HydroMet

User Manual

RainBal

KISTERS
Empowering decisions of tomorrow

12-2023 – 01-02-001

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I Disclaimer

The information provided in this manual was deemed accurate as of the publication date. However, updates to this information may have occurred.

This manual does not include all of the details of design, production, or variation of the equipment nor does it cover every possible situation which may arise during installation, operation or maintenance. KISTERS shall not be liable for any incidental, indirect, special or consequential damages whatsoever arising out of or related to this documentation and the information contained in it, even if KISTERS has been advised of the possibility of such damages.

Any errors found in any KISTERS product should be reported to KISTERS where every effort will be made to quickly resolve the problem.

This document is public.

II Safety Instructions

- Read the user manual including all operating instructions prior to installing, connecting and powering up the KISTERS RainBal. The manual provides information on how to operate the product. The manual is intended to be used by qualified personnel, i.e. personnel that have been adequately trained, are sufficiently familiar with installation, mounting, wiring, powering up and operation of the product.
- Keep the user manual on hand for later reference!
- If you encounter problems understanding the information in the manual (or part thereof), please consult the manufacturer or its appointed reseller for further support.
- KISTERS RainBal is intended to be used in hydrometeorological or environmental monitoring applications.
- Before starting to work, you have to check the functioning and integrity of the system.
  - Check for visible defects on the RainBal, this may or may not include any or all of the following mounting facilities, connectors and connections, mechanical parts, internal or external communication devices, power supplies or power supply lines, etc.
  - If defects are found that jeopardize the operational safety, work must be stopped. This is true for defects found before starting to work as well as for defects found while working.
- Do not use the KISTERS RainBal in areas where there is a danger of explosion.
- The present user manual specifies environmental/climatic operating conditions as well as mechanical and electrical conditions. Installation, wiring, powering up and operating the KISTERS RainBal must strictly comply with these specifications.
- Perform maintenance only when tools or machinery are not in operation.
- If guards are removed to perform maintenance, replace them immediately after servicing.
- Never make any electrical or mechanical diagnostics, inspections or repairs under any circumstances. Return the product to the manufacturer's named repair centre. You can find information on how to return items for repair in the relevant section of the KISTERS website.
-  Disposal instructions: After taking the KISTERS RainBal out of service, it must be disposed of in compliance with local waste and environmental regulations. The KISTERS RainBal is never to be disposed in household waste!
-  Inputs and outputs of the device are protected against electric discharges and surges (so-called ESD). Do not touch any part of the electronic components! If you need to touch any part, please discharge yourself, i.e. by touching grounded metal parts.

1 Introduction

Thank you for choosing our product. We hope you will enjoy using the device.

KISTERS manufactures, sells, installs and operates quality instrumentation, data loggers and communication technology. Products are designed with passion for environmental monitoring and with a deep understanding of the quality, accuracy and robustness needed to fulfil the requirements of measurement practitioners in the field.

The present User Manual will help you understand, install and deploy the device. If, however, you feel that a particular information is missing, incomplete or confusing, please do not hesitate to contact us for further support!

The HS RainBal is a rain gauge based on a weighing principle with self emptying functionality. The amount and the intensity of rainfall is determined by collecting rain in a bucket and by the continuous measuring of weight increments. Sophisticated algorithms are implemented to suppress the impact of temperature fluctuations, vibrations caused by wind, or evaporation.

The heated version RainBal is equipped with an inside funnel heater to melt solid precipitation by electrical energy into liquid.

1.1 Measurements and Data Processing

Principal measurements provided by HS RainBal are:

- Amount of precipitation registered since previous reading
- Total amount of precipitation (since power-on)
- Amount of precipitation registered during current or previous precipitation
- Precipitation intensity
- Temperature (internal or ambient, depending on configuration)
- Weight of the bucket content

The measurement of the precipitation amount is based on continuously measuring the weight of the bucket content. One **measurement cycle** takes **10 seconds**. At the end of each cycle all measured values are updated and prepared to be sent using a communication protocol. Any value can be read in any period greater or equal 10 seconds. Because of the algorithm implemented it can take up to 120 seconds to register complete amounts of precipitation fallen into the bucket, mainly depending on precipitation intensity and wind.

1.2 Interfaces

RainBal is equipped with the SDI-12 version 1.4 serial interface, RS 485 and a contact voltage-free pulse output for emulation of a tipping-bucket rain gauge. RS-485 various protocols can be used, e.g. MODBUS RTU, MODBUS ASCII. For comfortable maintenance work the Bluetooth LE and USB-over-Bluetooth interface is available.

1.3 Heated Version RainBal 200/314-H

The heater is powered by a separate power supply and is switched on automatically if the temperature falls below a preset threshold. The heating supply voltage can range from 10 to 30 VDC. The heating power depends on the voltage, there is no power regulator.

Heating Management

The heating can operate in one of four modes depending on the value of the **HEAT** parameter. Modes **0** (permanently off) and **1** (permanently on) are intended mainly for maintenance purposes, in modes **2** and **3** the heater is switched on or off automatically depending on the internal or ambient air temperature and the value of **THEAT** parameter.

Heating Mode 2

The heater is switched on if the temperature falls below the value of the **THEAT** parameter and switched off if the temperature rises above **THEAT** + 1°C. The factory preset value of **THEAT** is +4 °C.

Heating Mode 3

This mode can be used to save the heating energy. It is the same as mode 2 except that the heater is only switched on if precipitation is being detected. This allows the use of solar power packages and/or batteries during the winter period. In this case we do highly recommend to monitor and control the battery capacity by the connected data logger to measure battery voltage and current. In this case it is required that the logger is equipped with a relay to switch and connect the heater battery to the heater terminals of the instrument.

Further support and consulting on request, depending on geographical location and altitude of the site.

1.4 Mounting

See the separate RainBal installation guide that is included in the scope of delivery and can be downloaded from the website.

2 Installation

See the separate RainBal installation guide that is included in the scope of delivery and can be downloaded from the website.

Installation for Measuring Heights of 1.0 and 1.5 m

RainBal can be mounted on a 2" threaded pole with ground plate corresponding to the HS TB series. In addition, a mechanical mount bracket HS 334 is required (3-point to inner threaded 2" pipe adapter).

See mounting Instructions: HS 334 Multi Adapter for RainBal.

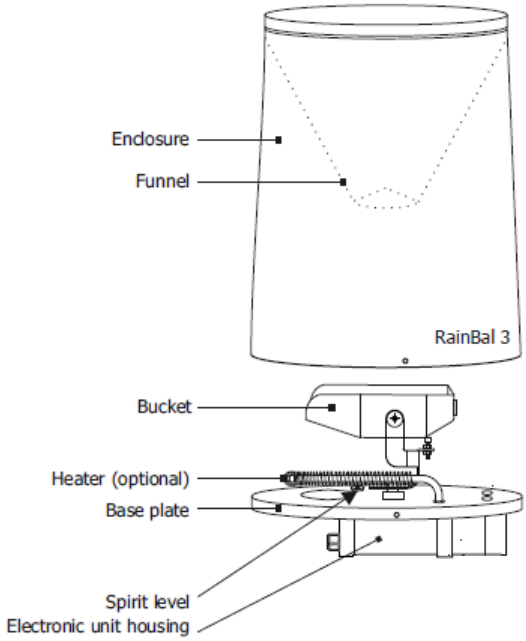

Figure 1 – Overview of sub-assemblies

Measuring height RainBal with HS 334X adapter	Pos 9: Length 2" threaded pipe
1.0 m	300 mm
1.5 m	800 mm

Consult these chapters for installation instructions.

- General Requirement 8
- Preparing the Precipitation Gauge for Mounting 9
- Mounting the Precipitation Gauge on the Pedestal 9
- Mounting the Precipitation Gauge on a Pole Using the Pole-Mounting Adapter 9
- Finishing Installation 9

2.1 General Requirement

The site for installing a precipitation gauge should be open but not too windy. The distance from the gauge to any surrounding object should be at least twice the height of the object above the gauge orifice. As for the height of the orifice please follow local regulations and/or requirements. The most commonly used height varies between 1.0 and 1.5 m above the surrounding terrain. In any case the orifice must be placed above the maximum expected depth of snow cover. Avoid installing the precipitation gauge on a slope or the roof of buildings.

Mounting the Pedestal

1. Prepare a concrete base and attach three M8 bolts to it (e.g. use wall plugs and hanger bolts).
2. Screw three M8 nuts onto the bolts and place the ground plate (10) of the threaded pipe (9) on them (see figure Overview of sub-assemblies 8). **Note**: The ground plate is round but the HS 334 Multi-Adapter (8) is triangular.
3. Make the upper (instrument) flange (8) of the pedestal horizontal using a spirit level in two directions perpendicular to each other. Fix the pedestal using another three nuts and washers. Do not tighten the nuts yet.

2.2 Preparing the Precipitation Gauge for Mounting

Detach the enclosure (2) from the rain gauge base plate (6) loosening the screws at the bottom edge of the enclosure. Remove the bucket (3) from the base plate.

2.3 Mounting the Precipitation Gauge on the Pedestal

Attach the base plate (6) to the pedestal using three M8 screws. Place a spirit level on two ends of the support triangle (4) and adjust the level with the lower flange nuts if necessary. Place the spirit level on another two ends of the support triangle and repeat the procedure. Now tighten the nuts thoroughly.

2.4 Mounting the Precipitation Gauge on a Pole Using the Pole-Mounting Adapter

Set the mounting adapter (8 or 11) on the pole. Do not tighten the fixing screws yet. Attach the base plate (6) to the adapter using three M8 screws. Now level the base plate (6) using a spirit level and fixing screws of the adapter. Place the spirit level on two ends of the support triangle (4) or use the built-in spirit level (17) of the precipitation gauge. Finally tighten the fixing screws of the mounting adapter.

For more details, see the separate installation instructions on 3-point to 2“- and 3-point to 4“ adapter with installation poles and ground plate for mounting onto concrete.

2.5 Finishing Installation

1. Put back the bucket (3) and the enclosure (2). Mind the right position of the enclosure. Fix the enclosure tightening the screws around the lower edge.
2. Use your finger to check if the rain gauge has been assembled correctly: the rim of the enclosure must not touch the bucket!

3 Configuration

This chapter contains the following subsections:

3.1 Interfaces

RainBal is equipped with the SDI-12 version 1.4 serial interface, RS 485 and a contact voltage-free pulse output for emulation of a tipping-bucket rain gauge. RS-485 various protocols can be used, e.g. MODBUS RTU, MODBUS ASCII. For comfortable maintenance work the Bluetooth LE and USB-over-Bluetooth interface is available. The serial interfaces are both fully equipped and can be selected with the implemented protocols. Both interfaces cannot be operated simultaneously.

By default the interface is set to SDI-12 V1.4.

Possible interface settings						
Protocol	**SDI-12**		**MODBUS**		**ASCII**	
Interface	**Settings**	**Address**	**Settings**	**Address**	**Settings**	**Address**
SDI-12	1200,7,E,1	0	N/A	N/A	N/A	N/A
RS-485	9600,8,N,1	0	9600,8,E,1	48	9600,8,N,1	0

The pulse output is available in metric and imperial units with different pulse factors. Here the behaviour of a reed contact is simulated, which is usually integrated in tipping bucket rain gauges.

The pulse output is working simultaneously to any selected interface and protocol and can also be used as redundant output to be connected to a second device.

For changing the interface or other parameters, please use the app 44 available for IOS and android smart phones.

More information see installation guide.

3.2 External Connection

See the separate RainBal installation guide that is included in the scope of delivery and can be downloaded from the website.

On the bottom side of the base plate there are either M12-8pol or additionally M12-4pol (for the heated version) connectors with cap to utilize and connect the delivered cables. The bar ends or open wires have to be connected to the corresponding terminals of the data logger, AWS or SCADA system. A standard length of the cables is 10 meters but a cable of customs and site specific length can be ordered upon request.

The maximun length for the cables is 15 m for M12 SAC-4pol (heater cable) and 50 m for M12-8pol (instrument supply and interfaces).

Please use the APP to switch to RS 485 mode or other settings.

4 Operation

This chapter contains the following subsections:

4.1 Data Communication

Communication modes:

- Standard: SDI-12, Version 1.4, default address is '0'.
- Optional: RS-485: 9600bps, 8bit, no parity, 1 stop bit, default address is '0' – Modbus RTU and Modbus ASCII.

Protocols	RainBal 200	RainBal 314
SDI-12, Version 1.4	X	X
RS 485 Modbus	X	X

Table 1 – Protocols

The communication mode is preset to SDI-12.

Independent of the communication protocol in use, RainBal stores all data in so-called "registers". All measured and status values and parameters are stored in the registers. The table Protocols 11 describes the most important registers that you may need in order to work with the sensor.

Register acronym	Description
PR	Precipitation amount between two readings (SDI 12) M" command), after reading value is reset
PRTOT*	Precipitation amount from power ON, or reset up to 999.99mm
PRLAST*	Precipitation amount of present or last precipitation event, used for validation with weight or with water and for APP and SDI12.
WAVG*	Total weight of bucket
PRINST**	Instant precipitation between two readings with "M" command, delay is max. 10 sec.
RI**	Instant 10-sec rain intensity express in mm/h
PRcor	Corrected PR value
PRtot	Corrected PRTOT value
T	Temperature
TMIN	1-minute temperature minimum
TMAX	1-minute temperature maximum
TAVG	1-minute temperature average
U	Power supply
WS	Wind speed estimation used for corrected data
HEAT	Heating mode: 0 ~ heating OFF, 1 ~ heating ON, 2 ~ heating ON when temperature ('T') is below THEAT, 3 ~ heating ON when temperature ('T') is below THEAT and it rains
THEAT	Parameter: heating temperature threshold
IMRATIO	Parameter: precipitation that equals one pulse

Table 2 – Description of Registers

Note:

* For more information on how these values vary in time, refer to figure PRTOT, PRLAST and WAVG – graphical view of variations in time 13.

** For more information on how these values vary in time, refer to figure RI and 1-minute precipitation – graphical view of variations in time 13.

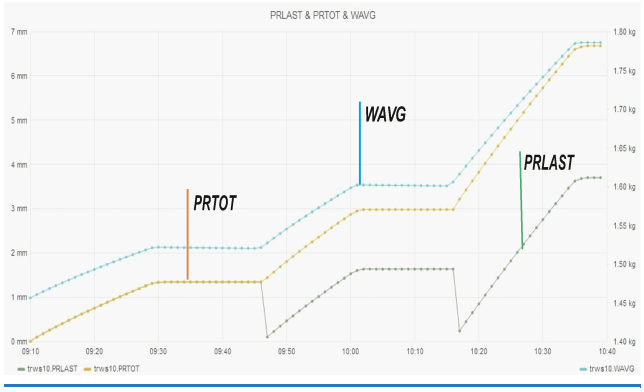

Figure 2 – PRTOT, PRLAST and WAVG – graphical view of variations in time

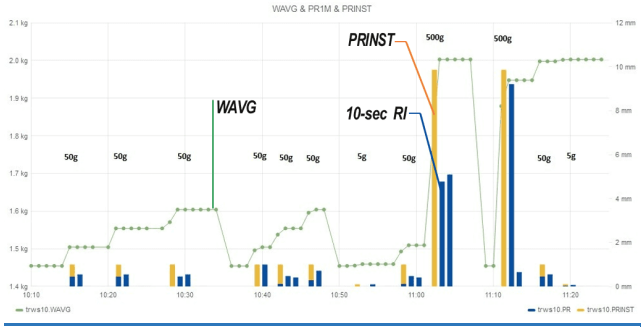

Figure 3 – RI and 1-minute precipitation – graphical view of variations in time

Follow the links for further information.

- SDI-12 13
- RS-485 30
- Table of Output Data 32

4.1.1 SDI-12

Only the most important commands are described here. For more information on SDI-12 protocol please visit www.sdi-12.org. In all examples in this section `a` represents a sensor address and `ccc` the 3 character CRC code, appended if data was requested with the *aMC!*, *aRC!* etc. command.

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4.1.1.1 General SDI-12 Commands

Address query	
Command:	`?!`
Response:	`a<CR><LF>`

Address query		
Explanation:	a	the sensor address
Example:	?!0<CR><LF>	

Change address		
Command:	aAb!	
Response:	b<CR><LF>	
Explanation:	a	the original address
	b	the new address
Example:	0A3!3<CR><LF>	

Send identification		
Command:	aI!	
Response:	a14HYQUESTRAINB1011400,SN=2595<CR><LF>	
Explanation:	HYQUEST	company name
	RAINB10	sensor model
	11400	sensor version (1.14.00)
	SN=2595	serial number

4.1.1.2 SDI-12 Measurement Commands (Metric Units)

Basic data (amount of precipitation and weight)

Basic data (amount of precipitation and weight)		
Start measurement		
Command:	aM! aMC!	
Response:	a0003<CR><LF>	
Send data		
Command:	aD0!	
Response:	a+PR±WAVG+PRTOT<CR><LF> a+PR±WAVG+PRTOTccc<CR><LF>	
Explanation:	PR	amount of precipitation registered since previous reading [mm]
	WAVG	weight of the bucket content [g]
	PRTOT	total amount of precipitation [mm]
Example		
	0M!00003<CR><LF> 0D0!0+0.130+2893.481+116.443<CR><LF> 0MC!00003<CR><LF> 0D0!0+2.5+49.074+2.5Dsk<CR><LF>	

Precipitation intensity and last or current rain precipitation amount	
Start measurement	
Command:	aM1! aMC1!
Response:	a0003<CR><LF>
Send data	

Precipitation intensity and last or current rain precipitation amount		
Command:	aD0!	
Response:	a+PRLAST+RIINST+RI<CR><LF> a+PRLAST+RIINST+RIccc<CR><LF>	
Explanation:	PRLAST	amount of precipitation registered during current or previous precipitation [mm]
	RIINST	instantaneous precipitation intensity [mm/h]
	RI	one-minute precipitation intensity [mm/h]
Example		
	0M1!00003<CR><LF> 0D0!0+3.794+2.5+1.3<CR><LF> 0MC1!00003<CR><LF> 0D0!0+2.5+0+0BrY<CR><LF>	

Temperature and service data		
Start measurement		
Command:	aM2! aMC2!	
Response:	a0006<CR><LF>	
Send data		
Command:	aD0!	
Response:	a±T±TMIN±TAVG±TMAX+U+STATUS<CR><LF> a±T±TMIN±TAVG±TMAX+U+STATUSccc<CR><LF>	
Explanation:	T	temperature [°C]
	TMIN	one-minute temperature minimum value [°C]

Temperature and service data		
	TAVG	one-minute temperature average value [°C]
	TMAX	one-minute temperature maximum value [°C]
	U	internal power supply voltage [V]
	STATUS	various status data [-]
Example		
	0M2!00006<CR><LF> 0D0!0+10.80+10.80+10.80+10.81+3.327+1<CR><LF> 0MC2!00006<CR><LF> 0D0!0+21.85+21.84+21.85+21.85+3.306+1DmY<CR><LF>	

Corrected precipitation amount data		
Start measurement		
Command:	aM3! aMC3!	
Response:	a0003<CR><LF>	
Send data		
Command:	aD0!	
Response:	a+PRcor+PRTOTcor+WS<CR><LF> a+PRcor+PRTOTcor+WScccc<CR><LF>	
Explanation:	PRcor	corrected amount of precipitation [mm]
	PRTOTcor	corrected total amount of precipitation [mm]
	WS	estimate of wind speed [dimensionless quantity]
Example		

Corrected precipitation amount data	
	0M3!00003<CR><LF> 0D0!0+0.150+121.511+2.3<CR><LF> 0MC3!00003<CR><LF> 0D0!0+2.677+2.677+0.9KDC<CR><LF>

Instantaneous precipitation amount		
Start measurement		
Command:	aM4! aMC4!	
Response:	a0001<CR><LF>	
Send data		
Command:	aD0!	
Response:	a+PRINST<CR><LF> a+PRINSTccc<CR><LF>	
Explanation:	PRINST	instantaneous precipitation [mm]
Example		
	0M4!00001<CR><LF> 0D0!0+0.251<CR><LF> 0MC4!00001<CR><LF> 0D0!0+2.5I`u<CR><LF>	

4.1.1.3 SDI-12 Measurement Commands (Imperial Units)

Basic data (amount of precipitation and weight), imperial units
Start measurement

Basic data (amount of precipitation and weight), imperial units		
Command:	aM5! aMC5!	
Response:	a0003<CR><LF>	
Send data		
Command:	aD0!	
Response:	a+I_R±I_WAVG+I_PRTOT<CR><LF> a+I_R±I_WAVG+I_PRTOTccc<CR><LF>	
Explanation:	I_PR	amount of precipitation registered since previous reading [in]
	I_WAVG	weight of the bucket content [oz]
	I_PRTOT	total amount of precipitation [in]
Example		
	0M5!00003<CR><LF> 0D0!0+0.00512+102.06454+4.58437<CR><LF> 0MC5!00003<CR><LF> 0D0!0+0.09839+1.73082+0.19681AcI<CR><LF>	

Precipitation intensity and last or current rain precipitation amount, imperial units	
Start measurement	
Command:	aM6! aMC6!
Response:	a0003<CR><LF>
Send data	
Command:	aD0!

Precipitation intensity and last or current rain precipitation amount, imperial units		
Response:	a+I_PRLAST+I_RIINST+I_RI<CR><LF> a+I_PRLAST+I_RIINST+I_RIccc<CR><LF>	
Explanation:	I_PRLAST	amount of precipitation registered during current or previous precipitation [in]
	I_RIINST	instantaneous precipitation intensity [in/h]
	I_RI	one-minute precipitation intensity [in/h]
Example		
	0M6!00003<CR><LF> 0D0!0+0.14937+0.09843+0.05118<CR><LF> 0MC6!00003<CR><LF> 0D0!0+0.09839+0.000+0.000E}g<CR><LF>	

Temperature and service data, imperial units		
Start measurement		
Command:	aM7! aMC7!	
Response:	a0006<CR><LF>	
Send data		
Command:	aD0!	
Response:	a±I_T±I_TMIN±I_TAVG±I_TMAX+U+STATUS<CR><LF> a±I_T±I_TMIN±I_TAVG±I_TMAX+U+STATUSccc<CR><LF>	
Explanation:	I_T	temperature [°F]
	I_TMIN	one-minute temperature minimum value [°F]
	I_TAVG	one-minute temperature average value [°F]

Temperature and service data, imperial units		
	I_TMAX	one-minute temperature maximum value [°F]
	U	internal power supply voltage [V]
	STATUS	various status data [-]
Example		
	0M7!00006<CR><LF> 0D0!0+51.44+51.44+51.44+51.46+3.327+1<CR><LF> 0MC7!00006<CR><LF> 0D0!0+71.31+71.29+71.31+71.31+3.306+1BRQ<CR><LF>	

Corrected precipitation amount data, imperial units		
Start measurement		
Command:	aM8! aMC8!	
Response:	a0003<CR><LF>	
Send data		
Command:	aD0!	
Response:	a+I_PRcor+I_PRTOTcor+WS<CR><LF> a+I_PRcor+I_PRTOTcor+WSccc<CR><LF>	
Explanation:	I_PRcor	corrected amount of precipitation [in]
	I_PRTOTcor	corrected total amount of precipitation [in]
	WS	estimate of wind speed [dimensionless quantity]
Example		
	0M8!00003<CR><LF>	

Corrected precipitation amount data, imperial units	
	0D0!0+0.00591+4.78390+2.3<CR><LF> 0MC8!00003<CR><LF> 0D0!0+0.09839+0.20378+0FYY<CR><LF>

Instantaneous precipitation amount, imperial units		
Start measurement		
Command:	aM9! aMC9!	
Response:	B0001<CR><LF>	
Send data		
Command:	aD0!	
Response:	a+I_PRINST<CR><LF> a+I_PRINSTccc<CR><LF>	
Explanation:	I_PRINST	instantaneous precipitation amount [in]
Example		
	0M9!00001<CR><LF> 0D0!0+0.00988<CR><LF> 0MC9!00001<CR><LF> 0D0!0+0.09843F^z<CR><LF>	

4.1.1.4 SDI-12 Reading Status Commands

Reading status byte (mapped per bit)	
Command:	aR0! aRC0!
Response:	a+STATUS<CR><LF>

Reading status byte (mapped per bit)		
	a+STATUSccc<CR><LF>	
Explanation:	STATUS	status register, mapped per bit
Example:	0R0!0+1<CR><LF> 0RC0!0+1Bo_<CR><LF>	

Reading status bits		
Command:	aR1! aRC1!	
Response:	a+STATUS0+STATUS1+STATUS2+STATUS3+STATUS4+STATUS5+STATUS6 +STATUS7<CR><LF> a+STATUS0+STATUS1+STATUS2+STATUS3+STATUS4+STATUS5+STATUS6 +STATUS7ccc<CR><LF>	
Explanation:	STATUS0	1: activated
	STATUS1	1: 80% of bucket capacity reached
	STATUS2	1: unexpected restart detected
	STATUS3	(reserved)
	STATUS4	1: heater is on
	STATUS5	(reserved)
	STATUS6	(reserved)
	STATUS7	(reserved)
Example:	0R1!0+1+0+0+0+0+0+0+0<CR><LF> 0RC1!0+1+0+0+0+0+0+0+0GuL<CR><LF>	

4.1.1.5 SDI-12 Verification

Verification		
Start verification		
Command:	aV!	
Response:	a0001<CR><LF>	
Send verification data		
Command:	aD0!	
Response:	a+PRLAST<CR><LF>	
Explanation:	PRLAST	amount of precipitation registered during verification (mm or in, depending on UNITS set)
Example		
	0V!00001<CR><LF> 0D0!0+2.508<CR><LF>	

For more information on the sensor verification procedure consult ch. Maintenance 37.

4.1.1.6 SDI-12 Settings

Setting measurement units		
Command:	aXset|190|B!	
Response:	aOK<CR><LF>	
Explanation:	UNITS	measurement units: 0: metric 1: imperial

Setting measurement units		
Example:	0Xset|190|1!0OK<CR><LF>	

Setting the amount of precipitation corresponding to one pulse on contact output		
Command:	aXset|176|IMPRATIO!	
Response:	aOK<CR><LF>	
Explanation:	IMPRATIO	amount of precipitation corresponding to one pulse on contact output (0.01 … 1 mm)
Example:	0Xset|176|0.1!0OK<CR><LF>	

Setting the temperature threshold for heating		
Command:	aXset|5|THEAT!	
Response:	aOK<CR><LF>	
Explanation:	THEAT	the temperature below which the heater is switched on [°C]
Example:	0Xset|5|2.5!0OK<CR><LF>	

Setting the heating mode		
Command:	aXset|4|HEAT!	
Response:	aOK<CR><LF>	
Explanation:	HEAT	heating mode: 0: permanently off 1: permanently on 2: on if temperature is below threshold 3: on if temperature is below threshold and if it is raining or snowing

Setting the heating mode		
Example:	0Xset|4|3!0OK<CR><LF>	

Setting the communication protocol on RS-485 interface		
Command:	aXset|3|RS485!	
Response:	aOK<CR><LF>	
Explanation:	RS485	communication protocol on RS-485: 0: no RS-485 interface 1: MODBUS RTU 2: MODBUS ASCII 3: HyQuest protocol 4: SDI-12 5: User 1 6: VAISALA VRG
Example:	0Xset|3|1!0OK<CR><LF>	

Setting the serial communication parameters		
Setting the Baud rate		
Command:	aXset|48|BAUD!	
Response:	aOK<CR><LF>	
Explanation:	BAUD	Baud rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)
Example:	0Xset|48|1200!0OK<CR><LF>	
Setting number of data bits		

Setting the serial communication parameters		
Command:	aXset|49|DATA!	
Response:	aOK<CR><LF>	
Explanation:	DATA	number of data bits (5, 6, 7, 8, 9)
Example:	0Xset|49|7!0OK<CR><LF>	
Setting parity		
Command:	aXset|50|PARITY!	
Response:	aOK<CR><LF>	
Explanation:	PARITY	parity (n, e, o)
Example:	0Xset|50|e!0OK<CR><LF>	
Setting number of stop bits		
Command:	aXset|51|STOP!	
Response:	aOK<CR><LF>	
Explanation:	STOP	number of stop bits (1, 2)
Example:	0Xset|51|1!0OK<CR><LF>	

Getting and setting measurement parameters
Getting measurement parameters

Getting and setting measurement parameters		
Command:	aXmsg|M! aXmsg|Mi!	
Response:	aLIST<CR><LF>	
Explanation:	i	the number of an additional measurement (1…9)
	LIST	a semicolon-separated list of internal register numbers
Example:	0Xmsg|M!0145;146;157<CR><LF> 0Xmsg|M5!0241;252;243<CR><LF>	
Setting measurement parameters		
Command:	aXmsg|M|LIST! aXmsg|Mi|LIST!	
Response:	aOK<CR><LF>	
Explanation:	i	the number of an additional measurement (1…9)
	LIST	a semicolon-separated list of internal register numbers
Example:	0Xmsg|M5|241;252;243!0OK<CR><LF>	

4.1.1.7 SDI-12 Sensor Maintenance (Extended) Commands

Resetting PRTOT and PRLAST values	
Command:	aXclear!
Response:	aOK<CR><LF>
Explanation:	Both **PRTOT** and **PRLAST** values (total precipitation amount and current/previous precipitation amount) are set to zero. The aXclear! command performs the same action as Data reset in the KISTERS PreciBal (RainBal) App 44

Resetting PRTOT and PRLAST values	
Example:	0Xclear!0OK<CR><LF>

4.1.1.8 SDI-12 Commands

Identify measurement commands		
Command:	aIM! aIMi! aIV! etc.	
Response:	a000n<CR><LF>	
Explanation:	i	the number of an additional measurement (1…9)
	n	the number of measurement values the sensor will take and return
Examples:	0IM!00003<CR><LF> 0IM2!00006<CR><LF> 0IV!00001<CR><LF> etc.	

Identify measurement parameter commands		
Command:	aIM_ppp! aIMi_ppp! aIV_ppp! etc.	
Response:	a,ID,UNIT,REGNO,TYPE,ATTR,DECIMAL,MIN,MAX;<CR><LF>	
Explanation:	i	the number of an additional measurement (1…9)
	ppp	the order number of a measured parameter
	ID	concise identification of the parameter

Identify measurement parameter commands		
	UNIT	unit of measurement
	REGNO	internal register number
	TYPE	internal data type (e.g. FLOAT, UINT8, UINT32, CHAR, BOOL etc.)
	ATTR	attribute (RO: read only, RW: read/write)
	DECIMAL	decimal places
	MIN	minimum possible value
	MAX	maximum possible value
Examples:	0IM_001!0,PR,mm,145,FLOAT,RO,3,0,9999, ;<CR><LF> 0IM_002!0,WAVG,g,146,FLOAT,RO,3,-60000,60000, ;<CR><LF> 0IV_001!0,PRLAST,mm,156,FLOAT,RO,3,0,9999, ;<CR><LF> etc.	

4.1.2 RS-485

Over RS-485 three main protocols are available: MODBUS (RTU, ASCII), SDI-12. You can select the protocol by setting the **RS485** parameter to the desired value.

- SDI-12 Protocol over RS-485 30
- ASCII Protocol 30
- MODBUS Protocol 31

4.1.2.1 SDI-12 Protocol over RS-485

Commands and responses are the same as those on the SDI-12 13 interface. Initial BREAK is not required.

4.1.2.2 ASCII Protocol

Only the request of a basic set of data commands is implemented. **Note**, that unlike SDI-12 and MODBUS, the ASCII protocol provides integer values only; that is why precipitation amounts are in micrometres and the weight is in milligrams. The ASCII protocol shares its address with the SDI-12 protocol.

Requesting basic data (amount of precipitation and weight)		
Command:	<ENQ>a<CR>	
Response:	<SOH>a<STX>PR<TAB>WAVG<TAB>PRTOT<ETX><CR><LF>	
Explanation:	PR	amount of precipitation registered since previous reading [µm]
	WAVG	weight of the bucket content [mg]

Requesting basic data (amount of precipitation and weight)		
	PRTOT	total amount of precipitation [µm]

4.1.2.3 MODBUS Protocol

The default (factory preset) device address is **48**. Use function code **04** (read input registers) to read data from the sensor. For list of registers see the table below. Since all measurements are of type float, read two consecutive registers to get a value. For more information on MODBUS protocol, please visit www.modbus.org.

Note:

1. To change the address use the corresponding SDI-12 command (ch. Reset/Clear Cumulative Precipitation Counters 35) or the KISTERS PreciBal (RainBal) App 44.
2. The MODBUS protocol shares the address with the SDI-12 protocol but its interpretation is different: While the SDI-12 address is a **character**, the MODBUS address represents the **ASCII code** of the SDI-12 address (e.g. SDI-12 address **0** = MODBUS address **48**).

MODBUS input registers (function code 04)				
Measurement name	**Explanation**	**Register address**	**Register count**	**Data type**
PR	amount of precipitation registered since recent power-on or software restart of the instrument [mm]	290	2	float
WAVG	weight of the bucket content [g]	292	2	float
TAVG	one-minute temperature average value [°C]	294	2	float
PRLAST	amount of precipitation registered during current or previous precipitation [mm]	312	2	float
PRTOT	total amount of precipitation [mm]	314	2	float
I_PR	amount of precipitation registered since recent power-on or software restart of the instrument [in]	482	2	float
I_PRLAST	amount of precipitation registered during current or previous precipitation [in]	484	2	float
I_PRTOT	total amount of precipitation [in]	486	2	float
I_TAVG	one-minute temperature average value [°F]	490	2	float
I_WAVG	weight of the bucket content [oz]	504	2	float

4.1.3 Table of Output Data

(Configuration parameters are highlighted.)

Internal register number	Register name	Description	Unit	Range	Resolution	Type
3	RS485	Communication protocol on RS-485 interface	-	0: no RS-485 intfc. 1: MODBUS RTU 2: MODBUS ASCII 3: HyQuest protocol 4: SDI-12 5: User 1 6: VAISALA VRG	1	uint8
4	HEAT	Heating mode	-	0: permanently off 1: permanently on 2: on if Ta<THEAT 3: on if Ta<THEAT and is raining or snowing	1	uint8
5	THEAT	Temperature threshold for heating	°C	-70 … 125	0.1	float
48	BAUD	Baud rate (RS-485)	baud	300 … 115200	N/A	uint32
49	DATABIT	Number of data bits (RS-485)	-	5 … 9	1	uint8
50	PARITY	Parity (RS-485)	-	n,e,o	N/A	char
51	STOPBIT	Number of stop bits	-	1 … 2	1	uint8
64	U	Internal power supply voltage	V	0 … 5	0.001	float
65	T	Temperature	°C	-50 … 70	0.01	float
66	STATUS	Status data (values of registers STATUS0..STATUS7)	-	0 … 255	1	uint8
80	STATUS0	1: Sensor activated	-	0 … 1	1	bool
81	STATUS1	1: 80% of bucket capacity reached	-	0 … 1	1	bool
82	STATUS2	1: Unexpected restart detected	-	0 … 1	1	bool
83	STATUS3	reserved	-	0 … 1	1	bool
84	STATUS4	1: heater is on	-	0 … 1	1	bool

Internal register number	Register name	Description	Unit	Range	Resolution	Type
85	STATUS5	reserved	-	0 … 1	1	bool
86	STATUS6	reserved	-	0 … 1	1	bool
87	STATUS7	reserved	-	0 … 1	1	bool
145	PR	Amount of precipitation	mm	0 … 9999	0.001	float
146	WAVG	Weight of the bucket content	g	-3000 … 33000	0.001	float
147	TAVG	One-minute temperature average	°C	-50 … 70	0.01	float
156	PRLAST	Amount of precipitation registered during current or previous precipitation	mm	0 … 9999	0.001	float
157	PRTOT	Total amount of precipitation	mm	0 … 9999	0.001	float
160	RI	One-minute precipitation intensity	mm/h	0 … 3600	0.1	float
162	PRcor	Corrected amount of precipitation	mm	0 … 9999	0.001	float
165	PRTOTcor	Corrected total amount of precipitation	mm	0 … 9999	0.001	float
167	RIINST	Instantaneous precipitation intensity	mm/h	0 … 3600	0.1	float
169	TMIN	One-minute temperature minimum value	°C	-50 … 70	0.01	float
170	TMAX	One-minute temperature maximum value	°C	-50 … 70	0.01	float
171	PRINST	Instantaneous precipitation amount	mm	0 … 9999	0.001	float
174	WS	Estimate of wind speed	-	0 … 999	0.1	float
176	IMPRATIO	Amount of precipitation corresponding to one pulse on contact output	mm	0.01 … 1	0.01	float
190	UNITS	Measurement units	-	0: metric 1: imperial	1	uint8
240	I_T	Temperature	°F	-58 … 158	0.01	float
241	I_PR	Amount of precipitation	in	0 … 393.662	0.00001	float
242	I_PRLAST	Amount of precipitation registered during current or previous	in	0 … 39.331	0.00001	float

Internal register number	Register name	Description	Unit	Range	Resolution	Type
		precipitation				
243	I_PRTOT	Total amount if precipitation	in	0 ... 393.662	0.00001	float
244	I_RIINST	Instantaneous precipitation intensity	in/h	0 ... 142	0.001	float
245	I_TAVG	One-minute temperature average	°F	-58 ... 158	0.01	float
246	I_TMIN	One-minute temperature minimum value	°F	-58 ... 158	0.01	float
247	I_TMAX	One-minute temperature maximum value	°F	-58 ... 158	0.01	float
248	I_PRINST	Instantaneous precipitation amount	in	0 ... 393.662	0.00001	float
249	I_PRcor	Corrected amount of precipitation	in	0 ... 393.662	0.00001	float
250	I_PRTOTcor	Corrected total amount if precipitation	in	0 ... 393.662	0.00001	float
252	I_WAVG	Weight of the bucket content	oz	-106 ... 1165	0.00001	float
253	I_RI	One-minute precipitation intensity	in/h	0 ... 142	0.001	float

4.2 Diagnosis

Practice of diagnosis (mechanical items – see figure Overview of sub-assemblies 8):

1. Turn the RainBal on and let it stabilise for about three minutes.
2. Put a weight or pour a known amount of water into the bucket. **Note**: Weights must be placed in the center of the bucket. The enclosure must be in place.
3. Check the output from the RainBal impulse output and/or serial output (SDI-12 or RS-485). Follow the instructions in the following chapters for serial SDI-12 and serial RS-485 communication. Reference values for representative weights and areas can be found in the Verification Procedure Reference Table 35.

Weight [g]	RainBal 200: Pr [mm]			RainBal 314: Pr [mm]		
	min.	nom.	max.	min.	nom.	max.
20	0,990	1,000	1,010	0,666	0,673	0,680
25	1,238	1,250	1,263	0,690	0,696	0,703
50	2,475	2,500	2,525	1,577	1,592	1,608
100	4,950	5,000	5,050	3,155	3,185	3,215
200	9,900	10,000	10,10	6,310	6,370	6,430

Table 3 – Verification Procedure Reference Table, Relative Accuracy 1%

Follow the links for further information.

- SDI-12: Sensor Diagnosis 35
- RS-485: Sensor Diagnosis 36

4.2.1 SDI-12: Sensor Diagnosis

This chapter contains the following subsections:

- Step 1: Reset/Clear Cumulative Precipitation Counters 35
- Step 2: Put Known Weight and Wait 35
- Step 3: Read Data & Check Precipitation Value 35

4.2.1.1 Step 1: Reset/Clear Cumulative Precipitation Counters

- Command: `aXreset!`
- Response: `aOK<CR><LF>`
  - resets the statistic calculation module,
  - rainfall counter {PRTOT} set to zero
- Example:
  - Command: `1Xreset!`
  - Response: `1OK<CR><LF>`

4.2.1.2 Step 2: Put Known Weight and Wait

- (A) Carefully deposit a known precision weight in the centre of the RainBal bucket; reference weights are illustrated in the Verification Procedure Reference Table 35.
- (B) Wait for at least three minutes for the accumulated precipitation calculation to complete.

4.2.1.3 Step 3: Read Data & Check Precipitation Value

- To start the diagnosis/verification process, send the following command:
  - Command: `aV!`
  - Response: `atttn<CR><LF>`
- To read data from the RainBal, send the following command:
  - Command: `aD0!`
  - Response: `a<Reg.Val.156><CR><LF>`
    Here `<Reg.Val.156>` corresponds to **PRLAST** and contains the precipitation equivalent in mm corresponding to the inserted weight.
- Compare measured value with the reference value and evaluate according to the validity range in the Verification Procedure Reference Table 35.
- Example:
  - Command: `1V!<CR>`
  - Response: `10001<CR><LF>`

- Command: `1D0!<CR>`
- Response: `1+1.247<CR><LF>`
  Here `<Reg.Val.156>` corresponds to **PRLAST** and 1.247 mm is the precipitation equivalent in mm for a RainBal with an orifice Ø = 200 cm^2 and an inserted precision weight of 25 g.

- Test successfully passed because 1.238 mm ≤ 1.247 mm ≤ 1.263 mm.

4.2.2 RS-485: Sensor Diagnosis

For the sensor diagnosis the SDI-12 protocol is used on the RS-485 port. Subsequently, the entire diagnosis follows the same steps and uses the same commands as described in ch. SDI-12: Sensor Diagnosis 35.

5 Maintenance

WARNING

Be careful while emptying the bucket. Accidentally dropping the bucket on the load cell can damage the sensor.

- Generally, thanks to its design and measurement principle, the RainBal precipitation gauge requires very low maintenance. However, to guarantee a long-term and a trouble-free operation it is recommended to perform some simple maintenance tasks on a regular basis (see the table below).
- The periodical maintenance should be preferably performed at the beginning and at the end of the winter season and during a dry period to prevent loss in precipitation while maintenance work is performed.
- At the beginning of any maintenance work switch the sensor to the maintenance mode in order to prevent it from registering fake precipitation during the work. If you forget to switch the maintenance mode off when finished, the maintenance mode will be switched off after 30 minutes automatically.

Summary of recommended maintenance tasks	
Task	**Period**
Visual check 37	twice a year
Cleaning 37	twice a year or as necessary
Checking heater 37	once a year, at the beginning of winter season
Checking horizontal position 37	once a year, at the end of winter season
Checking accuracy of measurement 38	once a year, at the end of winter season

5.1 Visual Check

Check if there is any visible damage, if the rain gauge is correctly assembled and if all screws are tightened. Always check if there is no contact between the bucket and the enclosure. Check if the bucket of an E-series precipitation gauge can be tipped freely.

5.2 Cleaning

Remove any dirt (dust, leaves, insects, insect nests, spider's webs etc.) from both inside and outside parts of the precipitation gauge. Use a brush and/or a soft cloth and clean water or mild detergent.

5.3 Heater Check

Run the HS APP application 44, connect to the RainBal and on the `Settings` screen change the heating mode to 1 (permanently on). Wait for about five minutes and check with your hand if the rim (or internal heater) has become warm. Don't forget to switch the heating mode back to automatic (2 or 3).

5.4 Checking Horizontal Position

For quick check of horizontal position just place a spirit level in two directions perpendicular to each other onto the rim. If not satisfactory repeat the initial procedure of making the base plate horizontal (see ch. Installation 8).

5.5 Checking Accuracy of Measurement

To check the accuracy of measurement the SDI-12 verification command (`aV!`) is used. The accuracy check should be performed at dry weather and no or only light wind (wind speed less than 2 m/s, no gusts). To check accuracy, you need a precise reference weight (20, 25, 50, 100 or 200 gr) and a data logger which supports the SDI-12 transparent mode. Alternatively, you can use an accurate amount of water (doesn't apply to E-series precipitation gauges which can only be checked by a weight).

Procedure:

1. If connected to a running data logger, stop the measurement.
2. Empty the bucket.
3. Enter the SDI-12 transparent mode.
4. Enter the `aXclear!` command.
5. Wait for 2 minutes.
6. Put a reference weight on the bottom of the bucket. Try to place it precisely in the centre.
7. Wait for at least 3 minutes to be sure the internal calculation has finished.
8. Enter the `aV!` command. The response should be `a0001<CR><LF>`.
9. Enter the `aD0!` command. The test has passed if the returned value in millimetres lies within the interval Minimum..Maximum for given reference weight and orifice area (see table below).
10. Remove the reference weight.
11. Enter the `aXclear!` command once again so that the precipitation measured during the test won't be read by data logger.
12. Leave the SDI-12 transparent mode and resume the measurement.

RainBalReference weight [g]	RainBal 200			RainBal 314		
	Minimum [mm]	Precise value [mm]	Maximum [mm]	Minimum [mm]	Precise value [mm]	Maximum [mm]
20	0.99	1	1.01	0,666	0,673	0,680
25	1.238	1.25	1.263	0,690	0,696	0,703
50	2.475	2.5	2.525	1,577	1,592	1,608
100	4.95	5	5.05	3,155	3,185	3,215
200	9.90	10	10,1	6,310	6,370	6,430

6 Repair

KISTERS precision instruments and data loggers are produced in quality-controlled processes. All KISTERS production and assembly sites in Australia, New Zealand and Europe are ISO 90001 certified. All equipment is factory tested and/or factory calibrated before it is shipped to the client. This ensures that KISTERS products perform to their fullest capacity when delivered.

Despite KISTERS most rigorous quality assurance (QA), malfunction may occur within or outside of the warranty period. In rare cases, a product may not be delivered in accordance with your order.

In such cases KISTERS' return and repair policy applies. For you as a customer, this means the following:

- Contact KISTERS using the Repair Request Form and the Declaration of Contamination made available online:

Region (Language)	Download Link
Asia-Pacific (English)	Repair Request Form (APAC) Declaration of Contamination (APAC)
Europe, the Middle East and Africa (English)	Repair Request Form (EMEA) Declaration of Contamination (EMEA)
Germany (German)	Repair Request Form (DE) Declaration of Contamination (DE)

  In response you will receive a reference number that must be referenced on all further correspondence and on the freight documents accompanying your return shipment.
- Please provide as much information and/or clear instructions within the return paperwork. This will assist our test engineers with their diagnosis.
- Please do not ship the goods prior to obtaining the reference number. KISTERS will not reject any equipment that arrives without reference number; however, it may take us longer to process.

Custom requirements for items sent to KISTERS for warranty or non-warranty repairs: Check with your national customs/tax authorities for details, processes and paperwork regarding tax exempt return of products. Typically, special custom tariff codes are available (such as HS Code = 9802.00) that verify the item is being returned for repair and has no commercial value. Please note that the customs invoice / dispatch documents should also clearly state: "Goods being returned to manufacturer for repair – No Commercial value". It is mandatory to have any returned goods accompanied by a commercial invoice on headed paper. KISTERS reserves the right to charge the customer for time spent rectifying incorrect customs documents.

Note: Please ensure that your goods are packed carefully and securely. Damage that occurs during transit is not covered by our warranty and may be chargeable.

7 Technical Data

	Model	
	RainBal 200	**RainBal 314**
Orifice area	200 cm^2	314 cm^2
Precipitation range	Unlimited	
Accuracy of precipitation amount	± 0.025 or ± 1 %	0.016 mm or ±1 %
Accuracy of precipitation intensity	± 1.5 mm/h or ± 1 %	
Threshold for precipitation amount	0.025/40 min.	0.016 mm/40 min.
Threshold for precipitation intensity	0.025 mm/min.	0.016 mm/min.
Maximum precipitation intensity	2000 mm/hr.	
Resolution	0.001 mm	
Measuring element	Strain-gauge bridge	
Supply voltage	5 … 30 VDC (reverse polarity protected)	
Power consumption	max 40 mW, typ 1.2 mA at 12 VDC	
Heating voltage (heating power)	10 … 28 VDC / 5-35 Watt	
Pulse output	relay contact; 2 Hz (250:250 ms); 1/0.1/0.01 mm/pulse |1 / 0.1 / 0.01 / 0.001 inch/pulse; 24V/0.5A max.	
Interfaces	SDI-12, RS-485 2W (300 … 115200bps), Bluetooth LE, USB over Bluetooth	
Communication protocols	SDI-12 V1.4, MODBUS RTU, MODBUS ASCII, HS ASCII	
Connectors	M12 8-pin; M12 4-pin (for optional heater)	
Dimensions (without pedestal)	Ø253 x 320 mm	Ø253 x 355 mm
Weight	4.6 kg	5.2 kg
Operation temperature	0 … +70 °C (without heating) -10 … +70 °C (with heating at 24 VDC)	

	Model	
	RainBal 200	**RainBal 314**
Deployment temperature range	-40 .... +70 °C	
Operation humidity	0 ... 100 %	
Degree of protection	IP65	
Surge protection	all inputs/outputs	

8 Obligations of the Operator and Disposal

This chapter contains the following subsections:

8.1 Obligations of the Operator

European Union

In the Single European Market it is the responsibility of the operator to ensure that the following legal regulations are observed and complied with: national implementation of the framework directive (89/391/EEC) and the associated individual directives, in particular 2009/104/EC, on minimum safety and health requirements for the use of work equipment by employees at work.

Worldwide

Regulations: If and where required, operating licences must be obtained by the operator. In addition, national or regional environmental protection requirements must be complied with, regardless of local legal provisions regarding the following topics:

- Occupational safety
- Product disposal

Connections: Local regulations for electrical installation and connections must be observed.

8.2 Dismantling / Disposal

When disposing of the units and their accessories, the applicable local regulations regarding environment, disposal and occupational safety must be observed.

Before dismantling

- Electrical Devices:
  - Switch off the units.
  - Disconnect electrical appliances from the power supply, regardless of whether the appliances are connected to the mains or to another power source.
- Mechanical devices:
  - Fix all loose components. Prevent the device from moving independently or unintentionally.
  - Loosen mechanical fastenings: Please note that appliances can be heavy and that loosening the fastenings may cause them to become mechanically unstable.

Disposal

Operators of old appliances must recycle them separately from unsorted municipal waste. This applies in particular to electrical waste and old electronic equipment.

Electrical waste and electronic equipment must not be disposed of as household waste!

Instead, these old appliances must be collected separately and disposed of via the local collection and return systems.

Integrated or provided batteries and accumulators must be separated from the appliances and disposed of at the designated

collection point. At the end of its service life, the lithium-ion battery must be disposed of according to legal provisions.

EU WEEE Directive

As players in the environmental market, KISTERS AG is committed to supporting efforts to avoid and recycle waste. Please consider:

- Avoidance before recycling!
- Recycling before disposal!

This symbol  indicates that the scrapping of the unit must be carried out in accordance with Directive 2012/19/EU. Please observe the local implementation of the directive and any accompanying or supplementary laws and regulations.

9 Appendices

This chapter contains the following subsections:

9.1 HS PreciBal (RainBal) App

The PreciBal (RainBal) App is changing the way you interact with the device. The PreciBal (RainBal) App provides a suite of innovative, easy to use features that put the power of the device right in the palm of your hand.

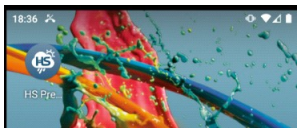
The PreciBal (RainBal) App connects to the device using Bluetooth®.

The App is available for free for Android and iOS.

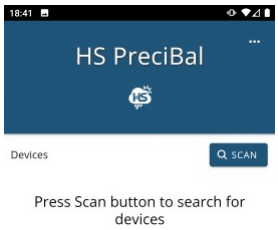
9.1.1 PreciBal/RainBal App Functionality in a Nutshell

- Pair with and connect to your device(s).
- Access measurement data from various registers with numerical and graphical visualisation.
- Display and edit selected parameter settings.
- Display and forward log data by email (device status information).
- Update the Firmware.

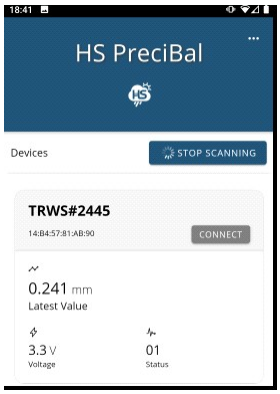
9.1.2 Precibal/RainBal App – User Interface



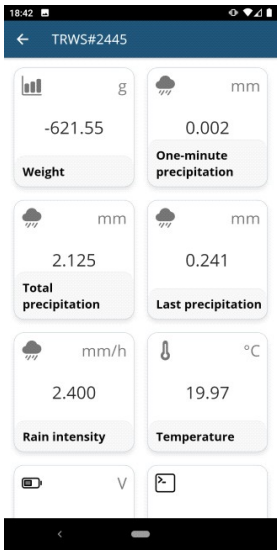
To start the PreciBal (RainBal) App: Click the PreciBal (RainBal) Icon on your smartphone and tablet.



The App opens. Press the [**SCAN**] button to start scanning for nearby devices.



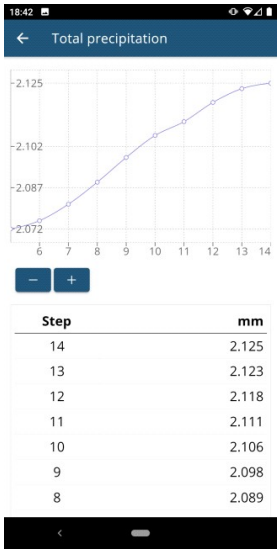
The App starts searching for devices. When a device is found it is inserted in a list. The [**CONNECT**] button enables you to connect to a specific device. Once the device you want to connect to is found, you may want to “STOP SCANNING”.



Once properly connected, the PreciBal (RainBal) App shows the latest readings from the device.

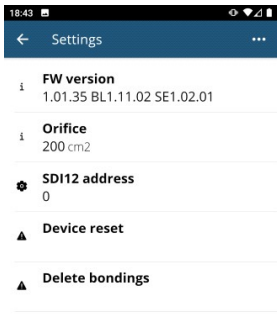
Each value is shown in a separate tile.

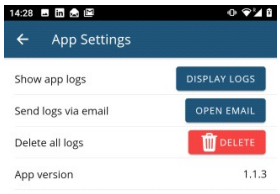
Depending on your device, the list of tiles may be too long to fit the screen. Use the usual touch display functions to scroll up and down to view all values or a desired specific data value.



Tiles are active elements, just like a button. Clicking a tile gives access to a detailed view on the data.

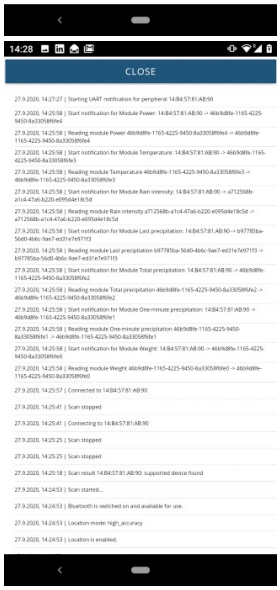
The screenshot on the left-hand side visualises “Total precipitation” data with a line graph showing on top and a numeric table of individual values at the bottom.

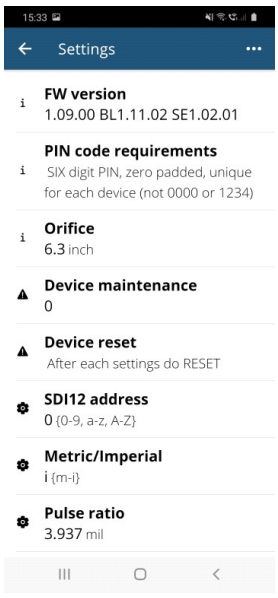


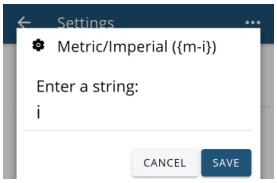


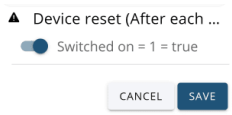
Other tiles provide access to device settings as illustrated in the screenshots.

Device status log information can be viewed on the mobile device and/or forwarded by email.









Changing physical units: The default setting is metric units. Use the **SETTINGS** menu of the App to switch to imperial units. The setting is performed manually: entering 'm' sets metric units, entering 'I' sets imperial units. To activate the settings, reset the device (also using the **SETTINGS** menu of the App).

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