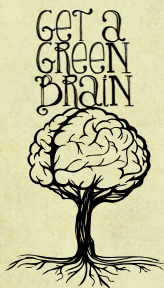


MEA

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climate monitoring
and
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Junior Weather Station User Manual

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Notices

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Design Changes

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Warranty

MEA offers a 12 month, **return-to-factory** warranty on all new logging systems and hardware. The warranty applies to hardware, software and system defects only. The warranty does not cover acts of misuse by the user or third parties, including misuse arising from failure to install or operate a system or its components in accordance with relevant system documentation, or failure to seek advice from MEA regarding correct installation or operation of a system or its components.

Support

If you have questions or problems that cannot be resolved using the information in this manual, contact MEA technical support using the details above. If phoning, ask for the Operations Manager and explain the issue. The Operations Manager will assign a Technician to help resolve the issue. Quoting your MEA Job Reference Number will enable us to quickly locate your details.

Phone support is generally available Monday to Friday between 9am and 5pm Central (ie South Australian) Standard or Summer Time.

Site visits can be arranged but will incur charges for labour, travel time and where applicable, accommodation and meals.

MEA technicians can only offer support for issues relating directly to the operation of Magpie software or MEA logging systems or hardware. For general computer issues please consult a computer technician.

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Introduction

Thank you for purchasing an MEA Junior Weather Station. This manual explains how to install and operate your weather station. Please read it thoroughly before attempting to install or operate your weather station.

Please note that your weather station has been 'built to order' and the manual may make reference to climate sensors or other features which are not part of your particular system.

If you have a question about the installation or operation of your Junior Weather Station which is not answered in this manual, or if you see something you think is wrong, please contact MEA using the details inside the front cover of this manual.

Contents of the Shipping Crate

Your Junior Weather Station has been shipped to you in a large plywood box so that the weather station is well protected in transit.



The combined weight of the weather station and the shipping crate is approximately 60 kg. Use mechanical lifting aids or team lifting when moving the shipping crate.

The crate contains:

- A data recorder and data transfer devices in a square plastic enclosure, bolted to an upright.
- A cross arm with a solar panel and solar radiation sensor attached.
- An LP02 global solar radiation sensor.
- A PA2 wind speed sensor and a PRV wind direction sensor.
- A HC2-S3 air temperature and relative humidity sensor.
- An MEA2040 leaf wetness sensor.
- A 6507A soil temperature sensor.
- A universal mounting bracket and U-bolt assemblies.
- A disk or USB drive containing software and documentation.
- A USB cable.

The Assembled Weather Station

Following assembly your weather station will look like this.

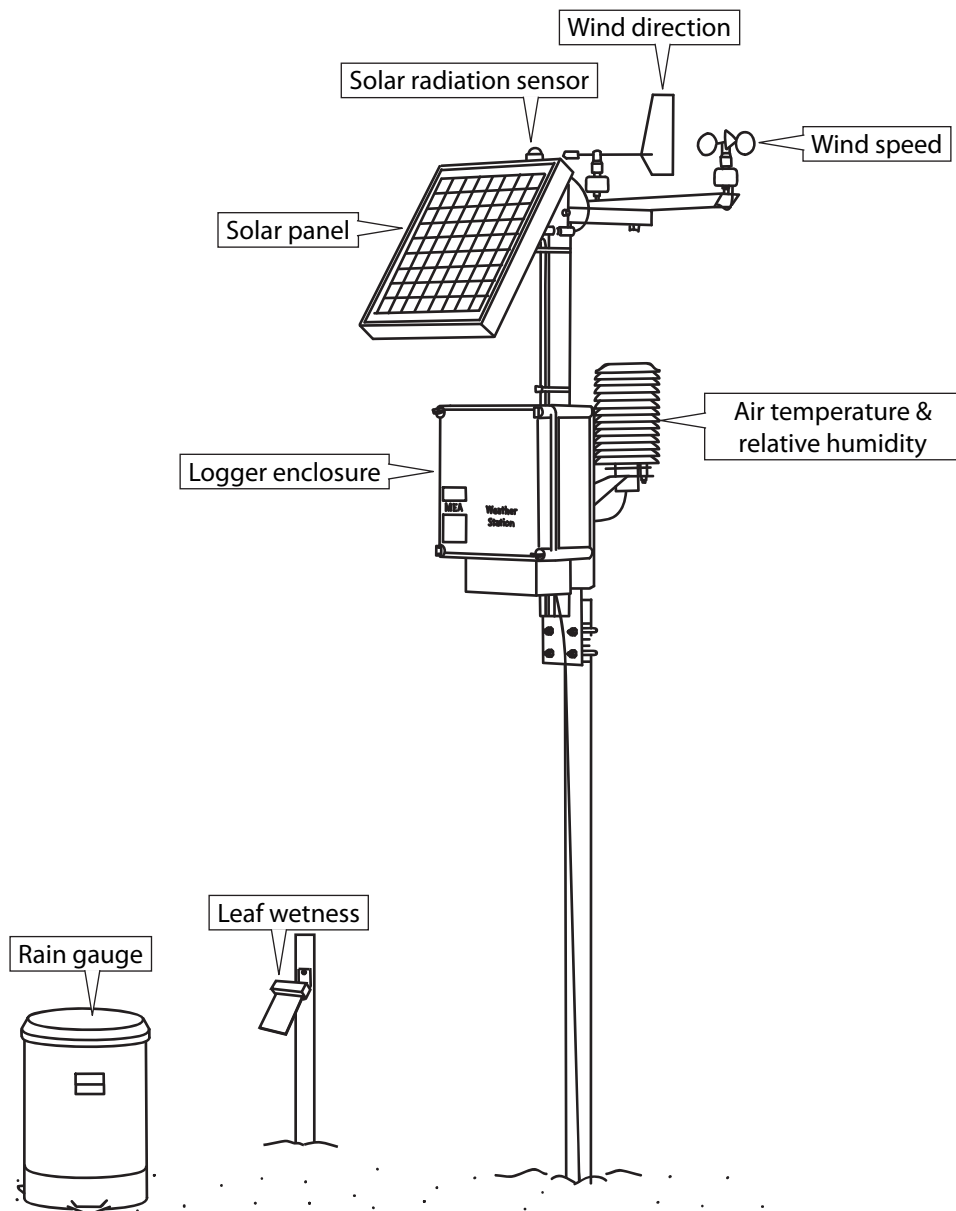


Fig. 1. Junior Weather Station.

Solar panel. The solar panel keeps the system battery charged and powers the data logger and all of the instruments on your weather station.

Solar radiation sensor. This sensor measures direct and diffuse (global) solar radiation in a 180° field of view. Solar radiation measurements can be used in the calculation of Daylight Hours and potential Evapotranspiration.

Wind direction sensor. Wind direction can be an important thing to know for spray applications.

Wind speed sensor. Wind speed is also an important thing to know for spray applications. Wind speed measurements can also be used in the calculation of potential Evapotranspiration.

Air temperature and relative humidity sensor shelter. Air temperature and relative humidity can be used in the calculation of potential Evapotranspiration, Delta-T, Apparent Temperature, and Dew Point. Air temperature can also be used in the calculation of Frost Hours, Degree Days and Chill Days.

The **logger enclosure**. This contains the data logger, system battery and, if ordered, the devices that will transfer your weather recordings to the Internet.

The **rain gauge**. A two-compartment bucket inside the gauge collects rainfall as it passes through the gauge. As each compartment becomes full, the bucket 'tips' around a pivot, then the other compartment begins to fill. Each 'tip' corresponds to 0.2 mm of rainfall.

Leaf wetness sensor. The sensor acts like an artificial leaf and detects the presence of moisture on its surface. Rather than simply 'wet' or 'dry', the sensor can measure surface moisture over the entire range from 0 to 100%.

Soil temperature sensor (not shown).

Virtual Instruments

The inputs from the climate sensors on your Junior Weather Station are combined in Magpie software to calculate additional values, called 'virtual' instruments.

Delta T

Delta T is one of the standard indicators for acceptable spray conditions. It is indicative of evaporation rate and droplet lifetime. Delta T is calculated by subtracting the wet bulb temperature from the dry bulb temperature. The result is expressed as °C.

When applying pesticides, Delta T should ideally be between 2 and 8°C (Source: <http://reg.bom.gov.au/info/leaflets/Pesticide-Spraying.pdf>).

Your Junior Weather Station calculates Delta T from air temperature, relative humidity and the altitude of the site where the station is located.

You will need to enter the altitude into the logging scheme so that Delta T can be correctly calculated. Please see "Entering Your Altitude for the Delta T Instrument" on page 46 for further details.

Degree Days

Degree days are a measure of heat accumulation used to predict plant maturation rates. It is calculated from air temperature. By default, the calculation assumes that no growth will occur below 10°C or above 35°C. The result is expressed in °C, and is updated at 9 am each day.

Dew Point

Dew point is the temperature to which the air would have to be cooled to in order for condensation of water vapour to occur. It is calculated from air temperature and relative humidity. The result is expressed in °C.

Chill Units

Vegetative and fruiting buds for some types of crop remain dormant until they have accumulated sufficient 'chill units'. The 'Utah Method' is used to assign chill units with a positive value between 1.4 and 12.4°C, zero units from 12.5 to 15.9°C and negative units above 16°C.

Chill units are updated at 9 am each day.

Frost Hours

Frost hours is the accumulation of time below a threshold air temperature of 2°C. The calculation is an indication of the conditions under which frost is likely to occur, not an actual measurement of frost conditions. The result is expressed in hours and is updated at 9 am each day.

The threshold value can be adjusted to suit local conditions if required. Please see “Changing the Threshold Temperature for Frost Hours” on page 47 for further details.

Daylight Hours

Daylight hours is the accumulation of time spent above a threshold global solar radiation measurement of 10W/m². The result is expressed in hours and is updated at 9 am each day.

EvapoTranspiration

Evapotranspiration is the combined loss of water from a soil surface (evaporation) and from the stomatal pores of plants (transpiration). Magpie uses the FAO Penman-Monteith model to calculate potential ETo. ETo is calculated from air temperature, relative humidity, solar radiation, wind speed, daylight hours, latitude and altitude. The result is expressed in mm and is updated at 9 am each day.

You will need to enter the latitude and altitude for the weather station site in the logging scheme so that ETo can be correctly calculated. Please see “Entering Latitude and Altitude for the ETo Instrument” on page 48 for further details.

Site Preparation

Before installing the weather station, select and prepare a suitable site.

The site selected should be representative of the average conditions over the area of interest.

If the site is not staffed, then the weather station should be located in a secure area or out-of-sight. Any protective fencing should not shade the solar panel or solar radiation sensor.

The following requirements should be considered:

- The ground should not be either too hard or too soft to prevent inexpensive installation of the weather station or any necessary protective fencing.
- If your weather station delivers data to the Internet, the site should have good mobile phone reception.
- The site should be easy to get to for maintenance and inspection of the station.
- The general area should be level.
- The area should not be artificially watered.
- Any vegetation surrounding the weather station will need to be cropped to a height of a few cm as part of routine maintenance.
- The use of compacted 'hard standings' is not recommended as this can give unrepresentative soil and air temperature results.
- A separate area approximately 4 m from the weather station should be prepared for the rain gauge.

The distance of any obstruction (eg fences, trees, buildings) less than 15 m tall should be at least four times the height of the tallest obstruction away from the weather station.

For obstructions taller than 15 m the distance to the weather station will need to be increased up to ten times the height of the obstruction if the angle from the top of the weather station to the top of the obstruction is more than 45°. Isolated thin masts closer to the enclosure are acceptable if they don't cast a shadow on the solar radiation sensor or solar panel and are located down-wind of the prevailing winds.

Sites chosen should **not** be:

- Subject to flooding or inundation by storm surge.
- Affected by a high water table.
- Prone to subsidence.
- Unduly susceptible to lightning strike.
- Vulnerable to bushfire.

Hardware Installation

Required Tools and Equipment

To install the weather station and rain gauge you will need:

- A galvanised steel post with an outside diameter of 40~50 mm, 1.5 m long.
- Rapid-set concrete if the post is to be concreted in.
- 13 mm AF spanner.
- 10 mm AF spanner.
- Medium Phillips No. 2 screwdriver.
- 5 mm AF hexagonal key.
- 4 mm AF hexagonal key (supplied).
- Shovel or 40 mm Auger.
- Post level.
- Sledgehammer.
- Compass.
- Stepladder.
- Laptop with Magpie 3 software and the logging scheme installed (software supplied).
- USB Type-A male to Type-B male cable (supplied).

Mounting Post

The weather station is designed to be mounted to a galvanised steel tube with an outside diameter of 40~50 mm. The post needs to be positioned in a place where the sun can shine on the solar panel for most of the daylight hours and tall enough to ensure that the panel can 'see over' any obstacles.

Galvanised Post: Concrete Method

1. Dig a hole about 150 mm in diameter and 400 mm deep.
2. Drive the pole into the bottom of the hole an extra 100 mm so that it stands vertically and 1 m remains above the surface. Use the **post level** to ensure that the post is vertical.
3. Backfill the hole with quick setting concrete according to the instructions on the bag.

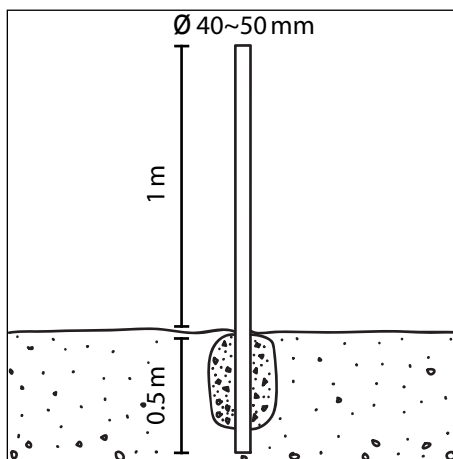


Concrete dust can be hazardous to your health. Follow all safety directions printed on the concrete bag.

4. Let the concrete set before fitting anything to the post. Check the post and ensure that it is firmly supported in the ground.

Galvanised Post: No Concrete Method

1. If the soil conditions allow it, auger a 40 mm hole 300 ~ 400 mm deep and drive the post directly into the soil so that 1 m remains above the surface.
2. Check the post and ensure that it is firmly supported in the ground and is vertical.



Bolt the Weather Station to the Post

Mount the weather station to the post as per the diagram below.

1. Loosely fit 2 U-bolts and clamp saddles to the front of the mounting bracket below the logger enclosure (if using a square post the clamp saddles can be left out).
2. Slide the U-bolts over the top of the post until the spine of the weather station rests on top of the post, as indicated in Fig. 2.
3. Make sure the solar panel faces north then tighten the nuts on the U-bolts using a **13 mm AF spanner**.

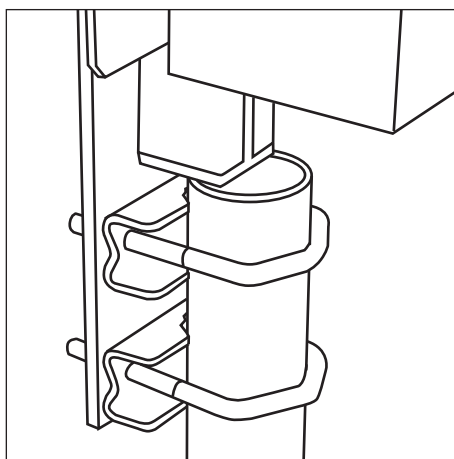


Fig. 2. Bolt the weather station to the top of the post as shown.

Hint: This will be easier with two people so that one person can hold the weather station while the other tightens the nuts.

Adjust the Solar Panel

The solar panel **should face north** and be adjusted at an angle suitable for the latitude of the station.

1. Use a compass to north-align the solar panel.
2. Use a **5 mm AF Hex key** to remove the 2 tilt adjustment screws.
3. Swing the solar panel up until it is at your **latitude +15° from horizontal** (45° works well enough throughout most of Australia). The tilt adjustment bracket has 7 positions, pick the one closest to your desired tilt.
4. Re-insert the tilt adjustment screws and tighten.

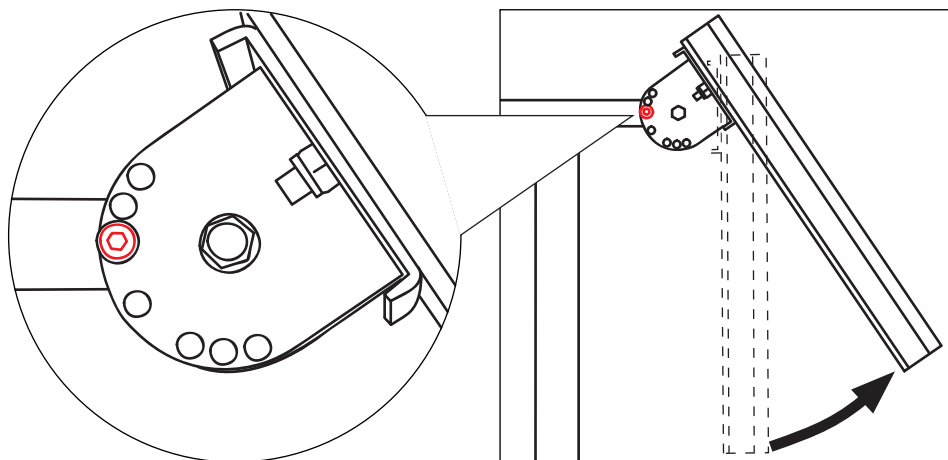


Fig. 3. Remove the tilt-adjustment screws (illustrated in red) on both sides of the tilt adjustment bracket, move the solar panel to your desired angle and replace the screws.

Level the Solar Radiation Sensor

The solar radiation sensor is shipped pre-mounted to its mounting bracket on the cross arm to the rear of the solar panel, but will require levelling on site.

1. Remove the packing materials covering the glass dome of the sensor.
2. Position the **step ladder** so that you can see the built-in bullseye level on the solar radiation sensor.
3. If the bubble is centred inside the black ring on the level then no further adjustment is required.
4. If levelling adjustment is required, use a medium **Phillips No. 2 screwdriver** and a **8 mm AF spanner** to loosen the mounting screws.
5. Use a **4 mm AF Hex key** to adjust the 3 levelling screws until the bubble is centred inside the black ring on the bullseye level.
6. Tighten the mounting screws evenly.
7. Check to ensure that the in-line connectors on the solar radiation sensor cable are connected.

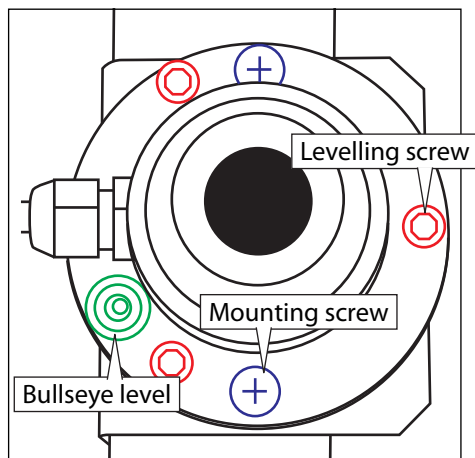


Fig. 4. Levelling the radiation sensor.

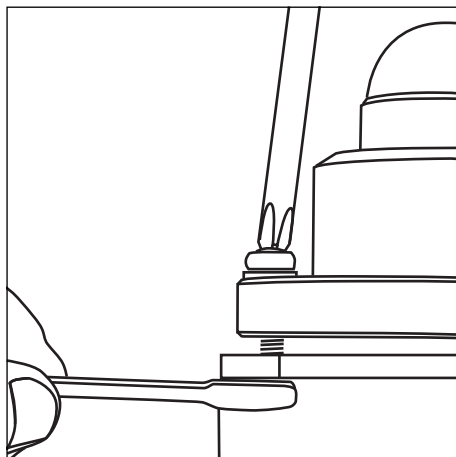


Fig. 5. Loosen the mounting screws.

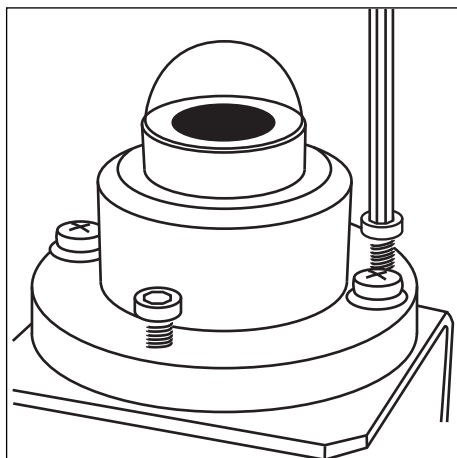


Fig. 6. Adjust the levelling screws.

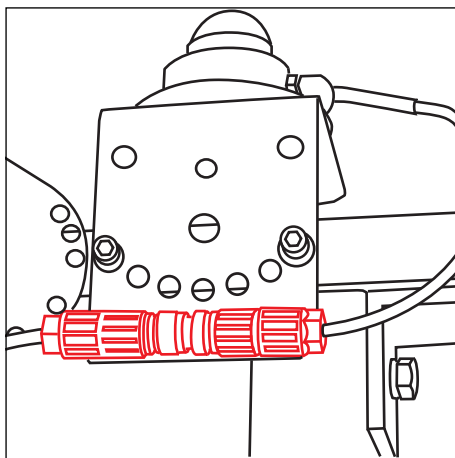


Fig. 7. Check the in-line connectors.

Air Temperature & Relative Humidity Sensor

The sensor is housed in the louvred shelter behind the logger enclosure. It requires no user installation.

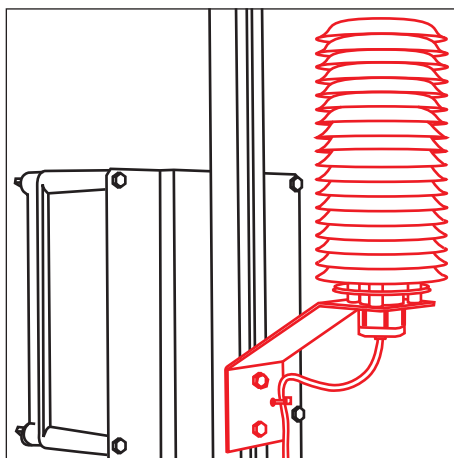


Fig. 8. The sensor shelter.

Install the Rain Gauge

The rain gauge is a tipping-bucket gauge with a resolution of 0.2 mm per tip.

This gauge should be located in a cleared area approximately 4 ~ 8 m from the weather station to minimise any effect the system might have on the operation of the gauge.

The gauge should be bolted to a concrete paver or similar using 6 mm expanding masonry bolts (not supplied).

The rain gauge cable should either be trenched in or passed through an appropriate length of plastic conduit. The conduit will need to have an internal diameter of at least 20 mm to allow the rain gauge cable to be passed through it.

The following method describes the installation of a gauge mounted to a paver and using plastic conduit to protect the cable.

1. Unroll the rain gauge cable and place the gauge at your intended site. Make sure there will be enough 'slack' in the cable to allow it to hang straight down from the underside of the logger enclosure.
2. Dig a trench approximately 100 mm deep from the base of the enclosure mounting post to the site where you will install the gauge.
3. Place a paver at the end of the trench. Mark the paver using the holes in the mounting flange in the base of the gauge as a template, then drill the mounting holes in the paver and bolt the gauge to it.
4. The collector is held to the base of the rain gauge with 3 Allen head screws. Loosen the screws using a **4 mm AF Hex key** and remove the collector.
5. Level the gauge by reference to the bullseye level in the gauge base.
6. Remove any packing or rubber bands that have been used to prevent the buckets tipping while in transit, then re-fit the collector.
7. Lay out enough conduit to reach the base of the enclosure mounting post and then push the rain gauge cable through it.
8. Run the cable through a 90° elbow, then a short length of straight conduit so that the cable will emerge just below the enclosure.

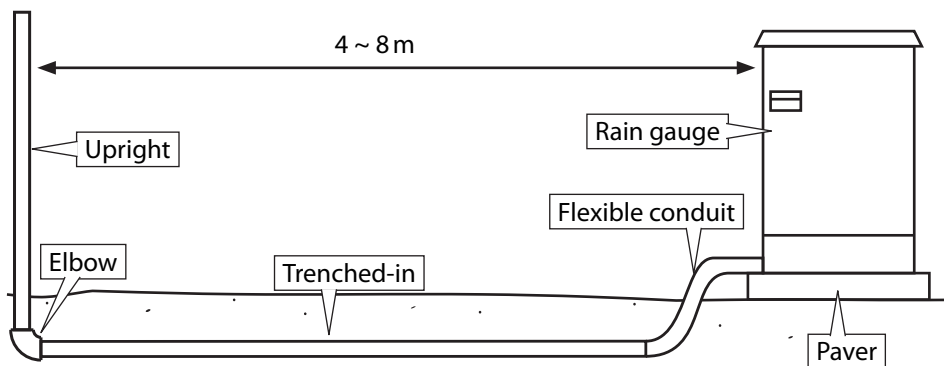


Fig. 9. Protection of the rain gauge cable using conduit sections and trenching.

9. Remove the cable cover on the bottom side of the enclosure. Loosen the mounting screws with a medium Phillips head screwdriver. Squeeze the sides of the cover to free it from the screws.
10. Plug the connector on the rain gauge cable into the socket labelled "RAIN GAUGE" on the underside of the logger enclosure. The correct socket is also marked on the board inside the enclosure. Replace the cable cover.

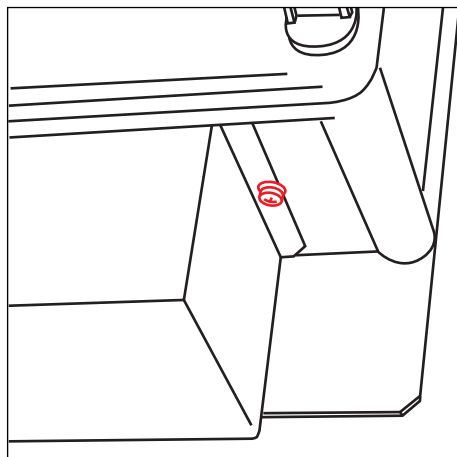


Fig. 10. Loosen the screws to remove the cable cover.

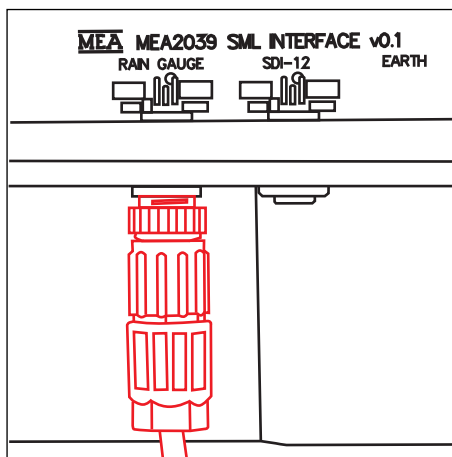


Fig. 11. Connect the rain gauge cable to the logger enclosure.

Soil Temperature Sensor

The soil temperature sensor is a bead thermistor housed in a rugged stainless steel case.

The sensor will need to be buried at a soil depth which represents your zone of interest. 'Standard' depths for soil temperature measurements are 5, 10, 20, 50 and 100 cm.

The site for soil temperature measurements should be a level plot of bare ground (about 75 cm²) and typical of the surrounding soil for which information is required.

The sensor can be installed horizontally or vertically.

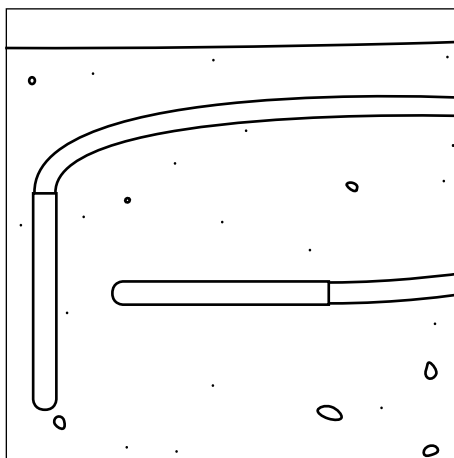


Fig. 12. The soil temperature sensor can be installed vertically or horizontally.

The sensor typically comes with 20 m of cable to provide installation flexibility. The sensor cable should be trenched in and/or protected with conduit in order to protect it from damage by machinery or animals.

The sensor can be run through the same conduit / laid in the same trench as the rain gauge cable if convenient.

Hint: If the rain gauge cable trench is used, do not bury the soil temperature sensor under the rain gauge. Excavate a 'branch' trench and install the soil temperature sensor at least 0.5 m from the rain gauge so that the sensor is not subject to inundation from runoff from the rain gauge.

Leaf Wetness Sensor

The MEA2040 Leaf Wetness Sensor acts like an artificial leaf and detects the presence of moisture on its surface. Rather than simply 'wet' or 'dry', the sensor can measure surface moisture over the entire range from 0 to 100%.

- The sensor should be installed 'circuit side up'.
- The sensor should be installed in a position and at an angle which enables it to best represent a leaf in the canopy of the crop of interest.
- The sensor should be installed at an angle under the foliage where it will be one of the last things to get wet, and such that water does not 'pool' on the surface.
- The sensor is fitted with a 45° angle bracket which enables it to be mounted to a post or wooden stake. Note that the screw holding the bracket can be undone and the bracket inverted if required. Choose a stake or post which allows the sensor to be located at the desired canopy height. If necessary a metal extension can be fitted to the bracket.
- Once installed, use a cable tie to support the cable to reduce any strain imposed on it or the sensor.

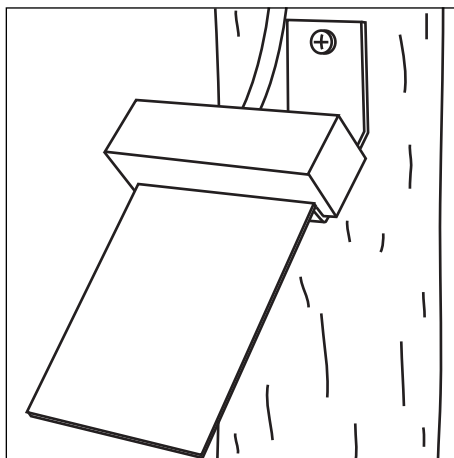


Fig. 13. A leaf wetness sensor screwed to a wooden post.

Software Installation and Operation

A Brief Introduction to Magpie

For more detailed information on Magpie please refer to the **Magpie 3 User Manual**, which can be found on the MEA USB drive.



In MEA systems data recording is referred to as **logging**. Log actions are grouped together in memory locations called **buffers**.

The data logger behaviour is specified by a program referred to as a **logging scheme**. Magpie is used to write schemes, and **load** them into the data logger.

The logging scheme is also used to view recorded and **real time** data on a PC using MEA's Magpie software.

Install Magpie 3 Software and the Logging Scheme

Install Magpie 3 and the logging scheme from the supplied USB drive:

1. Plug the drive into your computer and navigate to it.
2. Locate the file **install.exe** and double left-click on it to run it. Any software located in the **Installers** folder will be installed to your computer in the locations listed below.

How to Find Magpie Files on Your Computer

By default, Magpie 3 will install to:

C:\Program Files\Magpie 3 (for 32-bit Windows operating systems)

or

C:\Program Files (x86)\Magpie 3, (for 64-bit Windows operating systems).

The scheme and subsequent data files will be installed at either of the following locations:

Windows XP and 2000

C:\Documents and Settings\All Users\Documents\MEA\Magpie\Schemes

In Explorer Documents will be displayed as Shared Documents.

Windows Vista and Windows 7

C:\Users\Public\Documents\MEA\Magpie\Schemes

In Explorer Documents will be displayed as Public Documents.

Loading the Logging Scheme

To load the logging scheme into the data logger you will need:

- A laptop computer with Magpie software and the logging program (referred to as a “scheme”) installed.
- A USB type A to type B cable (supplied).

Install the System Battery

The system battery is a **12V 7 Ah sealed lead acid** battery. Locate the battery and remove any packing materials.

1. Remove the lid of the logger enclosure.
2. Remove the clear terminal protectors from the terminal tabs on the battery .
3. Place the battery on the battery shelf as shown, with the negative (-) terminal closest to the battery shelf.
4. Connect the battery cable as shown. The receptacles on the battery cable simply slide over the terminal tabs on the battery.

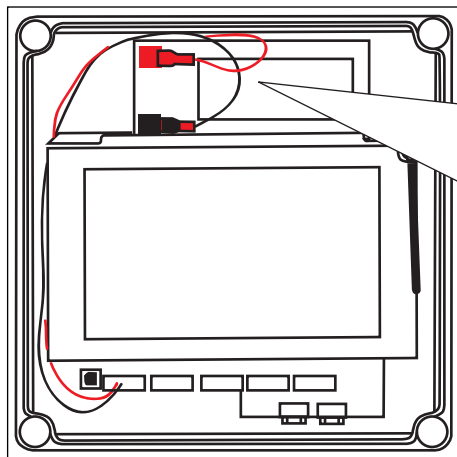


Fig. 14. Place the battery on the shelf.

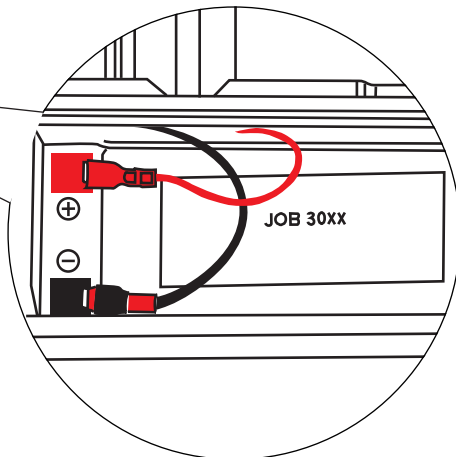


Fig. 15. Connect the battery as shown.



**Connect the red lead on the battery cable to the positive (+) terminal.
Connect the black lead to the negative (-) terminal.**

Connect the Laptop to the Weather station

1. Remove the lid of the logger enclosure.
2. Start your laptop. Plug the B-type connector into the COM port shown below, and the other end into your laptop.
3. Windows will install a generic USB driver. Navigate to the Device Manager to find out which COM port has been assigned to the cable.

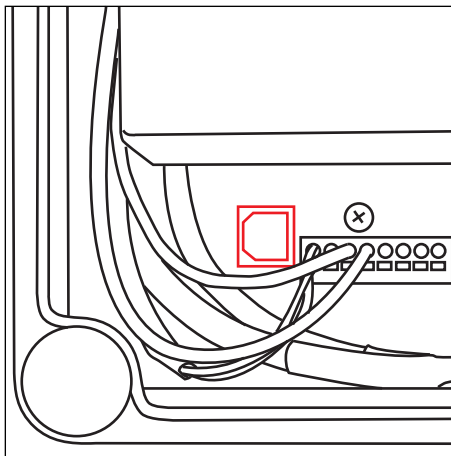


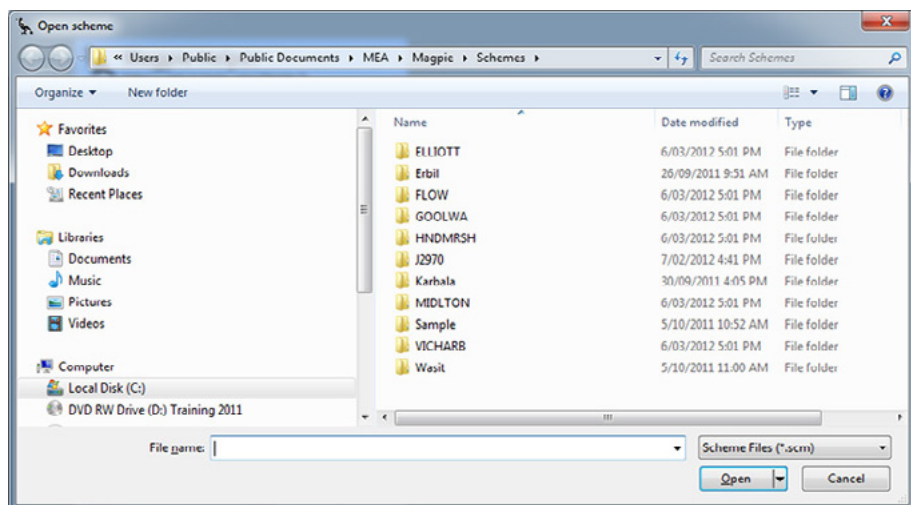
Fig. 16. The data logger's COM port.

Hint: If you have a weather station with no telemetry devices, there will already be a USB extension cable plugged into the USB port on the logger. This will give you access to the port without having to remove the enclosure lid.

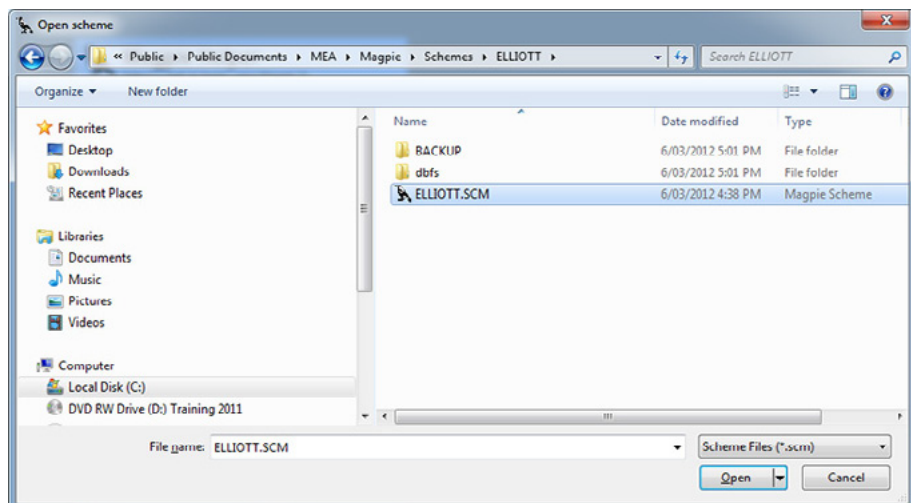
4. Start Magpie software and open the logging scheme.

Open the Logging Scheme

1. From the **File** menu select **Open Scheme**.
2. The **Open a scheme** window will open.

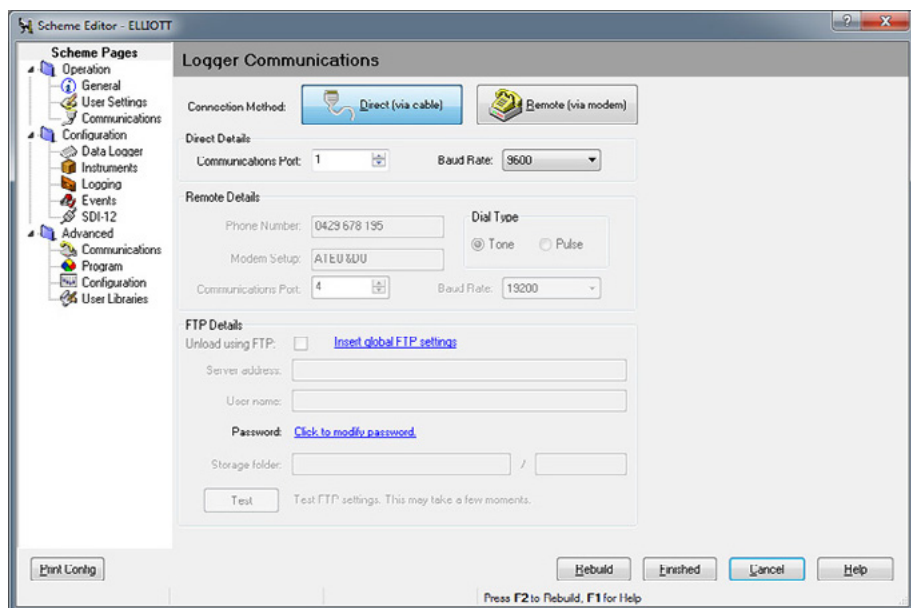


3. Select a scheme folder and double-click to open it.
4. Select the scheme file and double-click the icon, or select **Open**.



Set the Connection Method and COM Port

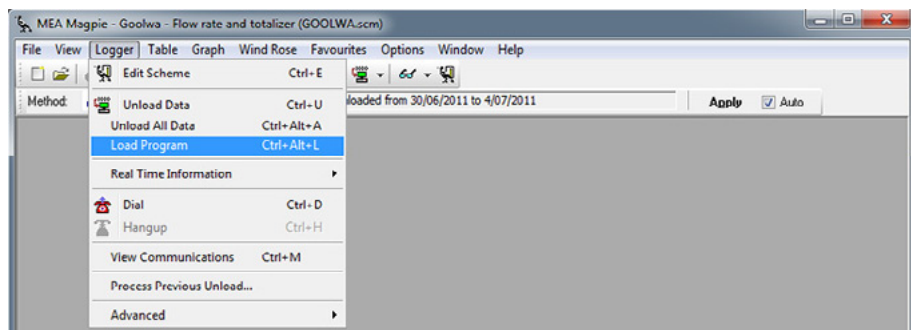
1. From the menu bar select **Logger** ⇒ **Edit Scheme**.
2. Go to **Operation** ⇒ **Communications**.



3. Set the Communications Method to **Direct (via cable)**.
4. Select the Communications Port your serial cable is attached to.
5. Leave the **Baud Rate** at 9600.
6. Select **Finish** to save your changes and close the scheme editor.

Program the Data Logger

1. From the menu bar select **Logger** ⇒ **Load Program**



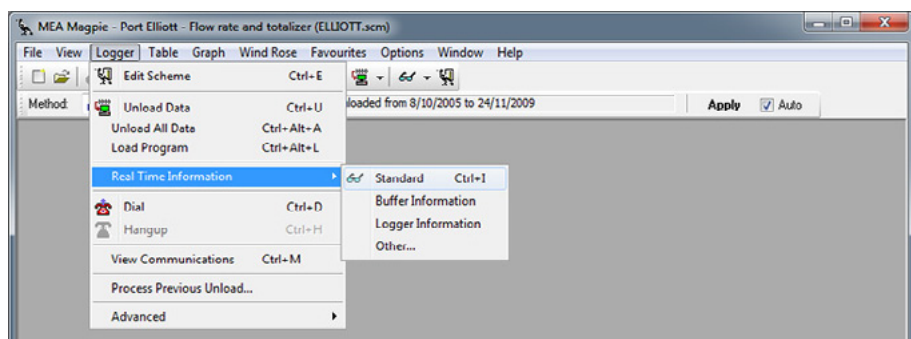
2. Once the load process is complete, use the Standard RTI screen to check that the logger has gone from a 'Primed' to a 'Logging' state, has the correct date & time, and that the channel inputs are showing expected values.

Real Time Information

Once the scheme has been loaded into the data logger you can see sensor inputs by viewing the **Standard Real Time Information** screen.

To open the Standard RTI screen:

From the menu bar select **Logger** ⇒ **Real Time Information** ⇒ **Standard**



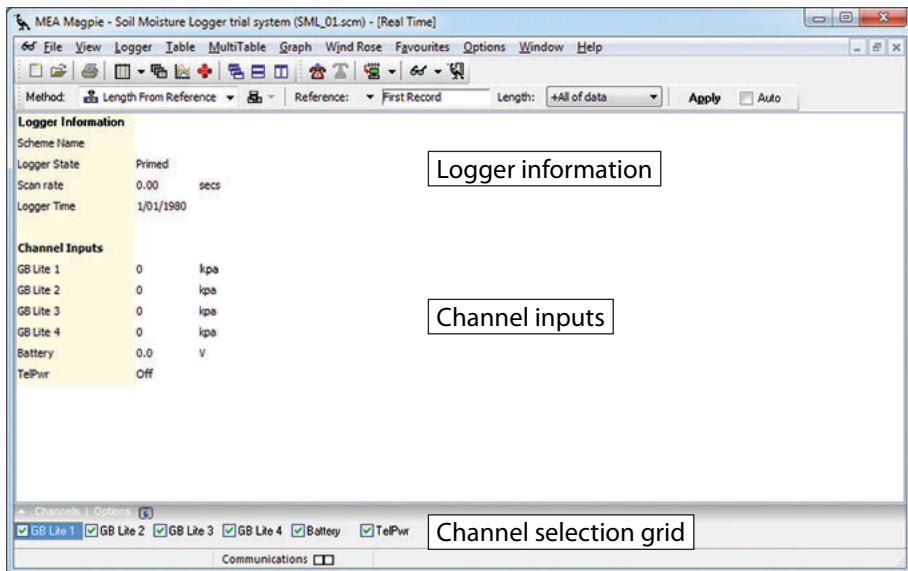


Fig. 17. Standard RTI screen.

Logger Information

Scheme Name

Check that this is the correct scheme before unloading.

Logger State

Can be 'Primed', 'Logging' or 'Stopped'. Data will only be recorded when the data logger is in a 'Logging' state.

Scan Rate

The rate at which the logger is programmed to sample the sensor inputs.

Logger Time

Check to see if the logger date / time is correct. The logger takes its time from the computer which is used to load it. It does not automatically update changes between Standard and Daylight Savings times.

Channel Inputs

Inputs from the climate sensors will update at the scan rate of the logger.

The battery voltage will update every scan.

Channel Selection Grid

It is possible to customise your RTI display by checking or un-checking these boxes. All are checked by default.

If your Junior weather station is the model that uploads data to the Internet, see the section “Test the Packet Data Terminal” on page 41.

Otherwise, if you are satisfied that the weather station is operational, unplug the USB cable and replace the logger enclosure lid.

Retrieving Measurements

The process of transferring recorded data from the data logger is known as 'unloading'.

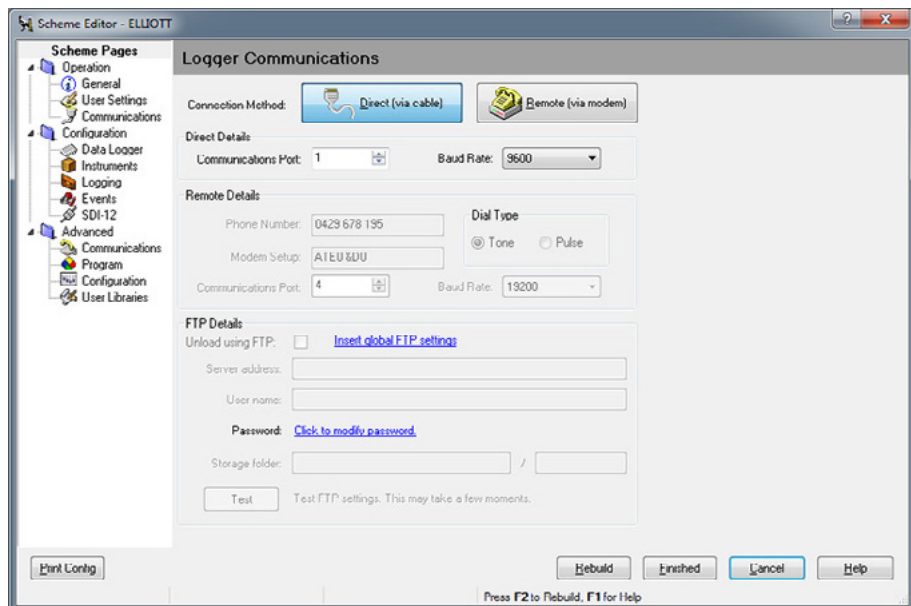
Unloading copies data from the data logger to your PC. Unloading does not erase the data in the data logger.

Data can be unloaded by direct cable connection, or by Internet connection.

Set the Connection Method

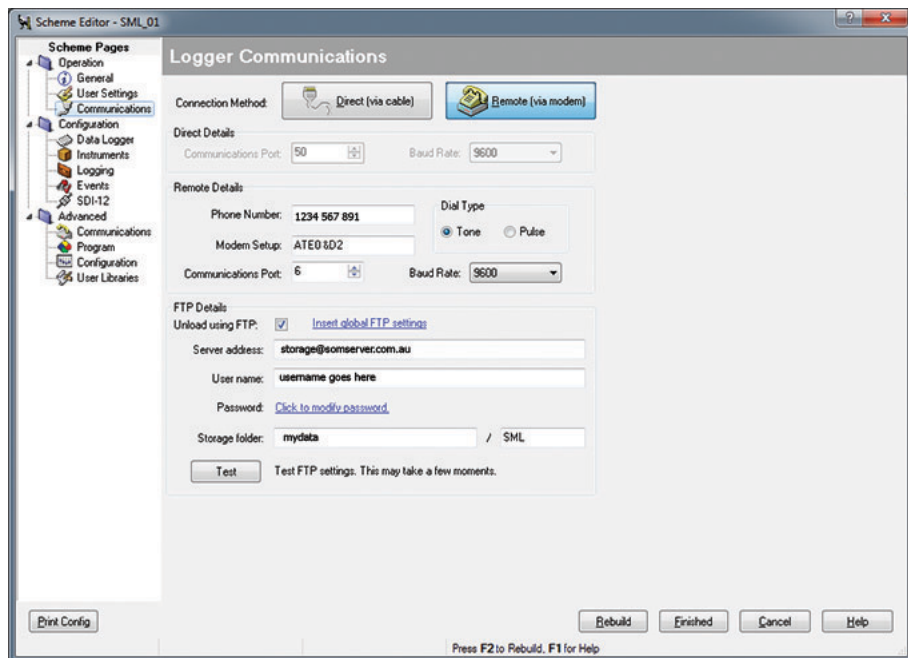
1. From the File menu select **Edit Scheme**.
2. Go to **Operation** ⇒ **Communications**.

Connect Using a Cable Connected Between Your Computer and The Weather station



1. Set the Communications Method to **Direct (via cable)**.
2. Select the Communications Port your serial cable is attached to.
3. Leave the **Baud Rate** at 9600.
4. Select **Finish** to save your changes and close the scheme editor.

Connect Using an Internet Connection



1. Set the Communications Method to **Remote (via modem)**.
2. The Communications Port option will be greyed-out.
3. Leave the **Baud Rate** at 9600.
4. Under **FTP Details**, ensure that **Unload using FTP** is checked.
5. Select **Finish** to save your changes and close the scheme editor.

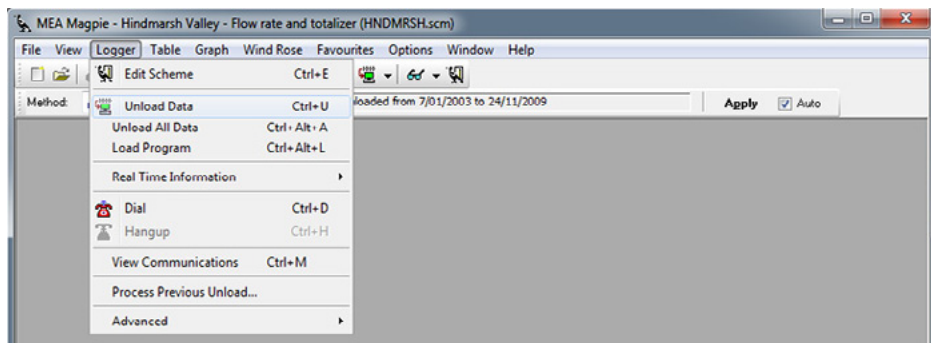
Hint: Magpie will remember the last connection method you used.

Unload Data

The unload process is the same for any connection method (for unloading via cable you will need the appropriate cable connected between the data logger and your computer).

To unload data:

1. From the menu bar select **Logger** ⇒ **Unload data**.



OR

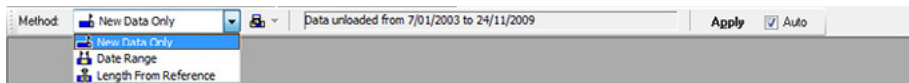
Select the unload icon on the logger toolbar .

View Data

The Navigator

The navigator is used to select the period of data viewed.

There are three methods, New Data Only, Date Range and Length From Reference.



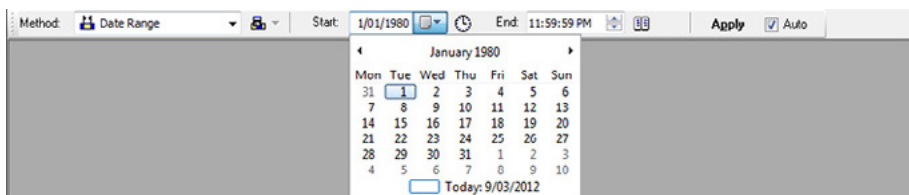
New Data Only

Displays the data recorded since the last unload.



Date Range

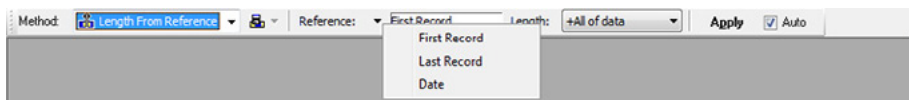
Use the calendar and clock functions to select a precise range of data. Set the **End** date and time first.



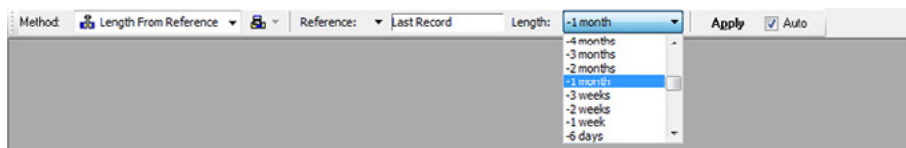
Hint: If you want to adjust the date but can only see the clock icon, press it anyway. The calendar will appear.

Length From Reference

Select a starting point for the data.



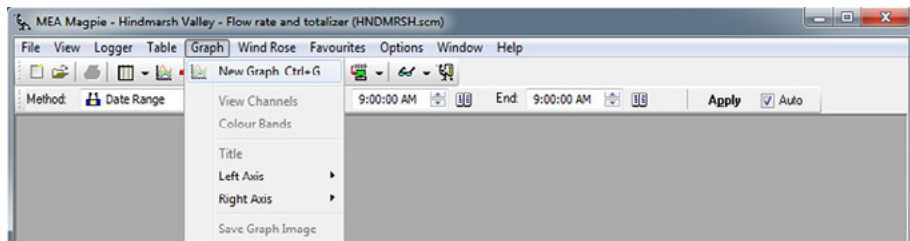
Then select the amount of data you want to see.



Select the **Apply** button, or check the **Auto** box to automatically apply navigator settings whenever changes are made.

Open a New Graph

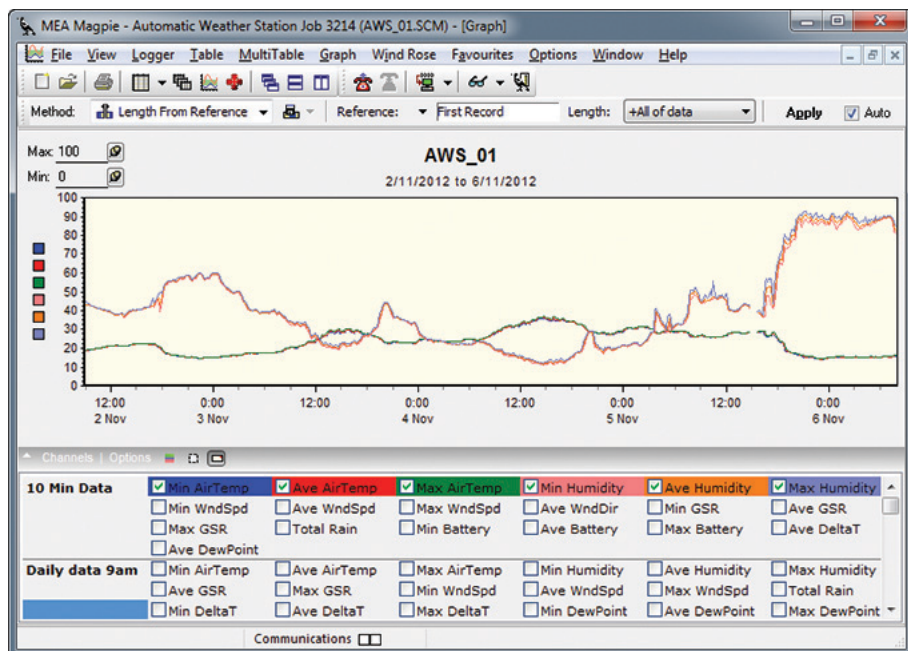
From the menu bar select **Graph** ⇒ **New Graph**.



OR

Select the New Graph icon from the scheme toolbar .

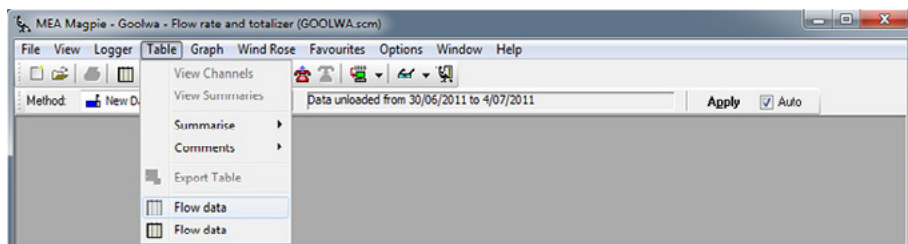
A new graph will be blank by default. Turn traces on or off by checking or un-checking the boxes in the channel selection grid.



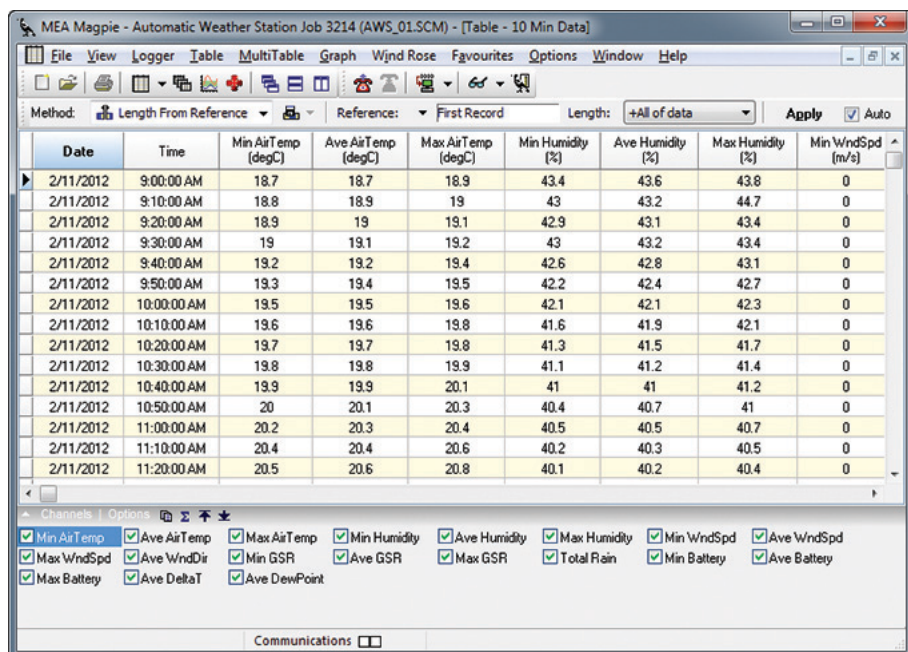
The period of data displayed is determined by the navigator settings.

Open a New Table

From the menu bar select **Table**, then select the table corresponding to the buffer you want to see.



A new table will show all columns by default. Turn columns on or off by checking or un-checking the boxes in the channel selection grid.



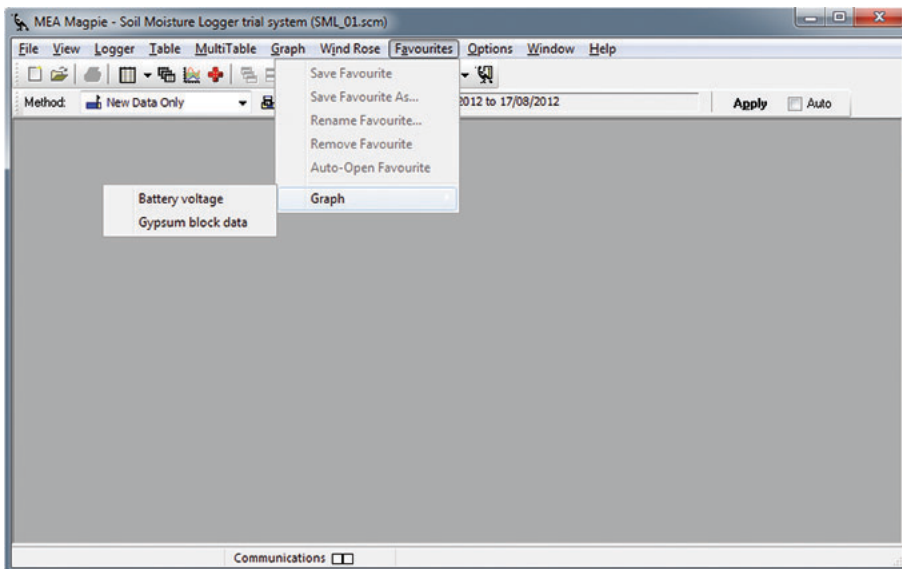
The period of data displayed is determined by the navigator settings.

Only one buffer is available at a time in a table.

Favourite Graphs and Tables

It is possible to save custom graphs and tables as Favourites. See the *User Manual for Magpie 3* for further details.

MEA may have created a number of favourite graphs and tables for you. Favourites are created and accessed under the **Favourites** menu.



Favourites use the current navigator settings.

Test the Packet Data Terminal

The Packet Data Terminal (PDT) automatically unloads the data logger every hour and sends the data to the Internet using the mobile phone network.

To test the operation of the PDT, remove the lid from the logger enclosure and fold down the internal panel to reveal the circuit board. The TEST button and diagnostic lights are located on the left-hand side of the circuit board.

Force a PDT Transfer

1. Ensure the weather station has been in operation long enough to log some data - it will log every 10 minutes.
2. Press and hold the TEST button until all the diagnostic lights are lit.
3. The PDT will begin performing a normal unload from the data logger. This process involves communicating with the logger, modem, network and FTP Server in order to complete the process.

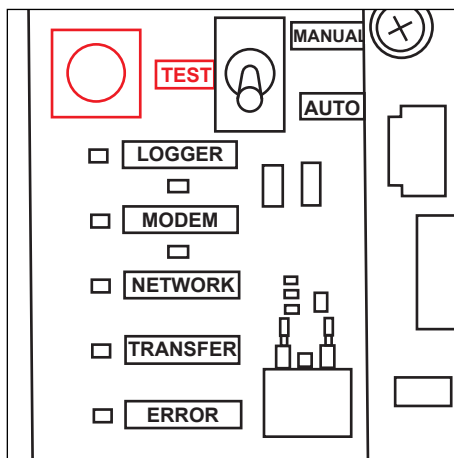


Fig. 18. The TEST button and diagnostic lights for the PDT.

Hint: The Manual / Auto toggle switch should be in the **Auto** position for normal operation.

Observe the result

Each stage of the sequence is indicated by a green light. In order:

1. The **LOGGER** light will flash.
2. The **MODEM** light will flash, and then be steadily lit.
3. The **NETWORK** light will flash, and then be steadily lit.
4. The **TRANSFER** light will flash, and then be steadily lit for a brief period.
5. The **MODEM** light will flash.
6. All lights will go out.

If any part of the sequence fails then the red **ERROR** light will turn on in parallel with the green light indicating the current stage of the sequence.

What the Lights Mean

The PDT has five LEDs on the front panel to give status information. During normal operation, the lights indicate when specific activity occurs. They also help to indicate the source of a potential fault. If the **LOGGER**, **MODEM** or **NETWORK** lights are lit or flashing whilst the **ERROR** light is on, an error has occurred at this stage. The table below indicates the LED states for an unload.

★ = flashing green light

● = green light on permanently

LGR	MDM	NET	TFR	ERR	Activity
★	○	○	○	○	Indicates communication with the data logger.
○	★	○	○	○	The PDT is configuring or dialling the modem, or is accepting a received call.
○	●	○	○	○	The modem is connected to the packet data network, or is receiving a call.
○	○	★	○	○	PDT is negotiating with the packet data network.
○	○	●	○	○	PDT is logged on to the FTP server.
○	○	○	★	○	Data transfer is in progress.
○	○	○	●	○	Indicates a successful transfer.

Review the Most Recent Result

When the PDT is inactive, all lights are off to save energy. The result of the most recent transfer can be obtained by briefly pressing the TEST button. If an error occurred then the light corresponding to the source of error will flash (more than one green light may flash) along with the red ERROR light. The lights will go out after a few seconds.

LGR	MDM	NET	TFR	ERR	
					A transfer has not been attempted since power was applied.
					Logger information is lost or invalid.
					Errors occurred during communication with data logger.
					Failure occurred whilst making the connection.
					Network authentication or FTP login failed.
					Transaction error or timeout occurred with the FTP server.
					Indicates a successful transfer.



Testing FTP Unloading in Magpie 3

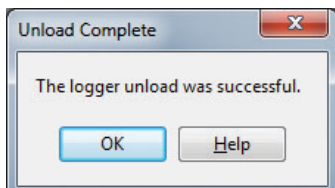
Select the Correct Communications Method

The screenshot shows the 'Scheme Editor - SML_01' window. On the left is a tree view of 'Scheme Pages' including Operation, Configuration, Data Logger, Instruments, Logging, Events, SDI-12, Advanced, Communications, Program, Configuration, and User Libraries. The 'Logger Communications' tab is active. It contains three sections: 'Direct Details', 'Remote Details', and 'FTP Details'. In 'Direct Details', 'Direct (via cable)' is selected. In 'Remote Details', 'Remote (via modem)' is selected. In 'FTP Details', 'Unload using FTP' is checked, and the 'Test' button is visible. The 'Test' button has a tooltip that says 'Test FTP settings. This may take a few moments.' At the bottom of the window are buttons for 'Print Config', 'Rebuild', 'Finished', 'Cancel', and 'Help'. A footer note says 'Press F2 to Rebuild, F1 for Help'.

1. Start Magpie 3 and open the scheme.
2. Under the **Logger** menu, select **Edit Scheme** to open the Scheme Editor.
3. Go to **Operation** ⇒ **Communications**.
4. Make sure that the **Connection Method** is **Remote (via modem)** and that **Unload using FTP** is checked.
5. Click **Finished** to close the Scheme Editor.

Unload the Logger

1. From the **Logger** menu, select **Unload Data**.
2. Unloading will begin immediately.
3. At the completion of the unload process, you will see the **Unload Complete** dialog.

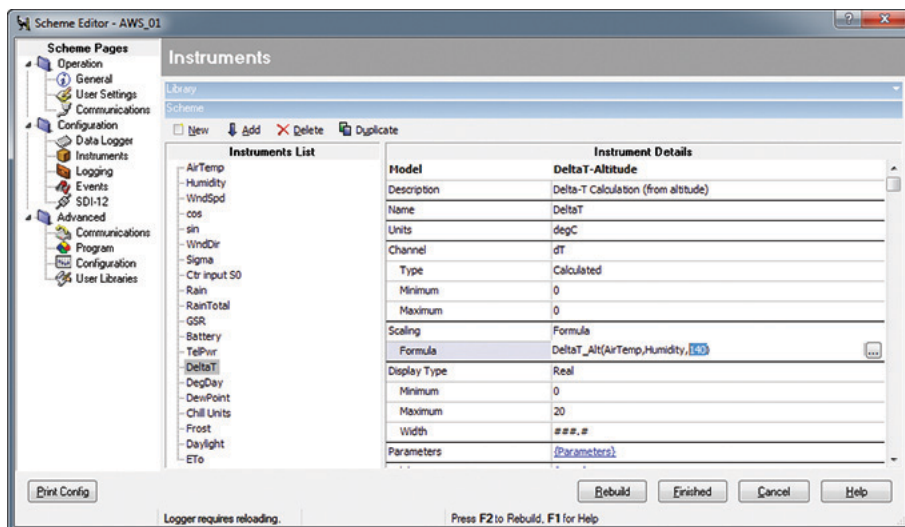


4. Open a new Graph or Table and check to see if data has been logged at the last logical logging interval before the test transmission.

How to Change Parameters for Virtual Instruments

Entering Your Altitude for the Delta T Instrument

1. From the File menu select **Edit Scheme**.
2. When the scheme editor opens, go to **Configuration** ⇒ **Instruments**.
3. In Instruments List pane, left-click on the **DeltaT** instrument to highlight it.



4. In the Instrument Details pane, find the **Formula** field.
5. The formula will be expressed as **DeltaT_Alt(AirTemp, Humidity, 140)**. The value to the right of **Humidity** is the altitude in metres.

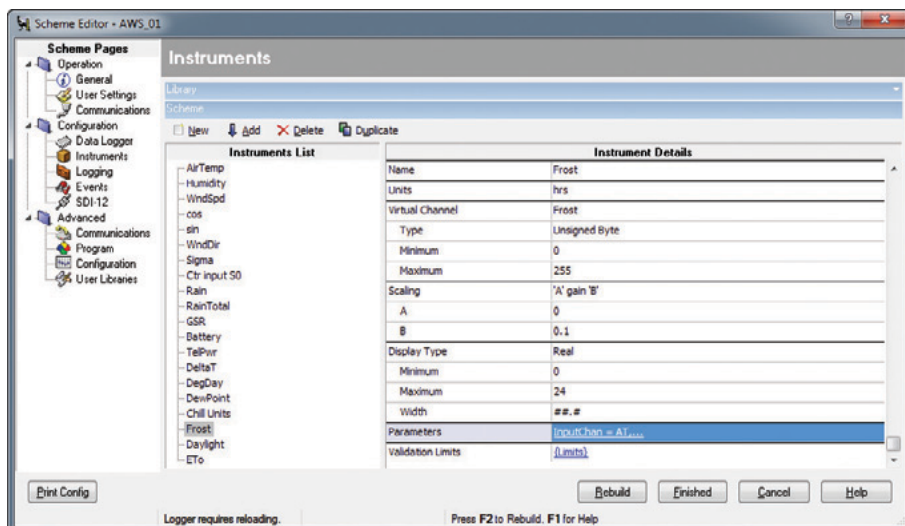
Scaling	Formula
Formula	DeltaT_Alt(AirTemp, Humidity, 140)

6. Over-type the altitude with the correct value for the site where the weather station is located.
7. Click **Finish** to save your changes and close the scheme editor.

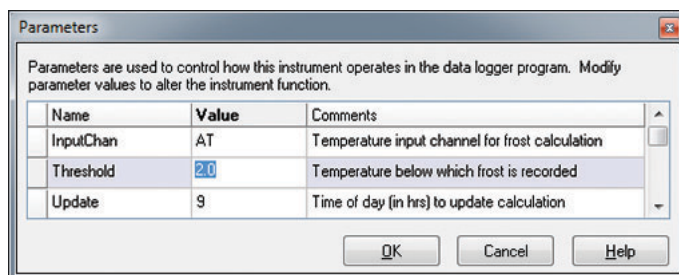
Hint: There is no need to re-program the data logger following this change.

Changing the Threshold Temperature for Frost Hours

1. From the File menu select **Edit Scheme**.
2. When the scheme editor opens, go to **Configuration** ⇒ **Instruments**.
3. In Instruments List pane, left-click on the **Frost** instrument to highlight it.



4. In the Instrument Details pane, find the **Parameters** field.
5. Click on the statement **InputChan=AT...** to open the parameters window.
6. Over-type the Threshold with your preferred value then click OK to close the parameters window.

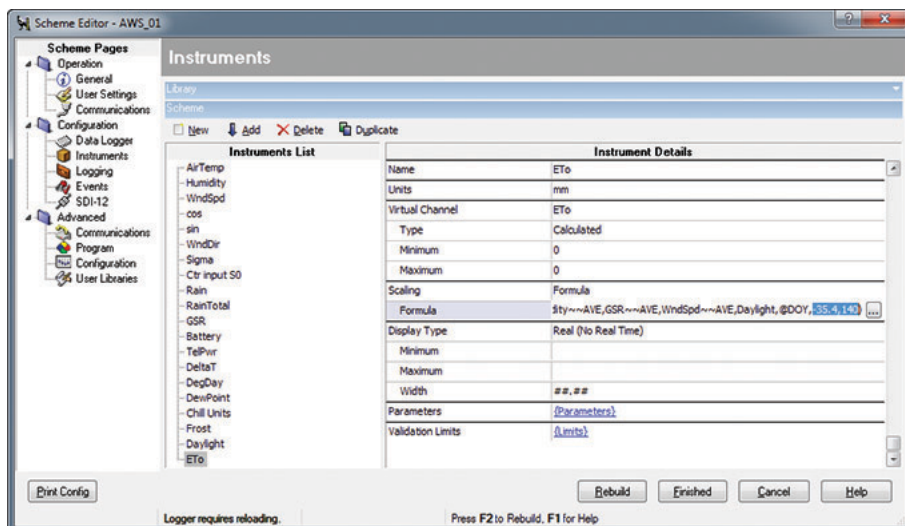


7. Click **Finish** to save your changes and close the scheme editor.

Hint: There is no need to re-program the data logger following this change.

Entering Latitude and Altitude for the ETo Instrument

1. From the File menu select **Edit Scheme**.
2. When the scheme editor opens, go to **Configuration** ⇒ **Instruments**.
3. In Instruments List pane, left-click on the **ETo** instrument to highlight it.



4. In the Instrument Details pane, find the **Formula** field.
5. The formula will be expressed as **FAOEvap(AirTemp~~MIN,AirTemp~~AVE,AirTemp~~MAX,Humidity~~AVE,GSR~~AVE,WndSpd~~AVE,Daylight,@DOY,-35.4,140)**. The values to the right of **@DOY** are the latitude in decimal degrees and the altitude in metres.

Scaling	Formula
Formula	\$ity~~AVE,GSR~~AVE,WndSpd~~AVE,Daylight,@DOY,35.4,140)

6. Scroll to the far-right of the formula and over-type the latitude and altitude with the correct values for the site where the weather station is located.
7. Click **Finish** to save your changes and close the scheme editor.

Hint: There is no need to re-program the data logger following this change.

System Maintenance

Power Supply Maintenance

Failure of the system power supply will result in loss of data. The power supply is less likely to fail if you monitor its performance and perform some basic maintenance procedures.

Solar Panel

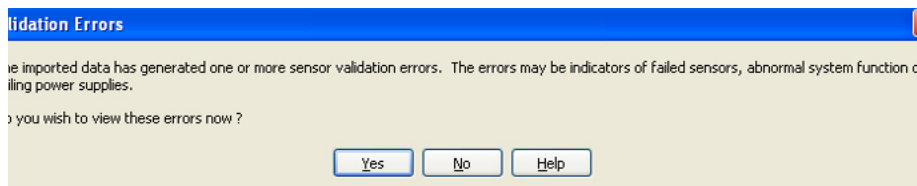
The system relies on the operation of the solar panel to maintain system power.

1. Inspect the panel weekly for signs of fouling by bird faeces, the build-up of dust and obstruction by objects.
2. Clean the solar panel using a soft cloth and clean water or water mixed with mild detergent. Do not use anything which could scratch the glass cover on the panel.
3. Keep surrounding vegetation trimmed so that it will not cast shadows on the panels.

Battery Validation Errors

Your logging scheme has been configured to monitor the voltages of the system battery. Additionally, the battery instrument has been flagged to raise Validation Errors if the logged battery voltage falls below a voltage relevant to the battery type and application.

When downloading data for viewing in Magpie, you may see a dialog similar to the one below:



Select **Yes** to see the validation errors:

Source	Type	Started	Ended	Comments
LIVEWALL7	Battery less than 12 volts	Tue, 23-August-2011 1:50:00 AM	Tue, 23-August-2011 9:10:00 AM	Battery voltage level cautioned. Keep check in short term. Problem if battery falls to 11.5 volts
LIVEWALL7	Battery less than 12 volts	Tue, 23-August-2011 7:10:00 PM	Tue, 23-August-2011 9:10:00 AM	Battery voltage level cautioned. Keep check in short term. Problem if battery falls to 11.5 volts
LIVEWALL7	Battery less than 12 volts	Tue, 23-August-2011 11:00:00 PM	Wed, 24-August-2011 10:00:00 AM	Battery voltage level cautioned. Keep check in short term. Problem if battery falls to 11.5 volts
LIVEWALL7	Battery less than 12 volts	Wed, 24-August-2011 11:00:00 AM	Wed, 24-August-2011 10:00:00 AM	Battery voltage level cautioned. Keep check in short term. Problem if battery falls to 11.5 volts
LIVEWALL7	Battery less than 12 volts	Wed, 24-August-2011 11:00:00 AM	Wed, 24-August-2011 2:10:00 PM	Battery voltage level cautioned. Keep check in short term. Problem if battery falls to 11.5 volts
LIVEWALL7	Battery less than 12 volts	Wed, 24-August-2011 11:30:00 PM	Wed, 24-August-2011 11:20:00 PM	Battery voltage level cautioned. Keep check in short term. Problem if battery falls to 11.5 volts
LIVEWALL7	Battery less than 12 volts	Wed, 24-August-2011 11:30:00 PM	Wed, 24-August-2011 11:40:00 PM	Battery voltage level cautioned. Keep check in short term. Problem if battery falls to 11.5 volts
LIVEWALL7	Battery less than 12 volts	25/08/2011 9:10:00 AM	25/08/2011 10:20:00 AM	Battery voltage level cautioned. Keep check in short term. Problem if battery falls to 11.5 volts
LIVEWALL7	Battery less than 12 volts	25/08/2011 10:50:00 AM	25/08/2011 2:10:00 PM	Battery voltage level cautioned. Keep check in short term. Problem if battery falls to 11.5 volts

Fig. 19. The battery validation errors will be similar to the ones shown above.

System Battery

Pay attention to the logged values for the system battery. There will be a 'Battery voltage' graph in the Favourites, Graphs menu.



If voltage values for the system battery fall to less than 11 V, the battery may be damaged.

How to Replace the System Battery

The system battery should last for many years if the solar panel is kept clean. The battery can be damaged if the solar panel is dirty and unable to provide adequate charge, or if the sensor cables are damaged in such a way as to create an electrical 'short'.

All batteries, no matter how well cared for, will eventually require replacement. Replace the battery with a **12V 7 Ah sealed lead acid** battery. To replace the system battery:

1. Unload the data logger following the instructions at "Retrieving Measurements" on page 33. Any stored data will be lost as soon as the system battery is disconnected.
2. Follow the instructions at section "Install the System Battery" on page 26.
3. Re-program the data logger following the instructions at "Program the Data Logger" on page 30.

How to Replace the System Fuse

The fuse may blow if sensor cables are damaged or the battery is incorrectly connected. The system fuse is a **2 A 250V 20 mm glass fuse**. The fuse holder is identified in Fig. 20.

To replace the fuse:

1. Cover the solar panel and disconnect the system battery.
2. Pull down the internal plate to expose the circuit board.
3. Twist the top of the fuse holder anti-clockwise to remove it.
4. Replace the blown fuse with a known good fuse **with the same specifications**.

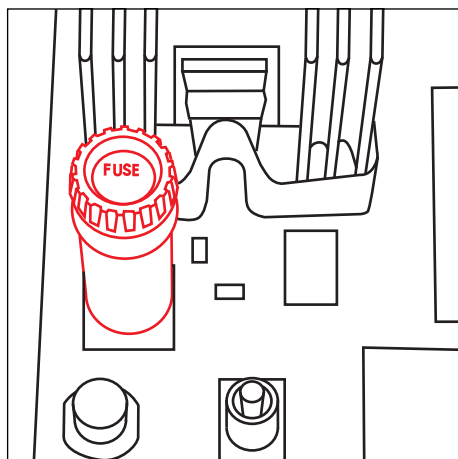


Fig. 20. The system fuse holder.

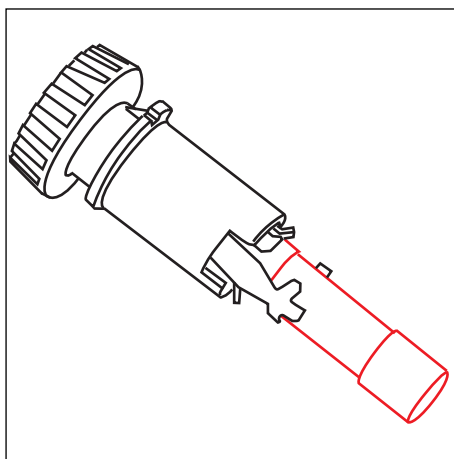


Fig. 21. The fuse is held captive in the lid.

5. Replace the top of the fuse holder re-connect the system battery and uncover the solar panel. The PDT diagnostic lights below the fuse holder should commence a chasing sequence, indicating that the PDT is starting up.
6. Attempt to unload the data logger - the logger's backup battery may have been able to retain data.
7. Regardless of whether the unload was successful, re-program the data logger as per the instructions at "Program the Data Logger" on page 30.

Sensor Maintenance

Wind Sensor Maintenance

Periodically inspect the wind sensors for damage. Check the operation of the bearings by feel - the cupset and van should both rotate freely. If the bearing exhibit resistance or feel rough, the instrument(s) should be replaced.

Solar Radiation Sensor Maintenance

1. If the solar radiation sensor dome is dirty, wipe it with a cloth dampened with clean water.
2. The sensor dome is sealed and fully weatherproof. If the dome is damaged or if condensation appears in the dome, please contact MEA.
3. The manufacturer recommends that the sensor calibration be checked every two years. This requires removal of the sensor and return to MEA.

Air Temperature & Humidity Sensor Maintenance

The manufacturer recommends that the calibration of the sensor be checked on an annual basis. This involves a two-point calibration with the sensor head fitted to a humidity chamber containing reference salt solutions. Return the sensor head to MEA for calibration. To remove the sensor:

1. Undo the plastic nut on the underside of the shelter. When the sensor is loose, pull it downward until it is clear of the shelter. Do not pull hard on the cable.
2. Unscrew the locking collar on the sensor head and pull the head clear of the sensor body. Package the sensor head carefully and send it to MEA.

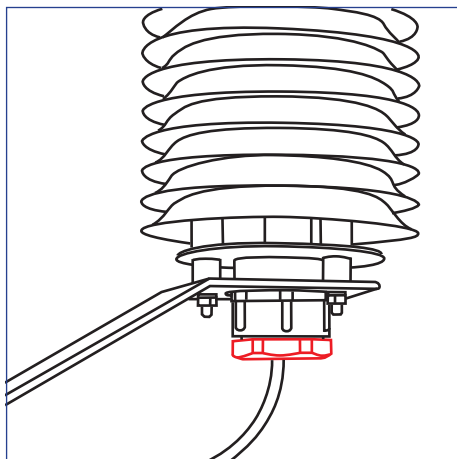


Fig. 22. Undo the plastic nut to release the sensor.

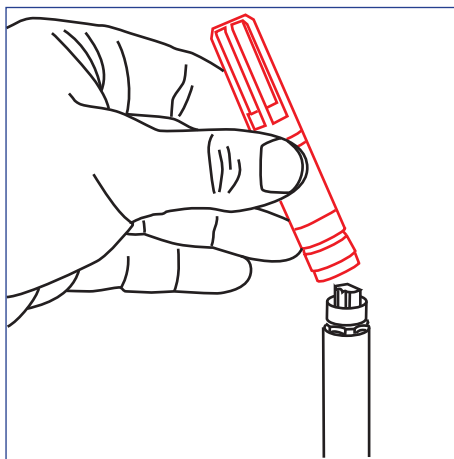


Fig. 23. Remove the sensor head for calibration.

3. Return the sensor body to the shelter to protect the exposed connector.
4. The shelter itself should be inspected for cleanliness. Remove spiders and webs using a soft brush. Clean the shelter using a cloth dampened with clean water.

Rain Gauge Maintenance

Routine maintenance should include cleaning the accumulated dirt and debris from the collector funnel and buckets, as well as ensuring that the gauge is level.

1. Remove the collector using a **4 mm AF Hex key** to loosen the screws in the gauge base. Remove any grasses, dirt etc from the collector with a soft brush.

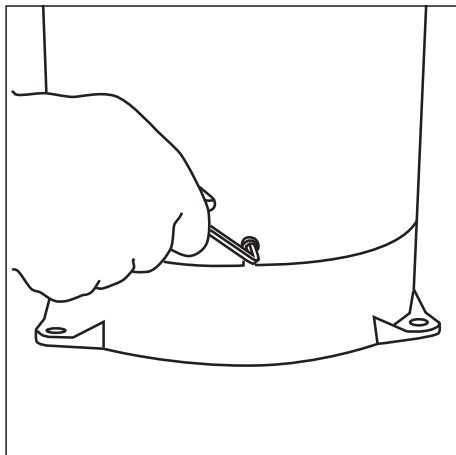


Fig. 24. Remove the collector.

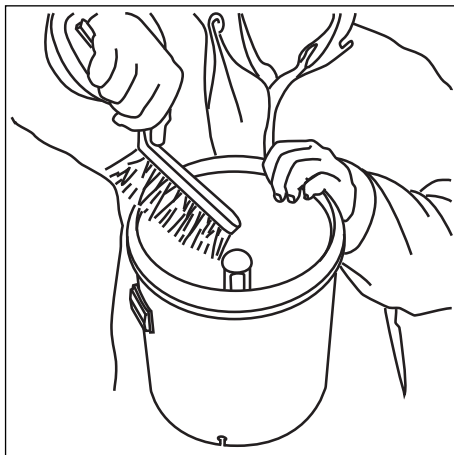


Fig. 25. Clean the collector.

2. Check the bullseye level in the base and adjust the gauge footing if required. Push the filter and siphon out of the collector.

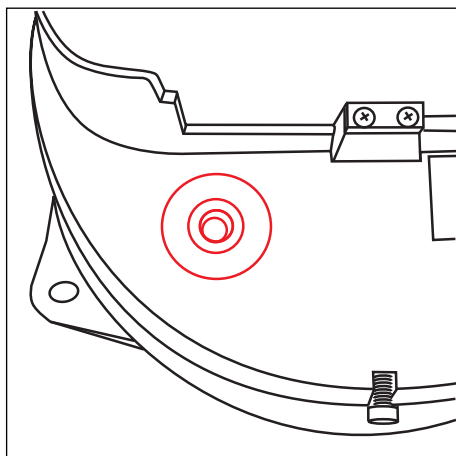


Fig. 26. Check the level.

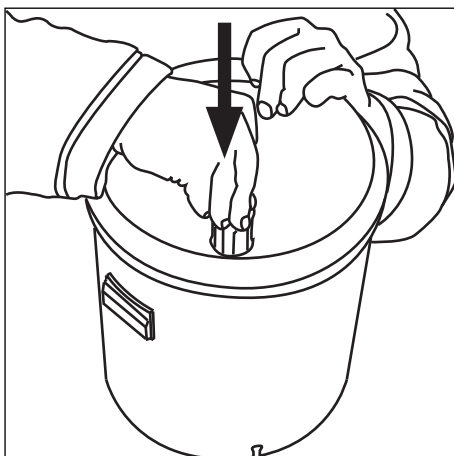


Fig. 27. Push the filter downward.

3. Separate the filter and siphon. The filter can be cleaned using a small brush e.g. toothbrush. Use a pipe-cleaner to clean the siphon nozzle if required.

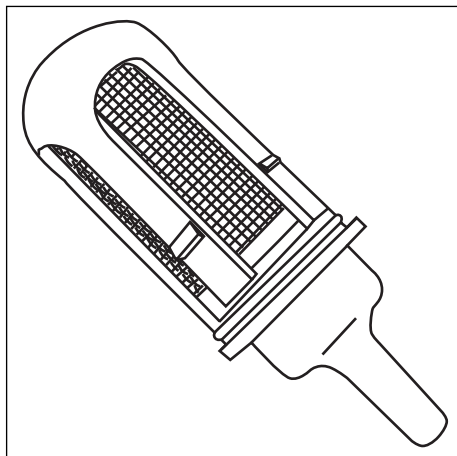


Fig. 28. The filter / siphon assembly.

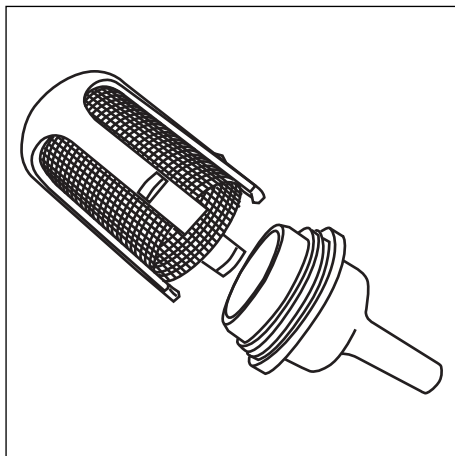


Fig. 29. Separate the filter and siphon.

4. Clean the inside of the buckets with a clean soft cloth dampened with mild soapy water. Do not touch the inside surface of the buckets with your fingers.

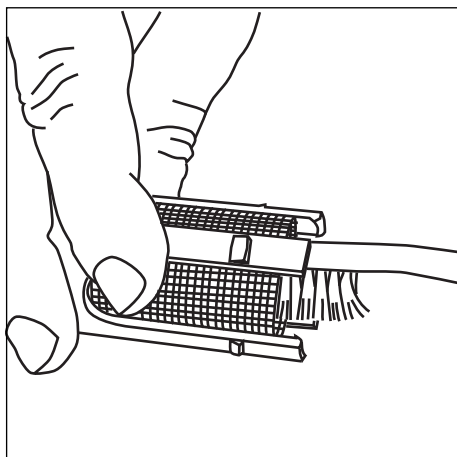


Fig. 30. Clean the filter and the siphon.

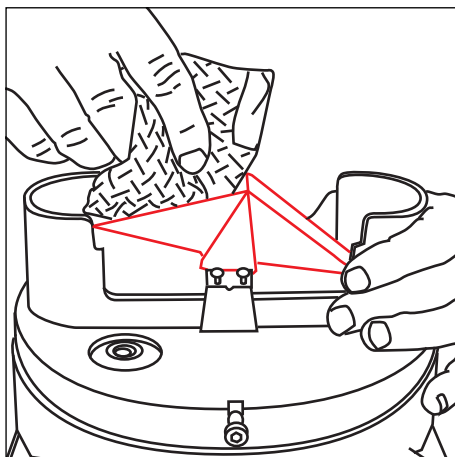


Fig. 31. Clean the bucket with a soft cloth.

5. Rinse all parts and buckets (don't wet the wiring terminal block) with clean water and reassemble.

6. Vegetation surrounding the gauge should be clipped level with the top of the gauge to minimise wind deformation of rainfall and to prevent material falling into the collector.

The gauge calibration should be checked annually.

1. Pass exactly 653 ml of water through the gauge at a slow and steady rate and count the number of times the bucket tips.
2. Repeat the procedure 3 times to obtain an average. A correctly calibrated gauge should tip 101 times ± 3 tips (ie between 98 and 104 tips on average).
3. If required, calibration adjustment is made by altering the height of the stoppers beneath the tipping buckets. A pair of **8 mm AF spanners** is required.
 - Raise both stoppers an equal amount to increase the number of tips.
 - Lower both stoppers an equal amount to decrease the number of tips.
 - Alter the height of the stoppers 1/4 ~ 1/2 a turn each time before re-checking the calibration.

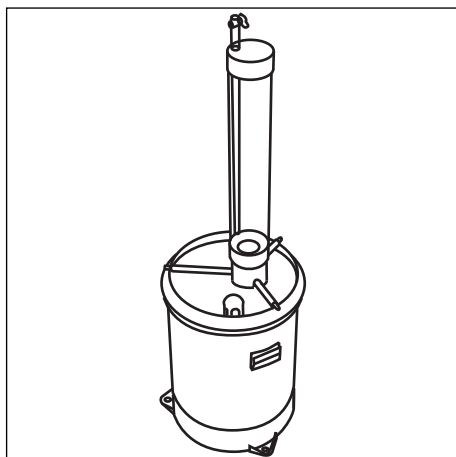


Fig. 32. Pass 653 ml of water through the gauge.

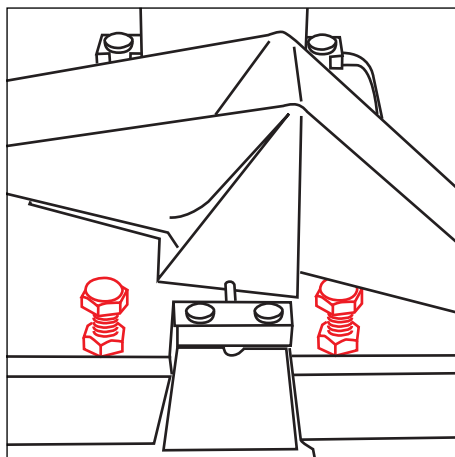


Fig. 33. Adjust the stoppers beneath the bucket if required.

Hint: If you do not want your weather station to record spurious rainfall, disconnect the cable from the weather station before commencing calibration.

MEA can supply calibration kits including a calibrated reservoir with self-regulating flow rate, stand and counter module.

Soil Temperature Sensor Maintenance

The soil temperature sensor is calibrated for life and contains no serviceable parts.

If you suspect that your soil temperature sensor is faulty, please contact MEA.

Leaf Wetness Sensor Maintenance

The sensor contains no serviceable parts. Its factory calibration will last the life of the sensor.

1. Periodically inspect the surface of the sensor for deterioration in the printed circuit.
2. Remove any dust or other materials using a cloth dampened with clean water. Do not use abrasives to clean the sensor.
3. Avoid touching the surface of the sensor with your fingers as the deposition of fats or grease will change the surface-tension of the sensor, potentially causing it to retain water for artificially long periods.
4. If the sensor cable crosses a road or track it should be protected in conduit and trenched in. Periodically inspect the sensor cable for damage.