INSTALLATION AND MAINTENANCE QUICK MANUAL

DataRain-4000

Electronic Weighing

Precipitation Sensor

EN

V1.0

senseca

Contents

1 Introduction

The DataRain-4000 is a precipitation sensor based on a weighing system featuring high accuracy and sensitivity. Its high precision along with its wide operating range makes this sensor adequate to measure precipitation under most intensity conditions.

The sensor includes an automatic draining system controlled by a position encoder that allows long-time operation collecting an unlimited volume of precipitation.

Output data can be supplied through a wide variety of interfaces and protocols, making DataRain-4000 compatible with any datalogger in the market.

The DataRain-4000 is available in two configurations: SR (Standard Resolution, default) and HR (High Resolution). The SR type operates without the need for a wind ring, while the HR type offers higher sensitivity but requires a wind ring for optimal performance.

Models/collecting area	200 cm2 / 400 cm2 collecting area
Accuracy	0.3 % (over the whole precipitation intensity range)
Operating range	0-2000 mm/h
Resolution	0.001 mm (Precipitation) / 0.001 mm/h (Intensity)
Power supply	(Sensor) 9 to 20VDC 20W (Heating Kit) 18 to 24 VDC (30W max. @ 24VDC / 15W max. @ 18VDC) *Fuses must be mounted in the power supply lines: (Sensor) 3.15A 5x20mm fast fuse (Littelfuse ref: 06173.15MXP) (Heating Kit) 2.5A 5x20mm fast (Littelfuse ref: 021702.5HXP)
Power consumption	< 35 mW typ. (Reed/Solid State Relay, NMEA) < 60 mW typ. (SDI12 requests every 5 s) < 182 mW typ. (Modbus & Proprietary Protocol) < 24 W max. during 2 s long draining event (every 8h)
Heating kit (optional)	24W heater powered from 18VDC to 24VDC that deliver a power of 13.5W to 24W
Dimensions (ext.)	Model 200 cm2: 330 x Ø 203 mm Model 400 cm2: 370 x Ø 270 mm
Interfaces	Reed/Solid State Relay, RS-232, RS-485, SDI-12, USB
Protocols	Pulses (Reed/Solid State Relay), Proprietary Binary Protocol, ASCII/NMEA, Modbus RTU, SDI-12
Operating temperature	Heated (no icing, no snow blowing): -40 ºC to +70 ºC Heated: -30 ºC to +60 ºC Unheated: 0 ºC to +60 ºC

2 DataRain Elements

(2) Cartridge filter

Stainless steel cartridge filter that prevents the entry of dirt, leaves, etc. to the accumulation chamber.

(5)Cylinder cover

Repulsed anodized aluminum.

(13) Reset & restore button

Different functions are available depending on the time it is pressed.

(12) Pressure compensation

It avoids any water condensation inside the electronic unit.

(8) Level and adjustment knobs

Three adjustment knobs and a spirit level to ensure proper internal leveling.

(6) Knurled screws

Three external units to ease removing the cylindrical cover.

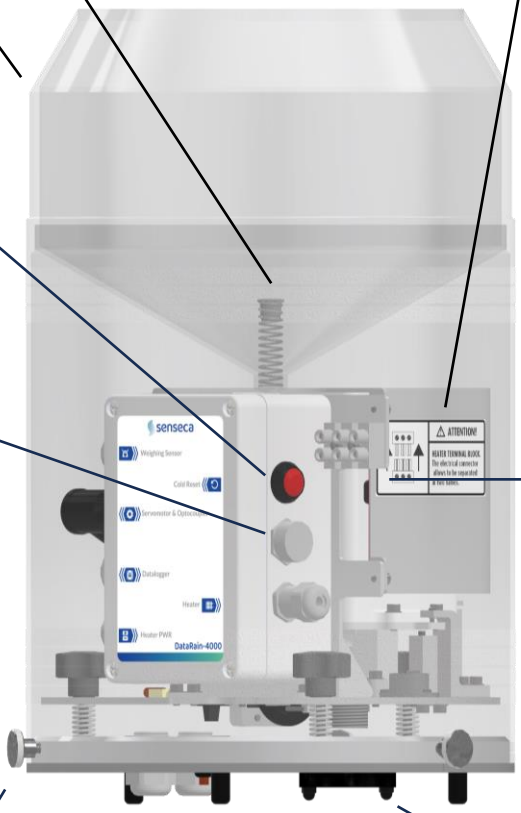
(9) Temperature probe

For smart operation and efficient heating control.

(1) Funnel-shaped collecting fixture

Precipitation collection towards the internal accumulation chamber.

Models: 200 or 400 cm2 collecting areas.



(10) Transport legs

The sensor is supplied with 3 legs that will be removed during installation.

(4) Electronic unit

IP66 electronic management unit for optimum low-power operation, filtering out vibration induced by strong winds, data exchange protocols, etc.

(3) Accumulation chamber

The collected precipitation is accumulated inside the internal accumulation chamber. The accumulated precipitation is processed every second and the chamber is automatically drained after the precipitation event is finished.

(14) Self-heating fixture

The optional heating kit includes a 24 W heater mounted sticked on the funnel inner surface to melt down solid precipitation accumulated on the external collector. When the cylinder cover is removed (e.g. maintenance), the heater power supply cable must be disconnected from the terminal block, which helps separating the whole assembly into two sub-assemblies.

(11) Anti-insect filter (opt.)

Cleanable and removable filter that prevents the entrance of insects in the measuring area.

(7) Draining management

Automatic self-controlled draining system with an internal position encoder.

3 Installation and start up

3.1 Remove the transport protection parts

The DataRain-4000 unit is supplied with shock protection parts to prevent any damage during transportation. In order to remove them:

a. Release the 3 knurled screws (6) and remove the cylinder cover (5). For units including the optional heating kit, proceed to carefully disconnect the heater from the terminal block (14) while removing the cylinder cover.
b. Proceed to remove both (elastic band and silicone strip) anti-shock protections. The elastic band to me removed is factory mounted around the electronic box and the accumulation chamber. The silicone strip is inserted between the electronic box and the accumulation chamber. The removal of these parts is essential for proper operation of the sensor.

3.2 Sitting and assembly considerations

Attention!

In general, the DataRain-4000 is supplied with factory settings that are valid for most project requirements (see section 3.5). An extended DOC with advanced instructions to fully manage the sensor is available.

Before installing the sensor, these recommendations must be followed:

- **Select a site** representative of the true rainfall or snowfall over the area. Sites free of wind gusts are recommended to minimize wind effects. The best sites are often found in clearings within forests or orchards and spaces isolated from dirt as dust, leaves, etc. to avoid early funnel clogging.
- **Minimum height**. The sensor must be installed high enough such that the draining area level (base) is above the maximum expected snow level at the site.
- **Strong anchorage**. Stable mechanical mounting and strong fastening are key for the precipitation sensor good performance.

3.3 Installation scenarios for DataRain-4000

1. **Mounted on SPL-4100 pedestal** (recommended). It must be fastened onto a concrete footing as shown in the diagrams (see section 3.4.a.1).
2. **Mounted on stainless steel support arm attached to lattice tower** (see section 3.4.a.2). This type of installation has some drawbacks so it is required to analyze before purchase process. It is only recommended when the installation site meets these conditions:
    a. Low wind speed exposure.
    b. The vegetation height nearby the station needs to be checked from time to time to make sure it does not obstruct precipitation from falling inside the rain gauge.
    c. The maximum admissible snow level must be below 40 cm (periodic snow clearing works must be considered for snowy sites).

3.4 Remove the transport protection parts

a. See the following installation schemes according the scenario selected.
   (1) SPL-4100 pedestal (Recommended). Valid for units labelled as HR and SR.

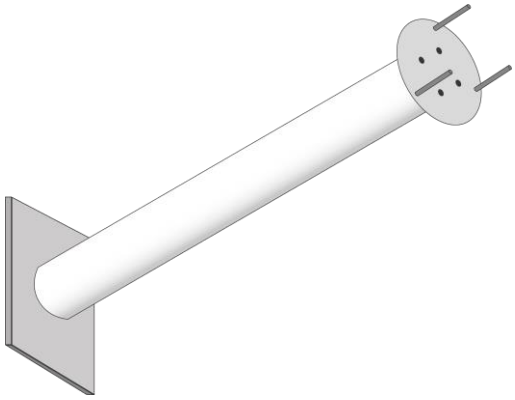


Fig. 3.1: SPL-4100

(2) Stainles steel support arm to tower. Valid for units labelled as SR.

Fig. 3.2: Support arm to tower

b. Mount the external supporting base (Ref. 1515.0153 for pedestal or Ref. 1515.0152 for arm to tower). Adjust and then tighten all the screws to ensure that the upper surface remains horizontal within ±0.5°.
c. Mount 6cm hex spacers on the holes found on the external supporting base. This raises the sensor's bottom baseplate to help cleaning the anti-insect filter (see section 5).
d. Ensure the cylinder cover is removed from the precipitation sensor (as explained in 3.1.a).
e. Place and fasten the precipitation sensor over the external supporting base. The sensor cable glands must be aligned with the oblong hole of the external base. The sensor outlet must be placed over the circular hole of the external base.
f. Adjust the sensor inner baseplate knobs to align the spirit level (8) so that the plate remains perfectly horizontal.

3.5 Wiring diagrams

The following table includes the cable requirements for the connection between logger and sensor.

Requirement	**For single interface connection and heater**	**For dual interface connection**
Wires	Shielded, 4-wire cable	Shielded, 6-wire cable
Min. conductor cross-section	0.75 mm^2	0.25 mm^2
Maximum length	10 m	3 m

Other cable features are:

- Stranded copper conductor with flexibility Class II (IEC60228)
- Insulation of cross-linked polyethylene (XLPE)
- Assembly laid-up together, wrapped with polyester tape
- Overall shield of bare copper wire with 60 % optical coverage
- Operating temperature: -30 ºC to 70 ºC

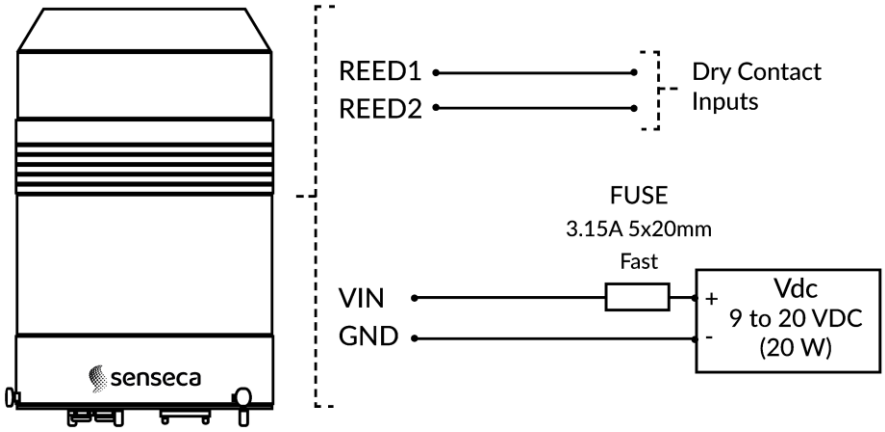


Fig. 3.3: Connections – Relay Reed interface

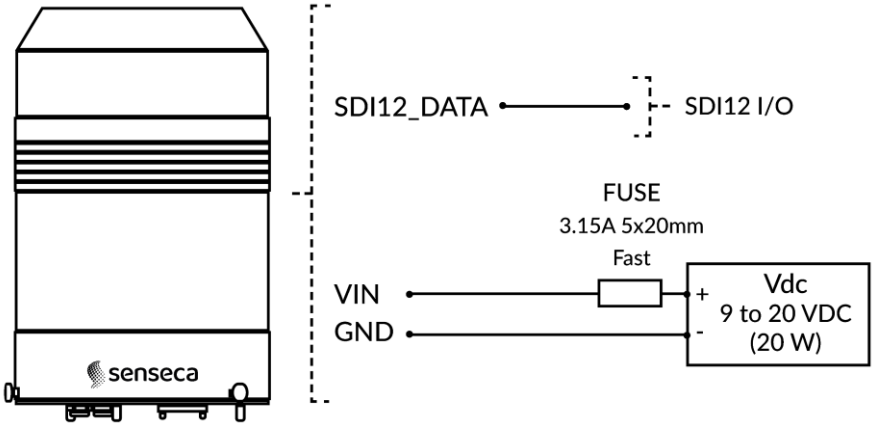


Fig. 3.4: Connections – SDI12

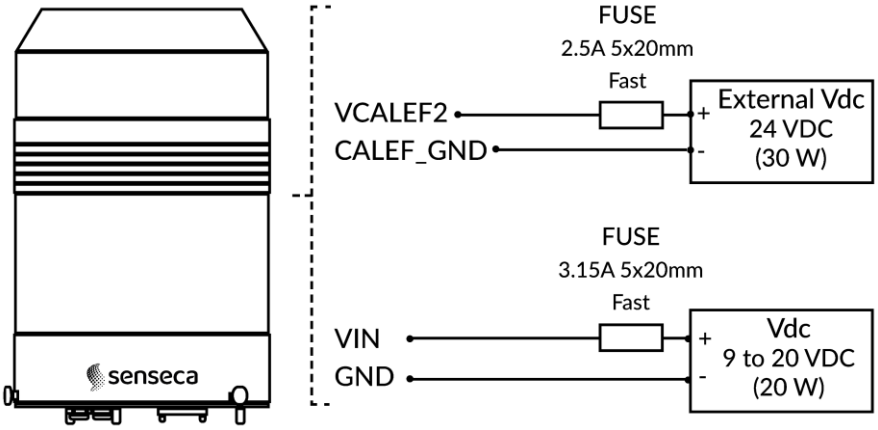


Fig. 3.5: Connections - Heater

4 Operation

4.1 General description

- **Precipitation measurement**. The precipitation collected by the funnel-shaped collecting piece (1) falls into the internal accumulation chamber (3), where it is measured by weighing principle. The weighing information is internally filtered and processed to provide the adequate and accurate precipitation measurements.

- **Data output**. Once the precipitation information is calculated, it is delivered through the interface/s and protocol/s previously configured by the user. Read section 3.6.

- **Automatic electronic draining management**. Unlimited cumulative precipitation can be measured due to the sensor's electronic draining management under the following conditions:

    - **After precipitation events**. The sensor detects the precipitation end and performs an automatic draining process.
    - **During precipitation events (not frequent).** When the precipitation accumulated on the internal chamber reaches a maximum threshold, the sensor performs an automatic draining process.
    - **Safety draining routines**. Periodically, the sensor performs a draining process to ensure that both the precipitation is entirely thrown out and the electronic draining module operates properly.

- **Self-diagnosis information**. The sensor supplies some extra internal status data. This information is bit-coded forming a 16-bit code updated every second. The Sensor Status Coded Data provides information about the internal hardware status, the draining events in the last minute, the draining system status, etc.

- **Low temperatures**. A self-managed heating kit with built-in smart energy-efficient heating control can be optionally mounted inside the precipitation sensor. It has been designed and adapted to perform the melting process when measuring solid precipitation.

4.2 Firmware operation timeouts

The following table is intended to clarify the timing for routines implemented in the DataRain-4000 firmware.

Function during precipitation sensor operation	Timing
Automatic draining events:	
N seconds after a precipitation event[1]	600 seconds
Periodic safety draining routine[1]	8 hours
Draining during precipitation (if precipitation accumulated in the chamber exceeds a threshold) [1]	NA
Maximum duration of draining event[1]	10 seconds
Weighing reference refresh:	
Precipitation Mode.	NA
No precipitation mode[1]	30 minutes
Reset button operation: The button is pressed during:	Time
Reset	< 1 seconds
Cold reset (the internal program is restarted)	≈ 4 seconds
Menu interface user settings restored to factory default: RS232, 9600, N, 8, 1	≈ 10 seconds
Menu mode.	
Automatically disabled after N min since last key was pressed. During 'menu mode' precipitation is not measured.	5 minutes

4.3 Protocols and data supplied

The DataRain-4000 precipitation sensor provides additional data obtained from precipitation measurement data processing and self-diagnosis information:

Information	Description	Unit	Format	Update
Intensity of precipitation	Average Intensity of precipitation in the last minute.	mm/h	IEEE 754 32-bit float	1 min
Intensity Control	Counter increased every time the intensity is updated.	-	Unsigned integer	NA
Accumulated Precipitation	Total accumulated precipitation since DataRain deployment. Option to restore to '0' via serial/USB user menu	mm	IEEE 754 32-bit float	1 sec
Precipitation in accu. chamber	Precipitation accumulated in the internal chamber.	g	IEEE 754 32-bit float	1 min
Temperature	Temperature provided by the internal temp. probe.	ºC	IEEE 754 32-bit float	1 sec
Status	16-bit diagnosis information	NA	Unsigned integer	1 sec

[1] Value for DataRain-4000-EDM labelled with SR. Customizable from the advanced menu.

The diagnosis information is returned as a 16-bit unsigned integer with the following information:

Bit 0: Cold reset in last min.

Bit 1: <Reserved>

Bit 2: Draining process not completed

Bit 3: <Reserved>

Bit 4: Hardware self-diagnosis status

Bit 5: Heater ON (1)/OFF(0)

Bit 6: Temp. out of range

Bit 7: <Reserved>

Bit 8: Automatic draining event in last minute

Bit 9: Draining module status

Bit 10: Freezing status

The information supplied by DataRain-4000 depends on the interface and protocol used to communicate with the logger:

Interface	Protocol	Data Refresh	Intensity (mm/h)	Intensity Control	Accumulated Precipitation (mm)	Precipitation in accumulation chamber (g)	Temperature (ºC)	Status
Reed/Solid State Relay	NA	NA			✓			
RS-232 or RS-485	Proprietary	Polled	✓	✓	✓	✓	✓	✓
	ASCII/NMEA	1-60 s	✓	✓	✓	✓	✓	✓
	Modbus	Polled	✓	✓	✓	✓	✓	✓
SDI-12	SDI-12	Polled	✓	✓	✓	✓	✓	✓

For more information on the content of each protocol, please refer to the associated manual.

5 Operation

5.1 Periodic over all cleaning

With the purpose of keeping the sensor high accuracy over time, at least two over all cleaning tasks should be completed per year, under normal operating conditions. However, the frequency of these tasks changes depending on the dirt, dust, pollen, leaves, insects, etc. present near the installation site.

Follow these steps for periodic over all cleaning:

1. Switch either the datalogger off or the DataRain-4000 external power supply off. This will prevent it from collecting unreal data during cleaning operations.
2. Carefully clean the following elements:
   (A) Funnel shaped collecting piece and cartridge filter cleaning.
   (B) Anti-Insect filter cleaning (optionally mounted)
   (C) Accumulation chamber cleaning

5.2 Internal over all cleaning and revision

Occasionally, an internal over all cleaning and revision task should be completed. The frequency of this task changes depending on the dirt, dust, pollen, leaves, insects, etc. present near the installation site. Scheduling cleanup tasks every 6 months to 1 year is recommended.

Follow these steps for an internal over all cleaning and revision:

1. Follow the steps described in 5.1.
2. Check the sensor inside (draining area, leveling knobs, area between electronic unit and accumulation chamber). Ensure it is clean and free from insects.
3. Put the DataRain-4000 cylinder cover back to its original position and switch the datalogger / sensor power supply on.

5.3 Additional recommendations

During DataRain-4000 handling, take into account the following considerations:

Attention!
Never pull up or raise the sensor from the accumulation chamber. It could damage the weighing cell unit.

Attention!
Do not touch the automatic draining system while the sensor power supply is ON. Moving parts can cause injury.

Attention!
Silica gel desiccant is supplied inside the electronic unit. If you find it has lost its effectiveness or its color has changed, replace the bag by a new one.

NOTES

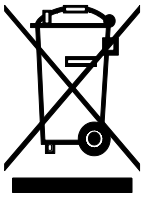
WARRANTY

The manufacturer is required to respond to the "factory warranty" only in those cases provided by Legislative Decree 6 September 2005 - n. 206. Each instrument is sold after rigorous inspections; if any manufacturing defect is found, it is necessary to contact the distributor where the instrument was purchased from. During the warranty period (24 months from the date of invoice) any manufacturing defects found will be repaired free of charge. Misuse, wear, neglect, lack or inefficient maintenance as well as theft and damage during transport are excluded. Warranty does not apply if changes, tampering or unauthorized repairs are made on the product. Solutions, probes, electrodes and microphones are not guaranteed as the improper use, even for a few minutes, may cause irreparable damages.
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales of Goods" apply.

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.
We reserve the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.

CE RoHS

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