GUÍA – MANUAL – HARDWARE + SOFTWARE

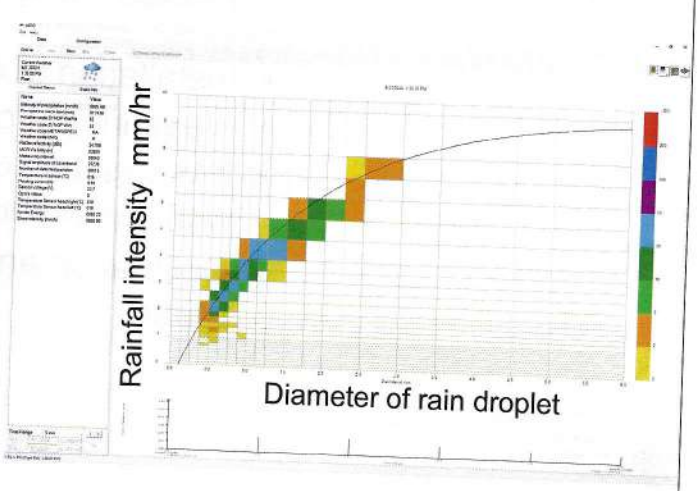
DISDROMETRO + CÁMARA ALL SKY

Disdrometer under preliminary observation in MRI

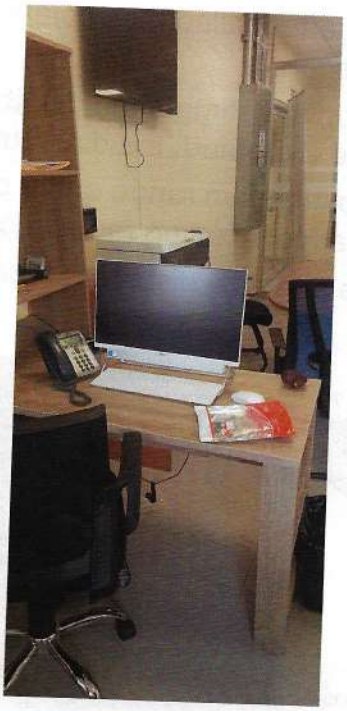
- The disdrometer, Parsivel 2 was installed on March 18, 2024.
- Missing observations occurs in May 28 to July 10 due to no connection to COM4 port.

t MRI

Meteorological Research Institute



Observation site in UTP



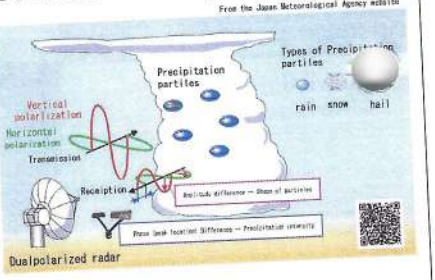
A) Disdrometer Observation for Accurate Precipitation Estimation in the Panama

A) Disdrometer measurement

Rainfall correction due to wind

Distribution of raindrop sizes are observed with Disdrometer. This allows us to investigate the relationship between rain type and the distribution and that between rain intensity and the distribution. A correction formula for existing weather radar is derived, and corrects radar rainfall data. Rain gauge is also corrected using this observation.

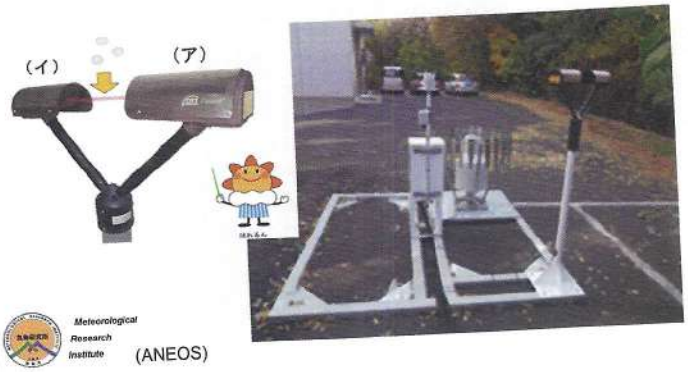
- Installation of disdrometer in Panama
- Measure the particles in Panama City
- Investigation of changes in particle distribution varying with season and diurnal cycles
- Calibration and validation of weather radar



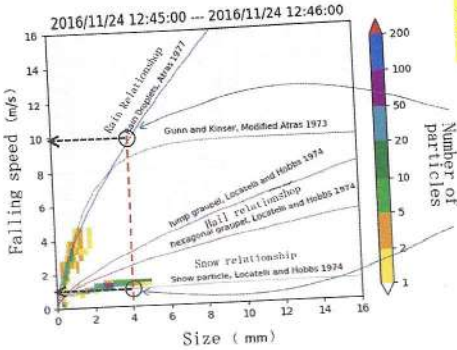
Meteorological Research Institute

Disdrometer

- A new radar called dual polarization radar can measure the size of rain particles as well as rain intensity.
- Methods to estimate the distribution and types of precipitation particles is a hot topic. To validate a method, the disdrometer observation is used as the correct answer.
- The observation range of the disdrometer is only about the size of the palm of your hand, but the dual polarization radar is capable of observing the distribution and types in a wide area.
- Where and how disaster-induced rain clouds are developed in a wide area (150km radius).



Meteorological Research Institute (ANEOS)



Identifying how fast a certain size of particle falls for each type of precipitation particles grains of a certain size.

The relationship between Rain's "falling speed" and "size."
A raindrop with a width of 4 mm takes 1 second when it falls about 10m)

The relationship between the "falling speed" and "size" of snow.
Snow with a width of 4mm travels about 1.5m in 1 second)

(Dr. Umehara@MRI)

All sky camera

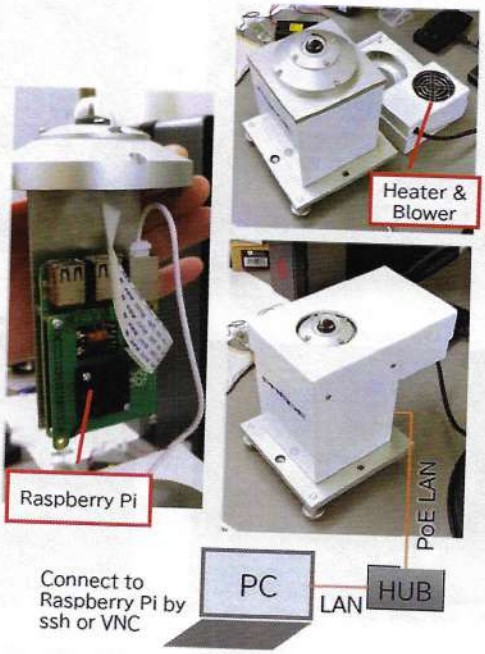
Specification

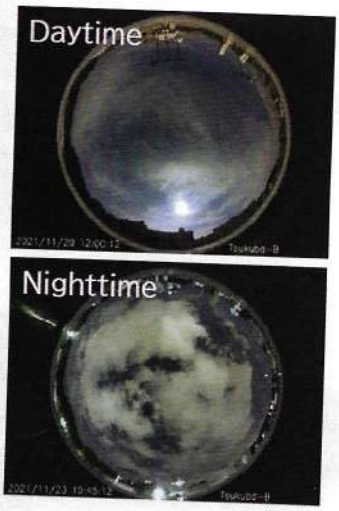
Camera
- Raspberry Pi camera module v2
- Sensor: Sony IMX219
- Sensor resolution: 3280x2464 pixels
- Optical size: 1.4"
- RGB color
- Power supply & Data transfer: PoE LAN

Fish-eye lens (Entaniya Co. Ltd.)
- View angle: 220°
- Equidistance projection

Housing (Prede Co. Ltd.)
- Weather resistant
- Blower to protect the glass dome
- Heater to melt the snow and to evaporate water on the dome

Software
- Capturing an image with an exposure depending on different scenes by python software.
- Time lapse recording by linux command, "cron".



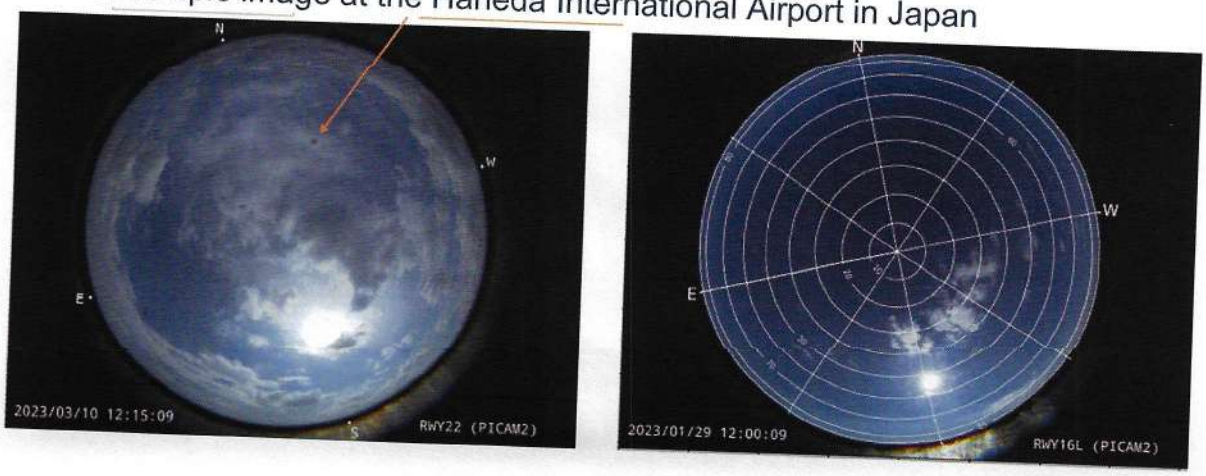


Meteorological Research Institute

All sky camera

Detectable variables
- Cloud distribution
- Cloud base height
- Cloud motion vector

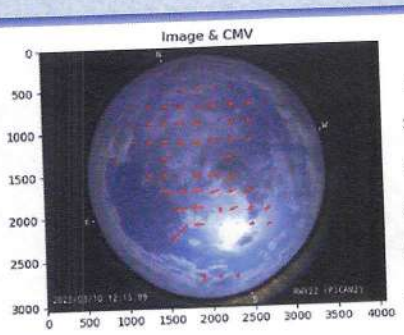
A sample image at the Haneda International Airport in Japan

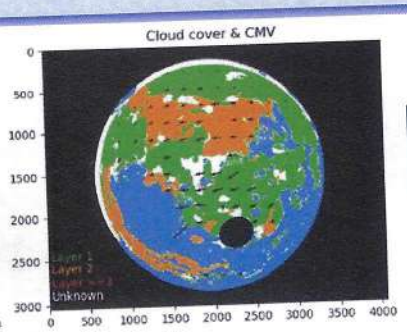


Meteorological Research Institute

Cloud motion vector

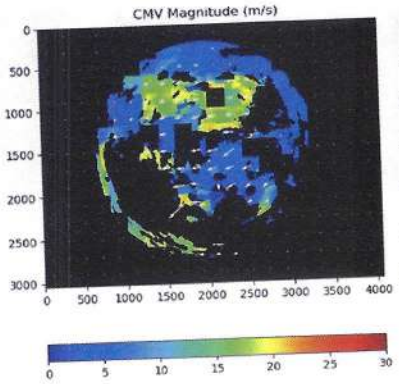
Image and vector

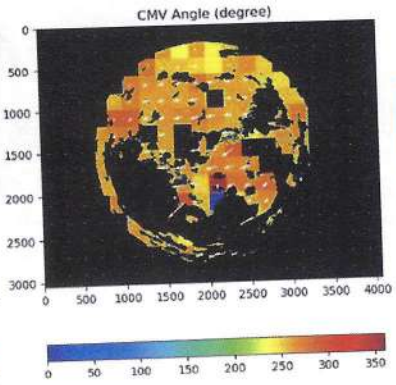




Cloud cover and moving vector

Moving speed and vector





Moving direction and vector

Meteorological Research Institute

RAINWATER MANAGEMENT – CITY OF POZNAŃ, POLAND

Challenge

To better deal with the consequences of climate change, the city of Poznań has implemented active rainwater management. As a basis for the management, reliable data on the amount and intensity of precipitation are needed.

Solution

A measuring network consisting of 23 precipitation gauges with the OTT Pluvio²L and OTT Parsivel disdrometer were set up. Additionally, existing tipping bucket stations were converted and integrated. The data is now stored and visualised in the RainBrain app.

Benefits

This data enables a better understanding of how the drainage infrastructure functions during various precipitation events. Now, the local precipitation model is updated and the water resources in the area can be managed in a more targeted manner.

Impact of Accurate Measurements

The weighing precipitation sensor OTT Pluvio²L was chosen for the project as the focus is on the accuracy of the measurement for amount of precipitation and the stations must function reliably and with low maintenance requirements. The disdrometer provides additional information for a precise description of the precipitation that occurs.

The combination of these data parameters supports:

- monitoring of precipitation events
- optimising the operation of the drainage network
- improving investment planning
- planning preventive measures and emergency management
- determining accurately the amount of water retained and discharged
- adapting to climate change

Data visualized in the RainBrain app. This project was completed by OTT HydroMet local partners, Retencja.

OTT Parsivel Disdrometer (left). OTT Pluvio²L and a standing cabinet (right).

an OTT HydroMet brand

Contact Us

by Kurt Nemeth & Eduard Beck

HERE COMES THE RAIN

High-precision measurement of hydrometeors

A new version of the Parsivel laser-based disdrometer offers greater levels of accuracy in the precise identification of hydrometeors

A new system, the OTT Parsivel², is able to measure hydrometeors less than 2mm with an uncertainty of ±1 class, and hydrometeors over 2mm with an uncertainty of ±0.5 classes. As a result, Parsivel will improve the characterization and typing of precipitation, derived precipitation rate, visibility in precipitation, and radar reflectivity.

Standard rain gauges record the amount of precipitation, and many also provide an approximate value for intensity. An electronic disdrometer records the size and number of precipitation particles and, in addition to the amount and intensity, also determines the type of precipitation. Depending on the measurement method selected, the individual hydrometeor is recorded either mechanically when it hits a membrane or optically.

The extinction principle was first proposed in 2000 for the measurement of precipitation. This direct physical measurement principle registers precipitation particles on the basis of the shadowing effects that they generate when falling through a light band. From the degree and duration of the shadowing effects, the size and rate of fall of the particles can be derived. As a result, the precipitation event can be classified within a range of 32 precipitation classes, e.g. as drizzle or snow.

The extinction principle made it possible, for the first time, to classify hydrometeors and to determine their distribution and derive a number of further parameters. These included the kinetic precipitation energy, visibility during precipitation spectrum analyses, and the determination of weather codes.

Figure 1: New laser-based disdrometer OTT Parsivel²

Laser-based disdrometer

Employing the extinction principle, OTT Hydromet developed a new kind of laser-based disdrometer in 2005. The OTT Parsivel was drift-free and automatically compensated for the influence of temperature and the aging characteristics of the laser diodes. It was comprised of two symmetrically arranged measuring heads. One of them housed the transmitting unit, which generated a horizontal laser beam; the other accommodated the receiving unit, which converted the beam into an electrical signal.

The absolute measurement accuracy of a laser-based disdrometer is proportional to the homogeneity and therefore to the quality of the laser energy concentration of the laser band. Although the OTT Parsivel showed device-specific, heterogeneous characteristics, these were individually calibrated using simulation with reference particles and statistical correlation methods, thereby enhancing the statistical measurement accuracy. However, the spectrum of the classes for size and velocity were corrected by the calibration data. This led to measurement uncertainties for the raw data classification (±2 to ±3 class widths in the whole measuring range from 0.2mm to 25mm). Assuming a natural statistical distribution of hydrometeors in the process of precipitation, the statistical correlation did indeed compensate the output data calculated, but not the actual spectrum of precipitation.

In comparison with optical disdrometers, which operate on video technology, the price-performance ratio of the OTT Parsivel was extremely favorable, and the system became widely popular in measurement networks. Seeking to continuously improve the technology, OTT Hydromet identified a need for a more homogeneous laser band and higher accuracy, including the raw data. This led to the development of OTT Parsivel².

Laser energy concentration

OTT Parsivel² provides homogeneous laser energy concentration over the complete laser bandwidth, offering an impressive measurement accuracy of the class widths, which until now has only been available in expensive disdrometers: 0.2 to 2mm, ±1.0 size class; 2 to 25mm, ±0.5 size class.

Naturally, the high accuracy of the raw data also has a direct effect on the calculation of precipitation intensity, present weather codes, visibility during precipitation, and radar reflectivity.

In addition to optimization of raw data accuracy, a number of further enhancements have been incorporated into the design of the Parsivel². These include:

integrated USB interface to facilitate laptop connection; integrated connector plug for power supply and data interfaces; electrical separation of measurement electronics and heating separated galvanically to facilitate the utilization of solar power, while the heating system is supplied via the mains. Other enhancements include: reduced electricity consumption of 1.4W with a wide voltage supply range of nine to 36VDC; integrated temperature sensor, as in theory insects passing through the laser band could be interpreted as snow – this is now excluded through plausibility checks on the basis of measured temperature; and finally, control LEDs for displaying function, measurement, communication, and status.

Measuring heads of OTT Parsivel²

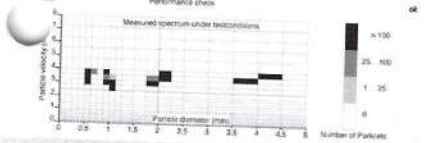
Raw data check

At the end of the production process for each new OTT Parsivel², the raw data is accurately and reproducibly checked. For this, the primary data, particle size and velocity are simulated with a transparent rotating disc incorporating black circles of various diameters. Following this evaluation, the maximum measurement uncertainty of ±1 size class is obtained and documented in the factory acceptance test certificate (FAT).

Individual calibration by statistical correlation is no longer necessary, as a result of the homogeneous laser module of the Parsivel². This is an advantage to users in the field because electronic components do not have to be sent in for repairs in the event of a defect. Instead they can be exchanged and repaired on-site by OTT Hydromet or authorized local partners. Factory checks and elaborate recalibration procedures are also unnecessary, as a result of the new features employed by OTT Parsivel². Static influences, such as the level of contamination of the optics and the aging characteristics/long-term stability of the laser diodes, are automatically calibrated by integrated software in the event of "no precipitation".

Accordingly, measurement results are not influenced by these parameters, and high levels of accuracy are maintained in the long term. Dynamic disturbance variables such as the temperature characteristic of the laser diodes are compensated by the differential extinction measurement method. Consequently, the device is virtually maintenance free and therefore ideal for unmanned use, even at remote measuring stations.

Testbericht	Test report		
Steamaufnahme bei 24 V	Current consumption at 24 V	[40 ..55]	41 mA
Stromaufnahme mit Heizung	Current consumption with heating	[3400 ..3600]	3515 mA
RS-485 Schnittstelle	RS-485 Interface		ok
SDI-12 Schnittstelle	SDI-12 Interface		ok
Impulsausgang	Pulse Output		ok
Messabweichung (Teststand)	Deviation (Test rig)	[0 ..5%]	2.9 % Abw
Werkskalibrierung	Factory setting		ok
Funktionstest	Performance check		ok



Detail of factory acceptance test (FAT) for a specific Parsivel²

Precipitation intensity

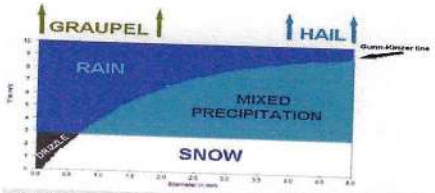
To determine the intensity of precipitation, the internal evaluation logic takes account of each individual hydrometeor in the raw data field. In addition, the absolute particle size, a drop shape model, and factors such as edge measurement correction are included in the calculation. This renders the calculation of intensity particularly precise. Just a few particles detected within the measurement interval lead to an intensity output without delay, corresponding to a discrimination threshold of 0.001mm/h.

For liquid precipitation the measurement accuracy is at least ±5% across the whole intensity range up to 1,200mm/h. This corresponds to the requirements of the World Meteorological Organization (WMO) in accordance with the WMO Guideline No. 8.

In this way, the system represents a maintenance-free alternative to tipping bucket or weighing rain gauges for liquid precipitation. The original OTT Parsivel had already been successfully tested in a WMO comparative test for precipitation intensity in Vigna di Valle, 2004 to 2008, and was found to be suitable for use in accordance with the WMO guidelines.

Present weather sensor (PWS)

As a PWS, the system classifies the current weather and the types of precipitation (rain, sleet, snow, hail, and graupel) in accordance with a weather code laid down by the WMO. Unmanned weather stations require an automatic and reliable method of identification. A high level of accuracy of the raw data is particularly important for weather phenomena during the lowest intensities, with only a few particles and mixed spectra. In field comparisons, this is where most discrepancies occur between



Classification of precipitation by drop size and velocity. The Gunn-Kinzer line indicates the terminal fall velocity for raindrops of various sizes

observed and automatically specified weather codes. Therefore, plausibility checks are required.

With the aid of the extinction method, the Parsivel² accurately measures the size and velocity of individual hydrometeors. Both parameters are incorporated into the DSD (drop size distribution) classification.

Plausibility checks of PW records are quickly conducted by analyzing raw data and spectra. Each transmitted spectrum can be displayed graphically and is easy for an observer to interpret, so that it can be used for any corrections to the automatic weather code. Naturally, checks are also possible via software routines at the control center, so that high observer quality can be maintained while manpower can be reduced at the measuring stations.

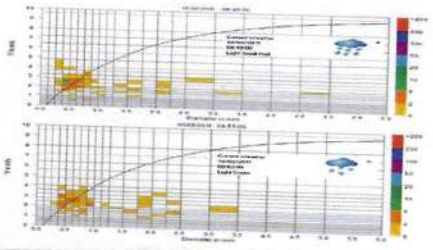
Optimizing weather radar through ground-based disdrometer data

To ensure a timely warning of impending flooding, it is necessary to measure the amount and spatial distribution of precipitation quickly and accurately. This goal is achieved with a combination of weather radar measurements (spatial information with reduced accuracy) and ground-based disdrometer measurements.

Normally, a precipitation radar measures the radar reflectivity (Z) on the basis of ground shadowing only from a height of 1,000 to 2,000m above the ground, therefore providing information to localize precipitation areas. In order to accurately determine the precipitation input, a quantitative recording of the precipitation intensity (R) on the ground is required. This requires both extrapolation of the radar data to the ground and derivation of the reflectivity factor Z to the precipitation rate R.

Usually, the spatial distribution of the precipitation rate from the radar measurement is adjusted with data from rain gauges on the ground with the shortest time delay possible. A potential problem is the so called "bright band", i.e. the snow/rain melting layer, which is usually about 200-500m below the zero degree boundary. The bright band can lead to overestimates of the precipitation rate, as melting snow is highly reflective. However, the height of the bright band is not always accurately recorded by weather radars.

Conventional rain collectors can also fail in this respect: although they supply values to adjust the precipitation intensity R, they do not take account of either the type of precipitation or the height of the bright band. As a present weather sensor with a modern optical disdrometer, OTT



Displays of raw data spectra, showing Gunn-Kinzer line and automatic PW code (above "Light small hail", below "Light snow"). The color code indicates the frequency of measured hydrometeors

> "The bright band can lead to overestimates of the precipitation rate, as melting snow is highly reflective"

Parsivel² supplies the type and distribution of precipitation at the reference height with the ground temperature. Based on this information it is possible to adjust weather radar data without delay. Precipitation forecasts that are derived from such data become considerably more precise and thereby improve the quality of flood forecasts.

Despite the many advantages of the modern optical disdrometer, human weather observers are still indispensable for many locations. However, modern measuring devices offer a variety of functions that exceed human recording capacity and are able to deliver very accurate data in a timely manner. They are extremely robust and reliable; they never go on vacation or suffer from the frailties of human health; and they can withstand extreme weather conditions. ▮

Kurt Nemeth is BDM Meteorology with OTT Hydromet GmbH; Eduard Beck works with RS-D, OTT Hydromet GmbH

an OTT HydroMet brand

OTT Parsivel²

Laser Present Weather Sensor

OTT HydroMet

Multifunctional laser-optic disdrometer in the premier class

OTT Parsivel²

Introduction

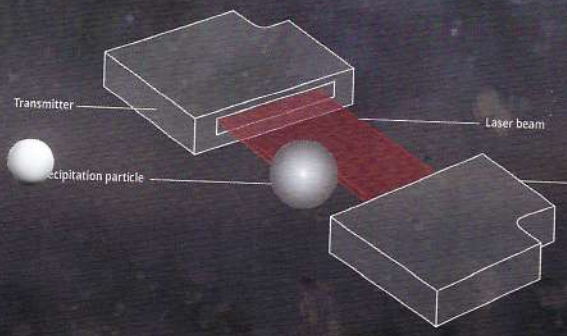
The OTT Parsivel² is a modern, laser-based disdrometer for comprehensive and reliable measurement of all types of precipitation. The device works on the extinction principle and measures precipitation particles using the shadowing effects they cause when they pass through a laser band.

The Parsivel² captures both the size and the rate of fall in detail of the individual hydrometeors and classifies them into a range of 32 classes. Depending on the measurement interval set, the resulting precipitation spectrum covers a time of between 10 seconds and one hour. A responsive signal processor uses the raw data to calculate precipitation type, amount, intensity, kinetic energy, visibility in the precipitation and the equivalent radar reflectivity. Using standard interfaces, both the calculated and the spectral data are output to a data-logger, an automatic weather station or a PC.

The principle

The OTT Parsivel² uses a laser-optical sensor to measure precipitation. The transmitter unit of the sensor generates a flat, homogenous beam profile that the receiver unit converts to an electrical signal. This signal changes whenever a hydrometeor falls through the beam anywhere within the measuring area (54 cm²). The degree of dimming is a measure of the size of the hydrometeor, and the fall velocity is derived from the duration of the extinction signal.

The measured values are characterized by high accuracy, which are retained over a long period. A ratiometric process also helps to ensure this, as it automatically compensates for the influence of the temperature characteristic curve and aging of the laser diodes.



Multifunctional, flexible and easy to use

Benefits

- **Accurate** – measures the size and speed of each individual hydrometeor and derives other important meteorological parameters
- **Maintenance free** – lowest obstruction to wind and freely accessible optical measuring area without moving parts or collection bucket
- **Durable** – continuous and precise precipitation data in all environmental and weather conditions. Integrated overvoltage protection
- **Economical in use** – Economical electronics and separately controllable head heating enable a flexibly designed power supply with low energy consumption
- **Convenient** – integrated USB interface configuration and online monitoring using a laptop
- **Flexible** – standard interfaces RS 485, SDI-12 and impulse for connecting to a datalogger, automatic weather station (AWS) or PC
- **Sensor health** – control LEDs to show function, measurement, communication and status
- **Seamless integration** – integrated push-in connection for connecting the electrical supply and data interfaces
- **Cleverly designed** – robust aluminium housing and symmetrically arranged measuring heads whose design prevents dripping in the direction of the laser band

Interfaces

The OTT Parsivel² communicates using several output interfaces: precipitation intensities are provided via the pulse output, present weather data via SDI-12 and complex spectral information via RS-485. With the help of the operating and monitoring software ASDO, the user can configure and optimize the data output in accordance with the respective application case. Thanks to the USB interface integrated into the device base, a laptop can be connected in no time.

Power supply and output interfaces can be connected conveniently and service-friendly via a device connector.

OTT ASDO user software

The convenient operating and monitoring software OTT ASDO is available in two versions:

- Basic version for setting all system parameters for startup, online recording and visualization of the data.
- Full version with integrated database for automated, convenient online operation. The measured values are saved on a PC with the help of the software at set intervals.

One device – five application solutions

1. Precipitation

The Parsivel² determines the precipitation intensity from as little as 0.001 mm/h. With the integral volume equivalent of all particle sizes classified per time unit, it calculates the amount and intensity of the precipitation that has fallen and takes account of physical aspects in the process, such as droplet model and differentiated precipitation densities. This leads to particularly precise results, even with mixed precipitation. With the values measured for size and velocity of the individual particles, the Parsivel² also determines the composition of the precipitation and records it statistically.

The drop size classification range covers the range from Ø0.2 mm (drizzle) up to Ø8 mm large droplets in thunderstorms, or even up to Ø25 mm in solid precipitation (hail).

2. Present Weather Sensor (PWS)

The Parsivel² classifies the current weather and the precipitation types (rain, drizzle/rain, snow, hail and sleet) according to an international weather code, which was originally introduced by the WMO. For unmanned weather stations, the automatic, reliable and unique identification of the current precipitation event is necessary. The Parsivel² determines the type, amount and composition of the precipitation.

3. Flood early warning

To be able to warn of impending flooding in a timely way, it is necessary to measure the amount and spatial distribution of precipitation quickly and exactly. This goal is achieved with a combination of weather radar measurements (spatial information with reduced accuracy) and ground-based disdrometer measurements.

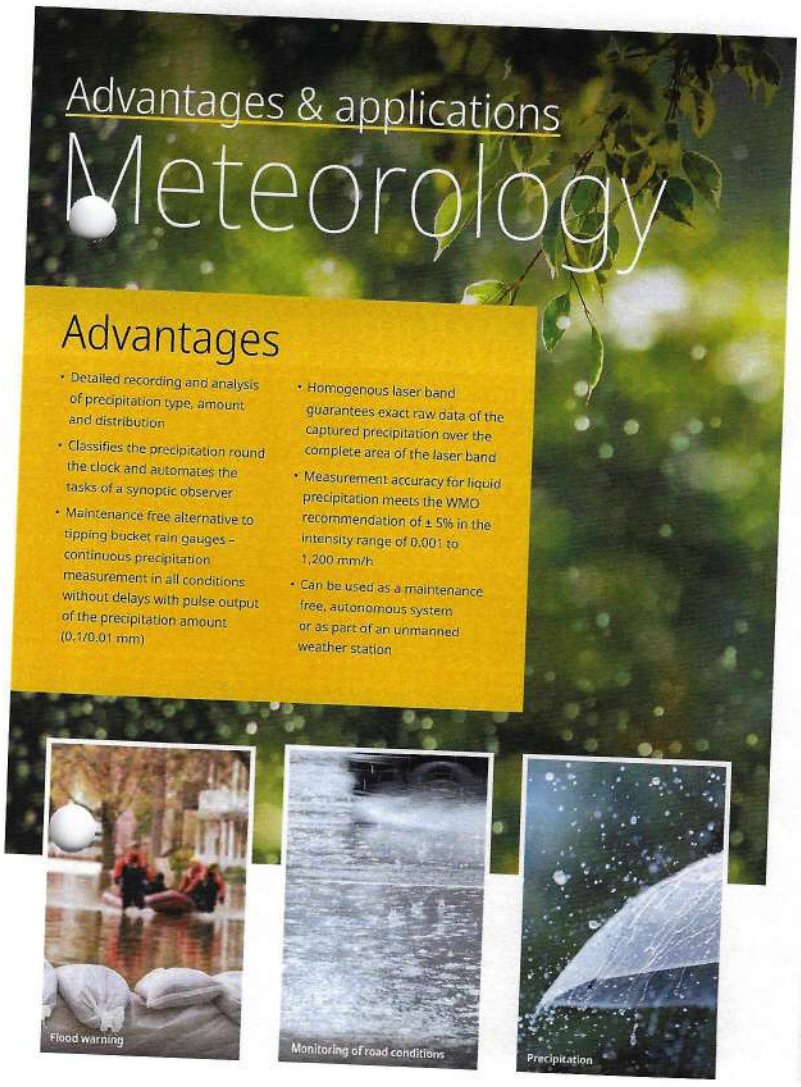
The Parsivel² not only provides the droplet size distribution on the ground (S), but also calculates all relevant ground data for deriving the local Z/R and Z/S ratios, such as precipitation rate (R) and the radar reflectivity (Z). These values can be used immediately to adjust the weather radar data and thus to optimize the intensity forecast in the spatial development of the precipitation event. Combined with water level sensors and drainage modeling, the Parsivel² is thus the central component for a modern, high performance, regional, flooding early warning system.

4. Monitoring of road conditions

Heavily localized precipitation can lead to aquaplaning or packed snow. To prevent accidents, fast traffic warning and control systems are necessary. Precipitation amount, hydrometeor composition and visibility are of significant importance in these systems. The Parsivel² is an intelligent sensor contributing to your Road Weather Information System.

5. Monitoring erosion

The Parsivel² calculates the distribution of kinetic precipitation energy and outputs it. Together with precipitation data and other parameters such as ground state or relief, the precipitation energy is decisive for the effect of the rain on the ground and an important input for erosion models.



Advantages & applications

Meteorology

Advantages

- Detailed recording and analysis of precipitation type, amount and distribution
- Classifies the precipitation round the clock and automates the tasks of a synoptic observer
- Maintenance free alternative to tipping bucket rain gauges – continuous precipitation measurement in all conditions without delays with pulse output of the precipitation amount (0.1/0.01 mm)
- Homogenous laser band guarantees exact raw data of the captured precipitation over the complete area of the laser band
- Measurement accuracy for liquid precipitation meets the WMO recommendation of ± 5% in the intensity range of 0.001 to 1,200 mm/h
- Can be used as a maintenance free, autonomous system or as part of an unmanned weather station

Flood warning

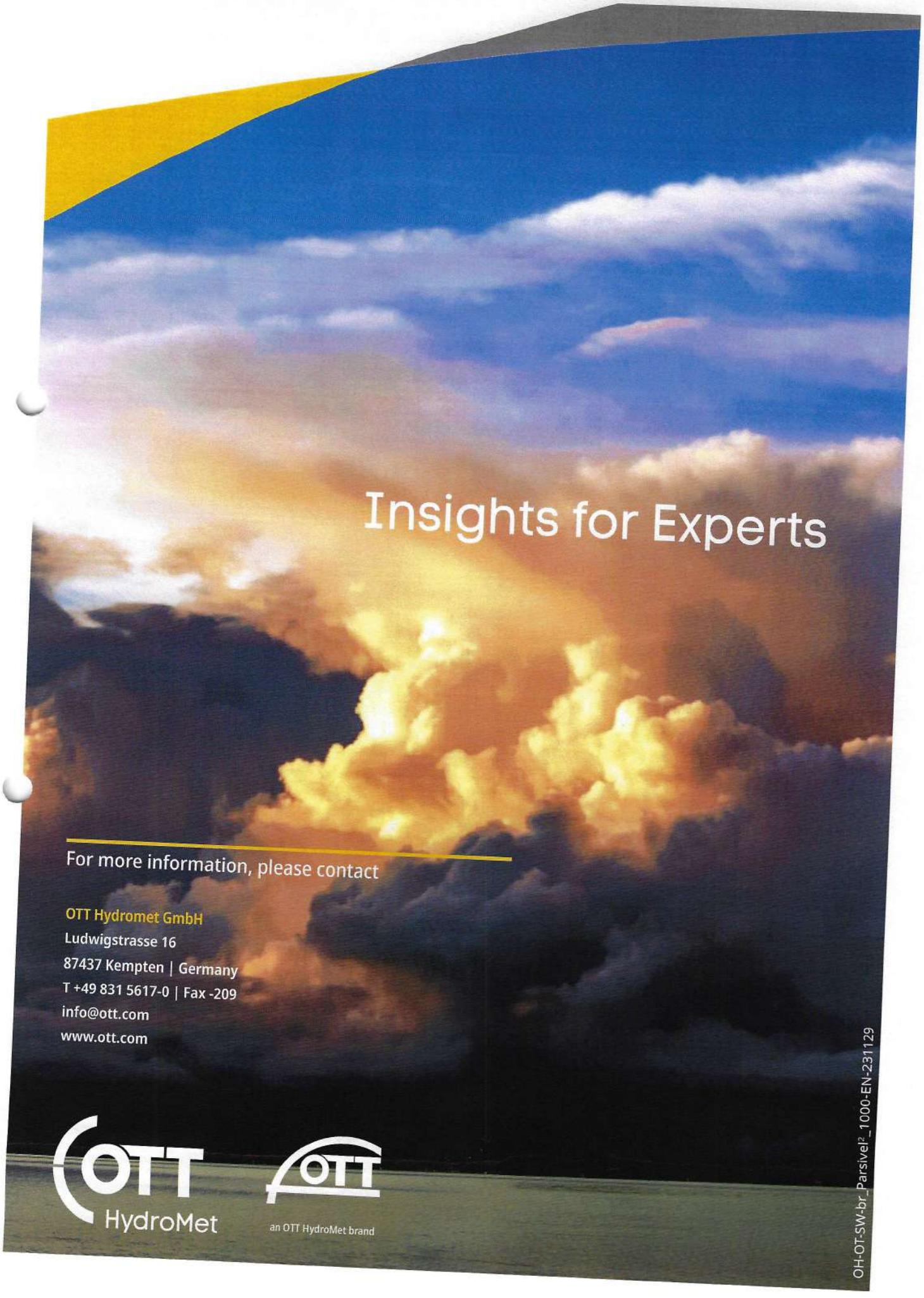
Monitoring of road conditions

Precipitation

Technical Specifications

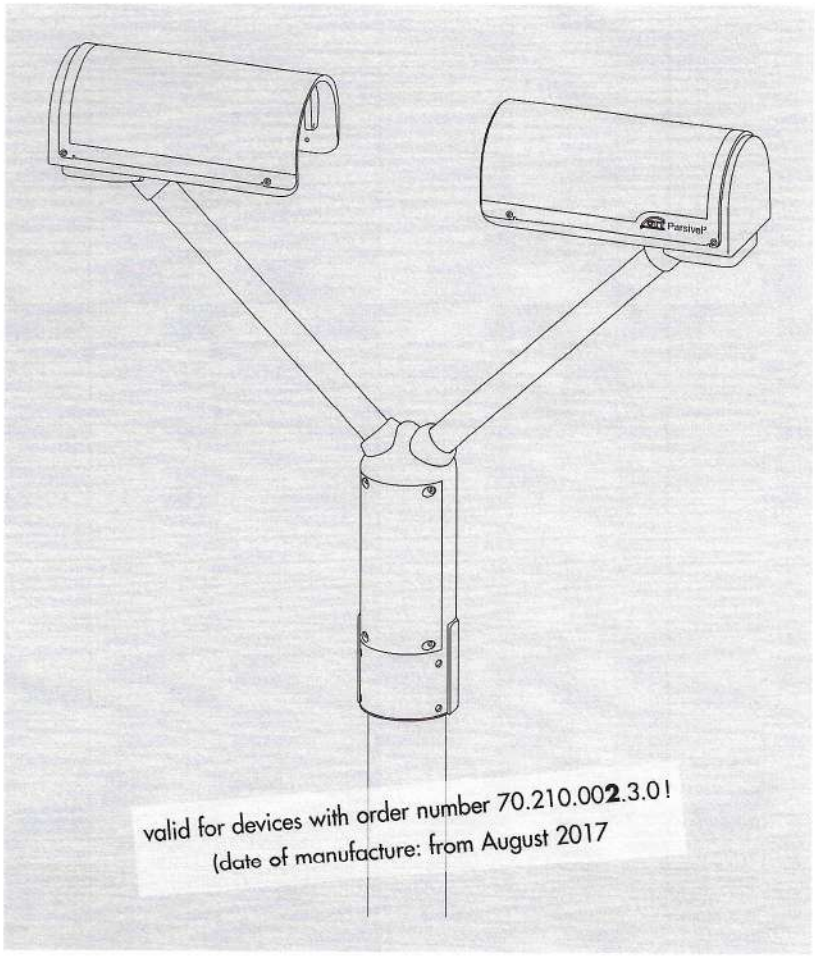
Optical sensor, laser diode	• Wavelength: 650 nm, Output power (peak): 0.2 mW • Laser class: 1, IEC/EN 60825-1: 2014
Measuring surface (W x D)	180 x 30 mm (54 cm²)
Measuring ranges	• Particle size: liquid precipitation: 0.2 ... 8 mm solid precipitation: 0.2 ... 25 mm • Particle velocity: 0.2 ... 20 m/s
Classification	• 32 size and 32 velocity classes
	• Measurement accuracy[1]: ± 1 size class (0.2 ... 2 mm) ± 0.5 size class (> 2 mm)
Types of precipitation	8 precipitation types (drizzle, drizzle/rain, rain, mixed rain/snow, snow, snow grains, sleet, hail)
Outputs	• Reports: WMO 4680/4677 (SYNOP), 4678 (METAR/SPECI) and NWS tables • Differentiation of precipitation types: drizzle, rain, hail, snow > 97 % (compared to a weather observer)
Precipitation intensity	• Snow depth intensity (volume equivalent) • 0.001 ... 1,200 mm/h
Radar reflectivity Z	• Accuracy[1]: ± 5 % (liquid) / ± 20 % (solid)
Kinetic energy	– 9.999 ... 99.999 dBz
Visibility in precipitation (MOR)	0 ... 999.999 J/(m²h)
De-icing protection	0 ... 20,000 m
Power supply	Microprocessor controlled heating • Electronics: 10 ... 28 V DC, reverse polarity protection • Optimum heating output of the sensor head heating system can be guaranteed with a power supply voltage of at least 20 V DC.
Power consumption (without heating)	65 mA@24 V DC
Heating capacity sensor heads	• 50 W (default) • 100 W (adjustable)
Lightning protection	Integrated
Interfaces (configurable[2])	• RS-485 for all values incl. spectral data (ELA-485; 1,200 ... 57,600 Baud) • SDI-12 for calculated values • USB for PC connection (configuration and service) • Output relay for pulse output of the precipitation amount in 0.1 m
Material	Powder-coated aluminium housing
Weight	max. 6.4 kg
Dimensions (H x W x D)	670 x 600 x 114 mm
Environmental conditions	• Temperature range: – 40 ... +70 °C • Relative humidity: 0 ... 100 %
Protection	IP65
Installation	2 inch pipe, Ø 50 ... 62 mm
Standards	• EN 61326-1: 2013, CE compliant • 2014/30/EU, CE compliant

[1] Proof under laboratory conditions using an OTT test system with reference particle simulation of 0.5 mm, 1.0 mm, 2.0 mm and 4.0 mm
[2] ASDO software supplied (basic version)


Insights for Experts
For more information, please contact
OTT Hydromet GmbH
Ludwigstrasse 16
87437 Kempten | Germany
T +49 831 5617-0 | Fax -209
info@ott.com
www.ott.com
OTT HydroMet
OTT
an OTT HydroMet brand
OH-OT-SW-br_Parsivel²_1000-EN-231129

Operating instructions

Present Weather Sensor OTT Parsivel²



valid for devices with order number 70.210.002**2**.3.0!
(date of manufacture: from August 2017

English

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

Table of contents

1 Scope of supply

OTT Parsivel² – 1 laser-optical disdrometer consisting of: two sensor heads with splash protection unit grid, tunnel housing with 30 mm wide and 180 mm long light strip, base holder with integrated electronics and 8-pin panel jack for connecting the supply voltage and electrical ports
– 1 installation set, consisting of
1 x cable lug for grounding
1 x flat washer
6 x grub screws M 8 x 16 mm
7 x grub screws M 8 x 25 mm
1 x hex nut M 8
2 x lock washers
1 x Allen key, 4 mm
– 1 USB connection cable. USB connector type A to USB type B, 3 m
– 1 OTT Parsivel PC software "ASDO", basic version
– 1 set of operating instructions

2 Order numbers

OTT Parsivel²	**Laser-optical disdrometer**	70.210.002.3.0
Accessories	**Connection cable, assembled** – 8-core, wire cross section 0.25/0.75 mm² – one end prepared with plug – one open cable end, insulation removed and provided with end sleeves – standard length 1 m, 3 m or 13 m individual length available on request according to customer requirements (1 m steps; max. 21/42 m)	70.210.409.4.1
	Power supply 24 V DC/100 W; control cabinet version – Protection class IP 20 – for top hat rail installation (TS 35) – Input voltage: 90 ... 260 V AC	65.030.003.9.2
	Power supply 24 V DC/100 W; protective housing version – Protection class IP 65 – in aluminum protective housing – Input voltage: 90 ... 260 V AC	65.030.007.9.2
	Interface converter – RS-485 / USB; galvanically isolated; electrical supply via USB interface	97.961.091.9.5
	Pedestal 2" – with bottom plate for attachment to a concrete base – with mounting plate for mains adapter (protective housing version) – Laser strip installation height: 1 m (length: 0.53 m) – Laser strip installation height: 2 m (length: 1.53 m) – Laser strip installation height: 3 m (length: 2.53 m)	 70.210.420.3.1 70.210.421.3.1 70.210.422.3.1
	Attachment set for pedestal – for attachment of the pedestal on a concrete base – 4 x anchor rods – 4 x anchor bolt glue cartridges	99.020.050.9.2
	OTT Parsivel PC software "ASDO", full version	56.551.001.9.7
Spare parts	**Splash protection unit grid (1 piece)**	70.210.410.3.1

3 OTT Parsivel² factory settings

The OTT Parsivel² is a flexibly configurable device with respect to interface activation and parameters and the heating settings, and is supplied with the following factory settings:

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

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

[1] the green and yellow wires in the connection cable are configured as an RS-485 interafce (alternatively: SDI-12)

4 Basic safety information

4.1 Markings and symbols used in the instruction

■ This bullet point indicates an instruction relating to a specific action.

▶ This bullet point indicates an item in a list.
– This bullet point indicates a sub-item in a list.

Remarks: ...
▶ Information on easier and more efficient work
▶ Further information
▶ Definition

Please note: ...
Information that prevents potential damage or malfunction on the OTT Parsivel².

4.2 Explanation of safety information used

The safety information used in these operating instructions is classified according to the nature and severity of a particular hazard. The hazard level defined is indicated by the signal word **WARNING/CAUTION** and a pictogram **(orange/yellow triangle)** in these operating instructions.

WARNING **Warning of a hazardous situation with a medium level of risk**

The safety information specifies the nature and source of the hazard. If you fail to carry out the specified actions, the hazardous situation can result in **death** or **serious injuries**.

▶ Action to prevent the hazardous situation!
▶ Action to prevent the hazardous situation!

CAUTION **Warning of a hazardous situation with a lower level of risk**

The safety information specifies the nature and source of the hazard. If you fail to carry out the specified actions, the hazardous situation can result in **minor** or **moderately severe injuries**.

▶ Action to prevent the hazardous situation!
▶ Action to prevent the hazardous situation!

4.3 For safe and trouble-free operation, please note

▶ These operating instructions contain basic instructions that must be followed during installation, operation and maintenance. Therefore, it is absolutely necessary that they be read by the assembler and by the responsible technical personnel/operator prior to installation and startup!
▶ These operating instructions must be accessible at the point of use of the measurement device.
▶ Personnel responsible for installation, operation and maintenance must have the appropriate qualifications for this work! Responsibilities, competency and the monitoring of personnel must be closely controlled by the owner. If personnel do not have the required knowledge, it must be provided through training and instruction. If necessary, OTT HydroMet can 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 warnings and 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 intended use of the OTT Parsivel² is the automatic determination of the meteorological precipitation type, quantity and intensity (for further information see chapter 4, "Introduction"). The operational safety of the supplied measuring device is only guaranteed if it is used as intended! Modifications or changes to the measuring device are only permitted after consultation with the manufacturer.
- To ensure safety, buy only original replacement parts and accessories authorized by the manufacturer. Use of other parts can void liability for any consequences arising therefrom!
- The OTT Parsivel² is equipped with a laser. Under reasonably foreseeable conditions, (i.e. when the device is used as intended), the accessible laser radiation is not dangerous for the eye (and for the skin). The OTT Parsivel² complies with the standard IEC/EN 60825-1:2014.

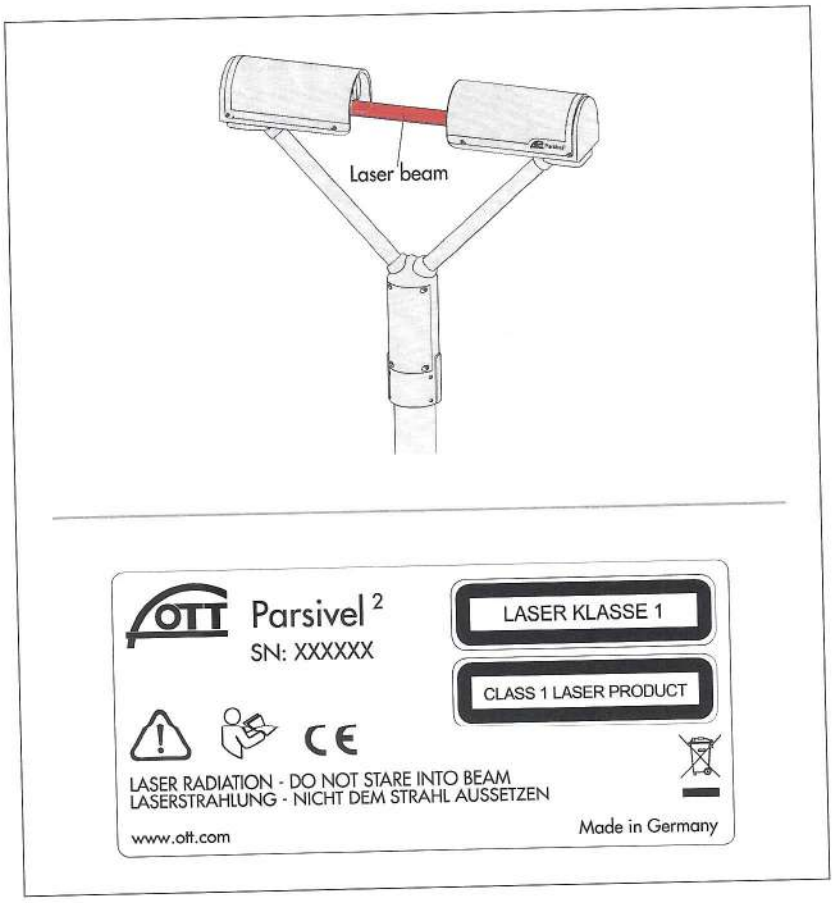
  – Classification: **Laser class 1**
  – Wavelength: **650 nm** (visible laser beam; colour: red)
  – Output power: **0.2 mW max.**

CAUTION **Temporary impairment of vision possible due to laser radiation**

When looking directly into the laser beam, glaire, impairment of colour vision and other sight disorders may occur.

- Do not look directly into the laser beam with the naked eye or with optical instruments!

Position of the laser beam (top) / OTT Parsivel² type plate (bottom).



5 Introduction

The OTT Parsivel² is a laser-based optical system for complete and reliable measurement of all types of precipitation. The size range of measurable liquid precipitation particles is from 0.2 ... 8 mm, for solid precipitation particles it is from 0.2 ... 25 mm. In the process, precipitation particles can have a particle speed (rate of fall) of from 0.2 ... 20 m/s. The precipitation particles are categorized as follows:

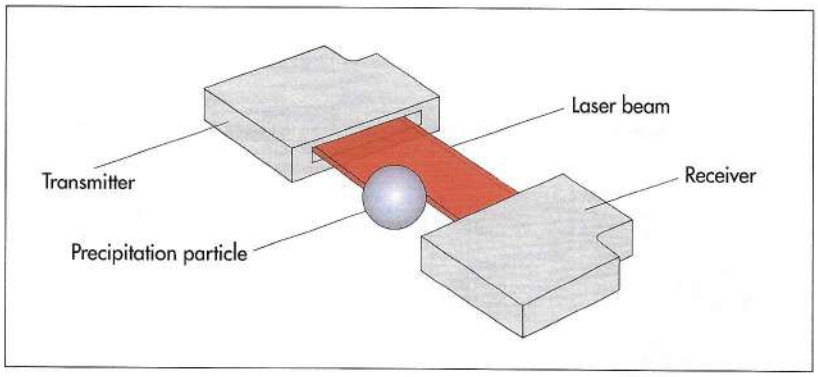
- Drizzle
- Drizzle with rain
- Rain
- Rain, drizzle with snow
- Snow
- Snow grains
- Soft hail
- Hail

The precipitation measurements are carried out using a special sensor head that was developed for this particular purpose. It detects precipitation optically. The data thus determined are processed and stored by a fast digital signal processor. The OTT Parsivel² issues one data telegram every 60 seconds.

5.1 Functional principle

The theory behind the OTT Parsivel² is a laser sensor that produces a horizontal strip of light. The emitter and the receiver are integrated into a single protective housing.

Fig. 1: Functional principle of the OTT Parsivel².



Measurement of particle size

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

Measurement of particle speed

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

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

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

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

5.2 Connection options for the OTT Parsivel²

The OTT Parsivel² can be connected to various devices as shown in the illustration below. Refer to the respective chapters in this regard.

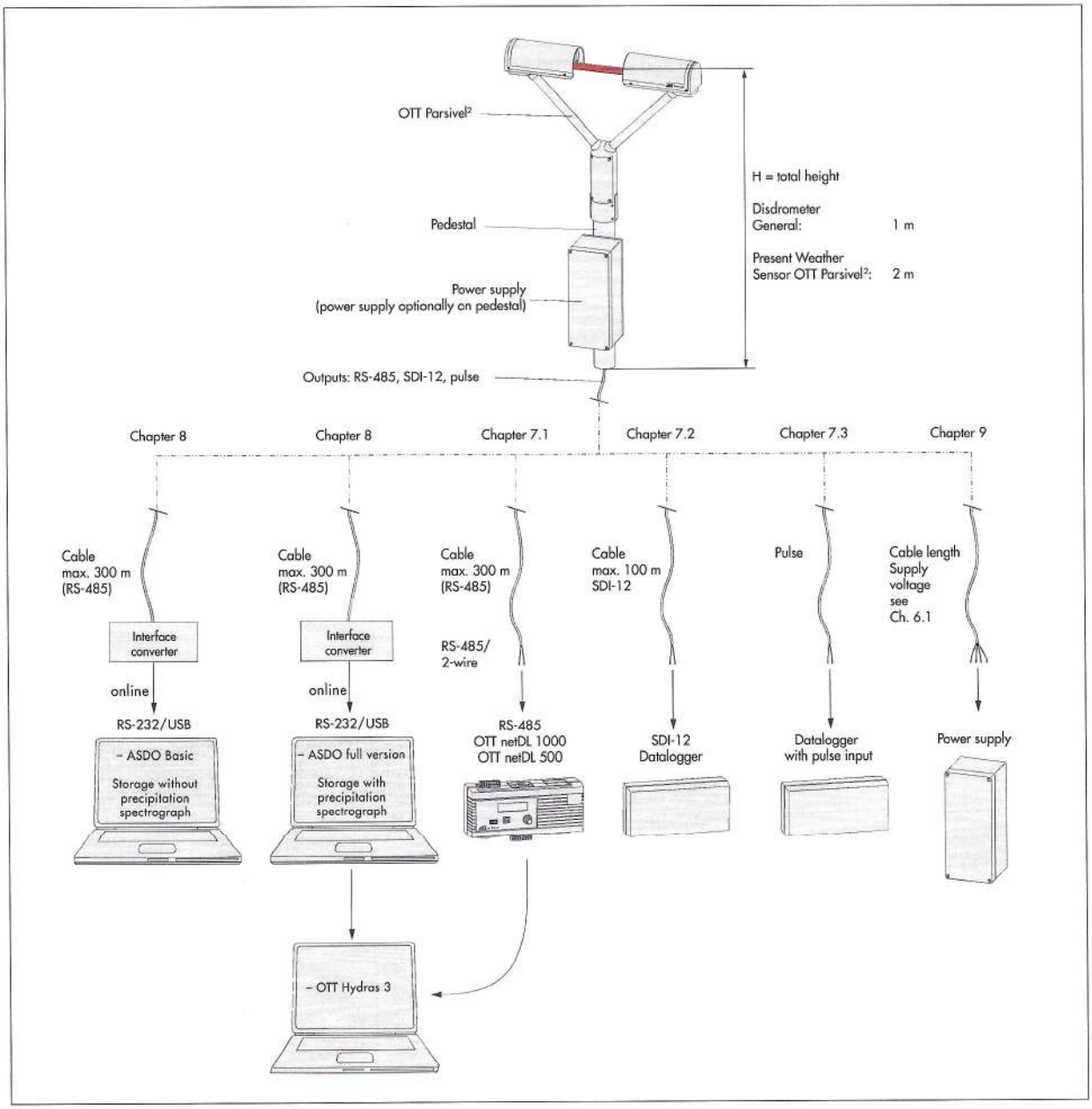


Fig. 2: Connection options for the OTT Parsivel².

6 Installing the OTT Parsivel²

When installing the OTT Parsivel², please observe the basic safety instructions in Chapter 4 of these operating instructions in addition to the activity-related warnings!

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

Prerequisites
The OTT Parsivel² is mounted on a pedestal. The pedestal must have the following specifications:

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

Before the OTT Parsivel² can be fastened to the pedestal, the data transmission cable and power supply must be installed.

6.1 Cable selection

The electrical connection of the OTT Parsivel² is made with an 8-core cable, prepared with a plug at the factory (accessory). This connection cable can be supplied with a standard length of one, three or 13 meters (individual lengths available on request). The wire cross section is 0.25 mm² (sensor head heating power supply: 0.75 mm²). If required, you can extend the cable keeping to the following criteria:

Data transmission cable
The OTT Parsivel² has the following interfaces:

- RS-485
- SDI-12
- Pulse output

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

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

- Twisted-pair cable; unshielded
- Usage length with RS-485 interface: max. 300 m
- Usage length with SDI-12 interface: max. 100 m
- Usage length with pulse output: max. 100 m
- Wire cross section from a cable length of 25 meter ≥ 0.5 mm² (below that: 0.25 mm²)

Power supply cable
Power supply for electronics: Wire cross section up to a cable length of 25 meter 0.25 mm², above that 0.5 mm². Maximum cable length 250 meter (when using an OTT power supply).
Power supply for sensor head heating: Maximum resistance of cable: 2 Ω.
The length of the cable is dependent on the wire cross section:

Wire cross section	max. cable length
0.75 mm²	21 m
1.0 mm²	28 m
1.5 mm²	42 m
2.5 mm²	70 m
4.0 mm²	112,5 m

CAUTION **Risk of crushing when installing the OTT Parsivel²**

The OTT Parsivel² has a weight of approx. 6.5 kg!

- Wear protective gloves when installing the OTT Parsivel²!

6.2 Connecting ground to OTT Parsivel² (recommendation)

To ground the OTT Parsivel², you will need the following parts from the installation set provided:

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

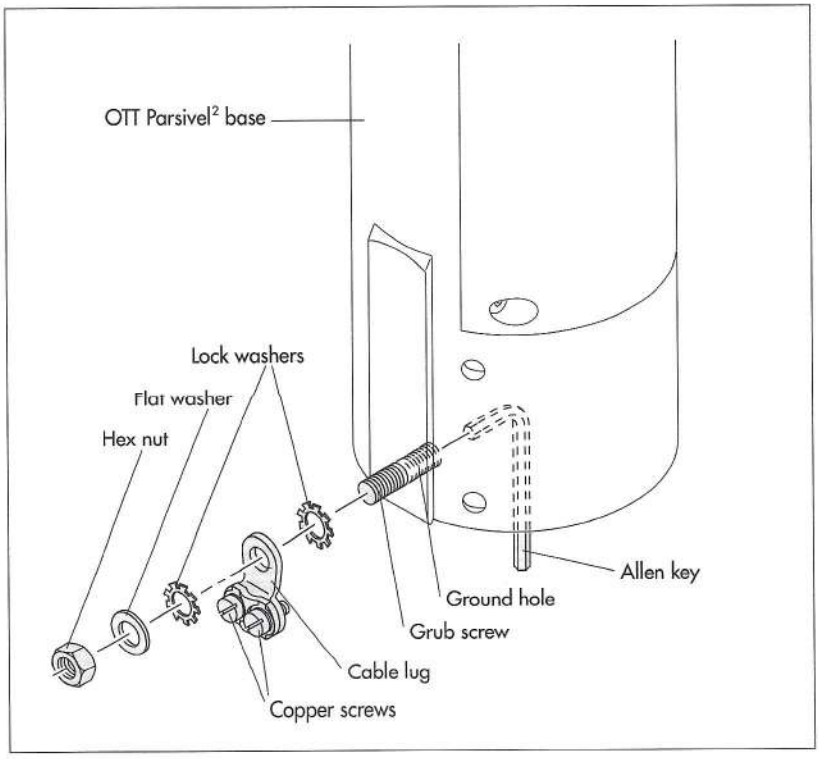
Also, you will need a grounding cable with a wire cross section of 16 mm².

In order to ground the OTT Parsivel², proceed as follows:

- Rotate the grub screw using the hex key from inside into the grounding hole (see Fig. 3) until the grub screw is flush with the inner wall inside the socket.
- Place the lock washers, cable lug and flat washer as shown in Fig. 3 onto the grub screw from the outside.
- Likewise, screw the hex nut from outside onto the grub screw and tighten it. Hold the grub screw from the inside using the hex key while doing so so that it does not rotate during tightening.
- Loosen the two copper screws of the cable lug by rotating them a few turns.
- Remove the insulation from one end of the grounding cable approximately 2 cm.
- Insert the uninsulated end of the grounding cable between the two plates of the cable lug and retighten the two copper screws. The other end of the cable must be properly grounded near the OTT Parsivel².

Fig. 3: Grounding the OTT Parsivel².

The individual parts to fasten the cable lug are included in the installation kit.



6.3 Installing the OTT Parsivel² on a pedestal

Proceed as follows to install the OTT Parsivel²:

- If necessary: Attach the power supply (protective housing version) to the mounting plate of the pedestal using the bolts and nuts supplied.
- Feed the connection cable with the 8-pin plug from the power supply on the leg or from a control cabinet upwards through the pedestal.
- Connect the plug to the socket in the base of the OTT Parsivel². Tighten the cap nut for the plug by hand.

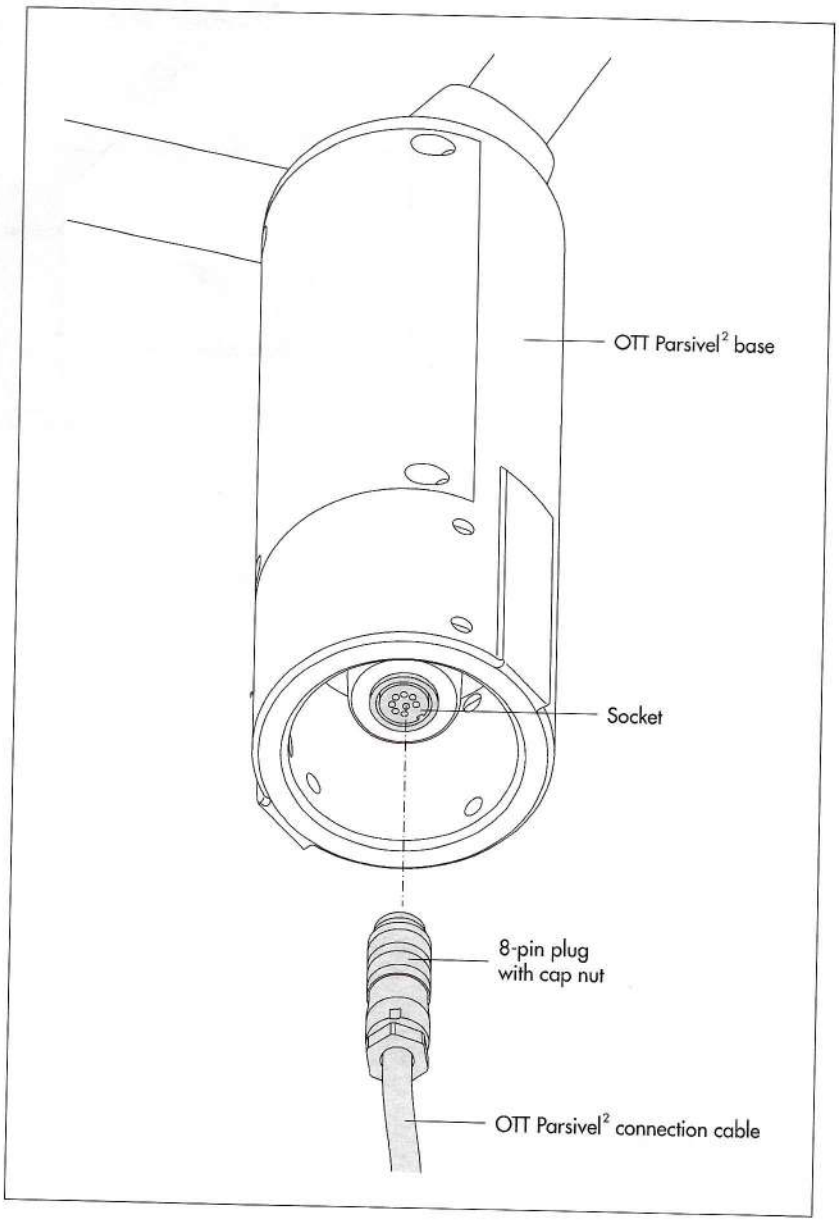
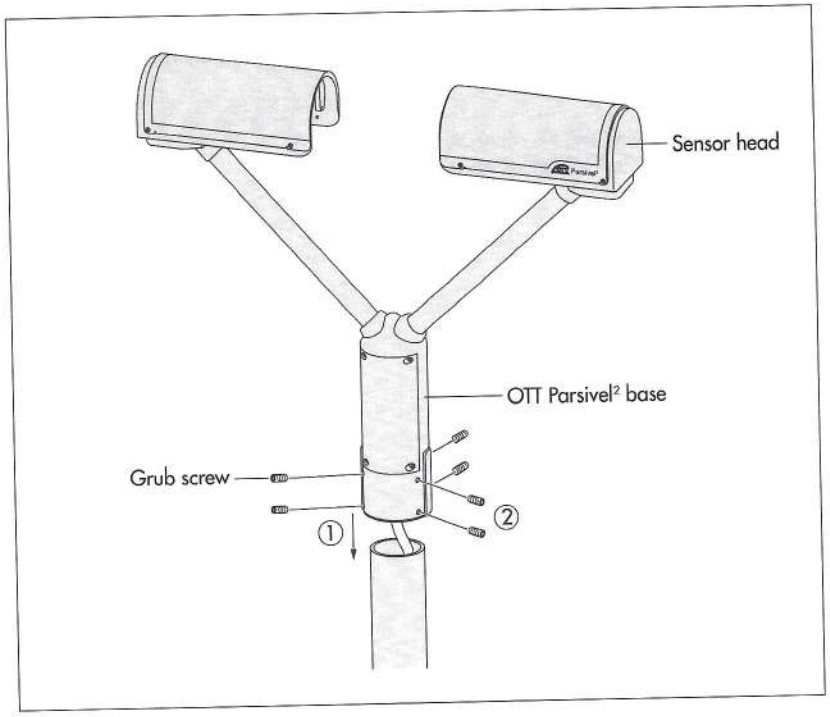


Fig. 4: Connecting the connection cable to the OTT Parsivel² base.

- Slide the connected and grounded OTT Parsivel² onto the pedestal.

- Orient the OTT Parsivel² such that the laser beam is perpendicular to the local main wind direction.
- Evenly tighten the 6 M 8 x 16 grub screws, or M 8 x 25 depending on the diameter of the pedestal, using the 4 mm hex key provided (installation set) so that the sensor heads are horizontal as much as possible.

Fig. 5: Installing the OTT Parsivel² on the pedestal.



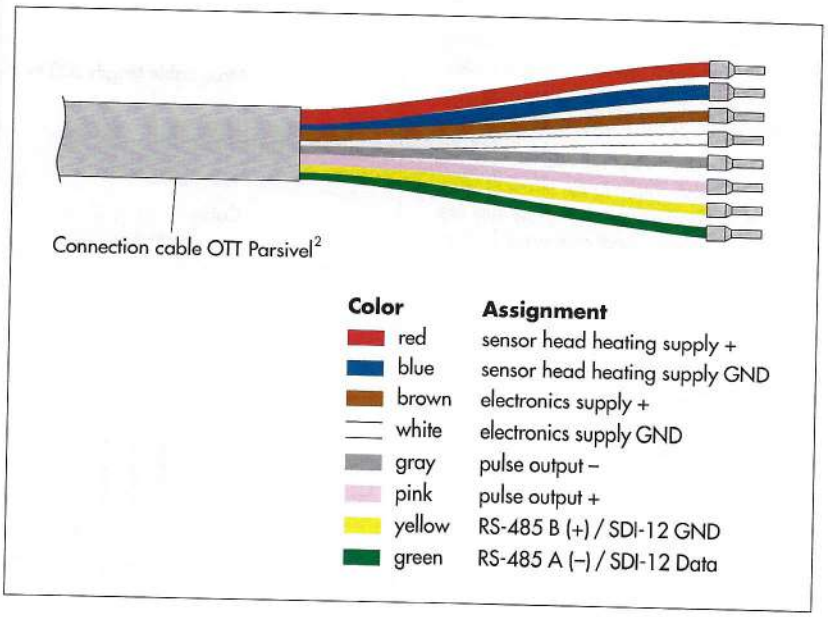
7 Connecting the OTT Parsivel² to a datalogger

The OTT Parsivel² can be connected to the following dataloggers:

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

The connection to a datalogger is made with a prepared, 8-core connection cable (accessory). This cable also has 2 wires for the electrical power supply for the electronics and two for the sensor head heating of the OTT Parsivel².

Fig. 6: Wiring assignment of the connection cable.



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

Parallel operation of the pulse output with either the RS-485 or the SDI-12 interface is possible to a limited extent. With this operating type, the OTT Parsivel² does not send the pulse at intervals of one minute but at the time interval set for sample intervals on the datalogger or PC.

7.1 Connecting the OTT Parsivel² to an OTT netDL IP datalogger using the RS-485 interface

The measured values determined by the OTT Parsivel² can be called and stored via the OTT netDL IP datalogger.

- To do so, connect the OTT Parsivel² as shown in Fig. 7 to the OTT netDL using the RS-485 interface.

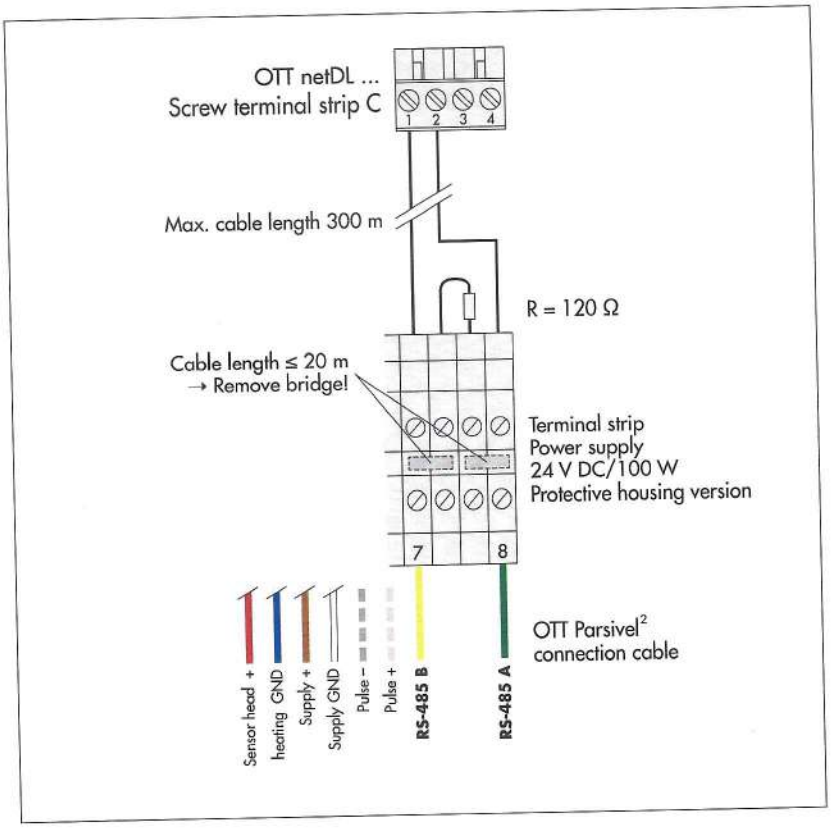


Fig. 7: Connecting the OTT Parsivel² to the OTT netDL via the RS-485 interface.

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

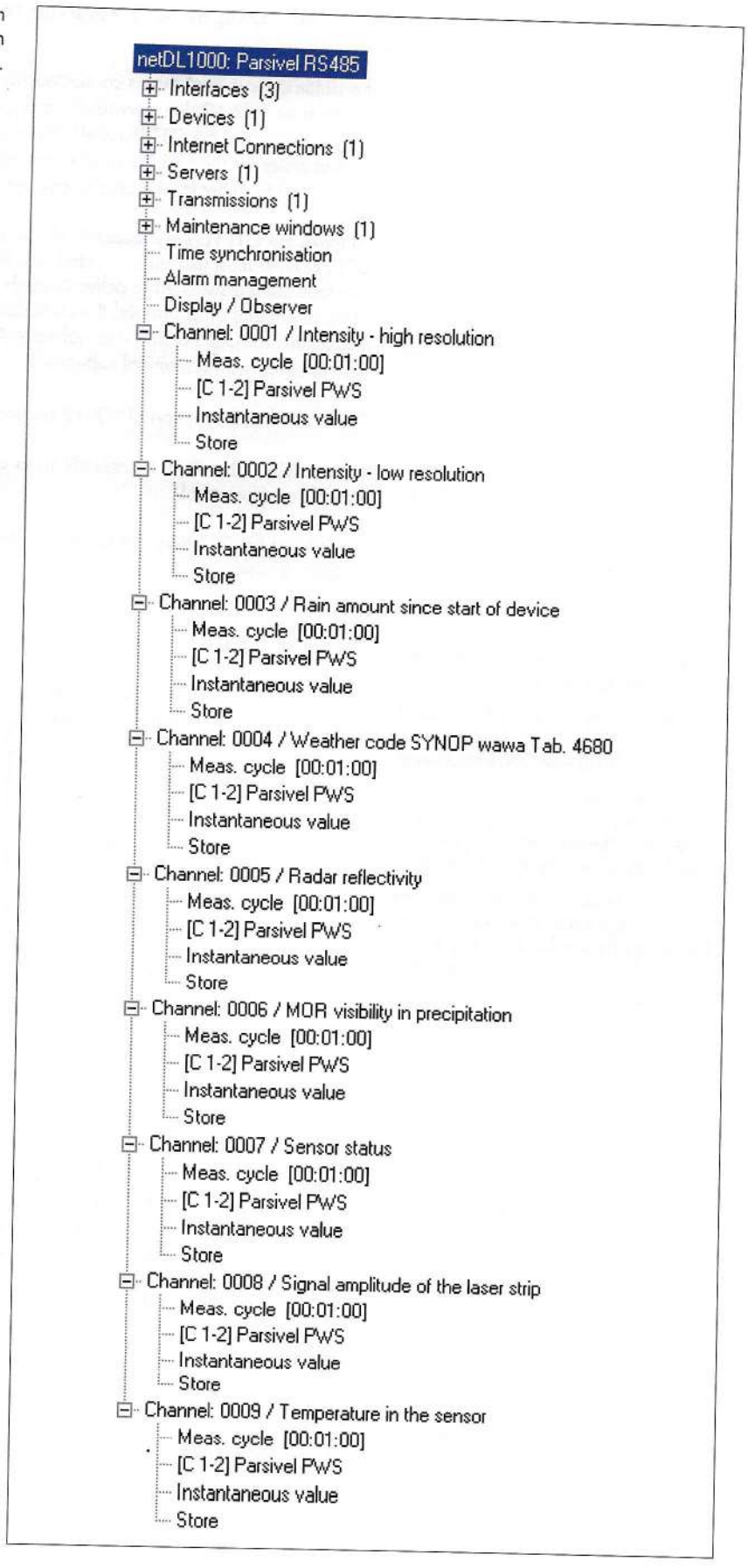
In addition, the four wires of the voltage supply (sensor head heating: red + blue; electronics: brown + white) must be connected to the power supply; see Chapter 9.

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

Configuring the OTT netDL IP datalogger for RS-485 communication

To call the data from the OTT Parsivel² with the OTT netDL and to store them, a configuration must be set up in the OTT netDL. Figure 8 shows an OTT netDL example configuration for communication via the RS-485 interface. See also the operating instructions for the "OTT netDL IP datalogger".
Note that the measurement cycle must be set up with the same value in all channels set up in the OTT Parsivel².

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



7.2 Connecting the OTT Parsivel² to a datalogger via an SDI-12 interface

If a datalogger is used that is connected via an SDI-12 interface, the datalogger functions as "SDI-12 data recorder", and specifies the measurement time and sample interval of the OTT Parsivel². The measurement time must be ≥1 min in this case in order for the OTT Parsivel² to collect sufficient data during winter operation as well to allow for the precise assignment of precipitation type.

To make the OTT Parsivel² capable of communicating for an SDI-12 interface, the OTT Parsivel² must first be connected to a PC via the USB interface. The SDI-12 interface can be switched to active through the Parsivel user software ASDO or using a terminal program and the command "CS/S/E/1<CR>" (see operating instructions for OTT Parsivel user software ASDO and Chapter 11 "Operating the OTT Parsivel² with a terminal software").

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

Connecting the OTT Parsivel² to a datalogger using an SDI-12 interface (general)

- Connect the OTT Parsivel² to any datalogger as shown in Fig. 10 via the SDI-12 interface.

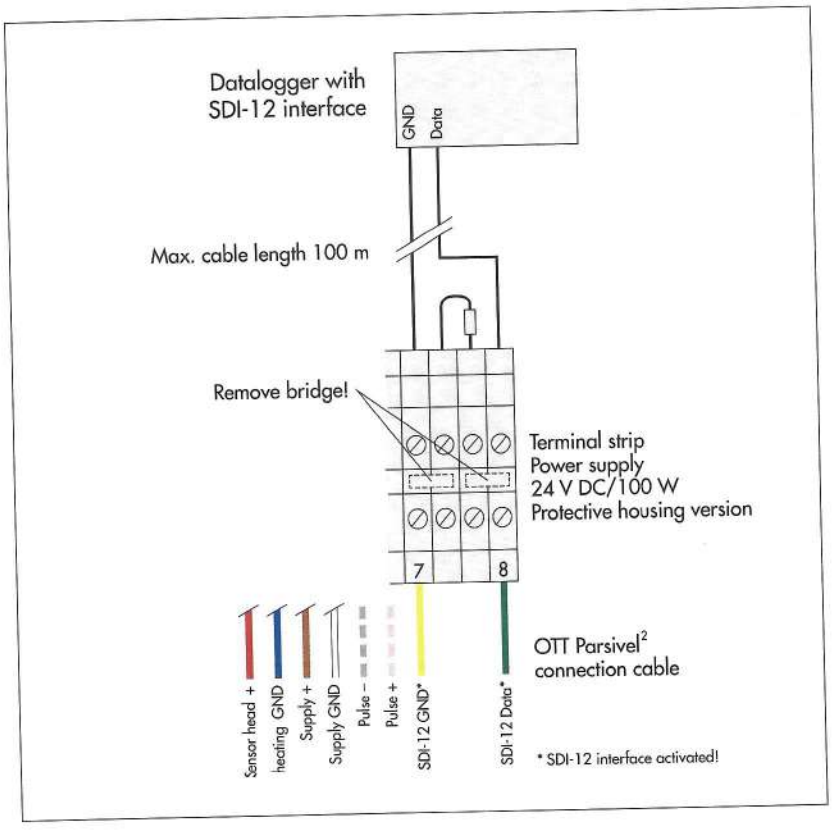


Fig. 9: Connecting the OTT Parsivel² to a datalogger via the SDI-12 interface.

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

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

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

Connecting the OTT Parsivel² to an OTT netDL IP datalogger via the SDI-12 interface

- Connect the OTT Parsivel² as shown in Fig. 10 to the OTT netDL using the SDI-12 interface:

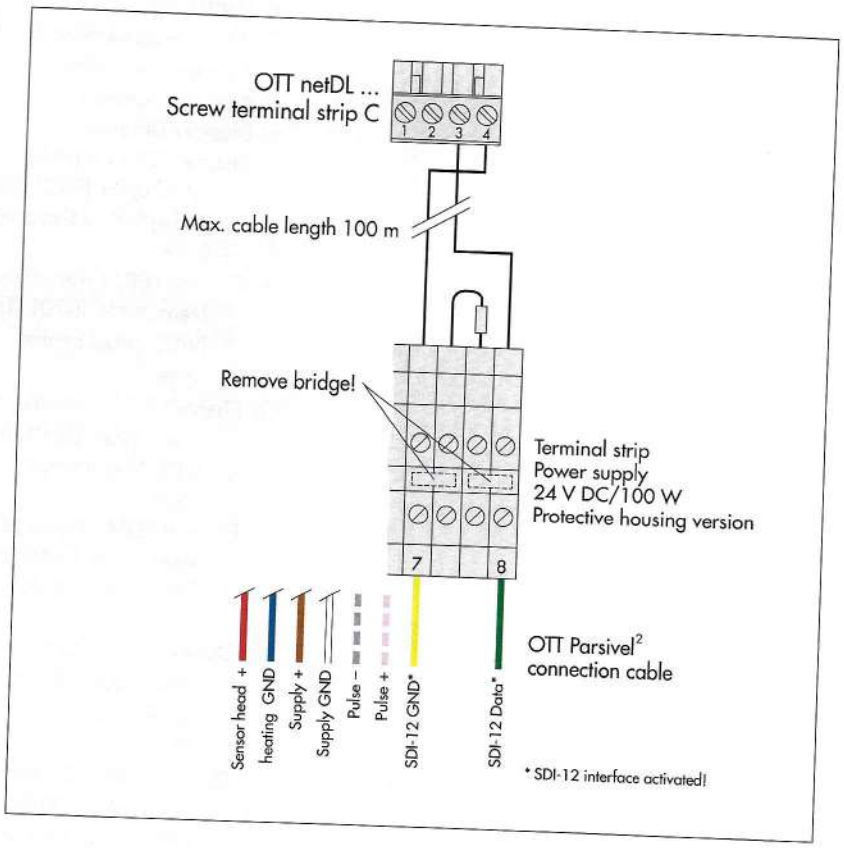


Fig. 10: Connecting the OTT Parsivel² to an OTT netDL via the SDI-12 interface.

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

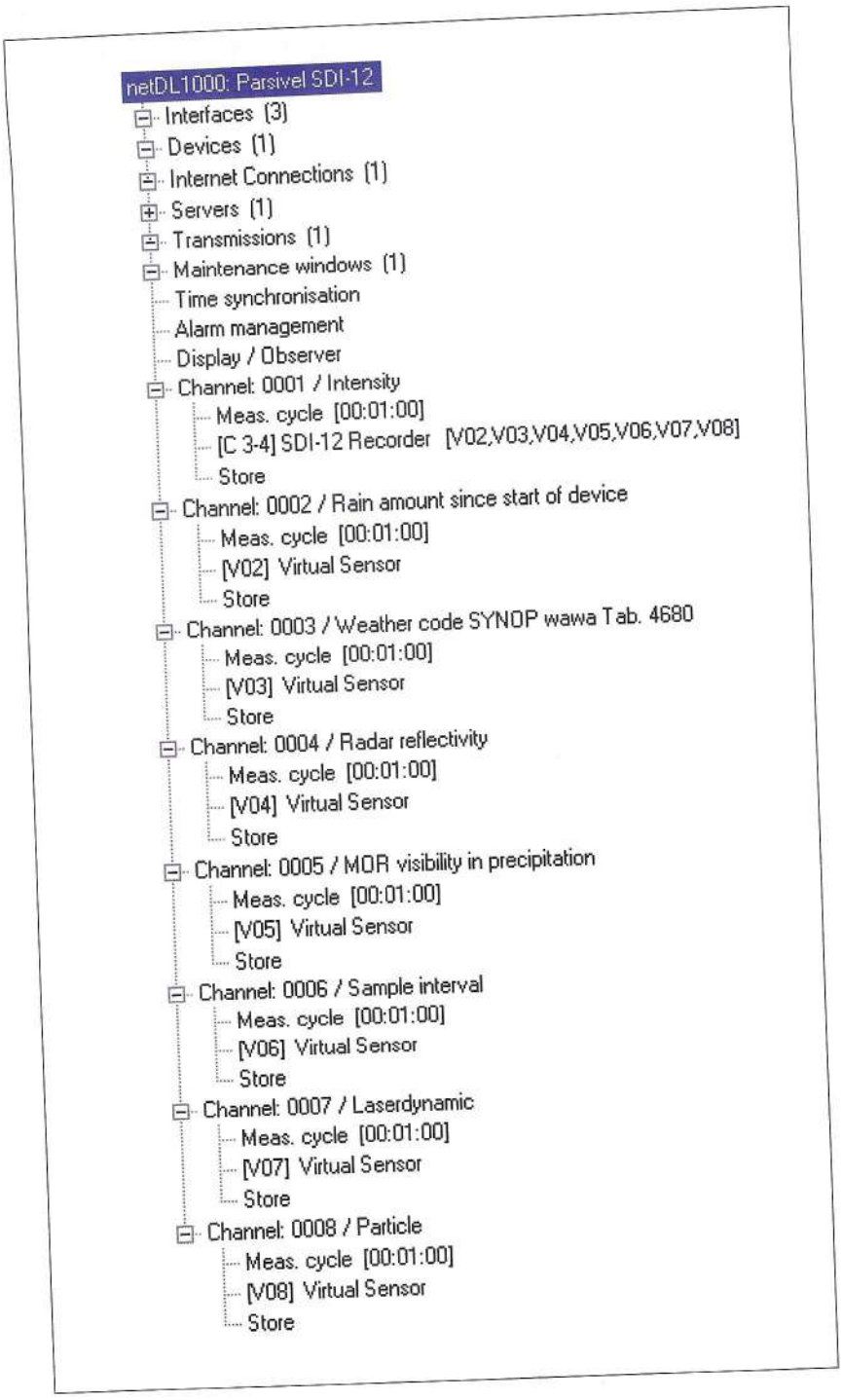
In addition, the four wires of the voltage supply (sensor head heating: red + blue; electronics: brown + white) must be connected to the power supply; see Chapter 9.

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

Configuring the OTT netDL IP datalogger for SDI-12 communication

To call the data from the OTT Parsivel² with the OTT netDL and to store them, a configuration must be set up in the OTT netDL. Figure 11 shows an OTT netDL example configuration for communication via the SDI-12 interface. See also the operating instructions for the "OTT netDL IP datalogger ...". Note that the measurement cycle must be set up with the same value in all channels set up in the OTT Parsivel², and that no "instantaneous value" can be stored in any of the channels of the OTT netDL configuration, as false measurements can arise otherwise.

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



7.3 Connecting the OTT Parsivel² to a datalogger with pulse input

Pulse input

The rainfall amount can be detected in a manner similar to rain collectors according to the tipping bucket principle using pulse input to a datalogger.
For the pulse output of the OTT Parsivel², the following values apply:

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

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

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

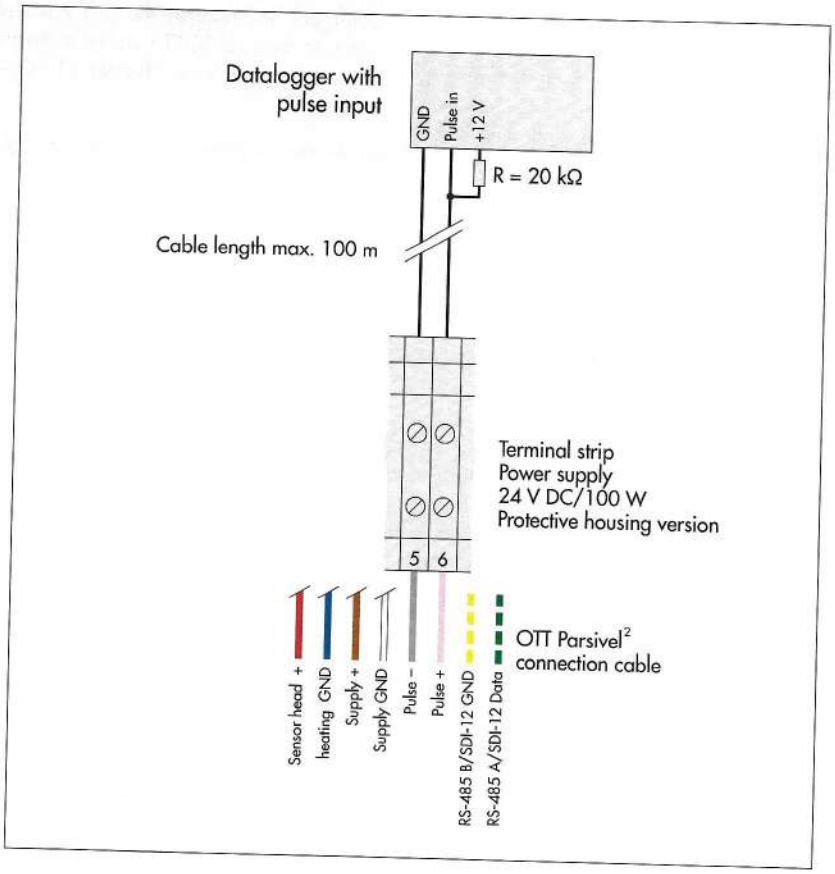


Fig. 12: Connecting the OTT Parsivel² to the datalogger with pulse input.

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

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

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

8 Connecting the OTT Parsivel² to a PC

The OTT Parsivel² contains an RS-485 interface. Depending on whether your PC has an RS-232 or USB interface, a corresponding interface converter must be used that provides automatic conversion between the OTT Parsivel² and the PC. Here we recommend using the RS-485/USB interface converters from our list of accessories.

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

To connect the OTT Parsivel² to your PC, proceed as follows:

- Connect the RS-485 interface of the OTT Parsivel² to the interface converter used (see Chapter 8.1or 8.2).
- Connect the interface converter to the PC.
- Start the OTT Parsivel software ASDO [1] or a terminal program on the PC (such as "Hyperterminal").
- Configure and operate the OTT Parsivel² with the OTT Parsivel software ASDO (see also manual "OTT Parsivel software ASDO") or alternatively with a terminal software (see also Chapter 11 "Operating the OTT Parsivel² with a terminal software").

[1] under Microsoft Windows 10/11 administrator rights are required!

8.1 Connecting the OTT Parsivel² to the RS-485/USB interface converter

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

Setting the dip switches at the interface converter

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

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

2-wire communication

- Connect the OTT Parsivel² as follows to the 5-pin terminal of the interface converter:

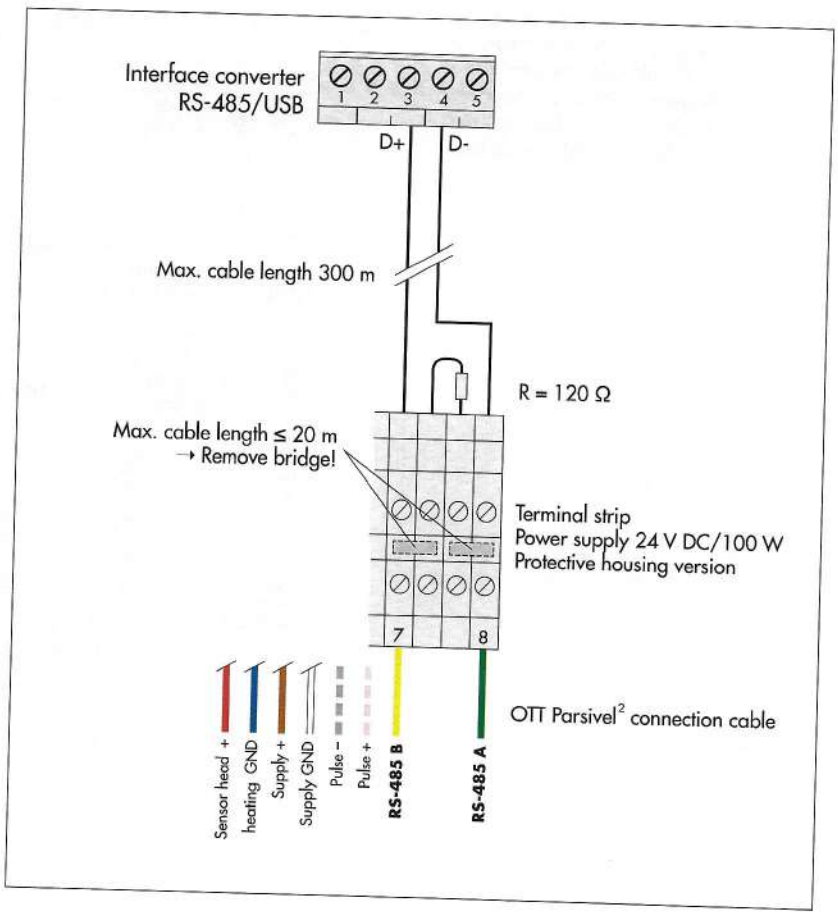


Fig. 13: Connecting the OTT Parsivel² to an RS-485/USB interface converter.

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

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

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

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

8.2 Connecting the OTT Parsivel² to any RS-485 interface converter

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

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

8.3 Connecting the OTT Parsivel² to a PC for configuring using a USB interface

If you do not want to work with the factory settings of the OTT Parsivel² and read out the data only with a datalogger, it is necessary to configure the OTT Parsivel² before its first use using the OTT Parsivel software ASDO Basic [1] or a terminal program. To do so, the OTT Parsivel² is temporarily connected to a PC with a USB interface.

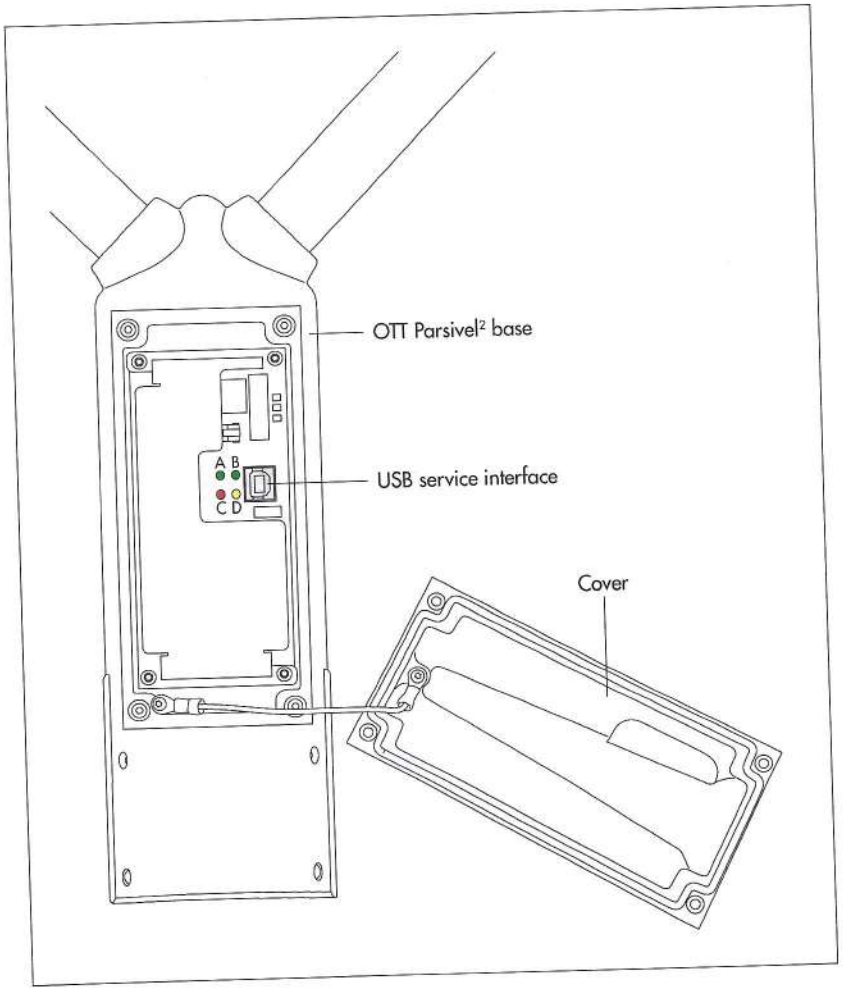
! **Please note:** The OTT Parsivel² is not supplied with power via the USB interface! As in normal measurement operation, the power supply is from an additionally connected power supply (brown and white wire of the connection cable).

Connecting the OTT Parsivel² to a PC via USB interface:

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

Fig. 14: Position of the USB service interface in the OTT Parsivel² base.

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



- Remove the cover of the OTT Parsivel² base (Allen key, 4 mm).
- Connect the USB cable to a USB interface of the PC (USB plug type A).
- Connect the USB cable to service interface of the OTT Parsivel² (USB plug type B; see Fig. 14).
- Start the OTT Parsivel Software ASDO Basic [1] or terminalsoftware on your PC and make the required settings.

[1] under Microsoft Windows 10/11 administrator rights are required!

- After completion, disconnect the connection between PC and OTT Parsivel².
- Replace the cover on the OTT Parsivel² base; ensure that you do not kink or jam the cable in the process!

Installing the USB interface driver

For establishing a communication link over the USB interface, the PC requires a dedicated USB interface driver. Depending on the operating system used, proceed as follows when connecting OTT Parsivel² to the PC for the first time:

- Windows **7/8:** install OTT USB-Schnittstellentreiber manually
- Windows **10/11:** the operating system usually automatically installs a universal Microsoft USB interface driver (if necessary: install OTT USB interface driver manually)

Windows 7/8 [1]

- Log on to the PC with administrator rights.
- Connect the OTT Parsivel² to a USB interface of the PC, see above → the PC detects the new hardware and displays the message [2]: "Found New Hardware – OTT Parsivel²" → the "Found New Hardware Wizard" opens.
- Select "No, not this time".
- Select "Next".
- Select "Install from a list or specific location (Advanced)".
- Select "Next".
- Connect the USB stick (supplied) with the OTT USB interface drivers to another USB port on the PC [3].
- Select "Search for the best driver in these locations" and "Search removable media (CD-ROM, ...)".
- Select "Next" → the assistent installs the OTT USB interface driver. After completing the installation process, the message "The software for the following hardware has been installed: OTT PARSIVEL2" appears.
- Select "Next". Now a communication link via the USB interface may be established.

Windows 10/11 [4]

- Log on to the PC with administrator rights.
- Copy USB interface driver from USB stick (supplied) to PC [3].
- Connect the OTT Parsivel² to a USB interface of the PC, see above.
- If an installation wizard starts: cancel the installation wizard.
- Start Windows device manager (right click on start menu and select "Device Manager").
- Click on "Serial USB Device (COMx)" under "Ports (COM & LPT)".
- Click on "Install Driver" in the "Driver" tab.
- Click on "Browse my computer for driver software".
- Click on "Browse", navigate to the OTT USB Interface Driver directory and click "OK".
- Click "Next" → the operating system installs the OTT USB interface driver on the PC.

Notes:

- The USB interface cannot be used as a permanent connection between your PC and the OTT Parsivel².
- When using the USB interface, the OTT Parsivel² does not send any data via the SDI-12/RS-485 interface or the pulse output.

[1] description based on Windows 7; with small differences also valid for Windows 8
[2] in the notification area of the taskbar
[3] alternatively, please download the OTT USB interface driver from "www.ott.com/resources/"
[4] if manual installation is required

9 Connecting the OTT Parsivel² to a power supply

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

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

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

WARNING **Risk of electric shock!**

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

- Connect the power supply to the OTT Parsivel² as shown in Figures 15 or 16.

Fig. 15: Connecting power supply control cabinet version to the OTT Parsivel².

Install the power supply in the control cabinet on a standard top hat rail. For optimum running of the cable, in the area where the cable enters the control cabinet a terminal strip should be used.

When using the RS-485 interface, the total cable length between the OTT Parsivel² and the datalogger may be a maximum of 20 meters! Otherwise, a 120 Ohm terminator is necessary on the OTT Parsivel² between the yellow and green wires!

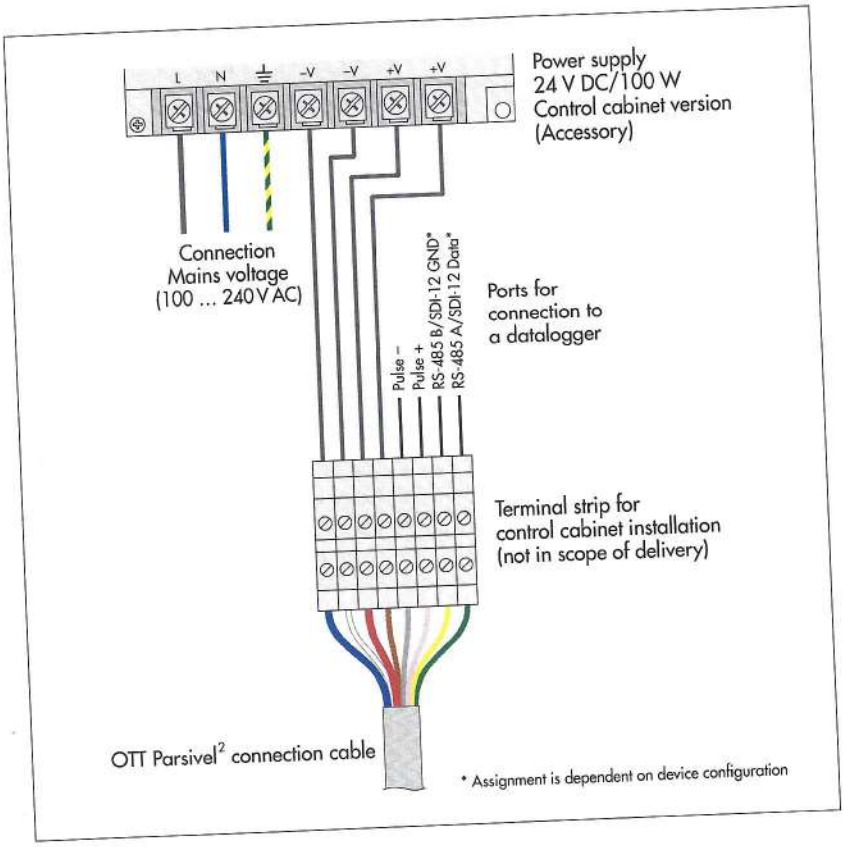
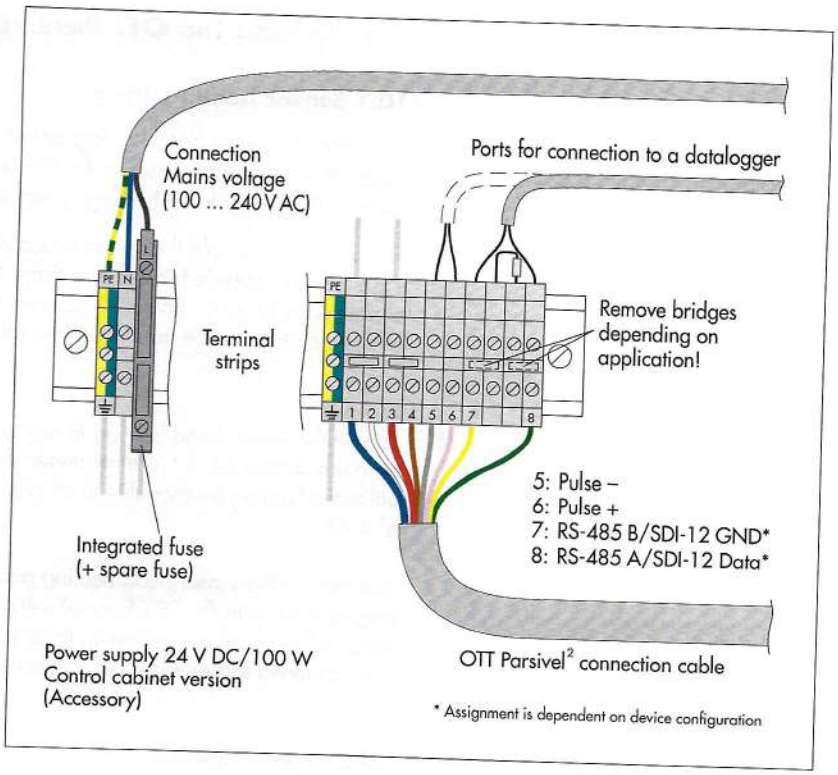


Fig. 16: Connecting power supply protective housing version to the OTT Parsivel².

Install the power supply onto the pedestal of the OTT Parsivel² using the bolts and nuts supplied. In this case, the connection cable has a length of one meter. Feed it through the hole in the leg and one of the three cable connections on the inside of the power supply.



10 Heating the OTT Parsivel²

10.1 Sensor head heating

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

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

Note:
Enable the sensor head heating in any case if the OTT Parsivel² is used at temperatures below +4 °C! We recommend a power supply of $24V_{DC}$ to provide for unlimited heating functionality in all climatic conditions (resulting heating current of 4 A).

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

10.2 Screen heating

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

To prevent thawing, the screens of the OTT Parsivel² are equipped with a screen heating which may be switched off. The screen heating can either be used separately or together with the sensor head heating. Compared to the sensor head heating, power consumption of the screen heating is very low.

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

A typical application to turn the screen heating on/sensor head heating off would be a limited power supply of the OTT Parsivel²; e.g. if the system is running on solar power supply.

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

11 Operating the OTT Parsivel² with a terminal software

11.1 Setting up communications between the OTT Parsivel² and the terminal program

The OTT Parsivel² provides a USB interface for communication. This serial interface can be operated at various baudrates. Communication with the sensor is possible with any standard terminal software. Below, operation using the terminal software program "Hyper Terminal" is described since this is a part of Microsoft Windows® scope of delivery.

In order to operate OTT Parsivel² using Hyper Terminal, proceed as follows:

- Connect the OTT Parsivel² to your PC as described in Chapter 8 "Connecting the OTT Parsivel² to a PC".
- Start Hyper Terminal.
- After starting Hyper Terminal, the window "Connection Description" opens. Enter a name for the connection, select an arbitrary symbol and confirm your input with "OK". The next window "Connect to" now opens.
- Select the COM interface of your PC and confirm your input with "OK". The next window that opens is "Properties of COM [No.]".
- Enter the following connection settings:

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

After a successful connection with the OTT Parsivel² is made, it sends a "!" as an input prompt after pressing the enter key:

```
BOOTLOADER PARSIVEL
```

after approx. 10 seconds, the following message appears:

```
*** PARSIVEL 2 ***
OTT HYDROMET GmbH
Copyright (C) 2019
Version: V2.11.6
```

Approximately 60 seconds after starting to establish the connection, the OTT Parsivel² starts measuring automatically and outputs the data telegram.

11.2 Measured value numbers

The measurements and status values are output from the OTT Parsivel² in the form of a telegram. To this end, each value that can be output was assigned a measurement number. In addition, the number of digits that the value in the telegram can contain, the form in which this value is output, the covered range and in what unit it is precisely defined. These specifications are listed in the following table:

No.	Description	Digits	Form	Range	Unit
01	Rain intensity (32 bit [1])	8	0000.000	0.000 ... 9999.999	mm/h
02	Rain amount accumulated (32 bit [1])	7	0000.00	0.00 ... 0300.00	mm
03	Weather code acc. to SYNOP $w_a w_a$; Table 4680	2	00	00 ... 99	
04	Weather code acc. to SYNOP ww; Table 4677	2	00	00 ... 99	
05	Weather code METAR/SPECI w'w'; Table 4678	5	+RASN		
06	Weather code according to NWS	4	RLS+		
07	Radar reflectivity (32 bit [1])	6	00.000	–9.999 ... 99.999	dBz
08	MOR visibility in precipitation	5	00000	0 ... 20000	m
09	Sample interval	5	00000	0 ... 03600	s
10	Signal amplitude of the laser strip	5	00000	0 ... 99999	1
11	Number of particles detected and validated	5	00000	0 ... 99999	1
12	Temperature in the sensor housing	3	000	–99 ... 100	°C
13	Sensor serial number	6	123456		
14	Firmware IOP version number	6	2.02.3		
15	Firmware DSP version number	6	2.02.3		
16	Sensor head heating current	4	0.00	0.00 ... 4.00	A
17	Power supply voltage	4	00.0	0.0 ... 30.0	V
18	Sensor status	1	0	0 ... 3	see Chapt. 12.1
19	Date/time measuring start	19	00.00.0000_00:00:00	DD.MM.YYYY_hh:mm:ss	
20	Sensor time	8	00:00:00	hh:mm:ss	
21	Sensor date	10	00.00.0000	DD.MM.YYYY	
22	Station name	10	XXXXXXXXXX		
23	Station number	4	XXXX		
24	Rain amount absolute (32 bit [1])	7	000.000	0.000 ... 999.999	mm
25	Error code	3	000		
26	Temperature PCB	3	000	–99 ... 100	°C
27	Temperature in the right sensor head	3	000	–99 ... 100	°C
28	Temperature in the left sensor head	3	000	–99 ... 100	°C
30	Rain intensity (16 bit [1]) max. 30.000 mm/h	6	00.000	0.000 ... 30.000	mm/h
31	Rain intensity (16 bit [1]) max. 1200.0 mm/h	6	0000.0	0.0 ... 1200.0	mm/h
32	Rain amount accmulated (16 bit [1])	7	0000.00	0.00 ... 0300.00	mm
33	Radar reflectivity (16 bit [1])	5	00.00	–9.99 ... 99.99	dBz
34	Kinetic energy	7	000.000	0.000 ... 999.999	J/(m²h)
35	Snow depth intensity (volume equivalent)	7	0000.00	0.00 ... 9999.99	mm/h
60	Number of all particles detected	8	00000000	0 ... 8192	1
61	List of all particles detected (including size and particle speed)	13	00.000;00.000	0.200 ... 25.000; 0.20 ... 20.000	mm;m/s
90	Field N (d) 1. Value = average volume equivalent diameter (ved) of the 1. class	223	00.000S	–9.999 ... 99.999	$\log_{10}$ (1/m³ mm)
91	Field v (d) 1. Value = average particle speed (ps) of the 1. class	223	00.000S	0.000 ... 99.999	m/s
93	Raw data (volume equivalent diameter) 1. Value = number of particles 1. ved/1. ps ... 32. Value = number of particles 32. ved/1. ps; 33. Value = number of particles 1. ved/2. ps ... 64. Value = number of particles 32. ved/2. ps; 65. Value = ...	4095	000S	0 ... 999	1

[1] depending on which datalogger is used, the measured value number must be selected with the corresponding number of bits. S = Separator

Notes:

- Other values in the telegram that are not listed here are for service purposes only. Please ignore them.
- The OTT Parsivel² outputs all numerical values with a decimal **point** as decimal speparator!

11.3 Defining the formatting string

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

Formatting control codes

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

Formatting individual measured values

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

Formatting fields

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

11.4 OTT telegram

The following telegram configuration has been preset at the factory:

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

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

200248;000.000;0000.00;00;–9.999;9999;025;15759;00000;0;

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

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

11.5 Updating OTT Parsivel² firmware

OTT HydroMet provides the latest update versions to OTT software on its internet site at www.ott.com under the rubric "Software updates". The following file is needed to update the OTT Parsivel² firmware:

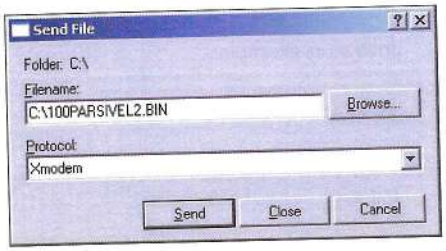
- *IOP.BIN

where * represents the respective version number.

To update the OTT Parsivel² firmware, proceed as follows:

- Connect your PC to the OTT Parsivel² via the corresponding interface converter as described in Chapter 8.
- Load the newest update of the OTT Parsivel² firmware onto your computer from the OTT home page.
- Start a terminal software program on your PC and make the appropriate settings as described in Chapter 11.1 "Setting up communications between the OTT Parsivel² and the terminal software".
- After OTT Parsivel² has started measurement operations and has issued a data telegram, reset the OTT Parsivel² firmware with the command CS/Z/1<CR>.
  OTT Parsivel² answers with "Bootloader OTT Parsivel²".
- Press <CR> repeatedly directly after the message.
  OTT Parsivel² replies with "?".
- Input the command sup <CR>.
  OTT Parsivel² answers with "Start upload Firmware with XMODEM/CRC".
- Select "Transfer | Send file" in the menu bar.
  The "Send file" window opens:

Fig. 17: "Send file" window.



- Select the file "*IOP.BIN" under "Filename" using the "Browse" button; you had previously stored this file on your PC.
- Select the "Xmodem" protocol type from the "Protocol" selection window.
- Confirm your input with "Send". The "Xmodem file send for OTT Parsivel2" window opens:

Fig. 18: "Xmodem file send for OTT Parsivel2" window.

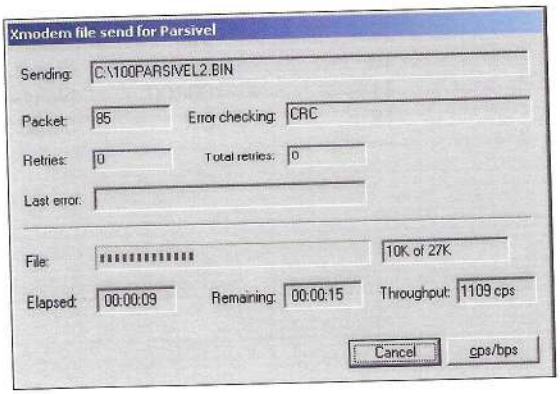
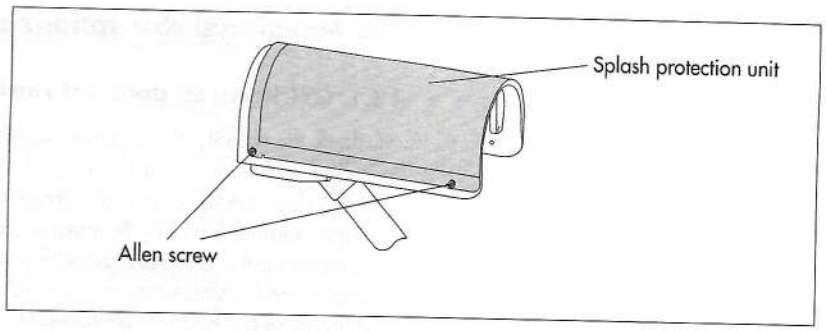


Abb. 19: Splash protection unit.



Clean the splash protector as follows:

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

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

12.4 Verifying particle size measurements

If there is any doubt in relation to the plausibility of the measurement values determined by the OTT Parsivel², you can perform an approximate verification in the field (or in a laboratory). Reference spheres (e.g. steel spheres) with known diameters are required here; alternatively, a reference drop dispenser is used.
The reference spheres must fall through the centre of the laser strip within a measurement interval of 60 seconds. (Reference spheres falling through the edge of the laser strip must be avoided.)

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

[1] measurement value number 31, see Chapter 11.2

Please note:

- Such verification is representative only when using a device to precisely specify the particle speed and the falling path (centre of the laser strip).
  In addition, a collecting device must be used below the sensor heads to prevent damage to the struts and base of the OTT Parsivel².
- This method of verification permits only an approximate statement.
  In case of doubt, we recommend inspecting the OTT Parsivel² in the factory.
  A precision test stand is available for this purpose. The results are documented in an acceptance test certificate (FAT; Factory Acceptance Test).

13 Functional disruptions and remedies

13.1 OTT Parsivel² does not start

- Check the polarity of the power supply, the A+B connections of the RS-485 cables and the baud rate (see Ch. 6 and 7).
- If this does not work, start any terminal software program on your PC (e.g. Hyper Terminal) and try to make a connection to OTT Parsivel² (see Ch. 11 "Operating the OTT Parsivel² with a terminal software"). The OTT Parsivel² should send a status message of "ok" in response to the "CS/<CR>" command. If this does not happen, contact OTT Hydroservice.

13.2 Disruptions due to convection and vibrations

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

14 Note about the disposal of old units

Within the member countries of the European Union
In accordance with the European Union guideline 2012/19/EC, OTT takes back old devices within the member countries of the European Union and disposes of them in an appropriate way. The devices concerned by this are marked with the symbol shown aside. (WEEE registration number: 49590817.)

- For further information on the return procedure, please contact your ocal sales contact. You will find the addresses of all sales partners in the internet on "www.ott.com". Please take into consideration also the national implementation of the EU guideline 2012/19/EC of your country.

For all other countries
- Dispose of the OTT Parsivel² properly after taking out of service.
- Observe the regulations valid in your country for the disposal of electronic devices.
- Never put the OTT Parsivel² into the normal household waste.

Used materials
see Chapter 15, "Technical Data"

15 Technical data

Optical sensor laser diode	
Wavelength	650 nm
Output power (peak)	0.2 mW
Laser class	1 (IEC/EN 60825-1:2014)
Light strip surface (W x D)	30 x 1 mm
Measuring surface (W x D)	180 x 30 mm
Measuring range	
Particle size of liquid precipitation	0.2 ... 8 mm
Particle size of solid precipitation	0.2 ... 25 mm
Particle speed	0.2 ... 20 m/s
Design	32 precipitation size classes 32 particle speed classes
Radar reflectivity Z	–9.999 ... 99.999 dBz
Kinetic energy	0 ... 999.999 J/(m²h)
Outputs	Weather code: – SYNOP $w_a w_a$ Table 4680, – SYNOP ww Table 4677, – NWS – METAR/SPECI w'w' Table 4678 differentiation of the precipitation types drizzle, rain, hail, snow > 97 % compared to a weather observer Snow depth intensity (volume equivalent)
Visibility in precipitation (MOR)	Measurement range 0 ... 20 000 m
Rain rate	
Minimum intensity	0.001 mm/h drizzle rain
Maximum intensity	1,200 mm/h
Accuracy	±5 % (liquid) / ±20 % (solid) [1]
De-icing protection	Microprocessor controlled sensor head heating
Power supply	10 ... 28 V_{DC}, reverse polarity protection Optimum heating output of the sensor head heating system can be guaranteed with a power supply voltage of at least 20 V_{DC}.
Current drawn	
Electronics	110/55 mA at 12/24 V_{DC}
Electronics + screen heating	275/235 mA at 12/24 V_{DC}
Sensor head heating	max. 4 A at 24 V_{DC} [2] max. 2 A at 12 V_{DC} [3]
Interfaces	RS 485 (EIA-485) 1,200 ... 57,600 Baud half-duplex, 2-wire SDI-12 USB OTT Parsivel² has an output relay for pulse output for precipitation in 0.1 mm/pulse with max. 2 Hz pulse rate
Lightning protection	integrated
Material	powder-coated aluminum housing
Weight	max. 6.4 kg
Temperature range	–40 ... +70 °C
Relative humidity	0 ... 100 %
Max. wind speed without device damage	50 m/s
Type of protection	IP 65
Size (H x W x D)	670 x 600 x 114 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 ≥ 100 W necessary
[3] not recommended

Product certifications

CE (EU)	This device fulfills the essential requirements of the EMC Directive 2014/30/EU
FCC (US)	FCC Part 15, Class "B" limits. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Modifications or changes to this device that have not been expressly authorised by the body responsible for conformity may invalidate the user's authorisation to operate the device.
IC (CA)	Canadian Radio Interference-Causing Equipment Regulation, ICES-003, "Class B". This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Appendix A – CS command set

CS/F/1<CR>
With this command, all factory settings can be recreated.

CS/I/<parameter><CR>

Adjust sample interval and start transfer
In automatic mode, the sample interval can be adjusted in seconds with this command. After confirmation of the command, the first data set is output.
Value range: 0; 10 ... 3600
Factory setting: 30
If the value "0" is entered for the sample interval, the Polling mode is enabled.

CS/P<CR>

Enabling polling mode
OTT Parsivel2 issues a data telegram no later than 500 ms after receiving the command. This command disables the interval-controlled telegram.

CS/PA<CR>

Output all measurement values (in accordance with the table in Chapter 11.2). This data sequence is necessary for the import into the OTT Parsivel software ASDO.

CS/R<CR>

Repeat polling mode
OTT Parsivel² outputs the data telegram no later than 500 ms after the confirmation of the command.

CS/R/xx<CR>

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

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

Adjust baudrate
Warning: Changing the baudrate can lead to loss of the connectivity!
The baudrate can be adjusted from 9600 ... 115200. The baudrate is set at 19200 at the factory.

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

CS/C/R<CR>

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

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

Setting up RS-485 bus mode
Warning:
Enabling the bus mode can cause the loss of the connectivity!
With this command, it is possible to operate more than one sensor through one RS-485 interface. The sensors are than operated via the bus address.

Value range:	0 ... 1
Factory setting:	0
Description:	0 = RS-485 bus mode disabled 1 = RS-485 bus mode enabled
Address query:	*<CR> Answer: <Address><CR><LF>

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

Set bus address for RS-485 bus mode
Warning: Changing the bus address can cause the loss of the connectivity!
Value range: 0 ... 9
Factory setting: 0

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

Adjust time of day
The time of day of the OTT Parsivel² is set to the time of day of the PC.

CS/D/01.01.2000<CR>

Adjust date
The date of the OTT Parsivel² is set to the calendar of the PC.

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

Set SDI-12 mode
Enable or disable the SDI-12 mode.
Value range: 0 ... 1
Factory setting: 0
Description: 0 = SDI-12 mode disabled
1 = SDI-12 mode enabled

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

Set bus address for SDI-12 bus mode
This command sets the bus address for the SDI-12 bus mode.
Value range: 0 ... 9
Factory setting: 0

CS/K/xxxxxxxxxx<CR>

Input station name
This command allows a user-specific station name to be used. This name can encompass a maximum of 10 characters.
CS/K/PWS00001<CR>
Station name: PWS00001

CS/J/xxxx<CR>

Assign station ID
This command assigns a 4-digit station ID.

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

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

.

Value range: 0 ... 1
Factory setting: 0
Description: 0 = OTT telegram
1 = User telegram

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

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

CS/Z/1<CR>

Restart sensor, reset the rain amount

CS/L<CR>

Output current configuration

CS/?<CR>

This command outputs the command list.

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

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

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

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

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

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

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

This command turns the screen heating ON or OFF

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

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

Set threshold temperature for screen heating.
If the temperature of the OTT Parsivel² housing falls below the adjusted value, the the screen heating works with maximum heating power; if the temperature of the housing is higher than the adjusted value, it works with minimum heating power. The minimum/maximum heating power is each adjusted by a separate CS-command.

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

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

Set minimum heating power of the screen heating

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

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

Set maximum heating power of the screen heating

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

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

Set real time clock
This command sets the real time clock of the OTT Parsivel².

CS/U<CR>

Read out real time clock
With this command the current date and time of the OTT Parsivel² is read out.

Response: 01.01.2011 10:55:11 (example)

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

Activate/deactivate "Parsivel [1] Communication Mode"
With this command the OTT Parsivel² telegram (see Chapter 11.2 and 11.4) is set to the format of the previous generation of Parsivel.
This is required if you are using the OTT Parsivel² in a measuring network, together with one/several Parsivel [1] unit/s and the telegram/s of all units has/have to be identical.

Range of values:	0, 1
Factory setting:	0 (→ OTT Parsivel² telegram)
Description:	0 = Parsivel [1] Communication Mode deactivated
	1 = Parsivel [1] Communication Mode activated

For a description of the Parsivel [1] telegram refer to the "Operating instructions Present Weather Sensor Parsivel" (70.200.005.B.E).

[1] predecessor model of OTT Parsivel²

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

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

Range of values:	0, 1
Factory setting:	1
Description:	0 = Smear suppression deactivated
	1 = Smear suppression activated

Appendix B – SDI-12 commands and responses

B.1 Basic commands

All SDI-12 basic commands are implemented in the OTT Parsivel². The following SDI-12 basic commands are relevant for the operation of the OTT Parsivel²:

Command	Response	Description
`a!`	`a<CR><LF>`	Acknowledgement active `a` – Sensor address; factory setting = 0
`aI!`	`al3ccccccccmmmmmm` ... ... `vvvxxxxxx<CR><LF>`	Send identification `a` – Sensor address `13` – SDI-12 protocol version `cccccccc` – Manufacturer's identification (company name) `mmmmmm` – Sensor identification `vvv` – Sensor version (firmware) `xxxxxx` – Serial number Response OTT Parsivel² = 013OTT_____PARS_2202123456
`aAb!`	`b<CR><LF>`	Change sensor address `a` – Old sensor address `b` – New sensor address
`?!`	`a<CR><LF>`	Query sensor address `a` – Sensor address

`aM!`	`atttn<CR><LF>`
	and after 9 seconds
	`a<CR><LF>`
		Start measurement
		`a` – Sensor address
		`ttt` – Time in seconds until the sensor has determined the measurement result
		Response OTT Parsivel² = 009
		`n` – Number of measured values
		Response OTT Parsivel² = 8
		`a<CR><LF>` – Service request

`aD0!`	`a<value1><value2><value3>` ... ... `<value4><value5><value6>` ... ... `<CR><LF>`	Send data – Part 1 (after `aM!`, `aMC!`, `aC!`, `aCC!`) `a` – Sensor address `<value1>` – Rain intensity [mm/h] Measured value format: `pbbbb.eee` Range: +0.000 ... +9999.999 mm/h `<value2>` – Rain amount accumulated [mm] Measured value format: `pbbb.ee` Range: +0.00 ... +300.00 mm `<value3>` – Weather code according to SYNOP $w_a w_a$ Table 4680 Measured value format: `pbb` [1] Range: +00 ... +99 `<value4>` – Radar reflectivity [dBz] Measured value format: `pbb.eee` Range: –9.999 ... +99.999 dBz `<value5>` – MOR visibility in precipitation [m] Measured value format: `pbbbbb` Range: +0 ... +20000 m `<value6>` – Sample interval [s] Measured value format: `pbbbb` Range: +0 ... +3600 s `p` – Sign (+,–) `b` – Number (before decimal point) Output without leading zeros! `e` – Number after decimalpoint

Command	Response	Description
aD1!	a<value7><value8><CR><LF>	Send data – Part 2 (after aM!, aMC!, aC!, aCC!) <value7> – Signal amplitude of the laser strip [1] Measured value format: pbbbbb Range: +0 ... +99999 <value8> – Number of particles detected and validated [1] Measured value format: pbbbbb Range: +0 ... +99999 p – Sign (+) b – Number (before decimal point) Output without leading zeros! e – Number after decimal point
aMC!	atttn<CR><LF> and after 9 seconds a<CR><LF>	Start measurement and request CRC (Cyclic Redundancy Check); for details see command aM!. The responses to the following aD0! and aD1! commands are extended by one CRC value: <value1><value2><value3><value4><value5> ... ... <value6><CRC><CR><LF> or a<value7><value8><CRC><CR><LF>
aC!	atttnn<CR><LF>	Start concurrent measurement (simultaneous measurement with multiple sensors on one single bus line); for details see command aM!. The number of measured values in the response to this command has two digits: nn = 02.
aCC!	atttnn<CR><LF>	Start concurrent measurement (simultaneous measurement with multiple sensors on one single bus line) and request CRC (Cyclic Redundancy Check); for details see command aM!. The number of measured values in the response to this command has two digits: nn = 02. The responses to the following aD0! and aD1! commands are extended by on CRC value: a<value1><value2><value3><value4><value5>... ... <value6><CRC><CR><LF> or a<value7><value8><CRC><CR><LF>
aM1!	atttn<CR><LF> and after 9 seconds a<CR><LF>	Start additional measurement a – Sensor address ttt – Time in seconds until the sensor has determined the measurement result Response OTT Parsivel² = 009 n – Number of measured values Response OTT Parsivel² = 8 a<CR><LF> – Service request
aD0!	a<value1><value2><value3> ... ... <value4><value5><value6> ... ... <CR><LF>	Send data – Part 1 (after aM1!, aMC1!, aC1!, aCC1!) a – Sensor address <value1> – Kinetic energy [J/(m²h)] Measured value format: pbbb.eee Range: +0.000 ... +999.999 J/(m²h) <value2> – Snow depth intensity [mm/h] Measured value format: pbbbb.ee Range: +0.00 ... +9999.99 mm/h <value3> – Weather code according to SYNOP ww Table 4677 Measured value format: pbb [1] Range: +00 ... +99 <value4> – Temperature PCB [°C] Measured value format: pbbb Range: –99 ... +100 °C

Continued on page 42

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

Command	Response	Description
aV!	atttn<CR><LF>	Perform system test a – sensor address ttt – time in seconds until the sensor provides the result of the system test Response OTT Parsivel² = 000 n – Number of measured values Response OTT Parsivel² = 0 a<CR><LF> – service request
aD0!	a0<CR><LF>	Send data (after aV!) a – sensor address 0 – no system test performed

More information on the SDI-12 basic commands can be found in the document "SDI-12; A Serial-Digital Interface Standard for Microprocessor-Based Sensors; Version 1.4" (refer to website "www.sdi-12.org").

B.2 Advanced SDI-12 commands

All advanced SDI-12 commands are preceded by "**O**" which stands for OTT. Using these commands, the OTT Parsivel² may be configured from the Transparent Mode of a datalogger.

Command	Response	Description
▶ Deactivate SDI-12 interface		
aOSE0!	a0<CR><LF>	a – sensor address This command deactivates the SDI-12 interface if it was activated after commissioning via the OTT Parsivel ASDO software or via terminal software. For further information see Chapter 3 and 7 (wire assignment of the connection cable), as well as Appendix A, command "CS/S/E/<parameter><CR>"

Appendix C – Classification of precipitation types

After determining the volume equivalent diameter (D) and the particle speed (V), the OTT Parsivel² subdivides the particles into appropriate classes. The scale of this classification is smaller for small, slow particles than for large and fast particles.

C.1 Class limits

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

Classification according to volume-equivalent diameter

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

Note:
Class 1 and class 2 are limits and are not evaluated at the current time in measurements using the OTT Parsivel² since they are outside the measurement range of the device.

Classification according to particle speed

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

Appendix D – Categorization of precipitation type by precipitation codes

From the classification of precipitation particles, the OTT Parsivel² calculates the rain rate. The type of precipitation is based on the number of particles within the measurement range, and the precipitation code is determined from the precipitation intensity R (in mm/h of an equivalent amount of water).

D.1 Precipitation code according to SYNOP

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

- SYNOP $w_a w_a$ 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	< 0.1	51	51
moderate	≥ 0.1 ... < 0.5	52	53
heavy	≥ 0.5	53	55
Drizzle with rain			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 2.5	57	58
moderate	≥ 2.5 ... < 10.0	58	59
heavy	≥ 10.0	58	59
Rain			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 2.5	61	61
moderate	≥ 2.5 ... < 10.0	62	63
heavy	≥ 10.0	63	65
Rain, drizzle with snow			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 2.5	67	68
moderate	≥ 2.5 ... < 10.0	68	69
heavy	≥ 10.0	68	69
Snow			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 1.0	71	71
moderate	≥ 1.0 ... < 4.0	72	73
heavy	≥ 4.0	73	75
Snow grains			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
–[1]	> 0	77	77
Soft hail			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 1.0	87	87
mod./heavy	≥ 1.0	88	88
Hail			
Intensity	Rain rate [mm/h]	Tab. 4680	Tab. 4677
light	< 2.5	89	89
mod./heavy	≥ 2.5	89	90

[1] no classification made

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

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

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

No precipitation

NWS	Tab. 4678		
		C	NP

Drizzle

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 0.25	L–	–DZ
moderate	> 0.25 ... < 0.5	L	DZ
heavy	≥ 0.5	L+	+DZ

Drizzle with rain

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 2.5	RL–	–RADZ
moderate	> 2.5 ... < 7.6	RL	RADZ
heavy	≥ 7.6	RL+	+RADZ

Rain

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 2.5	R–	–RA
moderate	> 2.5 ... < 7.6	R	RA
heavy	≥ 7.6	R+	+RA

Rain, drizzle with snow

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 2.5	RLS–	–RASN
moderate	> 2.5 ... < 7.6	RLS	RASN
heavy	≥ 7.6	RLS+	+RASN

Snow

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 1.25	S–	–SN
moderate	> 1.25 ... < 2.5	S	SN
heavy	≥ 2.5	S+	+SN

Snow grains

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 1.25	SG	–SG
moderate	> 1.25 ... < 2.5	SG	SG
heavy	≥ 2.5	SG	+SG

Soft hail

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
light	≤ 1.25	SP	–GS
moderate	> 1.25 ... < 2.5	SP	GS
heavy	≥ 2.5	SP	+GS

Hail

Intensity	Rain rate [mm/h]	NWS	Tab. 4678
– [1]	> 0	A	GR

[1] no classification made

Appendix E – Note on the declaration of conformity

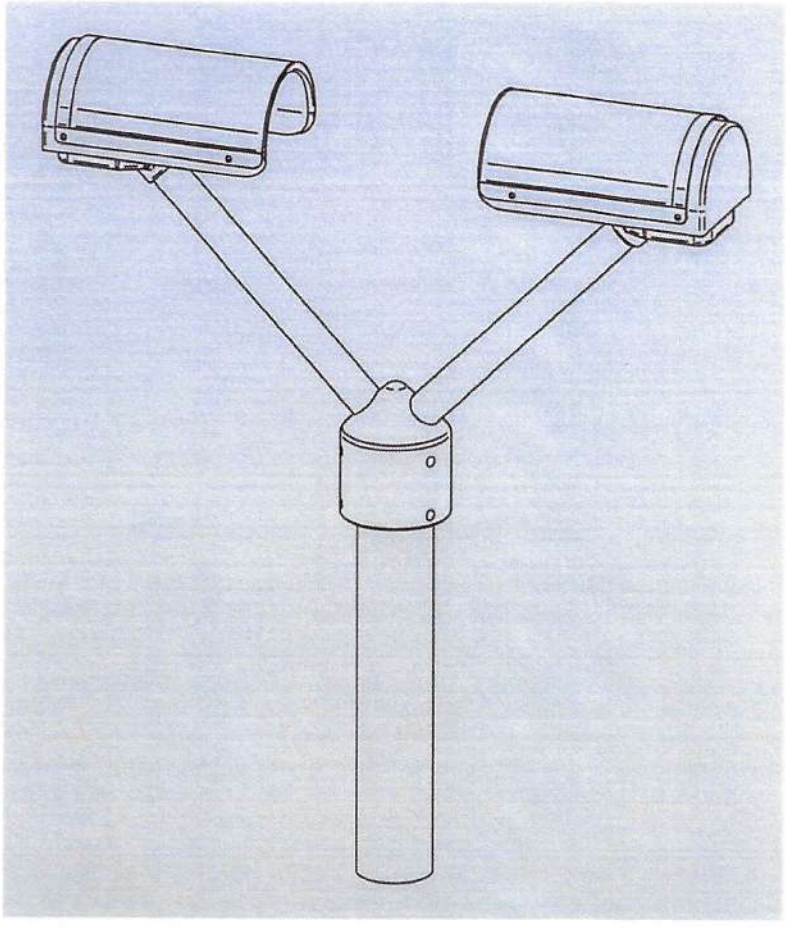
If required, you can download the current version of the declaration of conformity for the OTT Parsivel² from our website as a PDF file: "www.ott.com/resources".

Document number
70.210.002.B.E 05-0224

OTT HydroMet GmbH
Ludwigstrasse 16
87437 Kempten · Germany
Tel. +49 831 5617-0
Fax +49 831 5617-209
euinfo@otthydromet.com
www.otthydromet.com

Operating Instructions

Parsivel Application Software ASDO



English

We reserve the right to make technical improvements!

Table of Contents

1 Introduction

The Parsivel ASDO software makes it very easy to configure the Parsivel, read out data and display it. The software is available in the following versions:

- ASDO Basic
  Just application software, without database
- ASDO
  Full version with integrated database

ASDO is tailored especially to read out and configure the OTT Parsivel and supports the following functions:

- Online collection of Parsivel data sets
- Visualization of particle distribution
- Time sequence graph of precipitation intensity and other parameters
- Integrated database (not in the basic version)
- Automatic export in text format (for example to OTT Hydras 3)
- Configuration of the OTT Parsivel

2 Installation

2.1 Connecting the Parsivel to the PC

Since the Parsivel is equipped with an RS-485 interface and common PC's use standard RS-232 or USB interfaces, the Parsivel must be connected to the respective PC through a corresponding interface adapter.

2.2 Installing ASDO

Proceed as follows to install the Parsivel ASDO software:

- End all applications before you run the Setup program.
- Insert the ASDO CD-ROM into the CD drive of your PC.
- Open the appropriate language folder on the CD and start by double-clicking on the file "setup.exe" contained therein.
  The program "setup.exe" starts the installation assistant, which leads you through the rest of the installation process.
- Follow all messages given by the installation assistant and input the required information when asked:
  Target directory for the installation
  Program folder
  User information
  Each time you press the "Next" button, you are directed to the next window.
- In the last window, check your inputs once more and start the copying process by clicking on the "Next" button.
  The Setup program copies all required files into the selected directory of your PC.
- End the Setup program.

2.3 Starting ASDO for the first time

Proceed as follows to start the Parsivel ASDO software for the first time:

- Start ASDO (for example Windows Start menu "Programs | ASDO"). The software starts and the "ASDO Licensing" window opens.

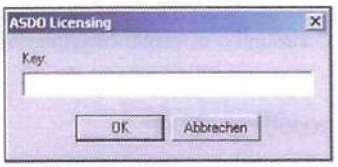


Fig. 1: Inputting the License Key in the "ASDO Licensing" window.

- If you have the full version of ASDO with integrated database, input the licensing key into the input field and confirm by clicking on the "OK" button. The license key can be found in the CD booklet.
  If you have the ASDO Basic software without the database, click on the "Cancel" button without entering a license key.
  The next time ASDO is started, the key request no longer appears.

If you would like to enter the license key later, proceed as follows:

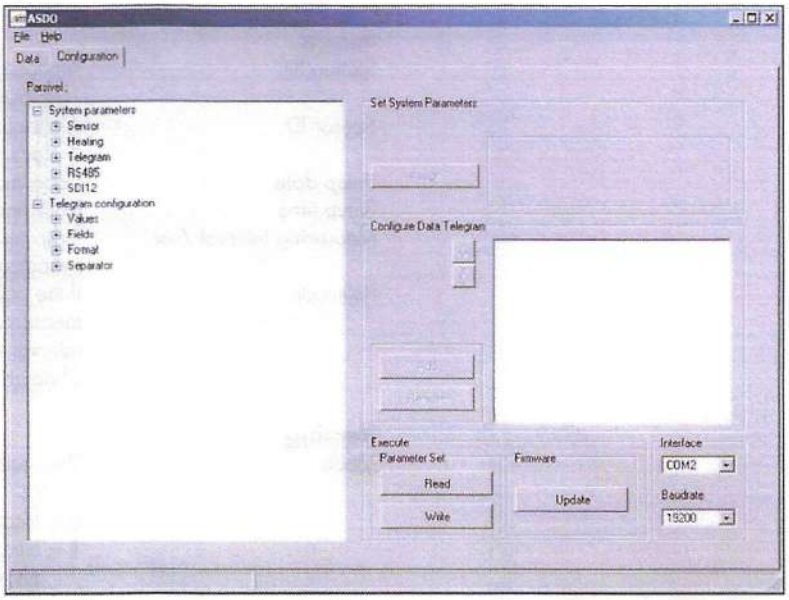
- Start ASDO.
- Select the "File | Register full version" menu. The "ASDO licensing" window opens.
- Enter the license key in the input field and confirm by clicking on the "OK" button. The full version can now be used.

3 Configuring the Parsivel

You can configure Parsivel system parameters and and telegram setup. To do so, proceed as follows:

- Connect the Parsivel to your PC as described in the operating instructions "Present Weather Sensor Parsivel".
- Start the Parsivel ASDO software on your PC.
- Select the "Configuration" tab:

Fig. 2: "Configuration" tab.



- Enter the interface on your computer to which the Parsivel is connected under "Interface".
- Enter the value of the baud rate of your connection under "Baud Rate".
- Make sure that Online Mode is stopped in the "Data" tab, since otherwise the COM-Port is active (see Chapter 4.1).
- Click on the "Read" button. The data of the connected Parsivel are read in and displayed in the left window as a tree diagram.

3.1 Set system parameters

To set the system parameters, proceed as follows:

- Click on the parameter in the tree diagram that you wish to change. The field "Set System Parameters" indicates the corresponding setttings that are available.
- Enter the desired value and confirm this input by clicking on the "Assign" button. The respective parameter is changed.
- Proceed in the same manner for all other parameters to be changed.
- Store the changes in the Parsivel by clicking on the "Write" button.

The system parameters are defined as follows:

Sensor

Station ID	Alphanumeric name of the station, 10-place input.
Sensor ID	Alphanumeric name of the sensor, 4-place input.
Setup date	Coordinated with the PC, cannot be manually set.
Setup time	Coordinated with the PC, cannot be manually set.
Measuring interval /sec	Indicates the sampling interval at which the Parsivel automatically sends measurement data.
Pollmode	If the polling mode is activated, ASDO reads the measured values from the Parsivel. The sampling interval entered in the "Data" tab applies here (see Chapter 8 "Displaying Data in Online Mode").

Heating

Mode	This mode can be set within the value range of 0 ... 2 : 0 = Heater turned off 1 = Heater automatically regulates the power supply within the range I_{min} to I_{max} to protect against ice buildup (see operating instructions "Present Weather Sensor Parsivel"). 2 = Heater constantly running at I_{max}
Max. Current in A/100	Configuring I_{max}
Min. Current in A/100	Configuring I_{min}
Switching temperature / °C	Configuring the minimum temperature. If the temperature drops lower than this, the heater turns on. The prerequisite for this is that Mode = 1.

Telegram

Usertelegram	The user telegram is configured through the telegram setup (see Chapt. 6.2 "Configuring the Telegram Setup"). If the user telegram is active, the measured values are output according to the user telegram. If it is inactive, the measured values are output in a predefined standard telegram.
Telegram	All parameters and formatting that had been defined for the user telegram are displayed here with formatting strings (see operating instructions "Present Weather Sensor Parsivel" Chapter 8, "Operating the Parsivel with a Terminal Software Package"). This list is read-only and cannot be changed here.

RS-485

Baudrate	Configuring the baud rate. In order to run in Online Mode, a baud rate of 19200 must be set.
4-Wire Mode	Activation/deactivation of 4-wire mode
Busmode	Activation/deactivation of bus mode
Bus address	Bus address configuration

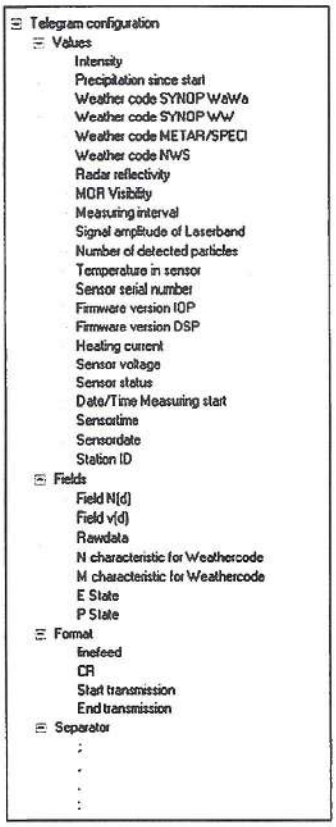
SDI 12

Mode	Activation/deactivation of the SDI-12 connection
Bus address	Bus address configuration

3.2 Configuring the telegram setup

This is where you can configure the telegram setup any way you wish.
The following values are available to you:

Fig. 3: Configuring the telegram setup.



To put together your individual telegram from this selection, proceed as follows:

- Mark the value in the tree diagram that you would like to include in the telegram.
- Click on the "Add" button. The marked value is included in the right selection window.
- Proceed in the same manner for all other values that you would like to include.
- To change the order of included values in the right selection window, mark the corresponding values and change their position using the red arrow keys.
- To delete a value from the selection window, mark the corresponding value and click on the "Remove" button.
- Store the completed telegram setup in Parsivel by clicking on the "Write" button.

Note:
Every change in the telegram setup is also recorded in the formatting string in the "System parameters | Telegram | Telegram" branch.

4 Displaying data in Online Mode

In the Online Mode, ASDO displays the currently measured values of the connected Parsivel. The display is updated at every sample. The Online Mode is not dependent on the database, and therefore can be used with any ASDO version. To do so, a baud rate of 19200 must be set in the configuration (see Chapt. 3.1 "Set System Parameters")

4.1 Starting Online Mode

To start Online Mode, proceed as follows:

- Select the "Data" tab in the start window.

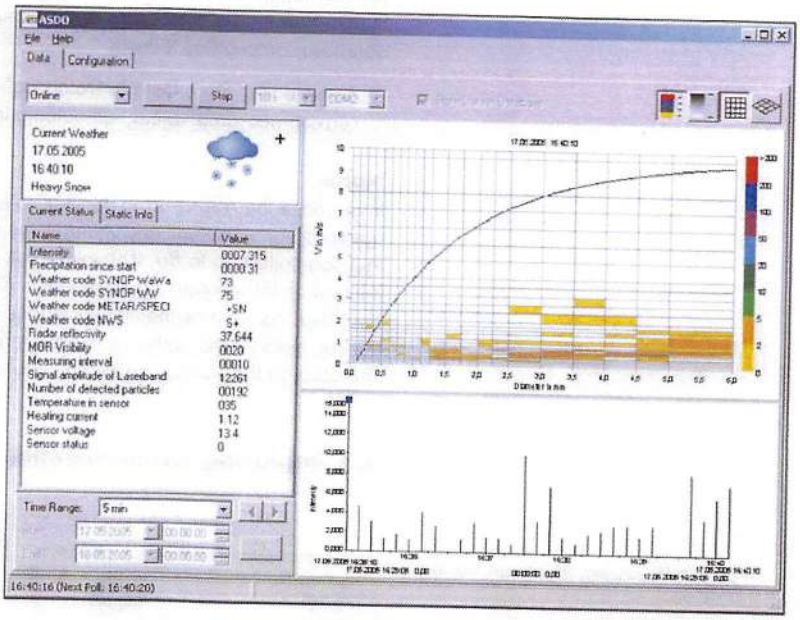


Fig. 4: "Data" tab. The Online Mode is selected and active.

- Select the "Online" option in the options bar.
- From the options bar, select the COM port through which the Parsivel is connected to your PC.
- Select the sampling interval from the options bar at which ASDO is to accept measured values from the Parsivel.

Note:

- This setting can only be made if Online Mode data transfer is deactivated by "Stop".
- Make sure that the poll mode is activated in the configuration (see Chapt. 3 "Configuring the Parsivel"). If it is deactivated, Parsivel actively sends its data at the period set in the configuration.
- The sampling interval does not coincide with the time when the communication starts, but rather with the PC clock.

Example:
Sampling interval = 10 minutes
If communication is started at 14:04:32, ASDO transfers the first measurement at 14:10:00.

▶ The current clock time and the time of the next measurement sample are displayed in the left field of the ASDO status line.

- Click on the "Start" button in the options bar.
  ASDO will transfer the data from the Parsivel at the next polling interval.

4.2 Storing measured values in a database

The full version of ASDO contains a database to which the polled measured values can automatically be sent. In order to store measured values in the database, the Station ID must have been defined in the configuration (see Chapt. 4 "Set System Parameters") In order to store measured data from Online Mode in a database, proceed as follows:

- Activate the "Store Data in Database" option in the options bar with ☑. All current measured values will automatically be sent to the database.

Note:
If you have the ASDO Basic Parsival software or if the "Store Data in Database" option is not activated, ASDO stores the data in Online Mode in a circular buffer that can collect up to 86,400 values per parameter. For example, at a polling interval of 10 seconds, approximately 10 days worth of data can be collected and filed. As soon as the circular buffer is full, the oldest data are written over. If the Parsivel's ASDO software is closed, the data on the circular buffer are deleted. The data on the circular buffer can not be displayed in Offline Mode.

4.3 Displaying current weather

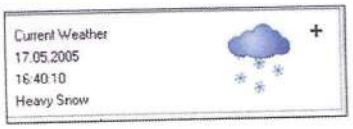


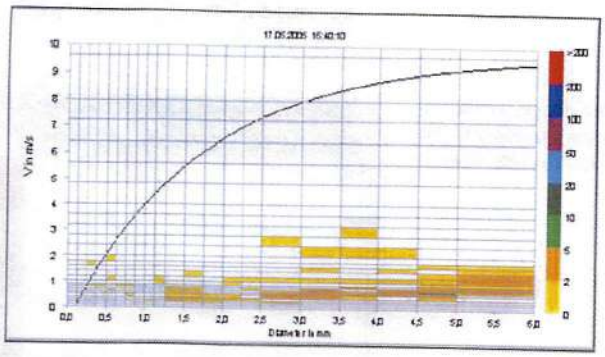
Fig. 5: Displaying the current weather.

In this frame,
– the date
– the time
– and the weather conditions, in words and pictorially

are displayed for the currently polled measurement. The data are updated each time a new measurement is read out.
"+" signifies a state of heavy precipitation
"" signifies a light state of precipitation

4.4 Representing measurement data in the precipitation spectrograph

Fig. 6: Precipitation spectrograph.



The X-axis of the precipitation spectograph is subdivided into 32 diameter classes and the Y-axis is subdivided into 32 velocity classes for precipitation particles. The Gunn-Kinzer curve is the reference curve, which is always shown in the spectrograph.

Parsivel determines the diameter and rate of fall of each precipitation particle. ASDO classifies the particles in the spectrograph according to these parameters. Depending on the number of detected particles, the display is colored accordingly.

This precipitation spectrograph is also updated in Online Mode with every newly read out data set.

The dimensional and the color representation of the spectrograph can be changed through four buttons on the options bar:

Display color. Every particle class is assigned a color. Example: In Figure 6, a green marking means that Parsivel has detected between 5 and 10 precipitation particles.

Display in shades of gray. Display by means of gray shading is continuous. The darker the fields are marked, the more precipitation particles were detected.

2-dimensional representation of the spectrograph.

3-dimensional representation of the spectrograph, only functional in the full ASDO version.

Note:

- To obtain the precise number of particles of a field in the precipitation spectrograph, point the mouse pointer to the desired field. The number of particles is output in the right field of the status row.
- To zoom the spectrograph in the X- or Y-axis, click in the spectrograph with the mouse pointer and draw it to the desired size.

Editing the colored column

The color assignment and division of upper boundaries of classes can be set as follows:

- Click on the colored column to the right of the spectrograph. The "Particle Classes" window opens:

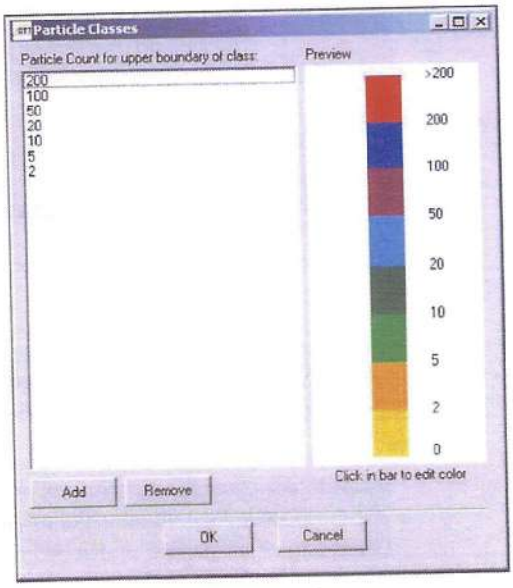


Fig. 7: "Particle Classes" window to determine the upper boundary of the class and to define the color column.

- To add a new upper boundary class, click on the "Add" button. The "Add Particle Class" window opens.

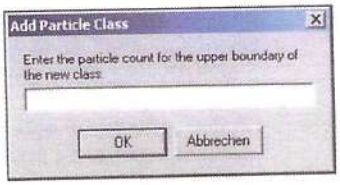
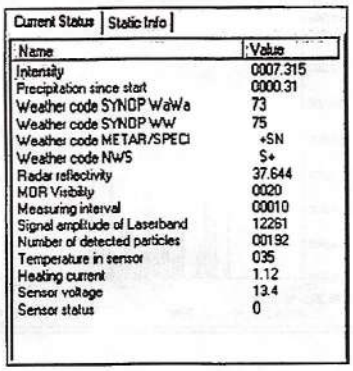


Fig. 8: "Add Particle Class" window. Entry for the value of the class boundary.

- Enter the desired upper boundary of the class and confirm your input with "OK". The class boundary will be created with the standard color black.
- To edit the color of the class boundary, click in the "Preview" frame of the "Particle Class" window on the corresponding color. The "Color" window opens. Select an arbitrary color and confirm your choice with "OK".

4.5 Displaying current measurement status

Fig. 9: "Current Status" tab.

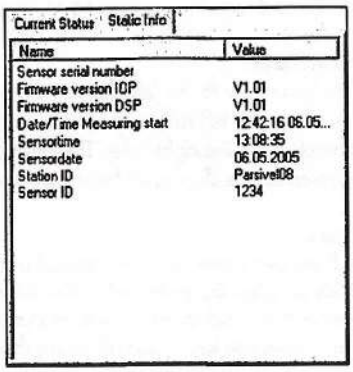


In the "Current Status" tab, all dynamic parameters and associated current values are displayed. These are updated with every new poll. To display these values graphically, proceed as follows:

- In the "Current Status" tab, click on the parameter that you wish to graphically display.
  Its graphical representation appears in the time sequence graph. The time frame corresponds to the settings from the "Time Frame" frame (see Chapter "Time Sequence graph" and "Time Range").

4.6 Displaying static Parsivel information

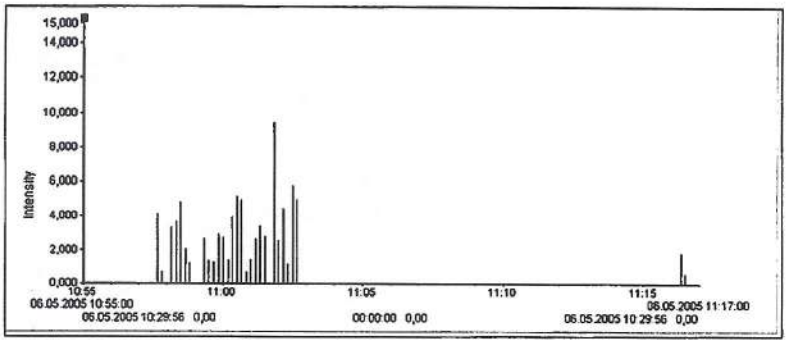
Fig. 10: "Static Info" tab.



All static system settings of the connected Parsivel are displayed in the "Static Info" tab.

4.7 Representing measurements in the time sequence graph

Fig. 11: Time sequence graph display.



The values of the parameter that is selected in the "Current Status" tab are shown graphically in the time sequence graph. The following parameters can not be shown graphically:

- Weather Code SYNOP ww
- Measurement interval
- Sensor status

The parameter that is currently displayed is to the left in the time sequence graph next to the Y-axis. The time range shown coincides with "Time Range" settings. The following values are output below the X-axis in two rows:

Upper row
To the left, the date and time of start is indicated, and to the right the date and time range is indicated. If a numerical time range was selected, ASDO updates the date and time info according to the polling interval.

Lower row
In the lower row to the left, the date, time and numerical value of the measurement where the left ruler is positioned are output, and on the right are the same parameters for the right ruler. The difference of the two time values and the two measurements is displayed between these two displays.

Rulers
You have two rulers at your disposal in the time sequence graph. In order to quickly position the rulers using the mouse, they have a square mark at their upper end. To shift a ruler, click on this mark and move the ruler while holding down the mouse key. After releasing the mouse key, the ruler jumps to the next measurement. The mark of the currently active ruler is green and that of the inactive ruler is blue. The active ruler can also be moved with the cursor key.

Setting the time range of the time sequence graph

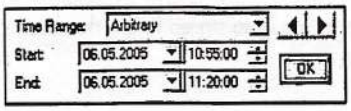


Fig. 12: Setting the time range of the time sequence graph.

In the "Time Range" frame, the display range of the time sequence graph can be adjusted. The following time ranges are possible:

- ▷ Arbitrary
- ▷ 5 min
- ▷ 15 min
- ▷ 30 min
- ▷ 60 min
- ▷ 2 h
- ▷ 6 h
- ▷ 12 h
- ▷ 24 h
- ▷ 2 d
- ▷ 7 d
- ▷ 14 d
- ▷ 30 d

Proceed as follows to set the time range:

☒ Select the desired time range in the "Time Range" selection window.

Selecting "Arbitrary" as the time range

If you would like to more precisely view a desired time range in the time sequence graph, select "Arbitrary" as the time range. ASDO continues to receive all updated values at the polling interval setting, but the time sequence graph remains locked onto the selected time range.
Proceed as follows to set the time range to "Arbitrary":

☐ Select the "Arbitrary" time frame option.
☐ Input the date and time for the start and end of the time range. You can either directly mark the individual positions of the date and time fields and overwrite them or you can edit the values using the black arrows in the selection fields.
☒ Click on the "OK" button.
☒ To display the previous or following time range with the same interval, click on the corresponding arrow key.

Selecting a predefined Time Range

If you select one of the predefined time ranges from the selection list, it is always displayed in the time sequence graph beginning with the most recent value and extending into the future. As soon as a new value is polled, this time frame shifts into the future by the polling interval selected.
Proceed as follows to set a numerical time range:

☒ Select the desired predefined time range in the selection list.
The time sequence graph is adjusted immediately after the selection.

5 Displaying data in Offline Mode

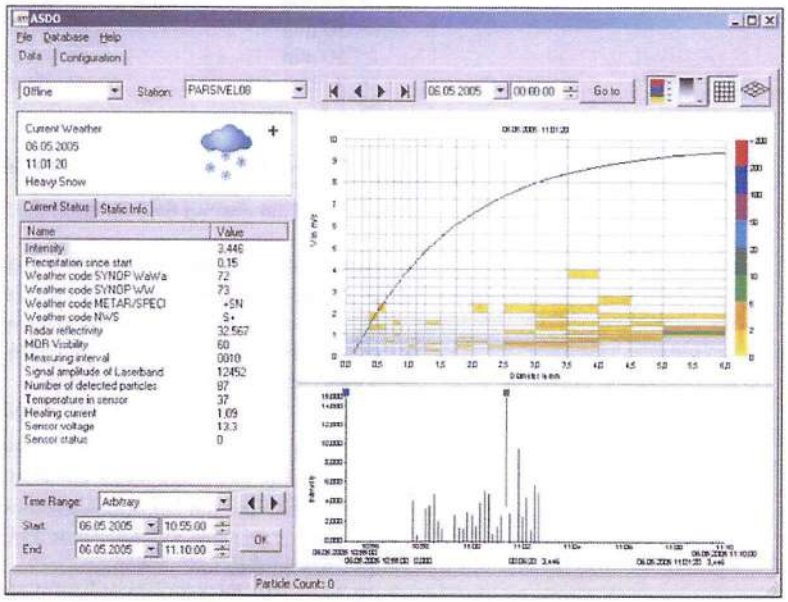
The Offline Mode is only available in the full ASDO version with database. In this mode, the data stored in the database can be displayed by all Parsivels connected previously.

5.1 Starting Offline Mode

To start Offline Mode, proceed as follows:

- Select the "Data" tab in the ASDO start window.

Fig. 13: "Data" tab. Offline Mode is selected.



- Select the "Offline" option in the options bar.
- In the options bar, select the station whose value you wish to display.

5.2 Displaying current weather

Fig. 14: Displaying the current weather.

In this frame,
- the date
- the time
- and the weather conditions, in words and pictorially

are displayed for the measurement that is selected either in the precipitation spectrograph or using the ruler in the time sequence graph. See the other chapters in this regard as well.

5.3 Representing measurement data in the precipitation spectrograph

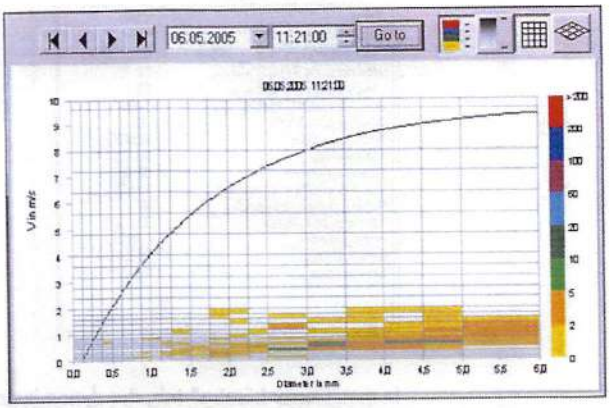


Fig. 15: Precipitation spectrograph in Offline Mode.

See Chapter 4.4 of these operating instructions for a general description of the precipitation spectrograph.

To display in the precipitation spectrograph a particular measurement from the database of the selected Parsivel, proceed as follows:

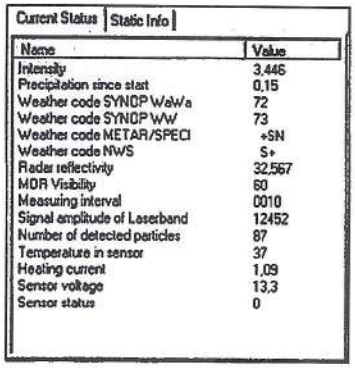
- Enter the date in the left selection field above the spectrograph and in the right selection field enter the time at which you would like to display the measurements. You can either directly mark the individual positions of the date and time fields and overwrite them or you can edit the values using the black arrows in the selection fields.
- Click on the "Go To" button.
- To display the measurement directly before or after, click on the ◀ or ▶ key. In order to display the first or last stored measurement from the measurement sequence of a Parsivel, click on the ⏮ or ⏭ key.

Note:

- When a measurement is selected, the corresponding data is output in the "Current Weather" window and in the "Current Status" tab. Also, the ruler in the time sequence graph is set to this measurement.

5.4 Displaying current measurement status

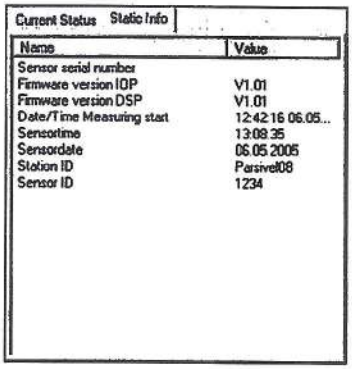
Fig. 16: "Current Status" tab.



In the "Current Status" tab, the dynamic parameters and the associated value of the selected Parsivel are displayed for the time range that had been entered through the precipitation spectrograph or had been selected in the time sequence graph using the ruler.

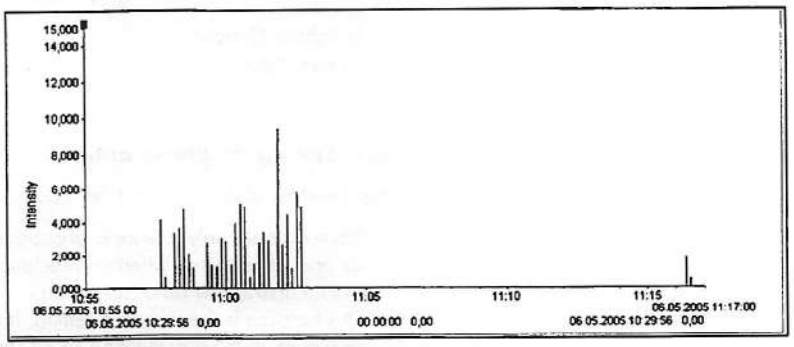
5.5 Displaying static Parsivel information

Fig. 17: "Static Info" tab.



All static system settings of the Parsivel selected in the options bar are displayed in the "Static Info" tab.

Fig. 18: Time sequence graph display.



The values of the parameter that is selected in the "Current Status" tab are shown graphically in the time sequence graph. The time range in the display corresponds to the setting in the "Time Range" frame (see Chapter 4.7). The parameter that is currently displayed is to the left in the time sequence graph next to the Y-axis.

The following values are output below the X-axis in two rows:

Upper row
To the left, the date and time of start is indicated, and to the right the date and time range is indicated.

Lower row
In the lower row to the left, the date, time and numerical value of the measurement where the left ruler is positioned are output, and on the right are the same parameters for the right ruler. The difference of the two time values and the two measurements is displayed between these two displays.

Rulers
You have two rulers at your disposal for time sequence graph. In order to quickly position the rulers using the mouse, they have a square mark at their upper end. To shift a ruler, click on this mark and move the ruler while holding down the mouse key. After releasing the mouse key, the ruler jumps to the next measurement. The mark of the currently active ruler is green and that of the inactive ruler is blue. The active ruler can also be moved with the cursor keys. If a measurement is selected using a ruler, this measurement is also displayed in the precipitation spectrograph.

Note:
When a specific value is marked with the ruler in the time sequence graph, the corresponding data are output in the "Current Weather" window, in the "Current Status" tab, and in the precipitation spectrograph.

6 Setting ASDO options

ASDO provides the following options:

- Database Options
- Export Options

6.1 Setting database options

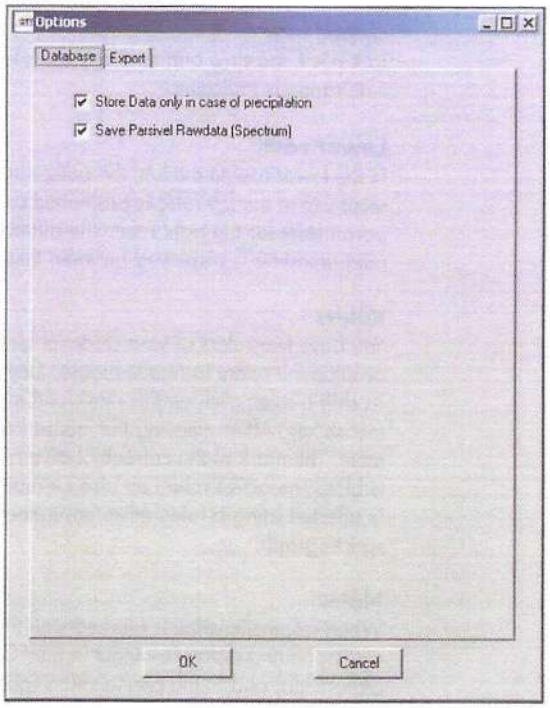
You have the ability to adjust the following database options:

- Store data set only if there is precipitation
  Ignores all data sets when no precipitation has been detected.
- Store Parsivel raw data (spectrum)
  This function is the standard setting. It allows the data from the database to be displayed in the precipitation spectrograph afterward as well. If this function is activated, much more of the database's storage space is used. If this function is not activated, the data can still be displayed in the time sequence graph, but not in the precipitation spectrograph.

Proceed as follows to set the database options:

- Select the "Database" tab:

Fig. 19: "Options" window "Database" tab.



- Activate the desired settings with ☑ and confirm with "OK".

6.2 Setting export options

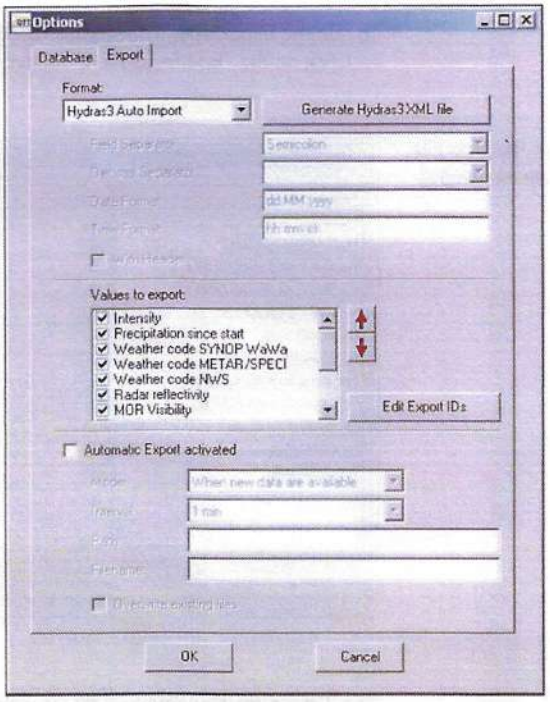
The following export settings are available to you:

- Defining the export format
- Defining the export data
- Activating automatic export

Proceed as follows to set the export options:

- Select the "Export" tab:

Fig. 20: "Options" window "Export" tab.



Defining the Export Format

The following export formats are available to you:

- Hydras 3 Autoimport
  Prepares the measured data for automatic import from the Hydras 3.
- Separate columns
  Outputs the measured data as CSV data that can be opened using Microsoft Excel, for example.

Proceed as follows to define the export format:

- Select the "Export" tab:
- Select the desired export format in "Format".
- If you have selected the "Separate Columns" format, select the field separator, the decimal separator, the date format and the time format in the corresponding selection fields.
- Then, define that data that you would like to export (see "Defining Export Data").

Defining Export Data

Under "Values to Export", you have the ability to define that data that ASDO is to export and in what sequence this is to occur.

To define the export data, proceed as follows:

- Select the values in the selection field under "Values to Export" that ASDO is to export by clicking in the box to the left of the corresponding value.

To edit the export data sequence, proceed as follows:

- Click on the name of the corresponding value so that it is marked in blue.
- Change the position of this value using the red arrows.

To edit the Export IDs , proceed as follows:

- Click on the "Edit Export IDs" button. The "Export ID" window opens.

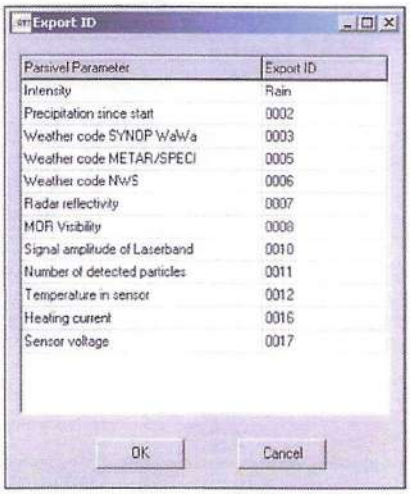


Fig. 21: "Export ID" window. The Export-ID of each parameter can be changed.

- Click on the ID number of the corresponding value and change it. The ID must not be longer than 4 places. Input is alphanumeric. The ID number that you determine here corresponds to the sensor number in the Hydras 3 application software.

Activating Automatic Export
This function allows you to automatically export to a database the values that ASDO retrieves from Parsivel. To do so, proceed as follows:

- Activate "Automatic Export activated" with ☑.
- Select the desired mode:
  - ▷ When new data becomes available
    Exports only when new data has been collected
  - ▷ Cyclical
    Exports data at a determined interval
- Enter the desired interval for the "Cyclical" mode for automatic exporting.
- Enter the path for the database to which the values are to be exported.
- Enter an export file name. To issue an individual name for each export file, you can define the file name from variables:

<DATE>	includes the date of the measurement in the file names. Form: YYYYMMPP
<TIME>	includes the time of the measurement in the file names. Form: HHMMSS
<STATION>	includes the station name in the file names.

  Give the file name the ending ".MIS".
- If you would like to overwrite the data in the selected file, select "Overwrite Existing Files" with ☑.

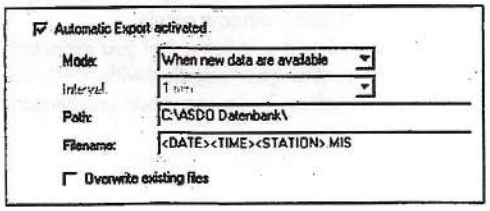


Fig. 22: Automatic Export settings.

Note:
If you would like to combine the automatic exporting of data from ASDO with the automatic import function of Hydras 3, make sure that the export and import paths agree.

Automatically exporting measurements from ASDO to Hydras 3
To export Parsivel measurements from ASDO to Hydras 3, a corresponding station must be created in Hydras 3 including sensors for the Parsival measurement. You have the ability to manually create this measuring station in Hydras 3 (see Hydras 3 Online Help) or in a simpler manner to export the desired measurement configuration from ASDO as an XML file. This, in turn can be imported to Hydras 3.

To do so, proceed as follows:

- Select the "Export" tab in the "Options" window.
- Select the "Hydras 3 Auto Import" format.
- Define the values to be imported.
- Confirm the configuration with "OK".
- Reopen the "Options" window and select the "Export" tab. The configuration that you defined in the previous steps is already in place.
- Now, click on the "Generate Hydras 3 XML File" button. A window with the same name opens.
- Enter the Station ID of the corresponding Parsivel in this window and confirm your entry with "OK". The "Save as" window opens.
- Enter a file name for the XML file and select the directory in which the file is to be saved.
- Open Hydras 3.
- Select the work area in the tree diagram in which the Parsivel measuring station is to be created.
- Select the "File | Import measuring station configuration (XML)" menu. The "Open" window opens.
- Select the XML file that you exported in the previous steps from ASDO and confirm your selection with "OK". Parsivel is now a measuring station in Hydras 3 with corresponding sensors.

7 Updating Parsivel firmware

OTT Hydromet provides the latest update versions to OTT software on its internet site at www.ott.com under the heading "Software updates". To update Parsivel firmware, proceed as follows:

- Download the update software for the Parsivel firmware from the OTT homepage into a directory on your computer. The update software for the Parsivel firmware includes two files with the names "*DSP.bin" and "*IOP.bin".
- Connect the Parsivel that you would like to update to your computer as described in the operating instructions "Present Weather Sensor Parsivel".
- Start the Parsivel ASDO software.
- Select the "Configuration" tab in the ASDO start window.
- In the "Interface" field, select the COM port of your PC to which the Parsivel is connected and the baud rate at which the transmission is configured.
- Click on the "Update" button. The "Open" window opens.
- From the file structure, select the directory to which you have saved the two Update files and mark the two files.
- Confirm the selection by clicking on the "Open" button. The Parsivel firmware is updated. When the update process is finished, the message "Firmware Update Successful" appears.
- Acknowledge the message by clicking on the "OK" button.

Document number
56.551.003.B.E 02-0511

OTT Hydromet GmbH

Ludwigstrasse 16
87437 Kempten · Germany
Phone +49 831 5617-0
Fax +49 831 5617-209

info@ott.com
www.ott.com

USB-COMi-M/USB-COMi-SI-M
USER'S MANUAL

2019 Edition

Titan Electronics Inc.
Web: www.titan.tw

The computer programs provided with the hardware are supplied under a license. The software provided should be used only with the NCOM series hardware designed and manufactured by TITAN Electronics Inc.

Trademarks

TITAN and the logo is a registered trademark of TITAN Electronics Inc. in Taiwan. Microsoft, Windows, Windows XP, Windows Vista, Windows Server, Windows 7, Windows 8, Windows 10 are trademarks of Microsoft Corporation. All other trademarks and brands are property of their respective owners.

Copyright

Disclaimer

TITAN Electronics Inc. provides this document and computer programs "as is" without warranty of any kind, either expressed or implied, including, but not limited to, its particular purpose. TITAN Electronics Inc. reserves the right to make improvements and changes to this user manual, or to the products, or the computer programs described in this manual, at any time.

Information provided in this manual is intended to be accurate and reliable. However, TITAN Electronics Inc. assumes no responsibility for its use, or for any infringements on the rights of third parties that may result from its use.

This product might include unintentional technical or typographical errors. Changes are periodically made to the information herein to correct such errors, and these changes are incorporated into new editions of the publication.

Contents

INTRODUCTION

The USB-COMi-M/USB-COMi-SI-M USB-to-Industrial Single RS-232/422/485 Adapter is designed to make industrial communication port expansion quick and simple. Connecting to an USB port on your computer or USB hub, the USB-COMi-M/USB-COMi-SI-M instantly adds an industrial communication port to your system. By taking advantage of the USB bus, the USB Industrial I/O Adapter makes it easier than ever to add RS-232, RS-422 or RS-485 device to your system with easy plug-and-play and hot plug features. Adapting the new technology, the industrial I/O communication port expansion now takes the new bus with easy and convenient connectivity.

Plugging the USB-COMi-M/USB-COMi-SI-M to USB port, the adapter is automatically detected and installed. There are no IRQ & COM port conflicts, since the port doesn't require any additional IRQ, DMA, memory as resources on the system. The RS-232/422/485 port functions as native Windows COM port, and it is compatible with Windows serial communication applications.

The USB Industrial I/O Adapter provides instant connectivity to RS-232/422/485 communication device for factory automation equipment, multi-drop data collection devices, barcode readers, time clocks, scales, data entry terminals, PC to PC long distance communications and serial communication in harsh environments. The USB Industrial I/O provides industrial solution for applications requiring single node or multi-drop communications over short and long distance.

Optical-isolation and surge protection are available to USB-COMi-SI-M.

The RS-232/422/485 port is optically isolated with 2000V DC optical isolation. The optical isolation protects your PC or notebook from spikes and surges on the RS-232 port or RS-422/485 network, by converting the electrical pulse into an optical signal and then changing it back into an electrical pulse. Your computer is well protected, since the surges and spikes cannot cross the optical link.

The RS-232/422/485 port is protected by a surge protector to withstand electrostatic discharge and power surges up to 25KV ESD. Surge suppression on all signals prevent damages caused by lightning or high voltages.

SPECIFICATIONS & FEATURES

USB-COMi-M

- Adds a high speed RS-232/422/485 serial port via USB connection
- 512 byte receive and transmit buffer for high speed data throughput
- Requires no IRQ, DMA, I/O port
- Data rates: 300bps to 1Mbps
- Connector: one DB9 male connector one 6-pin terminal block connector
- Auto transmit buffer control for 2-wire RS-485 half-duplex operation
- Termination resistors installed on-board
- RS-232 data signals: DCD, RxD, TxD, DTR, GND, DSR, RTS, CTS, RI
- RS-422 data signals: Tx-, Tx+, Rx+, Rx-, GND, RTS-, RTS+, CTS+, CTS-
- RS-485 data signals: Tx-, Tx+, Rx+, Rx- (4-wire), and data-, data+ (2-wire)
- Monitor LEDs of TxD, RxD indicating port status
- Supports power output of DC 5V 150mA, through pin 5 of terminal block connector, for external devices requiring power
- Easy operating mode configuration and setting
- Virtual COM port drivers provided for Windows 10, 8.1, 8, 7, Vista, 2012, 2008, 2003, XP

USB-COMi-SI-M

- Adds a high speed RS-232/422/485 serial port via USB connection
- 512 byte receive and transmit buffer for high speed data throughput
- Requires no IRQ, DMA, I/O port
- Data rates: 300bps to 1Mbps
- Connector: one DB9 male connector and one 6-pin terminal block connector
- Auto transmit buffer control for 2-wire RS-485 half-duplex operation
- Termination resistors installed on-board
- RS-232 data signals: RxD, TxD, GND, RTS, CTS
- RS-422 data signals: Tx-, Tx+, Rx+, Rx-, GND, RTS-, RTS+, CTS+, CTS-
- RS-485 data signals: Tx-, Tx+, Rx+, Rx- (4-wire), and data-, data+ (2-wire).
- Monitor LEDs of TxD, RxD indicating port status
- Supports power output of DC 5V 150mA, through pin 5 of terminal block connector, for external devices requiring power
- Easy operating mode configuration and setting
- Virtual COM port drivers provided for Windows 10, 8.1, 8, 7, Vista, 2012, 2008, 2003, XP
- *The RS-232/422/485 port is optically isolated with 2000V DC optical isolation*
- *The RS-232/422/485 port is protected by surge protector to withstand electrostatic discharge and power surges up to 25KV ESD*

Note: The USB-COMi-SI-M only supports RxD, TxD, GND, RTS, CTS signals for RS-232 mode.

HARDWARE INSTALLATION

Outside the unit, there is a 4-pin DIP switch used to select the mode of operation. You will need to set the switch settings to RS-232 mode, RS-422 mode, or RS-485 mode, as per the requirements of your application. After setting the switches, plug in the adapter to a USB port to start driver installation. The RS-232 & RS-422 & RS-485 mode block configuration settings are listed as follows.

RS-232 & RS-422 & RS-485 MODE BLOCK CONFIGURATION

SW (External DIP Switch) for Mode Setting

	Operation Mode	S1	S2	S3	S4
RS-232	Standard RS-232 Mode	OFF	ON	ON	ON
RS-422	4-wire with Handshaking	ON	ON	ON	ON
RS-485	Full-Duplex (4-wire)	ON	OFF	ON	ON
	Half-Duplex (2-wire) – with Echo	ON	OFF	OFF	ON
	Half-Duplex (2-wire) – without Echo	ON	OFF	OFF	OFF

JP1: Termination and Biasing Option Configuration

Inside the unit, there are 7x2 (JP1) header blocks for jumpers which enable Tx, Rx, CTS 120Ω termination resistors and Rx, Tx 750Ω biasing resistor. You will need to open up the case and set the jumper setting for RS-422 mode, or RS-485 mode, as per the requirements of your application. Settings are listed as follows:

JP1 Jumper		Function
1-2	Close	Tx+/- termination of 120Ω. This jumper should always be populated for RS-485.
3-4	Close	Pull-up Tx+ to VCC by 750Ω bias resistor. This jumper should be populated for pull-up Tx+.
5-6	Close	Pull-down Tx- to GND by 750Ω bias resistor. This jumper should be populated for pull-down Tx-.
7-8	Close	Rx+/- termination of 120Ω. This jumper should always be populated for RS-232/422/485 full-duplex mode.
9-10	Close	Pull-up Rx+ to VCC by 750Ω bias resistor. This jumper should be populated for pull-up Rx+.
11-12	Close	Pull-down Rx- to GND by 750Ω bias resistor. This jumper should be populated for pull-down Rx-
13-14	Close	CTS termination of 120 Ohm. This jumper should always be populated for RS-422 mode.

Note: Sometimes, when operating in RS-422 or RS-485, it is necessary to configure termination and biasing of the data transmission lines. Generally, this must be done in the cabling, since this depends on the installation of connections. Before applying the option, check your cable specification for proper impedance matching.

Biasing of data lines must only occur at a single point anywhere in the cabling. USB-COMi-M/USB-COMi-SI-M provides biasing for ease of installation. If your cabling already provides biasing, please be sure to disable this inside the unit.

Termination must not be installed in the middle of the cable. It is only permitted at both ends. Since a computer controlled serial port is almost always at one end of the cable, termination is disabled by default.

JP2: Enabling the +5V 150mA Power for an External Device

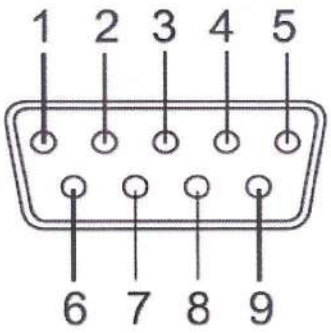
The USB-COMi-M/USB-COMi-SI-M provides a unique feature of supplying power output of 5V/150mA through pin 5 of the terminal block connector to serial device requiring power. By default, this feature is disabled; you need to open the metal case and close the jumper (JP2) to enable 5V 150mA power.

JP2 Jumper	Function
Close	Enable the DB9 pin 1 and pin 5 to support a 5V 150mA power for an external device
Open	Disable the 5V 100mA power (default)

SERIAL PORT CONNECTOR PINOUT

RS-232 Mode Pinout of 9-pin D-sub Connector (CN2)

The RS-232 serial ports are configured as data terminal equipment (DTE), with a 9-pin D-sub connector. Pin assignments are according to TIA/EIA-574, which formally defines the assignments for a COM port that are found on many personal computers.



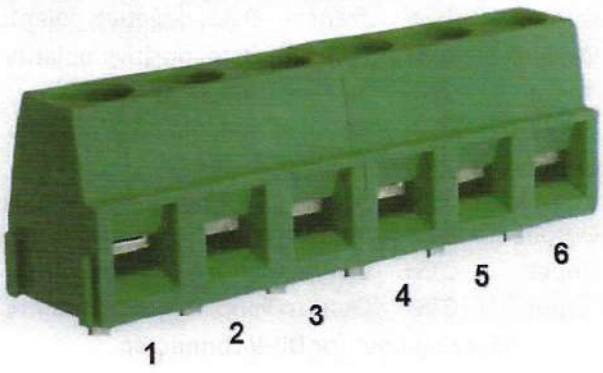
DB9 Male connector pin numbers

Pin Number	Pin Type		Description
1	Input	DCD	Data Carrier Detect
2	Input	RxD	Receive Data
3	Output	TxD	Transmit Data
4	Output	DTR	Data Terminal Ready
5	Ground	GND	Signal Ground
6	Input	DSR	Data Set Ready
7	Output	RTS	Request to Send
8	Input	CTS	Clear to Send
9	Input	RI	Ring Indicator

RS-232 pinout for DB-9 connector

Note: The USB-COMi-SI-M only supports RxD, TxD, GND, RTS, CTS for signals for RS-232 mode.

RS-232 Mode Pinout of 9-pin Terminal Block (TB1)



Terminal block connector pin numbers

Pin Number	Pin Type		Description
1	Input	DCD	Data Carrier Detect
2	Input	RxD	Receive Data
3	Output	TxD	Transmit Data
4	Output	DTR	Data Terminal Ready
5	Power	+5V	DC+5V 150mA
6	Ground	GND	Signal Ground

RS-232 pinout for 6-pin terminal block connector

Note: The USB-COMi-SI-M only supports RxD, TxD, DC+5V, GND signals for RS-232 mode.

RS-422 Mode Pinout

Pin Number	Pin Type		Description
1	Output	TxD-	Transmit Data, negative polarity
2	Output	TxD+	Transmit Data, positive polarity
3	Input	RxD+	Receive Data, positive polarity
4	Input	RxD-	Receive Data, negative polarity
5	Ground	GND	Signal Ground
6	Output	RTS-	Request to Send, negative polarity
7	Output	RTS+	Request to Send, positive polarity
8	Input	CTS+	Clear to Send, positive polarity
9	Input	CTS-	Clear to Send, negative polarity

RS-422 pinout for DB-9 connector

Pin Number	Pin Type		Description
1	Output	TxD-	Transmit Data, negative polarity
2	Output	TxD+	Transmit Data, positive polarity
3	Input	RxD+	Receive Data, positive polarity
4	Input	RxD-	Receive Data, negative polarity
5	Power	+5V	DC+5V 150mA
6	Ground	GND	Signal Ground

RS-422 pinout for 6-pin terminal block connector

RS-485 Full-Duplex Mode Pinout

Pin Number	Pin Type	Description	
1	Output	TxD-	Transmit Data, negative polarity
2	Output	TxD+	Transmit Data, positive polarity
3	Input	RxD+	Receive Data, positive polarity
4	Input	RxD-	Receive Data, negative polarity
5	Ground	GND	Signal Ground

RS-485 full-duplex pinout for DB-9 connector

Pin Number	Pin Type	Description	
1	Output	TxD-	Transmit Data, negative polarity
2	Output	TxD+	Transmit Data, positive polarity
3	Input	RxD+	Receive Data, positive polarity
4	Input	RxD-	Receive Data, negative polarity
5	Power	+5V	DC+5V 150mA
6	Ground	GND	Signal Ground

RS-422 full-duplex pinout for 6-pin terminal block connector

RS-485 Half-Duplex Mode Pinout

Pin Number	Pin Type	Description	
1	Output/Input	Data-	Transmit/Receive Data, negative polarity
2	Output/Input	Data+	Transmit/Receive Data, positive polarity
5	Ground	GND	Signal Ground

RS-485 half-duplex pinout for DB-9 connector

Pin Number	Pin Type	Description	
1	Output/Input	TxD-	Transmit/Receive Data, negative polarity
2	Output/Input	TxD+	Transmit/Receive Data, positive polarity
5	Power	+5V	DC+5V 150mA
6	Ground	GND	Signal Ground

RS-485 half-duplex pinout for 6-pin terminal block connector

PROPER WIRING FOR RS-422/485 OPERATION

This section will provide proper wiring information about RS-422 and RS-485 data communication. It is necessary to have the basic knowledge in order to avoid or find errors in data transmission. Failures in cabling are responsible for the vast majority of transmission problems.

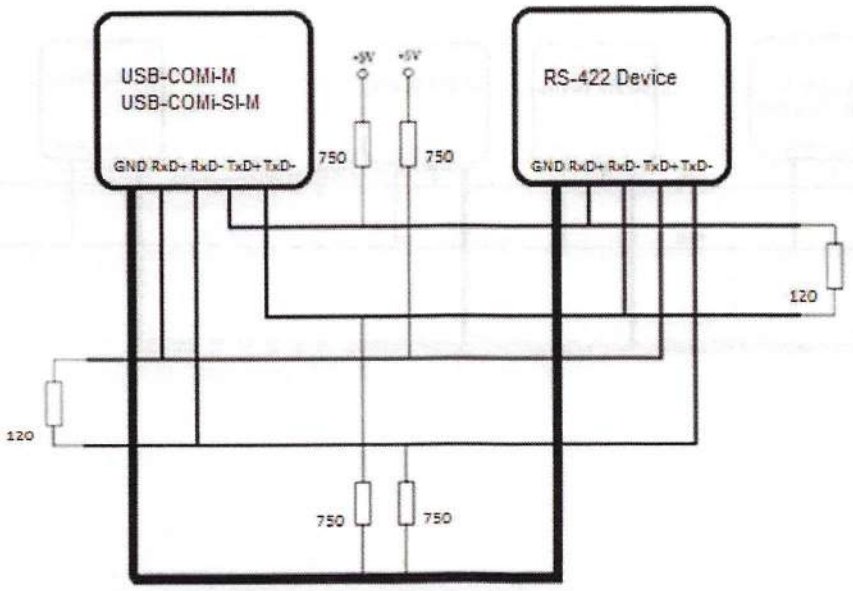
RS-422 & RS-485 Transmission Technique

The RS-422 and RS-485 use the same balanced transmission method. Signals are not transmitted as voltage on a single wire, like in RS-232. Instead, two wires are used; when one carries high voltage, the other one carries low voltage. The signal is defined by the difference in voltage between those two wires. This hardens the transmission against noise. Usually twisted pair cables are used, which further reduces the sensitivity for noise.

To make sure the signals meet the common voltage range, the GND of sender and receiver must be connected somehow. To ensure the signals are in the valid voltage range and the differential voltage can be correctly sensed by the receiver, the GND lines of the transmitter and receiver must be connected.

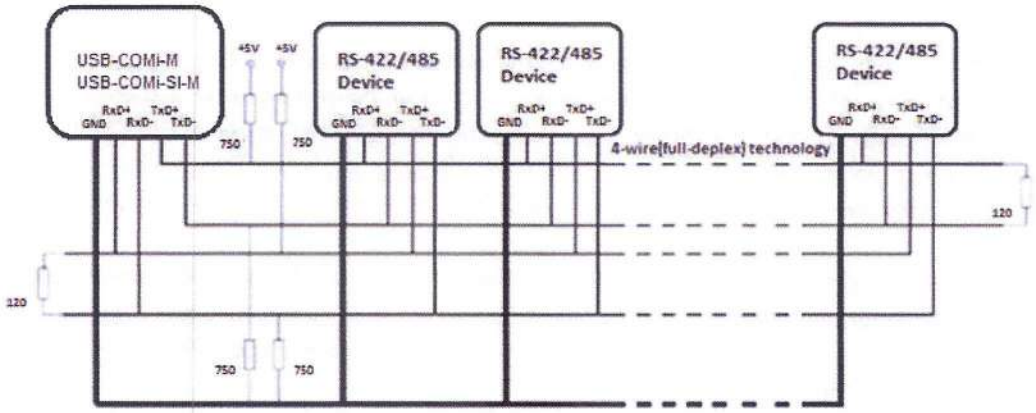
RS-422 Signals Connected

The following diagram shows how RS-422 signals are connected.



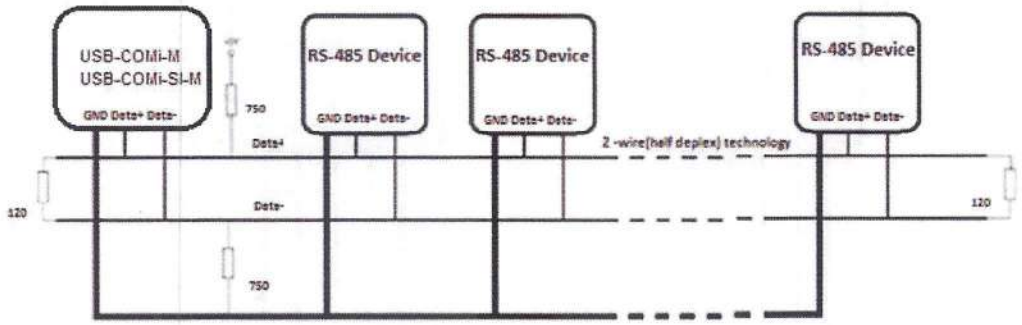
RS-422 & RS-485 4-wire Scheme

The RS-422 requires dedicated wire pairs for transmit and receive. The transmit wires are used to send data to as many as 10 receivers, as stated in the specifications of RS-422. Since the USB-to-Industrial Single RS-232/422/485 Adapter uses the RS-485's line driver technology, up to 32 receivers are possible. The following diagram shows RS-422 and RS-485 4-wire scheme:



RS-485 2-wire Scheme

The following diagram shows RS-485 2-wire scheme:



INSTALLING WINDOWS DRIVER

In most cases, the Windows driver of the USB-to-Industrial Single RS-232/422/485 Adapter will be installed automatically.

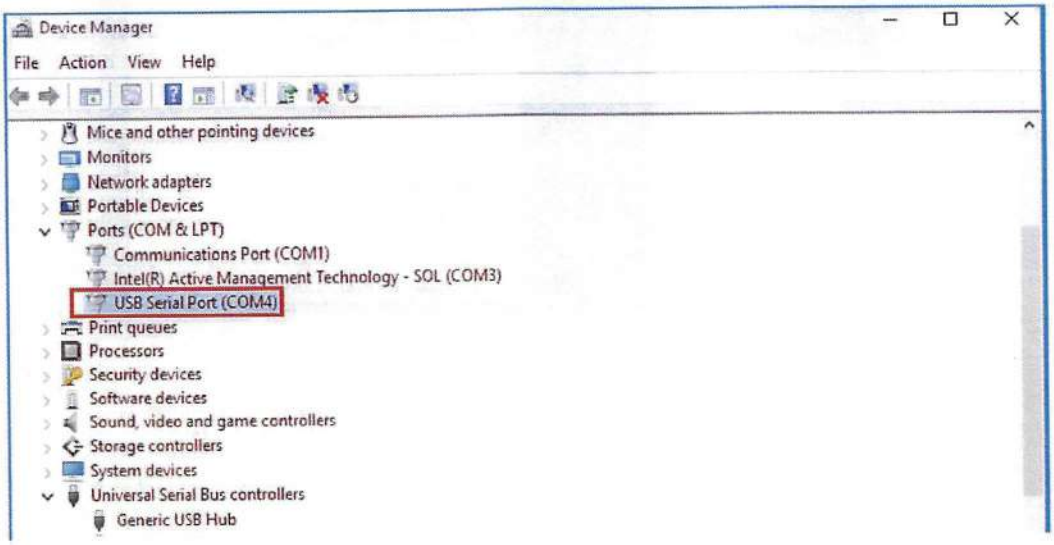
Installing in Windows 10, 8.1, 8, 7, Server 2012 and 2008 R2

Connect your computer to Internet and plug USB-to-Industrial Single RS-232/422/485 Adapter to the USB port. The driver will be installed automatically via Internet.

Installing in Windows XP, Vista, Server 2003 and 2008

Connect your computer to Internet and plug the USB-to-Industrial Single RS-232/422/485 Adapter to the USB port. When asked to install the drivers, allow your computer to search the Internet to load and install the drivers from Windows Update website automatically.

When USB-to-Industrial Single RS-232/422/485 Adapter driver installation is done, you will find "USB Serial Port (COMX)" under "Ports (COM & LPT)" of device manager.

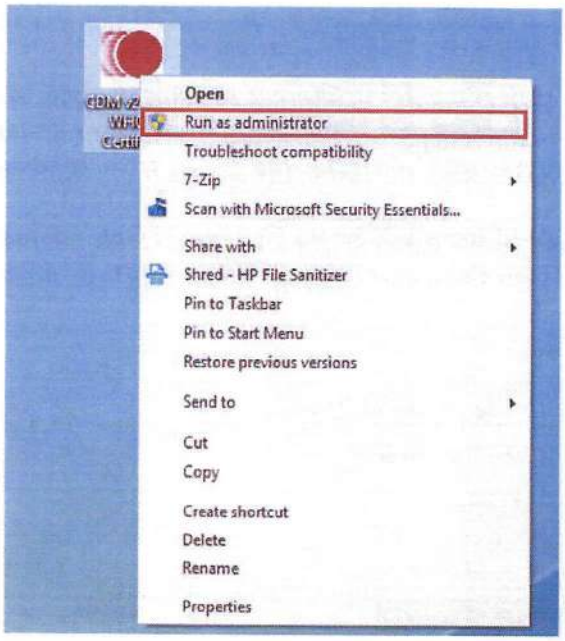


PRE-INSTALLING WINDOWS DRIVER

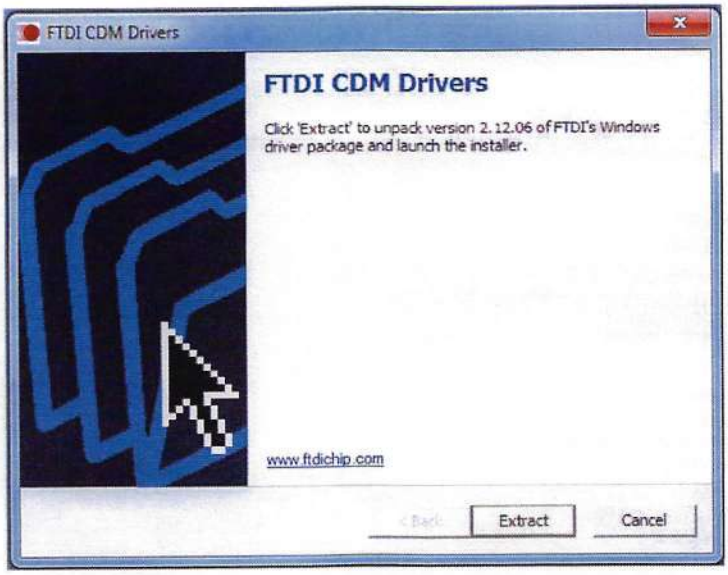
The Windows driver is also available as a setup program (CDMvX. XX. XX WHQL Certified.exe) to pre-install Windows driver into your PC. Run the pre-install setup program before plugging the USB-to-Industrial Single RS-232/422/485 Adapter into the PC. You can download the setup program (CDMvX. XX. XX WHQL Certified.exe) from:

http://www.ftdichip.com/FTDrivers.htm

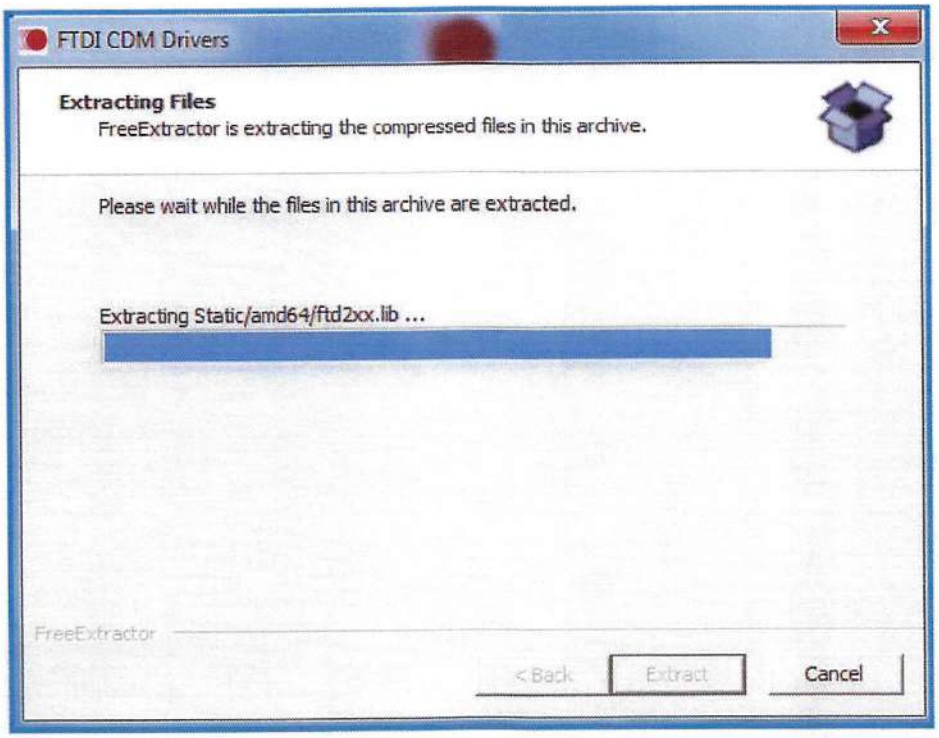
After downloading the driver setup program right click it and select "Run as administrator"



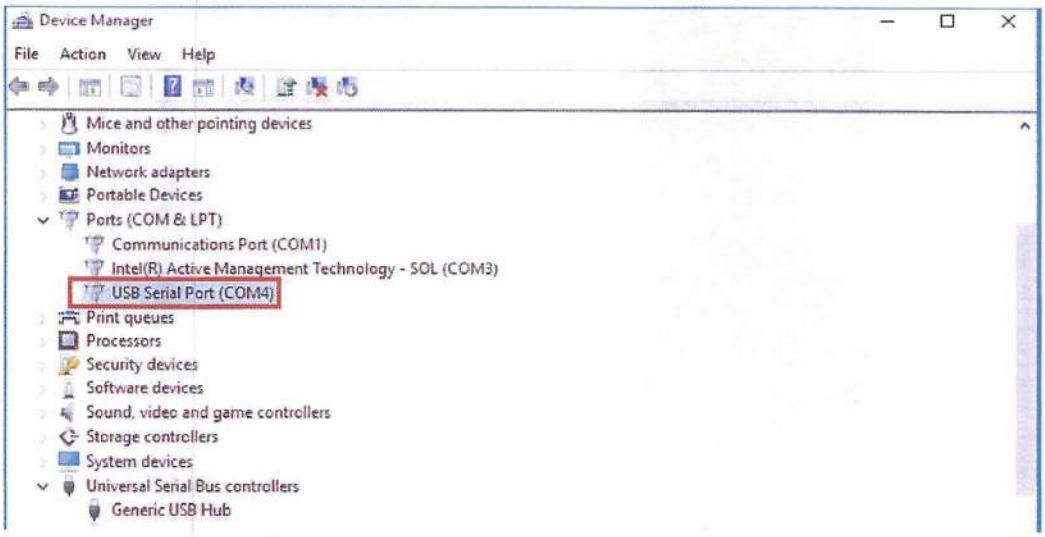
Press the "Extract" button



The driver will now be automatically installed.



Whenever the USB-to-Industrial Single RS-232/422/485 Adapter is plugged into the PC, the Windows driver will be installed and listed in device manager.



UNINSTALLING WINDOWS DRIVER

The program CDMuninstallerGUI.exe is used to remove installed drivers from the user's system and clean them from the Windows registry. You can download this program (CDMUninstaller_vX.X.zip) from:

http://www.ftdichip.com/Support/Utilities_htm#CDMUninstaller

Supported Operating Systems

The uninstaller is currently supported on the following operating systems:

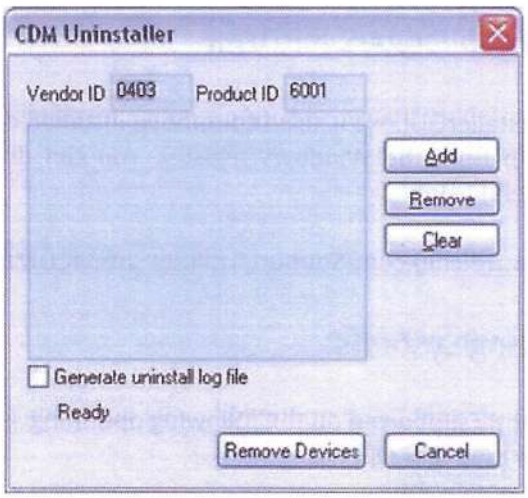
- Windows 10/8.1/8/7 (32 and 64-bit)
- Windows Vista (32 and 64-bit)
- Windows XP/2003 (32 and 64-bit)

Running the Application

To run the application, simply double click on the .exe file.

Removing a Driver

The figure below shows the window displayed upon running the application. The vendor ID and product ID text boxes allows the user to enter a 4-character hex value specifying the device that they wish to remove. All installed device drivers can be viewed from within the Windows device manager. The USB-to-Industrial Single RS-232/422/485 Adapter uses the FTDI default Vendor ID (0x0403). Depending on the specific model of USB-COMi-M/USB-COMi-SI-M, the valid Product IDs may be: 0x6001, 0x6010 or 0x6011...etc.


CDM Uninstaller
Vendor ID 0403
Product ID 6001
Add
Remove
Clear
Generate uninstall log file
Ready
Remove Devices
Cancel

To remove a device, it must be added into the device window. They must all have a unique vendor ID and product ID combination. To remove the device(s) click on the *'Remove Devices'* button.

The *'Remove'* button will remove the currently selected item from the device window and the *'Clear'* button will remove all the devices from the device window.

A message box will confirm successful removal from the system and the device will be removed from the device window. To create an uninstall log file, check *'Generate uninstall log file'* prior to removing the device. This will create a text file outlining all operations that were attempted during the removal process that will be saved in the same directory as the .exe file.

Error Messages

If there are no devices specified within the device window the following message will appear. Make sure that at least one device has been specified within the window by using the *'Add'* button.

If the application is unable to find any devices matching the vendor ID and product ID when removing a device, the following message box will appear. In this situation make sure that the details that you have entered are indeed correct by checking with the windows device manager.


Remove Failed
Failed to remove device VID_0403 PID_6001
This device could not be found on the system!
OK

The Vendor ID and Product ID must be a unique combination, if an attempt is made to add the same device twice the following message box will appear.

NEXCO 佐世保(工)施設工事区

筐体の管理銘版の構成について

西日本高速道路株式会社	
機器名	○○○○○○
仕様書番号	施仕第　○○○○○○　号
定格電圧	○○○○V　　周波数　○○Hz
製造年月	（西暦）年　○月
しゅん功年月	（西暦）年　○月
製 造 者	株式会社○○○○
施 工 者	株式会社○○○○

※管理銘版の構成は上記を基本とするが、適用する機材仕様書に上記以外の項目を定めている場合は、適宜追加する。

例）防災受信盤や換気制御盤では、「型式」や「製造番号」を追記している。

銘板に記載する年月日は下記のとおり。

・製造年月日：工場出荷日

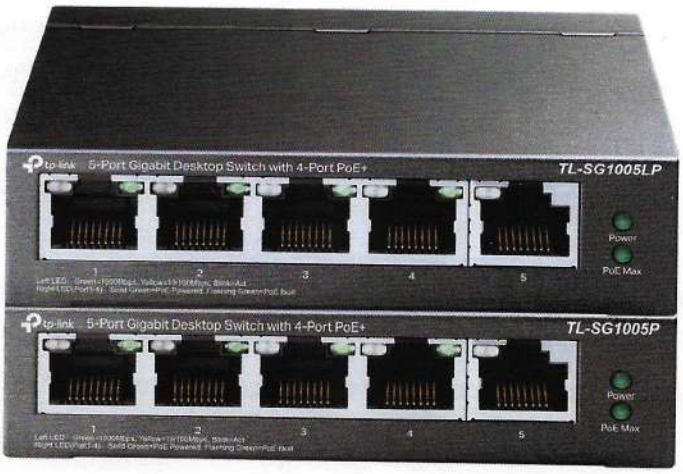
・しゅん功年月日：令和７年３月（FF 設備工事のみ令和６年 12 月）

※管理銘版の仕様は、適用する機材仕様書による。

※疑義がある場合は適宜監督員に相談する事。

5-Port Gigabit Desktop Switch with 4-Port PoE+

MODEL: TL-SG1005LP/TL-SG1005P



Highlights

- 5 10/100/1000Mbps RJ45 ports
- With four PoE ports, transfers data and power on one single cable
- Working with IEEE 802.3af/at compliant PDs, expands your network
- Supports PoE Power up to 30 W for each PoE port
- TL-SG1005LP supports PoE Power up to 40 W for all PoE ports, and TL-SG1005P supports up to 65 W
- 802.1p/DSCP QoS enable smooth latency-sensitive traffic
- IGMP Snooping optimizes multicast application
- Plug and play, no configuration and installation required

Overview

TL-SG1005LP/TL-SG1005P is a 5 10/100/1000 Mbps ports unmanaged switch that requires no configuration and provides 4 PoE (Power over Ethernet) ports. It can automatically detect and supply power with all IEEE 802.3af/at compliant Powered Devices (PDs). In this situation, the electrical power is transmitted along with data in one single cable allowing you to expand your network to where there are no power lines or outlets, where you wish to fix devices such as APs, IP Cameras or IP Phones, etc.

Power Over Ethernet

Four of the 5 Auto-Negotiation RJ45 ports (port-1 to port-4) of the switch support Power over Ethernet (PoE) function. These PoE ports can automatically detect and supply power with those IEEE 802.3af/at compliant Powered Devices (PDs).

Overload Arrangement

The switch has the priority function which will help protect the system when the system power is overloaded. If all PoE PDs power consumption is over the PoE power budget, a priority will be arranged among the PoE ports, then the system will cut off the power of the lowest-priority port.

Intelligent Power Management

Priority (port 1>port 2>port 3>port 4): This function will help protect the system if the system power becomes overloaded. Take TL-SG1005P as an example. If port 1, 2 and 4 are consuming 15.4 W respectively, and an additional PoE device with 19 W is inserted to port 3, the system will cut off the power of port 4 to compensate for the overload.

Easy of Use

The switch is easy to install and use. It requires no configuration and installation. With desktop and wall-mountable design, outstanding performance and quality, the TP-Link 5-Port Gigabit Desktop Switch with 4-Port+ PoE is a great selection for expanding your network.

Specifications

Interface & Performance		
Product Picture		
Model	TL-SG1005LP	TL-SG1005P
Standards	IEEE 802.3i, IEEE 802.3u, IEEE 802.3x, IEEE 802.1p, IEEE 802.3af, IEEE 802.3at	
Interface	5*10/100/1000 Mbps RJ45 Ports with 4 PoE+ Ports (Port 1 to Port 4) AUTO Negotiation/AUTO MDI/MDIX	
Network Media	10BASE-T: UTP category 3, 4, 5 cable (maximum 100 m) EIA/TIA-568 100Ω STP (maximum 100 m) 100BASE-TX: UTP category 5, 5e cable (maximum 100 m) EIA/TIA-568 100Ω STP (maximum 100 m) 1000BASE-T: UTP category 5, 5e, 6 or above cable (maximum 100 m) EIA/TIA-568 100Ω STP (maximum 100 m)	
Max Power Consumption	4.12 W (220 V/50 Hz, no PD connected) 47.5 W (220 V/50 Hz, with 40 W PD connected)	11.44 W (220 V/50 Hz, no PD connected) 75.74 W (220 V/50 Hz, with 56 W PD connected)
Max Heat Dissipation	14.05 BTU/h (no PD connected) 161.98 BTU/h (with 40 W PD connected)	39.03 BTU/h (no PD connected) 258.42 BTU/h (with 65 W PD connected)
PoE Ports (RJ45)	Standard: 802.3 af/at compliant PoE Ports: Port 1- Port 4 Power Supply: 40 W	Standard: 802.3 af/at compliant PoE Ports: Port 1- Port 4 Power Supply: 65 W
Transmission Method	Store-And-Forward	
Switching Capacity	10 Gbps	
Mac Address Table	2K	
Fan Quantity	Fanless	
External Power Supply	External Power Adapter(Output: 53.5 VDC / 0.81 A)	External Power Adapter(Output: 53.5 VDC / 1.31 A)
LED	Power, Link/Act, PoE Status, PoE Max	
Dimensions (W x D x H)	3.9 x 3.9 x 1.0 in. (99.8 x 98 x 25 mm)	
Certification	FCC, CE, RoHS	
Package Contents	Switch, Power Adapter, Installation Guide	

Note: PoE budget calculations are based on laboratory testing. Actual PoE power budget is not guaranteed and will vary as a result of client limitations and environmental factors.

Installation Guide

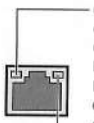
5/6/16-Port Gigabit Desktop PoE Switch

LED Explanation

Power

Power — On: Power on; Off: Power off

Link/Act and PoE Status



On (Green): Connected to a 1000 Mbps device
On (Yellow): Connected to a 10/100 Mbps device
Flashing: Transmitting/receiving data
Off: No device is connected to the corresponding port.

On: Providing PoE power
Flashing: Current-overload/Short-circuit
Off: Not providing PoE power

PoE MAX

PoE Max

TL-SG1005LP
On: 33 W ≤ Total power supply < 40 W
Flashing: Total power supply ≥ 40 W
Off: Total power supply < 33 W

TL-SG1005P
On: 58 W ≤ Total power supply < 65 W
Flashing: Total power supply ≥ 65 W
Off: Total power supply < 58W

TL-SG1006PP
On: 57 W ≤ Total power supply < 64 W
Flashing: Total power supply ≥ 64 W
Off: Total power supply < 57W

TL-SG116P
On: Total power supply ≥ 113 W
Flashing: Total power supply ≥ 113 W and lasts for more than 2 minutes
Off: Total power supply < 113W

Switches Explanation

Note: The numbers in brackets indicate the ports where the feature takes effect. For example, when Extend(1-4) is toggled to On, the Extend mode will be enabled for ports 1-4.

Priority (for TL-SG116P)

Off: All the ports transmit data with the same priority.
On: The corresponding ports transmit data with a higher priority than other ports. When congestion occurs, packets which are transmitted by the ports with a higher priority occupy the whole bandwidth.

Extend (for TL-SG1005P/TL-SG1006PP/TL-SG116P)

Off: The corresponding ports run at 10/100/1000 Mbps and support PoE power supply up to 100 m away.
On: The corresponding ports run at 10 Mbps and support PoE power supply up to 250 m away.

Isolation (for TL-SG116P)

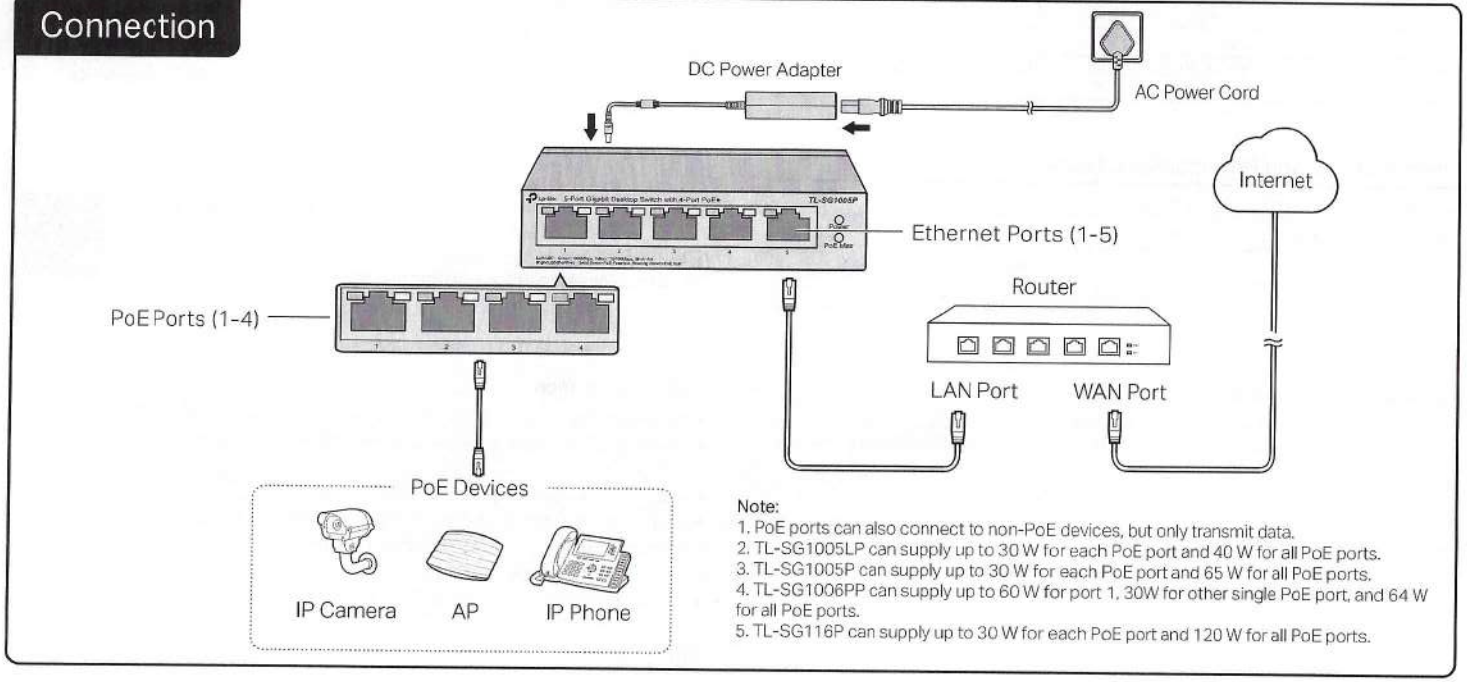
Off: Ports can transmit data with each other.
On: The corresponding ports cannot transmit data with other downlink ports. They can transmit data only with the uplink ports (ports 15-16 of TL-SG116P).

Recovery (for TL-SG1005P/TL-SG1006PP/TL-SG116P)

Off: The PoE Auto Recovery function is disabled.
On: The switch will constantly detect the working status of a PoE powered device (PD). When the switch finds that the PD works abnormally, the switch will reboot it.

Note: For simplicity, we will take TL-SG1005P for example throughout this Guide.

Connection



Note:
1. PoE ports can also connect to non-PoE devices, but only transmit data.
2. TL-SG1005LP can supply up to 30 W for each PoE port and 40 W for all PoE ports.
3. TL-SG1005P can supply up to 30 W for each PoE port and 65 W for all PoE ports.
4. TL-SG1006PP can supply up to 60 W for port 1, 30W for other single PoE port, and 64 W for all PoE ports.
5. TL-SG116P can supply up to 30 W for each PoE port and 120 W for all PoE ports.

Specifications

General Specifications

Standard	IEEE802.3i, IEEE802.3u, IEEE802.3ab, IEEE802.3x,IEEE802.3af, IEEE802.3at, IEEE802.3bt (for TL-SG1006PP only), IEEE802.1p
Interface	For TL-SG1005LP/TL-SG1005P: 5 10/100/1000 Mbps RJ45 Ports Auto-Negotiation MDI/MDIX PoE Ports: Port 1-Port 4 For TL-SG1006PP: 6 10/100/1000 Mbps RJ45 Ports Auto-Negotiation MDI/MDIX PoE Ports: Port 1-Port 4 For TL-SG116P: 16 10/100/1000 Mbps RJ45 Ports Auto-Negotiation MDI/MDIX PoE Ports: Port 1-Port 16 Total Power Supply: 40 W (TL-SG1005LP)/65 W (TL-SG1005P)/64W (TL-SG1006PP)/ 120 W (TL-SG116P)
Network Media (Cable)	10BASE-T: UTP category 3, 4, 5 cable (maximum 100 m); EIA/TIA-568 100Ω STP (maximum 100 m) 100BASE-TX: UTP category 5, 5e cable (maximum 100 m); EIA/TIA-568 100Ω STP (maximum 100 m) 1000BASE-T: UTP category 5e cable or above (maximum 100 m); EIA/TIA-568 100Ω STP (maximum 100 m)
Switching Capacity	10 Gbps (TL-SG1005LP/TL-SG1005P)/12Gbps (TL-SG1006PP)/ 32 Gbps (TL-SG116P)
Transfer Method	Store-and-Forward
MAC Address Learning	Automatically learning, automatically aging
Power Supply	External Power Adapter Input: 100-240 VAC, 50/60 Hz Output: 53.5 VDC /0.81 A (TL-SG1005LP) 53.5 VDC /1.31 A (TL-SG1005P/TL-SG1006PP) 53.5 VDC /2.43 A (TL-SG116P)
Wall Mountable	Yes
Distance Between Mounting Holes	39 mm (TL-SG1005LP/TL-SG1005P)/94mm (TL-SG1006PP)/ 200 mm (TL-SG116P)

Environmental and Physical Specifications

Operating Temperature	0 °C to 40 °C (32 °F to 104 °F)
Storage Temperature	-40 °C to 70 °C (-40 °F to 158 °F)
Operating Humidity	10% to 90%RH non-condensing
Storage Humidity	5% to 90%RH non-condensing

EU declaration of conformity

TP-Link hereby declares that the device is in compliance with the essential requirements and other relevant provisions of directives 2014/30/EU, 2014/35/EU, 2011/65/EU and (EU)2015/863.
The original EU declaration of conformity may be found at https://www.tp-link.com/en/support/ce/

UK declaration of conformity

TP-Link hereby declares that the device is in compliance with the essential requirements and other relevant provisions of the Electromagnetic Compatibility Regulations 2016 and Electrical Equipment (Safety) Regulations 2016.
The original UK declaration of conformity may be found at https://www.tp-link.com/support/ukca

Frequently Ask Questions (FAQ)

Q1. Why is the Power LED not lit?

The Power LED should be lit when the power system is working normally. If the Power LED is not lit, please try the following:

A1: Make sure the AC power cord is connected to the switch with power source properly.

A2: Make sure the voltage of the power supply meets the requirements of the input voltage of the switch.

A3: Make sure the power source is on.

Q2. Why is the Link/Act LED not lit while a device is connected to the corresponding port?

It is recommended that you check the following items:

A1: Make sure that the cable connectors are firmly plugged into the switch and the device.

A2: Make sure the connected device is turned on and works normally.

A3: The cable must be less than 100 meters long (328 feet). If Extend Mode is enabled, it should be less than 250 meters (820 feet).

Q3. Why are PoE ports not supplying power for PoE devices?

When the total power consumption of connected PoE devicesexceeds the maximum, the PoE port with a smaller port number has higher priority. The system will cut off power to the ports with larger port numbers to ensure supplying to other ports.
Take TL-SG1005P as an example. If port 1, 2 and 4 are consuming 15.4 W respectively, and an additional PoE device with 19 W is connected to port 3, the system will cut off the power of port 4 to compensate for the overload.

Q4. What should I notice before using the PoE Auto Recovery feature?

A1: Before upgrading a connected PoE powered device (PD), disable PoE Auto Recovery to avoid the PD's damage.

A2: When a PD does not send data packets to the switch for a long period in certain scenarios (e.g. an IPC in sleep mode), disable PoE Auto Recovery to avoid the PD repeatedly rebooting.

To ask questions, find answers, and communicate with TP-Link users or engineers, please visit **https://communitytp-link.com** to join TP-Link Community.

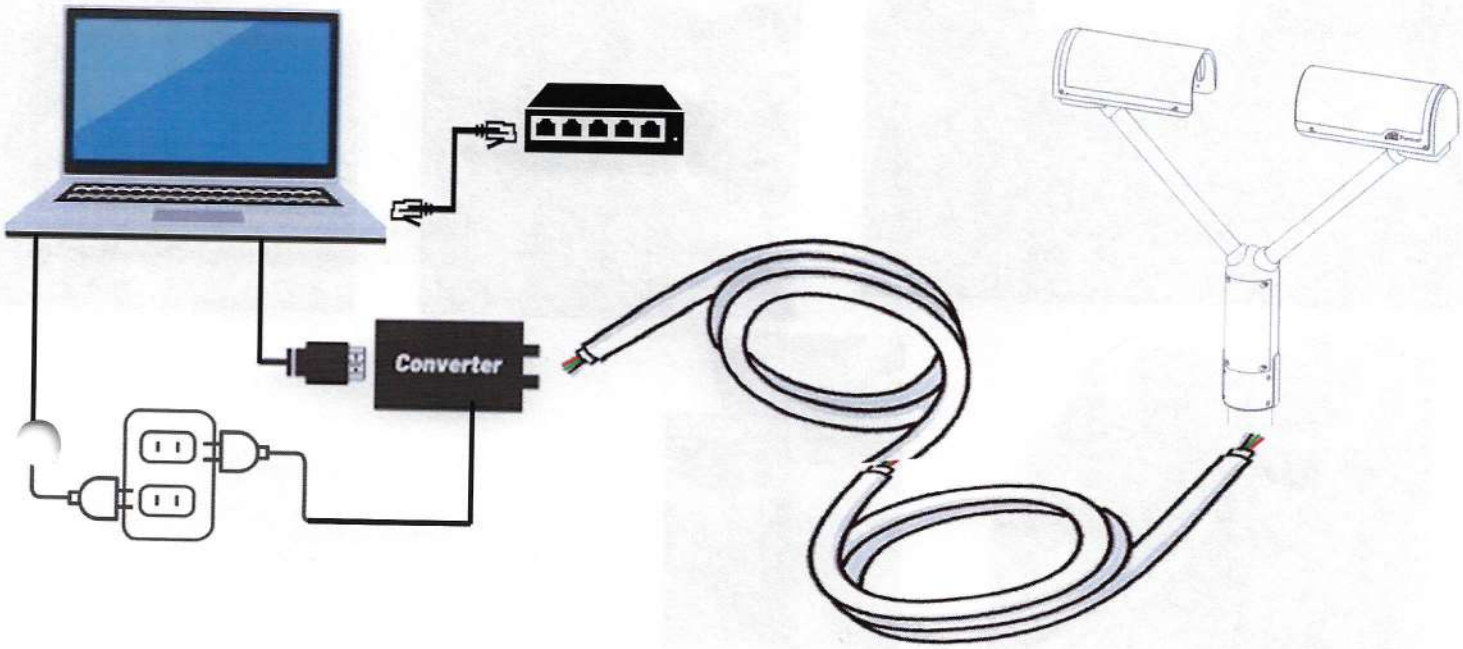
For technical support and other information, please visit **https://www.tp-link.com/support**, or simply scan the QR code.

Safety Information

- Keep the device away from water, fire, humidity or hot environments.
- Do not attempt to disassemble, repair, or modify the device.If you need service, please contact us.
- Place the device with its bottom surface downward.
- Do not use damaged charger or USB cable to charge the device.
- Do not use any other chargers than those recommended.
- Adapter shall be installed near the equipment and shall be easily accessible.
- The plug on the power supply cord is used as the disconnect device, the socket-outlet shall be easily accessible.

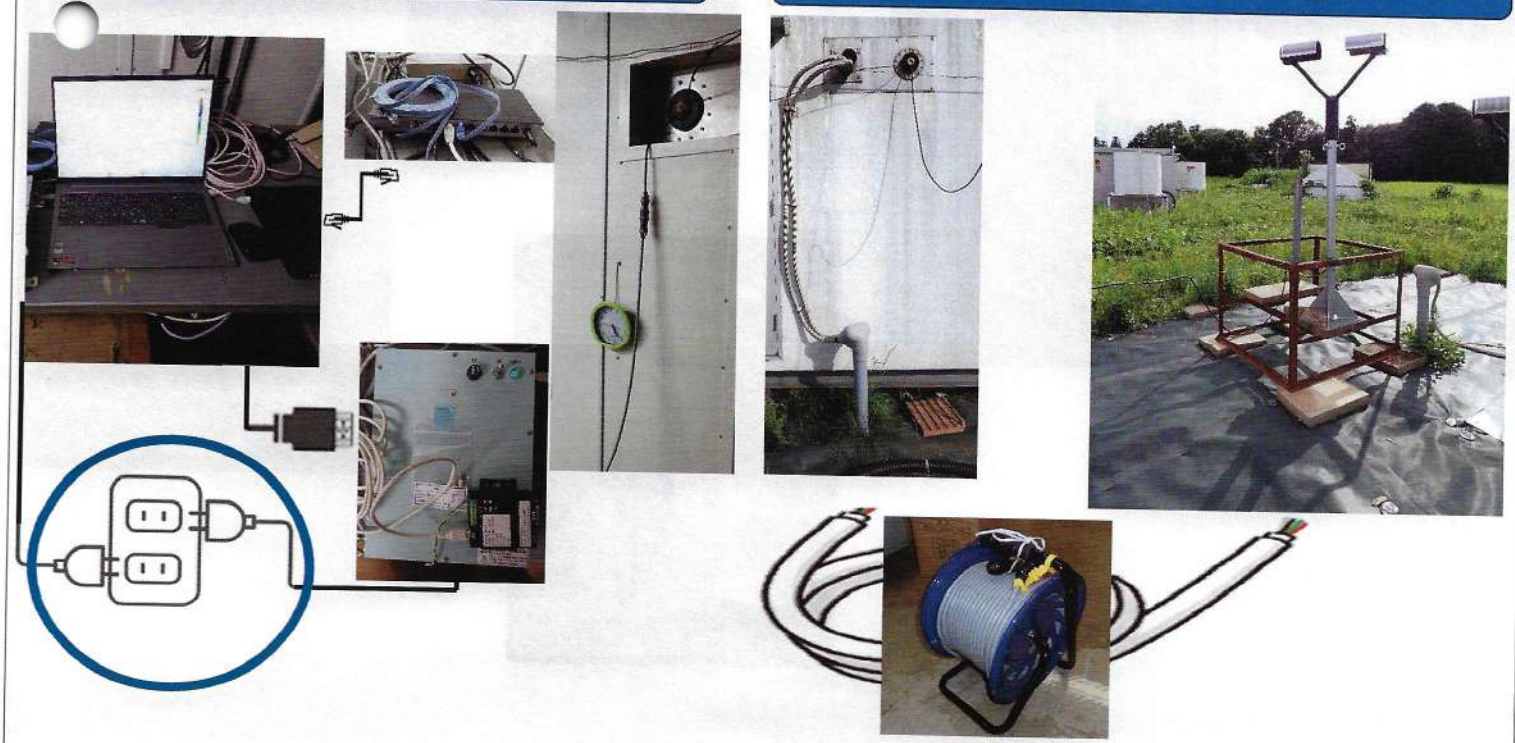
Indoor

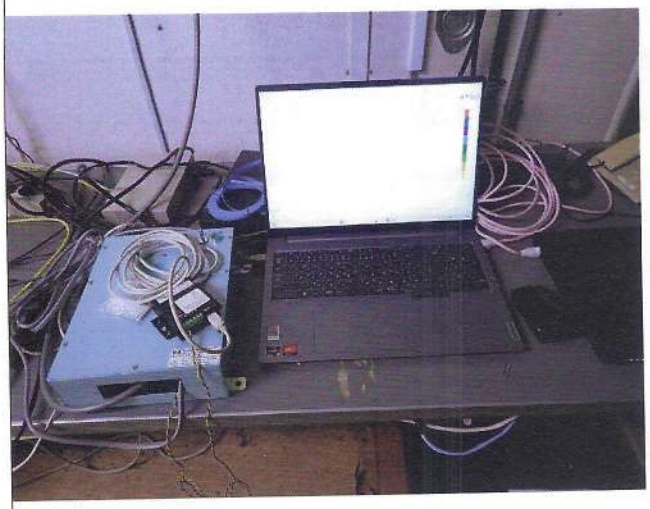
Outdoor

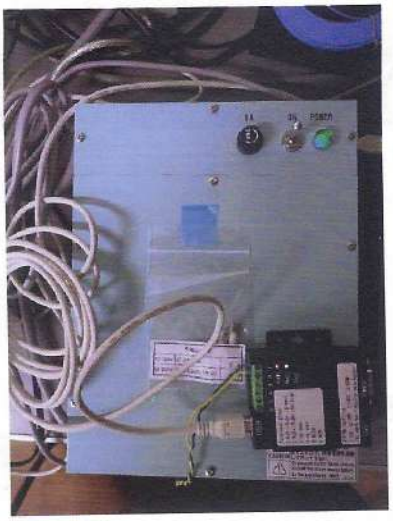


Indoor

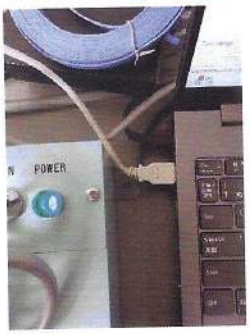
Outdoor

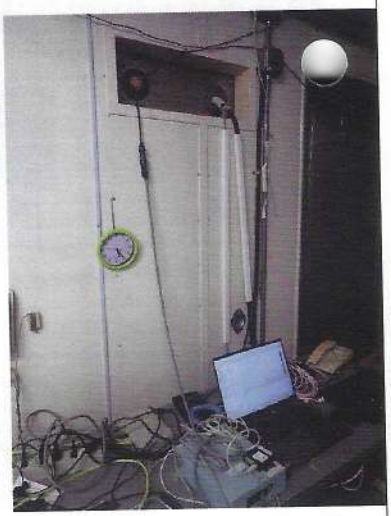


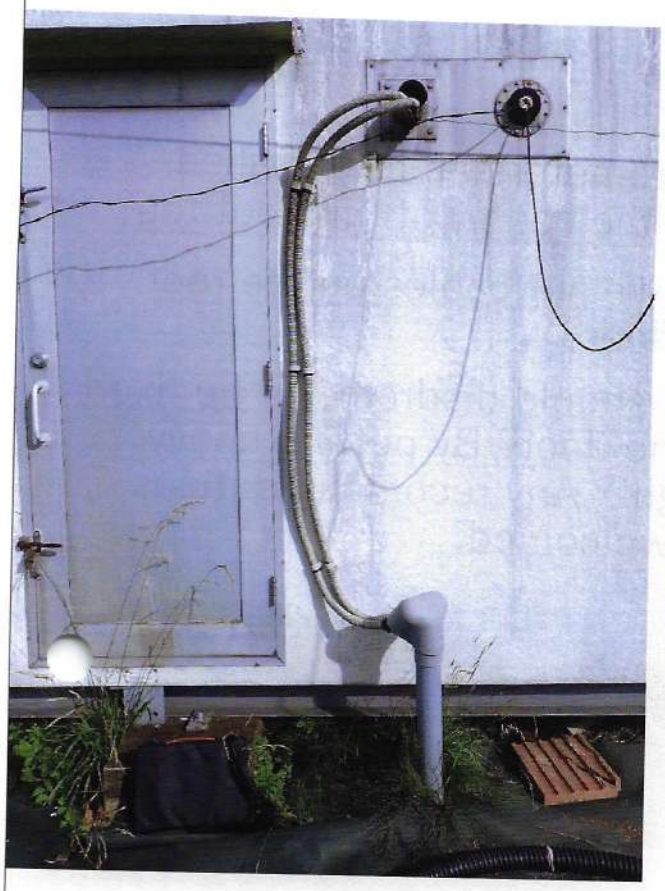


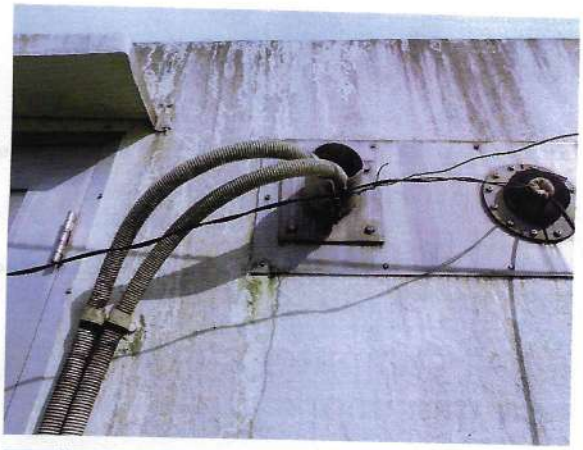


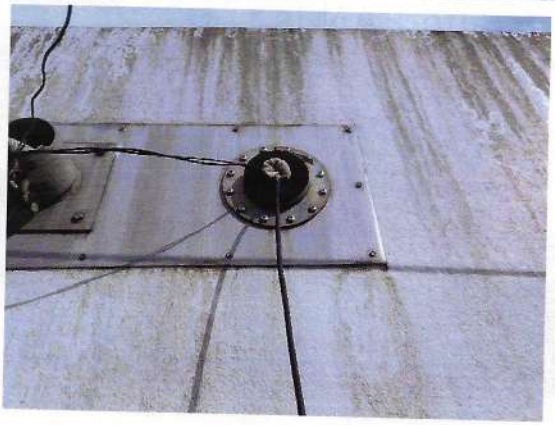

USB
6 5 4 3 2 1
Terminal Block
1:RxD-/TxD- (Green)
2:RxD+/TxD+ (Yellow)
3:no use
4:no use
5:DC5V
6:GND
PWR
RxD
TxD
DIPSW Setting
1:ON, 2:OFF, 3:OFF, 4:OFF
(RS-485 Half-Duplex w/o echo)
SW
Serial

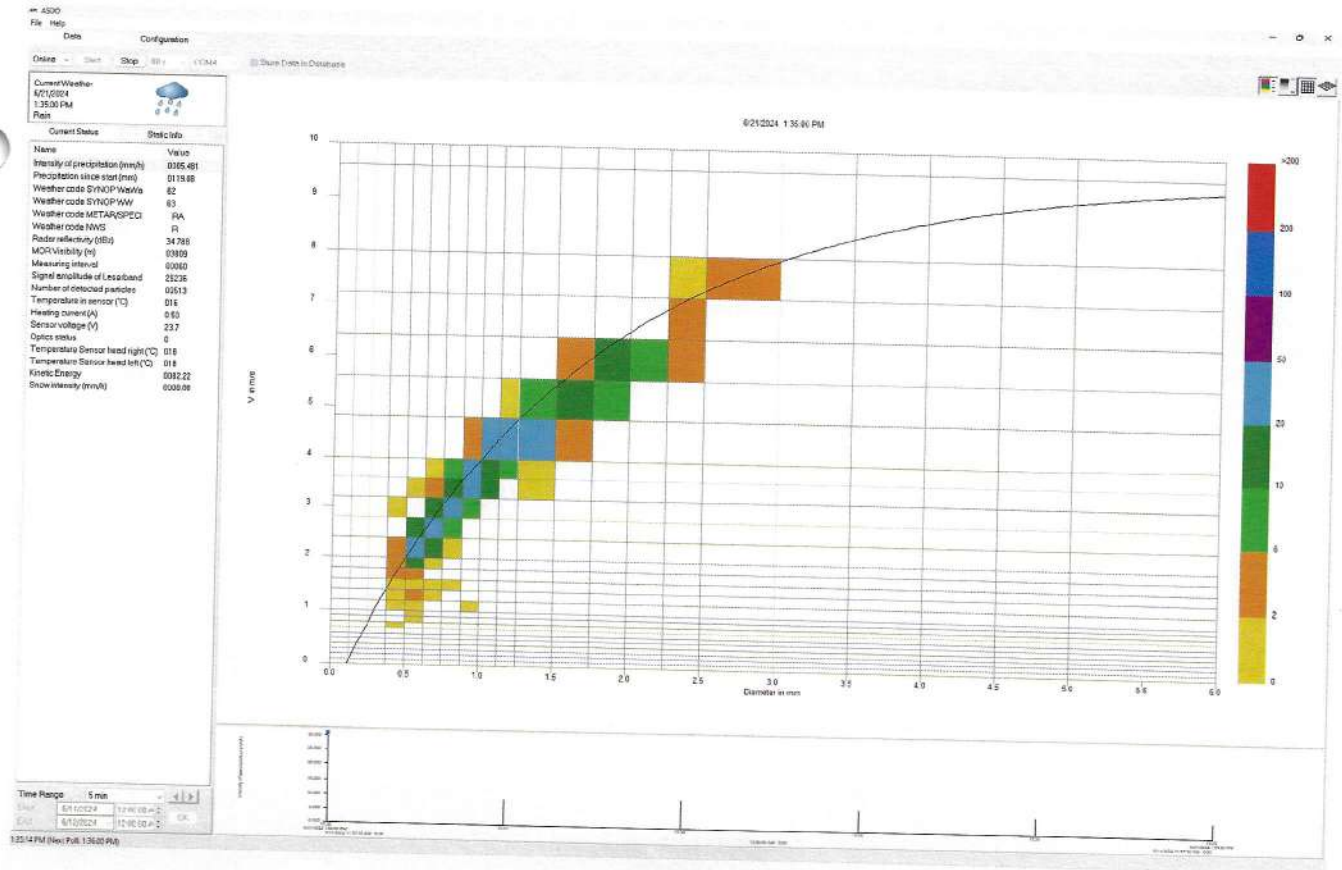

POWER










ASDO
File Help
Data
Configuration
Online
Start
Stop
Store Data in Database
Current Weathe-
6/21/2024
1:35:00 PM
Rain
Current Status
Static Info
Name
Value
Intensity of precipitation (mm/h)
0365.481
Precipitation since start (mm)
0119.68
Weather code SYNOP WaWa
82
Weather code SYNOP WW
63
Weather code METAR/SPECI
RA
Weather code NWS
R
Radar reflectivity (dBz)
34.788
MOR Visibility (m)
03809
Measuring interval
00060
Signal amplitude of Laserband
25236
Number of detected particles
03513
Temperature in sensor (°C)
016
Heating current (A)
0.60
Sensor voltage (V)
23.7
Optics status
0
Temperature Sensor head right (°C)
018
Temperature Sensor head left (°C)
018
Kinetic Energy
0082.22
Snow intensity (mm/h)
0000.00
Time Range
5 min
Start
6/11/2024
12:40:00 AM
End
6/21/2024
12:40:00 AM
OK
1:35:14 PM (Next Poll: 1:36:00 PM)
6/21/2024 1:35:00 PM
V in mm
Diameter in mm
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
0
1
2
3
4
5
6
7
8
9
10
>200
200
100
50
20
10
5
2
0

Cables to indoor

- Are there any holes where cables can be pulled into the house from the outside? If no, is it possible to make a hole?
- The logging computer can be put inside this door?
- AC power and LAN is available?

- Disdrometer can be installed near the center of this root top?
- Can we put cables on the roof top floor?
- How should disdrometer be fixed on the floor? By putting heavy weight? Any recommendations are welcomed.

Same function

LAN Cable PoE

Indoor

https://direct.sanwa.co.jp/ItemPage/500-LAN6A-05BL
https://direct.sanwa.co.jp/ItemPage/500-LAN6A-03BL

Outdoor and Weather-proof

https://www.sanwa.co.jp/product/syohin?code=KB-T6AWP-10BK
https://www.sanwa.co.jp/product/syohin?code=KB-T6AWP-20BK

Same function

PoE Switch

https://www.tp-link.com/jp/business-networking/poe-switch/tl-sg1005lp/v1/

PoE Injector

backup

https://www.elecom.co.jp/products/EIB-UG01-PL2.html

Same function

backup

PoE extender

https://www.amazon.co.jp/Lonlonty-RJ45-%E3%82%AB%E3%83%97%E3%83%A9%E3%83%BC-%E3%82%B3%E3%83%8D%E3%82%AF%E3%82%BF-CAT6A/dp/B0C8S5PDN4/ref=pd_ci_mcx_pspc_dp_d_2_t_1?pd_rd_w=65bsd&content-id=amzn1.sym.03e6f1e0-68dc-4e96-a4fb-2db2c2a22e4d&pf_rd_p=03e6f1e0-68dc-4e96-a4fb-2db2c2a22e4d&pf_rd_r=2SPYJG4FQG43WE5KKCP3&pd_rd_wg=xts9w&pd_rd_r=6885f0cb-81f6-400f-b5b8-10d1e0fcd955&pd_rd_i=B0C8S5PDN4&th=1

https://www.sanwa.co.jp/product/syohin?code=LAN-EXPOE3

Corrugated Tube

19mm × 25m × 2

Tube fixture

https://www.monotaro.com/p/0330/6354/
https://www.monotaro.com/p/0330/6345/

Spacer/Wedge

TKSB-B

https://www.monotaro.com/p/3918/2157/?fem1=1

https://store.shopping.yahoo.co.jp/interiortool/sm-99000131.html

SH-LVS140-SET

Cable Management Tube

https://www.elecom.co.jp/products/BST-15CR.html

気象庁　気象研究所　御中

NX-4107F

納入仕様書

新規・変更

品	名	光学式ディスドロメータ　パーシベル２
件	名	雨滴粒子分布測定装置の購入及び取付調整

社　名　：ＡＮＥＯＳ株式会社

所在地　：東京都目黒区中央町１－５－１２

連絡先　：（営業・技術）０３－５７６８－８２５１

営業		技術	
承認	担当	承認	担当
		斉	小村

1. 概　要

本装置は、シート状レーザーの送信部とそれに対向する受信部からなり、落下する降水粒子が光路範囲を通過する際に、降水粒子がレーザーを遮ることで生じる受信電圧降下量と、その降下時間から、個々の降水粒子の粒径および落下速度を同時に計測するセンサーです。

2. 構　成

(a) 構成機器

項目	品　　名	型　名	数　量	備　　考
1	光学式ディスドロメーター	Parisivel2	1台	アプリケーションソフト(ASDO)インストール用CD-R付属
2	センサケーブル(コネクタ付)	—	1本	
3	50mケーブル(コネクタ・リール付)	—	1式	
4	電源箱(電源及び付属ケーブル含む)	—	1台	
5	本体収納用アルミケース	—	1台	
6	RS485/USB変換器(付属ケーブル含む)	USB-COMi-SI-M	1台	
7	支柱(H=1.3m)	—	1台	

(b) 予備品

項目	品　　名	型　名	数　量	備　　考
1	ヒューズ(φ6.4x30 250V 8A)	—	1個	電源箱に付属

3. 仕　様

3.1 光学式ディスドロメーター(Parisivel2)

(1) 光学センサー　レーザーダイオード、波長650nm、出力ピーク0.2mW
レーザークラス1(IEC/EN 60825-1:2014)

(2) ビームサイズ　180mm(W)×30mm(D)　計測面積54cm2

(3) 粒子計測レンジ
粒子径　：0.2～ 8mm（液体）/ 0.2～25mm（固体）
粒子落下速度　：0.2～20m/s
等級　：32サイズ、32速度クラス
測定精度　：±1サイズクラス　(0.2～ 2mm)
±0.5サイズクラス　(>2mm)

(4) 降水種別　8タイプ（霧雨、霧雨/雨、雨、雨/雪、雪、雪粒、霙、霰または雹）

(5) レポート様式　WMO 4680/4477(SYNOP) 4678(METER) 及びNWS

(6) 降水強度
測定範囲：0.001mm/h～1,200mm/h
精度　：±5%（液体）/ ±20%（固体）

(7) 降水中の視程（MOR）　0～20,000m

(8) 出力情報
降水粒子のサイズと落下速度（初期データ）
降水計測（降水強度、累積雨量）、現在天気（降水タイプ）
視程、計測粒子総数

(9) 計測ハウジング　粉体塗装アルミニウム、冠雪防止自動制御ヒーターを備える

(10)	仕様環境条件	温度：-40～+70℃ 湿度：0～100%RH
(11)	保護等級	IP65、耐塩仕様
(12)	計測周期	10sec～60min （ASDO ソフトで設定変更可能）
(13)	電　源	DC10～28V
(14)	消費電力(DC24V)	センサー：1.6W ウィンドウヒーター：4W センサーヘッドヒーター：100W
(15)	出力信号	インタフェース：RS485 2-wire （半二重通信） ボーレート：1200～57600bps （ASDO ソフトで設定変更可能）
(16)	アプリケーションソフト(ASDO)	対応 OS：Microsoft Windows 10 以上 Parisivel2 センサーの設定、計測制御、データ取り込み及び出力情報の記録・表示を行う事ができます。 ※本ソフトのインストール用 CD-R を本体に付属します。
(17)	外形寸法	付図に示す
(18)	設置方法	2 インチパイプ（φ50～62mm）
(19)	質　量	約 6.4kg（本体のみ、ケーブルを除く）

3.2　電源箱

(1)	入力電圧	AC100V 50/60Hz
(2)	出力電圧	DC24V
(3)	最大出力電力	336W
(4)	外形寸法	付図に示す
(5)	質　量	約 3.1kg

3.3　RS485/USB 変換器(USB-COMi-SI-M)

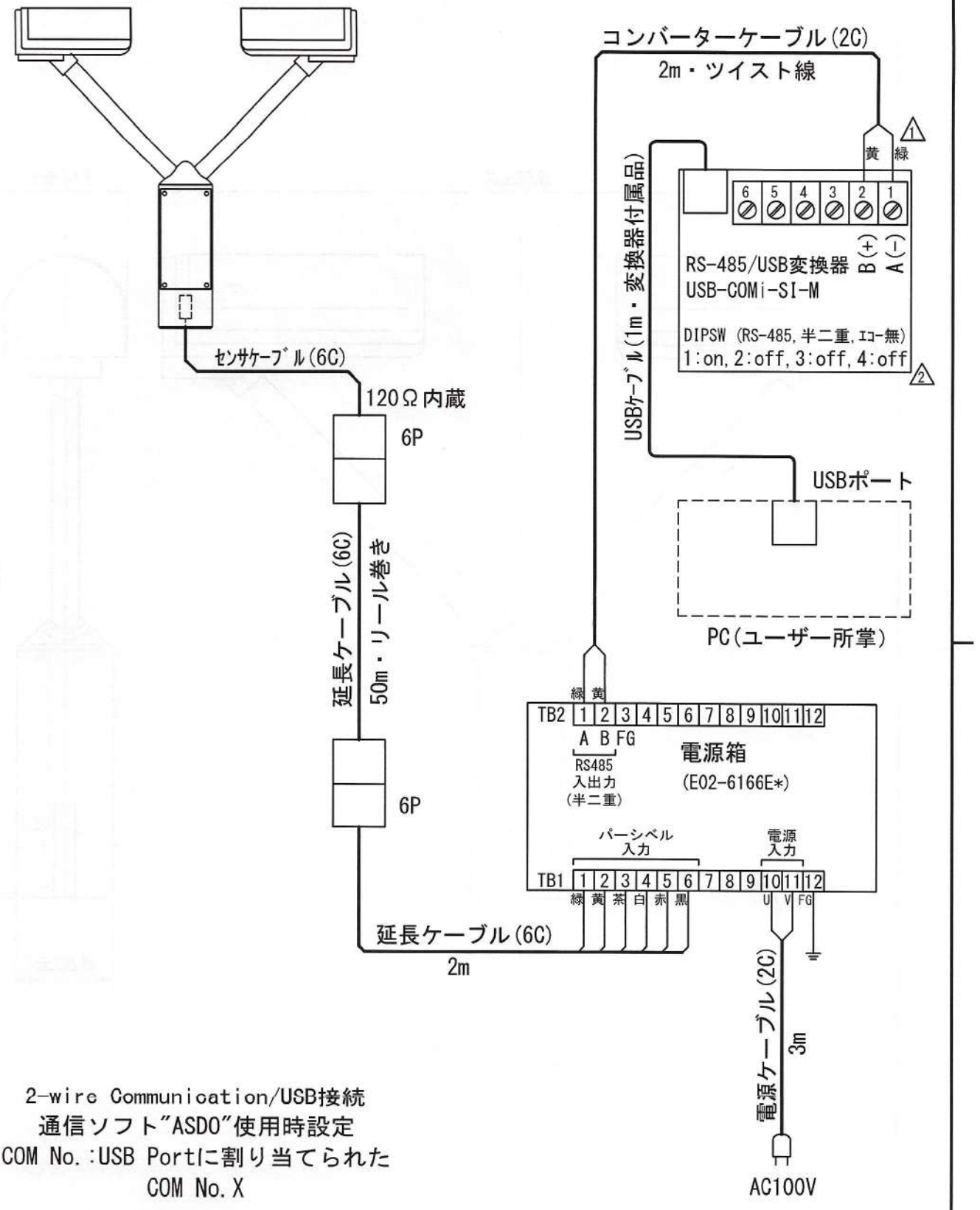
(1)	シリアルインタフェース	RS485 2-wire（半二重通信）
(2)	USB インタフェース	USB2.0
(3)	供給電源	USB ポートより供給
(4)	外形寸法	付図に示す
(5)	質　量	約 150g

付図一覧表

付図番号	図面名称	図面番号	備考
付図 1	パーシベル２　付属ケーブル　配線図	E05-0646A-1z2	
付図 2	光学式ディスドロメーター　パーシベル２　外観図	M01-5969C	
付図 3	電源箱　外観図	M01-5185A	
付図 4	RS485/USB 変換器　外観図	M01-5142	
付図 5	パーシベル２　付属ケーブル　外観図	M01-9246	
付図 6	パーシベル２　本体収納用アルミケース　外観図	M01-7313z1	
付図 7	パーシベル２　装柱図	C-1104F	

付図１

Rev.mark	Date	Contents of revision	Revised	Approved
1	'16.07.20	ｺﾝﾊﾞｰﾀｹｰﾌﾞﾙのﾀｰﾐﾈｰｼｮﾝ抵抗削除	小村	森
2	'23.03.01	DIPSW設定変更(ﾒｰｶｰ仕様変更の為)	小村	仁科
3				



2-wire Communication/USB接続
通信ソフト"ASDO"使用時設定
COM No.:USB Portに割り当てられた
COM No.X

Remark				
Approved by	Checked by	Drawn by	Scale	
技術 23.03.02 仁科	技術 23.03.02 清宮	技術 23.03.02 小村	Weight	
			Third angle system	
			Units mm	A4

Title: パーシベル２　付属ケーブル　配線図

Drawing No.: E05-0646A-1　Revision No.: z2

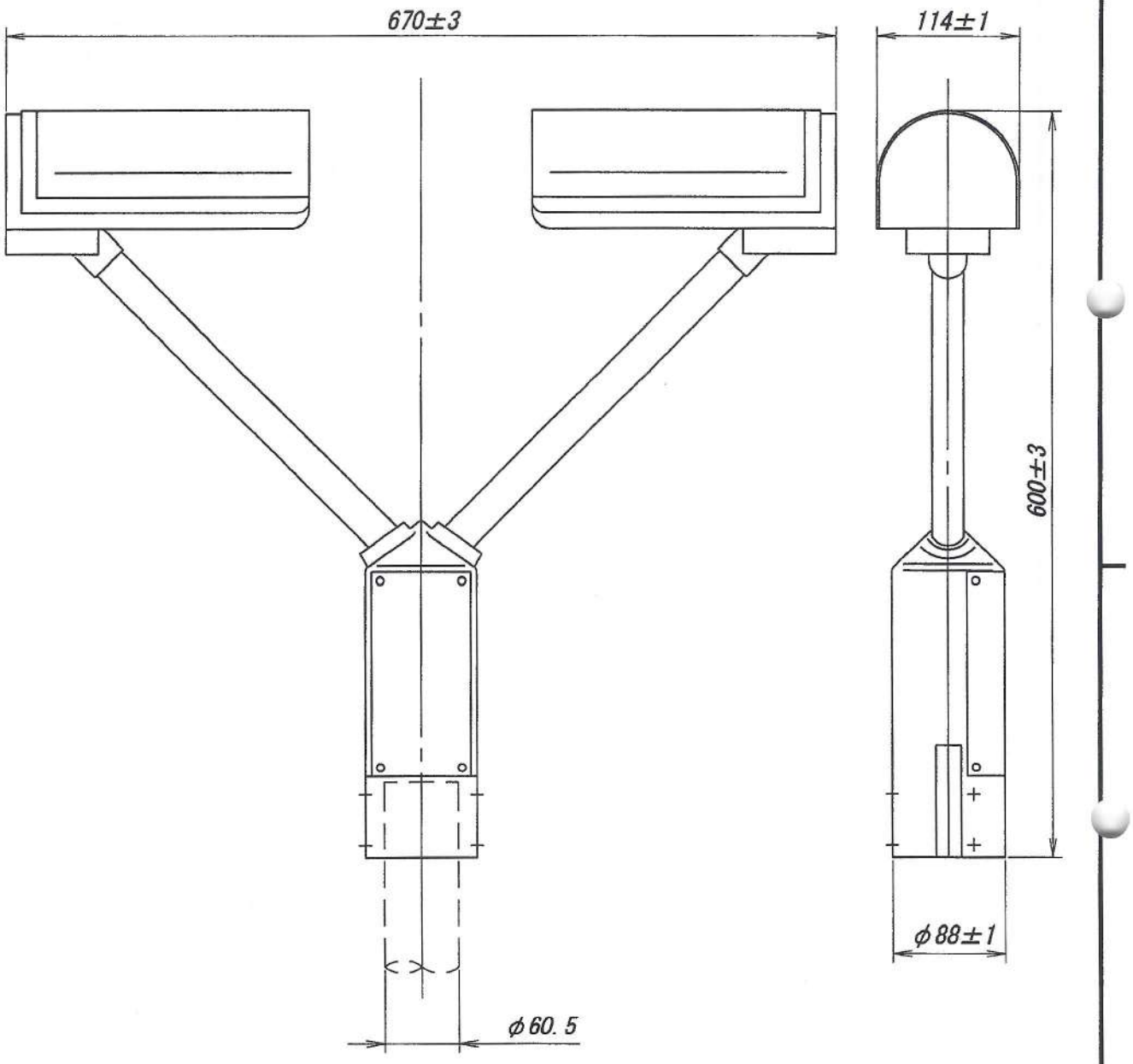
aneos

NQR404-14.改2

ANEOS株式会社

付図２

Rev. mark	Date	Contents of revision	Revised	Approved
1	—			
2	—			
3	—			



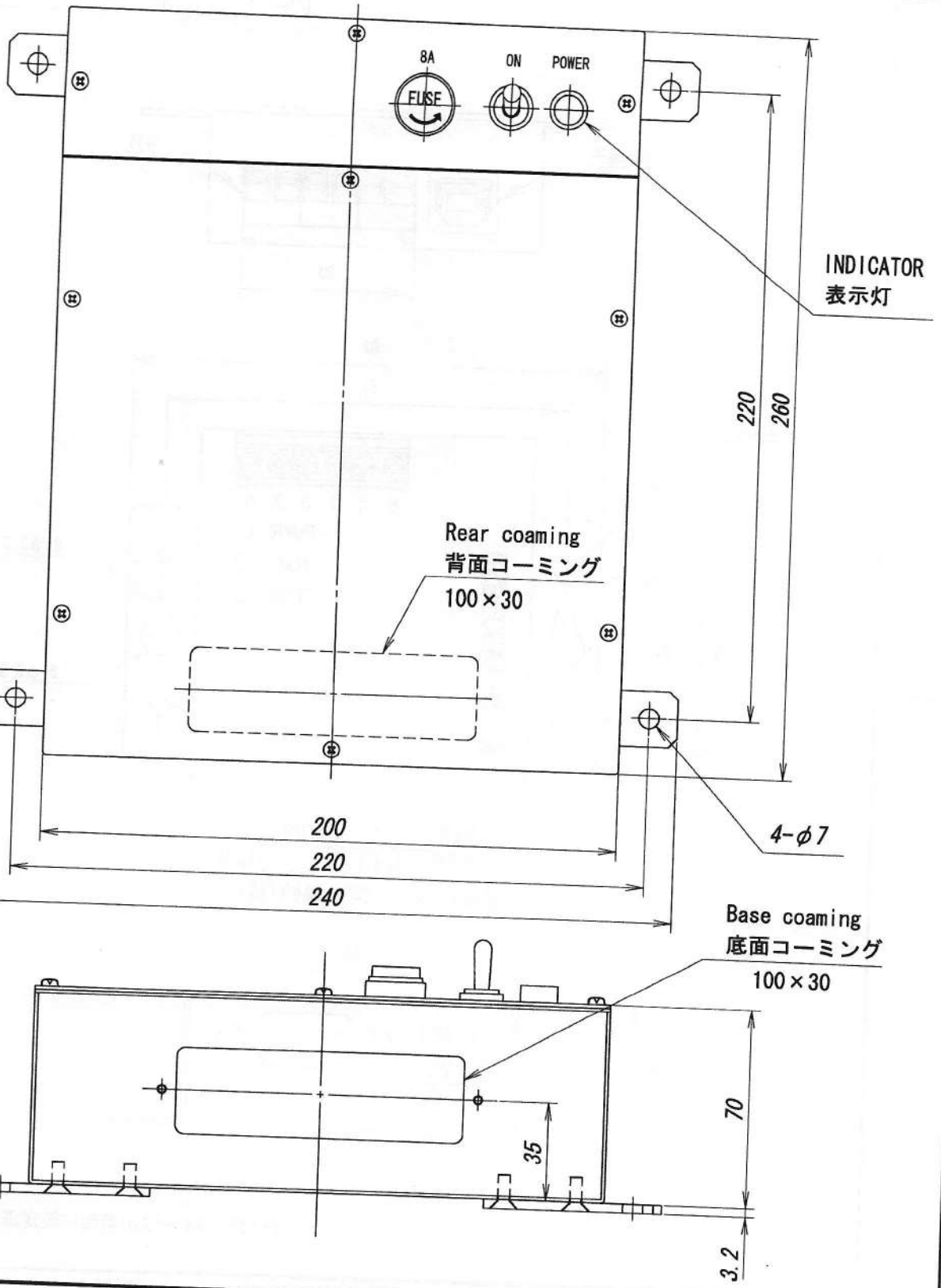
Remark					Title		
					光学式ディスドロメーター パーシベル２　外観図		
Approved by	Checked by	Drawn by	Scale	1 : 5			
技術 '14.7.31 森	技術 '14.7.31 文	技術 14.7.31 小村	Weight	6.4kg			
			Third angle system		Drawing No. M01−5969C	Revision No.	ANEOS
			Units mm	A4			

NQR404-14.改1

NEI・OK Group

付図３

Rev. mark	Date	Contents of revision	Revised	Approved
1 —				
2 —				
3 —				



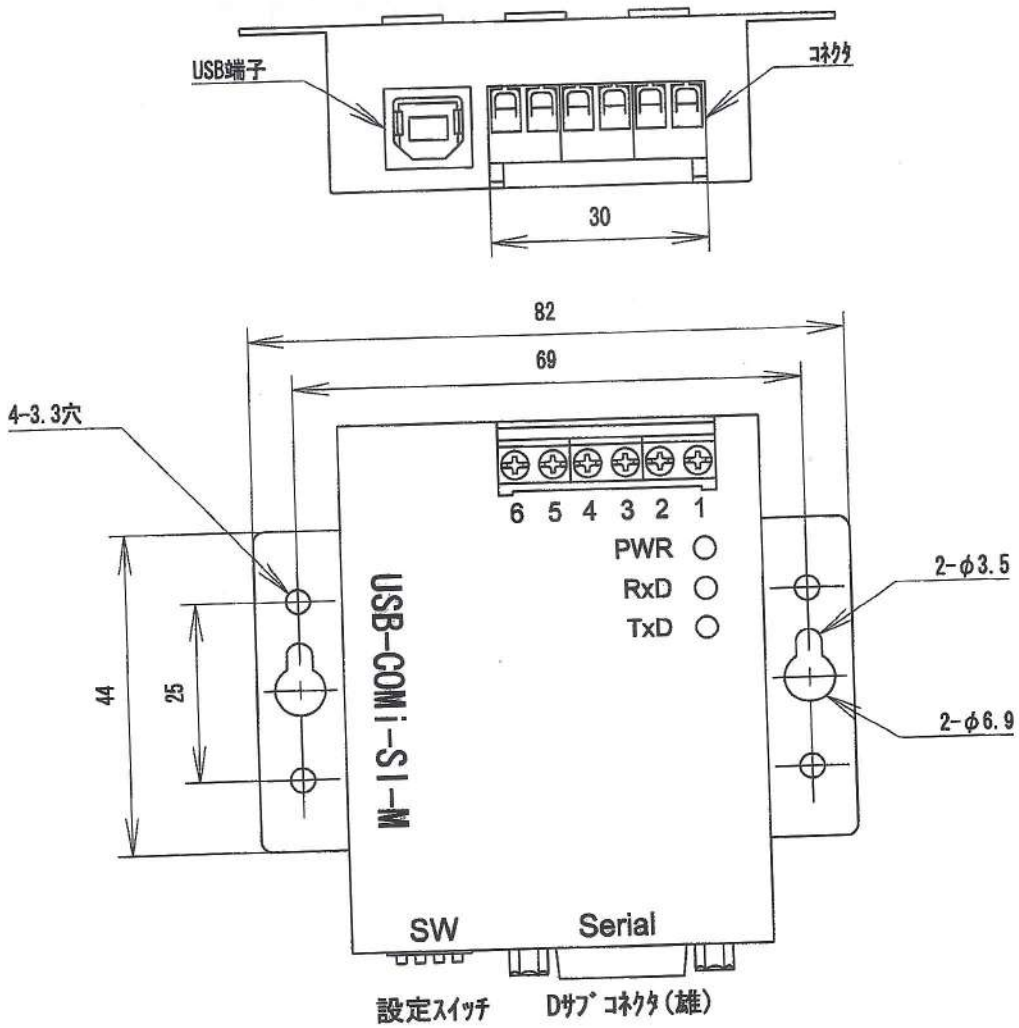
Remark					Title		
Approved by	Checked by	Drawn by	Scale	1 : 2	電源箱　外観図		
			Weight				
			Third angle system		Drawing No.	Revision No.	
			Units mm	A4	M01−5185A		

NQR404-14. 改1

NEI・OK Group

付図４

Rev. mark	Date	Contents of revision	Revised	Approved



注) 設定スイッチは出荷時に設定済みです。

Remark				Title	RS485/USB変換器　外観図
Approved by	Checked by	Drawn by	Scale 1 : 1	Drawing No.	MO1－5142
技術 08.10.28 仲島		技術 08.10.28	Weight 0.15 kg		Revision No. Z
			Third angle system Units mm	NEI NIPPON ELECTRIC INSTRUMENT, INC.	

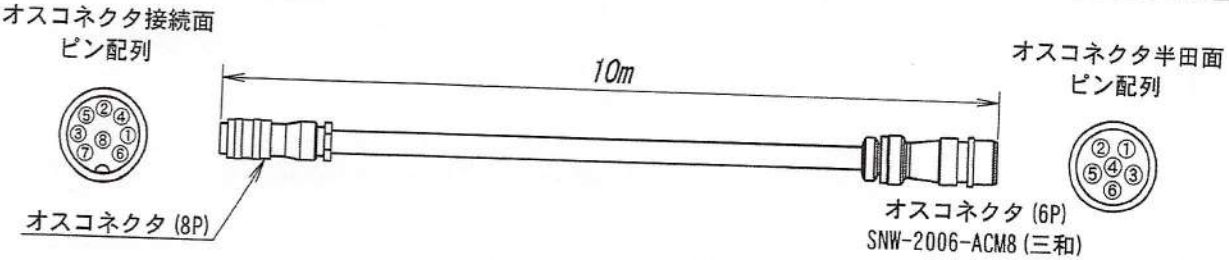
登録

NQR404-14. 改0

付図５

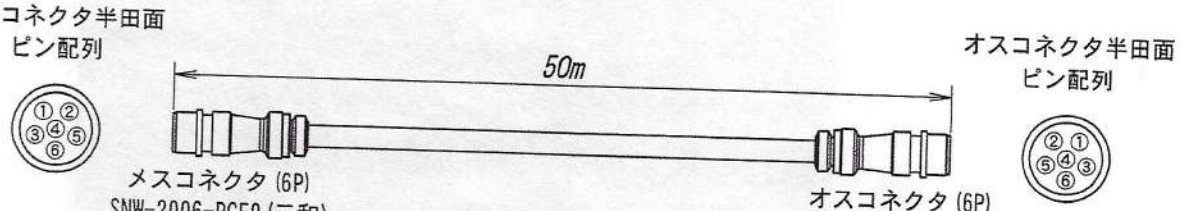
Rev. mark	Date	Contents of revision	Revised	Approved
1 —				
2 —				
3 —				

1. センサ接続ケーブル



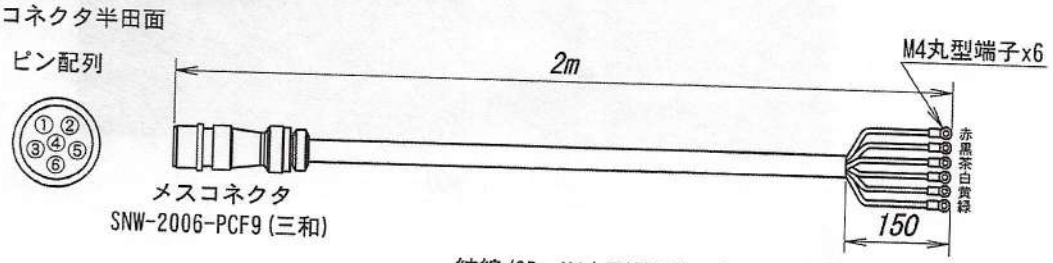
結線 (8P→6P) ：⑤-①、③-②、
⑦-③、⑧-④、⑥-⑤、①-⑥、
④-NC、②-NC

2. 延長ケーブル (50m)



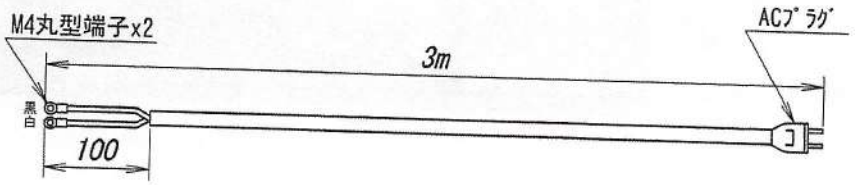
結線 (6P→6P) ：①-①、②-②、③-③、④-④、⑤-⑤、⑥-⑥

3. 延長ケーブル (2m)

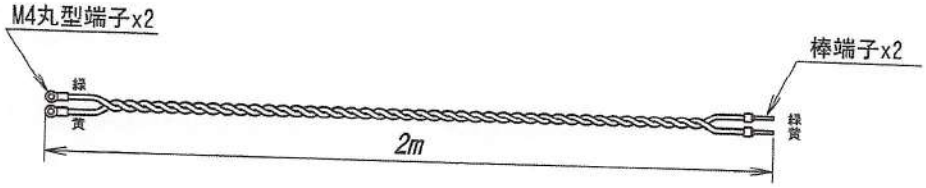


結線 (6P→M4丸型端子) ：①-赤、②-黒、③-茶、④-白、⑤-黄、⑥-緑

4. 電源ケーブル



5. コンバーターケーブル

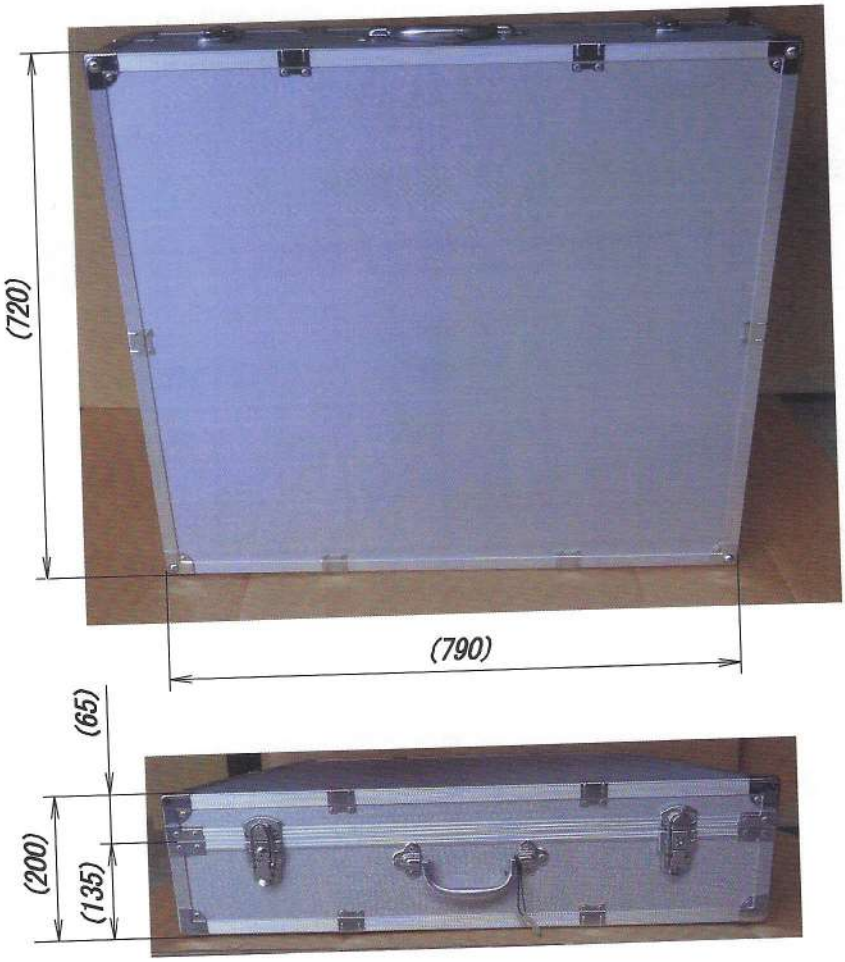


Remark					Title		
H22A410　製作仕様書:E05-0646A-2*					パーシベル２　付属ケーブル　外観図		
Approved by	Checked by	Drawn by	Scale				
技術 '23.3.01 仁科	技術 '23.3.01 清宮	技術 '23.3.01 小村	Weight				
			Third angle system		Drawing No.	Revision No.	aneos
			Units mm	A4	M01−9246		

NQR404-14. 改2

付図６

Rev. mark	Date	Contents of revision	Revised	Approved
1 —	'17.07.13	寸法修正、内寸削除	小村	森
2 —				
3 —				



Remark

Title

パーシベル２収納用　アルミケース
外観図

Approved by	Checked by	Drawn by	Scale	1 : 10
技術 17.07.13 森	技術 17.07.13 仲島	技術 17.07.13 小村	Weight	
			Third angle system	
			Units mm	A4

Drawing No. M01−7313

Revision No. z1

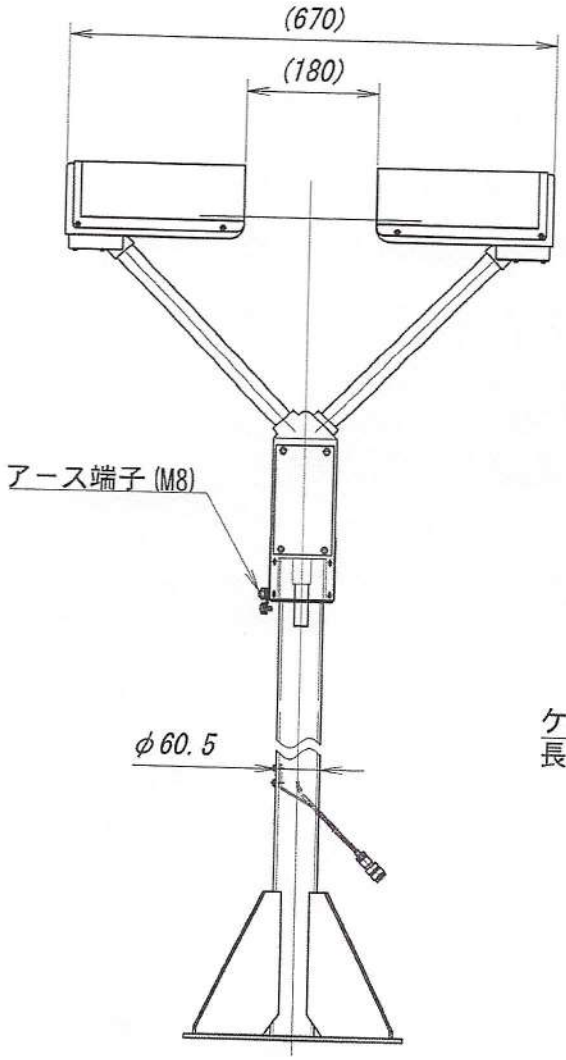
ANEOS

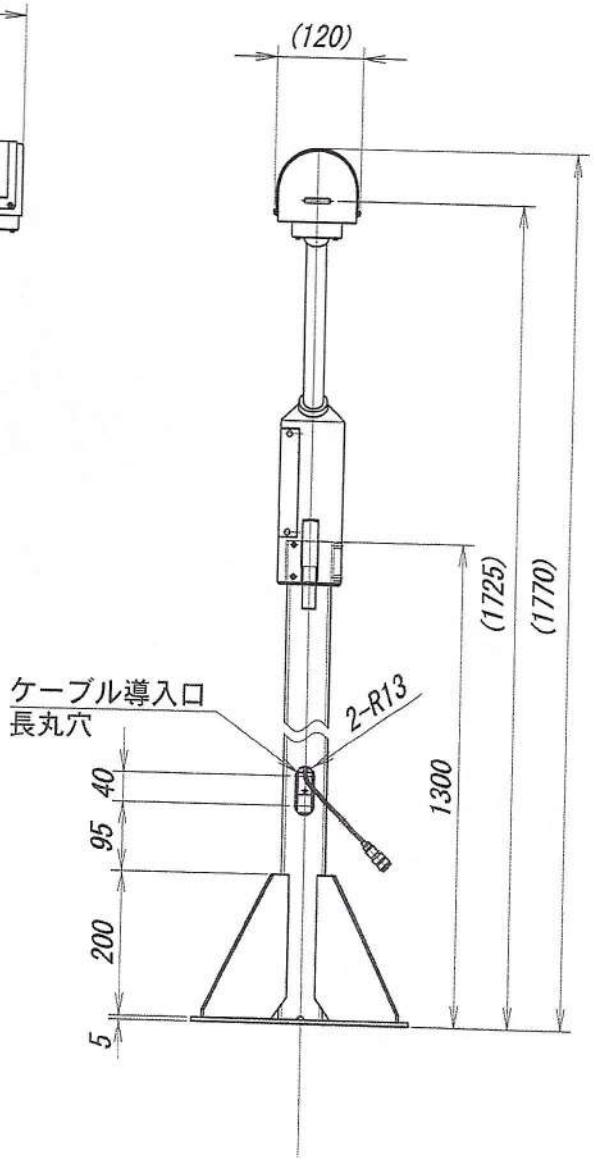
NEI・OK Group

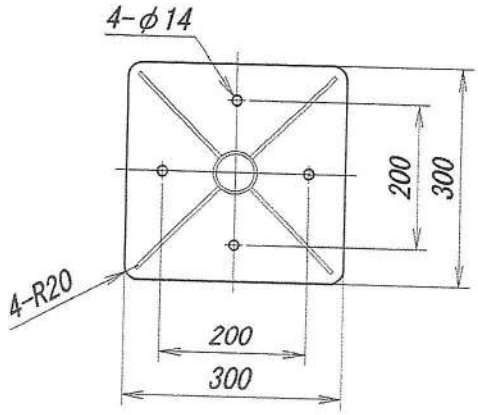
NQR404-14.改1

付図７

Rev. mark	Date	Contents of revision	Revised	Approved
1	—			
2	—			
3	—			







Remark				Title	パーシベル^2 現在天気計　装柱図
Approved by	Checked by	Drawn by	Scale 1：10		
技術 24.1.24 仁科	技術 '24.1.24 小村	技術 24.1.24 篠	Weight		
			Third angle system	Drawing No. C－1104F	Revision No.
			Units mm A4		

NQR404-14. 改2

ANEOS株式会社

New Whole-sky camera

Specification

Camera

- Raspberry Pi camera module v2
- Sensor: Sony IMX219
- Sensor resolution: 3280x2464 pixels
- Optical size: 1.4"
- RGB color
- Power supply & Data transfer: PoE LAN

Fish-eye lens (Entaniya Co. Ltd.)

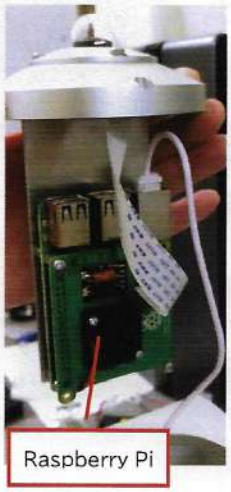
- View angle: 220°
- Equidistance projection

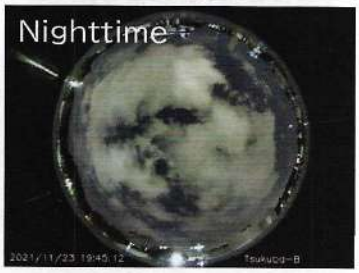
Housing (Prede Co. Ltd.)

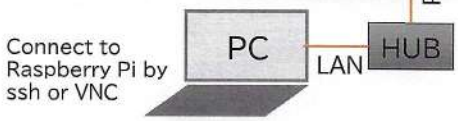
- Weather resistant
- Blower to protect the glass dome
- Heater to melt the snow and to evaporate water on the dome

tware

- Capturing an image with an exposure depending on different scenes by python software.
- Time lapse recording by linux command, "cron".







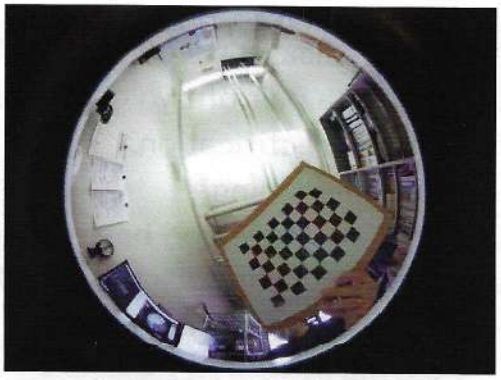
Geometric calibration

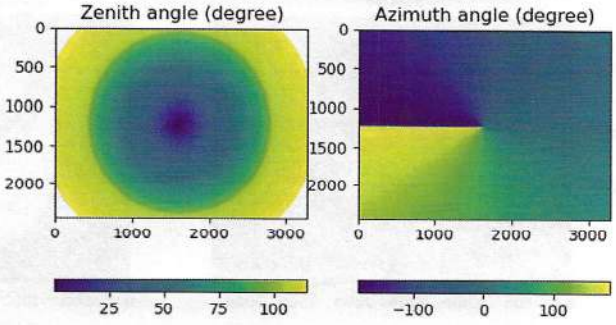
Geometric calibration estimates the intrinsic and extrinsic parameters to determine the measurement direction (zenith and azimuth angles) at each pixel in the world reference system.

Calibration of Intrinsic parameter

1. More than 10 different attitudes of the chess board are captured.
2. Finding the chess board corners.
3. Retrieving the intrinsic parameters from the detected corners by a method of Zhang (2000).
4. Zenith and azimuth angles of each pixel in the camera reference system are determined.

Zhengyou Zhang. A flexible new technique for camera calibration. Pattern Analysis and Machine Intelligence, IEEE Transactions on, 22(11):1330–1334, 2000.



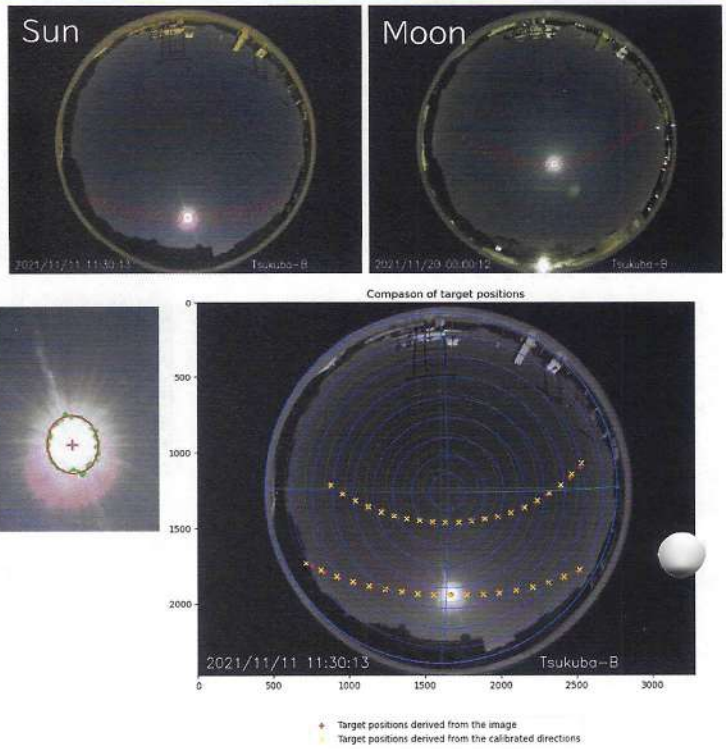


Geometric calibration

Calibration of Extrinsic parameter

1. Finding the center positions of sun and moon in the images at different times by the ellipse detection. The zenith and azimuth angles of sun and moon in the world reference system are known.
2. Retrieving the rotation from the sun and moon positions in the camera reference system to their positions in the world reference system by the Kabsch algorithm.
3. Checking the retrieved rotation by drawing the sun and moon positions derived from the images and from the corrected zenith and azimuth angles.

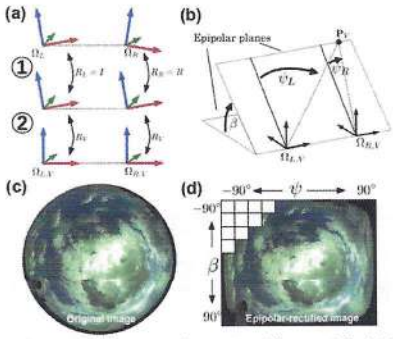
https://en.wikipedia.org/wiki/Kabsch_algorithm



Distribution of Cloud Base Height by Stereo Cameras

The distribution of cloud base height is estimated by the stereo camera (Beekmans 2016).

1. Prepare a pair of two calibrated images.
2. Epipolar rectification.
3. Stereo matching.
4. Calculate the cloud base height by triangulation.
5. Cloud pixels are discriminated by Red-Blue ratio.



Beeksman 2016, https://doi.org/10.5194/acp-16-14231-2016

Plan regarding to Sky radiometer

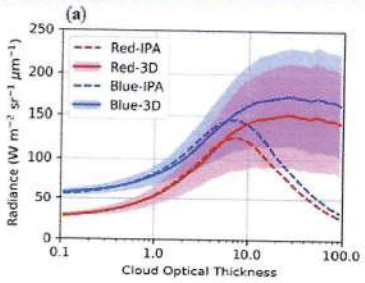
■ Cloud screening for aerosol retrieval

Excluding cloud contaminated measurements to upgrade the reliability of the aerosol retrieval.

■ Improvement of Cloud retrieval

Cloud retrieval by sky radiometer has multiple solutions, i.e. small and large COT. Thin and thick clouds could be discriminated by a picture of clouds.

The view angle of sky radiometer is very small. The spatial representation of the retrieval is small. The multiple retrievals for the measurements at each spatial points in the principal plane would be useful for the better spatial representation, and validation of the satellite remote sensing. Such retrieval becomes possible by the cloud discrimination by whole-sky camera.

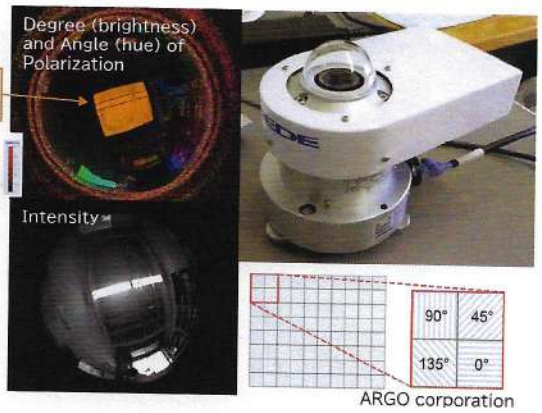


Masuda 2019

■ Whole-sky polarization camera

New whole-sky camera to measure the polarization (degree of linear polarization and angle of polarization) was developed. Now I am developing the software for the routine observation. Using the sky radiometer, polarization camera, and new RPstar (developed by Momoi, Sekiguchi, and Nakajima), the cloud and aerosol retrieval would be improved.

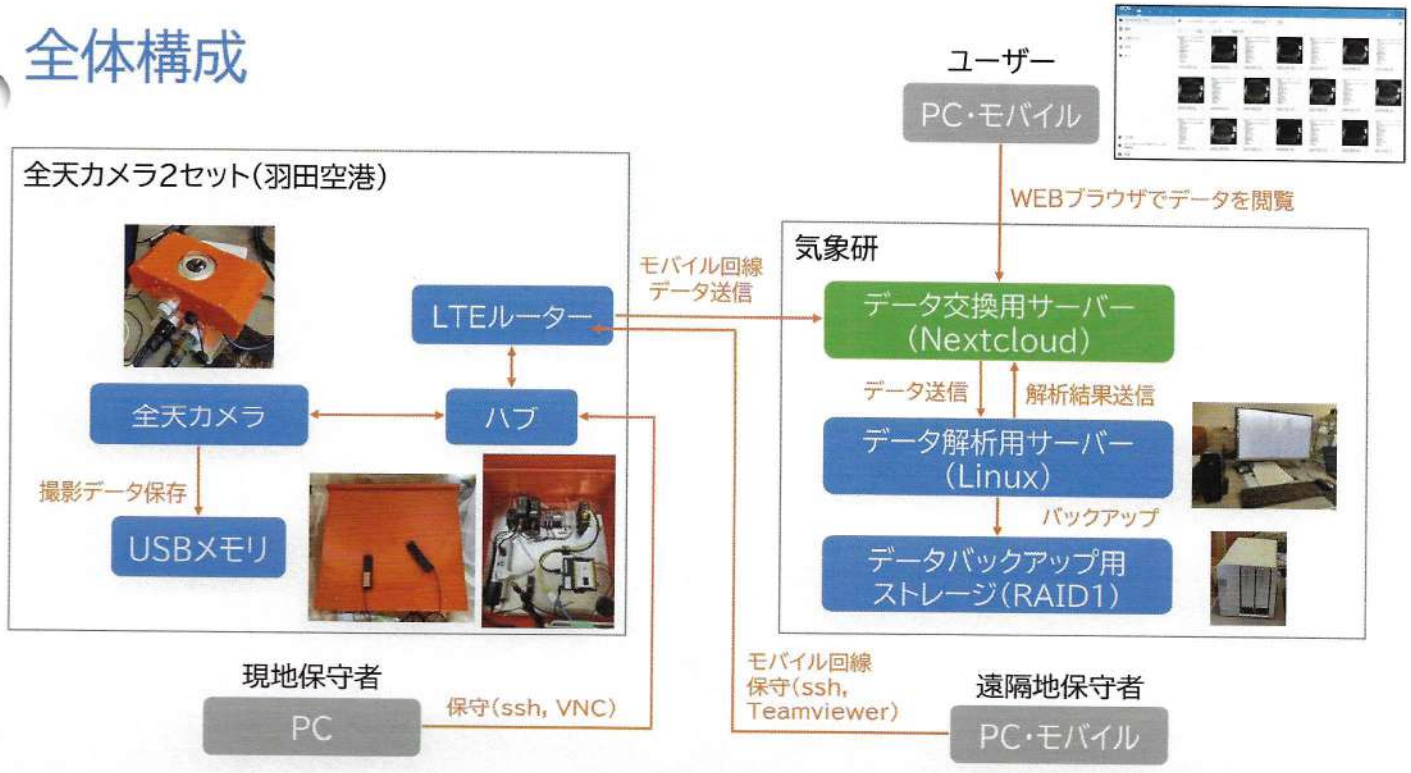
Whole-sky polarization camera



全天カメラ観測システムの構成

工藤玲(気象研)

全体構成



全天カメラの構成

外観

2基の通風ファンとヒーター

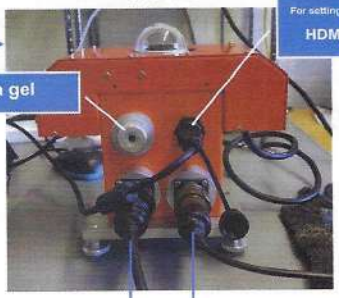
Two ventilation fans

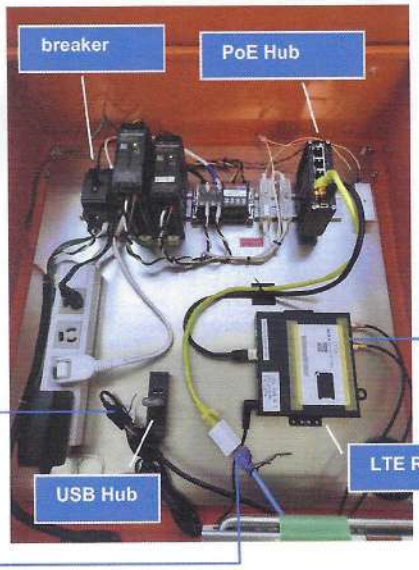
アンテナ

接続端子

For setting and maintenance
HDMI terminal

silica gel





底面の蓋を開けて
内部にアクセス

Raspberry Pi

USB端子
USBハブに挿したUSBメモリに撮影データを保存

PoE対応LAN端子
Raspberry Piの
電源供給とデータ通信

羽田空港における全天カメラ観測

- 観測期間： 2023年1月24日開始～
- 観測地点： RWY22(PICAM1)、RWY16L(PICAM2)
  RWY22、16Lは、滑走路の識別番号。
  PICAM1、2は、カメラの識別番号。

全天カメラのプロダクト

- 撮影した画像は、LTE回線経由で気象研究所のサーバーに即時に送られる。
- その後、画像解析を行い、各種プロダクトが作成される。
- 作成されたプロダクトは、撮影から5～10分遅れで気象研究所のクラウドサーバーにアップロードされる。
- プロダクトは、下記リンク先から閲覧可能。
  リンク先　https://mri-2.mri-jma.go.jp/owncloud/s/rsaj5jL6jdm9TcF
  パスワード　xYyT9id73s
- クラウドサーバーの容量制限のため、掲載するデータは8日分まで。
- リンク先のフォルダ構成

```
├─picam1 ------------------ RWY22(PICAM1)のフォルダ
└─picam2 ------------------ RWY16L(PICAM2)のフォルダ
    ├─data ---------------- 撮影画像
    ├─movie --------------- 動画
    ├─panorama ------------ パノラマ画像
    ├─panorama_movie ------ パノラマの動画
    ├─cloud_cover --------- 雲分布
    ├─cloud_base_height --- 雲底高度
    └─cloud_motion_vector - 雲の移動ベクトル
```

- “picam1”内も“picam2”と同じ構成だが、“cloud_base_height”と“cloud_motion_vector”がない。

撮影画像と動画

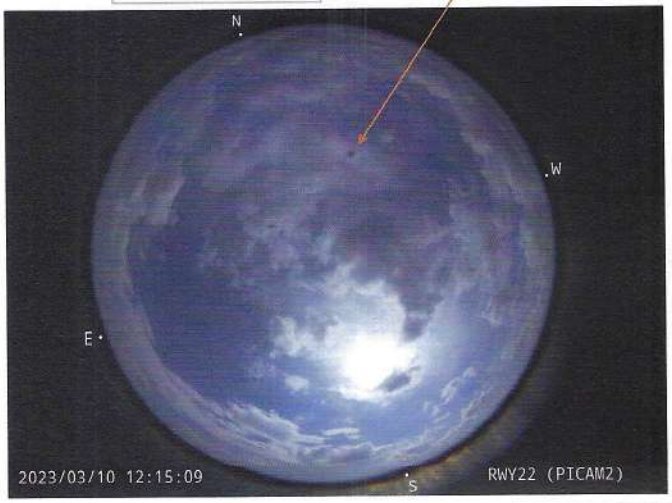
- 24時間、5分毎に2枚の撮影が行われる。
- 2枚の時間差は30秒で、雲の移動ベクトルの算出に用いる。
- 日の出、日の入り前後数時間は、露光時間の設定に時間がかかるため、最大で3分程度遅れて撮影される場合がある。
- 動画は1日分の撮影画像をまとめたもの。5分毎に更新される。
- フォルダ構成

```
└picam2
    ├data
    │  ├20230310 ----------------- 日付
    │     ├20230310_121509.jpg --- 撮影画像(年月日_時分秒.jpg)
    │     ├20230310_121509.txt --- 露光時間などの撮影時のカメラの設定
    ├movie
       ├20230310.mp4 ---------------- 静止画をつなげて作成した動画(年月日.mp4)
```

撮影画像と動画

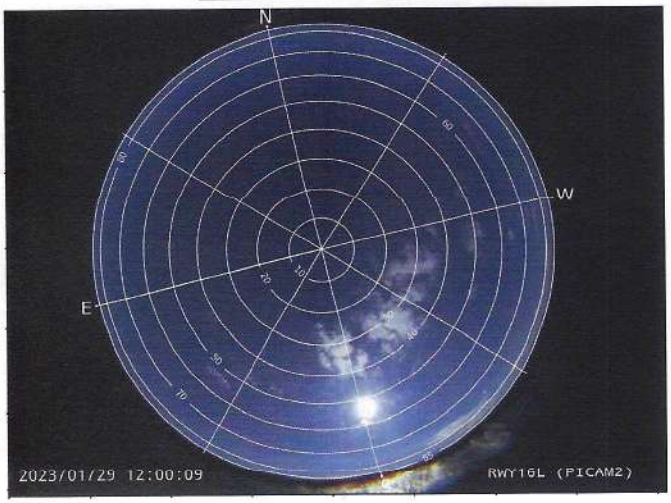
NESWは、方位。

ガラスドームの汚れ



撮影日時

天頂角・方位角



撮影地点名

パノラマ画像と動画

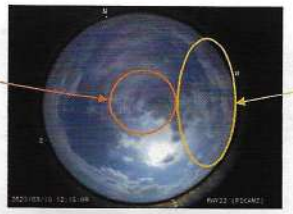
- 撮影画像をパノラマに展開した画像と動画。
- フォルダ構成

```
└picam2
    ├panorama
    │   ├20230310 ----------------- 日付
    │   │    ├20230310_121509.jpg --- 撮影画像(年月日_時分秒.jpg)
    ├panorama_movie
    │   ├20230310.mp4 ------------- 静止画をつなげて作成した動画(年月日.mp4)
```

パノラマ画像と動画

横軸の文字は方位。縦軸の数字は仰角。

仰角90度(天頂角0度)に近い部分は、元の画像の小さな領域を無理やり方位角方向に広げているため、横にのびて歪んでいる。



逆に、低仰角部分は、歪みが修正されるため、目視に近い像になる。

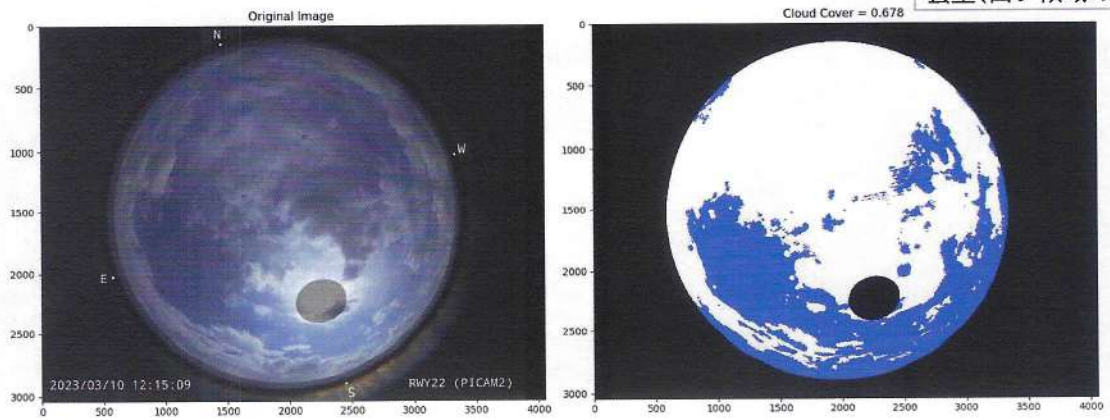
雲分布

- 撮影画像のRGB情報などから、ピクセル毎に雲か否かを判別し、雲の分布と雲量を導出している。
- フォルダ構成

```
└picam2
   ├cloud_cover
      ├cc
      │  ├20230310 --- 日付
      │     ├cc20230310_121509.jpg --- 雲判別結果
      ├sup
         ├20230310 --- 日付
            ├sup20230310_121509.jpg --- 雲判別に使用した各種データ
```

雲分布

雲量(白い領域の割合)



- 撮影画像
- 解析範囲は、天頂角0度から80度。
- ただし、太陽または月を含めない。
- 解析対象外の領域には、マスクをかけている。

- ピクセル毎の雲の判別結果。
  白: 雲
  青: 雲無し
  黒: 解析対象外

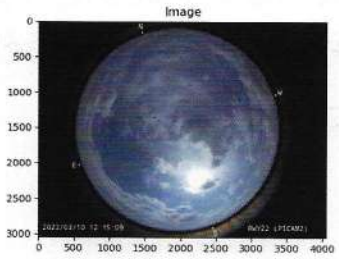
雲底高度

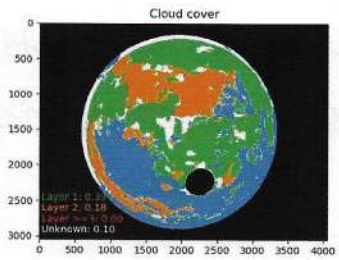
- 2地点の撮影画像から、ステレオ立体視によって、雲底高度の分布を算出している。
- 16L(PICAM2)の結果のみを出力。
- 雲底高度のヒストグラムから、各高度を代表する層を定義し、層ごとの高度をテキスト形式で出力している。
- フォルダ構成

```
└picam2
    ├cloud_base_height
        ├cbh
            ├20230310 --- 日付
                ├20230310_121509.jpg --- 雲底高度の分布
                ├20230310_121509.txt --- 各雲層を代表する雲底高度
```

雲底高度

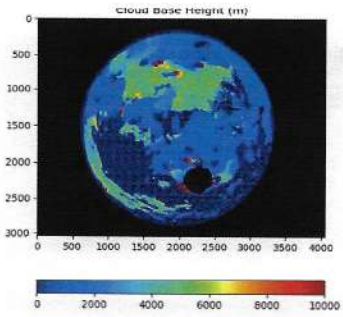
撮影画像

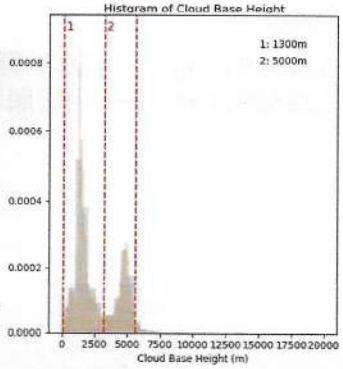




- ヒストグラムから判別した雲層の分布。
- 高度が分からなかった層は、高度不明(Unknown)とした。

雲底高度の分布





- ピクセル毎の雲底高度から作成したヒストグラム。
- 大きなピークを検出し、雲層として定義した。
- 高度が低い層から順番に番号をつけている。
- 数値は、各層のピークの雲底高度。

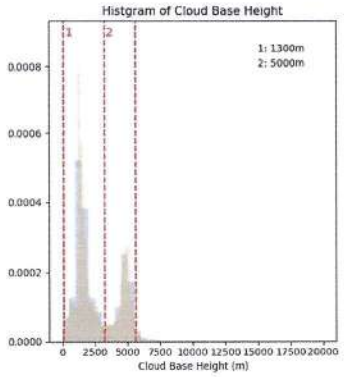
雲底高度

各雲層を代表する雲底高度のテキストデータ

```
File,/mnt/hdd1_12tb/climate3/observation/haneda/picam2/cloud_base_height/cbh/20230310/20230310_121509.png
Date_Time,20230310_121509
Layer number,{ncpeaks}
LayerMask,Cloud_cover,Peak_height(m),Mean(m),STD(m),25P(m),50P(m),75P(m)
Clear,0.322201094559581,0,0,0,0,0,0
Unknown,0.10232898108065933,0,0,0,0,0,0
Layer 3,0.3905241058152173,1300.0,1550.0472412109375,576.0076904296875,1261.2545166015625,1465.9652099609375,1805.646484375
Layer 4,0.18494581854454237,5000.0,4699.443359375,525.1171875,4449.94921875,4793.44921875,5066.54736328125
```

- File: 対応する画像データのファイル名。
- Date_time: 日付と時刻。
- Layer number: 雲層の数。{ncpeaks}はバグ。
- LayerMask: 各雲層の名前。
  - Layer 3は、ヒストグラムの雲層1のこと。数字のズレはバグ。
  - Clearは、雲無しの領域。
  - Unknownは、雲底高度を判別できなかった雲の領域。
- Cloud_cover: 雲量。
- Peak_height(m): ヒストグラムのピーク値。
- Mean(m):平均値。
- STD(m): 標準偏差。
- 25P(m): 25パーセンタイル。
- 50P(m): 50パーセンタイル。
- 75P(m): 75パーセンタイル。

＊パーセンタイルは、データを小さい順に並べたとき、値の順位を百分率で表したもの。
50パーセンタイルは中央値と同じ。



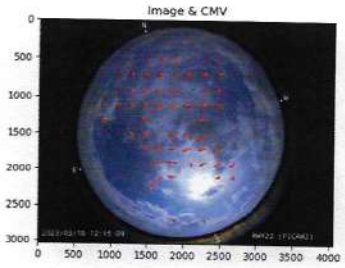
雲の移動ベクトル

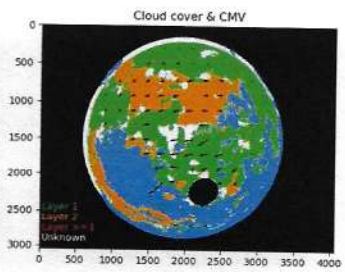
- 短い時間差の2枚の画像から、雲をトラッキングすることで、雲の移動ベクトルを算出している。
- 移動ベクトルの分布画像と、雲底高度算出時に定めた各雲層を代表する風向風速をテキスト形式で出力している。
- 雲底高度の情報と合わせると、各高度の風向風速が得られることになる。
- フォルダ構成

```
└picam2
   ├cloud_motion_vector
      ├cmv
         ├20230310 --- 日付
            ├20230310_121509.jpg --- 雲の移動ベクトルの分布
            ├20230310_121509.txt --- 各雲層を代表する移動ベクトル
```

雲の移動ベクトル

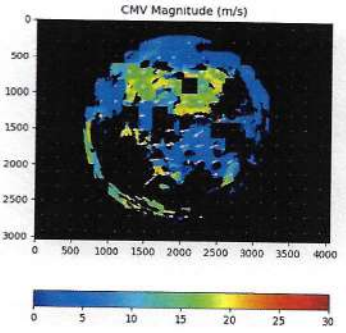
- 撮影画像と移動ベクトル
- ベクトルは、雲が画像内で何ピクセル分移動したかを表している。

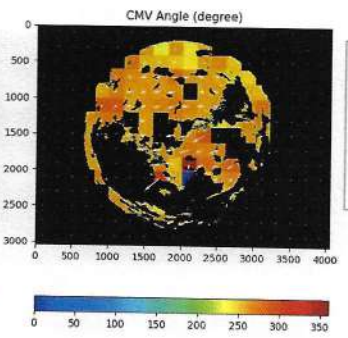




- 雲層と移動ベクトル

- 移動速度と移動ベクトル
- 移動速度は、その高度の風速に等しい。





- 移動方向と移動ベクトル
- 移動方向は、風向と同じ定義。
  北から南へ移動(北風):0/360度
  東から西へ移動(東風):90度
  南から北へ移動(南風):180度
  西から東へ移動(西風):270度

雲の移動ベクトル

各雲層を代表する移動ベクトルのテキストデータ

```
File,./out/cmv/20230310/20230310_121509.png
Date_Time,20230310_121509
Layer number,2
CMV Magnitude (m/s)
Layer,Mean,STD,25p,50p,75p
1,5.321515135116345,2.726850869093023,3.588040056939981,5.089930579732179,6.290068599183998
2,16.633042116252046,3.21899274220331,15.184278418726871,17.010555155584775,18.60425716635656
CMV Angle (degree), 360(0) for North, 90 for East, 180 for South, 270 for West
Layer,Mean,STD,25p,50p,75p
1,262.87586757030675,32.758963268006674,256.42119563437825,265.4655985438802,272.62138885134834
2,264.07174272448265,11.200290637879702,261.76961586646803,264.1262652557316,265.84534838009586
```

- File: 解析結果のファイル名。
- Date_time: 日付と時刻。
- Layer number: 雲層の数。
- CMV Magnitude (m/s): 移動速度。風速に等しい。
- CMV Angle (degree): 移動方向。風向と同じ定義。
- LayerMask: 雲層の番号。雲底高度の解析結果と同じ。
- Mean: 平均値。
- STD: 標準偏差。
- 25P: 25パーセンタイル。
- 50P: 50パーセンタイル。
- 75P: 5パーセンタイル。

移動方向は、風向と同じ定義。
北から南へ移動(北風):0/360度
東から西へ移動(東風):90度
南から北へ移動(南風):180度
西から東へ移動(西風):270度

It's quite complicated, so please contact me if you have any questions.

I don't think you can install AnyDesk within the Meteorological Research Institute network, so you will need to temporarily switch networks or install it at home.

・When connecting from outside

Case 1

Install AnyDesk on the remote Windows and also install AnyDesk on your home PC. Connect to the remote Windows from your home PC with AnyDesk.

Connect to the camera's Raspberry Pi from Windows using VNC or Windows Remote Desktop (see Remote Desktop Connection below).

Case 2

If you also install AnyDesk on the Raspberry Pi, you can connect to the Raspberry Pi directly from your home PC with AnyDesk without going through the remote Windows.

See below for information on installing and setting up AnyDesk.

・AnyDesk

Install AnyDesk on Windows and Raspberry Pi, and set up unattended access to connect from outside.

https://anydesk.com/ja/downloads/raspberry-pi

https://www.blue-star.jp/introduction-of-anydesk-for-easy-control-of-home-pc-from-outside-the-home/

Unattended access https://support.anydesk.com/ja/knowledge/unattended-access

・Remote desktop connection

Connect to Raspberry Pi from Windows using remote desktop.

https://www.raspberrypirulo.net/entry/remote-desktop

・Transfer observation data from a remote Windows to the Meteorological Research Institute

Case 1

Synchronize with NextCloud.

Case 2

Mirror to mri-2.mri-jma.go.jp using WinSCP.

WinSCP
https://forest.watch.impress.co.jp/library/software/winscp/
https://winscp.net/eng/docs/lang:jp

WinSCP mirroring
https://9-bb.com/winscp%E3%81%A7pc%E3%81%A8%E3%82%B5%E3%83%BC%E3%83%90%E3%83%BC%E3%81%AE%E5%90%8C%E6%9C%9F%E3%81%A8%E3%83%9F%E3%83%A9%E3%83%BC%E3%83%AA%E3%83%B3%E3%82%B0%E3%82%A2%E3%83%83%E3%83%97%E3%83%AD%E3%83%BC/

・Transfer the image data from the Raspberry Pi to the mri-2
Log in to the Raspberry Pi and create a key with ssh-keygen -t rsa.
Copy .ssh/id_rsa.pub to the mri-2.
On the mri-2,
cat id_rsa.pub >> ~/.ssh/authorized_keys
Check whether you can connect to the mri-2 via ssh from the Raspberry Pi without a password.
Once you've done this, the preparation is complete.
Connect to the Raspberry Pi and edit the shooting commands (capture.py and capture_tmp.py) in a text editor.
If you turn on the switch below, the shooting data will be synchronized every time you take a photo.

```
# Setting of data transfer
sw = 1 # On (1), Off(0)

The synchronization source and destination are set below.

indir = f'/media/picam/ESD-EMA/observation/data/{y:04}{m:02}{d:02}/'
outdir = f'/home/mriobs/observation/kozushima/picam2/data/{y:04}{m:02}{d:02}/'
cmd_data_transfer = 'rsync -auz -e ssh ' + indir + ' mriobs@mri-2.mri-jma.go.jp:' + outdir
```

You also need to set the latitude and longitude (lon, lat) of the installation location and the offset from UTC (dh).

Remote Desktop AnyDesk

Introducing AnyDesk

[AnyDesk]

Introducing AnyDesk

AnyDesk is a simple, fast, multilingual remote desktop. You can easily connect to a remote computer using a workspace ID. It is free for personal use, but there is a fee for business use.

Compatible with all platforms:

Get started

[AnyDesk]

Start using 1

Here's how to access Ubuntu remotely using the Windows version of AnyDesk. First, access this page from the connection source and click "Download now for free" to download it.

Start using 2

When you open the application downloaded from the connection source, the following screen will be displayed. ÿ Click "Install AnyDesk" here. ÿ
Select "Agree and install" in the opened tag to complete the installation.

Start using 3

ÿ Download AnyDesk in the same way at the connection destination. ÿ You can see that the workspace address to connect to is "100 100 100".

1

2

Remote Access Methods

[AnyDesk]

Remote Access Method 1

[Unmanned Access 1]

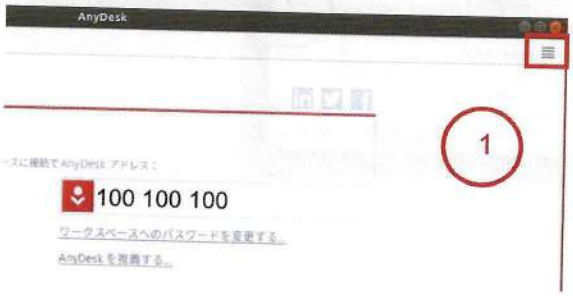
Let's actually use AnyDesk to access Ubuntu from Windows. Here, we will

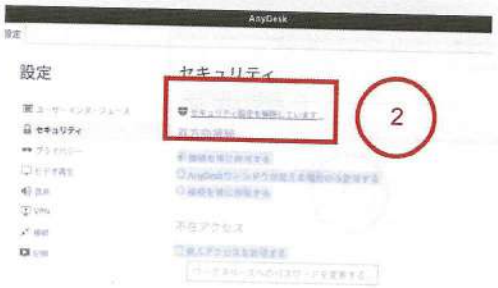
use "unattended access" which does not require manual approval when connecting (you set a password instead of approval). 1. First,

set a password at the connection destination. Click the button in the upper right of the following dialog . Click the button to open the settings menu.

ÿ Go to the "Security" tab in the connection menu and select "Disable security settings" Click "I'm

(You will need to enter your computer password here.)





Remote Access Method 2

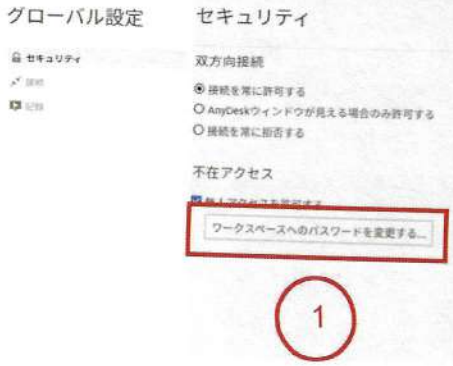
[Unmanned Access 2]

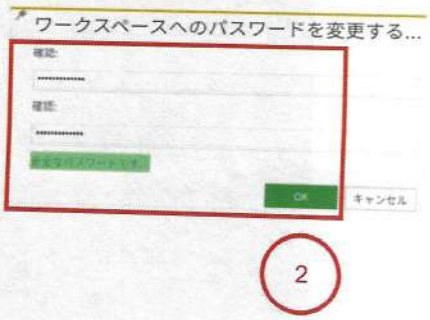
After that, the window with global settings for the connection (see left) will open.

ÿ Check "Allow unattended access" ÿ Click

"Change workspace password..." to set a password.

R





Remote Access Method 3

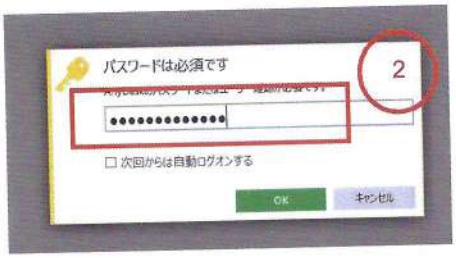
[Unmanned Access 3]

Once the settings are complete, return to the Windows desktop from

which you want to connect. 1. In "Other Workspaces" on the Windows desktop, enter the Ubuntu workspace address "100 100 100" that you confirmed earlier, and click "Connect."

ÿ In the dialog that opens, enter the workspace password.

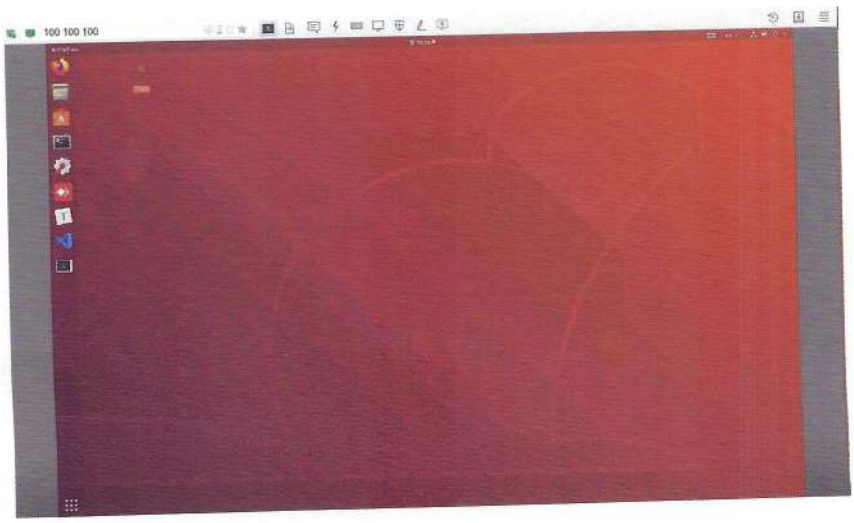
1



Remote Access Method 4

[Unmanned Access 4]

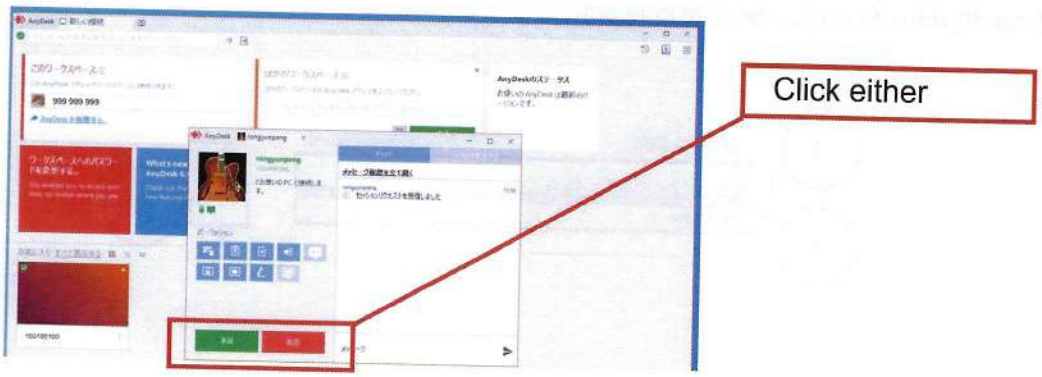
Connection complete screen



Remote Access Method 5

[Access by ID]

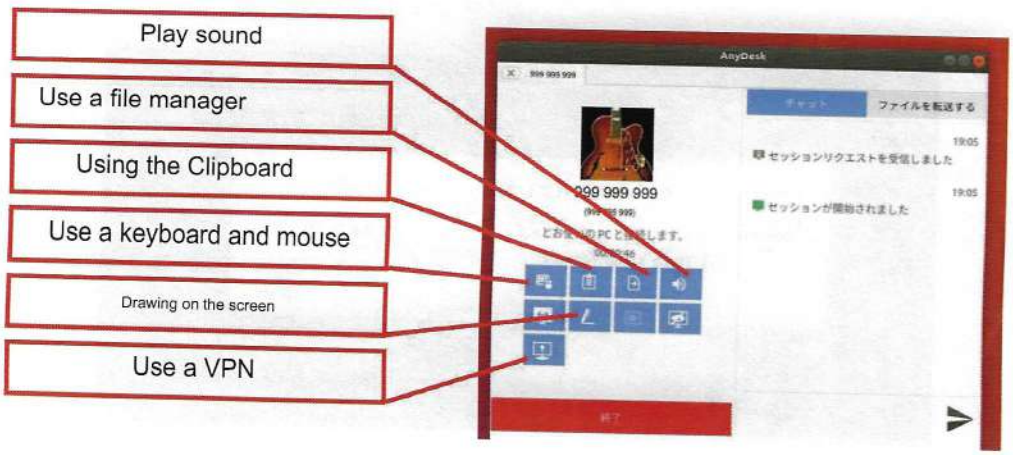
When connecting with AnyDesk, you can connect just by entering the ID. However, if you do not set a password first, you will need to manually approve the connection from the other party.



Remote Access Method 6

[Security Settings 1]

By operating the control panel of the remote device, you can grant various privileges to the remote device. The most commonly used functions are as follows:



Remote Access Method 7

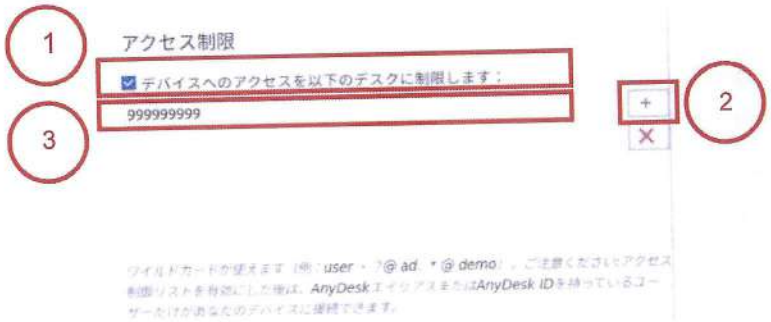
[Security Settings 2]

For security reasons, we recommend that you set access restrictions at the destination. 1.

Open the global settings of the destination and select "Limit device access" under "Access Restrictions".
Check the option "Limit to the following desks"

ÿ Click the "+" button. ÿ Enter the

AnyDesk ID from which you want to connect.

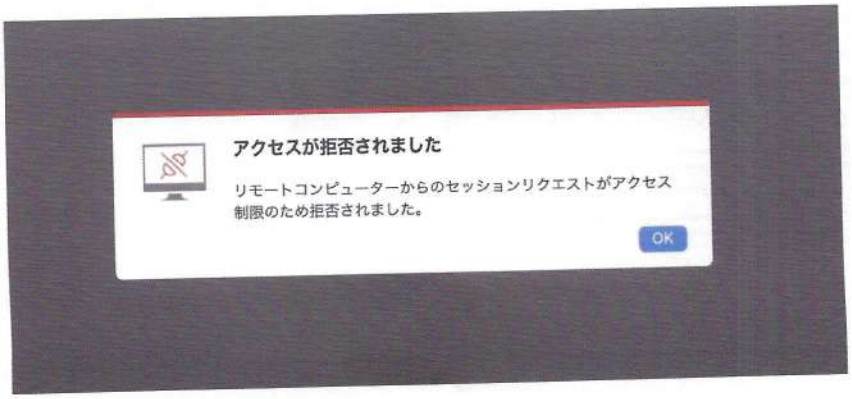


Security Settings

[Security Setting 3]

If you set access restrictions, only users on the list will be able to connect to this device.

If a user not on the list attempts to connect, the following screen will be displayed.



Diverse remote functions

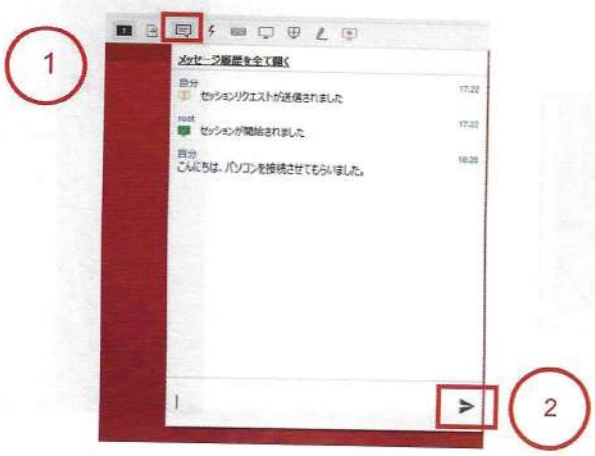
[AnyDesk]

Various remote functions 1

[Chat function]

You can use the chat function to exchange messages between the connection source and the connection destination.

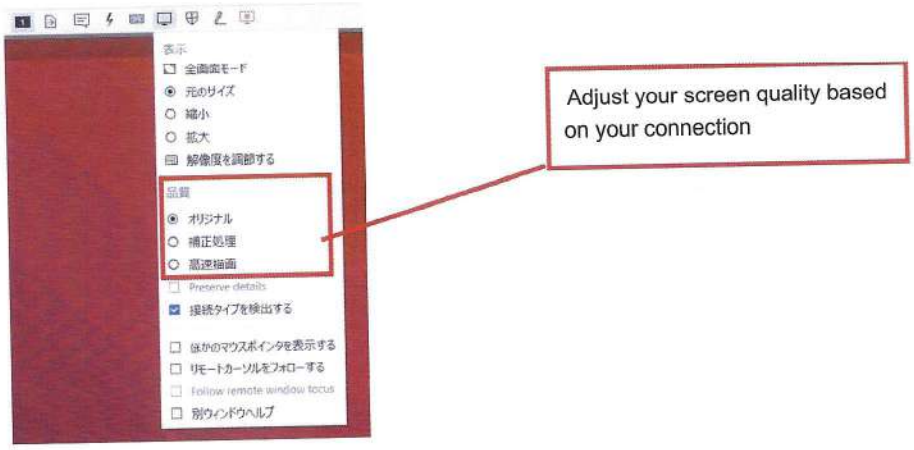
ÿ Click the "Chat" button in the top toolbox. ÿ Enter your message and send it.



Various remote functions 2

[Screen display settings 1]

You can configure various screen display settings by clicking the "Display Settings" button in the top toolbox of the connection source.

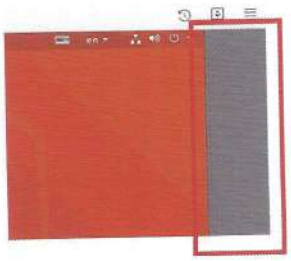


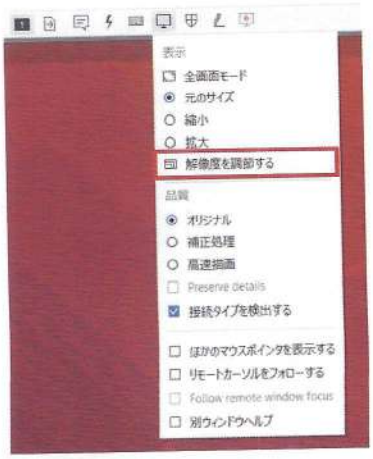
Various remote functions 3

[Screen display settings 2]

Since monitors have different resolutions, you may have problems occupying every corner of the screen as shown on the left.

This can be fixed by clicking "Adjust resolution".

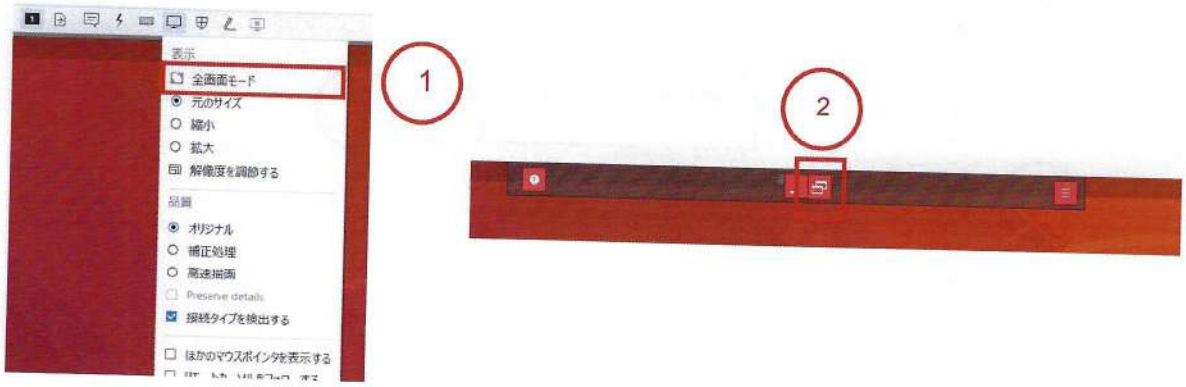




Various remote functions 4

[Screen display settings 3]

ÿ If you are in "full screen mode" and want to return to the original screen, move your mouse to the top of the screen. ÿ Click the button.



Various remote functions 5

[Restart the connection destination]

You can use AnyDesk to restart the connected computer. ÿ Open the "Action" pull-down menu in the top toolbox. ÿ Select "Restart the computer." ÿ Select "Normal restart."

Various remote functions 6

[Audio transmission]

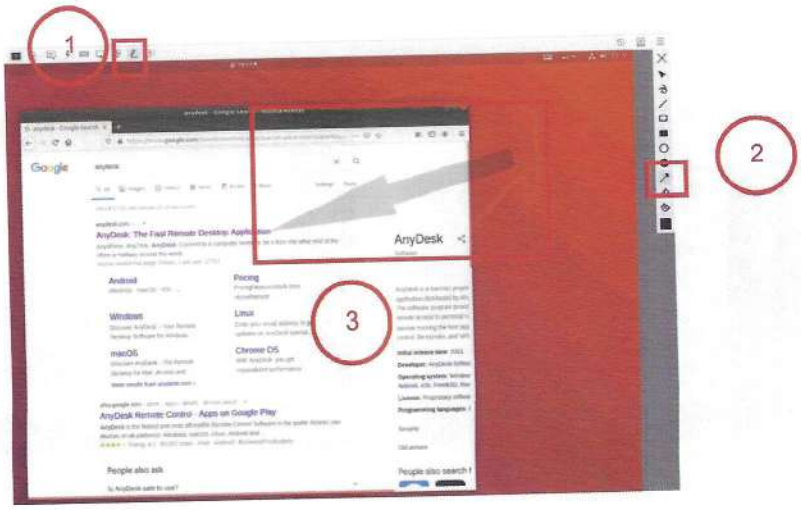
ÿ Operate the "Audio" tag in the destination settings (so that the audio from the destination can be played on the source). ÿ As shown below, check the option "Enable audio transmission and reception" and select "Transfer workstation audio output."

Various remote functions 7

[Drawing on the screen]

You can use the "Whiteboard" in the top toolbox to draw on the screen.

I drew an arrow on the screen by following these steps:

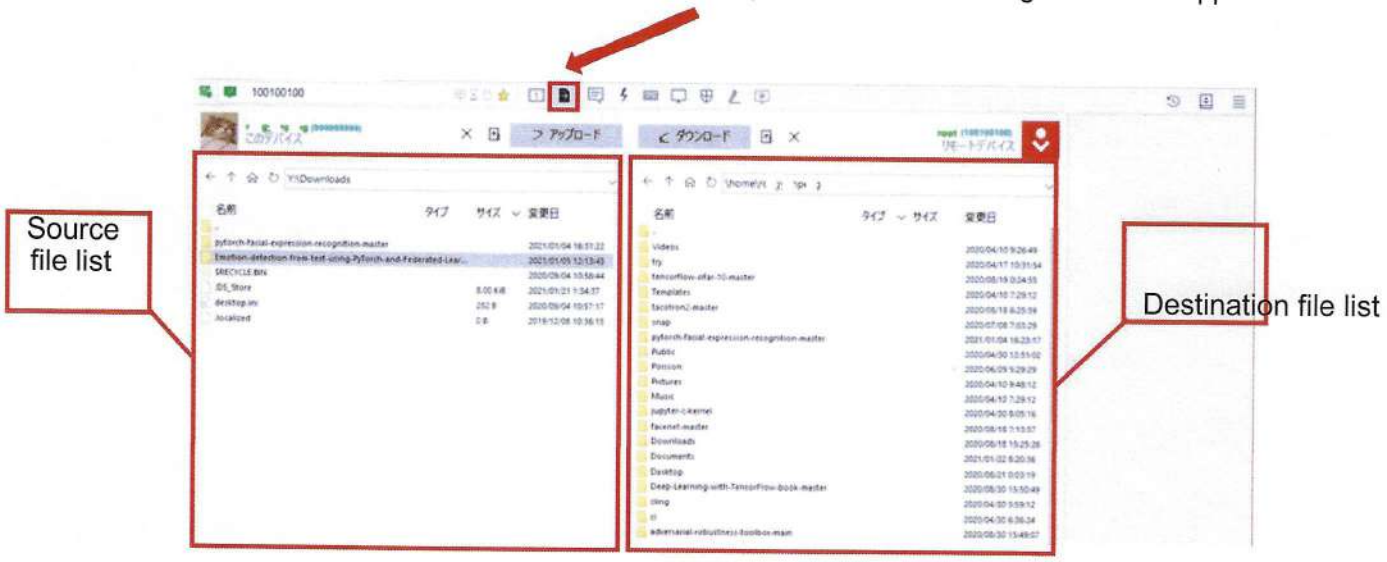


Various remote functions 8

[File transfer 1]

You can use the AnyDesk desktop to transfer files between your remote and remote devices.

When you click the "Start File Transfer" button in the top toolbox, the following screen will appear.



Various remote functions 9

[File transfer 2]

To transfer a file to the destination, follow the steps below. 1.

Select the file you want to transfer.

2. Click "Upload." 3. When the

message "Complete" appears on the right side of the screen, the transfer is complete.