Operating instructions
**Present Weather Sensor
Parsivel**

We reserve the right to make technical changes!
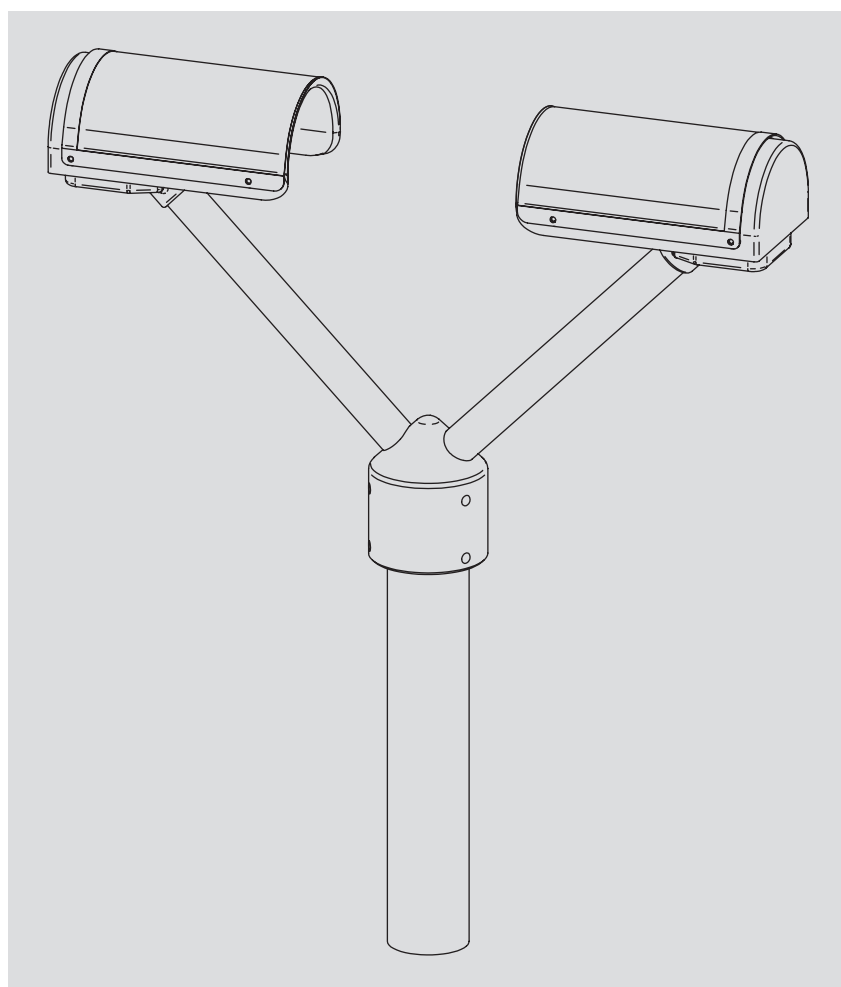
Table of contents

1 Scope of Delivery

▶ **Parsivel**
– 1 Parsivel measurement head is an optical sensor with 30 mm wide and 180 mm long light strip in the tunnel housing
– 1 Installation set with
    1 screwed terminal strip 7 slots
    7 wire end sleeves
    1 grounding cable lug
    1 flat washer
    6 M 8 X 16 grub screws
    7 M 8 X 25 grub screws
    1 M8 hex nut
    2 lock washers
    1 Allen key - 4 mm
    1 Allen key - 2.5 mm
– 1 Parsivel software ASDO Basic
– 1 set of operating instructions

2 Part Numbers

▶ **Parsivel**   **Parsivel**   70.200.005.9.0
– with 2 special spray protection units
– with installation set
– with Parsivel software ASDO Basic

▶ **Accessories**   **Interface converter**
– RS-485 / USB   97.961.091.9.5
– RS-485 / RS-232   97.970.041.9.5

Power supply Parsivel
IP 20, without mast support   97.850.011.9.5
IP 65, with mast support   97.850.012.9.5
Connecting cable Parsivel/Power supply IP 65   70.200.107.4.2
Connecting cable Parsivel/Electronic cabinet max. 100 m   97.000.038.9.5

Parsivel software ASDO for PC (full version)   56.551.001.9.7

LogoSens RS-485 termination module   70.200.803.9.5

Service Tool
consisting of
– interface converter RS-485/USB   97.970.044.9.5
– assembling cable for the interface converter   70.200.106.4.2

▶ **Replacement parts**   **Spray protection (1 piece)**   70.200.405.3.1

3 Parsivel Factory Settings

Parsivel is a flexibly configurable device concerning terminal assignment, interface parameters and heating settings, and is supplied with the following factory settings:

Operating mode:	RS-485 2-wire
Baud rate RS-485:	19,200 baud
RS-485 bus mode:	deactivated
Bus address RS-485:	0
SDI-12 interface:	deactivated
SDI-12 bus address:	0
Impulse output 0.1 mm:	activated
Status:	solid=0, liquid=1
Heating mode:	off
Data telegram:	OTT telegram (see Chapter 11.4)
Measurement interval:	30 s

The parameters can be set using Parsivel software ASDO or using a terminal software package. Information on the setting of these parameters is available in Appendix A, "CS Command Set" or in the operating instructions "Parsivel Software ASDO".

4 Safety Instructions

▶ 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 MESSTECHNIK can provided 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 Parsivel contains an embedded class 2 laser device and is a class 1/1M laser product which complies with IEC/EN 60825-1 A2:2001 (EU) / 21CFR 1040.10 and 1040.11 (USA) with the exception of laser notice LN50. Wavelength: 650 nm; output: max. 3 mW.

▶ Do not open the instrument and remove any barrier that would expose to laser beam of embedded laser class 2 device!

▶ Do not stare into the beam or view directly with optical instruments!

▶ Optical light barriers must never be removed except by OTT Service personnel. When barriers are removed, power to the Parsivel must be disconneted.

OTT Parsivel®
SN: XXXXXX

CLASS 1 LASER PRODUCT / 650 nm
Complies with 21 CFR 1040.10 and 1040.11,
with the exception of laser notice LN50
Visible Laser Radiation - Do not view directly with optical instruments

CLASS 1M LASER PRODUCT
IEC/EN 60825-1 A2:2001
Sichtbare Laserstrahlung - Nicht direkt mit optischen Geräten hineinschauen

www.ott-hydrometry.com   Made in Germany

5 Introduction

Parsivel 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 … 5 mm, for solid precipitation particles it is from 0.2 … 25 mm. In the process, precipitation particles can have a velocity 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
▶ Freezing rain
▶ 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. Parsivel issues one data telegram every 30 seconds.

5.1 Functional principle

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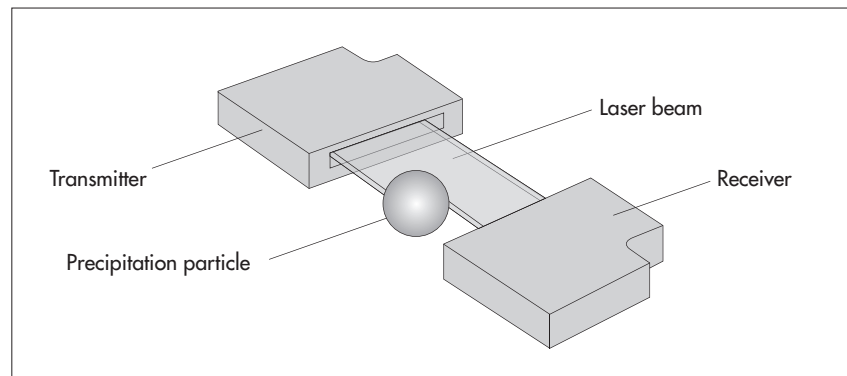
Measurement of particle size
If there are no particles in the laser beam, the maximum voltage is output at the receiver. Precipitation particles passing through the laser beam block off a portion of the beam corresponding to their diameter, thus reducing the output voltage; this determines the particle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

The Parsivel can be connected to various devices as shown in the illustration below. Refer to the respective chapters in this regard.

Parsivel

Pipe

Power supply

Signal outputs:
RS-485
SDI-12
Impulse
Status

H = Total height

Disdrometer
general: 1 m

Present Weather
Sensor Parsivel: 2 m

Chapter 8	Chapter 8	Chapter 7.1	Chapter 7.2	Chapter 7.3	Chapter 9

Cable
max. 300 m
(RS-485)

Cable
max. 300 m
(RS-485)

Cable
max. 300 m
(RS-485)

Cable
max. 70 m
SDI-12

Impulse
+ Status

SDI-12
cable length
see
chap. 6.1

Interface
converter

Interface
converter

RS-485/
2-wire

online

online

RS-232/USB

RS-232/USB

Termination module

SDI-12
data logger

data logger

power supply

– ASDO Basic

Storage without
precipitation
spectrograph

– ASDO full version

Storage with
precipitation
spectrograph

RS-485
LogoSens 2

– Hydras 3

6 Installing the Parsivel

Please follow Safty Instructions (see chapter 4) when installing the Parsivel!

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 Parsivel is mounted on a pipe. The pipe must have the following specifications:

▶ Pipe diameter 50 … 62 mm
▶ Pipe consists of an electrically conducting material and is grounded
▶ The concrete foundation of the pipe must have minimum dimensions of
   35 x 35 x 80 cm (L x W x H).

Before the Parsivel can be fastened to the standpipe, the data transmission cable and power supply must be installed.

6.1 Cable Selection

Data Transmission Cable
The Parsivel has the following signal outputs:

▶ RS-485
▶ SDI-12
▶ Impulse output
▶ Status output

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

▶ Twisted-pair cable
▶ Usage length for transfer via the RS-485 interface, max. 300 m
▶ Usage length for transfer via the SDI-12 interface, max. 70 m
▶ Cable cross section ≥ 0.5 mm^2

Power supply cable
For the 24 V power supply, we recommend a cable with a maximum resistance of 2 Ω. The maximum voltage drop at 2 A is 4 V. The cable length depends on the cable cross sectional area:

Cable cross section	max cable length
0.25 mm^2	14 m
0.5 mm^2	28 m
0.75 mm^2	42 m
1.0 mm^2	56 m
1.5 mm^2	84 m
2.5 mm^2	140 m
4.0 mm^2	225 m

6.2 Wiring the Parsivel

Proceed as follows to wire the Parsivel:

- ■ Pull the existing connection cables from the external electronic unit upward through the standpipe.
- ■ Remove the bottom cover of the sensor head, attached to the rear of which is the laser warning label. To do so, remove the two hex screws from the bottom cover using the 2.5 mm Hex key supplied.
- ■ Run the connecting cables from below through the cable gland (see Fig. 7) of the Parsivel and then through the interior of the Parsivel to the opened sensor head.
- ■ Connect the cables to the 7-slot screw terminal provided (installation set) according to the configuration of the Parsivel as described in Figures 2 through 4.

Fig. 2: Wiring assignment for a 2-wire connection with RS-485- and pulse-output. The SDI-12 connection is turned off. This terminal assignment is for standard use.

Parsivel

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Power supply GND
Power supply 11 ... 36 V DC
RS-485 2-wire B (+)
RS-485 2-wire A (–)
Digital Status
Digital Impulse
Digital GND
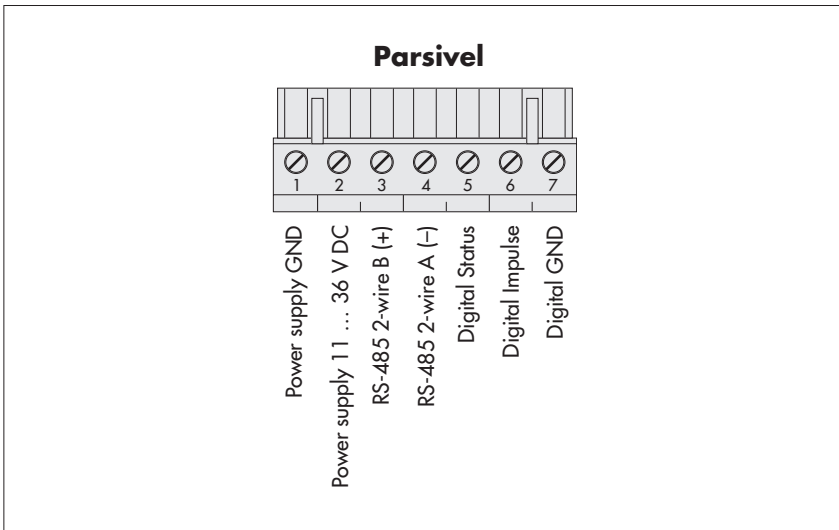
Fig. 3: Connection Assignment for a 4-wire connection with RS-485 transfer.

Parsivel

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Power supply GND
Power supply 11 ... 36 V DC
RS-485 4-wire B (+) IN
RS-485 4-wire A (–) IN
RS-485 4-wire B (+) Out
RS-485 4-wire A (–) Out

Parsivel

1	2	3	4	5	6	7

Power supply GND
Power supply 11 ... 36 V DC
RS-485 2-wire B (+)
RS-485 2-wire A (−)
SDI-12 Data
Digital Impulse
Digital GND/SDI-12 GND

■ Plug the screwed terminal strip onto the sensor head as shown in Figure 5.

Fig. 5: Plug the screw terminal strip onto the Parsivel sensor head.
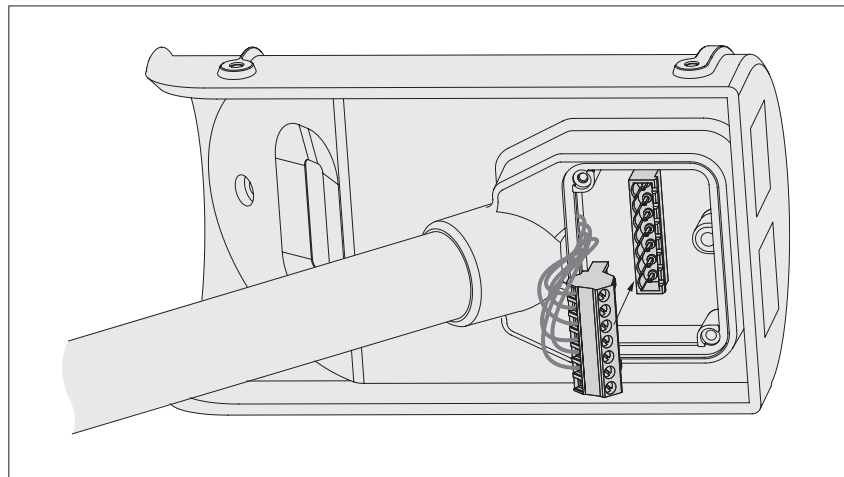
■ Re-fasten the bottom cover of the sensor head using the two Allen screws.
■ Tighten the screwed cable connection.
■ Connect the shielding to the corresponding power supply.

6.3 Grounding the Parsivel

To ground the Parsivel, 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 M8 hex nut

Also, you will need a grounding cable with a wire cross section of 16 mm^2.

In order to ground the Parsivel, proceed as follows:

- ■ Rotate the grub screw using the hex key from inside into the grounding hole (see Fig. 6) until the grub screw is flush with the inner wall inside the socket.
- ■ Place the lock washers, cable lug and washer as shown in Fig. 6 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 un-insulated end of the grounding cable between the two plates of the cable lug and re-tighten the two copper screws. The other end of the cable must be properly grounded near the Parsivel.

Fig. 6: Grounding the Parsivel. The individual parts to fasten the cable lug are included in the installation set.
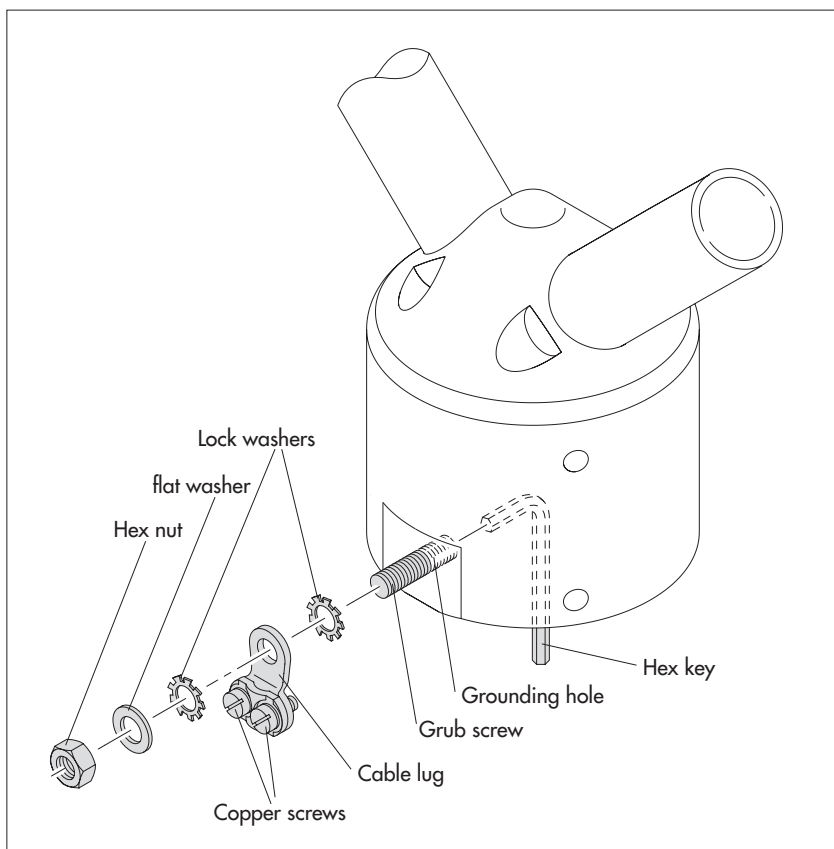
6.4 Installing the Parsivel

Proceed as follows to install the Parsivel:

- Slide the attached Parsivel downward onto the pipe.
- Orient the Parsivel 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 pipe stand, using the 4 mm hex key provided (installation set) so that the sensor head is horizontal as much as possible.

Fig. 7: Installing the Parsivel.
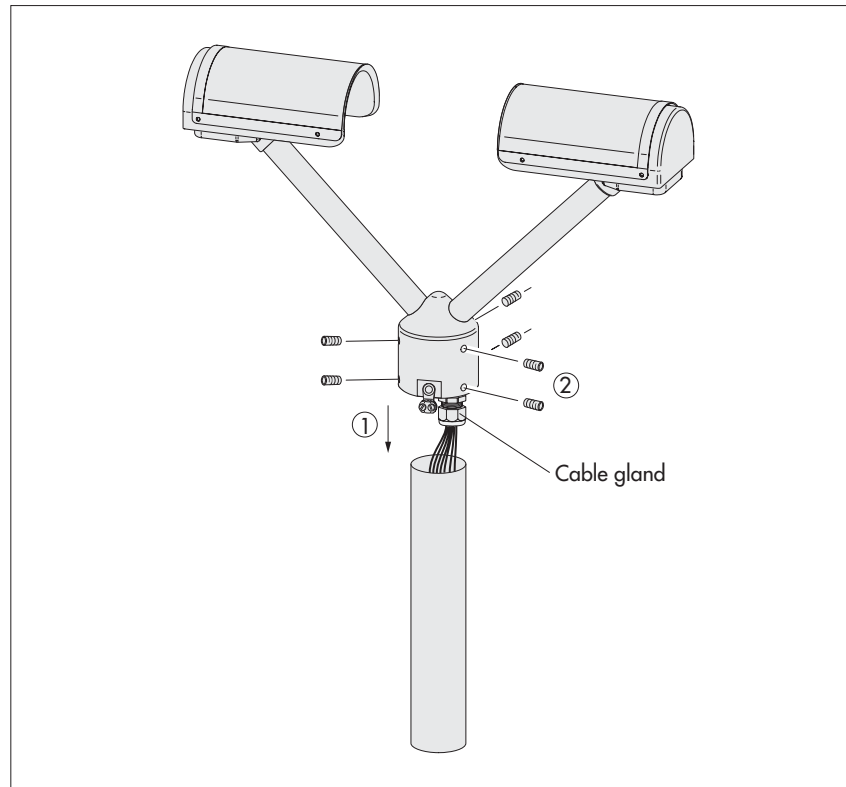
7 Connecting the Parsivel to a data logger

The Parsivel can be connected to the following data loggers:

▶ LogoSens with an RS-485 interface
▶ LogoSens with an SDI-12 interface
▶ Any data logger with an SDI-12 interface
▶ Parallel operation of a data logger with SDI-12 interface and a PC (RS-485)
▶ Data logger with impulse or status input

7.1 Connecting the Parsivel to the LogoSens Station Manager via RS-485 interface

The measured values determined by the Parsivel can be queried by the LogoSens station manager and stored.

Connect the Parsivel via the RS-485 interface to the LogoSens as shown in figure 8.

Fig. 8: Connecting the Parsivel to the LogoSens via the RS-485 interface.
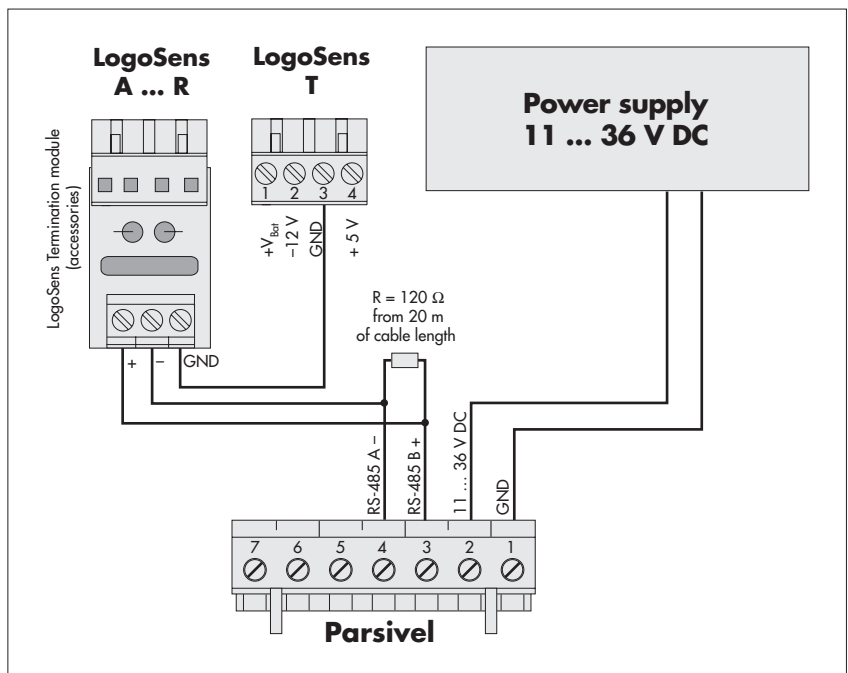
Configuring the LogoSens Station Manager for RS-485 communication
To be able to query and store the data from the Parsivel using the LogoSens, a configuration must be set up in the LogoSens. Figure 9 shows an example Logo-Sens configuration for communication via the RS-485 interface. See operating instructions of "LogoSens Station Manager" for more on this. Make sure that the measurement cycle set up in all Parsivel channels is provided with the same value.

Fig. 9: LogoSens Configuration Example
when connecting to an RS-485 interface.

```
LogoSens: Parsivel RS-485
  ┈ Communication interface COM1
  ┈ Communication interface COM2
  ┈ Alarm management
  ┈ Display / Observer
  ┈ Channel: 0001 / Rain intensity
        ┈ Meas. cycle
        ┈ [A] PARSIVEL M300
        ┈ Instantaneous value
        ┈ Store
  ┈ Channel: 0002 / Rain amount since start of device
        ┈ Meas. cycle
        ┈ [A] PARSIVEL M300
        ┈ Instantaneous value
        ┈ Store
  ┈ Channel: 0003 / Weather code SYNOP wawa Tab. 4680
        ┈ Meas. cycle
        ┈ [A] PARSIVEL M300
        ┈ Instantaneous value
        ┈ Store
  ┈ Channel: 0004 / Weather code SYNOP ww Tab. 4677
        ┈ Meas. cycle
        ┈ [A] PARSIVEL M300
        ┈ Instantaneous value
        ┈ Store
  ┈ Channel: 0005 / Radar reflectivity
        ┈ Meas. cycle
        ┈ [A] PARSIVEL M300
        ┈ Instantaneous value
        ┈ Store
  ┈ Channel: 0006 / MOR visibility in precipitation
        ┈ Meas. cycle
        ┈ [A] PARSIVEL M300
        ┈ Instantaneous value
        ┈ Store
  ┈ Channel: 0007 / Sensor status
        ┈ Meas. cycle
        ┈ [A] PARSIVEL M300
        ┈ Instantaneous value
        ┈ Store
  ┈ Channel: 0008 / Signal amplitude of the laser strip
        ┈ Meas. cycle
        ┈ [A] PARSIVEL M300
        ┈ Instantaneous value
        ┈ Store
  ┈ Channel: 0009 / Temperature in the sensor
        ┈ Meas. cycle
        ┈ [A] PARSIVEL M300
        ┈ Instantaneous value
        ┈ Store
```

7.2 Connecting the Parsivel to a Data logger via the SDI-12 Interface

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

To make the Parsivel capable of communicating for an SDI-12 interface, the Parsivel must first be connected to a PC via the RS-485 interface. The SDI-12 interface can be switched to active through the Parsivel application software ASDO or using a terminal program and the command "CS/S/E/1<CR>" (see operating instructions for the Parsivel application software ASDO and Chapter 11 "Parsivel Operated through Terminal Software").

Warning: The failure of the SDI-12 master will result in losing the connectivity in parallel operation with ASDO!

SDI-12 Data Formats

Value 0:   Rain intensity [mm/h]
Value 1:   Rain amount accumulated [mm]
Value 2:   Weather code according to SYNOP $w_a w_a$ table 4680
Value 3:   Radar reflectivity [dBz]
Value 4:   MOR visibility during precipitation [m]
Value 5:   Sample interval [s]
Value 6:   Signal amplitude of the laser strip [1]
Value 7:   Number of detected particles [1]

Connecting the Parsivel to any Data logger via the SDI-12 Interface
Connect the Parsivel to any data logger as shown in Fig. 10 via the SDI-12 interface:

Fig. 10: Connect the Parsivel to any data logger via the RS-12 interface.
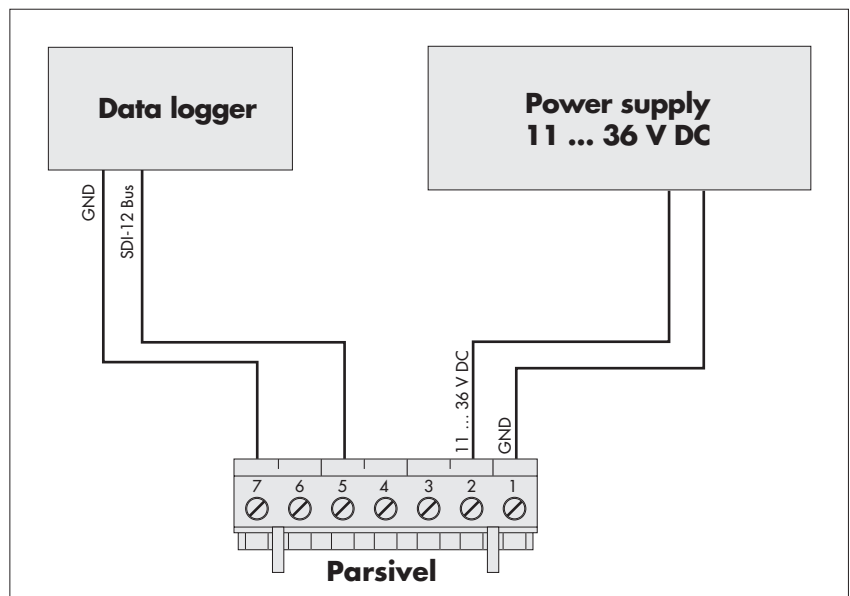
Connecting the Parsivel to the LogoSens Station Manager via the SDI-12 Interface

Connect the Parsivel to the LogoSens via the SDI-12 interface as shown in Fig. 11:
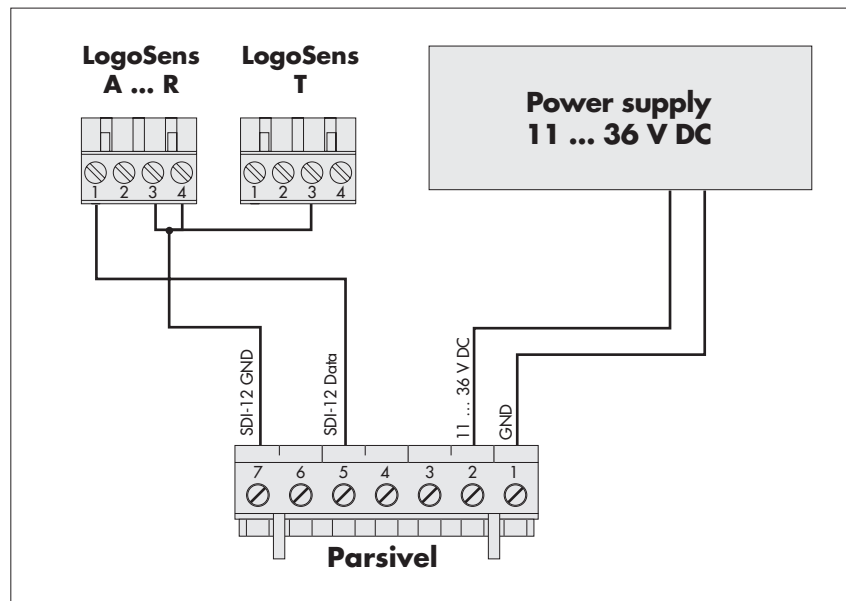
Configuring the LogoSens Station Manager for SDI-12 communication

In order to call up and store data from the Parsivel using the LogoSens, a configuration must be created in the LogoSens. Figure 12 shows an example LogoSens configuration for communication via the SDI-12 interface. See operating instructions of "LogoSens Station Manager" for more on this. Make sure that the measurement cycle set up in all Parsivel channels is provided with the same value and that in no channel of the LogoSens configuration an instantaneous vaue is defined, otherwise erroneous measurements are possible.

Fig. 12: LogoSens Configuration Example when connecting to an SDI-12 interface.

```
LogoSens: Parsivel SDI-12_E
  --- Communication interface COM1
  --- Communication interface COM2
  --- Alarm management
  --- Display / Observer
  ⊟-- Channel: 0001 / Rain intensity
       --- Meas. cycle
       --- [A]  SDI-12 Master  [V02,V03,V04,V05,V06,V07,V08]
       --- Store
  ⊟-- Channel: 0002 / Rain amount since start of device
       --- Meas. cycle
       --- [V02]  Virtual Sensor
       --- Store
  ⊟-- Channel: 0003 / Weather code SYNOP wawa Tab. 4680
       --- Meas. cycle
       --- [V03]  Virtual Sensor
       --- Store
  ⊟-- Channel: 0004 / Radar reflectivity
       --- Meas. cycle
       --- [V04]  Virtual Sensor
       --- Store
  ⊟-- Channel: 0005 / MOR visibility in precipitation
       --- Meas. cycle
       --- [V05]  Virtual Sensor
       --- Store
  ⊟-- Channel: 0006 / Time of measurement
       --- Meas. cycle
       --- [V06]  Virtual Sensor
       --- Store
  ⊟-- Channel: 0007 / Signal amplitude of the laser strip
       --- Meas. cycle
       --- [V07]  Virtual Sensor
       --- Store
  ⊟-- Channel: 0008 / Number of detected particles
       --- Meas. cycle
       --- [V08]  Virtual Sensor
       --- Store
```

Connecting the Parsivel in parallel to an SDI-12 data logger and to a PC

You have the option of reading out the measurement data from Parsivel in parallel via an SDI-12 data logger and via the Parsivel software ASDO on a PC (see the operating instructions to Parsivel's application software ASDO). The SDI-12 data logger specifies the time base for this.

Note:

The sample interval in the Parsivel software ASDO must be set to the sample interval of the SDI-12 data logger (see the operating instructions for the Parsivel application software ASDO).

Warning: The failure of the SDI-12 master will result in losing the connectivity in parallel operation with ASDO!

In order to operate the Parsivel simultaneously with the Parsivel software ASDO and an SDI-12 data logger, proceed as follows:

■ Connect the Parsivel to the RS-485/USB interface converter via the 2-wire connection.
■ Connect the LogoSens to the Parsivel via the SDI-12 interface.

Fig. 13: Parallel connection of SDI-12 data logger and Parsivel software ASDO.
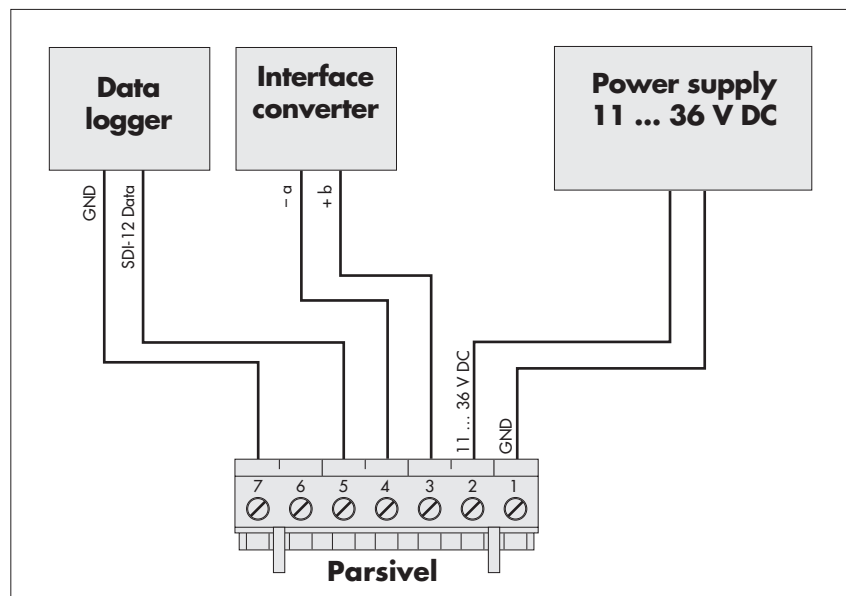
7.3 Connecting the Parsivel to a Data Logger with Impulse/Status Input

To be able to utilize the impulse and status output of the Parsivel, it is necessary for the 2-wire connection to be activated. The Parsivel is already configured at the factory for 2-wire connection. In case it has been reconfigured since its startup to a 4-wire connection or an SDI-12 connection, these connections must be deactivated with the help of a terminal software program (see Chapter 11 "Operating Parsivel using Terminal Software"). Use the following commands to accomplish this:

Deactivating the 4-wire connection: CS/C/4/0<CR>
Deactivating the SDI-12 connection: CS/S/E/0<CR>

Impulse Input
The rainfall amount can be detected in a manner similar to rain collectors according to the tilting scale principle using impulse input to a data logger.
For the impulse output of the Parsivel, the following values apply:

Impulse output duration: 250 ms
Pulse voltage: 0 V
Open circuit voltage: 5 V
Resolution: 0.1 mm/impulse, output frequency 2 Hz

Connect the Parsivel as follows to the data logger with impulse input:

Fig. 14: Connecting the Parsivel to the Data logger with Impulse Input.
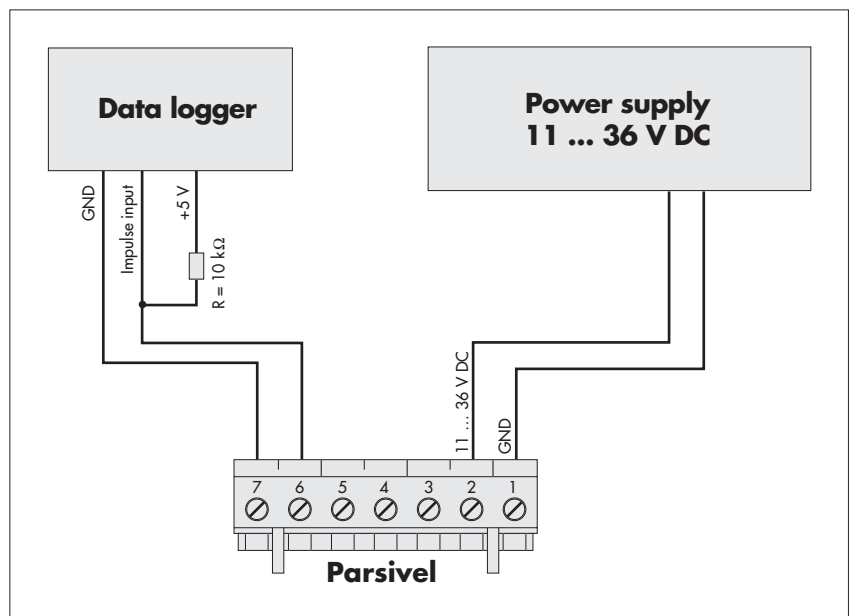
Status Input

With status input, it is possible to differentiate between solid and liquid precipitation. For the status output of the Parsivel, the following values apply:

Validity period: equal to the sample interval
Status voltage: Liquid precipitation = 5 V
                    Solid precipitation = 0 V

Connect the Parsivel as follows to the data logger with status input:

Fig. 15: Connecting the Parsivel to the data logger with Status Input.

8 Connecting the Parsivel to a PC

The Parsivel contains an RS-485 interface. Depending on whether your PC has an RS-232 or USB interface, a corresponding interface adapter must be used that provides automatic conversion between the Parsivel and the PC. Here, we recommend using the two interface converters or the Service Tool from our list of accessories.

To connect the Parsivel to your PC, proceed as follows:

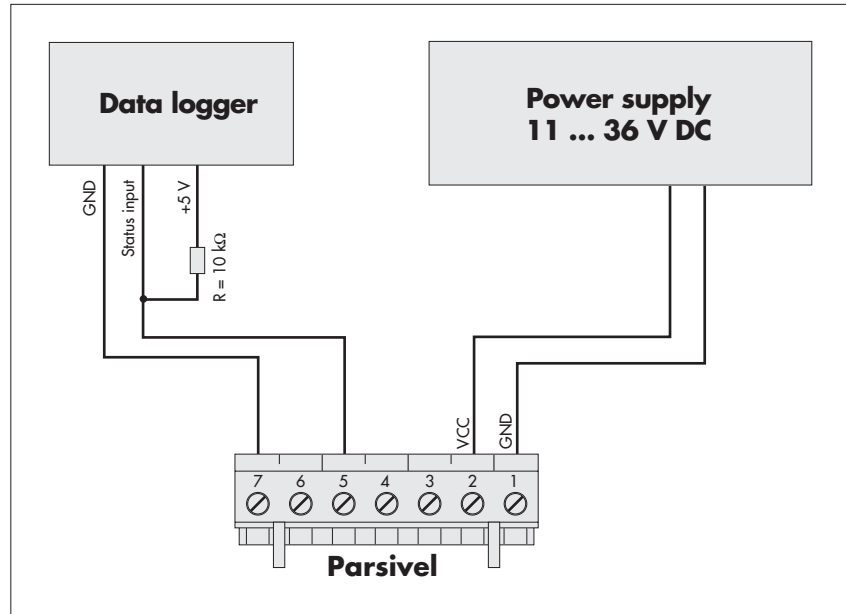- Connect the RS-485 interface of the Parsivel to the interface adapter used (see chapter 8.1, 8.2 or 8.3).
- Connect the interface adapter to the PC.
- Start the Parsivel Software ASDO or a terminal programm on the PC (such as „Hyperterminal").
- Configure and operate Parsivel with the Parsivel software ASDO (see also manual „Parsivel software ASDO") or alternatively with a terminal software (see also chapter 8 „Operating Parsivel with a terminal software").

8.1 Connecting the Parsivel to the Interface Converter RS-485/RS-232 (Accessories)

The RS-485/RS-232 interface converter (accessories) can be set for 2-wire communication as well as to 4-wire communication.

Setting the dip switches at the RS-485/RS-232 interface converter
Set the internal dip switches at the interface converter as follows:

Operating mode	1	2	3	4	5	6	7	8
RS-485, 4-wire 2-wire without echo Automatic control, without bus termination	on	on	off	on	off	off	off	off

2-wire communication
The Parsivel is configured at the factory for 2-wire communication. Connect the Parsivel as follows to a 9-pin Sub-D socket (female):

Fig. 16: Connecting the Parsivel to interface converters RS-485/RS-232 in 2-wire communication.

A (–)
B (+)

R = 120 Ω
R = 120 Ω

5
6   9

Parsivel

from 20 m of cable length

Interface converter RS-485/RS-232 solder side
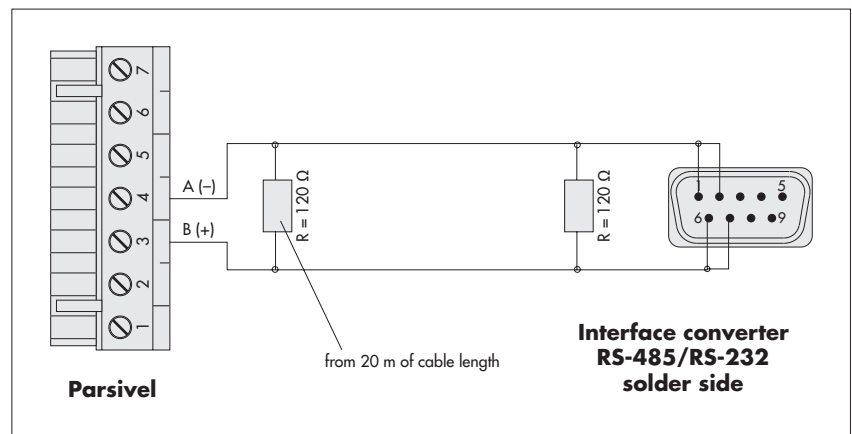
4-wire communication

Connect the Parsivel as follows to a 9-pin Sub-D socket (female) for 4-wire communication:

The Parsivel is configured at the factory for 2-wire communication. In order to switch the Parsivel from 2-wire communication to 4-wire communication, proceed as follows:

- Connect the cables as described in Figure 17 to the 7-slot screw terminal of the Parsivel (installation set, scope of delivery).
- Solder the corresponding cables as shown in Fig. 17 to the 9-pin Sub-D socket.
- Plug the 9-pin Sub-D socket onto the interface converter.
- Connect the interface converter to a PC (RS-232 null modem cable; socket/socket).
- Connect the power cables of the Parsivel to the power source (see Chapter 9 "Connecting the Power Supply (Accessories) to the Parsivel"
- Provide power to the interface converter.
- Start a terminal software program on the PC and make contact with the Parsivel (see Chapt. 11 "Operating the Parsivel using Terminal Software").
- Input the command "CS/C/4/1<CR>". Parsivel switches to 4-wire communication.

8.2 Connecting the Parsivel to the ADAM-4520 converter RS-485/RS-232 (accessories)

The ADAM-4520 converter RS-485/RS-232 (accessories) can only be set for 2-wire communication.

Setting the dip switches at the converter
Set the internal dip switches at the converter as follows:

Switch 1	1	2
10 bits	on	off

Switch 2	1	2	3	4	5	6	7	8	9	10
115,2 Kbps	off	off	off	off	off	off	off	off	on	off

2-wire communication
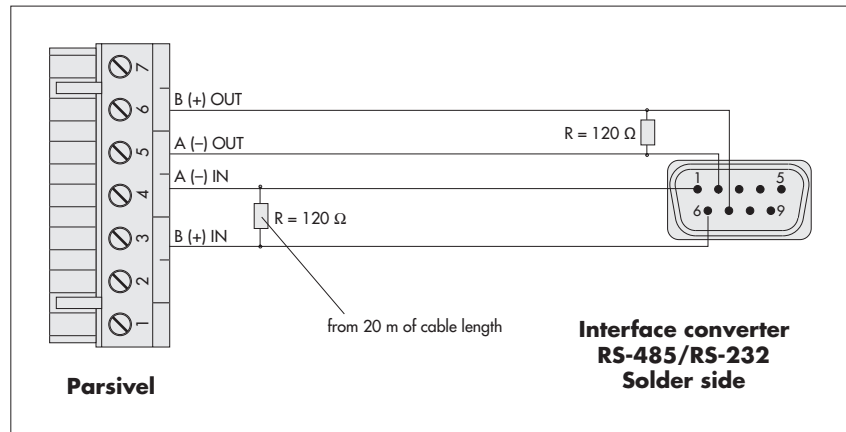Parsivel is configured at the factory for 2-wire communication. Connect the Parsivel as follows:

Fig. 18: Connecting the Parsivel to ADAM-4520 converter RS-485/RS-232 in 2-wire communication.
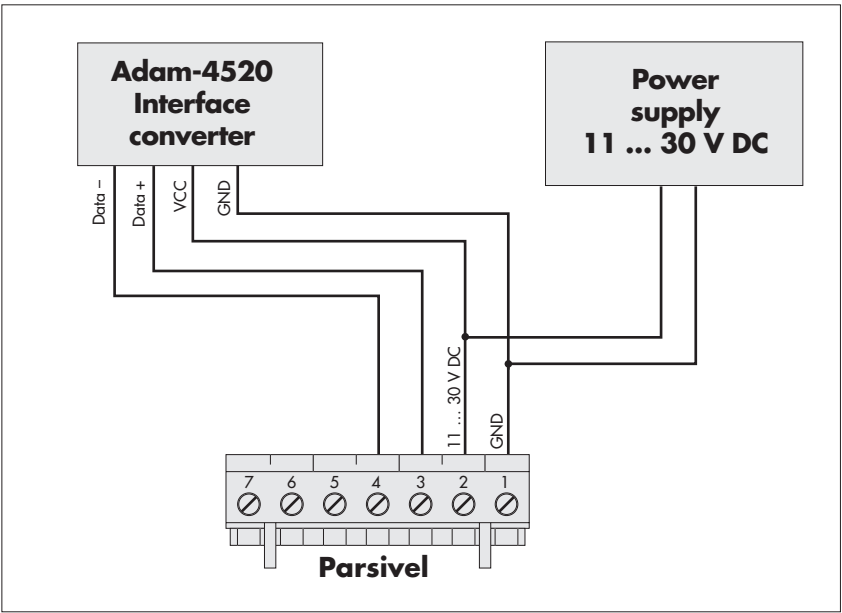
8.3 Connecting the Parsivel to the Interface Converter RS-485/USB (Accessories)

The RS-485/USB interface converter can be set for 2-wire communication as well as to 4-wire communication.

Setting the dip switches at the RS-485/USB interface converter
Set the external dip switches at the interface converter as follows:

Operating mode	1	2	3	4
RS-485, 4-wire	on	off	off	off
2-wire without echo Automatic control	off	off	on	on

2-wire communication
The Parsivel is configured at the factory for 2-wire communication. Connect the Parsivel as follows to the 6-pin terminal of the interface converter:

Fig. 19: Connecting the Parsivel to an RS-485/USB interface converter in 2-wire communication.
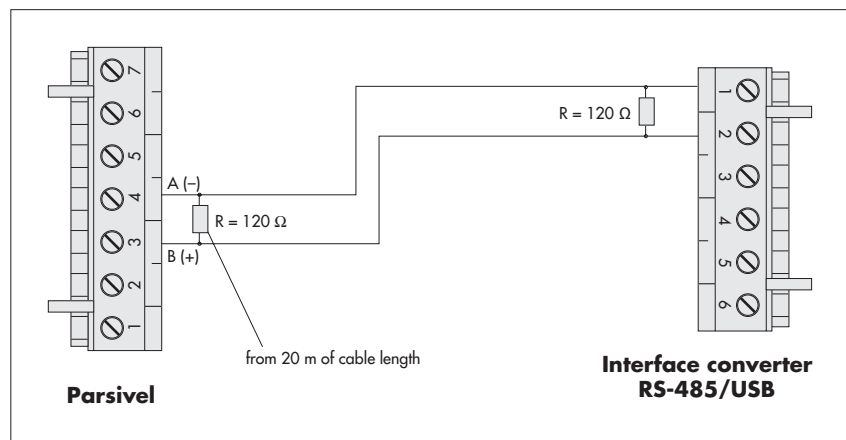
4-wire communication
Connect the Parsivel as follows to the 6-pin terminal of the interface converter for 4-wire communication:

Fig. 20: Connecting the Parsivel to an RS-485/USB interface converter in 4-wire communication.
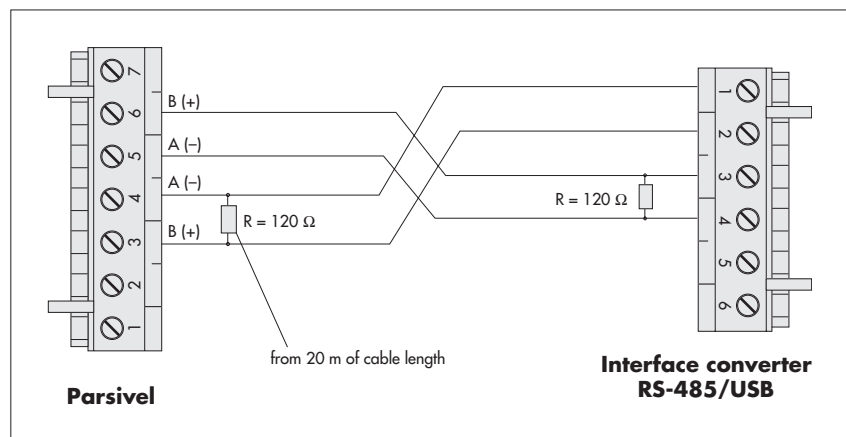
PThe Parsivel is configured at the factory for 2-wire communication. To switch the Parsivel from 2-wire communication to 4-wire communication, proceed as described in Chapter 8.1 "Connecting the Parsivel to an RS-485/RS-232 Interface Converter (Accessories)".

8.4 Connecting the Parsivel to any RS-485 Interface Converter

When using an interface converter that can not be purchased as an accessory from OTT Messtechnik, 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 separated!

8.5 Connecting the Parsivel for configuration via the Service-Tool to a PC

Please test and configure Parsivel according to your requirements regarding interface mode, heater on/off and protocol string before exposing Parsivel into the field. Apply therefor the Parsivel software ASDO Basic or a terminal software. OTT provides a Service Tool consisting of an interface converter RS-485/USB and an assembling cable in order to connect Parsivel to a PC with USB-interface.

Fig. 21: Connecting Parsivel via the Service-Tool to a PC.
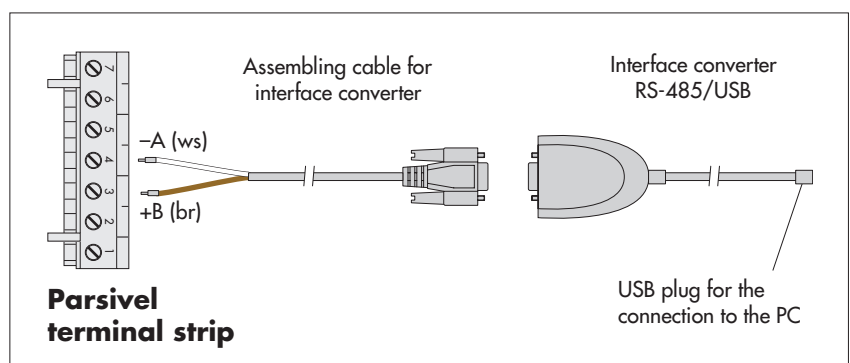
Proceed as follows to connect the Parsivel via the Service Tool to a PC:

▪ Install the driver software of the interface converter as described in the original manual of the interface converter.
▪ Set the jumper inside the interface converter as shown in fig. 22:

Fig. 22: Jumper-settings inside the interface converter.
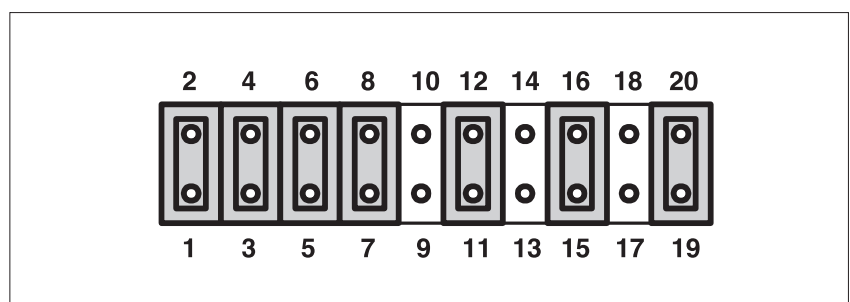
■ Connect both wires of the assembling cable for the interface converter to the 7-slot screw terminal of the Parsivel as shown in fig. 20. **Make shure, that all otzer interface lines are disconnected of the Parsivel srew terminal!**

■ Connect the 9-pin Sub-D socket of the assembling cable to the 9-pin Sub-D plug of the interface converter.

■ Connect the USB plug of the interface converter to the USB interface of the PC.

■ Start Parsivel software ASDO Basic or a terminal software on your PC.

■ Disconnect the Service Tool and Parsivel after the configuration procedure and reinstall the primarily interface connection of the installed system.

Note:
Please do not use this non-galvanic isolated interface converter for a permanent installation of Parsivel to a PC in terms of overvoltage protection and safety aspects.

9 Connecting the Parsivel to a Power Supply (Accessory)

OTT Messtechnik offers two power supplies (accessories) as a power source:

▶ Power Supply IP 20
▶ Power Supply IP 65

Information on the cable necessary for this can be found in Chapter 6.1 "Cable Selection".

Connect the power supply IP 20 or IP 65 to the Parsivel as shown in Figures 23 and 24.

Fig. 23: Connecting Power Supply IP 20 to the Parsivel.
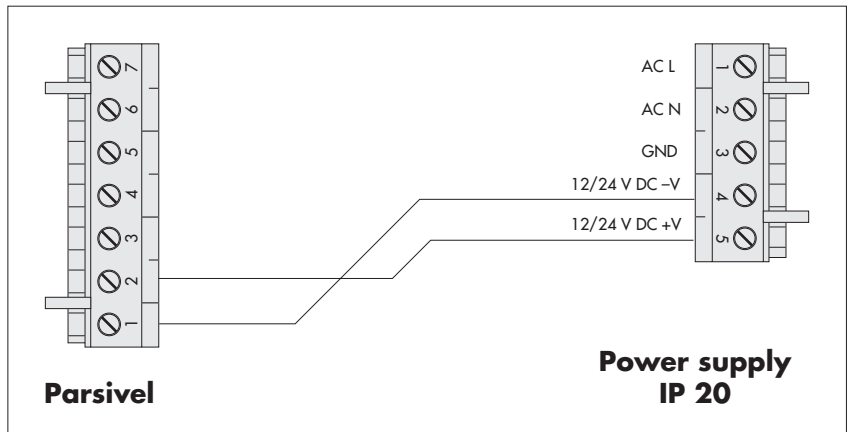
Fig. 24: Connecting Power Supply IP 65 to the Parsivel.
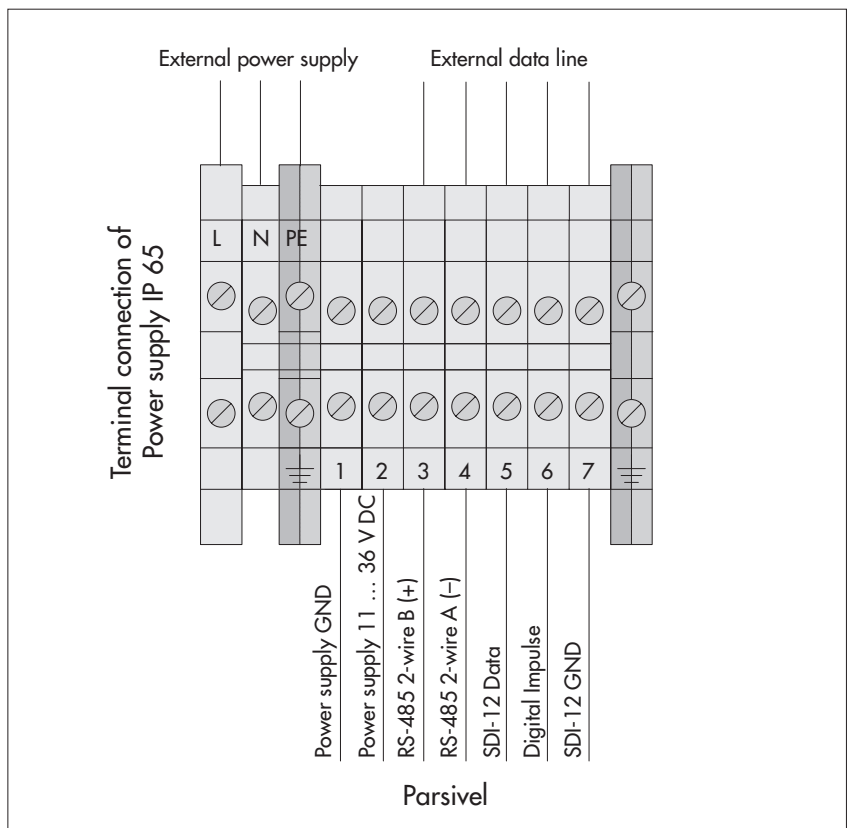
10 Heating the Parsivel sensor heads

An automatic heating system prevents ice buildup on the sensor heads. A temperature sensor in the sensor head measures the temperature each second. The 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 heating current is increased until either 10 °C is again reached in the sensor heads or until the maximum current consumption (I_{max}) is reached. In order to tailor the heating controls to the respective climatic conditions, I_{min} and I_{max} can be configured accordingly using the Parsivel software ASDO or alternatively using CS commands through a terminal software. In order to prevent condensation of the sensor apertures, the heater must be activated and I_{min} set to 0.15 A.

Optimum heating output can be guaranteed with a supply voltage of 20 V DC.

Information on the setting of I_{min} and I_{max} is available in Appendix A, "CS Command Set" or in the operating instructions "Parsivel Software ASDO".

Note:
Note that the sensor head heaters are deactivated at the factory! Activate the sensor heaters when using the Parsivel at temperatures below 4 °C! We recommend a power supply of 24V DC and a maximum heating current of 2 A to provide for unlimited heating functionality in all climatic conditions.

11 Operating Parsivel with a terminal software

11.1 Set up communications between the Parsivel and the terminal program

The Parsivel provides an RS-485 communication interface. This serial interface can be operated at various baud rates. Communication with the sensor is independent of the platform and thus 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® scope of delivery.

In order to operate Parsivel using Hyper Terminal, proceed as follows:

■ Connect the Parsivel to your PC as described in chapter 8 "Connecting Parsivel to the 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
Data bits:	8
Parity :	none
Stop bits:	1
Flow control:	none

After a successful connection with the Parsivel is made, it sends an identification telegram after it's turned on:

BOOTLOADER PARSIVEL

after approx. 10 seconds, the following message appears:

PARSIVEL PWS
WWW.OTT-HYDROMETRY.DE
TEL. ++49 (0)831 5617-0
FIRMWARE V 1.04

Approximately 30 seconds after sending the identification telegram, Parsivel starts measuring automatically and outputs the data telegram.

11.2 Measured value numbers

The measurements and status values are output from the Parsivel 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 and in what units is precisely defined. These specifications are listed in the following table:

Measured value No.	Description	Digits	Form	Units
01	Rain intensity (32 bit*)	8	0000.000	mm/h
02	Rain amount accumulated (32 bit*)	7	0000.00	mm
03	Weather code according to SYNOP $w_a w_a$ Table 4680	2	00	1
04	Weather code according to SYNOP ww Table 4677	2	00	1
05	Weather code METAR/SPECI w'w' Table 4678	5	+RASN	1
06	Weather code according to NWS Code	4	RLS+	1
07	Radar reflectivity (32 bit*)	6	00.000	dBz
08	MOR visibility in the precipitation	4	0000	m
09	Sample interval	5	00000	s
10	Signal amplitude of the laser strip	5	00000	1
11	Number of detected particles	5	00000	1
12	Temperature in the sensor	3	000	°C
13	Sensor serial number	6	123456	1
14	Firmware IOP version number	4	V1.01	1
15	Firmware DSP version number	4	V1.01	1
16	Current through the heating system	3	0.0	A
17	Power supply voltage in the sensor	4	00.0	V
18	Sensor status	1	0	1
19	Date/ time measurement begins	20	01.01.2000 _00:00:00_	
20	Sensor time	8	00:00:00	
21	Sensor date	10	00.00.0000	
22	Station name	10	XXXXXXXXXX	
23	Station number	4	XXXX	
24	Rain amount absolute (32 bit*)	7	000.000	mm
25	Error code	3	000	
30	Rain intensity (16 bit*)	6	00.000	mm/h
31	Rain intensity (12 bit*)	6	0000.0	mm/h
32	Rain amount accumulated (16 bit*)	7	0000.00	mm
33	Radar reflectivity (16 bit*)	5	00.00	dBz
90	Field N (d)	223	00.000x	$1/m^3$* mm
91	Field v (d)	223	00.000x	
93	Raw data	4095	000x	

*The measurement value number must be selected based on the data logger used along with the corresponding number of bits.

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;%12;%10;%11;%18;/r/n

According to this configuration, the measured 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 C "Categorization of precipiation type by precipitation codes")
07	-9.999	Radar reflectivity
08	9999	MOR visibility in the precipitation
12	025	Temperature in the sensor
10	15759	Signal amplitude of the laser strip
11	00000	Number of detected particles
18	0	Sensor status

11.5 Updating Parsivel Firmware

OTT Messtechnik provides the latest update versions to OTT software on its internet site at www.ott.com under the rubric "Software Updates". Two files are needed to update the Parsivel firmware:

▶ *IOP.BIN
▶ *DSP.BIN

where * represents the respective version number.

To update the Parsivel firmware, proceed as follows:

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

Fig. 25: "Send file" Window.
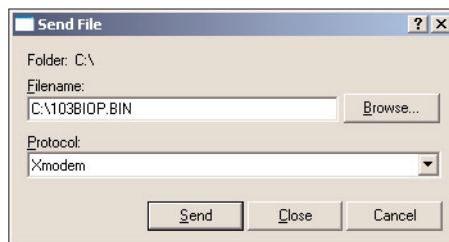
■ Select the file "*IOP.BIN" under "Filename" using the "Browse" button; you had previously stored this file on your PC.
■ Select the "Xmodem" protocol type from the "Protocol" selection window.
■ Confirm your input with "Send". The "Xmodem file send for Parsivel" window opens:

Fig. 26: "Xmodem file send for Parsivel" window.
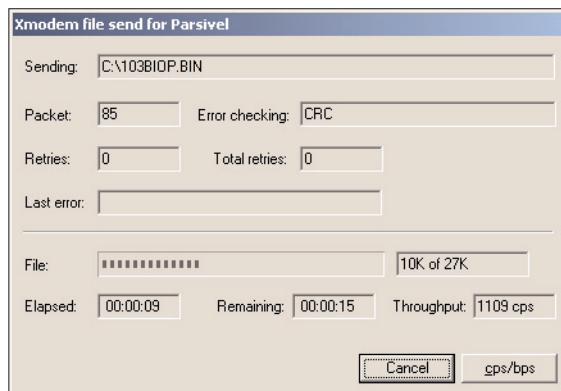
The data transfer runs and the window closes automatically after the data transfer has finished.
▪ Press <CR> repeatedly directly after closing the window.
▪ Input the command dup <CR>.
  Parsivel answers with "Start upload DSP Firmware with XMODEM/CRC".
▪ Select "Transfer | Send file" in the menu bar.
  The "Send file" window opens:

Fig. 27: "Send file" Window.

▪ Select the file "*DSP.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.
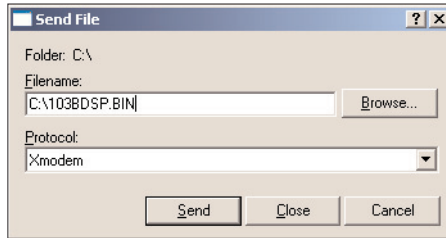▪ Confirm your input with "Send". The "Xmodem file send for Parsivel" window opens:

Fig. 28: "Xmodem file send for Parsivel" window

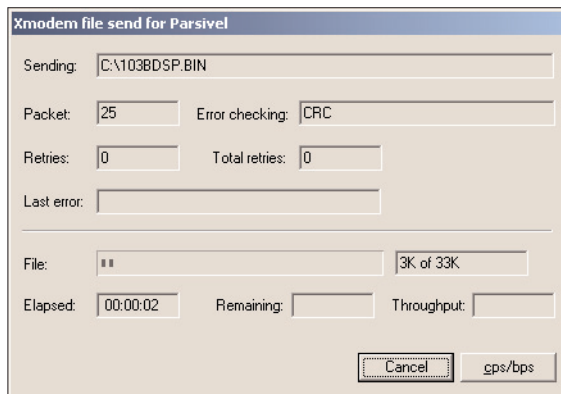The data transfer runs and the window closes automatically after the data transfer has finished.
▪ After the window has closed, input the command RUN <CR> to start Parsivel.
  The firmware was successfully updated.

35

12 Maintenance

Danger of eye injuries!

In working at the sensor there is a danger of eye injuries!

▶ Never look directly into the laser or view with optical instruments!
▶ Whenever working with the sensor, always turn power off!
▶ Never open the sensor!
▶ Please respect also the safety instructions in chapter 4!

12.1 Cleaning the laser's protective glass

Depending on the time of year and location, air pollution can lead to contamination of the laser's protective glass. 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 = Laser protective glass is dirty, but measurements are still possible
2 = Laser protective glass is 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 Messtechnik recommends that the laser's protective glass be cleaned at least semiannually, regardless of the messages.

To clean the laser's protective glass, proceed as follows:

■ Clean the laser's protective glass on both sensor heads from the outside with a soft cloth.

12.2 Keeping the light pathway open

Please follow Safty Instructions (see chapter 4) when keeping the light pathway open!

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

12.3 Cleaning the splash protector

Danger of injury!

When working with the splash protector, danger of injury exists due to sharp edges!

▶ Be careful when handling the splash protector!
▶ Wear gloves if necessary!

Danger of device damage!

The splash protector bends easily!

▶ Clean the splash protector on a flat surface!

A splash protector is attached to each sensor head of the Parsivel. 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.

Fig. 29: Splash protector.
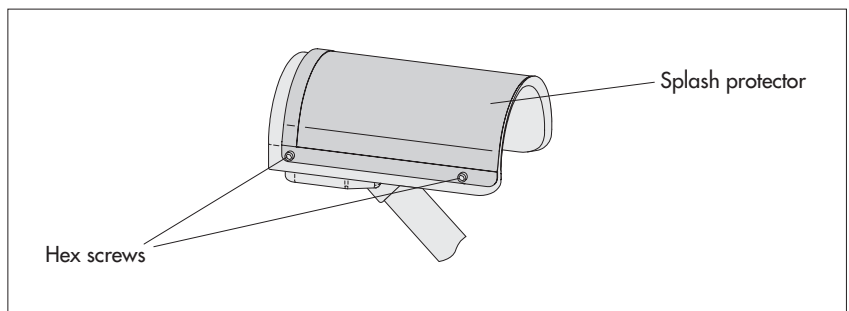
Clean the splash protector as follows:

■ 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 Messtechnik (see Chapter 2 "Part Numbers")

13 Functional disruptions and remedies

13.1 Parsivel Does Not Start

■ Check the polarity of the power supply, the A+B connections of the RS-485 cables and the baud rate (see Chapt. 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 Parsivel (see Chapt. 11 "Operating Parsivel using Terminal Software"). Parsivel 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 Technical data

Optical Sensor Laser Diode	
Wavelength	650 nm
Output Power	3 mW
Laser Class	1 (21 CFR 1040.10 and 1040.11)
	1M (IEC/EN 60825-1 A2:2001)
Beam Size (W x T)	180 x 30 mm
Measurement Surface	54 cm^2, Recognition of edge events
Measuring range	
Particle Size of Fluid Precipitates	0.2 … 5 mm
Particle Size of Solid Precipitates	0.2 … 25 mm
Particle Speed	0.2 … 20 m/s
Design	32 Precipitate Size Classes
	32 Speed Classes
	Radar Reflectivity Z
Weather Code	Outputs:
	– SYNOP $w_a w_a$ table 4680,
	– SYNOP ww table 4677,
	– NWS
	– METAR/SPECI w'w' table 4678
	differentiation of the precipitate types
	drizzle, rain, hail, snow > 97% accurate
	compared to a weather observer
Visibility with precipitation	Measurement range (MOR) 100 … 5.000 m
Rain rate	
Minimum intensity	0,001 mm/h drizzle rain
Maximum intensity	1200 mm/h
Accuracy	±5 % (liquid) / ±20 % (solid) [1]
De-icing protection	Microprocessor-controlled heating
Power supply	11 … 36 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	max. 2 A [2]
Interfaces	RS 485 (EIA-485) 1,200 … 57,600 Baud
	half-duplex, 2-wire
	RS 422 1,200 … 57,600 Baud,
	half-duplex, 4-wire
	SDI-12
	Parsivel has an output relay for simple
	status information (rain or snow) and/or
	impulse output for precipitation in 0.1 mm
	increments with max. 2 Hz impulse rate
Electromagnetic tolerance	meets EN 61000-4-2 up to EN 61000-4-6
	(10 V/m, 2 kV) for EMV requirements,
	CE- compliant
Lightning protection	integrated
Material	Galvanized aluminum housing
Weight	max. 5 kg
Temperature range	−40 … +70 °C; 0 … 100 % relative
	humidity
Protection	IP 67, resistant to salt spray
Size (H x W x T)	370 x 560 x 120 mm

[1] 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
[2] power output ≥ 50 W is needed

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
Standard :   30
If the value "0" is entered for the sample interval, the Polling mode is active.

CS/P<CR>

Activating polling mode
Parsivel issues a data telegram no later than 500 ms after receiving the command. This command deactivates the interval-controlled telegram.

CS/R<CR>

Repeat polling mode
The data telegram is output 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 baud rate
Warning: Changing the baud rate can cause the loss of the connectivity!
The baud rate can be adjusted from 9600 … 115200. The baud rate 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 baud rate
With this command, the current baud rate setting can be queried.

CS/C/4/<parameter><CR>

Set up 4-wire mode
Two different physical operating modes are possible.
Value range: 0 … 1
Standard :   0
Description :   0 = 2-wire RS-485
                       1 = 4-wire RS-485

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

Setting up RS-485 bus mode
Warning: Activating 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
Standard: 0
Description: 0 = RS-485 bus mode deactivated
                       1 = RS-485 bus mode activated
Address query: *<CR>
                       answer: <address><CR><LF>

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

Set bus address for RS-485 bus mode
Warning: Changing the bbus address can cause the loss of the connectivity!
Value range: 0 … 9
Standard: 0

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

Adjust time of day
The time of day of the Parsivel is set to the time of day of the PC.

CS/D/01.01.2000<CR>

Adjust date
The date of the Parsivel is set to the calendar of the PC.

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

Set SDI-12 mode
Activate or deactivate the SDI-12 mode.
Value range: 0 … 1
Standard: 0
Description: 0 = SDI-12 mode deactivated
                           1 = SDI-12 mode activated

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
Standard: 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 sensor ID
This command assigns a 4-digit sensor ID.

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

Select data telegram
The data telegram can be input in the command with the parameters 0 … 1.
Value range: 0 … 1
Standard: 0
Description: 0 = OTT telegram
                           1 = User telegram

CS/M/S/<CR>
STRING=><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 <para-
meter> 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 heating system.

Value range: 0 … 3
Standard: 0
Description: 0 = Off
                     1 = Automatic
                     2 = I_{max}
                     3 = I_{min}

CS/H/X/<parameter><CR>

Adjust I_{max}
This command sets the maximum current through the heating system.

Value range: 0 … 200   1/100 A
Standard: 200   (= 2 A)

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

Adjust I_{min}
This command sets the minimum current through the heating system.

Value range: 0 … 200   1/100 A
Standard: 15   (= 0,15 A)

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

Set minimum temperature of the sensor heater.
This command sets the minimum temperature to which the sensor is heated.

Value range: −40 … 85 C°
Standard: 10

Appendix B: Classification of precipitation types

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

B.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 x 32 = 1024 classes.

Classification according to volume-equivalent diameter

Class Number	Class Average in mm	Class Spread in 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 Parsivel since they are outside the measurement range of the device.

Classification according to speed

Class Number	Class average in m/s	Class spread in 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 C: Characterization of precipitation type by precipitation codes

From the classification of precipitation particles, Parsivel 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).

C.1 Precipitation code according to SYNOP

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

▶ SYNOP $w_a w_a$ Table 4680
▶ SYNOP ww Table 4677

No precipitation		Tab. 4680	Tab. 4677
		00	00

Drizzle			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	≤ 0.2	51	51
moderate	0.2 …0.5	52	53
strong	≥ 0.5	53	55

Drizzle with rain			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	≤ 0.2	57	58
moderate	0.2 …0.5	58	59
strong	≥ 0.5	58	59

Rain			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	≤ 0.2	61	61
moderate	0.5 …4.0	62	63
strong	≥ 4.0	63	65

Rain, drizzle with snow			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	≤ 0.5	67	68
moderate	> 0.5	68	69

Snow			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	≤ 0.5	71	71
moderate	0.5 …4.0	72	73
strong	≥ 4.0	73	75

Snow grains			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	≤ 0.5	77	77
moderate	0.5 …4.0	77	77
strong	≥ 4.0	77	77

Freezing rain			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	≤ 0.4	87	87
moderate	> 0.4	88	88

Hail			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	≤ 7.5	89	89
moderate	≥ 7.5	89	90

C.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

Drizzle

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 0.2	L–	–DZ
moderate	0.2 …0.5	L	DZ
strong	≥ 0.5	L+	+DZ

Drizzle with rain

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 0.2	RL–	–RADZ
moderate	0.2 …0.5	RL	RADZ
strong	≥ 0.5	RL+	+RADZ

Rain

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 0.2	R–	–RA
moderate	0.5 …7.5	R	RA
strong	≥ 7.5	R+	+RA

Rain, drizzle with snow

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 0.5	RLS–	–RASN
moderate	> 0.5	RLS	RASN
strong		RLS+	+RASN

Snow

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 0.5	S–	–SN
moderate	0.5 …2.5	S	SN
strong	≥ 2.5	S+	+SN

Snow grains

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 0.5	SG	–SG
moderate	0.5 …4.0	SG	SG
strong	≥ 4.0	SG	+SG

Freezing rain

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 0.4	SP	–GS
moderate	> 0.4	SP	GS
strong		SP	+GS

Hail

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 7.5	A	GR
moderate	≥ 7.5	A	GR

OTT

CE

Konformitätserklärung
Declaration of Conformity
Declaration de Conformité

Wir/ We/ Nous
Anschrift/ Address/ Adresse

OTT Messtechnik GmbH & Co. KG
Ludwigstraße 16
D-87437 Kempten

erklären, daß das Produkt/ declare, that the product/ declarons, que le produit

Bezeichnung/ Name/ Nom **Parsivel**

Artikel- Nr./ Article No./ No. d' Article **70.200.005.9.0**

mit den Anforderungen der Normen/ fulfills the requirements of the standard/ satisfait aux exigences des normes

EG (89/336/EWG):

national:	international:
EN 61326	IEC 61326

Störaussendung/ emission/ émission

Klasse/ class/ classe B	class/ classe B

Störfestigkeit/ noise immunity/ immunité

EN 61000-4-2 (4 kV/8 kV)	IEC 61000-4-2 (4 kV/8 kV)
EN 61000-4-3 (10 V/m)	IEC 61000-4-3 (10 V/m)
EN 61000-4-4 (2 kV)	IEC 61000-4-4 (2 kV)
EN 61000-4-5 (2 kV/ 1 kV)	IEC 61000-4-5 (2 kV/ 1 kV)
EN 61000-4-6 (10 V)	IEC 61000-4-6 (10 V)

Sicherheit von Laser Produkten/ Safety of laser products/ Sécurité de produits laser

EN 60825-1	IEC 60825-1
Klasse/ class/ classe 1M	class/ classe 1M

und den hinterlegten Prüfberichten übereinstimmt und damit den Bestimmungen entspricht/
and the taken test reports and therefore corresponds to the regulations of the Directive/
et les rapports d'essais notifiés et, ainsi, correspond aux réglement de la Directive.
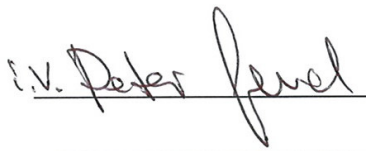
Ort und Datum der Ausstellung/
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Kempten, den _2006 - 05 - 10_

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Nom et signature de la personne autorisée

i.V. Peter Juvel