Operating Instructions
Precipitation gauge
OTT Pluvio² S
We reserve the right to make technical changes and improvements without notice.
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1 Scope of supply

**OTT Pluvio² S**
- Weighing precipitation gauge; collecting area: 200 cm²; capacity: 400 mm of precipitation.
- Consisting of: base plate with weighing mechanism, bucket support, collecting bucket, and pipe housing. With SDI-12, RS-485, and USB interfaces (for servicing purposes). Additional pulse outputs for amount of precipitation and status information.
- Optionally available with additional internal orifice rim heater.
- Installation accessory kit
  - 6 hexagon bolts M8 x 30;
  - 3 Phillips screws M5 x 35
  - 1 8-wire screw terminal strip;
  - 1 6-wire screw terminal strip;
  - 3 cable ties 140 x 3.6;
  - 1 Jumper
  - 1 open-ended wrench, size: 10/13
- USB cable
  - USB connector type A to USB connector type B, 3 m
- Operating Instructions
- Factory acceptance test (FAT) certificate

2 Order numbers

**OTT Pluvio² S**
- 70.030.002.9.0

**OTT Pluvio² S**
- incl. internal orifice ring heater 70.030.001.9.0

For accessories and replacement parts, refer to Appendix E
3 Introduction

The OTT Pluvio² S precipitation gauge is used for automatic determination of the meteorological intensity and amount of precipitation.

In contrast to conventional precipitation gauges, the OTT Pluvio² S works using the weighing principle. The OTT Pluvio² S reliably detects precipitation, whether liquid or solid, by determining the weight of the collecting bucket. The OTT precipitation gauge is characterized in particular by its low maintenance needs. This is achieved by means of a high-capacity collecting bucket, the lack of a collection funnel as is typical for tipping buckets, and the very robust design of the weighing mechanism.

A high-precision, stainless steel load cell, hermetically sealed against environmental influences that remains stable over a long period, is used as the sensor element. An integrated temperature sensor compensates for the temperature changes in the weighing mechanism. The mechanical overload protection prevents damage to the load cell from forces in a vertical direction higher than permitted, e.g. when emptying the collecting bucket.

Fig. 1: OTT Pluvio² S precipitation gauge.
Every 6 seconds, the precipitation gauge determines the weight of the collecting bucket including its content using a resolution of 0.001 mm (= raw data). The difference between this measured value and the basic weight of the empty collecting bucket gives the current bucket content.

A special filter algorithm prevents incorrect measurement results in the process from effects such as wind. The difference between the current bucket content and the previous one gives the precipitation intensity in mm/min or mm/h.

These 6-second values for the precipitation intensity are added to the accumulated precipitation amount (Accu total NRT – see below) by the OTT Pluvio³ S.

Depending on the filter algorithm run, the measured values are available as real-time and non-real-time values:

- **Real-time output (RT):** The OTT Pluvio³ S outputs the measurement result for intensities greater than 0.1 mm/min within a minute after occurrence of the precipitation event. Benefit: fast response time and precipitation output with correct intensity.

- **Non-real-time output (NRT):** The OTT Pluvio³ S outputs the measurement result 5 minutes after occurrence of the precipitation event. Benefit: more precise output with correct precipitation volume.

All measured values can be retrieved via a serial SDI-12 and RS-485 interface. In detail, these are:

- Intensity RT
- Accu RT/NRT (since the last measured value sample)
- Accu NRT (since the last measured value sample)
- Accu total NRT (since the last reset)
- Bucket RT
- Bucket NRT
- Temperature of load cell
- Status OTT Pluvio³ S (since the last measured value sample)

The OTT Pluvio³ S provides the precipitation values using a resolution of 0.001 mm. Individual response thresholds of ≥ 0.03 mm are applied to these values within one hour. A detailed description of the individual measured values can be found in Chapter 3.1.

The OTT Pluvio³ S uses two pulse outputs to output the amount of precipitation RT/NRT (output #1) as well as the status information (output #2) in parallel. The pulse factor may be selected: one pulse equals 0.05 mm, 0.1 mm, or 0.2 mm of precipitation.

Parallel operation of serial interface and pulse output allows two dataloggers or one datalogger and one PLC to be connected simultaneously.

The OTT Pluvio³ S is installed to a 2" pedestal the bottom plate of which is mounted to a concrete foundation. The standard installation height is 1 meter (height of the orifice ring rim). Alternatively, 1.2 or 1.5 meters are possible.

After connecting the supply voltage, the OTT Pluvio³ S automatically starts measuring operation (→ red LED is flashing, refer to Fig. 20). The OTT Pluvio³ S is calibrated in the factory. On site, no further calibration is necessary.

Any increases in weight greater than approx. 12 mm within 6 seconds are not output as precipitation, as they exceed a natural level of precipitation. Thus, spurious increases such as bucket changes or filling with anti-freeze are suppressed. Check measurements, even with large reference weights (> 240 g), are possible using the values of Bucket RT and Bucket NRT. The measured value sample is carried out in a joint data telegram with multiple measured values. Individual samples with different intervals are not possible.
For service purposes (test measurements, convenient setting of operating parameters and for an accuracy test) a USB interface has been provided. The particular advantage of this is: when using the USB interface, no separate power supply is required.

**Please note:** After connecting the USB interface, the OTT Pluvio² S interrupts communication on the serial interfaces!

The measuring system of the OTT Pluvio2 S prevents output of any incorrect precipitation amount and does not output any increases in precipitation through the interfaces after the following situations:

- USB interface was connected (pipe housing removed) for approx. 5 minutes
- Emptying (large reduction in weight) for approx. 5 minutes
- Startup/power failure for approx. 2 minutes

The OTT test weight kit (accessory) is used to perform annual check measurements (guided accuracy test) in conjunction with the OTT Pluvio² operating software. No recalibration is required.

### 3.1 Measured value output to the SDI-12 and RS-485 interfaces

#### Intensity RT

Moving precipitation growth over the last minute before the sampling interval (measuring method acc. to WMO Guideline No. 8). This measured value is particularly suited, for example, for the exact determination of intensity with heavy precipitation and for alarm management, but not for daily and monthly totals.

- **Output delay:** Real-time output (RT)
- **Units:** mm/h · mm/min  
  inch/h · inch/min
- **Threshold:** 0.1 mm/min · 6 mm/h
- **Sampling interval required:** 1 minute
- **Storing interval required:** 1 minute

**Note:** Larger sampling intervals always give the precipitation intensity of the minute just before the sampling interval! For precipitation intensities of < 0.1 mm/min, the OTT Pluvio² S sets the output value to zero. Thus, this output value may not be used for accumulating single intensity values.

#### Accu RT-NRT

This value is a combination of real-time and non-real-time output. This value provides the benefit of faster RT output together with subsequent non-real-time output delivering the maximum accuracy possible. It shows the accumulated amounts of precipitation over the sampling interval. If the amount of precipitation exceeds the threshold, the OTT Pluvio² S outputs the measurement result in real time. Otherwise, it collects the fine precipitation over a maximum of one hour and outputs the measured value in non-real time. If the fine precipitation does not reach the threshold within an hour, there will be no output. This measured value is similar to the behaviour of a precipitation gauge with tipping bucket. This measured value is particularly suited for daily or monthly totals and for alarm management.

- **Output delay:** Real-time output (RT) for precipitation events immediately exceeding the threshold, otherwise non-real-time output (NRT).
- **Units:** mm · inch
- **Threshold:** 0.03 mm within an hour
Recommended sampling interval: 1 minute (with simultaneous sampling of the precipitation intensity)

Recommended storing interval: Any time between 1 minute and 24 hours. The datalogger must total the individual measured values using a summing function over the complete storing interval!

**Note:** Every interface polling resets the total amount values in the OTT Pluvio² S to zero!

**Accu NRT**

This measured value outputs the sum of the correct amounts of precipitation over the sampling interval with a fixed output delay of 5 minutes. Due to better filtering, this valuable provides a more precise precipitation sum. Fine precipitation is collected over a maximum of one hour and output after reaching the threshold. If the fine precipitation does not reach the threshold within an hour, there will be no output. This value is particularly suited for daily and monthly totals.

Output delay: Non-real-time output (NRT)
Units: mm · inch
Threshold: 0.03 mm within an hour
Recommended sampling interval: 1 minute (with simultaneous sampling of the precipitation intensity)
Recommended storing interval: Any time between 1 minute and 24 hours. The datalogger must total the individual measured values using a summing function over the complete storing interval!

**Note:** Every interface polling resets the total measured value in the OTT Pluvio² S to zero. The 5 minute output delay provides the option for climatological databases to apply a timestamp correction when necessary.

**Accu total NRT**

This measured value outputs the sum of the correct amounts of precipitation since the last device start with a fixed output delay of 5 minutes. For this purpose, the individual Accu NRT values are totalled (redundant sensor). This value is particularly suited for daily or monthly totals as well as for tracking the plausibility of the Accu NRT and Accu RT-NRT values. Benefit: No loss of the collected precipitation amount values in case of temporarily disrupted data transfer.

Resetting this value is achieved
- by a separate SDI-12 reset command, or
- by switching the power supply on/off, or
- automatically if the measurement range (500 mm; 50 inch) is exceeded

Output delay: Non-real-time output (NRT)
Units: mm · inch
Threshold: 0.03 mm within an hour
Recommended sampling interval: 1 minute (with simultaneous sampling of the precipitation intensity)
Recommended storing interval: Any time between 1 minute and 24 hours (do not total/average measured values)
Bucket RT

This value outputs the currently measured, unfiltered bucket content. It corresponds to the measured weight raw data and is subjected to higher uncertainty with regard to temperature and wind impact. The measured value is particularly suited for quick reference measurements of the weighing mechanism and for determining the current bucket level. Using this measured value for separately calculating the amount of precipitation in an external datalogger is not reasonable!

Output delay: real-time output (EZ)
Units: mm · inch
Resolution: 0.001 mm (1 mm ≈ 20 g)
Recommended sampling interval: 1 minute (with simultaneous sampling of the precipitation intensity)
Recommended storing interval: any time between 1 minute and 24 hours (possibly averaging over 10 minutes)

Bucket NRT

This value outputs the currently measured, filtered bucket content. It corresponds to the filtered weight value and is subjected to uncertainty with regard to temperature impact. The value is particularly suited for determining the content of the bucket and for calculating the evaporation behaviour. Using this measured value for separately calculating the amount of precipitation in an external datalogger is not reasonable!

Output delay: non-real-time output (RT)
Units: mm · inch
Resolution: 0.001 mm (1 mm ≈ 20 g)
Recommended sampling interval: 1 minute (with simultaneous sampling of the precipitation intensity)
Recommended storing interval: any time between 1 minute and 24 hours

Temperature of load cell

Internal temperature of the load cell for compensating for the temperature change. This value is only relevant to internal purposes and generally differs from the current ambient temperature by several °C.

Units: °C · °F
Recommended sampling interval: 1 minute (with simultaneous sampling of the precipitation intensity)
Recommended storing interval: only as required (any time between 1 minute and 24 hours)

3.2 Measured value output at pulse output

The OTT Pluvio² S uses two pulse outputs to output the amount of precipitation RT/NRT (output #1) as well as the status information (output #2) in parallel. Parallel operation of serial interface and pulse output allows two dataloggers or one datalogger and one PLC to be connected simultaneously.

Electrical characteristics of the pulse and status outputs

Pulse ON contact closed
Pulse/pause ratio: 1:1 for 5 Hz ≈ 100/100 ms
for 2 Hz ≈ 250/250 ms
Contact design: non-bouncing, polarity independent, isolated
Current capacity, $I_{\text{max}}$: ≤ 100 mA (short-circuit proof; load cut-off at 200 mA)
Voltage, $U_{\text{max}}$: ≤ 28 V DC
**Pulse-Accu RT-NRT**

This measured value is same as Accu RT-NRT. However, the threshold is determined by the resolution of the pulse output (0.05 mm · 0.1 mm · 0.2 mm).
The measured value is output as a pulse sequence using a rate of 5 Hz (default) or 2 Hz (configurable through the OTT Pluvio® S operating software via USB interface).

Output delay: refer to Accu RT-NRT
Pulse factor (selectable): 0.05 mm · 0.1 mm · 0.2 mm
(1 mm = 20 · 10 · 5 Impulse)
0.01 inch
Resolution: 0.05 mm · 0.1 mm · 0.2 mm
Recommended sampling interval: continuous pulse counting
Recommended storing interval: any time between 1 minute and 24 hours

**Pulse status information**

This measured value corresponds to the current bucket level and additionally shows status information. Moreover, status information may be used as an alive signal.

0 pulses/min system error, device or cable at the pulse output faulty (output #2)
10 … 100 pulses/min 0 … 100 % of the approx. bucket level
120 pulses/min maintenance by means of operation through USB

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Fig. 2: Pulse output circuit diagram.
The locations of the terminals are shown in Fig. 6.
Output #1: Terminals #1 and #2.
Output #2: Terminals #3 and #4.

**Simplified schematic diagram**

![Simplified schematic diagram]

**Detailed diagram**

internal optoelectronic relay

![Detailed diagram]
Please note:
When the pulse outputs are connected to
- OTT dataloggers → no additional wiring is required to be made. You may directly connect the pulse outputs to the pulse inputs of an OTT datalogger.
- Third-party datalogger → external wiring at the pulse and status outputs must be designed in such a way, that the limits for $I_{\text{max}} \leq 120$ mA and $U_{\text{max}} \leq 28$ V will be kept in all operating conditions! Use a pull-up resistor as applicable!

3.3 Graphic display of measured value output for different precipitation intensities

Fig. 3: Precipitation intensity 0.03 … < 6 mm/h.
Pulse-Accu RT-NRT is shown based on a pulse factor of 0.1 mm.
Fig. 4: Precipitation intensity ≥ 6 mm/h. Pulse-Accu RT-NRT is shown based on a pulse factor of 0.1 mm.
Fig. 5: Precipitation intensity 9 mm/h. Pulse-Accu RT-NRT is shown based on a pulse factor of 0.1 mm.
3.4 Orifice ring rim heater

For the OTT Pluvio² S, an optional orifice rim heater is available. This heater reliably keeps the orifice rim free of snow and ice at low ambient temperatures (e.g. no snow or ice build-up). No snow will accumulate at the orifice rim.

The orifice rim heater consists of a ring-shaped heating element within the pipe housing with temperature sensor and an electronic heater control module for controlling and monitoring the heating function. The heater cable electrical connection is established automatically via two plug contacts and a connector block once the pipe housing is placed onto the base plate.

Only the orifice rim is heated to avoid unwanted losses caused by evaporation. Therefore, the orifice rim heater does not prevent the contents of the collecting container from freezing! The heater control unit reliably prevents a stack effect (errors in precipitation measurement caused by thermal effects) by using a low and continuously monitored orifice rim temperature.

Fig. 6: Schematic diagram of the OTT Pluvio² S orifice rim heater. The surface shown in grey (orifice rim) is the heated part of the pipe housing.
The OTT Pluvio² S unit heats the orifice rim until the target temperature of +4 °C (factory setting) is reached – as far as heating power and ambient conditions allow. To achieve this, the heater control system measures both ambient and orifice rim temperatures and uses these values together with the target temperature to calculate the pulse/pause ratio. Depending on this value, the heater control system supplies electricity to the heating element for 5 to 120 seconds.

In addition to this, several modes of operation provide the option of enabling/disabling the heater control system based on certain criteria (see below).

When the heater control system is enabled, the OTT Pluvio² S unit continuously performs a functional test for the orifice rim heater (heater self-test) to detect potential error conditions. When the heater control system is temporarily disabled, performing the heater self-test depends on the mode of operation set. The result is used for system checks in the measuring area. In case the error cannot be corrected (unusual operating conditions or faulty orifice rim heater), the "Heater functional check failed" status information is shown, refer to the response to the SDI-12 command aD2!; Chapter 6.1.

When the measured rim temperature exceeds 50 °C in heating mode, the rim heater system triggers an automatic safety shutoff of the heating element.

The orifice rim heater can be switched ON/OFF using an advanced SDI-12 command or via a separate power supply. Thus, the orifice rim heater may completely be switched OFF, for example in summer. In such case, a message is shown in the Status Information (response to the SDI-12 command aD2!; value 9).

The nominal supply voltage for operating the orifice rim heater is 24 V DC, and the maximum heating capacity with very low ambient temperatures is approx. 50 Watt. Optionally, the supply voltage of the orifice rim heater can be fed separately from or together with the supply voltage for the precipitation gauge.

As a special option, the orifice rim heater may be operated based on 12 V DC. In this case, effective heating power is 25 % of the rated power. For operation in moderate climate zones and using 12 V solar systems, this type of operation is basically allowed. The data specified for 24 V DC operation cannot be maintained across the entire temperature range (refer to the Specifications section). For temperatures below −5 … −10 °C, snow or ice may adhere to the unit.

Orifice rim heater modes of operation:

- **Mode #0** Orifice rim heater is completely switched OFF. (No heater self-test is performed).

- **Mode #1** Heater control system is continuously enabled.
  The heater control system keeps the temperature of the orifice rim at the preset target temperature. (Factory setting.)

- **Mode #2** Within a specified temperature range, the heater control system is continuously enabled.
  Same as Mode #1 with the heater control system temporarily disabling the heater when the temperature is below an adjustable temperature limit (−40 … +9 °C). Below the temperature limit, the heater self-test is performed based on a selectable interval (1 h … 7 d).
**Mode #3** The heater is controlled based on the National Weather Service (NWS) Standard. The heater control is active from a preset time (starting time) on and continuously keeps the orifice rim temperature at the predetermined setpoint. The On-time may be adjusted as well (1 … 1440 minutes). Outside this On-time, the heater self-test is performed based on a selectable interval (1 h … 7 d).

**Please note:** This mode requires the OTT Pluvio² S system time to be set correctly. In case a power failure lasts longer than 10 minutes, the OTT Pluvio² S system time will be lost. This will result in incorrect heater control system operation!

Fig. 7: Diagram of orifice rim heater Mode #3.

**Mode #4** Heater control system is operated based on precipitation events. Once precipitation has started, the heater control will be active for a preset after-run time (1 … 1440 minutes) and continuously keep the orifice rim temperature at the predetermined setpoint. Outside this after-run time, the heater self-test is performed based on a selectable interval (1 h … 7 d).

Fig. 8: Diagram of orifice rim heater Mode #4.
4 Basic safety information

- Please read these Operating Instructions before using the OTT Pluvio$^2$ S for the first time! Make yourself completely familiar with the installation and operation of the OTT Pluvio$^2$ S! Keep these Operating Instructions for later reference.

- The OTT Pluvio$^2$ S is used for automatic determination of the meteorological precipitation intensity and amount of precipitation. Use the OTT Pluvio$^2$ S only as described in these Operating Instructions!
  For further information → see Chapter 3, „Introduction“.

- Note all the detailed safety information given within the individual steps. All safety information in these Operating Instructions is identified by the warning symbol shown here.

- Avoid heavy shaking and shocks during transport and operation! The OTT Pluvio$^2$ S is equipped with a highly sensitive electronic weighing mechanism. Only use the original packaging for transport!

- Ensure the electrical, mechanical, and climatic specifications listed in the technical data are adhered to.
  For further information → see Chapter 10, „Specifications“.

- Carry out all recommended maintenance work at the frequencies specified.
  See Chapter 7, „Carrying out maintenance work“.

- Do not make any changes or retrofits to the OTT Pluvio$^2$ S! If changes or modifications are made, any warranty will be void.

- Have a defective OTT Pluvio$^2$ S checked and repaired only by the OTT repair center. On no account carry out repairs yourself! Only a qualified repair followed by a factory final test ensures the specified measurement accuracy.
  For further information → refer to Chapter 8, „Repair“.

- Properly dispose of the OTT Pluvio$^2$ S after taking out of service. On no account put the OTT Pluvio$^2$ S into the normal household waste.
  For further information → see Chapter 9, „Notes on the disposal of used units“. 
5 Installing the OTT Pluvio<sup>2</sup> S

The installation of the OTT Pluvio<sup>2</sup> S is carried out on a 2" pedestal made of galvanized steel (possible external diameter of pedestal 50 to 60.3 mm). The pedestal must be securely attached to a concrete foundation having the appropriate dimensions. The pedestals that are available from OTT as accessories are fitted with a bottom plate designed for this purpose.

The standard installation height recommended by the World Meteorological Organization, WMO, for precipitation gauges is 1 meter (height of bucket orifice). Alternatively, an installation height of 1.2 or 1.5 m is allowed.

Carefully choose your setup location according to your meteorological requirements. At the same time, ensure the location is free of vibration. For example, traffic on a nearby road can affect the measurement results through vibration.

The maximum distance to the data collection device and the power supply to which the OTT Pluvio<sup>2</sup> S is to be connected depends on the interface used:

- SDI-12 interface: 70 meters
- RS-485 interface: 1000 meters
- Pulse output: 1000 meters

For a OTT Pluvio<sup>2</sup> S with orifice rim heater, the maximum distance to the mains adapter of the orifice rim heater is 125 meters.

**Please note:** The OTT Pluvio<sup>2</sup> S precipitation gauge is equipped with a highly sensitive electronic weighing mechanism! Install the unit only as described in these Operating Instructions. To avoid damage to the OTT Pluvio<sup>2</sup> S weighing mechanism during installation: Avoid heavy shocks and large forces acting on the load cell and the bracket for the bucket support (for these items, please refer to Fig. 10)!

5.1 Recommended cable types/maximum cable lengths

For operating the OTT Pluvio<sup>2</sup> S, the following connections have to be made:

- power supply for the precipitation gauge,
- power supply of the orifice rim heater (optional),
- data collection device (SDI-12/RS-485 interface, pulse output),
- ground terminal.

For the precipitation gauge power supply and the connection of the data collection device, a common connection cable can be used.

For a OTT Pluvio<sup>2</sup> S with orifice rim heater, an additional connection cable may be used (alternatively two additional wires in the common connection cable).

Benefit: The orifice rim heater can be switched on and off separately from the precipitation gauge. In addition, power consumption of the orifice rim heater requires a larger wire cross-section to be used for longer connection cables.

In total, the connection area of the OTT Pluvio<sup>2</sup> S has two cable entrances (rubber grommets).

**Please note:** The protection concept of the OTT Pluvio<sup>2</sup> S against overloads is designed such that all overvoltages occurring are discharged via a ground connection. For this, the proper and functional installation of a grounding cable is absolutely necessary! This is connected to the OTT Pluvio<sup>2</sup> S at the ground terminal and at the other end in the area of the data collection device or directly at the OTT Pluvio<sup>2</sup> S to a concrete footing ground or ground rod.
Please note: All connection cables must be UV-resistant and suitable to be laid in the ground!

### Connection cable for data collection device/precipitation gauge

<table>
<thead>
<tr>
<th>Interface</th>
<th>Cable length</th>
<th>Cable type</th>
<th>Wire size</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDI-12</td>
<td>maximum 70 m</td>
<td>shielded low-voltage cable</td>
<td>3 x 0.5 mm²</td>
</tr>
<tr>
<td>RS-485</td>
<td>maximum 1000 m</td>
<td>twisted-pair cable</td>
<td>2 x 2 x 0.5 mm²</td>
</tr>
<tr>
<td>Pulse output</td>
<td>maximum 1000 m</td>
<td>shielded low-voltage cable</td>
<td>6 x 0.5 mm²</td>
</tr>
</tbody>
</table>

The connection cable recommended in each case includes the wires for power supply and data collection device.

1) with a point-to-point connection (no SDI-12 bus operation), a cable length of up to 300 m is possible.
2) with standard SDI-12 wiring, alternative 4 x 0.5 mm² wire with separate power supply.
3) the wires intended for power supply can be twisted pair, but do not have to be.

### Connection cable for orifice rim heater power supply 4)

<table>
<thead>
<tr>
<th>Cable length</th>
<th>Cable type</th>
<th>Wire size</th>
</tr>
</thead>
<tbody>
<tr>
<td>maximum 125 m</td>
<td>unshielded low-voltage cable</td>
<td>2 x 0.5 mm²</td>
</tr>
<tr>
<td>25 … 50 m</td>
<td>2 x 1.0 mm²</td>
<td></td>
</tr>
<tr>
<td>50 … 75 m</td>
<td>2 x 1.5 mm²</td>
<td></td>
</tr>
<tr>
<td>75 … 125 m</td>
<td>2 x 2.5 mm²</td>
<td></td>
</tr>
</tbody>
</table>

Calculation is based on: output voltage of the 24 V DC power supply (e.g. mains adapter)

4) optional: As necessary, alternatively provide two additional wires in the cable between data recording unit and power supply considering adequate wire cross-section.

### Grounding cable

- Cable length: max. 5 m
- Cable type: unshielded low-voltage cable
- Wire size: 1 x 10 mm²

### USB cable

If any changes are to be made to the factory settings, a USB cable is temporarily required during commissioning (supplied). Maximum cable length: 3 m.

Please note: The USB port has no overload protection. It is designed to be temporarily used as a service interface.

### 5.2 Required tools and equipment

- Open-ended wrench, size 13 mm (supplied)
- Phillips screwdriver, size: PH 2
- Slotted screwdriver, size: 0.8 mm x 4 mm and 1.0 mm x 6 mm
- Tool for stripping insulation on electrical cables
- Wire-cutting pliers
- For a connection cable with wires made of strands: Ferrules and crimping pliers
5.3 Preparing the installation location

Please note: The depth of the concrete foundation should be determined by the local conditions: The foundation must reach into the frost-free zone in the ground. The dimensions given for the foundation depth are typical values for conditions in Central Europe.

We recommend that an empty conduit pipe (with a wire for pulling in) for the connection and grounding cables is incorporated into the concrete foundation.

- Attach the pedestal with bottom plate to a concrete foundation measuring approx. 45 x 45 x 80 cm using the “Mounting kit for 2" pedestal” (refer to accessories); refer to Fig. 9 and appendix B and C!

Please note: The pedestal must be as vertical as possible!

- Pull the connection cable for the data collection device/power supply into the empty conduit pipe.
- OTT Pluvio² S with orifice rim heater: As applicable, pull additional connection cable for the orifice rim heater power supply into the empty conduit pipe.
- In case the ground for the OTT Pluvio² S is implemented centrally in the area of the data collection device: Also pull the grounding cable into the empty conduit pipe (alternatively, the ground is established directly at the OTT Pluvio² S using a concrete footing ground or ground rod).

Fig. 9: The location prepared for installing the OTT Pluvio² S.

For an OTT Pluvio² S with orifice rim heater, an additional connection cable may be used for supplying power to the orifice rim heater.

The cables may alternatively be routed outside of the pedestal. To protect the cables (e.g. against animal bites), routing the cables inside the pedestal is recommended.
5.4 Preparing the base plate

- Carefully transport the OTT Pluvio² S to the installation location in the closed shipping carton.
- Open the shipping carton and remove the acceptance certificate (FAT), the polybag including installation accessories and possibly further existing accessories.
- Remove the pipe housing with collecting bucket and put it first aside.
- Remove and open the inner carton (consider the hints on the carton) and remove the shaped foam part.

! Remove the base plate from the inner carton and carefully place it on a flat surface. **Please note: Do not** use the load cell or bracket for the bucket support to lift the base plate!

Fig. 10: OTT Pluvio² S base plate.
Unscrew 4 Phillips screws on the cover of the electronics unit approx. 3 mm, raise the cover slightly and pull it off forwards. When the foam rubber seal for the cover is stuck to the surface below, carefully pry the cover off using a slotted head screwdriver.

5.5 Preparing the connection cable

Connection cable for data collection device/power supply:

- Cut the connection cable so that it sticks out approx. 30 – 35 cm above the pedestal. (The „excess“ cable can be stored in the pedestal later.)
- Take the rubber grommet out of the electronics unit (see Fig. 15). Remove the white blanking plug from the rubber grommet and push the grommet onto the connection cable.
- Strip approx. 10 cm the outer sheath off the connection cable.
- Strip approx. 5 mm of the insulation off the individual wires.
- Put the cable shielding together and twist it.
- For a stranded connection cable: push ferrules onto the wires and crimp using crimping pliers.
- Connect the cable to the supplied screw terminal strips (included in the poly-bag); see Fig. 12 and 13:
  - SDI-12 interface → 8-wire screw terminal strip, contact 3
  - RS-485 interface
    - 2-wire → 8-wire screw terminal strip, contacts 1/2
    - 4-wire → 6-wire screw terminal strip, contacts 5/6 +
    - 8-wire screw terminal strip, contacts 1/2
  - Pulse output → 6-wire screw terminal strip, contacts 1/2
    - (Accu RT-NRT) + contacts 3/4
    - (pulse status information; as required)
  - Power supply → 8-wire screw terminal strip, contacts 6/7
    - (precipitation gauge) + contacts 5/8
    - (orifice rim heater; optional)

Orifice rim heater connection cable (optional)

If using a separate connection cable for the orifice rim heater: Assemble the cable as described above and connect to the 8-wire screw terminal strip, see Fig. 13.
Fig. 12: Connecting the cable for the data recording device/power supply for the precipitation gauge to 6-wire and/or 8-wire screw terminal strip (example SDI-12 interface).

Standard SDI-12 wiring has three wires (SDI-12 DATA, GND, and power supply (+12 V)). For separate power supplies, an additional GND wire is available.

Contacts 4, 6, and 8 of the 8-wire screw terminal strip are jumpered internally.

Fig. 13: OTT Pluvio² S with orifice rim heater: Connecting options for power supply of the precipitation gauge and orifice rim heater.

Please note: For version B, common supply voltage must be 24 V DC! (Otherwise, heating power is reduced; refer to "Specifications").

As necessary, two separate cables may be used (e.g. separate cable for optional orifice rim heater).

For clarity, the wires for connecting the data recording unit are shown as dashed lines.

The jumper is included (polybag containing installation accessories).

Contacts 4, 7, and 8 of the 8-wire screw terminal strip are jumpered internally.
5.6 Installing the base plate on the pedestal

- Place the base plate onto the pedestal such that the connection and grounding cables come out of the slit in the base plate flange (see Fig. 16).
- Lead connection and grounding cables through the opening in the base plate upwards.

- **Rotate the base plate so that terminal block of the orifice ring heater is facing southwards**! In extreme climatic conditions, this will prevent incorrect precipitation value output. These may occur during heavy rapid temperature variations together with lateral solar irradiation.
  * on the southern hemisphere: northwards
- Insert the six hexagon bolts into the base plate flange with open-ended wrench, size 13 mm (supplied).

**Please note:** insert all hexagon bolts approximately to the same depth! Do not yet fully tighten the hexagon bolts!

---

Fig. 14: Installing base plate onto pedestal.

![Diagram of base plate installation showing components and orientation]

* on the southern hemisphere: north

South*

Base plate

Orifice ring heater connector block

Base plate flange

Pedestal

Connecting cable

Hexagon bolts (6 x)

Grounding cable
5.7 Connecting the connection cable
- Push rubber grommet with connection cable into the slot.
- Connect 6-wire and 8-wire screw terminal strip to the appropriate PCB sockets.
- Connect the twisted shielding of the cables to the terminal, refer to Fig. 15.
- If necessary, pull back connection cable and store in pedestal (raise base plate again if necessary).
- Push a cable tie through the holes in the base plate and fix the connection cable using the cable tie.

5.8 Connecting the grounding cable
- Cut the grounding cable (cross-section 10 mm²) to approx. 25 … 30 cm.
- Strip off approx. 10 mm of the grounding cable insulation and connect to the earth terminal on the base plate underside. For a stranded grounding cable: push on ferrules and crimp using crimping pliers.
- If necessary, pull back the grounding cable and store in pedestal (lift the base plate once more if necessary).
- Connect the other end of the grounding cable to a foundation or earthing rod.
5.9 Aligning the base plate

- First, fix the base plate using the three upper hexagon bolts. Alternately tighten the bolts until they are all contacting the pedestal. Important: Insert all hexagon bolts approximately to the same depth!
- Using the lower hexagon bolts, adjust the base plate so that the air bubble is within the indicator marked ring. Inserting a hexagon bolt will cause the air bubble to move towards this bolt position. In case of large adjustment travel (pedestal is outside the vertical position for several degrees), turn the opposite hexagon bolts counter-clockwise as necessary!
- Alternately tighten all hexagon bolts while avoiding any distortion of the base plate! Maximum torque: 6 Nm.
- Again check bubble level for correct adjustment.
5.10 Performing final work

- Replace the electronics unit cover and tighten the four Phillips screws.
- Align the bucket support (refer to decal) and carefully place it onto the bracket for the bucket support.
- Secure the bucket support using three Phillips screws (included in polybag).

![Fig. 18: Placing and securing the bucket support.](image)

- Take the collecting bucket out of the pipe housing and remove all shaped form parts.
- Align the collecting bucket and place it onto the back support taking into account the anti-rotation protection, refer to Fig. 19!
- Use the two spring-loaded terminals to secure the collecting bucket.
As necessary: change the factory settings using the OTT Pluvio² S operating software. For installation procedure and using the operating software, refer to Section 7.6.

**Factory settings:**
- SDI-12 sensor address                             0
- serial interface                                          SDI-12
- temperature unit of measurement              °C
- intensity unit of measurement                   mm/min
- pulse factor                                            0.1
- pulse output rate                                     5 Hz
- orifice rim heater*                                  on
- heating mode*                                       1, continuously on
- orifice rim heater target temperature*      +4 °C
* version with ring heater option

For temperatures below 0 °C, add antifreeze; for details, refer to Section 7.2.

Connect the free cable end of the connecting cable to the data collection device and the power supply.

When using a separate connecting cable for the optional orifice rim heater:
Connect the cable for the orifice rim heater to the power supply.

Configure the data collection device. For this, refer to the manual for the data collection device. SDI-12 commands and responses used: refer to Chapter 6.

**Please note:** Connect the shield of the connection cables **also** at the data collection device/power supply!
Carry out functional check: Remove cover of the USB interface → red LED must briefly flash once a second.

Replace cover.

Fig. 20: Carrying out the functional check.

Align the pipe housing and place it onto the base plate. The pipe housing must completely seat on the base plate (refer to the detail drawing in Fig. 22)!

OTT Pluvio² S with orifice rim heater: Ensure that the sockets in the connection block are not contaminated.

Please note: Always place and remove the pipe housing of the OTT Pluvio² S with orifice rim heater straightly!
Tighten three knurled bolts.

Fig. 22: Fitting the pipe housing and tightening the knurled screws.

Please note: After startup, the OTT Pluvio² S uses a 2 minute delay to output the measured values. During this period, the precipitation values are identified in the status information as not completely available yet.
# 6 SDI-12 commands and responses

## 6.1 Basic commands

All SDI-12 basic commands are implemented in the OTT Pluvio² S. The following SDI-12 basic commands are relevant for the operation of the OTT Pluvio² S.

### Conventions applicable to measure value formats:
- **p** – Sign (+, −)
- **b** – Number ahead of the decimal point; output is without leading zeroes!
- **e** – Number after the decimal point

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a!</td>
<td>a&lt;CR&gt;&lt;LF&gt;</td>
<td>Acknowledgment active</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a – Sensor address; factory setting = 0</td>
</tr>
<tr>
<td>ai!</td>
<td>allccccocccmmmmmm ... ... vvvwwww&lt;CR&gt;&lt;LF&gt;</td>
<td>Send identification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a – Sensor address</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ll – SDI-12 protocol version</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ccccccc – Manufacturer identification (company name)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mmmmm – Sensor identification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>vvvv – Sensor version (firmware)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>xxxxxx – Serial number</td>
</tr>
<tr>
<td></td>
<td>OTT Pluvio² S response = 013OTT HACHPLUV2S100xxxxxx</td>
<td></td>
</tr>
<tr>
<td>aAb!</td>
<td>b&lt;CR&gt;&lt;LF&gt;</td>
<td>Change sensor address</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a – old sensor address</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b – new sensor address</td>
</tr>
<tr>
<td>??</td>
<td>a&lt;CR&gt;&lt;LF&gt;</td>
<td>Query sensor address</td>
</tr>
<tr>
<td></td>
<td>(not possible at SDI-12 bus operation)</td>
<td>a – sensor address</td>
</tr>
<tr>
<td>aM! / aM1!</td>
<td>attttn&lt;CR&gt;&lt;LF&gt;</td>
<td>Start measurement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a – Sensor address</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tttt – Time in seconds until the sensor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>has determined the measurement result</td>
</tr>
<tr>
<td></td>
<td>OTT Pluvio² S response = 000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>n – Number of measured values</td>
</tr>
<tr>
<td></td>
<td>OTT Pluvio² S response = 9 to aM 3 to aM1!</td>
<td></td>
</tr>
<tr>
<td>aMC! / aMC1!</td>
<td>attttn&lt;CR&gt;&lt;LF&gt;</td>
<td>Start measurement and request CRC (Cyclic Redundancy Check). For details, see command aM!. The responses to the D0! ... aD2! commands in this case are extended by a CRC value (example): a&lt;value1&gt;&lt;value2&gt;&lt;value3&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td>aC! / aC1!</td>
<td>attttn&lt;CR&gt;&lt;LF&gt;</td>
<td>Start concurrent measurement (simultaneous measurement with multiple sensors on one bus line). For details see command aM!. The number of measured values in the response to this command is two-digit: nn = 09 or 03.</td>
</tr>
<tr>
<td>aCC! / aCC1!</td>
<td>attttn&lt;CR&gt;&lt;LF&gt;</td>
<td>Start concurrent measurement (simultaneous measurement with multiple sensors on one bus line) and request CRC (Cyclic Redundancy Check). For more details, see command aM!. The number of measured values in the response to these commands is two-digit: nn = 09 or 03. The responses to the D0! ... aD2! commands in this case are extended by a CRC value (example): a&lt;value1&gt;&lt;value2&gt;&lt;value3&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt;</td>
</tr>
</tbody>
</table>

* **Note:** Each aM! command resets the total measured values “Accu RT-NRT” and “Accu NRT” to zero!
**Note on Bucket RT and Bucket NRT values:** These level values are not exactly zeroed in case of an empty collecting bucket. Depending on the climatic ambient conditions, they vary by maximum ±10 mm around zero.
### Command and Response

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(continuation of <code>aD2!</code>)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>aD0!*</code></td>
<td><code>a&lt;value1&gt;&lt;value2&gt;&lt;value3&gt; …</code></td>
<td></td>
</tr>
</tbody>
</table>

* after `aM1!`, `aMC1!`, `aC1!`, `aCC1!`

#### Description

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+0</td>
<td>Precipitation gauge working properly</td>
</tr>
<tr>
<td>+1</td>
<td>W: Bucket level ≥ 80 %</td>
</tr>
<tr>
<td>+2</td>
<td>W: USB interface is/was connected</td>
</tr>
<tr>
<td>+4</td>
<td>W: Restart (due to power failure)</td>
</tr>
<tr>
<td>+8</td>
<td>W: Restart (due to firmware)</td>
</tr>
<tr>
<td>+16</td>
<td>W: Weight change out of range</td>
</tr>
<tr>
<td>+32</td>
<td>W: Supply voltage &lt; 7 V</td>
</tr>
<tr>
<td>+64</td>
<td>A: Weight measurement unstable</td>
</tr>
<tr>
<td>+128</td>
<td>A: Weight measurement incorrect</td>
</tr>
<tr>
<td>+256</td>
<td>A: Weight below minimum</td>
</tr>
<tr>
<td>+512</td>
<td>A: Weight above maximum</td>
</tr>
<tr>
<td>+1024</td>
<td>A: No weight calibration</td>
</tr>
</tbody>
</table>

W = warning; A = alarm.

When the OTT Pluvio² S unit outputs other values than those indicated here, several events have occurred simultaneously. In such a case, the individual values are added up. Example: “+34” → Sum obtained from warnings “+2” and “+32”. The status information output – assuming the cause has been rectified – will be reset the next time the command `aM!` is used.

#### Send data

- **a** – Sensor address

<table>
<thead>
<tr>
<th><code>&lt;value1&gt;</code></th>
<th><strong>Temperature of electronics unit</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(approximate ambient temperature incl. delay)</td>
</tr>
<tr>
<td>[°C]:</td>
<td><code>pbb . d</code> (−40.0 ... +85.0)</td>
</tr>
<tr>
<td>[°F]:</td>
<td><code>pbbb . d</code> (−40.0 ... +185.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><code>&lt;value2&gt;</code></th>
<th><strong>Supply voltage</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>[V]:</td>
<td><code>pbb . d</code> (+4.5 ... +28.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><code>&lt;value3&gt;</code></th>
<th><strong>Temperature of orifice ring rim</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>[°C]:</td>
<td><code>pbb . d</code> (−40.0 ... +85.0)</td>
</tr>
<tr>
<td>[°F]:</td>
<td><code>pbbb . d</code> (−40.0 ... +185.0)</td>
</tr>
</tbody>
</table>

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 (see Internet page www.sdi-12.org).
### 6.2 Advanced SDI-12 commands

All advanced SDI-12 commands start with an “O” for OTT. These commands may be used, for example, to retrieve additional information from an OTT Pluvio² S through the transparent mode of a datalogger or to configure an OTT Pluvio² S.

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Description</th>
</tr>
</thead>
</table>

- **Read out firmware version**
  
  aOV!  

  acc. cc. c<CR><LF>  

  Read out firmware version of the OTT Pluvio² S  

  a – Sensor address  
  cc. cc. c – Firmware version  

  Example: V1.00.00 (first firmware version supplied)

- **Set/read the unit for the temperature measured values**
  
  aOUTb!  

  ab<CR><LF>  

  Set unit  

  aOUT!  

  ab<CR><LF>  

  Read out unit  

a – sensor address  
b – 0 = °C; factory setting  
1 = °F

- **Set/read unit for the intensity measurements**
  
  aOUIb!  

  ab<CR><LF>  

  Set unit  

  aOUI!  

  ab<CR><LF>  

  Read out unit  

a – Sensor address  
b – 0 = mm/min; factory setting  
1 = mm/h  
2 = inch/min  
3 = inch/h

Note: This command changes the units for “Accu …” and “Bucket …” at the same time; mm ↔ inch

- **Set/read pulse output rate**
  
  aOCIb!  

  ab<CR><LF>  

  Set pulse output rate  

  aOCI!  

  ab<CR><LF>  

  Read pulse output rate  

a – sensor address  
b – 0 = 5 Hz; factory setting  
1 = 2 Hz

- **Set/read pulse factor**
  
  aOSIb!  

  ab<CR><LF>  

  Set pulse factor  

  aOSI!  

  ab<CR><LF>  

  Read pulse factor  

a – sensor address  
b – 0 = 0.05 mm  
1 = 0.1 mm; factory setting  
2 = 0.2 mm
Set/read orifice rim heater target temperature (OTT Pluvio² S with orifice rim heater)

- **Set mode**
  - **aOCHb!**
  - **ab<CR><LF>**
  - **Set mode**
  - **a** – sensor address
  - **b** – 0 = Orifice rim heater disabled
  - 1 = Mode #1; continuously ON
  - 2 = Mode #2; temperature range control
  - 3 = Modus 3; NWS Standard
  - 4 = Modus 4; precipitation events

- **Read mode**
  - **aOCH!**
  - **ab<CR><LF>**
  - **Read mode**

Set target temperature

- **Set target temperature**
  - **aOCHSpb!**
  - **apb<CR><LF>**
  - **Set target temperature**
  - **a** – sensor address
  - **p** – sign (+)
  - **b** – 2 … 9 (+2 … +9 °C);
  - factory setting +4 °C

Read target temperature

- **Read target temperature**
  - **aOCHS!**
  - **apb<CR><LF>**
  - **Read target temperature**
  - **a** – sensor address
  - **p** – sign (+, –)
  - **b** – 40 … 9 (–40 … +9 °C);
  - factory setting –30 °C

Set/read orifice rim heater lower temperature limit (OTT Pluvio² S with orifice rim heater)

- **Orifice rim heater mode: #2**
  - **Set lower temperature limit**
    - **aOCHGpbb!**
    - **apbb<CR><LF>**
    - **Set lower temperature limit**
    - **a** – sensor address
    - **p** – sign (+, –)
    - **bb** – 40 … 9 (–40 … +9 °C);
    - factory setting –30 °C

- **Read lower temperature limit**
  - **aOCHG!**
  - **apbb<CR><LF>**
  - **Read lower temperature limit**

Set/read orifice rim heater on-time/after-run time (OTT Pluvio² S with orifice rim heater)

- **Orifice rim heater mode: #3, #4**
  - **Set on-time/after-run time**
    - **aOCHDbbbb!**
    - **abbbbb<CR><LF>**
    - **Set on-time/after-run time**
    - **a** – sensor address
    - **bbbb** – 1 … 1440 (1 … 1440 minutes);
    - factory setting 20 minutes

- **Read on-time/after-run time**
  - **aOCHD!**
  - **abbbbb<CR><LF>**
  - **Read on-time/after-run time**

Set/read orifice rim heater starting time (OTT Pluvio² S with orifice rim heater)

- **Orifice rim heater mode: #3**
  - **Set starting time**
    - **aOCHZhh:mm:ss!**
    - **ahh:mm:ss<CR><LF>**
    - **Set starting time**
    - **a** – sensor address
    - **hh:mm:ss** – 00:00:00 … 23:59:59;
    - factory setting 14:00:00 Uhr

- **Read starting time**
  - **aOCHZ!**
  - **ahh:mm:ss<CR><LF>**
  - **Read starting time**

Set/read orifice rim heater self-test interval (OTT Pluvio² S with orifice rim heater)

- **Orifice rim heater mode: #1, #2, #3, #4**
  - **Set self-test interval**
    - **aOCHTbbbb!**
    - **abbbbb<CR><LF>**
    - **Set self-test interval**
    - **a** – sensor address
    - **bbbb** – 1 … 10 080 (1 … 10 080 minutes);
    - factory setting 60 minutes*

  - **Read self-test interval**
    - **aOCHT!**
    - **abbbbb<CR><LF>**
    - **Read self-test interval**

* by OTT Pluvio² operating software adjustable values: 1, 12, 24 hours; 2, 3, 4, 5, 6, 7 days
Set/read serial interface (SDI-12 or RS-485)

\[ \text{aOCL} \quad \text{ab}<\text{CR}><\text{LF}> \]

Set serial interface

\[ \text{aOCL}! \quad \text{ab}<\text{CR}><\text{LF}> \]

Read serial interface

\[ \text{a} - \text{Sensor address} \]

\[ \text{b} - 0 = \text{SDI-12}; \text{factory setting} \]

\[ 1 = \text{RS-485 2-wire} \]

\[ 2 = \text{RS-485 4-wire} \]

Set/read protocol on RS-485 interface

\[ \text{aOCMB} \quad \text{ab}<\text{CR}><\text{LF}> \]

Set protocol

\[ \text{aOCM}! \quad \text{ab}<\text{CR}><\text{LF}> \]

Read protocol

\[ \text{a} - \text{Sensor address} \]

\[ \text{b} - 0 = \text{SDI-12 protocol; factory setting} \]

\[ 1 = \text{ASCII (RS-485 command line mode)} \]

Reset Accu total NRT

\[ \text{aOMR}! \quad \text{a}<\text{CR}><\text{LF}> \]

Reset Accu total NRT

\[ \text{a} - \text{Sensor address} \]
6.3 RS-485 command line mode (ASCII text retrieval)

When using the RS-485 interface, the default transmission protocol is the SDI-12 protocol. This assumes that the data recording device connected can process the SDI-12 protocol. The OTT netDL or OTT DuoSens dataloggers can handle this protocol.

To easily incorporate the OTT Pluvio² S unit into any measuring station infrastructure, a so-called command line mode is implemented in the OTT Pluvio² S. Using an ASCII character format command set, any measured values can be retrieved and various settings made. This command set must be implemented in the data recording device. In the OTT Pluvio² S unit, a number of operating parameters are to be set using the OTT Pluvio² operating software.

**Switching to RS-485 command line mode**

- Communication interface: RS-485 or RS-485 4-wire
- RS-485 protocol type: ASCII Text ...

**Transmission parameters**

- ... 57 600; 19 200; **9 600**; 4 800; 2 400; 1 200 bd (8 N 1)

**Units**

- Temperature values: °C · °F
- Intensity: mm/min · mm/h
- inch/min · inch/h

**Commands**


- Immediately after the character M, any separator can follow optionally. This character then separates the individual values from each other in the answer from the OTT Pluvio² S.

**Output format**

<table>
<thead>
<tr>
<th>Measured value</th>
<th>metric</th>
<th>imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity RT</td>
<td>+0000.000/+00.000</td>
<td>+00.000/+0.000</td>
</tr>
<tr>
<td>Accu RT/NRT</td>
<td>+000.000</td>
<td>+00.000</td>
</tr>
<tr>
<td>Accu NRT</td>
<td>+000.000</td>
<td>+00.000</td>
</tr>
<tr>
<td>Accu total NRT</td>
<td>+000.000</td>
<td>+00.000</td>
</tr>
<tr>
<td>Bucket RT</td>
<td>+000.000</td>
<td>+000.000</td>
</tr>
<tr>
<td>Bucket NRT</td>
<td>+000.000</td>
<td>+000.000</td>
</tr>
<tr>
<td>Temperature of load cell</td>
<td>+0.000</td>
<td>+000.000</td>
</tr>
<tr>
<td>Heater status*</td>
<td>+000</td>
<td>+000</td>
</tr>
<tr>
<td>Status*</td>
<td>+000</td>
<td>+000</td>
</tr>
</tbody>
</table>

* for description of the status information, see Chapter 6.1

- **E[separator]<CR>** additionally to the command M returns the values “Temperature electronics unit”, “Supply voltage” and “Temperature orifice ring rim”

- **R<CR>** resets the value “Accu total NRT” to zero

- **W<CR>** switches the orifice rim heater ON

- **S<CR>** switches the orifice rim heater OFF

- **I<CR>** retrieves various pieces of information from the device: Serial number, firmware, device version, unit, hardware index, PCB number, load cell number

**Examples**

- **M;<CR>**
  
  +0.000;+0.000;+0.000;+0.000;+263.909;
  +263.904;+24.0;+0;+0;<CR><LF>

- **E;<CR>**
  
  +0.000;+0.000;+0.000;+0.000;+263.909;+263.904;
  +24.0;+0;+24.4;+12.2;+24.2;CRC023B;<CR><LF>

- **R<CR>**
  
  OK

- **W<CR>**
  
  Heating ON

- **S<CR>**
  
  Heating OFF

- **I<CR>**
  
  00000361534;V1.00.0;200:mm/h;E0;005760018;31200106

* **Note:** Each command M or E resets the total measured values “Accu RT-NRT” and “Accu NRT” to zero!
7 Performing maintenance operations

To ensure smooth operation of the precipitation gauge, we recommend to perform the following maintenance operations at the intervals given:

- Emptying: bucket level ≥ 80 %
- Add anti-freeze: ambient temperature < 0 °C
- Visual inspection: once a year
- Check measurement: once a year

7.1 Emptying the collecting bucket

You may empty the bucket contents at any time, irrespective of the level. Any collecting bucket overflow will result in incorrect measurements, but will not damage the precipitation gauge.

- When to empty?
  When the collecting bucket level is 80 % or more (≥ 320 mm of precipitation); refer to Bucket RT/Bucket NRT values; Status information includes warning “+1”; response (value 9) to SDI-12 command “aD2!” after “aM!”、“aMC!”、“aC!” oder “aCC!”.

- Interval
  Typically once or twice a year;
  (more frequently in regions with heavy amount of precipitation).

CAUTION  Risk of injury by falling collecting bucket!

A completely filled collecting bucket has a weight of approx. 8.5 kg!

- Be careful when emptying the collecting bucket.
- As applicable, ask another person to assist.

How to empty the collecting bucket:

- Loosen three knurled screws.
- Remove the pipe housing upwards.
- Remove both spring-loaded terminals and carefully remove the collecting bucket.
  Please note: Proceeding carelessly, e.g. roughly placing the filled collecting bucket on the bucket support, may damage the weighing mechanism.
- Empty the collecting bucket.
- Place the collecting bucket on the bucket support (note the anti-rotation protection) and secure it using the two spring-loaded terminals, refer to Fig. 19.
- Align the pipe housing and install it, refer to Fig. 22.
- Tighten three knurled screws.

7.2 Adding anti-freeze agent for winter operation

For temperatures below 0 °C*, we recommend anti-freeze agent be added to the collecting bucket. This anti-freeze causes the collected solid precipitation to gradually thaw in the collecting bucket.

Moreover, it prevents the unit from getting damaged when the collecting bucket is filled for more than 80 % and the contents is frozen. Please use the anti-freeze POWERCOOL DC 924-PXL in an aqueous solution, refer to Appendix E (manufacturer: Thermochema GmbH, A-4460 Losenstein; Phone +43 7255 4244-0; www.thermochema.at.)

* temperatures all over the day of continuously < approx. −5 °C. When temperatures of above 0 °C occur for a longer period during the day, adding anti-freeze is not necessary.
How to add anti-freeze agent:
- Preparing the anti-freeze solution: Mix 1 litre of anti-freeze with 0.4 litre of water.
- Carefully add anti-freeze solution to the collecting bucket (the pipe housing does not have to be removed for this).

Please note: Add anti-freeze agent only as an aqueous solution (add 40 % of water)! Never use neat! (POWERCOOL is hygroscopic.)

Note on disposing of anti-freeze solution
Typically, the anti-freeze solution of a single precipitation gauge may be disposed of into the public sewage system. However, observe all applicable local regulations. Please refer to your local authority responsible for questions regarding disposal and/or contact Thermochema GmbH.

Note on winter operation without anti-freeze
Basically, the unit may be operated in the winter season without adding anti-freeze solution. However, this mandatorily requires the collecting bucket to be checked and emptied in regular intervals!

Please note: When the accumulated precipitation freezes that has filled the collecting bucket up to 80 %, this may result in permanent damage to the weighing mechanism.

Note on third-party anti-freeze solution products
Basically, third-party products may be used provided the following requirements are met:
- Good solubility in water, low-density (i.e. the anti-freeze agent does not settle below the water).
- Low evaporation (do not use methanol).
- Little corrosive effect on aluminium and stainless steel.
- Low freezing point even with high collecting bucket level.
- Low hygroscopic properties (absorption of moisture from ambient air, which would affect the measurement results).
- Note chemical compatibility with collecting bucket (ASA).
- No gumming after use in open containers for several months.

7.3 Performing the visual inspection
- Check smooth movement of the collecting bucket in all directions at the lower edge of the bucket orifice. The collecting bucket upper edge may not contact the pipe housing!
- If present, carefully remove any contamination (e.g. insects, insect nests, spider webs, etc.), and icing.

7.4 Additional checks in cases of defect
- Is the collecting bucket distorted?
- Is the collecting bucket correctly positioned on the bucket support?
- Is the pipe housing correctly positioned and not damaged?
- Is the weighing mechanism contacting other components, e.g. caused by contamination?
- Is the red LED flashing (refer to Fig. 20)?
- Use Chapter 7.5 to isolate the failure.
- If in doubt, perform a Guided Accuracy Test as described in Chapter 7.6.
7.5 Troubleshooting/remedy

Loss of communication through the SDI-12 or RS-485 interfaces

General (both interface types)

▷ OTT Pluvio² S is connected to PC/tablet via USB cable (in this case, the OTT Pluvio² S unit disconnects communication over the SDI-12/RS-485 interfaces); red LED flashing in 1 second interval, green LED permanently lit:
  → disconnect USB cable.

▷ Precipitation gauge supply voltage missing, incorrectly connected, or is outside the specified range; red LED is continuously OFF:
  → restore power supply to the unit (replace fuse as necessary);
  → check supply voltage level and adjust as necessary;
  → check supply voltage wiring and correct as necessary.

▷ Precipitation gauge and the data recording unit connected are powered by two isolated power sources; GNDs of the two power supplies are not connected to each other:
  → establish connection between the two GNDs.

SDI-12 interface

▷ Incorrect configurations of the OTT Pluvio² S and/or of the data recording unit connected:
  → check the SDI-12 sensor address of OTT Pluvio² S and correct as necessary (using the OTT Pluvio² Operating Software);
  → check the “Communication interface” (SDI-12) setting and correct as necessary (using the OTT Pluvio² Operating Software);
  → check the configuration of the data recording unit connected and correct as necessary (refer to the data recording unit Operating Instructions).

RS-485 interface – SDI-12 protocol

▷ RS-485 interface wiring is incorrect (pins “Data RS-485 …”):
  → 2-wire: check pin assignments of “… - A”, “… - B” and swap as necessary;
  → 4-wire: check pin assignments of “… TX - A”, “… TX - B” as well as of “… RX - A”, “… RX - B” and swap as necessary.

▷ Incorrect configurations of the OTT Pluvio² S and/or of the data recording unit connected:
  → check the SDI-12 sensor address of OTT Pluvio² S and correct as necessary (using the OTT Pluvio² Operating Software);
  → check the “Communication interface” (RS-485/RS-485 4-wire) setting and correct as necessary (using the OTT Pluvio² Operating Software);
  → check the “RS-485 protocol type” (SDI-12 protocol) setting and correct as necessary (using the OTT Pluvio² Operating Software);
  → check the configuration of the data recording unit connected and correct as necessary (refer to the data recording unit Operating Instructions).

▷ When an RS-485 interface converter is used – incorrect settings:
  → check settings and correct as necessary.

▷ When terminal software (e.g. for testing) is used – incorrect settings:
  → check settings and correct as necessary.
RS-485 interface – ASCII protocol

- RS-485 interface wiring is incorrect (pins “Data RS-485 ...”):
  - 2-wire: check pin assignments “... - A”, “... - B” and swap as necessary;
  - 4-wire: check pin assignments “... TX - A”, “... TX - B” as well as of “... RX - A”, “... RX - B” and swap as necessary.
- Incorrect configurations of the OTT Pluvio² S and/or of the data recording unit connected:
  - check the “Communication interface” (RS-485/RS-485 4-wire) setting and correct as necessary (using the OTT Pluvio² Operating Software);
  - check the “RS-485 protocol type” (ASCII text ...) setting and correct as necessary; make sure that Baud rate is correct; 1200 … 57,600 Bd (using the OTT Pluvio² Operating Software);
  - check the configuration of the data recording unit connected and correct as necessary (refer to the data recording unit Operating Instructions).

Loss of communication through the USB interface

- Connection between OTT Pluvio² S and PC/tablet via USB cable failed; red LED is flashing in 1 second interval, green LED is OFF:
  - check connection via USB cable and correct as necessary.
- USB grounding cable/ivers on PC/tablet is not or incorrectly installed:
  - (re)install USB grounding cable/ivers.

No or incorrect pulses available at the pulse outputs

- Precipitation gauge supply voltage missing, incorrectly connected, or is outside the specified range; red LED is continuously OFF:
  - restore power supply to the unit (replace fuse as necessary);
  - check supply voltage level and adjust as necessary;
  - check supply voltage wiring and correct as necessary.
- Supply voltage* for external circuitry connected to the pulse output is missing, incorrectly connected, or limits for U_max and I_max are exceeded:
  - power external circuitry*;
  - check wiring of the pulse outputs and correct as necessary;
  - check external circuitry and correct as necessary, so that the limits for U_max and I_max are kept.
* not required for OTT dataloggers
- Incorrect configurations of the OTT Pluvio² S and/or of the data recording unit connected:
  - check the “Pulse output frequency” setting and correct as necessary (using the OTT Pluvio² Operating Software);
  - check the “Pulse factor” setting and correct as necessary (using the OTT Pluvio² Operating Software);
  - check the configuration of the data recording unit connected and correct as necessary (refer to the data recording unit Operating Instructions).

**Note:** The “Pulse status information” output continuously provides pulses (alive signal) when the unit is operating properly. Depending on collecting bucket level, 10 … 100 pulses per minute are output or, when the OTT Pluvio² S unit is connected to a PC/tablet via USB cable, 120 pulses per minute are output.
Orifice rim heater self-test failed/is not run

- Orifice rim heater supply voltage is missing, incorrectly connected, or is outside the specified range:
  - restore power supply to the orifice rim heater (replace fuse as necessary);
  - check supply voltage level and adjust as necessary;
  - check wiring of the orifice rim heater and correct as necessary.
- Pipe housing (including built-in orifice rim heater) is not installed:
  - install the pipe housing.
- Pipe housing without built-in orifice rim heater of another OTT Pluvio² S is accidentally installed:
  - install the pipe housing with built-in orifice rim heater.
- No self-test is run:
  - check the “Self-test interval” (Modes 2, 3, 4) setting and correct as necessary (using the OTT Pluvio² Operating Software);
  - force self-test by a “Power-Reset” once.

Orifice rim heater does not work/does not work as expected

- Orifice rim heater supply voltage is missing, incorrectly connected, or is outside the specified range:
  - restore power supply to the orifice rim heater (replace fuse as necessary);
  - check supply voltage level and adjust as necessary; make sure that output power of power source is sufficient;
  - check orifice rim heater wiring and correct as necessary; make sure that cable cross-section is sufficient;
  - check heater status (using the OTT Pluvio² Operating Software).
- Pipe housing (including built-in orifice rim heater) is not installed:
  - install the pipe housing.
- Pipe housing without built-in orifice rim heater of another OTT Pluvio² S is accidentally installed:
  - install the pipe housing with built-in orifice rim heater.
- Configuration of the orifice rim heater results in unexpected heater performance:
  - check settings
    - mode of operation
    - orifice rim target temperature (modes #1, #2, #3, #4)
    - lower temperature limit (mode #2)
    - switch-on time (mode #3)
    - on-time (mode #3)
    - after-run time (mode #4)
  - and correct as necessary (using the OTT Pluvio² Operating Software).
- OTT Pluvio² S system time is incorrect (e.g. after power supply failure):
  - correct system time (using the OTT Pluvio² Operating Software).
**No/low precipitation output**

- No precipitation output
  - when USB interface is/was connected,
  - after emptying,
  - start-up/power failure:
    → wait for 5 minutes.
- Collecting bucket overflow:
  → empty the collecting bucket.
- Evaporation rate is very high (collecting bucket is empty and ambient temperature is high):
  → add approx. 1 to 2 litres of water to the collecting bucket.
- Apparently low output for NRT values:
  → wait for 5 minutes (delay caused by filter algorithm).
- Increase in weight > approx. 12 mm within 6 seconds:
  → no precipitation output (filter algorithm detects foreign matter), since amount of natural precipitation is exceeded; check precipitation gauge status:
   Warning “+16” (using the OTT Pluvio² Operating Software).
- Precipitation gauge probably failed:
  → perform Guided Accuracy Test (using the OTT Pluvio² Operating Software).
- Precipitation gauge is not level:
  → check the bubble level indicator and correct adjustment as necessary.

**Note:** Check whether measured value used is suited for present application (behaviour over time: Real-time output (RT), Non Real-time output (NRT), or combination value (RT-NRT))! For a description of the individual measured values, refer to Chapter 3.1. Use another measured value as necessary.

**Incorrect precipitation output**

- Foreign matter (leafs, insects, …) have entered the collecting bucket (increase in weight < approx. 12 mm within 6 seconds; any higher increase is detected as foreign matter by the filter algorithm):
  → manually correct the amount of precipitation by deducting a respective amount.
- Base plate is incorrectly levelled:
  → Rotate the base plate so that the connector block of the orifice rim heater is facing in South direction (North direction on the southern hemisphere)!
  Refer to Chapter 5.6.
- Anti-freeze agent without water was added (hygroscopic behaviour):
  → Add anti-freeze agent only as an aqueous solution (add 40 % of water)!
7.6 Performing the Guided Accuracy Test (check measurement)

The "OTT Pluvio² S Software" flash drive is available as an accessory to the OTT Pluvio² S (refer to Appendix E).

In addition to the Operating Instructions (PDF file), USB grounding cableivers, and OTT datalogger example configurations, this flash drive includes the OTT Pluvio² Operating Software. Alternatively, the individual files are found on our website www.ott.com/resources for free download.

Using the OTT Pluvio² Operating Software, a Guided Accuracy Test may be performed. Using this test, the OTT Pluvio² S can be easily and quickly checked for proper operation on site.

In addition to this feature, other operations are provided by this Operating Software: e.g. modify OTT Pluvio² S basic settings, start measurements, or update the firmware.

⚠️ Please note: Perform the Accuracy Test on calm days without precipitation! (Otherwise, the test will be affected by wind and unwanted precipitation.) The USB interface also supplies operating voltage to the OTT Pluvio² S. No additional power supply is required. However, if present, it does not have to be removed.

Preparatory work
Prerequisite: PC (notebook) running Microsoft Windows 7 or later operating system.

- Log on to the PC as an administrator
- Installing the OTT Pluvio² Operating Software:
  - copy the file "setup.exe" into a directory of the PC;
  - start the file "setup.exe" → the "InstallShield Wizard" (installation program) opens;
  - follow the installation instructions on the screen.
- Installing the USB grounding cableivers (FTDI drivers):
  - copy the file "CDM v2.12.00 WHQL Certified" into a directory of the PC;
  - remove the USB interface cover and connect the OTT Pluvio² S to the PC via the USB cable (included); refer to Fig. 23;
  - complete the device driver installation wizard that is automatically started;
  - start the file "CDM v2.12.00 WHQL Certified".  

Fig. 23: Connecting the OTT Pluvio² S to the PC using the USB interface.

Once the PC supplies power to the OTT Pluvio² S via the USB interface, a green LED below the USB interface is lit.
Performing the Guided Accuracy Test

- Loosen the three knurled screws at the pipe housing.
- Remove the pipe housing upwards.
- Remove both spring-loaded terminals and carefully remove the collecting bucket.
- Remove the USB interface cover and connect the OTT Pluvio² S to the PC via the USB cable (included); refer to Fig. 23.
- Start the OTT Pluvio² S Operating Software.
- Select the “Connect” button – the Operating Software will establish a connection to the OTT Pluvio² S unit and retrieves different status information.
- Select the “Guided Accuracy Test” button – a wizard will guide you through the accuracy test. Make sure you follow all the steps and notes shown on the display!
- After completing the accuracy test, remove the USB cable.
- Replace the USB interface cover.
- Empty the collecting bucket as necessary, reinstall it and secure it using the two spring-loaded terminals; refer to Fig. 23.
- Align the pipe housing and install it, refer to Fig. 22.
- Retighten three knurled screws.

**Please note:** After attaching the USB interface, the OTT Pluvio² S disconnects communication over the other interfaces!!
8 Repair

In case of a device malfunction, use Section 7.5 to see if you can resolve the problem yourself.

In case of unit failure, please contact the OTT repair center:

OTT Hydromet GmbH
Repaircenter
Ludwigstrasse 16
87437 Kempten · Germany
Phone  +49 831 5617-433
Fax  +49 831 5617-489
repair@ott.com

Please note: Only have a defective OTT Pluvio² S checked and repaired by the OTT repair center. Never attempt to repair the unit yourself! On no account carry out repairs yourself! Only a qualified repair followed by a factory final test ensures the specified measurement accuracy. Any repairs or attempted repairs carried out by the client will void any warranty.

After being properly trained, expressly authorized partner companies or clients are allowed to perform repairs by replacement of components on their own. For more information, please contact the OTT HydroService department.

9 Notes about the disposal of used units

Within the member countries of the European Union

In accordance with the European Union Directive 2002/96/EC, OTT takes old devices back within the member countries of the European Union and disposes of them properly. The devices concerned by this are marked with the symbol shown aside.

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 directive 2002/96/EC of your country.

For all other countries

Dispose of the OTT Pluvio² S properly after taking out of service.
Observe any applicable local regulations for the disposal of electronic devices!
Never put the OTT Pluvio² S into the normal household waste!

Materials used

Base plate: stainless steel/aluminium
Collecting bucket: ASA
Bucket support: ASA
Pipe housing: ASA

The material identification is found on the component itself for plastic parts.
10 Technical Data

Supply voltage
Current consumption
Power consumption

Recordable precipitation
Recordable precipitation amount
Resolution
   Intensity
   Amount of precipitation
Accuracy

Measuring range
   Bucket content
Collecting area
Sampling interval (Poll)
Output delay
   Real time
   Non-real-time (filtered values)

Interfaces
   USB
   SDI-12
   RS-485 (2- or 4-wire)

Pulse output

Measured values/status values output

Supply voltage for orifice rim heater

Heater current consumption
Heater power

Operating range of the orifice rim heater (ambient temperature)
Measuring range of orifice rim temperature
Target temperature for orifice ring rim
Accuracy of target temperature

Dimensions Ø x h
Weight (empty)
Housing material
   Base plate
   Collecting bucket
   Bucket support
   Pipe housing
Degree of protection
   Pipe housing closed
   Pipe housing open
   Load cell
Temperature range
   Operation
   Storage
   Temperature compensation
Max. wind speed without device damage
Relative humidity
EMV
Salt resistance

6.6 ... 28 VDC; typ. 12 VDC; reverse-polarity protected typ.
12 mA (measuring); typ. 18 mA (communication) at 12 VDC
≤ 145 mW (without heater)

recordable precipitation amount
400 mm

0.001 mm/min oder mm/h
0.001 mm
refer to limits/accuracy

400 mm ≈ 8 l
200 cm² (Ø 159.6 ±0.1 mm)
1 minute ... 60 minutes

< 1 minute
5 minutes (max. collecting period is 60 minutes)

Version 2.0 (only for service purposes – no overload protection)
Version 1.3
SDI-12 protocol and RS-485 command line mode; transfer speed
factory setting (RS-485): 9600 baud; 8 N 1
2 or 5 Hz

Intensity RT, Accu RT/NRT, Accu NRT, Accu total NRT, Bucket RT,
Bucket NRT, Temperature of load cell, OTT Pluvio2 S status,
Heater status

12 ... 28 VDC; typ. 12/24 VDC; reverse-polarity protected
(no isolation of the power supply for the orifice rim heating and
the precipitation gauge necessary)
max. 2.2 A
at 12 V*: 12.5 Watt
at 24 V: 50 Watt
* Temperature ramp of the orifice rim temperature restricted to
12 K (wind speed 0 m/s each)

-40 ... +60 °C
-40 ... +85 °C
+2 ... +9 °C; factory setting +4 °C
±1 °C

288 mm x 651 mm
approx. 7.8 kg

stainless steel/aluminium
ASA, UV resistant
ASA, UV resistant
ASA, UV resistant

IP 65
IP 63
IP 67

-40 ... +60 °C
-40 ... +70 °C
-25 ... +45 °C

50 m/s

0 ... 100 %, non-condensing

2004/108/EG; EN 61326-1:2013
EN 60068-2-11

CE
<table>
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<th>Measured value</th>
<th>Unit</th>
<th>Measuring range</th>
<th>Threshold</th>
<th>Resolution</th>
<th>Accuracy absolute</th>
<th>Accuracy relative</th>
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<td><strong>SDI-12/RS-485 interface</strong></td>
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<td></td>
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<tr>
<td>Intensity RT</td>
<td>mm/h</td>
<td>0.000 … 3000.000</td>
<td>6.000</td>
<td>0.60</td>
<td>±6 ±1 %</td>
<td>±1 %</td>
<td>&lt;1</td>
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<tr>
<td></td>
<td>mm/min</td>
<td>0.000 … 50.000</td>
<td>0.100</td>
<td>0.001</td>
<td>±0.1 ±1 %</td>
<td>±1 %</td>
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<tr>
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<td>mm</td>
<td>0.000 … 500.000</td>
<td>0.030</td>
<td>0.001</td>
<td>±0.1 ±1 %</td>
<td>±1 %</td>
<td>1 … 65</td>
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<td>0.000 … 500.000</td>
<td>0.030</td>
<td>0.001</td>
<td>±0.1 ±1 %</td>
<td>±1 %</td>
<td>5 … 65</td>
</tr>
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<td>0.030</td>
<td>0.001</td>
<td>±0.1 ±1 %</td>
<td>±1 %</td>
<td>5 … 65</td>
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<td>Bucket RT</td>
<td>mm</td>
<td>7.000 … 400.000</td>
<td>0.001</td>
<td>±0.1</td>
<td>±0.2 %</td>
<td>&lt;1</td>
<td></td>
</tr>
<tr>
<td>Bucket NRT</td>
<td>mm</td>
<td>7.000 … 400.000</td>
<td>0.001</td>
<td>±0.1</td>
<td>±0.2 %</td>
<td>5</td>
<td></td>
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<tr>
<td>Temperature of load cell °C</td>
<td>–40.0 … +85.0</td>
<td>0.1</td>
<td>±1</td>
<td></td>
<td></td>
<td></td>
<td>&lt;1</td>
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<td>0 … 128</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>&lt;1</td>
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<td></td>
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<td>&lt;1</td>
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<td>Temp. of electronics unit °C</td>
<td>–40.0 … +85.0</td>
<td>0.1</td>
<td>±1</td>
<td></td>
<td></td>
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<td>&lt;1</td>
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<td>V</td>
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<td>±0.5</td>
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<td>&lt;1</td>
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<td>Temp. of orifice ring rim °C</td>
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<td>0.1</td>
<td>±1</td>
<td></td>
<td></td>
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<td>&lt;1</td>
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<td><strong>Pulse outputs</strong></td>
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<td>Pulse status information</td>
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<td>1</td>
<td></td>
<td></td>
<td></td>
<td>&lt;1</td>
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<tr>
<td>Pulse-Accu RT-NRT</td>
<td>mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Output rate 2 Hz</td>
<td></td>
<td>0.05 … 6.0* / 0.1 … 12.0** / 0.2 … 24.0***</td>
<td>0.1/0.2</td>
<td>±0.1/0.2 ±1 %</td>
<td>&lt;1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Output rate 5 Hz</td>
<td></td>
<td>0.05 … 15.0* / 0.1 … 30.0** / 0.2 … 60.0***</td>
<td>0.1/0.2</td>
<td>±0.1/0.2 ±1 %</td>
<td>&lt;1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pulse factor: 0.05** **Pulse factor: 0.1** **Pulse factor: 0.2**
Appendix A – Connecting the OTT Pluvio² S to an OTT datalogger

A.1 Connecting the OTT Pluvio² S to an OTT netDL or OTT DuoSens via SDI-12 or RS-485 interface

Method A: Connecting the OTT Pluvio² S via the SDI-12 interface (protocol and physical interface: SDI-12). The maximum length of the cable is 70 m.

- Connect the OTT Pluvio² S to the OTT netDL IP datalogger or to the OTT DuoSens Compact Datalogger as shown in Figure A1.
- Also refer to the OTT netDL/OTT DuoSens Operating Instructions.

Method B: Connect the OTT Pluvio² S using the physical RS-485 interface (SDI-12 protocol via physical RS-485 interface). The maximum cable length is 1000 m.

- Connect the OTT Pluvio² S to the OTT netDL IP datalogger or to the OTT DuoSens Compact Datalogger as shown in Figure A2.
- Also refer to the OTT netDL/OTT DuoSens Operating Instructions.

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Fig. A1: Connecting the OTT Pluvio² S to an OTT netDL or OTT DuoSens via the SDI-12 interface.

The letters above the screw terminal strips identify the connectivity options available on the OTT netDL/OTT DuoSens.

For this application, only the 8-wire screw terminal strip is needed.

Fig. A2: Connecting the OTT Pluvio² S to an OTT netDL or OTT DuoSens via the RS-485 interface (SDI-12 protocol).

The letters above the screw terminal strips identify the connectivity options available on the OTT netDL/OTT DuoSens.

For this application, only the 8-wire screw terminal strip is needed.

The GND connection represented by the dashed line is necessary only in case the OTT Pluvio² S and the OTT netDL/OTT DuoSens are powered by separate power supplies.
Configuring the OTT netDL/OTT DuoSens for the OTT Pluvio³ S with SDI-12 interface

- Create a OTT netDL/OTT DuoSens channel with “SDI-12 Master” or “OTT SDI RS485” function block (“Serial sensors” tab).
- Make the following settings:

  ![Fig. A3: Setting the operating parameters of the OTT netDL/OTT DuoSens SDI-12 Master function block.](image)

  The function block OTT SDI RS485 is set in the same way.
  (Example shown: OTT DuoSens).

<table>
<thead>
<tr>
<th>Value no.</th>
<th>Virtual Terminal ID</th>
<th>Value no.</th>
<th>Virtual Terminal ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V02</td>
<td>6</td>
<td>V06</td>
</tr>
<tr>
<td>2</td>
<td>V03</td>
<td>7</td>
<td>V07</td>
</tr>
<tr>
<td>3</td>
<td>V04</td>
<td>8</td>
<td>V08</td>
</tr>
<tr>
<td>4</td>
<td>V05</td>
<td>9</td>
<td>V09</td>
</tr>
</tbody>
</table>

- **Terminal block**
  - OTT netDL “SDI-12 Master”: C 3-4 (specified)
  - OTT netDL “OTT SDI RS485”: C 1-2 (specified)
  - OTT DuoSens “SDI-12 Master”: A 3-4 (specified)

- **Slave address**
  - SDI-12 bus address. Each slave address may be assigned on an SDI-12 bus line only once. (Check/set: refer to OTT netDL/OTT DuoSens Operating Instructions, Chapter SDI-12 Transparent Mode.) Typical setting: “0” (only one OTT Pluvio³ S is connected to the terminal block, no bus operation).
  - Identifies which value (the xth of n values + status information) of the OTT Pluvio³ S is recorded in this channel. Typical setting: “1” (first one of nine (“M!” Measuring Mode) or three (“M1!” Measuring Mode) measured values).

- **Measuring mode**
  - “M!” or “M1!” (for allocating the measured values, refer Chapter 6, “SDI-12 commands and responses”)

- **Value no./Virtual Terminal ID**
  - Allocating the additional measured values of the OTT Pluvio³ S to virtual terminals (for allocating the measured values, refer to Chapter 6, “SDI-12 commands and responses”)

- **Concurrent mode**
  - Only for OTT netDL: refer to the operating program online help.

- **Instantaneous value**
  - Only for OTT netDL: refer to the operating program online help.

In the respective Channel function blocks, set the required units and number of digits after the decimal place.

**Notes:**

- For recording all the 12 measured values + status information for an OTT Pluvio³ S, 12 channels in the OTT netDL/OTT DuoSens are thus necessary. The first channel contains the function block “SDI-12 Master” or “OTT SDI RS485” as the input signal. The other channels each contain a function block “Virtual Sensor” (V02 to V09) as the input signal, (V03 in case of M11). Of course, just individual channels can also be recorded. In this case, there are fewer entries required in the “Value no./Virtual Terminal ID” field.

- Further information on the SDI-12 commands and responses used can be found in Chapter 6, “SDI-12 commands and responses”.

- The OTT Pluvio³ S makes the measurement results available for retrieval immediately after the aM! and aM1! SDI-12 commands.
A.2 Connecting the OTT Pluvio² S to an OTT netDL or OTT DuoSens via the pulse output

Connect the OTT Pluvio² S to the OTT netDL IP datalogger or to the OTT DuoSens Compact Datalogger as shown in Figure A5. Also refer to the OTT netDL/OTT DuoSens Operating Instructions. Maximum cable length: 1000 m.

Fig. A5: Connecting the OTT Pluvio² S to an OTT netDL or OTT DuoSens via the pulse output.

The letters above the screw terminal strips identify the connectivity options available on the OTT netDL/OTT DuoSens. One pulse input of the OTT netDL/DuoSens is used in each case for the precipitation amount and the status information.
Configuring OTT netDL/OTT DuoSens for OTT Pluvio² S with pulse output

- Create two OTT netDL/OTT DuoSens channels with function block “Pulse input” ("Digital sensors" tab). (When you only want to record the amount of precipitation, one function block is sufficient.)
- Make the following settings:

<table>
<thead>
<tr>
<th>Terminal block</th>
<th>Pulse factor</th>
<th>Debounce delay [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTT netDL:</td>
<td>0.05 · 0.1 · 0.2</td>
<td>only for OTT netDL:</td>
</tr>
<tr>
<td>OTT DuoSens:</td>
<td>(one pulse corresponds to 0.05, 0.1 mm, or 0.2 mm of precipitation.)</td>
<td>time in milliseconds during which the pulse input is disabled after recording a pulse. This prevents the OTT netDL from recording unwanted pulses caused by bouncing switch contacts. Set 8 ms for the OTT Pluvio² S.</td>
</tr>
</tbody>
</table>

Please note:
- Always position a pulse input at the beginning (top) of the function tree.
- After changing the pulse factor, a data reset (reset the OTT netDL/OTT DuoSens) is necessary!
- In the “Channel” function block, set the required unit and number of digits after the decimal place.

Pulse input function block

Please note:
- Communication interface COM1
- Alarm management
- Display / Observer
- Channel 1/20 / imp. Acc/RT INRT
  - Meter cycle [000.00]
  - [B 1-2] [Pulse input]
  - Instantaneous value
  - State
- Channel 1/117 / imp. Status
  - Meter cycle [000.00]
  - [B 3-4] [Pulse input]
  - Instantaneous value
  - State
Appendix B – Dimensions of the OTT Pluvio² S with pedestal and bottom plate

Installation height (orifice ring)

<table>
<thead>
<tr>
<th>Length</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td></td>
</tr>
<tr>
<td>1500</td>
<td></td>
</tr>
</tbody>
</table>

Ø 159.6 ± 0.1 mm

200 cm²

 Ø 253 mm (max. 288 mm)

Pedestal with bottom plate
(Length: 424 mm, 624 mm, 924 mm)

Optional empty conduit pipe laying

Empty conduit pipe for connecting and earth cables

Concrete foundation

Concrete foundation

800 mm

0
Appendix C – Dimensions of pedestal with bottom plate

**Dimensions A**
- Installation height **1.0 m**: 424 mm
- Installation height **1.2 m**: 624 mm
- Installation height **1.5 m**: 924 mm

**Order numbers**
1. 70 030 430 2.1
2. 70 030 431 2.1
3. 70 030 432 2.1

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![Diagram of pedestal with bottom plate]
Appendix E – Accessories/replacement parts

Accessories

2”-pedestal with bottom plate for 1.0 m installation height
- length 424 mm
- incl. bottom plate for attaching to a concrete foundation
- installation height (height of orifice ring): 1.0 m

2”-pedestal with bottom plate for 1.2 m installation height
- length 624 mm
- incl. bottom plate for attaching to a concrete foundation
- installation height (height of orifice ring): 1.2 m

2”-pedestal with bottom plate for 1.5 m installation height
- length 924 mm
- incl. bottom plate for attaching to a concrete foundation
- installation height (height of orifice ring): 1.5 m

Mounting kit for 2” pedestal
- for attaching the 4” pedestal to a concrete foundation
- 4x compound anchor cartridge
- 4x anchor rod M12
- 4x hexagon nut M12 + washer

Wind shield OTT PWS ...
- … 100 for 1.0 m installation height
- … 120 for 1.2 m installation height
- … 150 for 1.5 m installation height

Wind shield mounting kit OTT PWS ...
- for attaching the wind shield to a concrete foundation
- 4x compound anchor cartridge
- 4x anchor rod M10
- 4x hexagon nut M10 + washer

OTT POD 100 platform
- for use with OTT PWS 100 or OTT PWS 150 wind shields
- for OTT Pluvio² S installation heights of 2.0 or 2.5 m
- height: 1 m

Mounting kit for OTT POD 100 platform
- for attaching the platform to a concrete foundation
- 4x compound anchor cartridge
- 4x anchor rod M16
- 4x hexagon nut M16 + washer

24 VDC power supply for C-rail mounting
- 50 W
- degree of protection: IP 20
- for C-rail mounting
- input voltage: 90 … 260 VAC

24 VDC power supply in separate protective casing
- 50 W
- degree of protection: IP 65
- aluminium protective casing
- input voltage: 90 … 260 VAC

Cable for OTT Pluvio² S without heater
- twisted pair configuration
- PUR, gray
- 2 x 2 x 0.50 mm²
- shielded

Cable for OTT Pluvio² S with heater
- special PUR, gray
- 7 x 0.75 mm²
- shielded
**OTT Pluvio² S software flash drive** 56.575.001.9.7
- incl. USB interface drivers
- incl. OTT Pluvio² operating software
- incl. example configurations for the OTT datalogger

**Anti-freeze** 0.929.002.002
- POWERCOOL DC 924-PXL
- package size: 10 litre canister

**Anti-theft protection for OTT Pluvio² S** 70.030.040.9.2

**U-lock (weather-resistant) for anti-theft protection** 99.000.083.9.5

**Test weight kit** 70.020.071.9.2
- tare weigh 2.5 kg ± 100 g
- test weight 200 g M1
- DKD certificate for test weigh
- in transport box

**Replacement parts** Collecting bucket 70.030.401.1.1

**USB cable** 97.970.065.9.5
- USB connector type A to USB type B, 3 m