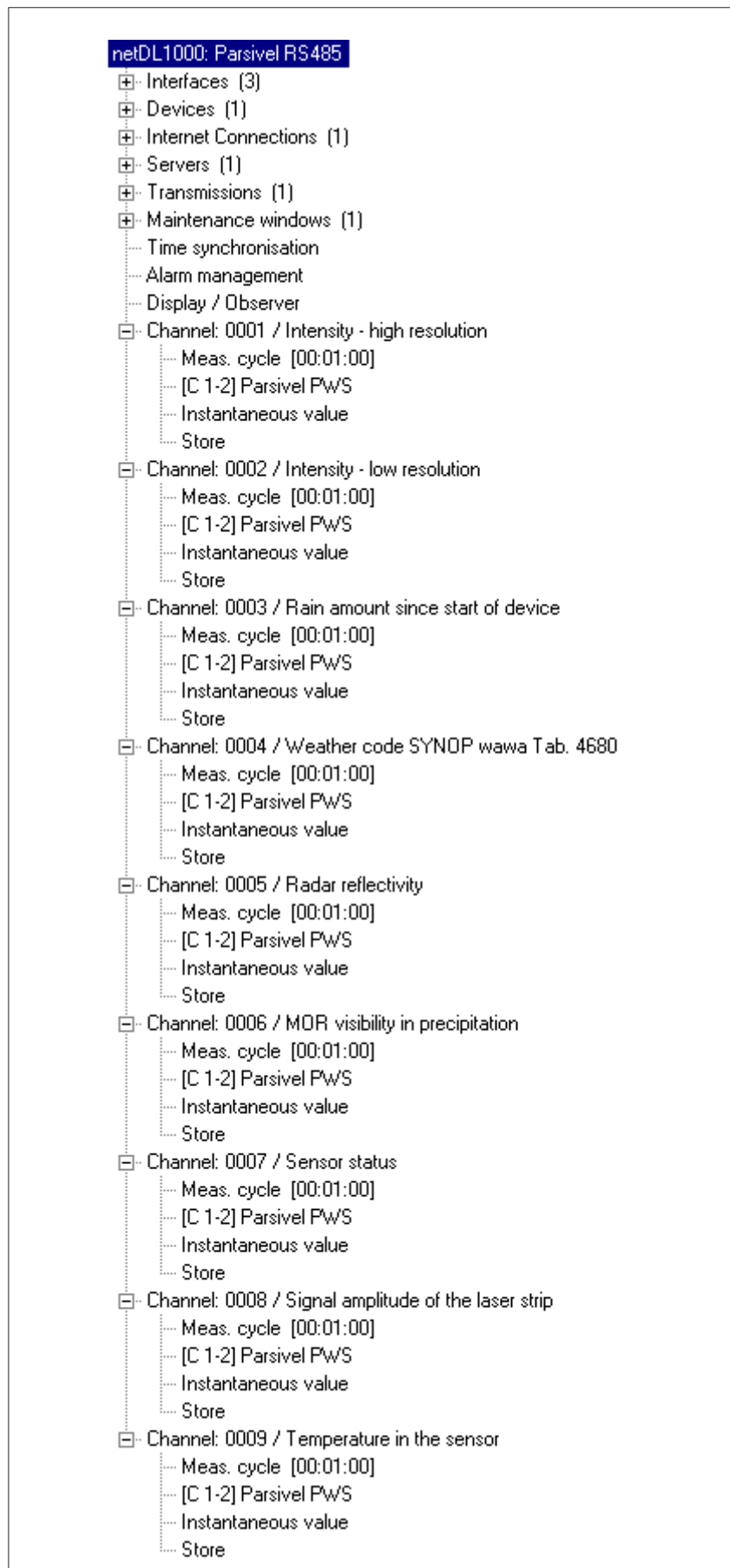


### Configuring the OTT netDL IP datalogger for RS-485 communication

To call the data from the OTT Parsivel<sup>2</sup> with the OTT netDL and to store them, a configuration must be set up in the OTT netDL. Figure 8 shows an OTT netDL example configuration for communication via the RS-485 interface. See also the operating instructions for the "OTT netDL IP datalogger".

Note that the measurement cycle must be set up with the same value in all channels set up in the OTT Parsivel<sup>2</sup>.

Fig. 8: Configuration example of an OTT netDL connected to an RS-485 interface.





## 7.2 Connecting the OTT Parsivel<sup>2</sup> to a datalogger via an SDI-12 interface

If a datalogger is used that is connected via an SDI-12 interface, the datalogger functions as a master, and specifies the measurement time and sample interval of the OTT Parsivel<sup>2</sup>. The measurement time must be  $\geq 1$  min in this case in order for the OTT Parsivel<sup>2</sup> to collect sufficient data during winter operation as well to allow for the precise assignment of precipitation type.

To make the OTT Parsivel<sup>2</sup> capable of communicating for an SDI-12 interface, the OTT Parsivel<sup>2</sup> must first be connected to a PC via the USB interface. The SDI-12 interface can be switched to active through the Parsivel user software ASDO or using a terminal program and the command "CS/S/E/1<CR>" (see operating instructions for OTT Parsivel user software ASDO and Chapter 11 "Operating the OTT Parsivel<sup>2</sup> with a terminal software").

For a detailed description of SDI-12 commands refer to Annex B.

### Connecting the OTT Parsivel<sup>2</sup> to a datalogger using an SDI-12 interface (general)

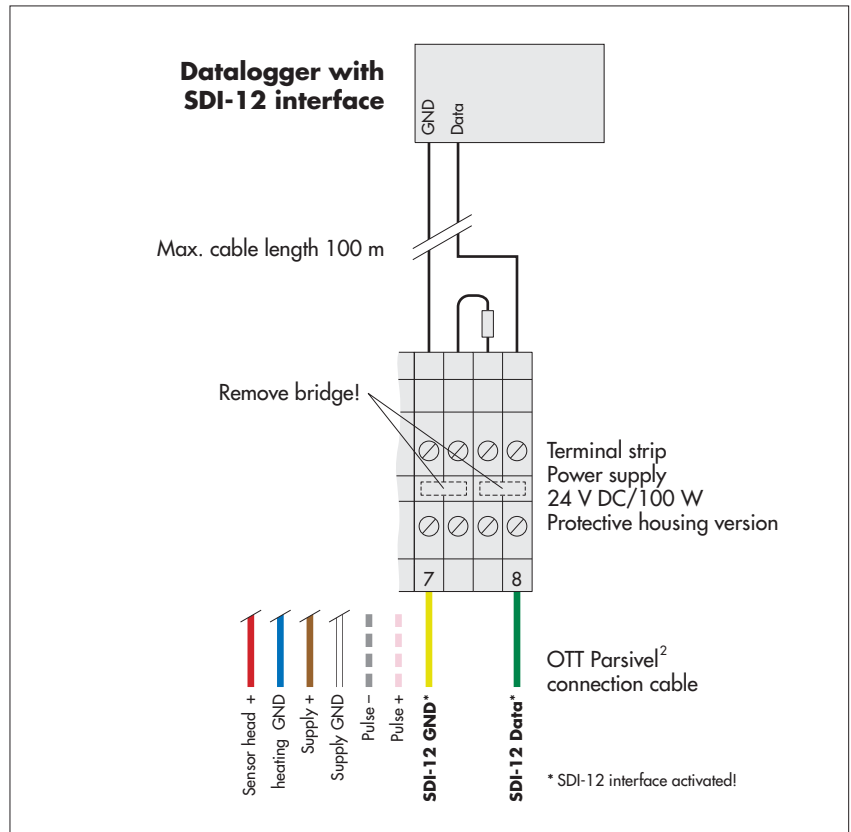
- Connect the OTT Parsivel<sup>2</sup> to any datalogger as shown in Fig. 10 via the SDI-12 interface.

Fig. 9: Connecting the OTT Parsivel<sup>2</sup> to a datalogger via the SDI-12 interface.

The figure shows the example connection using the terminal strip of an OTT power supply (accessory).

In addition, the four wires of the voltage supply (sensor head heating: red + blue; electronics: brown + white) must be connected to the power supply; see Chapter 9.

Likewise connect the two wires of the pulse output to the terminal strip. For this application, however, they are not connected further.



## Connecting the OTT Parsivel<sup>2</sup> to an OTT netDL IP datalogger via the SDI-12 interface

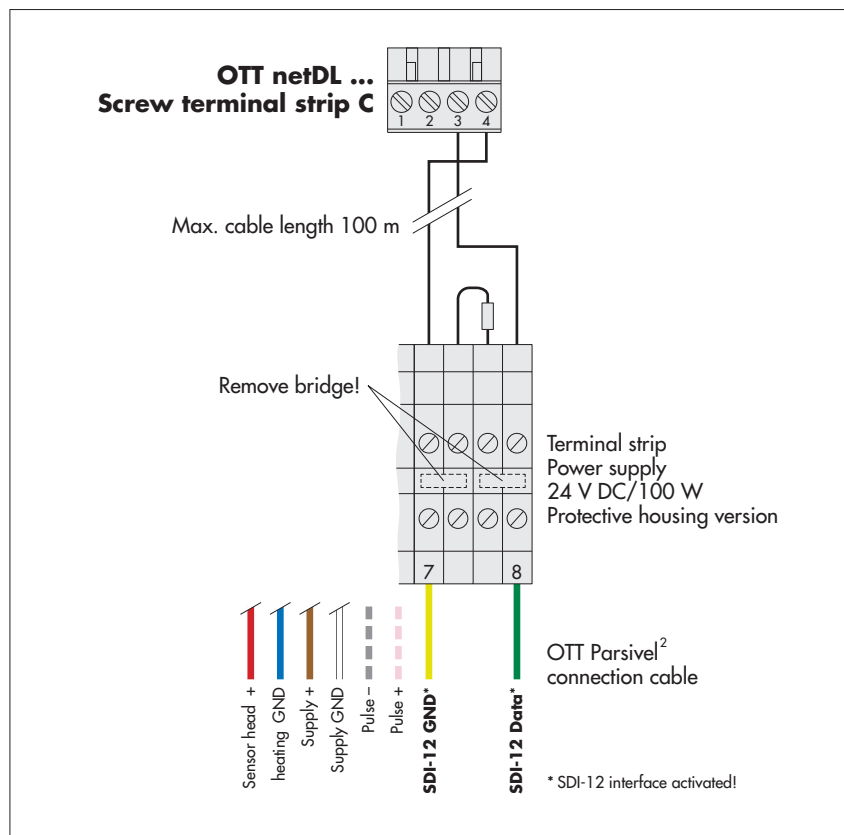
- Connect the OTT Parsivel<sup>2</sup> as shown in Fig. 10 to the OTT netDL using the SDI-12 interface:

Fig. 10: Connecting the OTT Parsivel<sup>2</sup> to an OTT netDL via the SDI-12 interface.

The figure shows the example connection using the terminal strip of an OTT power supply (accessory).

In addition, the four wires of the voltage supply (sensor head heating: red + blue; electronics: brown + white) must be connected to the power supply; see Chapter 9.

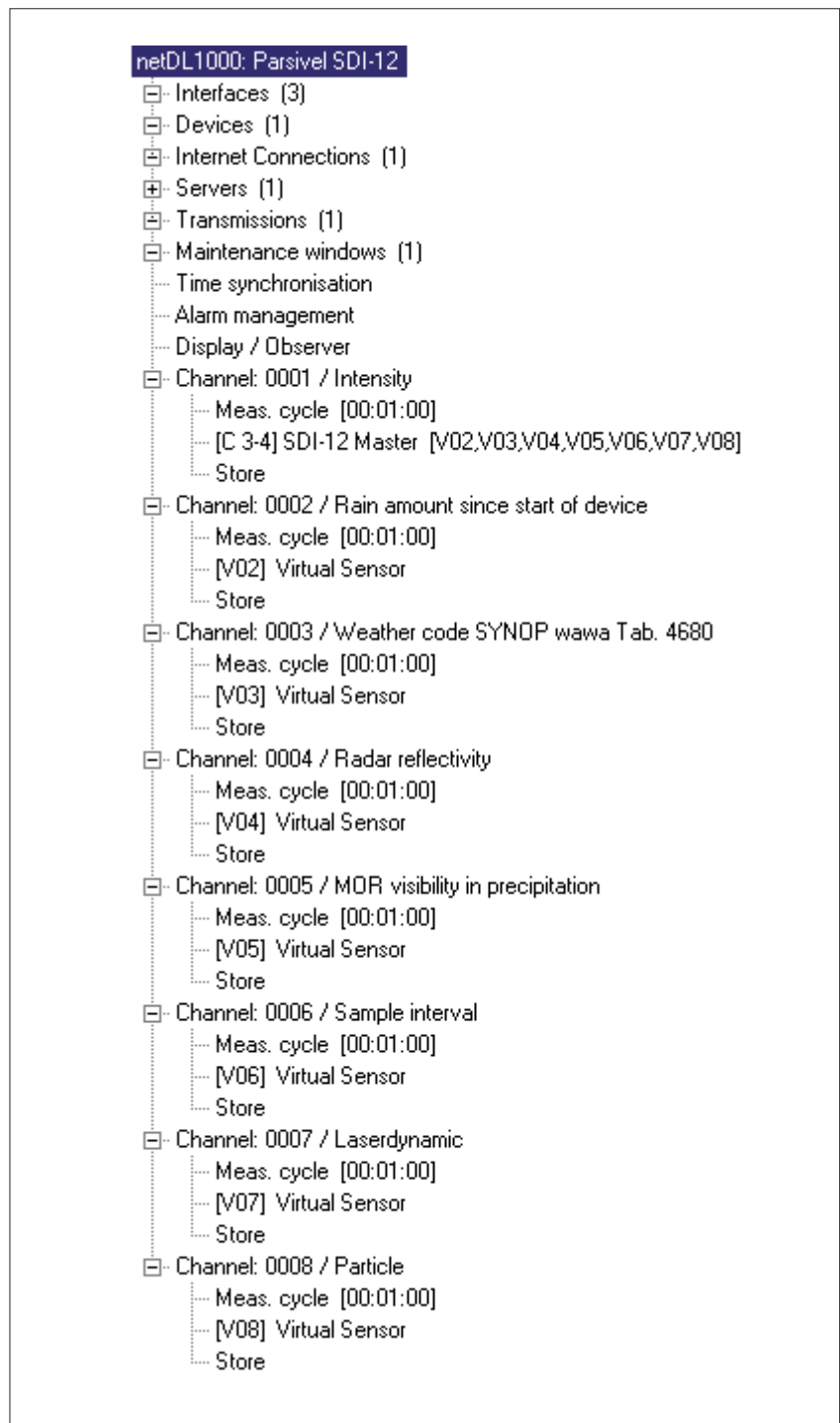
Likewise connect the two wires of the pulse output to the terminal strip. For this application, however, they are not connected further.



## Configuring the OTT netDL IP datalogger for SDI-12 communication

To call the data from the OTT Parsivel<sup>2</sup> with the OTT netDL and to store them, a configuration must be set up in the OTT netDL. Figure 11 shows an OTT netDL example configuration for communication via the SDI-12 interface. See also the operating instructions for the "OTT netDL IP datalogger ...". Note that the measurement cycle must be set up with the same value in all channels set up in the OTT Parsivel<sup>2</sup>, and that no "instantaneous value" can be stored in any of the channels of the OTT netDL configuration, as false measurements can arise otherwise.

Fig. 11: Configuration example of an OTT netDL connected to an SDI-12 interface.



### 7.3 Connecting the OTT Parsivel<sup>2</sup> to a datalogger with pulse input

#### Pulse input

The rainfall amount can be detected in a manner similar to rain collectors according to the tipping bucket principle using pulse input to a datalogger. For the pulse output of the OTT Parsivel<sup>2</sup>, the following values apply:

Pulse output duration: 250/25 ms  
 Pulse voltage: 0 V (max. 100 mA)  
 Open circuit voltage: 5 ... 28 V  
 Resolution: 0.1 mm/pulse, output frequency 2 Hz  
 0.01 mm/pulse, output frequency 20 Hz

You can set the resolution with the OTT Parsivel software ASDO or alternatively using a terminal software. Notes on setting these parameters can be found in Appendix A "CS command set" or in the "OTT Parsivel software ASDO" operating instructions.

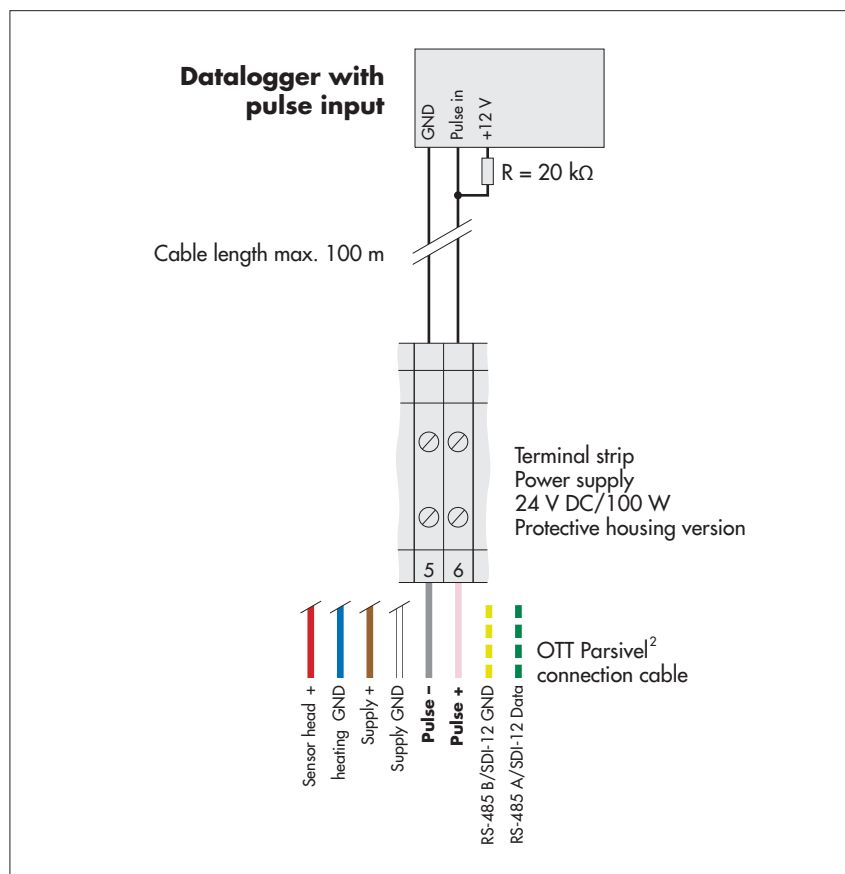
- Connect the OTT Parsivel 2 as follows to the datalogger with pulse input:

Fig. 12: Connecting the OTT Parsivel<sup>2</sup> to the datalogger with pulse input.

The figure shows the example connection using the terminal strip of an OTT power supply (accessory).

In addition, the four wires of the voltage supply (sensor head heating: red + blue; electronics: brown + white) must be connected to the power supply; see Chapter 9.

Likewise connect the two wires of the RS-485/SDI-12 interface to the terminal strip. For this application, however, they are not connected further.



## 8 Connecting the OTT Parsivel<sup>2</sup> to a PC

The OTT Parsivel<sup>2</sup> contains an RS-485 interface. Depending on whether your PC has an RS-232 or USB interface, a corresponding interface converter must be used that provides automatic conversion between the OTT Parsivel<sup>2</sup> and the PC. Here we recommend using the RS-485/USB interface converters from our list of accessories.

If you want to use the RS-232-interface of a PC, you have to buy a suitable RS-485/RS-232 interface converter from a specialist dealer. (As RS-232-interfaces are not common anymore for new PCs, OTT HydroMet does not offer RS-485/RS-232 interface converters as accessories anymore).

To connect the OTT Parsivel<sup>2</sup> to your PC, proceed as follows:

- Connect the RS-485 interface of the OTT Parsivel<sup>2</sup> to the interface converter used (see Chapter 8.1 or 8.2).
- Connect the interface converter to the PC.
- Start the OTT Parsivel software ASDO <sup>1)</sup> or a terminal program on the PC (such as "Hyperterminal").
- Configure and operate the OTT Parsivel<sup>2</sup> with the OTT Parsivel software ASDO (see also manual "OTT Parsivel software ASDO") or alternatively with a terminal software (see also Chapter 11 "Operating the OTT Parsivel<sup>2</sup> with a terminal software").

<sup>1)</sup> under Microsoft Windows 10 administrator rights are required!

### 8.1 Connecting the OTT Parsivel<sup>2</sup> to the RS-485/USB interface converter

The RS-485/USB interface converter (accessory; see Chapter 2) can be set for 2-wire communication as well as 4-wire communication.

#### Setting the dip switches at the interface converter

■ Set the external dip switches at the interface converter as follows:

Operating mode	1	2	3	4
RS-485, 2-wire, without echo, automatic control, termination on	OFF	ON	OFF	ON

#### 2-wire communication

■ Connect the OTT Parsivel<sup>2</sup> as follows to the 5-pin terminal of the interface converter:

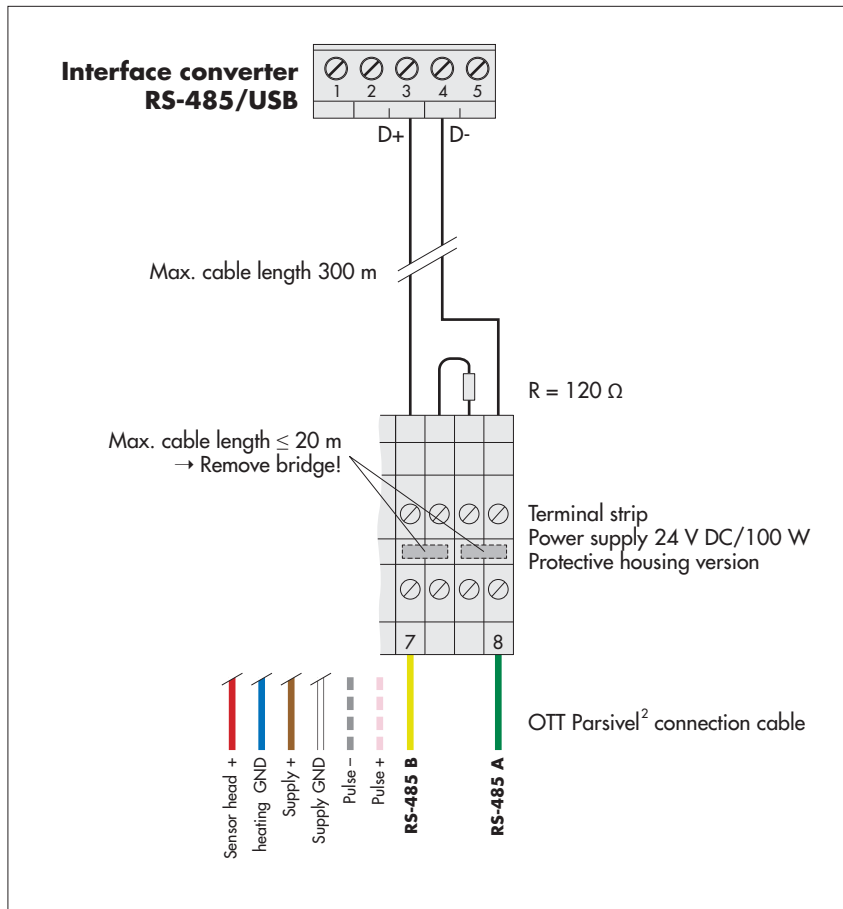
Fig. 13: Connecting the OTT Parsivel<sup>2</sup> to an RS-485/USB interface converter.

The figure shows the example connection using the terminal strip of an OTT power supply (accessory).

In addition, the four wires of the voltage supply (sensor head heating: red + blue; electronics: brown + white) must be connected to the power supply; see Chapter 9.

Likewise connect the two wires of the pulse output to the terminal strip. For this application, however, they are not connected further.

The power supply for the interface converter comes from the USB interface.



### 8.2 Connecting the OTT Parsivel<sup>2</sup> to any RS-485 interface converter

When using an interface converter that can not be purchased as an accessory from OTT HydroMet, the following must absolutely be adhered to:

- ▶ Interface converters must be configured in the "automatic send/receive control" mode for 2-wire connections through software commands without hardware handshake cables and "Echo-Off"!
- ▶ The interface converter must be galvanically isolated!

### 8.3 Connecting the OTT Parsivel<sup>2</sup> to a PC for configuring using a USB interface

If you do not want to work with the factory settings of the OTT Parsivel<sup>2</sup> and read out the data only with a datalogger, it is necessary to configure the OTT Parsivel<sup>2</sup> before its first use using the OTT Parsivel software ASDO Basic<sup>1)</sup> or a terminal program. To do so, the OTT Parsivel<sup>2</sup> is temporarily connected to a PC with a USB interface.

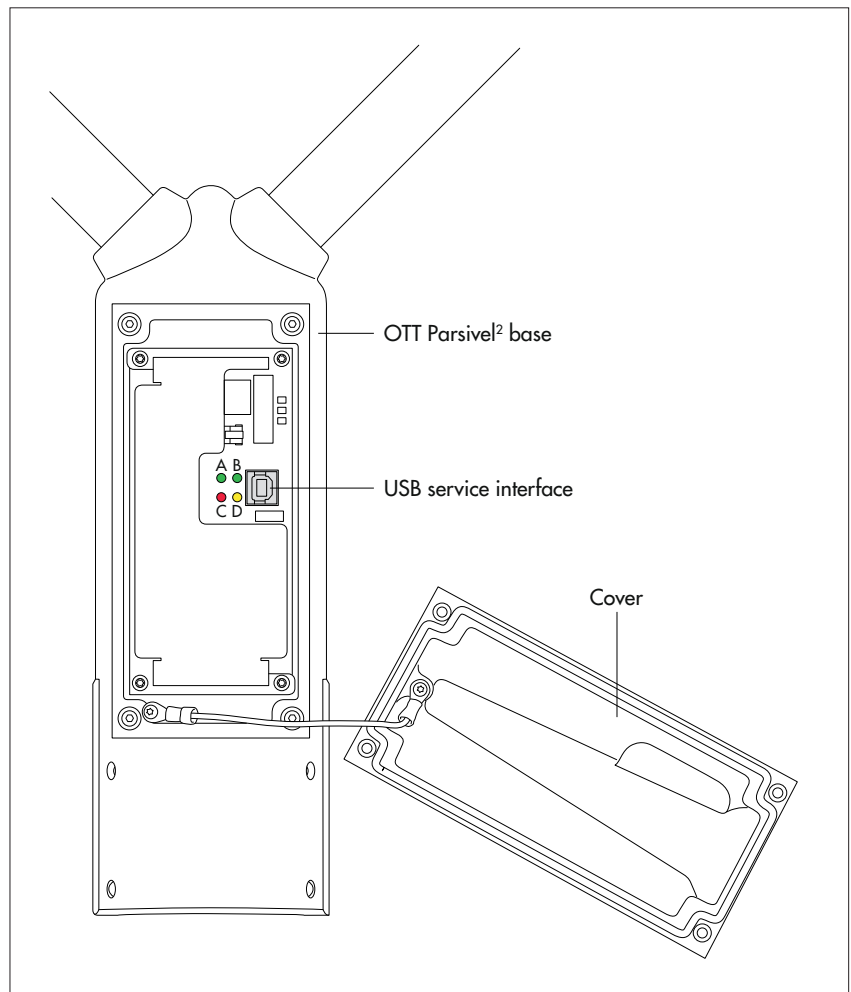
**Please note:** The OTT Parsivel<sup>2</sup> is not supplied with power via the USB interface! As in normal measurement operation, the power supply is from an additionally connected power supply (brown and white wire of the connection cable).

#### Connecting the OTT Parsivel<sup>2</sup> to a PC via USB interface:

(Requirements: USB interface drivers are installed; see below)

Fig. 14: Position of the USB service interface in the OTT Parsivel<sup>2</sup> base.

- Meaning of the LEDs:
- A** (green): Communication via RS-485/SDI interface active
  - B** (green): USB interface active
  - C** (red): an error has occurred
  - D** (yellow): particle recognized



- Remove the cover of the OTT Parsivel<sup>2</sup> base (Allen key, 4 mm).
- Connect the USB cable to a USB interface of the PC (USB plug type A).
- Connect the USB cable to service interface of the OTT Parsivel<sup>2</sup> (USB plug type B; see Fig. 14).
- Start the OTT Parsivel Software ASDO Basic<sup>1)</sup> or terminalsoftware on your PC and make the required settings.

<sup>1)</sup> under Microsoft Windows 10 administrator rights are required!

- After completion, disconnect the connection between PC and OTT Parsivel<sup>2</sup>.
- Replace the cover on the OTT Parsivel<sup>2</sup> base; ensure that you do not kink or jam the cable in the process!

### Installing the USB interface driver

For establishing a communication link over the USB interface, the PC requires a dedicated USB interface driver. Depending on the operating system used, proceed as follows when connecting OTT Parsivel<sup>2</sup> to the PC for the first time:

- Windows **7/8**: install OTT USB-Schnittstellentreiber manually
- Windows **10**: the operating system usually automatically installs a universal Microsoft USB interface driver (if necessary: install OTT USB interface driver manually)

#### Windows 7/8 <sup>1)</sup>

- Log on to the PC with administrator rights.
- Connect the OTT Parsivel<sup>2</sup> to a USB interface of the PC, see above → the PC detects the new hardware and displays the message<sup>2)</sup>: "Found New Hardware – OTT Parsivel<sup>2</sup>" → the "Found New Hardware Wizard" opens.
- Select "No, not this time".
- Select "Next".
- Select "Install from a list or specific location (Advanced)".
- Select "Next".
- Insert the "OTT Parsivel<sup>2</sup> Software" CD-ROM into PC drive<sup>3)</sup>.
- Select "Search for the best driver in these locations" and "Search removable media (CD-ROM, ...)".
- Select "Next" → the assistant installs the OTT USB interface driver. After completing the installation process, the message "The software for the following hardware has been installed: OTT PARSIVEL2" appears.
- Select "Next". Now a communication link via the USB interface may be established.

#### Windows 10 <sup>4)</sup>

- Log on to the PC with administrator rights.
- Insert the "OTT Parsivel<sup>2</sup> Software" CD-ROM into PC drive<sup>3)</sup>.
- Connect the OTT Parsivel<sup>2</sup> to a USB interface of the PC, see above.
- If an installation wizard starts: cancel the installation wizard.
- Start Windows device manager (right click on start menu and select "Device Manager").
- Click on "Serial USB Device (COMx)" under "Ports (COM & LPT)".
- Click on "Install Driver" in the "Driver" tab.
- Click on "Browse my computer for driver software".
- Click on "Browse", navigate to the OTT USB Interface Driver directory on the CD, and click "OK".
- Click "Next" → the operating system installs the OTT USB interface driver on the PC.

#### Notes:

- ▶ The USB interface cannot be used as a permanent connection between your PC and the OTT Parsivel<sup>2</sup>.
- ▶ When using the USB interface, the OTT Parsivel<sup>2</sup> does not send any data via the SDI-12/RS-485 interface or the pulse output.

<sup>1)</sup> description based on Windows 7; with small differences also valid for Windows 8

<sup>2)</sup> in the notification area of the taskbar

<sup>3)</sup> alternatively, download OTT USB interface driver from „[www.ott.com/resources/](http://www.ott.com/resources/)“

<sup>4)</sup> if manual installation is required



## 9 Connecting the OTT Parsivel<sup>2</sup> to a power supply

OTT HydroMet offers two power supplies (accessory) for the power source:

- ▶ Power supply 24 V DC/100 W; protective housing version
- ▶ Power supply 24 V DC/100 W; control cabinet version

The connection of the power supply is made with an 8-core, prepared connection cable (accessory). If required, you can extend the cable. More information on this can be found in Chapter 6.1 "Cable selection".

### WARNING



### Risk of electric shock!

- ▶ Only connect power supplies if you have the required electrical knowledge!
- ▶ For all work on the power supply: Always ensure the mains cables are off-circuit and secure them against switching back on.

- Connect the power supply to the OTT Parsivel<sup>2</sup> as shown in Figures 15 or 16.

Fig. 15: Connecting power supply control cabinet version to the OTT Parsivel<sup>2</sup>.

Install the power supply in the control cabinet on a standard top hat rail.

For optimum running of the cable, in the area where the cable enters the control cabinet a terminal strip should be used.

When using the RS-485 interface, the total cable length between the OTT Parsivel<sup>2</sup> and the datalogger may be a maximum of 20 meters! Otherwise, a 120 Ohm terminator is necessary on the OTT Parsivel<sup>2</sup> between the yellow and green wires!

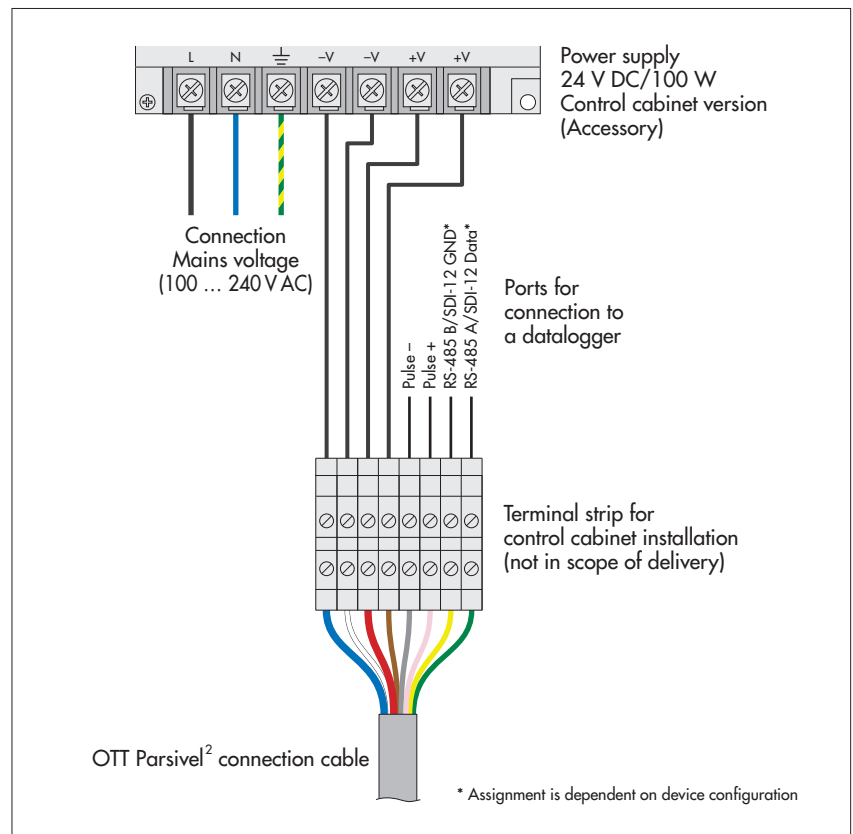
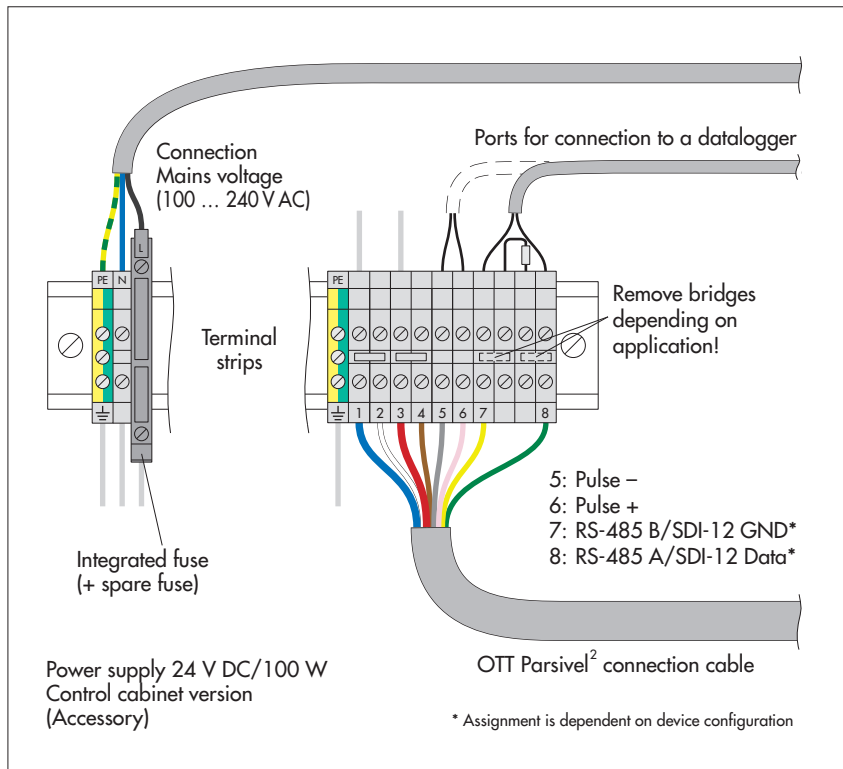


Fig. 16: Connecting power supply protective housing version to the OTT Parsivel<sup>2</sup>.

Install the power supply onto the pedestal of the OTT Parsivel<sup>2</sup> using the bolts and nuts supplied. In this case, the connection cable has a length of one meter. Feed it through the hole in the leg and one of the three cable connections on the inside of the power supply.



## 10 Heating the OTT Parsivel<sup>2</sup>

### 10.1 Sensor head heating

An automatic sensor head heating system prevents ice buildup on the sensor heads. A temperature sensor in the sensor head measures the temperature each second. The sensor head heating system adjusts according to this value

The purpose is to hold the sensor heads at a constant temperature of at least +10 °C. If the outside temperature drops below +10 °C, the sensor head heating current is switched on until +10 °C is reached again in the sensor heads. The heating control can be adapted to the respective climatic conditions.

**Note:**

Enable the sensor head heating in any case if the OTT Parsivel<sup>2</sup> is used at temperatures below +4 °C! We recommend a power supply of 24V DC to provide for unlimited heating functionality in all climatic conditions (resulting heating current of 4 A).

You can set the sensor head heating performance (operating mode, minimum temperature) with the OTT Parsivel software ASDO or alternatively using a terminal software. Notes on setting these parameters can be found in Appendix A "CS command set" or in the "OTT Parsivel software ASDO" operating instructions".

### 10.2 Screen heating

Inlet and outlet openings of the laser beam in the sensor heads are each covered by one glass screen. The formation of condensation (thawing) on the glass screens is possible, depending on the climate conditions at the installation location. In most cases, the formation of condensation will affect the measurements.

To prevent thawing, the screens of the OTT Parsivel<sup>2</sup> are equipped with a screen heating which may be switched off. The screen heating can either be used separately or together with the sensor head heating. Compared to the sensor head heating, power consumption of the screen heating is very low.

In principle, if there is a risk of thawing, we recommend to turn the screen heating on, especially in case the sensor head heating is turned off (factory setting: ON).

A typical application to turn the screen heating on/sensor head heating off would be a limited power supply of the OTT Parsivel<sup>2</sup>; e.g. if the system is running on solar power supply.

You can set the screen heating performance (ON/OFF, threshold temperature, minimum heating power, maximum heating power) with the OTT Parsivel software ASDO or alternatively using a terminal software. Notes on setting these parameters can be found in Appendix A "CS command set".

## 11 Operating the OTT Parsivel<sup>2</sup> with a terminal software

### 11.1 Setting up communications between the OTT Parsivel<sup>2</sup> and the terminal program

The OTT Parsivel<sup>2</sup> provides a USB interface for communication. This serial interface can be operated at various baudrates. Communication with the sensor is possible with any standard terminal software. Below, operation using the terminal software program "Hyper Terminal" is described since this is a part of Microsoft Windows<sup>®</sup> scope of delivery.

In order to operate OTT Parsivel<sup>2</sup> using Hyper Terminal, proceed as follows:

- Connect the OTT Parsivel<sup>2</sup> to your PC as described in Chapter 8 "Connecting the OTT Parsivel<sup>2</sup> to a PC".
- Start Hyper Terminal.
- After starting Hyper Terminal, the window "Connection Description" opens. Enter a name for the connection, select an arbitrary symbol and confirm your input with "OK". The next window "Connect to" now opens.
- Select the COM interface of your PC and confirm your input with "OK". The next window that opens is "Properties of COM [No.]".
- Enter the following connection settings:

Bits per second:	19200
Databits:	8
Parity:	none
Stopbits:	1
Flow control:	none

After a successful connection with the OTT Parsivel<sup>2</sup> is made, it sends a "!" as an input prompt after pressing the enter key:

```
BOOTLOADER PARSIVEL
```

after approx. 10 seconds, the following message appears:

```
*** PARSIVEL 2 ***  
OTT HYDROMET GmbH  
Copyright (C) 2016  
Version: V2.10.0
```

Approximately 60 seconds after starting to establish the connection, the OTT Parsivel<sup>2</sup> starts measuring automatically and outputs the data telegram.

### 11.2 Measured value numbers

The measurements and status values are output from the OTT Parsivel<sup>2</sup> in the form of a telegram. To this end, each value that can be output was assigned a measurement number. In addition, the number of digits that the value in the telegram can contain, the form in which this value is output, the covered range and in what unit it is precisely defined. These specifications are listed in the following table:

No.	Description	Digits	Form	Range	Unit
01	Rain intensity (32 bit <sup>1)</sup> )	8	0000.000	0.000 ... 9999.999	mm/h
02	Rain amount accumulated (32 bit <sup>1)</sup> )	7	0000.00	0.00 ... 0300.00	mm
03	Weather code acc. to SYNOP w <sub>g</sub> w <sub>g</sub> ; Table 4680	2	00	00 ... 99	
04	Weather code acc. to SYNOP ww; Table 4677	2	00	00 ... 99	
05	Weather code METAR/SPECI w'w'; Table 4678	5	+RASN		
06	Weather code according to NWS	4	RLS+		
07	Radar reflectivity (32 bit <sup>1)</sup> )	6	00.000	-9.999 ... 99.999	dBz
08	MOR visibility in precipitation	5	00000	0 ... 20000	m
09	Sample interval	5	00000	0 ... 03600	s
10	Signal amplitude of the laser strip	5	00000	0 ... 99999	1
11	Number of particles detected and validated	5	00000	0 ... 99999	1
12	Temperature in the sensor housing	3	000	-99 ... 100	°C
13	Sensor serial number	6	123456		
14	Firmware IOP version number	6	2.02.3		
15	Firmware DSP version number	6	2.02.3		
16	Sensor head heating current	4	0.00	0.00 ... 4.00	A
17	Power supply voltage	4	00.0	0.0 ... 30.0	V
18	Sensor status	1	0	0 ... 3	see Chapt. 12.1
19	Date/time measuring start	19	00.00.0000_00:00:00	DD.MM.YYYY_hh:mm:ss	
20	Sensor time	8	00:00:00	hh:mm:ss	
21	Sensor date	10	00.00.0000	DD.MM.YYYY	
22	Station name	10	XXXXXXXXXX		
23	Station number	4	XXXX		
24	Rain amount absolute (32 bit <sup>1)</sup> )	7	000.000	0.000 ... 999.999	mm
25	Error code	3	000		
26	Temperature PCB	3	000	-99 ... 100	°C
27	Temperature in the right sensor head	3	000	-99 ... 100	°C
28	Temperature in the left sensor head	3	000	-99 ... 100	°C
30	Rain intensity (16 bit <sup>1)</sup> ) max. 30.000 mm/h	6	00.000	0.000 ... 30.000	mm/h
31	Rain intensity (16 bit <sup>1)</sup> ) max. 1200.0 mm/h	6	0000.0	0.0 ... 1200.0	mm/h
32	Rain amount accumulated (16 bit <sup>1)</sup> )	7	0000.00	0.00 ... 0300.00	mm
33	Radar reflectivity (16 bit <sup>1)</sup> )	5	00.00	-9.99 ... 99.99	dBz
34	Kinetic energy	7	000.000	0.000 ... 999.999	J/(m <sup>2</sup> h)
35	Snow depth intensity (volume equivalent)	7	0000.00	0.00 ... 9999.99	mm/h
60	Number of all particles detected	8	00000000	0 ... 8192	1
61	List of all particles detected (including size and particle speed)	13	00.000;00.000	0.200 ... 25.000; 0.20 ... 20.000	mm;m/s
90	Field N (d) 1. Value = average volume equivalent diameter (ved) of the 1. class	223	00.000S	-9.999 ... 99.999	log <sub>10</sub> (1/m <sup>3</sup> mm)
91	Field v (d) 1. Value = average particle speed (ps) of the 1. class	223	00.000S	0.000 ... 99.999	m/s
93	Raw data (volume equivalent diameter) 1. Value = number of particles 1. ved/1. ps ... 32. Value = number of particles 32. ved/1. ps; 33. Value = number of particles 1. ved/2. ps ... 64. Value = number of particles 32. ved/2. ps; 65. Value = ...	4095	000S	0 ... 999	1

<sup>1)</sup> depending on which datalogger is used, the measured value number must be selected with the corresponding number of bits. S = Separator

**Note:** Other values in the telegram which are not included in this list are intended exclusively for service purposes. Please ignore them.

### 11.3 Defining the formatting string

There are various strings available to tailor the format of the existing data protocol to your individual requirements. These must be individually assigned to each measurement number in the data telegram.

#### Formatting control codes

String:	Meaning:
/n	Line feed
/r	Return
/s	Start transmission
/e	End transmission

#### Formatting individual measured values

String:	Meaning:
%04	Output measured value No. 4

#### Formatting fields

String:	Meaning:
%90;	Output data field no. 90 with ";" as a separator Other signs can be used as well as a separator.

### 11.4 OTT telegram

The following telegram configuration has been preset at the factory:

```
%13;%01;%02;%03;%07;%08;%34;%12;%10;%11;%18;/r/n
```

According to this configuration, the measurement values are displayed as in the following example:

```
200248;000.000;0000.00;00;-9.999;9999;025;15759;00000;0;
```

According to the table in Chapter 11.2, the data protocol is thus defined as follows:

Meas. value No.	Meas. value	Definition
13	200248	Sensor serial number
01	000.000	Rain intensity
02	0000.00	Rain amount since start of device
03	00	Weather code according to SYNOP $w_a w_a$ (see Appendix D "Categorization of precipitation type by precipitation codes")
07	-9.999	Radar reflectivity
08	9999	MOR visibility in the precipitation
34	000.00	Kinetic energy
12	025	Temperature in the sensor housing
10	15759	Signal amplitude of the laser strip
11	00000	Number of particles detected and validated
18	0	Sensor status

## 11.5 Updating OTT Parsivel<sup>2</sup> firmware

OTT HydroMet provides the latest update versions to OTT software on its internet site at [www.ott.com](http://www.ott.com) under the rubric "Software updates". The following file is needed to update the OTT Parsivel<sup>2</sup> firmware:

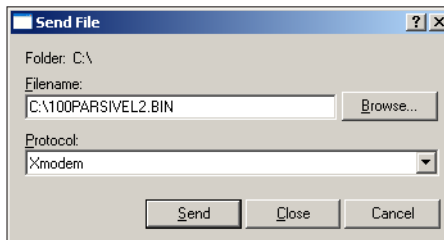
► \*IOP.BIN

where \* represents the respective version number.

To update the OTT Parsivel<sup>2</sup> firmware, proceed as follows:

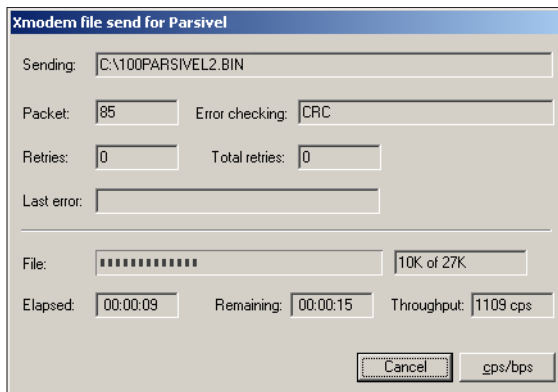
- Connect your PC to the OTT Parsivel<sup>2</sup> via the corresponding interface converter as described in Chapter 8.
- Load the newest update of the OTT Parsivel<sup>2</sup> firmware onto your computer from the OTT home page.
- Start a terminal software program on your PC and make the appropriate settings as described in Chapter 11.1 "Setting up communications between the OTT Parsivel<sup>2</sup> and the terminal software".
- After OTT Parsivel<sup>2</sup> has started measurement operations and has issued a data telegram, reset the OTT Parsivel<sup>2</sup> firmware with the command CS/Z/1<CR>. OTT Parsivel<sup>2</sup> answers with "Bootloader OTT Parsivel<sup>2</sup>".
- Press <CR> repeatedly directly after the message. OTT Parsivel<sup>2</sup> replies with "?".
- Input the command sup <CR>. OTT Parsivel<sup>2</sup> answers with "Start upload Firmware with XMODEM/CRC".
- Select "Transfer | Send file" in the menu bar. The "Send file" window opens:

Fig. 17: "Send file" window.



- Select the file "\*IOP.BIN" under "Filename" using the "Browse" button; you had previously stored this file on your PC.
- Select the "Xmodem" protocol type from the "Protocol" selection window.
- Confirm your input with "Send". The "Xmodem file send for OTT Parsivel<sup>2</sup>" window opens:

Fig. 18: "Xmodem file send for OTT Parsivel<sup>2</sup>" window.



The data transfer runs and the window closes automatically after the data transfer has finished.

- After the window has closed, input the command RUN <CR> to start OTT Parsivel<sup>2</sup>. The firmware was successfully updated.



## 12 Maintenance / Verification

! **Please follow Safety instructions (see chapter 4) when installing the OTT Parsivel<sup>2</sup>!**

### 12.1 Cleaning the screens

Inlet and outlet openings of the laser beam in the sensor heads are each covered by one glass screen. Depending on the time of year and location, air pollution can lead to contamination of these screens. This can result in a drop in the sensor dynamics. The last value (Sensor status) of the OTT telegram provides a reference concerning the current state of the optics, wherein the following error codes are reported:

- 0 = Everything OK
- 1 = Screens are dirty, but measurements are still possible
- 2 = Screens are dirty, partially covered. No further usable measurements are possible.
- 3 = Laser damaged

It is a good idea to clean the laser optics beginning at Status 1. OTT HydroMet recommends that the screens be cleaned at least semiannually, regardless of the messages.

To clean the screens, proceed as follows:

- Clean the screens on the sensor heads from the outside with a soft cloth.

### 12.2 Keeping the light pathway open

At regular intervals, remove all impediments, such as leaves, branches or spider webs that are in the way of the light pathway.

### 12.3 Cleaning the splash protection unit

---

#### **CAUTION Risk of injury!**



When working on the splash protection unit, there is a danger of injury from sharp edges!

- ▶ Take care when working on the splash protection unit!
- ▶ Wear gloves as necessary!



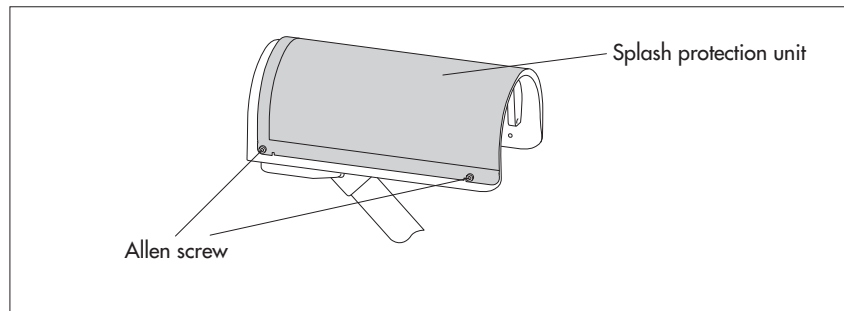
#### **Danger of damaging the device!**

The splash protection unit can bend easily!

- ▶ Clean the splash protection unit on a level surface!

A splash protector is attached to each sensor head of the OTT Parsivel<sup>2</sup>. The splash protector has many small holes that break up incident raindrops so that no secondary spectra are detected in the laser beam due to splashing. As soon as the holes are plugged by bird droppings, pollen or similar material, the drops can no longer be broken up and the splash protector has to be cleaned.

Abb. 19: Splash protection unit.



Clean the splash protector as follows:

- Loosen the four hex screws of the respective splash protector using an M4 hex key and remove the splash protector.
- Clean the splash protector using a brush and commercially available household cleanser on both sides under running water.
- Reinstall the splash protector onto the respective sensor head using the hex screws.

If the splash protector can no longer be cleaned or if it is defective, it can be purchased as a replacement part from OTT HydroMet (see Chapter 2 "Part numbers").

#### 12.4 Verifying particle size measurements

If there is any doubt in relation to the plausibility of the measurement values determined by the OTT Parsivel<sup>2</sup>, you can perform an approximate verification in the field (or in a laboratory). Reference spheres (e.g. steel spheres) with known diameters are required here; alternatively, a reference drop dispenser is used. The reference spheres must fall through the centre of the laser strip within a measurement interval of 60 seconds. (Reference spheres falling through the edge of the laser strip must be avoided.)

##### Example:

In each case, 15 steel spheres ( $\varnothing$ : 1, 2.5 and 4 mm) fall individually, from a height of 0.25 m, through the centre of the laser strip. The list<sup>1)</sup> that is output must contain all 30 objects and their respective classes for both the diameter and the particle speed. The particle speed is approx. 2.21 m/s. (Resulting classes: diameter: 9, 15/16, 18/19; particle speed: 16)

<sup>1)</sup> measurement value number 31, see Chapter 11.2

##### Observe the following:

- ▶ Such verification is representative only when using a device to precisely specify the particle speed and the falling path (centre of the laser strip). In addition, a collecting device must be used below the sensor heads to prevent damage to the struts and base of the OTT Parsivel<sup>2</sup>.
- ▶ This method of verification permits only an approximate statement. In case of doubt, we recommend inspecting the OTT Parsivel<sup>2</sup> in the factory. A precision test stand is available for this purpose. The results are documented in an acceptance test certificate (FAT; Factory Acceptance Test).

## 13 Functional disruptions and remedies

### 13.1 OTT Parsivel<sup>2</sup> does not start

- Check the polarity of the power supply, the A+B connections of the RS-485 cables and the baud rate (see Ch. 6 and 7).
- If this does not work, start any terminal software program on your PC (e.g. Hyper Terminal) and try to make a connection to OTT Parsivel<sup>2</sup> (see Ch. 11 "Operating the OTT Parsivel<sup>2</sup> with a terminal software"). The OTT Parsivel<sup>2</sup> should send a status message of "ok" in response to the "CS/<CR>" command. If this does not happen, contact OTT Hydroservice.

### 13.2 Disruptions due to convection and vibrations

In rare cases, intense sun can affect the sensor due to the high sensitivity of the device; this is caused by refractive index fluctuations (mirage effects) in connection with wind. The same applies to vibrations. Most of these types of disruptions are recognized and removed through formal analysis of the signals. Nevertheless, some disruption signals cannot be differentiated from the signals of small particles. Further examinations of the particle collective over the respective reporting period help to prevent precipitation reports during good weather for the most part.

## 14 Note about the disposal of old units



### Within the member countries of the European Union

In accordance with the European Union guideline 2002/96/EC, OTT takes back old devices within the member countries of the European Union and disposes of them in an appropriate way. The devices concerned by this are marked with the symbol shown aside. (WEEE registration number: 49590817.)

- For further information on the return procedure, please contact your local sales contact. You will find the addresses of all sales partners in the internet on "www.ott.com". Please take into consideration also the national implementation of the EU guideline 2002/96/EC of your country.

### For all other countries

- Dispose of the OTT Parsivel<sup>2</sup> properly after taking out of service.
- Observe the regulations valid in your country for the disposal of electronic devices.
- Never put the OTT Parsivel<sup>2</sup> into the normal household waste.

### Used materials

see Chapter 15, "Technical Data"

## 15 Technical data

Optical sensor laser diode	
Wavelength	650 nm
Output power (peak)	0.2 mW
Laser class	1 (IEC/EN 60825-1:2014)
Light strip surface (W x D)	30 x 1 mm
Measuring surface (W x D)	180 x 30 mm
Measuring range	
Particle size of liquid precipitation	0.2 ... 8 mm
Particle size of solid precipitation	0.2 ... 25 mm
Particle speed	0.2 ... 20 m/s
Design	32 precipitation size classes 32 particle speed classes
Radar reflectivity Z	-9.999 ... 99.999 dBz
Kinetic energy	0 ... 999.999 J/(m <sup>2</sup> h)
Outputs	Weather code: - SYNOP w <sub>0</sub> w <sub>0</sub> Table 4680, - SYNOP ww Table 4677, - NWS - METAR/SPECI w'w' Table 4678 differentiation of the precipitation types drizzle, rain, hail, snow > 97 % compared to a weather observer Snow depth intensity (volume equivalent) Measurement range 0 ... 20 000 m
Visibility in precipitation (MOR)	
Rain rate	
Minimum intensity	0.001 mm/h drizzle rain
Maximum intensity	1,200 mm/h
Accuracy	±5 % (liquid) / ±20 % (solid) <sup>1)</sup>
De-icing protection	Microprocessor controlled sensor head heating
Power supply	10 ... 28 V DC, reverse polarity protection Optimum heating output of the sensor head heating system can be guaranteed with a power supply voltage of at least 20 V DC.
Current drawn	
Electronics	110/55 mA at 12/24 V DC
Electronics + screen heating	275/235 mA at 12/24 V DC
Sensor head heating	max. 4 A at 24 V DC <sup>2)</sup> max. 2 A at 12 V DC <sup>3)</sup>
Interfaces	RS 485 (EIA-485) 1,200 ... 57,600 Baud half-duplex, 2-wire SDI-12 USB OTT Parsivel <sup>2</sup> has an output relay for pulse output for precipitation in 0.1 mm/pulse with max. 2 Hz pulse rate
Electromagnetic tolerance	fulfills EN 61326-1:2013, CE compliant
Lightening protection	integrated
Material	powder-coated aluminum housing
Weight	max. 6.4 kg
Temperature range	-40 ... +70 °C
Relative humidity	0 ... 100 %
Max. wind speed without device damage	50 m/s
Protection	IP 65, resistant to salt spray
Size (H x W x D)	670 x 600 x 114 mm

<sup>1)</sup> under laboratory conditions and statistically correlated by OTT calibration system with reference particle calibration of 0.5; 1.0; 2.0 and 4.0 mm

<sup>2)</sup> power output ≥ 100 W necessary

<sup>3)</sup> not recommended

## Appendix A – CS command set

CS/F/1<CR>

With this command, all factory settings can be recreated.

---

CS/I/<parameter><CR>

Adjust sample interval and start transfer

In automatic mode, the sample interval can be adjusted in seconds with this command. After confirmation of the command, the first data set is output.

Value range: 0; 10 ... 3600

Factory setting: 30

If the value "0" is entered for the sample interval, the Polling mode is enabled.

---

CS/P<CR>

Enabling polling mode

OTT Parsivel<sup>2</sup> issues a data telegram no later than 500 ms after receiving the command. This command disables the interval-controlled telegram.

---

CS/PA<CR>

Output all measurement values (in accordance with the table in Chapter 11.2).

This data sequence is necessary for the import into the OTT Parsivel software ASDO.

---

CS/R<CR>

Repeat polling mode

OTT Parsivel<sup>2</sup> outputs the data telegram no later than 500 ms after the confirmation of the command.

---

CS/R/xx<CR>

Output individual measurements

After confirmation of the command, the indicated measurement is output according to the table in Chapter 11.2 "Measured value numbers".

---

CS/C/R/<parameter><CR>

Adjust baudrate

**Warning:** Changing the baudrate can lead to loss of the connectivity!

The baudrate can be adjusted from 9600 ... 115200. The baudrate is set at 19200 at the factory.

1200 baud, 8, N, 1	2400 baud, 8, N, 1
4800 baud, 8, N, 1	9600 baud, 8, N, 1
19200 baud, 8, N, 1	38400 baud, 8, N, 1
57600 baud, 8, N, 1	

---

CS/C/R<CR>

Query baudrate

With this command, the current baudrate setting can be queried.

---

CS/C/B/<parameter><CR>

Setting up RS-485 bus mode

**Warning:**

Enabling the bus mode can cause the loss of the connectivity!

With this command, it is possible to operate more than one sensor through one RS-485 interface. The sensors are then operated via the bus address.

Value range: 0 ... 1

Factory setting: 0

Description: 0 = RS-485 bus mode disabled

1 = RS-485 bus mode enabled

Address query: \*<CR>

Answer: <Address><CR><LF>

---

CS/C/A/<parameter><CR>

Set bus address for RS-485 bus mode

**Warning:** Changing the bus address can cause the loss of the connectivity!

Value range: 0 ... 9

Factory setting: 0

---

CS/T/12:00:00<CR>

Adjust time of day

The time of day of the OTT Parsivel<sup>2</sup> is set to the time of day of the PC.

---

CS/D/01.01.2000<CR>

Adjust date

The date of the OTT Parsivel<sup>2</sup> is set to the calendar of the PC.

---

CS/S/E/<parameter><CR>

Set SDI-12 mode

Enable or disable the SDI-12 mode.

Value range: 0 ... 1

Factory setting: 0

Description: 0 = SDI-12 mode disabled

1 = SDI-12 mode enabled

---

CS/S/A/<parameter><CR>

Set bus address for SDI-12 bus mode

This command sets the bus address for the SDI-12 bus mode.

Value range: 0 ... 9

Factory setting: 0

---

CS/K/xxxxxxxxxx<CR>

Input station name

This command allows a user-specific station name to be used. This name can encompass a maximum of 10 characters.

CS/K/PWS00001<CR>

Station name: PWS00001

---

CS/J/xxxx<CR>

Assign station ID

This command assigns a 4-digit station ID.

---

CS/M/M/<parameter><CR>

Select data telegram

The data telegram can be input with the parameters 0 ... 1

Value range: 0 ... 1

Factory setting: 0

Description: 0 = OTT telegram

1 = User telegram

---

CS/M/S/<parameter><CR>

Set formatting string

You can create a data telegram that is optimized according to your needs. This command sets the formatting string. The formatting string is placed in the <parameter> spot (see also Chapter 11.3 "Defining the formatting string").

---

CS/Z/1<CR>

Restart sensor, reset the rain amount

CS/L<CR>

Output current configuration

---

CS/?<CR>

This command outputs the command list.

---

CS/H/M/<parameter><CR>

This command adjusts the operating mode of the sensor head heating.

Value range: 0, 1, 3  
Factory setting: 1  
Description: 0 = OFF  
1 = Automatic operation  
(Sensor head heating is always on whenever the temperature in the sensor heads falls below the adjustable minimum temperature)  
3 = Sensor head heating continuously ON

---

CS/H/T/<parameter><CR>

Set minimum temperature of the sensor heads

If the temperature in the sensor heads is lower than the adjusted value, the sensor head heating in operating mode 1 will be active until the minimum temperature is reached.

Value range: -40 ... +40 °C  
Factory setting: 10 °C

---

CS/H/N/<parameter><CR>

This command turns the screen heating ON or OFF

Value range: 0, 1  
Factory setting: 1  
Description: 0 = OFF  
1 = Screen heating is continuously ON and works with minimum or maximum heating power, depending on the temperature of the housing.

---

CS/H/U/<parameter><CR>

Set threshold temperature for screen heating.

If the temperature of the OTT Parsivel<sup>2</sup> housing falls below the adjusted value, the the screen heating works with maximum heating power; if the temperature of the housing is higher than the adjusted value, it works with minimum heating power. The minimum/maximum heating power is each adjusted by a separate CS-command.

Value range: -40 ... +40 °C  
Factory setting: +10 °C

---

CS/H/Q/<parameter><CR>

Set minimum heating power of the screen heating

Value range: 0 ... 100 %  
Factory setting: 25 %

---

CS/H/P/<parameter><CR>

Set maximum heating power of the screen heating

Value range: 0 ... 100 %  
Factory setting: 100 %

---

CS/U/01.01.2011 10:55:11<CR>

Set real time clock

This command sets the real time clock of the OTT Parsivel<sup>2</sup>.

---

CS/U<CR>

Read out real time clock

With this command the current date and time of the OTT Parsivel<sup>2</sup> is read out.

Response: 01.01.2011 10:55:11 (example)

---

CS/\*/D/<parameter><CR>

Activate/deactivate "Parsivel<sup>1</sup>) Communication Mode"

With this command the OTT Parsivel<sup>2</sup> telegram (see Chapter 11.2 and 11.4) is set to the format of the previous generation of Parsivel.

This is required if you are using the OTT Parsivel<sup>2</sup> in a measuring network, together with one/several Parsivel<sup>1</sup>) unit/s and the telegram/s of all units has/have to be identical.

Range of values: 0, 1

Factory setting: 0 (→ OTT Parsivel<sup>2</sup> telegram)

Description: 0 = Parsivel<sup>1</sup>) Communication Mode deactivated

1 = Parsivel<sup>1</sup>) Communication Mode activated

For a description of the Parsivel<sup>1</sup>) telegram refer to the "Operating instructions Present Weather Sensor Parsivel" (70.200.005.B.E).

<sup>1</sup>) predecessor model of OTT Parsivel<sup>2</sup>

---

CS/\*/X/<parameter><CR>

Activate/deactivate smear suppression

A heat haze (also known as a heat shimmer) occurs across hot surfaces if ascending atmospheric layers of different temperatures, and therefore different atmospheric densities, are present. Smear suppression compensates against the effect of a heat haze on measurement values.

Range of values: 0, 1

Factory setting: 1

Description: 0 = Smear suppression deactivated

1 = Smear suppression activated



## Appendix B – SDI-12 commands and responses

### B.1 Basic commands

All SDI-12 basic commands are implemented in the OTT Parsivel<sup>2</sup>. The following SDI-12 basic commands are relevant for the operation of the OTT Parsivel<sup>2</sup>:

Command	Response	Description
<b>a!</b>	<b>a&lt;CR&gt;&lt;LF&gt;</b>	Acknowledgement active a – Sensor address; factory setting = 0
<b>aI!</b>	<b>a13ccccccmmmmmm ... ... vvvxxxxxx&lt;CR&gt;&lt;LF&gt;</b>	Send identification a – Sensor address 13 – SDI-12 protocol version ccccccc – Manufacturer's identification (company name) mmmmmm – Sensor identification vvv – Sensor version (firmware) xxxxxx – Serial number Response OTT Parsivel <sup>2</sup> = 013OTT____PARS_2202123456
<b>aAb!</b>	<b>b&lt;CR&gt;&lt;LF&gt;</b>	Change sensor address a – Old sensor address b – New sensor address
<b>?!</b>	<b>a&lt;CR&gt;&lt;LF&gt;</b>	Query sensor address a – Sensor address
<b>aM!</b>	<b>atttn&lt;CR&gt;&lt;LF&gt;</b> and after 9 seconds <b>a&lt;CR&gt;&lt;LF&gt;</b>	Start measurement a – Sensor address ttt – Time in seconds until the sensor has determined the measurement result Response OTT Parsivel <sup>2</sup> = 009 n – Number of measured values Response OTT Parsivel <sup>2</sup> = 8 <b>a&lt;CR&gt;&lt;LF&gt;</b> – Service request
<b>aD0!</b>	<b>a&lt;value1&gt;&lt;value2&gt;&lt;value3&gt; ... ... &lt;value4&gt;&lt;value5&gt;&lt;value6&gt; ... ... &lt;CR&gt;&lt;LF&gt;</b>	Send data – Part 1 (after <b>aM!</b> , <b>aMC!</b> , <b>aC!</b> , <b>aCC!</b> ) a – Sensor address <b>&lt;value1&gt;</b> – Rain intensity [mm/h] Measured value format: <b>pbbbb.eee</b> Range: +0.000 ... +9999.999 mm/h <b>&lt;value2&gt;</b> – Rain amount accumulated [mm] Measured value format: <b>pbbb.ee</b> Range: +0.00 ... +300.00 mm <b>&lt;value3&gt;</b> – Weather code according to SYNOP w <sub>0</sub> w <sub>1</sub> Table 4680 Measured value format: <b>pbb [1]</b> Range: +00 ... +99 <b>&lt;value4&gt;</b> – Radar reflectivity [dBz] Measured value format: <b>pbb.eee</b> Range: -9.999 ... +99.999 dBz <b>&lt;value5&gt;</b> – MOR visibility in precipitation [m] Measured value format: <b>pbbbbbb</b> Range: +0 ... +20000 m <b>&lt;value6&gt;</b> – Sample interval [s] Measured value format: <b>pbbbb</b> Range: +0 ... +3600 s  p – Sign (+,-) b – Number (before decimal point) Output without leading zeros! e – Number after decimalpoint

Command	Response	Description
aD1!	a<value7><value8><CR><LF>	<p>Send data – Part 2 (after aM!, aMC!, aC!, aCC!)</p> <p>&lt;value7&gt; – Signal amplitude of the laser strip [1] Measured value format: pbbbb Range: +0 ... +99999</p> <p>&lt;value8&gt; – Number of particles detected and validated [1] Measured value format: pbbbb Range: +0 ... +99999</p> <p>p – Sign (+) b – Number (before decimal point) Output without leading zeros! e – Number after decimal point</p>
aMC!	atttn<CR><LF> and after 9 seconds a<CR><LF>	<p>Start measurement and request CRC (Cyclic Redundancy Check); for details see command aM!.</p> <p>The responses to the following aD0! and aD1! commands are extended by one CRC value: &lt;value1&gt;&lt;value2&gt;&lt;value3&gt;&lt;value4&gt;&lt;value5&gt; ... ... &lt;value6&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt; or a&lt;value7&gt;&lt;value8&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt;</p>
aC!	atttn<CR><LF>	<p>Start concurrent measurement (simultaneous measurement with multiple sensors on one single bus line); for details see command aM!. The number of measured values in the response to this command has two digits: nn = 02.</p>
aCC!	atttn<CR><LF>	<p>Start concurrent measurement (simultaneous measurement with multiple sensors on one single bus line) and request CRC (Cyclic Redundancy Check); for details see command aM!. The number of measured values in the response to this command has two digits: nn = 02.</p> <p>The responses to the following aD0! and aD1! commands are extended by one CRC value: a&lt;value1&gt;&lt;value2&gt;&lt;value3&gt;&lt;value4&gt;&lt;value5&gt; ... ... &lt;value6&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt; or a&lt;value7&gt;&lt;value8&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt;</p>
aM1!	atttn<CR><LF> and after 9 seconds a<CR><LF>	<p>Start additional measurement</p> <p>a – Sensor address ttt – Time in seconds until the sensor has determined the measurement result Response OTT Parsivel<sup>2</sup> = 009 n – Number of measured values Response OTT Parsivel<sup>2</sup> = 8 a&lt;CR&gt;&lt;LF&gt; – Service request</p>
aD0!	a<value1><value2><value3> ... ... <value4><value5><value6> ... ... <CR><LF>	<p>Send data – Part 1 (after aM1!, aMC1!, aC1!, aCC1!)</p> <p>a – Sensor address</p> <p>&lt;value1&gt; – Kinetic energy [J/(m<sup>2</sup>h)] Measured value format: pbbb.eee Range: +0.000 ... +999.999 J/(m<sup>2</sup>h)</p> <p>&lt;value2&gt; – Snow depth intensity [mm/h] Measured value format: pbbbb.ee Range: +0.00 ... +9999.99 mm/h</p> <p>&lt;value3&gt; – Weather code according to SYNOP ww Table 4677 Measured value format: pbb [1] Range: +00 ... +99</p> <p>&lt;value4&gt; – Temperature PCB [°C] Measured value format: pbbb Range: -99 ... +100 °C</p>

Continued on page 42

Command	Response	Description
		<p>&lt;value5&gt; – Temperature in the right sensorhead [°C] Measured value format: <b>pbbb</b> Range: -99 ... +100 °C</p> <p>&lt;value6&gt; – Temperature in the left sensorhead [°C] Measured value format: <b>pbbb</b> Range: -99 ... +100 °C</p> <p><b>p</b> – Sign (+,-) <b>b</b> – Number (before decimal point) Output without leading zeros! <b>e</b> – Number after decimal point</p>
<b>aD1!</b>	<b>a</b> <value7><value8> ... ... <value9><CR><LF>	<p>Send data – Part 2 (after <b>aM1!</b>, <b>aMC1!</b>, <b>aC1!</b>, <b>aCC1!</b>)</p> <p>&lt;value7&gt; – Sensor status [1] (see Chapt. 12.1) Measured value format: <b>pb</b> Range: +0 ... +3</p> <p>&lt;value8&gt; – Sensor head heating current [A] Measured value format: <b>pb.ee</b> Range: +0.00 ... +4.00 A</p> <p>&lt;value9&gt; – Power supply voltage [V] Measured value format: <b>pbb.e</b> Range: +0.0 ... +30.0 V</p> <p><b>p</b> – Sign (+) <b>b</b> – Number (before decimal point) Output without leading zeros! <b>e</b> – Number after decimal point</p>
<b>aMC1!</b>	<b>atttn</b> <CR><LF> and after 9 seconds <b>a</b> <CR><LF>	<p>Start additional measurement and request CRC (Cyclic Redundancy Check); for details see command <b>aM1!</b>. The responses to the following <b>aD0!</b> and <b>aD1!</b> commands are extended by one CRC value: <b>a</b>&lt;value1&gt;&lt;value2&gt;&lt;value3&gt;&lt;value4&gt;&lt;value5&gt; ... ... &lt;value6&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt; or <b>a</b>&lt;value7&gt;&lt;value8&gt;&lt;value9&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt;</p>
<b>aC1!</b>	<b>atttnn</b> <CR><LF>	<p>Start concurrent measurement (simultaneous measurement with multiple sensors on one single bus line); for details see command <b>aM1!</b>. The number of measured values in the response to this command has two digits: <b>nn</b> = 02.</p>
<b>aCC1!</b>	<b>atttnn</b> <CR><LF>	<p>Start concurrent measurement (simultaneous measurement with multiple sensors on one bus line) and request CRC (Cyclic Redundancy Check); for details see command <b>aM1!</b>. The number of measured values in the response to this command has two digits: <b>nn</b> = 02. The responses to the following <b>aD0!</b> and <b>aD1!</b> commands are extended by one CRC value: <b>a</b>&lt;value1&gt;&lt;value2&gt;&lt;value3&gt;&lt;value4&gt;&lt;value5&gt; ... ... &lt;value6&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt; or <b>a</b>&lt;value7&gt;&lt;value8&gt;&lt;value9&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt;</p>

Command	Response	Description
aV!	atttn<CR><LF>	Perform system test <b>a</b> – Sensor address <b>ttt</b> – Time in seconds until the sensor provides the result of the system test Response OTT Parsivel <sup>2</sup> = 000 <b>n</b> – Number of measured values Response OTT Parsivel <sup>2</sup> = 0 <b>a&lt;CR&gt;&lt;LF&gt;</b> – Service request
aD0!	a0<CR><LF>	Send data (after aV!) <b>a</b> – Sensor address <b>0</b> – no system test performed

More information on the SDI-12 basic commands can be found in the document "SDI-12; A Serial-Digital Interface Standard for Microprocessor-Based Sensors; Version 1.3" (refer to website "[www.sdi-12.org](http://www.sdi-12.org)").

## B.2 Advanced SDI-12 commands

All advanced SDI-12 commands are preceded by "O" which stands for OTT. Using these commands, the OTT Parsivel<sup>2</sup> may be configured from the Transparent Mode of a datalogger.

Command	Response	Description
▶ Set/read the unit for level/pressure measured values		
aOSE<value>!	a<value><CR><LF>	Activate SDI-12 mode <b>a</b> – Sensor address <b>&lt;value&gt;</b> – +0 = SDI-12 mode deactivated; factory setting +1 = SDI-12 mode activated

## Appendix C – Classification of precipitation types

After determining the volume equivalent diameter (D) and the particle speed (V), the OTT Parsivel<sup>2</sup> subdivides the particles into appropriate classes. The scale of this classification is smaller for small, slow particles than for large and fast particles.

### C.1 Class limits

The measured particles are subdivided into D and V classes in a two-dimensional field, wherein there are 32 different D and V classes so that there are a total of  $32 \times 32 = 1024$  classes.

#### Classification according to volume-equivalent diameter

Class number	Mid-value of class [mm]	Class spread [mm]
1	0.062	0.125
2	0.187	0.125
3	0.312	0.125
4	0.437	0.125
5	0.562	0.125
6	0.687	0.125
7	0.812	0.125
8	0.937	0.125
9	1.062	0.125
10	1.187	0.125
11	1.375	0.250
12	1.625	0.250
13	1.875	0.250
14	2.125	0.250
15	2.375	0.250
16	2.750	0.500
17	3.250	0.500
18	3.750	0.500
19	4.250	0.500
20	4.750	0.500
21	5.500	1.000
22	6.500	1.000
23	7.500	1.000
24	8.500	1.000
25	9.500	1.000
26	11.000	2.000
27	13.000	2.000
28	15.000	2.000
29	17.000	2.000
30	19.000	2.000
31	21.500	3.000
32	24.500	3.000

#### Note:

Class 1 and class 2 are limits and are not evaluated at the current time in measurements using the OTT Parsivel<sup>2</sup> since they are outside the measurement range of the device.

### Classification according to particle speed

Class number	Mid-value of class [m/s]	Class spread [m/s]
1	0.050	0.100
2	0.150	0.100
3	0.250	0.100
4	0.350	0.100
5	0.450	0.100
6	0.550	0.100
7	0.650	0.100
8	0.750	0.100
9	0.850	0.100
10	0.950	0.100
11	1.100	0.200
12	1.300	0.200
13	1.500	0.200
14	1.700	0.200
15	1.900	0.200
16	2.200	0.400
17	2.600	0.400
18	3.000	0.400
19	3.400	0.400
20	3.800	0.400
21	4.400	0.800
22	5.200	0.800
23	6.000	0.800
24	6.800	0.800
25	7.600	0.800
26	8.800	1.600
27	10.400	1.600
28	12.000	1.600
29	13.600	1.600
30	15.200	1.600
31	17.600	3.200
32	20.800	3.200

## Appendix D – Categorization of precipitation type by precipitation codes

From the classification of precipitation particles, the OTT Parsivel<sup>2</sup> calculates the rain rate. The type of precipitation is based on the number of particles within the measurement range, and the precipitation code is determined from the precipitation intensity R (in mm/h of an equivalent amount of water).

### D.1 Precipitation code according to SYNOP

The definitions of the precipitation codes below are listed according to the following tables:

- ▶ SYNOP  $w_a w_o$  Table 4680
- ▶ SYNOP  $w w$  Table 4677

<b>No precipitation</b>	Tab. 4680	Tab. 4677
	00	00

<b>Drizzle</b>			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 0.1	51	51
moderate	≥ 0.1 ... < 0.5	52	53
heavy	≥ 0.5	53	55

<b>Drizzle with rain</b>			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 2.5	57	58
moderate	≥ 2.5 ... < 10.0	58	59
heavy	≥ 10.0	58	59

<b>Rain</b>			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 2.5	61	61
moderate	≥ 2.5 ... < 10.0	62	63
heavy	≥ 10.0	63	65

<b>Rain, drizzle with snow</b>			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 2.5	67	68
moderate	≥ 2.5 ... < 10.0	68	69
heavy	≥ 10.0	68	69

<b>Snow</b>			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 1.0	71	71
moderate	≥ 1.0 ... < 4.0	72	73
heavy	≥ 4.0	73	75

<b>Snow grains</b>			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
- <sup>1)</sup>	> 0	77	77

<b>Soft hail</b>			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 1.0	87	87
mod./heavy	≥ 1.0	88	88

<b>Hail</b>			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 2.5	89	89
mod./heavy	≥ 2.5	89	90

<sup>1)</sup> no classification made

## D.2 Precipitation code according to the NWS and METAR/SPECI w'w', Table 4678

The definitions of the precipitation codes below are listed according to the following tables:

- ▶ NWS
- ▶ METAR/SPECI w'w' Table 4678

### No precipitation

		NWS	Tab. 4678
		C	NP
<b>Drizzle</b>			
Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 0.25	L-	-DZ
moderate	> 0.25 ... < 0.5	L	DZ
heavy	≥ 0.5	L+	+DZ
<b>Drizzle with rain</b>			
Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 2.5	RL-	-RADZ
moderate	> 2.5 ... < 7.6	RL	RADZ
heavy	≥ 7.6	RL+	+RADZ
<b>Rain</b>			
Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 2.5	R-	-RA
moderate	> 2.5 ... < 7.6	R	RA
heavy	≥ 7.6	R+	+RA
<b>Rain, drizzle with snow</b>			
Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 2.5	RLS-	-RASN
moderate	> 2.5 ... < 7.6	RLS	RASN
heavy	≥ 7.6	RLS+	+RASN
<b>Snow</b>			
Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 1.25	S-	-SN
moderate	> 1.25 ... < 2.5	S	SN
heavy	≥ 2.5	S+	+SN
<b>Snow grains</b>			
Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 1.25	SG	-SG
moderate	> 1.25 ... < 2.5	SG	SG
heavy	≥ 2.5	SG	+SG
<b>Soft hail</b>			
Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 1.25	SP	-GS
moderate	> 1.25 ... < 2.5	SP	GS
heavy	≥ 2.5	SP	+GS
<b>Hail</b>			
Intensity	Rain rate [mm/h]	NWS	Tab. 4678
- <sup>1)</sup>	> 0	A	GR

<sup>1)</sup> no classification made



## **Appendix E – Note on the declaration of conformity**

If required, you can download the current version of the declaration of conformity for the OTT Parsivel<sup>2</sup> from our website as a PDF file: "[www.ott.com/resources](http://www.ott.com/resources)".







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