EXTREME ENVIRONMENTS. EXTREMELY RELIABLE.

SDI-AWP-225/SDI-AWP-425

All Weather Precipitation Gauges

User's Manual

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Chapter 1 GENERAL

1.1 GENERAL

The FTS All Weather Precipitation (AWP) Gauge is an SDI-12 sensor which measures all types of precipitation within a wide temperature range. It is designed to withstand harsh wind and snow conditions without sacrificing sensitivity and accuracy. It boasts a combination of simple mechanical construction and sophisticated firmware, guaranteeing superior performance.

A free application for Bluetooth communication between the AWP and a mobile phone is available for both Android and iOS[1]. The application allows you to update firmware, check functionality, accuracy, validation, and settings of several parameters. Details of the application are found in Chapter 5.

1.2 MEASUREMENTS

The principal measurements provided by the AWP are:

- Amount of precipitation registered since previous reading
- Total amount of precipitation since power applied
- Amount of precipitation registered during current or previous precipitation
- Precipitation intensity
- Temperature (internal or ambient, depending on configuration)
- Weight of bucket content
- Status values (e.g. heater on/off, 80% of bucket capacity reached)

The AWP Gauge is available in two models which come with a mounting template for the installation of the pedestal and wind shield options.

	SDI-AWP-225	**SDI-AWP-425**
Orifice area	200 cm^2	400 cm^2
Bucket capacity	30 l	30 l
Approximate amount of precipitation for bucket capacity	1500 mm	750 mm

1.3 ACCESSORY OPTIONS

The AWP can be ordered with a mounting pedestal and a wind screen for ease of mounting and greater accuracy of measurement in windy conditions.

1.3.1 MOUNTING PEDESTAL

Two heights of pedestals are available for mounting the AWP: a 1m and a 1.5 meter option. Note the height ordered is the height of the AWP rim once mounted and not the actual height of the pedestal.

[1] Look for "MPS system AiO" available through Download on the App Store Get it on Google play

1.3.2 WIND SHIELD

A wind shield can be ordered to reduce the effects of wind on the precision of measurements. Wind shield is available in 1m and 1.5m heights to match the height of the pedestal ordered.

1m wind shield 1.5m wind shield

Figure 1-1: AWP with pedestal and wind shield

1.4 ACCESSORY ORDERING INFORMATION

ITEM	PART #	PART DESCRIPTION
AWP - 225 Gauge, 1m (3.3 ft) pedestal	AWP2-MNT-1M	AWP 2xx Pedestal 1m (3.3 ft) with concrete anchors
AWP - 225 Gauge, 1.5m (4.9 ft) pedestal	AWP2-MNT-1.5M	AWP 2xx Pedestal 1.5m (4.9 ft) with concrete anchors
AWP - 425 Gauge, 1m (3.3 ft) pedestal	AWP4-MNT-1M	AWP 4xx Pedestal 1m (3.3 ft) with concrete anchors
AWP - 425 Gauge, 1.5m (4.9 ft) pedestal	AWP4-MNT-1.5M	AWP 4xx Pedestal 1.5m (4.9 ft) with concrete anchors
Wind Shield (AWP-225 and AWP-425 1m)	AWP-WS-1M	Wind Shield, 1m (3.3 ft)
Wind Shield (AWP-225 and AWP-425 1.5m)	AWP-WS-1.5M	Wind Shield, 1.5m (4.9 ft)

1.5 PARTS

The following exploded view shows the major components of an AWP.

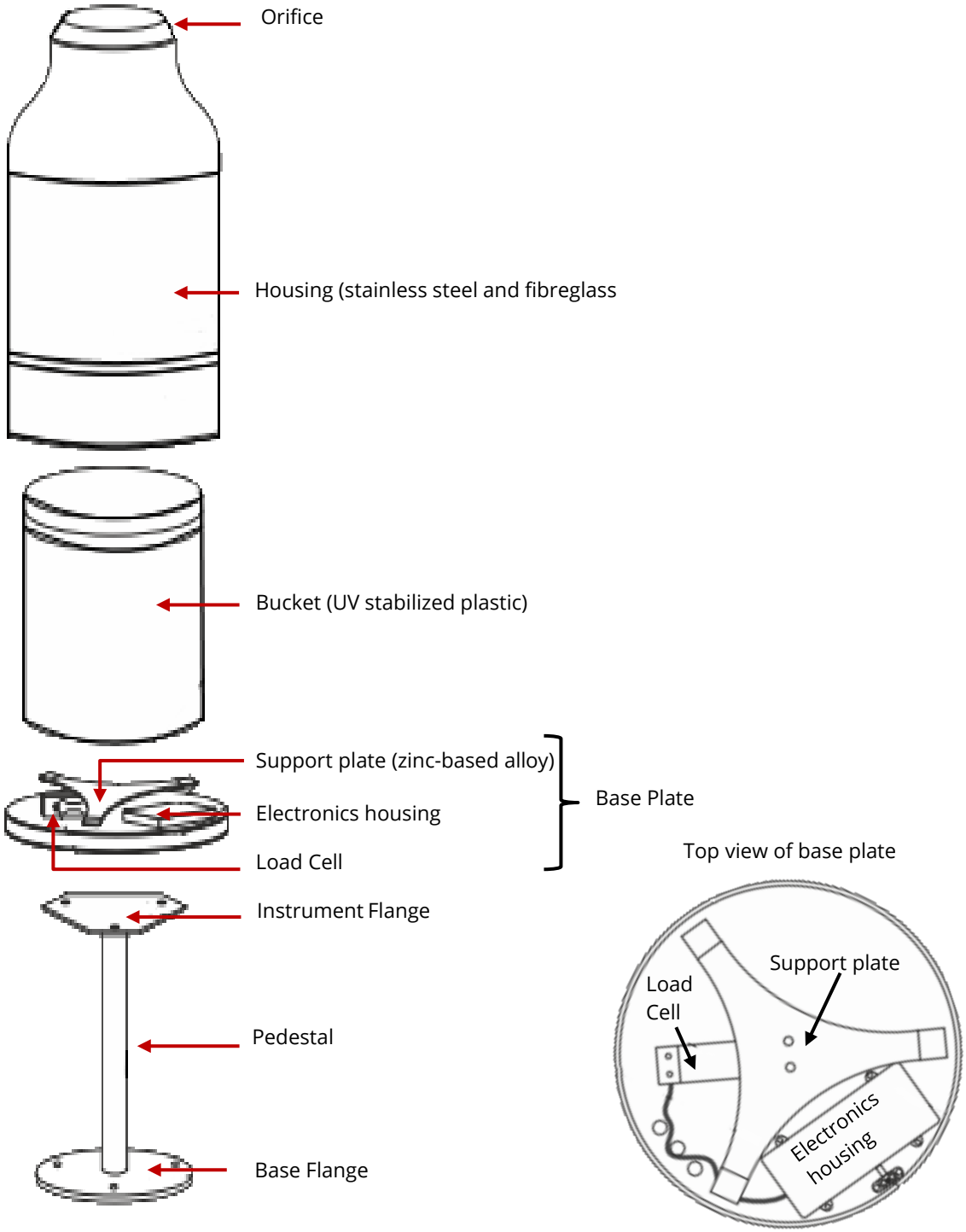


Figure 1-2: Major components of an AWP

1.6 MOUNTING HEIGHTS

Each model of AWP is mounted on a pedestal. There are two heights of pedestals for each model of AWP so that the resultant height of the orifice will be either 1m or 1.5 m. The pedestal sizes are identified by the resultant height of the AWP orifice not the pedestal height itself.

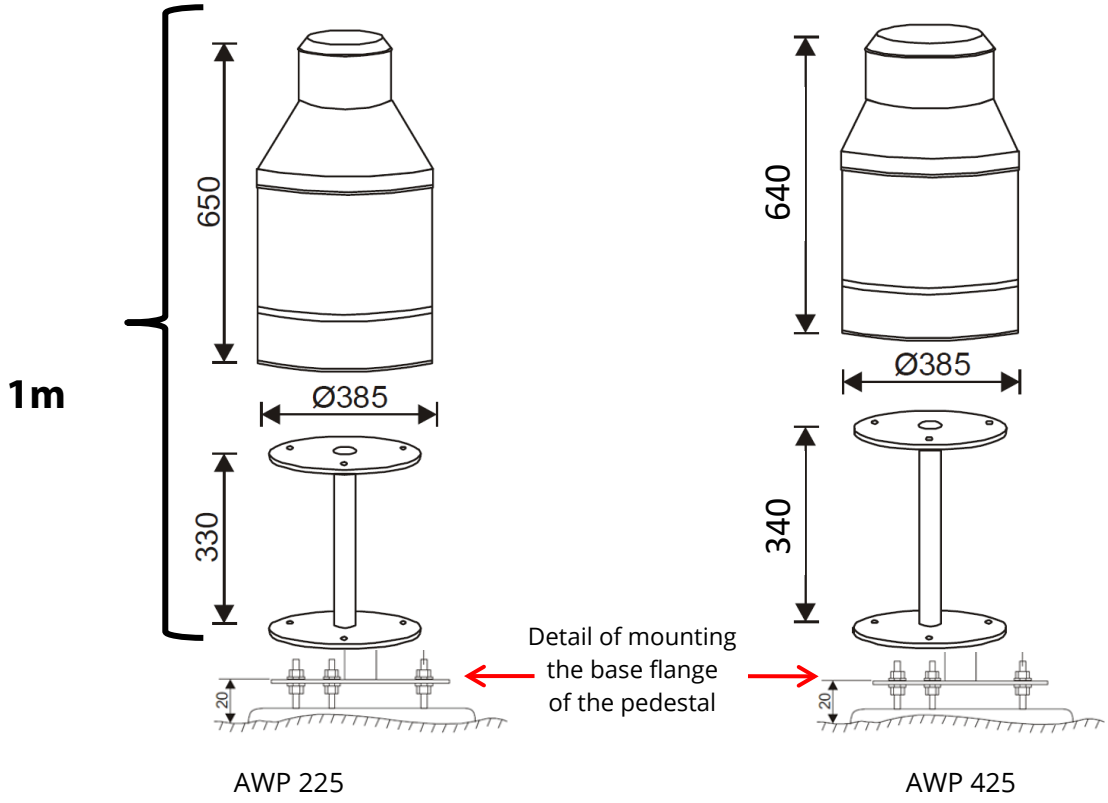


Figure 1-3: AWP225/AWP425 showing 1m pedestals
Unless otherwise indicated, all measurements are in mm.

Resultant orifice height is determined by:

The distance from the ground to the lower flange of the pedestal (20 mm) **+** pedestal height **+** AWP height.

Chapter 2 INSTALLATION AND MAINTENANCE

2.1 SITE SELECTION

- The installation site should be open but protected from winds.
- The distance from the gauge to any obstruction should be at least twice the height of the Obstruction above the orifice.
- The base plate of the rain gauge should be mounted in way, that the fixed side of the load cell faces north in the northern hemisphere/south in the southern hemisphere.
- Avoid installing on a slope or the rood of a building.
- The gauge should be mounted so that the orifice will be at a height above the maximum expected snow depth.

NOTE: If required by local conditions, the orifice may be positioned at a height of 1.5 meters above the surrounding terrain using the 1.5m pedestal

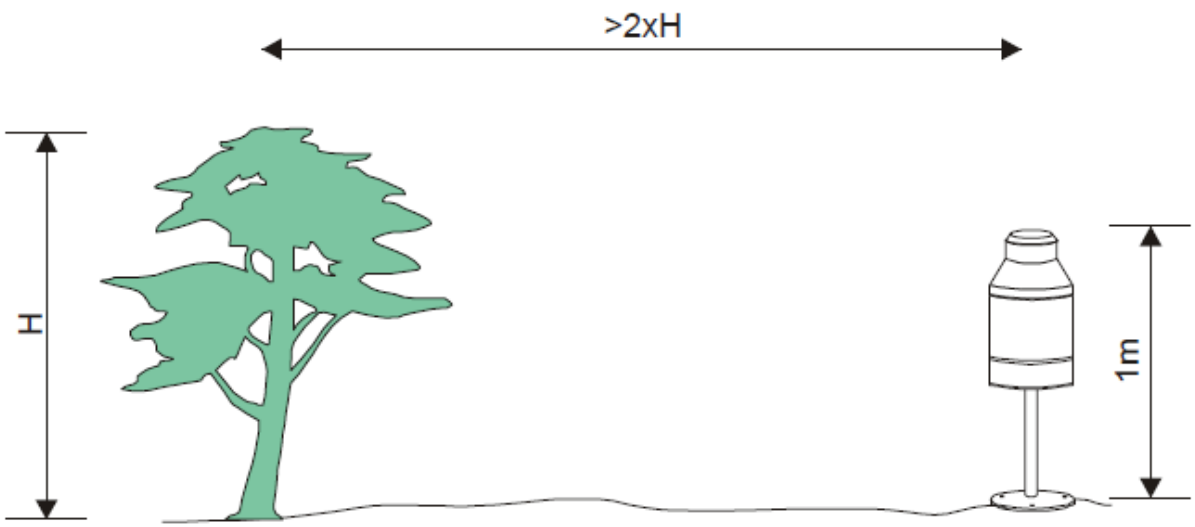


Figure 2-1: AWP placement

2.2 REQUIRED TOOLS

In order to install the AWP, the following tools are required:

- Philips #2 screwdriver
- M8 or 5/16” open end or combination wrench (in accordance with bolts in concrete base)
- 6 x M8 or 5/16” nuts (to match bolts in concrete base)
- 3 x washers for mounting the base flange
- One of a 20g, 25g, 50g or 100g weight (for measurement accuracy test of the sensor)
- Spirit level

2.3 CONCRETE BASE

The stand should be bolted to a concrete base. Use the template provided with your shipment (drawing #20094) which also includes the template for wind screen mounts.

1) Prepare a level concrete base and attach the provided 3/8" x 3-3/4" Stud Anchor (Part #21238) (see Figure 2-2) corresponding to the holes in the base flange of the mounting stand.

IMPORTANT!

- The vertex of the triangle formed by the bolts should face north (northern hemisphere) or south (southern hemisphere)
- When preparing the concrete base, ensure mounts for the wind screen (if being used) are also constructed.

2) Screw a nut onto each of the bolts so that the distance above ground level is 20 mm (see Figure 2-2).

2.4 MOUNTING

1) Place the base flange of the pedestal onto the bolts.

NOTE: the base flange is always round but the instrument flange can be hexagonal on some models (see Figure 2-3)

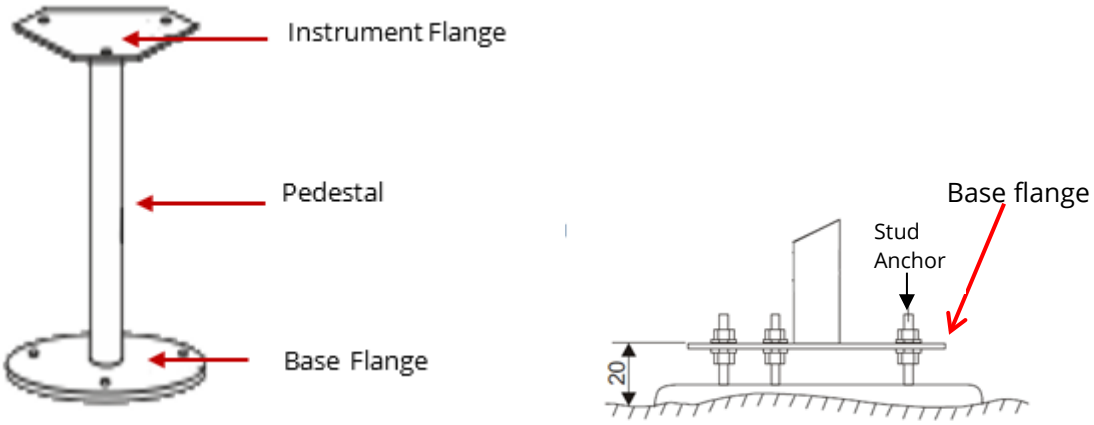


Figure 2-2: Base and mounting the pedestal

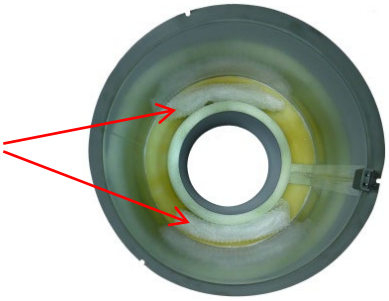
2) Level the Instrument flange using the spirit level. Check the horizontal plane in two directions perpendicular to each other. Adjust the lower nuts as necessary to achieve a level horizontal plane.

3) Fix the stand using another 3 nuts and washers. Do not fully tighten the nuts.

4) Detach the housing from the rain gauge base plate by loosening the screws at the bottom edge of the housing.

5) Remove the packing supports and packing material from the interior of the housing

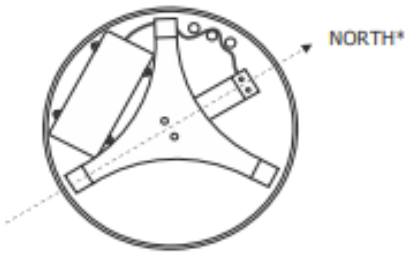
Packing material



6) Lift the bucket from the support plate.

7) Attach the base plate to the pedestal (instrument flange) using the three bolts with a locking washer.

IMPORTANT: Ensure the load cell is oriented to the north (northern hemisphere) or south (southern hemisphere)

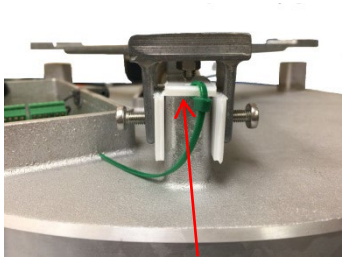


*South in southern hemisphere

8) Check the horizontal position of the support plate with the level and adjust the position using the lower flange nuts if necessary. Once level, tighten all nuts thoroughly.

9) The rain gauge is fitted with two transport screws and a transport bracket to prevent damage of the load cell during transport (see figure 2-3). Loosen both screws so that there is a space of at least 1 millimeter between the tip of the screw and the body of the gauge and remove the transport detent.

IMPORTANT: Retain the transport detent as it should be used any time the instrument is transported.



TRANSPORT
DETENT

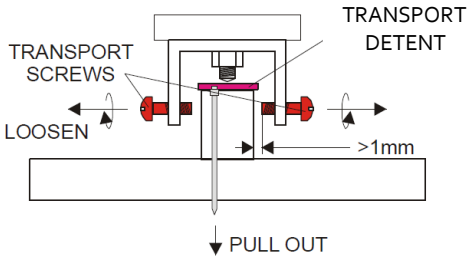


Figure 2-3: Transport restraints - detent

10) Replace the bucket ensuring it is correctly centred.

11) If operating in an area in which freezing conditions are expected, add 500 ml of environmentally friendly antifreeze to the bucket. See section 2.6.3 for details of using antifreeze.

12) Replace the housing, aligning the male part of the heat connector with the female connector located on the base plate and the outer slots with the bolt holes on the base. Press down firmly until there is no gap between the outer lip of the housing and the base ridge. Secure the housing with the bolts.

13) In order for the AWP to function correctly, there can be no contact between the bucket and the housing.

> HINT: Run your finger between the bucket and the housing to ensure there is no contact between the two.

14) Connect the SDI-12 cable to one of the SDI ports on an Axiom data logger using the military connector.

15) Wait 4 minutes and check the weight reported by the gauge. The weight of the empty bucket should be returned (1500g ±75g).

16) If the expected weight is not returned, review the setup and repeat #14. If the expected weight is still not returned, do a measurement accuracy check (section 2.5).

2.5 MEASUREMENT ACCURACY CHECK

A measurement accuracy check should be performed in dry weather with wind speeds less than 2 m/s and no gusts. You will need a precise reference weight (20, 25, 50, or 100g) or accurate amount of water. The check is done from the datalogger's transparent mode using the SDI-12 verification command (*a***V!).** Once the AWP is in place, powered, and configured with the Datalogger, you can conduct an optional calibration verification to ensure its operation and accurate conversion of weight to amount of precipitation. Details of the SDI-12 Commands and SDI-12 notation used here can be found in Chapter 3.

1) Once power is supplied, let the AWP stabilize for 3 minutes.

2) From the Datalogger's transparent mode, send the Reset command (this command clears the cumulative precipitation):

   Command: *a***Xclear!** In which *a* is the sensor address
   Response: *a*OK

3) Wait 2 minutes

4) Carefully place a weight in the centre of the bottom of the bucket or pour a known amount of water into the bucket.

5) Wait at least three minutes for the calculation of accumulated precipitation to complete.

6) Verify and Read the data:

   Command: *a***V!** ; Start verification
   Response: *a0001*
   Command: *a***D0!** : Read data
   Response: *a*<Reg.Val.156> : The value of Reg. No. 156 (PRLAST) equals the precipitation in mm corresponding to the inserted weight

7) Compare the measured value with the known weight/water amount and evaluate the calibration according to the limits in Table 2-1.

TABLE 2-1: REFERENCE TABLE FOR VERIFICATION PROCEDURE. RELATIVE ACCURACY 1%

Weight (g)	AWP-225			AWP-425		
	Min	Nom.	Max	Min	Nom	Max
20	*0.990*	**1.000**	*1.010*	*0.495*	**0.500**	*0.505*
25	*1.238*	**1.250**	*1.263*	*0.619*	**0.625**	*0.631*
50	*2.475*	**1.500**	*02.525*	*1.238*	**1.250**	*1.263*
100	*4.950*	**5.000**	*5. 050*	*2.475*	**2.500**	*2.525*

Example: Using an AWP 225 and 25g weight, sensor address 0 (zero)

Command: 0Xclear!
Response: 0OK
Command: 0V!
Response: 00001
Command: 0D0!
Response: 0+1.247!

Accuracy check passed. 1.247 falls between the Min (1.238) and Max (1.263) limits for a 25 g weight

8) Remove the weight/water.

   a) If not using anti-freeze, reset the gauge (*a***Xclear!)** so that the precipitation measured during the test won't be read by the data logger, replace the housing and secure the site.

   b) If using anti-freeze, follow steps 8 – 12.

9) Before putting anti-freeze in, power down the gauge.

10) Put in the anti-freeze.

11) Power up the gauge and wait about 3 minutes for the internal calculation to run.

12) Enter a "Measurement" command followed by a "Get Data" command

Command: *a***M!** ; Start measurement
Response: *a0003*
Command: *a***D0!** : Read data
Response: *a+0+nnn+0*
In which: a=SDI-12 address of the gauge
0 = PR - the amount of precipitation registered since previous reading [mm]
nnn = WAVG the weight of the bucket content [g] (the anti-freeze)
0 = PRTOT - the total amount of precipitation [mm].

13) Reset the gauge (*a***Xclear!),** replace the housing and secure the site**.**.

2.6 FIRMWARE UPDATES

Firmware updates are done through the mobile application. Details of the application and firmware updates are found in Chapter 5.

Chapter 3 PRINCIPLE OF OPERATION AND REGISTER TABLES

The measurement of the precipitation amount is based on the continuous measuring of the weight of the bucket content. One measurement cycle takes 10 seconds. At the end of each 10-second measurement cycle the AWP begins generating a series of pulses. The count of the pulses corresponds to the precipitation amount registered during that cycle and depends on the value of IMPRATIO parameter (the amount of precipitation corresponding to one pulse). If there is not enough time to generate all pulses during one measurement cycle the remaining pulses will be accumulated and sent during following cycles

At the end of each cycle all measured values are updated and prepared to be sent to the data logger. Any value can be read in any period greater or equal 10 seconds. The algorithm can take up to 120 seconds to register the complete amount of precipitation fallen into the bucket, mainly depending on the precipitation intensity and wind.

3.1 PRECIPITATION MEASUREMENT CALCULATIONS

There are three precipitation amounts calculated:

	MEASUREMENT	REGISTER NAME	CALCULATION
1	Amount of precipitation registered since previous reading	PR	At power-up, the value of PR is set to zero. At the end of each 10-second measurement cycle the precipitation amount registered during that cycle is added to the PR value. After a measurement/send data command aM!/aD0!), the value of PR is set to zero
2	Total amount of precipitation	PRTOT	At power-up, the value of PRTOT is set to zero. At the end of each 10-second measurement cycle the precipitation amount registered during that cycle is added to the PRTOT value. The value is never set to zero while the AWP is running continuously.
3	Amount of precipitation registered during current or previous precipitation	PRLAST	a) At power-up, the value of PRLAST is set to zero. At the end of each 10-second measurement cycle the precipitation amount registered during that cycle is added to the PRLAST value indicating current precipitation. Precipitation which stops and restarts with breaks less than 10 minutes, is considered current precipitation and is included in the PRLAST value. b) After the rain has stopped (a break of 10 minutes or more), the PRLAST remains unchanged, indicating previous precipitation. c) After a period of 10 or more minutes without precipitation, once precipitation re-starts, PRLAST will be set to zero and the calculation cycle restarts at a).

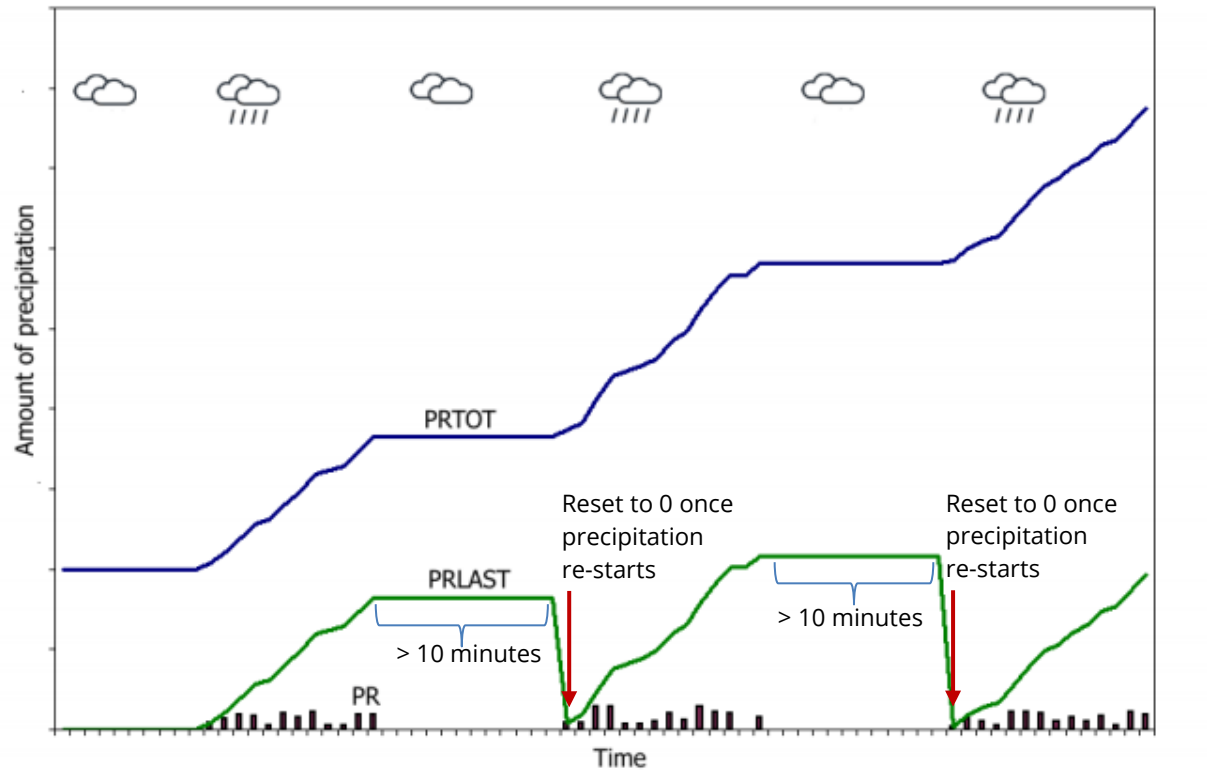


Figure 3-1: Comparison of PR, PRTOT, and PRLAST

3.2 RAIN INTENSITY (RI)

The value of RI represents an estimate of the instantaneous rain intensity calculated from increase of the bucket content weight during one measurement cycle. The RI reacts quickly to the changes in real rain intensity.

3.3 MEASURING BUCKET CONTENT

The value of WAVG represents a filtered weight of the bucket content including weight of the bucket itself.

3.4 TEMPERATURE MEASUREMENT

The electronic thermometer is placed inside the electronic unit housing thus the T represents the inside temperature. The additional temperature values (TAVG, TMIN, TMAX) are one-minute running values.

3.5 REGISTER TABLES

All measured and status values and parameters are stored in registers. See Table 3-1 for register descriptions and parameters.

TABLE 3-1: REGISTER DESCRIPTIONS

Register Number	Register Name	Description	Unit	Range	Resolution
4	***HEAT***	Heating mode: 0 ~ heating OFF, used for maintenance 1 ~ heating ON, used for maintenance 2 ~ AUTO: heating ON when Temperature ('T') is below THEAT, heating OFF when temperature rises above THEAT + 1°C. 3 ~ AUTO when raining: heating ON when Temperature ('T') is below THEAT and it there is precipitation, heating OFF when temperature rises above THEAT + 1°C	_	0-3	1
5	***THEAT***	Parameter: heating temperature threshold in ºC. Default Setting = 4.0ºC.	°C	-70 - 125	0.1
64	***U***	Internal Power supply voltage	V	0 -5	0.001
65	***T***	Temperature (Internal)	°C.	-50 – 70	0.01
66	***STATUS***	Status data (bit-mapped values of registers STATUS0 to STATUS7	_	0 - 255	1
80	***STATUS1***	1: 80% of bucket capacity reached	_	0 - 1	1
81	***STATUS2***	1: Unexpected restart detected	_	0 - 1	1
82	***STATUS3***	reserved	_	0 - 1	1
83	***STATUS4***	1: heater is on	_	0 - 1	1
84	***STATUS5***	reserved	_	0 - 1	1
85	***STATUS6***	reserved	_	0 - 1	1
86	***STATUS7***	reserved	_	0 - 1	1
145	***PR***	Amount of precipitation	mm	0 -9999	0.001
146	***WAVG****	Weight of bucket content including weight of bucket	g	-3000 - 33000	0.001
147	***TAVG***	One-minute temperature average	°C	-50 - 70	0.01
156	***PRLAST***	Amount of precipitation registered during current or previous precipitation	mm	0 - 999	0.001
157	***PRTOT****	Total amount of precipitation amount from power ON or reset	mm	0 – 9999	0.001
162	***PRcor***	Corrected amount of precipitations	mm	0 – 9999	0.001
165	***PRTOTcor***	corrected total amount of precipitation	mm	0 – 9999	0.001

Register Number	Register Name	Description	Unit	Range	Resolution
167	***RI***	Precipitation Intensity	mm/hr	0 - 999	0.1
169	***TMIN***	One-minute temperature minimum value	°C	-50 - 70	0.01
170	***TMAX***	One-minute temperature maximum value	°C	-50 - 70	0.01
171	***PRINST***	Instantaneous precipitation amount	mm	0 – 9999	0.001
174	***WS***	Estimate of wind speed	m/s	0 – 999	0.1
176	***IMRATIO***	Amount of precipitation corresponding to one pulse on contact output	mm	0.01 - 1	0.01
190	UNITS	Measurement units	–	0 – 1	1
240	I_T	Temperature	°F	-58 – 158	0.01
241	I_PR	Amount of precipitation	in	0 - 393662	0.01
242	I_PRLAST	Amount of precipitation registered during current or previous precipitation	in	0 – 39331	0.01
243	I_PRTOT	Total amount if precipitation	in	0 - 393662	0.01
244	I_RI	Precipitation intensity	in/hr	0 – 39331	1
245	I_TAVG	One-minute temperature average	°F	-58 – 158	0.01
246	I_TMIN	One-minute temperature minimum value	°F	-58 – 158	0.01
247	I_TMAX	One-minute temperature maximum value	°F	-58 – 158	0.01
248	I_PRINST	Instantaneous precipitation amount	in	0 - 393662	0.01
249	I_PRcor	Corrected amount of precipitation	in	0 - 393662	0.01
250	I_PRTOTcor	Corrected total amount if precipitation	in	0 - 393662	0.01
252	I_WAVG	Weight of the bucket content including bucket weight	oz	-106 - 1165	0.00001

Chapter 4 SDI-12 COMMUNICATION

The SDI-12 hardware port has the following parameters:

- 1200bps
- 7bit
- Even parity
- 1 stop bit

Default SDI-12 address = 0. If your AWP will be used with a pre-set configuration, ensure it is set to the address used in the configuration file.

4.1 NOTATION FOR SDI COMMANDS[2]

SDI commands are strings of characters sent to the SDI device. The spacing and case of the strings must be maintained and values/data entered as indicated for **set** commands.

Note the following:

- the "*a*" in each command should be replaced with the sensor address number
- the "*a*" in each response will be replaced with the sensor's address number
- every command must terminate with an exclamation mark (!)
- the measurement command must be followed by a Send Data command (**aD0!**) to view the data
- The relevant Register Name is indicated in the **Get/Set** commands. Refer to Table 3-1: Register Descriptions for the specifics of the referenced register item.
- All measurement commands can be implemented with a CRC (cyclical redundancy check)[1] by including the letter C in the command
- the CRC is added at the end of the message for commands with CRC

4.2 GENERAL SDI-12 COMMANDS[1]

Command Name	Command	Response and Explanation
Address Query	**?!**	*a* – the address of the sensor
Acknowledge Active	*a***!**	*a* – sensor at address a is active
Change Address	*a***A***b***!**	*b* is the new address, a single alphanumeric character in the range 0-9, a-z, A-Z
Send Identification	*a***I!**	*a*14MPSSYSTMTRWS10vvvxxxxxxxxxxxxx *a* = address 14= SDI-12 compatibility number (SDI-12 version 1.4) MPSSYSTM = manufacturer identifier TRWS10 = sensor model number vvv = firmware version number xxxx…. :xxx = detailed firmware number: serial #

[2] A detailed description and explanation of SDI-12 commands can be found in, *"SDI-12: A Serial-Digital Interface Standard for Microprocessor-Based Sensors Version 1.3"*, published by the SDI-12 Support Group. http://www.sdi-12.org/archives/SDI-12%20Specification%201.3%20July%2025%202004.pdf

Command Name	Command	Response and Explanation
Start Verification	***a*V**!	This command tells the sensor to return a verification in response to a subsequent D command. *a0001* 000 = the time in seconds until the sensor will have the measurement *1* = the sensor will make one measurement. Measures <Reg.Val156> (PRLAST)
Send Data	aD!	**Response to aD!** a+PRLAST PRLAST = amount of precipitation registered during verification (mm or mil, depending on UNITS set)

4.3 MEASUREMENT AND SEND DATA COMMANDS (METRIC UNITS)

The measurement command must be followed by a Send Data command (**aD0!**) to view the data.

The response format of a measurement command is *a*tttn in which:

a = sensor address
ttt = the time in seconds until the sensor will have the measurement(s) ready
n = A digit between 1 and 9. The number of measurement values the sensor will make and return in response to a D command

Refer to Table 3-1 for details of the Register Name parameters indicated..

4.3.1 BASIC DATA (PRECIPITATION AMOUNT AND WEIGHT)

Measurement Command	Send Data Command	Response and Explanation
aM! aMC!	aD0!	a0003 a+PR±WAVG+PRTOT PR = amount of precipitation registered since previous reading [mm] WAVG = weight of the bucket content [g] PRTOT = P total amount of precipitation [mm].

4.3.2 PRECIPITATION INTENSITY AND LAST/CURRENT PRECIPITATION AMOUNT

Measurement Command	Send Data Command	Response and Explanation
aM1! aM1C!	aD0!	a0002 a+PRLAST+RI PRLAST = amount of precipitation registered during current or previous precipitation [mm] RI = precipitation intensity [mm/hr]

4.3.3 TEMPERATURE AND SERVICE DATA

Measurement Command	Send Data Command	Response and Explanation
aM2! aM2C!	aD0!	a0006 a±T±TMIN±TAVG±TMAX+U+STATUS T = temperature [ºC] TMIN = one-minute temperature minimum value [ºC] TAVG = one-minute temperature average value [ºC] TMAX = one-minute temperature maximum value [ºC] U = internal power supply voltage [V] STATUS = various status data

4.3.4 CORRECTED PRECIPITATION AMOUNT DATA

Measurement Command	Send Data Command	Response and Explanation
aM3! aM3C!	aD0!	a0003 a+PRcor+PRTOTcor+WS PRcor = corrected amount of precipitation [mm] PRTOTcor = corrected total amount of precipitation [mm] WS = estimate of wind speed [m/s]

4.3.5 INSTANTANEOUS PRECIPITATION AMOUNT

Measurement Command	Send Data Command	Response and Explanation
aM4! aM4C!	aD0!	a0001 a+PRINST PRINST = instantaneous precipitation [mm]

4.4 MEASUREMENT AND SEND DATA COMMANDS (IMPERIAL UNITS)

The measurement command must be followed by a Send Data command (**aD0!**) to view the data.

The response format of a measurement command is *a*tttn in which:

a = sensor address
ttt = the time in seconds until the sensor will have the measurement(s) ready
n = A digit between 1 and 9. The number of measurement values the sensor will make and return in response to a D command

Refer to Table 3-1 for details of the Register Name parameters indicated.

4.4.1 BASIC DATA (PRECIPITATION AMOUNT AND WEIGHT)

Measurement Command	Send Data Command	Response and Explanation
aM5! aM5C!	aD0!	a0003 a+I_PR±I_WAVG+I_PRTOT I_PR = amount of precipitation registered since previous reading [in] I_WAVG = weight of the bucket content [oz] I_PRTOT = P total amount of precipitation [in].

4.4.2 PRECIPITATION INTENSITY AND LAST/CURRENT PRECIPITATION AMOUNT

Measurement Command	Send Data Command	Response and Explanation
aM6! aM6C!	aD0!	a0002 a+I_PRLAST+I_RI I_PRLAST = amount of precipitation registered during current or previous precipitation [mil] I_RI = precipitation intensity [mil/hr]

4.4.3 TEMPERATURE AND SERVICE DATA

Measurement Command	Send Data Command	Response and Explanation
aM7! Am7C!	aD0!	a0006 a±I_T±I_TMIN±I_TAVG±I_TMAX+U+STATUS I_T = temperature [ºF] I_TMIN = one-minute temperature minimum value [ºF] I_TAVG = one-minute temperature average value [ºF] I_TMAX = one-minute temperature maximum value [ºF] U = internal power supply voltage [V] STATUS = various status data

4.4.4 CORRECTED PRECIPITATION AMOUNT DATA

Measurement Command	Send Data Command	Response and Explanation
aM8! aM8C!	aD0!	a0003 a+I_PRcor+I_PRTOTcor+WS I_PRcor = corrected amount of precipitation [mil] I_PRTOTcor = corrected total amount of precipitation [mil] WS = estimate of wind speed [m/s]

4.4.5 INSTANTANEOUS PRECIPITATION AMOUNT

Measurement Command	Send Data Command	Response and Explanation
aM9! aM9C!	aD0!	a0001 a+I_PRINST I_PRINST = instantaneous precipitation [mIL]

4.5 SDI-12 READING STATUS COMMANDS

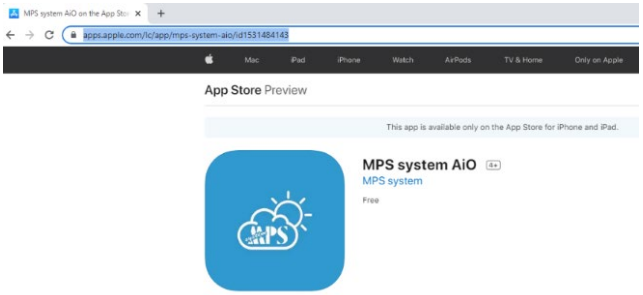
This command returns a reading status byte (bit-mapped) from the bit-mapped status register

Command	Response and Explanation
aR0!	a+STATUS
aR1!	a+STATUS0+STATUS1+STATUS2+STATUS3+STATUS4+STATUS5+STATUS6 +STATUS7 In which: STATUS0 = 1:activated STATUS1 = 1: 80% of bucket capacity reached STATUS3 = (reserved) STATUS4 = 1:heater is on STATUS5 = (reserved) STATUS6 = (reserved) STATUS7 = (reserved)

Chapter 5 MOBILE APPLICATION

The free mobile application[3] permits you to connect to the AWP through a Bluetooth wireless interface and perform various tasks. Download the MPS Bluetooth app here:

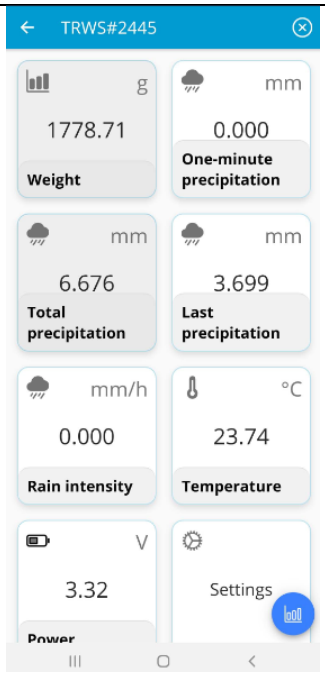
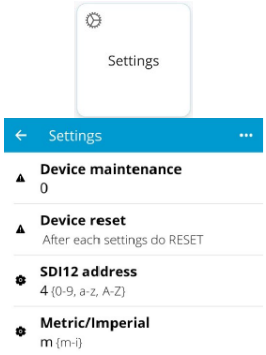
https://apps.apple.com/lc/app/mps-system-aio/id1531484143



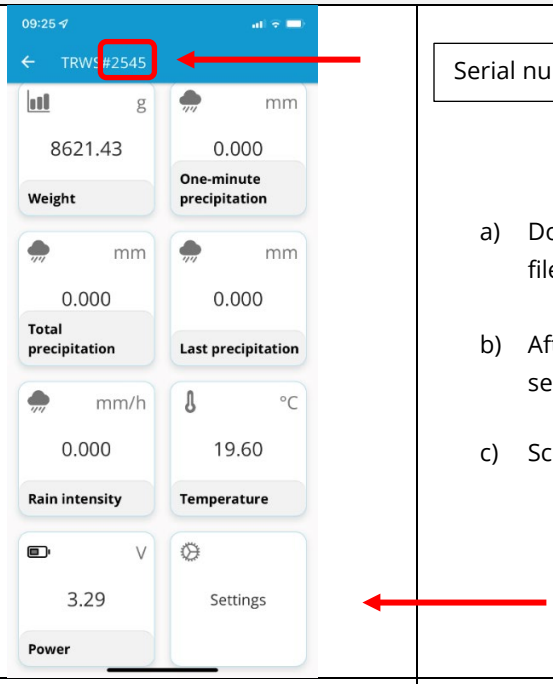
5.1 SUMMARY OF TASKS

SCAN FOR NEARBY DEVICES	
	Tap on the ***Scan*** button on and wait until a list of nearby devices appears. Each list item contains identification of the device (e.g. TRwS), its serial number and set of basic measurements including the contents of the ***Status*** register provided by Bluetooth advertising packets. Eventually you can tap on ***Stop scanning.***
CONNECTING TO A DEVICE	
	Select the desired sensor from the scanned list and tap on the ***Connect*** button. Wait until panels with measurements are shown.
DISPLAY CURRENT MEASUREMENT	

[3] Look for "MPS system AiO" available through Download on the App Store Get it on Google play

<table>
<tr><td> 
</td><td>Once connected to the sensor, a set of panels with current measurements is shown. While connected, the values will be updated at regular intervals.
• Tap on a panel to show a short-term history of the single measurement
• Touch-and-hold and then select two measurements to show their history.</td></tr>
<tr><td colspan="2">DISPLAY A SHORT-TERM HISTORY</td></tr>
<tr><td> 
</td><td>• Tap on a panel to show a short-term history of the single measurement
• Touch-and-hold and then select two measurements to show their history.
• Display precise values of the displayed measurement(s) by tapping on a data point of the graph.
• Zoom in or out from the vertical axis (axes) by tapping the Plus and Minus buttons
• Tap on a row in the table below the graph to centre the horizontal axis around the corresponding data point.
• Go back to the current measurements screen by tapping the arrow in the upper left corner.</td></tr>
<tr><td colspan="2">CHECKING AND CHANGING THE SENSOR SETTINGS</td></tr>
<tr><td> 
</td><td>• Tap on the Settings panel on the Current measurements screen. (Scroll down if the panel is not visible.) Now you can see the Settings screen with current sensor settings.
• Tap on an item to change it. Enter a new value and tap on Save button. If prompted to enter a PIN enter the zero-padded serial number of the sensor, e.g. 002549.
• In order that the changes take effect it is necessary to reset the sensor by tapping Device reset.
• There is a special item called Device maintenance. Set its value to 1 at the beginning of a maintenance work on the sensor in order to prevent the sensor from registering fake precipitation during the work.</td></tr>
</table>

UPDATING THE FIRMWARE

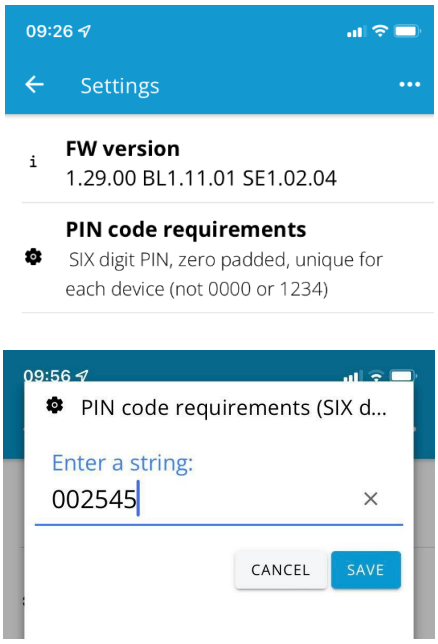


Serial number needed for PIN in step (d).

a) Download the firmware files to your phone. Firmware files are found on the FTS Customer Support site

b) After Scanning and connecting to the unit, record the serial number as it is required for the next step

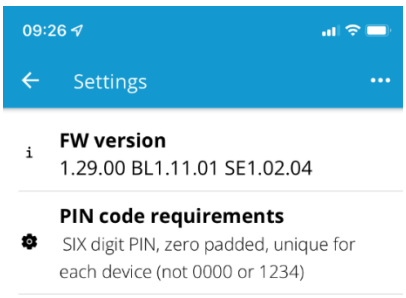
c) Scroll down and select "Settings"



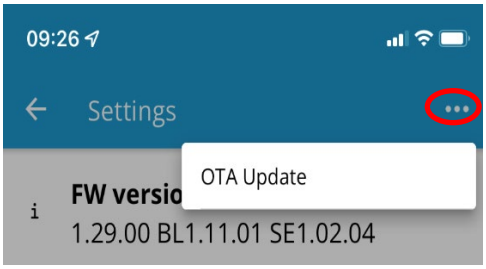
d) Select PIN code requirements and enter the gauge PIN.

The PIN is a 6-digit code which starts with 00 followed by the gauge's 4-digit serial number seen at the top of the page in the previous step. It is also found on the label under the bucket.

e) Select "Save"

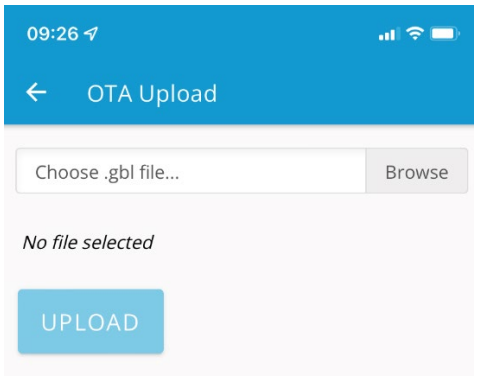


f) You will see the current firmware version.



g) In the upper right corner of the screen, select the … to view further options.

h) Select the OTA Update (over the air update)



i) Press “Browse” to select the file. Select the firmware version file that starts with the same integer as the firmware version currently loaded on the gauge.

j) Select the .gbl file to “Upload”

k) The upload process takes at least 15 minutes.

l) Once the update is complete, power cycle the gauge by disconnecting it from the Datalogger, wait a few seconds, and then re-connect it.

m) Go to transparent mode and issue the SDI-12 Information command (aI!) to confirm the serial number and firmware version.

n) Disconnect from the gauge.

Chapter 6 MAINTENANCE

The AWP requires minimal maintenance. Refer to the following table for the recommended maintenance routine:

Table 5-1: Recommended maintenance schedule

Visual Inspection	Twice a year (minimum) and at every site visit.	Section 5.1
Cleaning	Twice a year or as necessary	Section 5.2
Empty bucket	When bucket nears 80% of its full capacity	Section 5.3
Add Antifreeze	If operating in freezing conditions, on setup, and after emptying bucket	Section 5.4
Checking heater	Annually (at start of winter season)	Section 5.5
Check horizontal position	Annually, at end of winter season	Section 5.6
Measurement Accuracy Check	Annually, at end of winter season	Section 5.5

6.1 VISUAL INSPECTION

When at the site, inspect for any signs of visible damage to the components including cable runs. Check all the fittings to ensure they are still tight.

Ensure the bucket is properly seated by running your finger between the bucket and the cover to ensure there is no contact between the two.

6.2 CLEANING

Remove any dirt and debris including insect nests, spider webs etc which may have accumulated around the instrument and in the bucket.

6.3 EMPTYING THE BUCKET

6.3.1 REQUIRED TOOLS

- Siphon/pump
- Large, covered bucket (for storing and transporting anti-freeze treated contents)
- 5/32 hex key
- 13 mm combination wrench (or adjustable wrench)
- 5mm socket head
- 9/32 socket wrench

The bucket contents can be emptied at any time; however, it is prudent to empty it after long periods of precipitation or when the bucket is at 80% or more capacity. You can determine if the bucket needs to be emptied by checking the status register (R0 or R1 command). Should the bucket overflow, measurements will be inaccurate, but the weighing mechanism and other electronics will not be damaged.

The contents of the bucket can be emptied by siphoning, pumping, bailing, or pouring. The first two are the preferred method if the bucket is at near capacity or if it has a wind screen. If pouring, there is a risk of injury if proper workplace techniques are not used.

- Consider reducing the load by removing some contents by bailing, siphoning, or pumping.
- If necessary, solicit assistance.
- Use proper lifting techniques.
- Minimize twisting.

6.3.2 STEPS

1) Power down the AWP by disconnecting it from the Datalogger.

> NOTE: Once re-connected to the data logger, logging will continue as programmed, maintaining the continuity of measurements from the point of disconnection.

2) Remove the windscreen for easier access to the sensor, if required
3) Remove the bucket contents.

> **IMPORTANT!** If the bucket contents have been treated with antifreeze, follow manufacturer's directions for the safe handling, storage and disposal of the contents.

Siphon/pump: feed the siphon/pump hose into the bucket and remove the bucket contents.

Pouring:

a) Remove the windscreen to gain access to the AWP.

b) Remove the cover.

c) Determine if the bucket can be safely removed:

CAUTION! The bucket weighs **24 kg (53 lbs)**.at 80% capacity; **30 kg (66 lbs) at 100% capacity**.

- Consider reducing the load by removing some contents by siphoning or pumping.
- If necessary, solicit assistance to lift.
- Use proper lifting techniques.
- Minimize twisting.

d) Carefully lift the bucket from the base plate and pour out the contents ensuring contents treated with anti-freeze are stored in accordance with manufacturer's directions. Inspect the interior of the bucket and remove any debris.

4) Replace the bucket, cover and screws (if bucket had been removed).
5) Ensure the bucket is properly seated by running your finger between the bucket and the cover to ensure there is no contact between the two.
6) If adding anti-freeze, do so now.

7) Re-connect the SDI-12 cable to the Datalogger.

8) Depending on specific values being measured and mathematical processes being run by your agency, consider resetting the variables in accordance with your agency's requirements.

6.4 ANTIFREEZE

The collection bucket is very sturdy and will maintain its shape even if its contents freeze. If the AWP will be operating in temperatures below freezing, it is recommended to add 500 ml of environmentally friendly antifreeze to the bucket to prevent the collected precipitation from solidifying.

When adding anti-freeze, unplug the AWP from the datalogger, add the anti-freeze and then re-connect to the data logger

> IMPORTANT: DO NOT pour anti-freeze directly into the bucket when the AWP is connected to the data logger as the anti-freeze will register as precipitation.

If emptying the bucket before adding anti-freeze, follow the steps in section 5.3.2 and add the anti-freeze before powering re-connecting power to the gauge.

Selecting Antifreeze

When selecting an antifreeze product consideration should be given to the following:

- Propylene glycol based (or other environmentally friendly formulation)
- Water soluble
- Low evaporation point
- Compatible with AWP construction materials

> IMPORTANT! Follow manufacturer's directions for the safe handling, storage and disposal of the antifreeze being used.

Disposal

When disposing of bucket contents treated with antifreeze, do not dump contents into the environment. It is recommended to collect the contents and dispose of in an environmentally friendly manner. Ensure all local regulations are observed.

6.5 CHECK HORIZONTAL POSITION

Place a spirit level on the rim. Check in two directions perpendicular to each other. If not level, adjust the lower flange nuts as necessary.

6.6 TRANSPORTING THE AWP

When transporting the AWP, it should be prepared to prevent movement of the interior elements.

Restrain the support plate using the supplied transport detent/ transport nuts. Refer to Section 2.4 Step 9. Consider using a removable thread locker designed to lock the nuts against vibration loosening.

Use firm packing material in the narrow portion of the housing to hold the rain bucket in position on the support plate. See picture in section 2.4 Step 5.

Chapter 7 SPECIFICATIONS

7.1 SPECIFICATIONS

	AWP 225	AWP 425
MEASUREMENT		
Collecting area	200 cm^2	400 cm^2
Capacity	1500 mm	750 mm
Accuracy absolute	±0.1%	
Accuracy relative [%]	±1%	
Accuracy of amount	0.025mm	
Accuracy of intensity	0.025mm/min	
Threshold amount	0.05/40min	0.025/40min
Threshold intensity	0.05mm/min	0.025mm/min
Maximum Rain Intensity	120 mm/min	
Resolution	0.001mm/0.01mm	
Measuring Element	Load Cell IP67	
Ambient Air Temperature Measurement	Optional, -40 to +70 ºC	
Wind Speed estimation	Optional	
ELECTRICAL & INTERFACE		
Power supply	5 – 30VDC	
Power Consumption	24V/0.5mA	
Serial output	SDI-12	
PYSICAL		
Dimensions	385 x 650 mm	385 x 610 mm
Weight	9.5 kg	
Bucket Weight	1500g ±75g	
ENVIRONMENTAL		
Operating Temperature Range	-40 to +70ºC	
Operating Humidity Range	0 – 100%	
Degree of Protection	IP65	

DOCUMENT REVISION HISTORY

Revision	Date	Description
1	10 Jun 2021	Original
2	29 Nov 2021	Separated steps in section 2.5.
3	05 Dec 2022	Expanded FW update procedure in Ch 5 (PM-430)