WSML - Soil Moisture Logger

User Guide

WSML - Soil Moisture Logger
Irrigation Management System
Revision 1.0

WATER-INSIGHT

Contents

Contact Water-Insight

Water-Insight
12 Midas Place, Middleton
Christchurch 8024
New Zealand
Phone: +64-3-366-3713
Fax: +64-3-365-2815
Email: support@waterinsight .co.nz
Web: www.waterinsight .co.nz

Revision Details

1.0   January 2019   First Issue to support Rev A hardware and V1.00 firmware

Introduction

About This User Guide

This document provides assistance with the installation and operation of the Water-Insight Wireless Soil Moisture Logger (WSML) and associated sensors. Included in this document is:

- How to configure and Install the WSML
- How to install the Sensors
- Configuration
- Device Specifications
- An introduction on collecting and analysing soil moisture data.

Other documents that should be read in conjunction with this document include:

- EP3 User Guide for additional information on how to collect and quickly view basic WSML data.
- Additional application notes which provide specific operational assistance.

Contact Water-Insight for application notes, which can be obtained to provide guidance for specific configuration scenarios, detailing the configuration workflow steps.

This guide assumes that you have been trained on and are familiar with Water-Insight's Irrigation Management System (IMS) suite of products and software, their configuration and their terminology. Please refer to other Water-Insight resources for introductory training material or specific Owners Manual's, if provided, for detailed descriptions of each product.

This version of the guide incorporates feature additions made to the product to support **version 1.00** of the WSML firmware (the FSK modulation version).

IMPORTANT. **Version 1.02** of the WSML supports LORA radio modulation and is not covered in this guide. Contact Water-Insight for details.

Product overview

The WSML is a soil moisture tensiometer, measuring water tension in kPA. Up to four probes plus a soil temperature probe and tipping bucket rain gauge can be fitted. It can be battery powered with a solar powered charger.

Figure 1: WSML with solar charging

Features

- Fits Up to 4 soil moisture probes
- Fits 1 soil temperature probe
- Fits 1 rain gauge
- 900 MHz (FSK modulation) short range radio up to approximately 400m for local network communications to EP3.
- 900 MHz (lora modulation) for approximately 5000m operation to internet gateway equipment
- Data Collection tool for Water-Insight Soil Moisture sensors, Soil Temperature Sensors and Rain Gauge. (FSK operation only)
- Water-Insight Workbench used for additional configuration and firmware upgrades
- Solar power charging and battery operation (when supplied with Water-Insight RSS01 remote solar Station enclosure

Hardware

Feature	Function
A	Power Input (nominally 12 Vdc)
B	USB Type Mini B – Firmware upgrade and configuration
C	RF connector SMA
D	Sensor input pairs (signal/ground) - Rain = rain gauge input - Temp = soil temperature input - SM = Soil moisture probe (up to 4)

IMS Systems Overview

The Water-Insight's Irrigation Management System (QIMS) is a suite of hardware and software products used to configure, control, and monitor Water-Insight's Irrigation Point Controllers (IPC). The primary aim of the irrigation solution is to manage water application at defined flow rates over a wide area promote pasture growth.

The QIMS system design utilises a low-cost controller (IPC) at each irrigation point. The IPC is self-contained device operating from solar power with on-board battery storage. The IPC operates a low power latching solenoid to control an irrigation sprinkler valve. The IPCs communicate via a 900 MHz mesh radio network, allowing watering schedules to be centrally managed.

A typical system consists of one or more (usually many) IPCs mounted on posts or in pods each connected to a sprinkler valve via a solenoid. Each IPC runs a scheduled watering plan according to a real time clock in the device. An EP3 or INC is used to send the time and schedule information to the IPC. Each IPC is defined in a

human readable configuration file with a name and serial number and radio address. On some sites a repeater (IPC-R) is used to overcome terrain issues and difficult radio communications environments.

All IMS systems are provisioned with an EP3. Medium sized systems can be run with an INC and larger systems augment the INC with the IMS software and hardware products.

In addition to sprinkler control the IMS system includes the ability to monitor water tank levels, water flow meters and via the WSML, provides the ability to measure soil moisture, soil temperature and rainfall.

WSML data is collected using the EP3 handheld programmer and transferred to the IMS software system for analysis and display (FSK version).

WSML data can be transmitted to Water-Insight's cloud-based servers via lora gateway equipment for remote access via web applications (lora version)
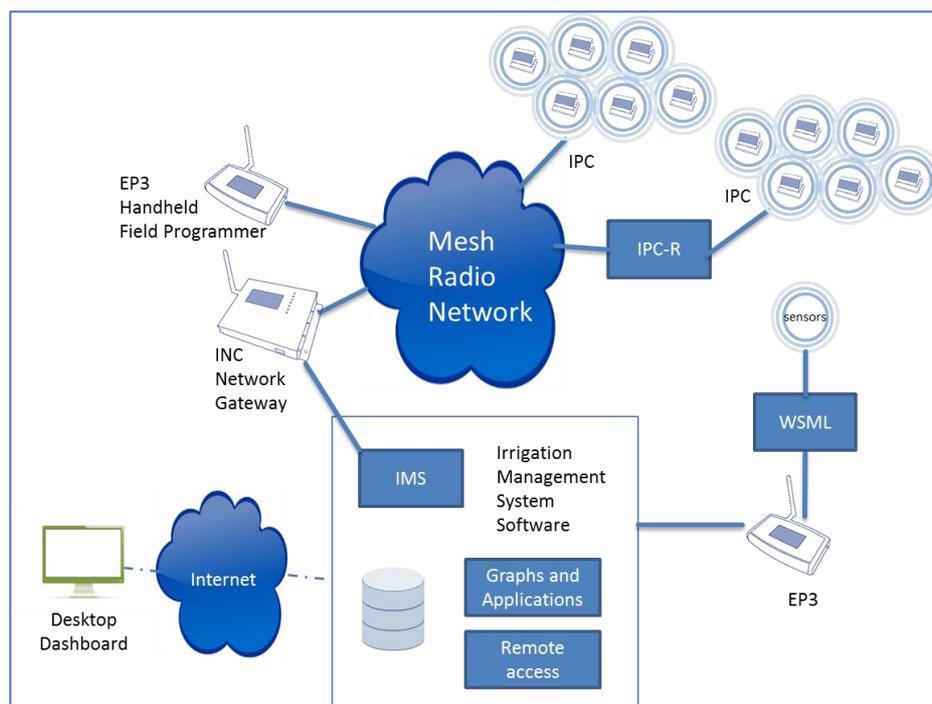
Figure 2: Typical IMS System options (FSK version)

Key:

IPC – Irrigation Point Controller.
EP3 – Handheld Programming tool.
INC – Irrigation Network Controller.
IPC – R, repeater device for IPCs
WSML, Wireless Soil Moisture Logger
IMS - Water-Insight's Irrigation Management Software System and base station
Mesh Radio Network – the Water-Insight radio network over which communications and messages to all IPC devices propagate.

Connecting the WSML directly to IMS Cloud

Versions of the WSML that implement LoRA radio modulation can connect directly to IMS cloud applications for analysis, via a Water-Insight LoRa gateway. Contact Water-Insight for further details. The diagram below shows how data is collected using the two product versions.
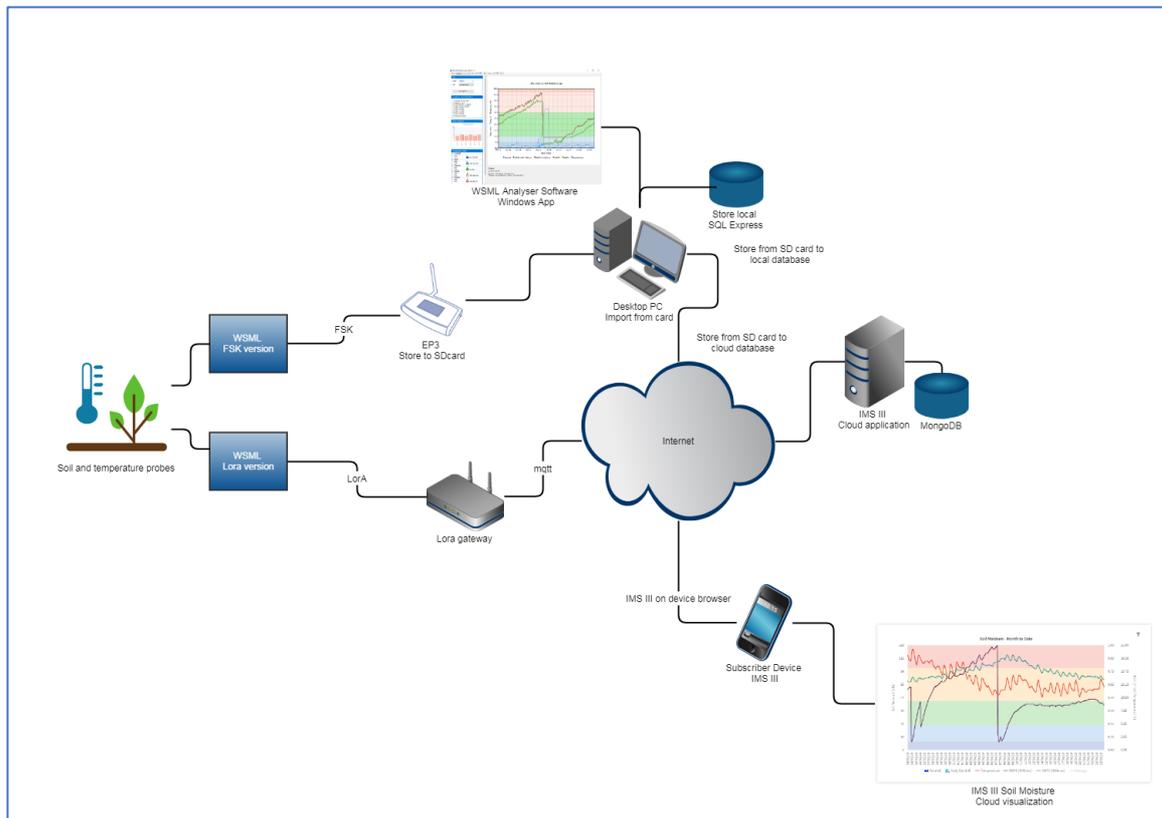
Figure 3. WSML showing local and cloud data collection.

Getting started

This section describes procedures for readying the WSML for use. The WSML is typically supplied in a kit consisting of:

- RSS01 solar power enclosure and station including
  - WSML
  - 12V sealed lead acid battery
  - Solar panel plus mounting bracket
  - Mounting plate for RSS01
 - High gain whip antenna incl. 2m cable
  - Cable connection to Solar panel
- Soil moisture probes (200mm rod version and 400 mm rod version)
- Optional rain gauge
- Optional temperature probe

System and Equipment Requirements

The following equipment should be carried by the installer when maintaining a WSML, in addition to general tools such as spanners, side cutters, drill bits and screwdrivers:

- EP3 handheld programmer (plus SD Card) (refer EP3 Manual)
- Configuration file (on SD card) for the WSML
- Low loss Multi-core cable (to suit number of probes, 1 pair per probe)
- Junction box plus fittings
- Flexible conduit plus mounting clamps
- Cable ties as necessary
- Mounting pole and brackets if unit needs to be mounted above 2m to avoid animal contact
- Note. A larger cable gland may be required if there are a large number of sensor devices to be connected.

Preparing the Unit for First Use.

Before deploying to site there are a few time saving considerations.

Ensure that the WSML is fitted with the latest firmware before deploying to site. If necessary, firmware can be upgraded using Water-Insight Workbench installed on a laptop and connected to the WSML using a type A-MiniB cable, see upgrade procedure below.

IMPORTANT. Before installation the soil moisture probes must be "charged" by immersing the probe tip in water overnight. The probe must remain wet until it is installed in the ground.

Verify that the WSML is working by connecting it to the battery then scanning for it using the EP3 (refer below). The SD card with an appropriate configuration file must be inserted in the Ep3. If scanning the device does not return a response then consult Water-Insight for support

Review the site instalment requirements. Probes should usually be installed in a paddock that will be irrigated, away from a fence line and fenced off from animal activity. Cable runs should be calculated and a plan for providing environmental protection to cables by trenching or using conduit should be in place.

Determine the size of the cable(s) for the sensors. If necessary ream out the hole in the RSS01 enclosure to fit a larger gland (metal, type IP68 e.g. Duratech 4-8mm or 5-10mm).

Installation

Installing the WSML

This will vary depending on your use of a metal pole or fence post to mount the RSS01 enclosure. Follow these steps:

Step	Process
1.	Mount the enclosure using the supplied mounting plate or modify the plate to accommodate straps for a pole.
2.	Mount the solar panel bracket above the RSS01, facing north and at approximately 45 degrees angle to the horizon.
3.	Mount the radio antenna above the solar panel with free space around the antenna itself
4.	Remove the case lid of the RSS01
5.	Connect the rf coaxial cable to the WSML through the cable gland provided. Loop and tie back excess cable. Tighten the gland firmly but not overtight
6.	Connect the solar panel cable to the labelled junction connector in the case via the cable gland provided. Trim excess cable before connecting and tie back. Tighten the gland but do not overtighten.
7.	If the probes have been installed and cable run complete then pass the probe cable into the unit via the gland provided.
8.	Do not connect the power until the probe wires have been connected.
9.	Fit the probe wires to their respective input pairs. Tie back or trim excess cable. Ensure a firm fit in the screw connector.
10.	Connect the wires to the battery terminals
11.	Verify that the EP3 communicates to the WSML
12.	Verify at least 12V is available at the power junction.

Post mounted syste

Pole mounted system

– for post mounts note post slotted to fit bracket (above)

- for pole mounts note probes on ground using trenched cables and conduit (above right)

- pole mount not the bracketing arrangment and use of cross member from RSS01 mounting plate to pol backet. (right)

- note use of sealing tape for wires wrapped around the probes to prevent animal interference. (above right)

Installing Soil Moisture Probes

Recommendations made here are for soil moisture sensors being installed for fixed set (post or pod) sprinkler systems used on pasture. Water-Insight uses Watermark sensors for its probes.

The sensors should be located in the effective root zone at locations which will give a representative picture of the soil water status of the field. Water-Insight supplied sensor probes for insertion at 200 mm and 400 mm. But other probe lengths can be used according to the root system (crop type or pasture). Alternatively, probes can be buried directly instead of mounted on rods. Approximate 2-3 probes should be used at each location. The WSML supports up to 4 probes.

Water penetration and holding capacity across a field can differ due to soil type, soil interfaces and topography. These sources of variation are good locations for your sensors. Avoid placement under electric fences if possible and use fenced of areas if cattle or other animals are likely to be nearby. The best strategy for anyone using the sensors for the first time is to use an adequate distribution of sensors in a small area to get a good feel for the soil moisture patterns and their effect on crop growth.

Set probes approximately 1m apart. Avoid disturbing the ground with excess digging and loosening of the soil strata.

It is important that the Watermark sensor probe be saturated when installed. It is also critical to get a snug fit between the sensor and the surrounding soil. Lack of a snug fit is the most common problem in sensor effectiveness. Just before installation, the sensor should be soaked for several hours in irrigation water, preferably overnight. Keep the sensor moist while transporting it to its installation site. If possible, it is advisable to precondition the sensor by putting it through several wet-dry cycles (30 minutes soaking followed by several hours of drying). This will improve sensor response during the first few irrigations.

Make a probe access hole to the depth required with a 22mm auger. For very coarse or gravelly soils, a slightly oversized hole 24-25mm may be needed to prevent abrasion damage to the membrane. In this case, you will need to "grout in" the sensor with a slurry made from the sample soil to get a snug fit in the soil. A long Auger will be needed for the 400mm probe. If you encounter small stones that cannot be shifted by the auger, use a pointed rod worked into the soil to create a path for the auger.

Form some soil from the auger residue into a muddy ball and cake it around the probe tip. Fill the bottom of hole with a watery soil slurry and push the sensor down into the hole so it "bottoms out." The access hole should be carefully backfilled and tamped down to eliminate air pockets. The sensor wire lead is capped and
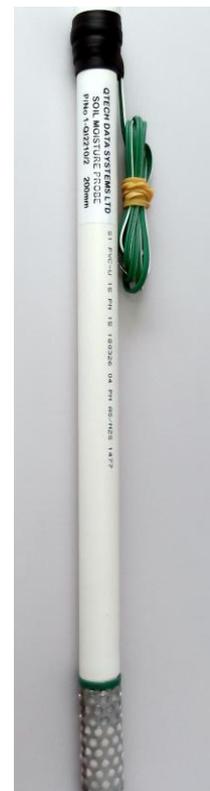
does not straight out of the hole because this could allow water to channel down to the sensor and produce unrealistically high readings. Excess cable can be wound around the probe and sealed with tape.

For probes likely to come into contact with animals the sensor wires should be inserted into conduit and placed in a shallow trench (and covered with dirt). Run the conduit to the SML mounting position and if necessary, join the sensors wires in a junction box and feed a multi-core cable to the SML enclosure itself.

It may take some time (allow one month) before the soil has returned to its normal composition and solidity. Loose soil will affect probe readings.

The most common problems in the field are:

1. Sensor does not have a snug fit in the soil. This usually happens when an oversized access hole has been used and the backfilling of the area around the sensors is not complete. Sensor may need to be reinstalled.
2. Sensor is not in an active portion of the root zone. Or the irrigation is not reaching the sensor area. This can happen if the sensor is sitting on top of a rock or below a hard pan which may impede water movement. Reinstalling the sensor usually solves this problem.
3. When the soil dries out to the point where you consistently see readings higher than 80 cbars, soil/sensor contact can be lost due to soil shrinkage. An irrigation which only partially rewets the soil (soil suction remains above 40 cbars) will not fully rewet the sensor which can result in continued high readings. This is most often seen in heavier soils and during peak crop water demand when irrigation may not be fully adequate. Full rewetting of the soil and sensor usually restores soil/sensor contact. should give a good indication of this behaviour.

Installing Soil Temperature Probe

Soil moisture probe accuracy is affected by soil temperature. Soil temperature also is an indicator of pasture growth.

The Water-Insight supplied probe is a thermocouple mounted in a metal tube (rod). The rod should be inserted to about 100-150 mm in the ground between the soil moisture probes. Note that air temperature can have a small affect on the probe readings which are likely to go up and down in temperature during the day or night.

The probe wire can be joined to the low loss multi core cable at the junction box. Trench underground or otherwise protect the cable wire in conduit.

Installing Software

The Soil Moisture Analyser Client application can be installed onto a Microsoft Windows compatible pc running Windows 7 or later.

Ensure that Microsoft .NET framework V4.0 or later is installed before installing the software. Contact Water-Insight for a copy of the installer application. Run the installer and after accepting the license agreement follow the on-screen directions to complete the installation.

The Water-Insight Workbench software is free to download from the Water-Insight Website (http://www.Water-Insight .co.nz/shop/SCADA+Supervisory+Control+and+Data+Acquisition.html). There are two versions of the installation file. The DN version contains Microsoft .NET framework 2.0 bundled. If you already have .NET Framework installed on your PC, install the non DN version. Run the installer and accept the software licensing agreement in order to install the software. Version 2.07 or later is required.

Installing the EP3 firmware

Soil moisture data can be collected by the Water-Insight EP3 Handheld unit running version 5.04 of the firmware or later. If your device is running an older version of firmware consult the EP3 User Guide for the firmware upgrade process. New firmware can be obtained from Water-Insight on request.

Configuration

Water-Insight Workbench

The WSML is configured using Water-Insight workbench via the USB interface (Type A-MiniB cable required). To connect to the device, connect the USB cable, wait for the USB drivers to install, launch Workbench, choose the wireless soil moisture logger device type from the top menu and press the connect button. Once connected the
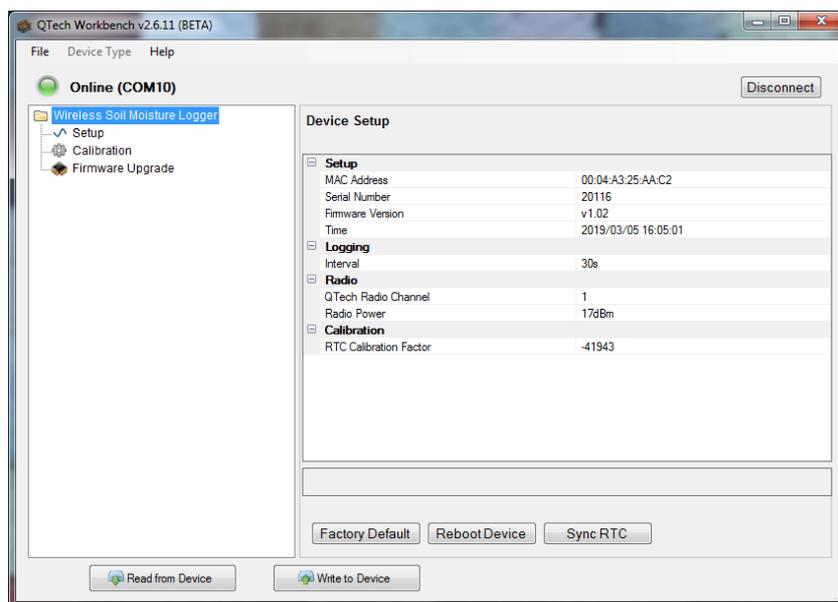
There are three forms to choose from:

1. Setup, the main configuration screen
2. Calibration used by Water-Insight to calibrate the real time clock in the unit
3. Firmware upgrade for updating the firmware in the device (see below)

Workbench Setup

There are only a few configuration parameters that need to be set up during installation. The most important is the logging interval which dictates how often the probes are measured and data captured. Configurable parameters are as follows:

Item	Description
MAC Address	Radio address, not configurable by user, do not change
Serial Number	Water-Insight assigned, not configurable, do not change
Firmware version	Configured using firmware upgrade process, read only on setup form
Time	WSML local time. To synchronise to time on PC press Sync RTC button
Interval	Logging interval in seconds, recommended logging interval for soil moisture is 3600 seconds (1 hour) intervals less than 15 minutes on not recommended on solar powered units.
Water-Insight radio channel	Water-Insight assigned, not configurable by user, do not change. This channel is matched to the receiving equipment (see also EP3 pod configuration file when configuring the EP3 to collect data records from the WSML)
Radio Power	Max value 18 dBm
RTC Calibration factor	Water-Insight assigned, not configurable, do not change

In addition, there are a number of functions that can be undertaken:

Item	Description
Factory Defaults	This returns the device to its factory state. Do not do this unless instructed by a Water-Insight technician otherwise the device may cease to work without further configuration.
Reboot Device	Force the device to reset. This can be done after updating a configuration and writing it to the device to cause new configuration values to take effect.
Sync RTC	Synchronised the device real time clock to the PC
Read from Device	Returns the current device settings
Write to device	Saves new configuration settings to the device.
Connect/disconnect	enables and disables communications to the device.

Workbench Firmware Upgrade Process

From time to time the firmware in the WSML may need to be upgraded. In particular two separate firmware options are offered: a) firmware using the FSK radio modem for communications and b) firmware using LORA radio modulation. To run the firmware upgrade wizard in Workbench click the firmware upgrade category to begin the process. Read the steps on the screen carefully.
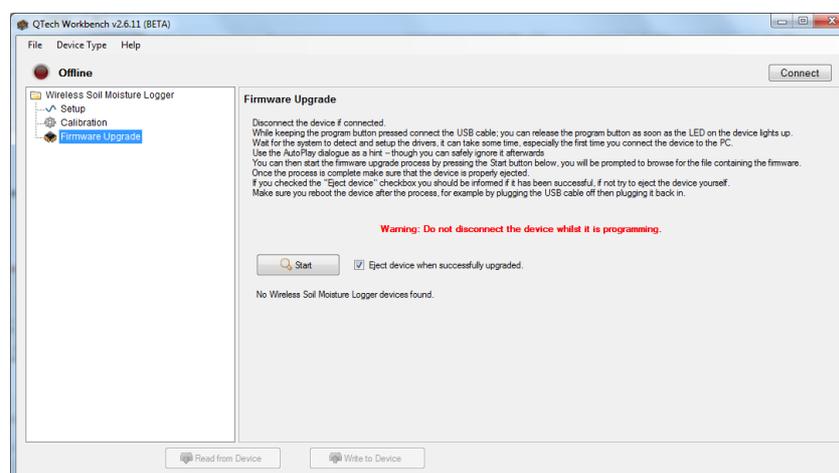
Follow these steps to upgrade the firmware on the device. Ensure the new firmware version is stored in a folder on your PC first.

Step	Process
1.	Disconnect the USB cable if connected. And remove the power connector
2.	Press and hold the prog pushbutton on the device circuit board
3.	Insert the USB cable
4.	Release the prog button when the DBG led on the circuit board is illuminated
5.	Ignore the auto-play dialogue box if it appears on the PC screen
6.	Press the start button in workbench (firmware upgrade form)
7.	Browse and select the new firmware file. Opening the file will commence the upgrade process.
8.	On completion eject the device (this can happen automatically but if not select the drive using Windows Explorer, right click and choose eject from the pop up menu.
9.	Remove the USB cable
10.	Reconnect the power

EP3 Setup

Version 5.04 of the EP3 firmware adds support for collecting data records from the WSML. Please also refer to the IMS EP3 User Guide for instruction in the operation of the EP3 and communication to the WSML for data retrieval.

To communicate with a WSML using the EP3, the EP3 must load an IPC configuration file (typically called a podlist) with a configuration definition for the logger. Users familiar with IPC devices will note that this is the same process for defining IPC devices, and flow or tank meters in an IMS system.

Configuration File

The podlist is stored on an SD Card and loaded (as one loads an IPC configuration) into the EP3. WSML devices that are included in the IPC configuration file (podlist) are listed in the EP3. A typical pod entry looks like:

```
[pod12]
name     = WSML2
serial   = 1234
address  = 00:04:A3:25:A9:60
channel  = 10
type     = moisture
```

You can use a text editor to create the podlist entry on a PC running Microsoft Windows.

The serial number must match the serial number on the WSML device and supplied with the product packaging. The MAC address (or radio address) is also supplied with the product packaging. The radio channel assigned by Water-Insight is usually pre-programmed and will be noted on the packaging. The user can change the radio channel but must use Workbench above to set the value. The device type (moisture) is required to identify the unit as a WSML to the EP3.

The configuration file is typically given a filename such as "pod-config.ini" the file type must be ".ini" but other filenames may be used. It must be saved to an SD Card (see section technical specifications). A folder must be created on the card named "pods". The file must be stored in this folder.

Note. The SD Card must be formatted for the FAT32 file system.

Loading the Configuration file

The process is described fully in the EP3 User Guide but summarised here.

Step	Process
1.	Insert the SD card containing the pod configuration file (e.g. pod-config.ini) in a folder named **pods** into the EP3
2.	From the main menu on the EP3 tap **IPC Files**. The file should be listed
3.	Select the file using the **up/down** buttons. It will be underlined when selected
4.	Tap **load** to upload the configuration to the EP3.

Once the configuration is loaded the EP3 is ready to communicate with the WSML.

Data Collection

The WSML is programmed to periodically measure and log its sensor inputs to create record log entries. It creates a timestamped entry for each record. The WSML is usually battery powered with a solar charging unit and is designed to assume a low power state when not actively measuring.

However, to support radio communications it listens for communications from the EP3. In Low Power Duty Cycling Mode:
- WSML listens for 50 ms every 10 seconds,
- Responds to requests destined to the broadcast address. On receiving a message destined for itself it then goes into an active mode.

When Active:
- WSML listens and respond to valid requests,
- Responds only to requests destined for its own address,
- Timeout after 30 seconds of inactivity.

The process for capturing and analysing data is as follows:

Select WSML device	Get Logs	Transfer Card to Desktop	Import to Analyser App
• Use EP3 to connect • scan for WSML devices	• Save to SD Card		• Store to database • Graph Results

Connecting to WSML

To commence connecting to and downloading the log follow these steps:

Step	Process
1.	From the Main menu on the EP3 tap **settings** then tap **data** EP3 Settings — Back Time / ScrnCal Info / Comms Data / SpecAnl
2.	If no devices are listed tap the *scan* button to search for loggers in range. Once a device is listed, use the *up*/*down* buttons to scroll to the desired device then tap *select* to connect to it. Data Loggers — Back Up Down Scan Select
3.	When searching for devices a "searching" indicator is displayed. If no device can be located the search will eventually time out. Data Loggers — Back WSML2 / Up Down Scan Select
4.	Once the device is selected the screen will display a number of function buttons: WSML2 — Back Get Status Get Logs Get Values / Set Time
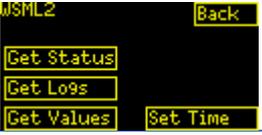
WSML Interface Functions

Item	Description
Get Status	Returns the WSML device status and properties
Get Logs	Retrieves log records and saves to the SD card
Get Values	Force the WSML to carry out a sensor measurement
Set Time	Synchronise the time on the WSML to the EP3 clock

It is recommended that **Get Status** be issued to the device first to establish a working connection. The results will show the device firmware version, the current date and time on the device and the number of records it has logged but have yet to be retrieved by the EP3.

Figure 4

Get logs will trigger the EP3 to read the saved measurements from the WSML and save them into a file. It is important to have an SD card inserted at this point. If a card is not present then the EP3 will not attempt to read the records. The file name is created as a combination of the EP3 date and time, along with the WSML name (taken from the IPC configuration file).

Get Values will trigger the WSML to perform a measurement on demand. Note that that the rainfall counter is not reset as part of an "on-demand" measurement; The value displayed is simply the rainfall since the previous periodic sampling event.

Set Time will cause the WSML to synchronise its internal real time clock with that of the EP3. Note - before setting the WSML clock, ensure that the EP3 time and date is correct.

It is recommended that **Get Status** be issued to the device first to establish a working connection. The results will show the device firmware version, the current date and time on the device and the number of records it has logged but have yet to be retrieved by the EP3.

Figure 5

Get logs will trigger the EP3 to read the saved measurements from the WSML and save them into a file. It is important to have an SD card inserted at this point. If a card is not present then the EP3 will not attempt to read the records. The file name is created as a combination of the EP3 date and time, along with the WSML name (taken from the IPC configuration file).

Get Values will trigger the WSML to perform a measurement on demand. Note that that the rainfall counter is not reset as part of an "on-demand" measurement; The value displayed is simply the rainfall since the previous periodic sampling event.

Set Time will cause the WSML to synchronise its internal real time clock with that of the EP3. Note - before setting the WSML clock, ensure that the EP3 time and date is correct.

Once the data logs have been retrieved and stored on the SD Card the card can be removed and analysed using the Analyser software on a PC, see below.

Quick Soil Moisture Readings.

The **Get values** command returns the current state of the sensors:

Figure 6

Soil temperature is measured in Degree C. Soil temperature in New Zealand at about 1m is typically 12-15 Degrees.

Soil moisture is measured in kPa in the range 0-200 kPa. Low pressure values indicate very wet conditions, high values very dry conditions.

A rule of thumb is approximately 50 kPa represents about 25 mm of plant available water for shallow rooted crops in clay loam soils at about 200 mm probe depth. The value will increase to about 70 kPa if the probe is 400 mm deep.

Rainfall is measured in mm. This shows the rain accumulated since the last measurement. Rainfall is measured every hour and the value reset before the next accumulation period starts. For daily accumulated rainfall the advanced data analysis tools must be used.

Data Analysis

To analyse the data from the WSML. Remove the SD Card and insert it into a desktop computer, on which the Water-Insight Soil Moisture Analyser software has been installed. Follow the process to import the data from the card and graph the readings. Please refer to the WSML User Guide for more information on the import and graphing functions.

Analyser User Interface

After installation the user must create a site by entering a name in the **Site** dialogue and selecting a suitable soil type that most closely represents the soil type where the WSML probes are located.

The date range for the display of log information can be selected using the period control or by nominating the start and stop dates for display. The graph will adjust the horizontal time axis accordingly.

For systems with multiple probes the display plots can be turned on or off by selecting the checkboxes in the **Conditions** dialogue. This dialogue also shows the current value of each probe.
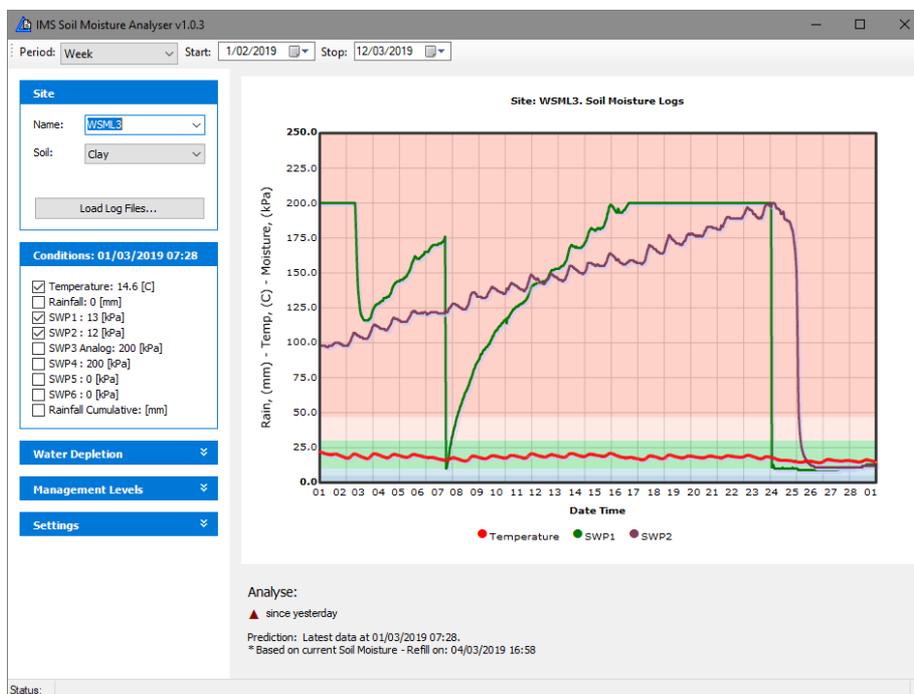
Water Depletion

An estimate of the water depletion based on the soil type is provided in the Water Depletion dialogue. This is a accompanied by an brief analysis report which indicates if the ground is trending towards wetter or drier conditions. A red triangle pointing up indicates the ground is getting drier and green triangle pointing down indicates getting wetter.
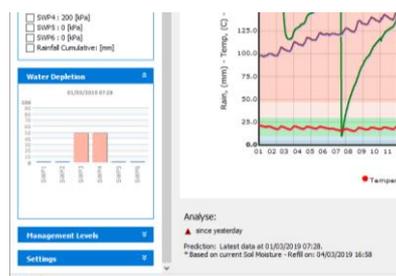
Management Levels

The coloured bands on the main graph are calibrated by the user over time, adjusted to the site conditions to the site to indicate normal, stressed and saturated water thresholds. This enables the user to perform a quick assessment to see if the soil moisture is at a level that needs irrigation or not. The green band indicates optimal water content. Red bands indicate that the ground is dry and should be irrigated. Blue bands indicate that the water content is nearing field capacity and irrigation is not required.

Management Levels	⌃
◢ **1.Too Full**	
Begin	0
Color	46, 121, 179
◢ **2.Full**	
Begin	5
Color	109, 175, 207
◢ **3.Normal**	
Begin	10
Color	0, 191, 37
◢ **4.Refill**	
Begin	30
Color	255, 180, 164
◢ **5.Stress**	
Begin	47
Color	251, 105, 75

The position of the bands on the graph depends on the type of soil and should be adjusted by the user after assessing a range of soil measurements over a month to best define the thresholds.

Settings

The **Settings** dialogue is provided to extract data logs stored in the local database on the PC and upload them to Water-Insight's cloud-based server and web application to view soil moisture graphs using a mobile phone or tablet device. These settings are provided to the user by Water-Insight if the user is subscribed to Water-Insight's IMS services. Contact Water-Insight for details.

Settings	⌃
◢ **Cloud**	
Broker Name	**192.168.3.129**
Save data	**False**
Topic	**telemetry/ims/farms/01:2**
User name	**mqtt-test**
User password	**mqtt-test**
◢ **Web API**	
Save data	**False**
URL	**http://192.168.3.129:3001**

Uploading log files

To use the analyser software the log files collected from the WSML onto an SD Card the files must first be uploaded to the analyser software database

Step	Process
1.	Launch the Analyser software on your PC
2.	Insert the SD card containing the log files into the card Slot in th PC. If your PC does not provide an SD Card interface connector contact Water-Insight for a SD Card – USB adaptor
3.	Click the **load files** button on the analyser software and navigate to the external drive folder for the SD Card
4.	Select the log file which will be a timestamped comma separated variable (.CSV)

Step	Process
	file and click the **open** button on the window. This will import and save the logs.

Interpreting the Graph

Once the log files are loaded the user can select the time period to view using the period or start/stop date ranges.
The graph will plot the selected probes according to the colour legend below the graph.
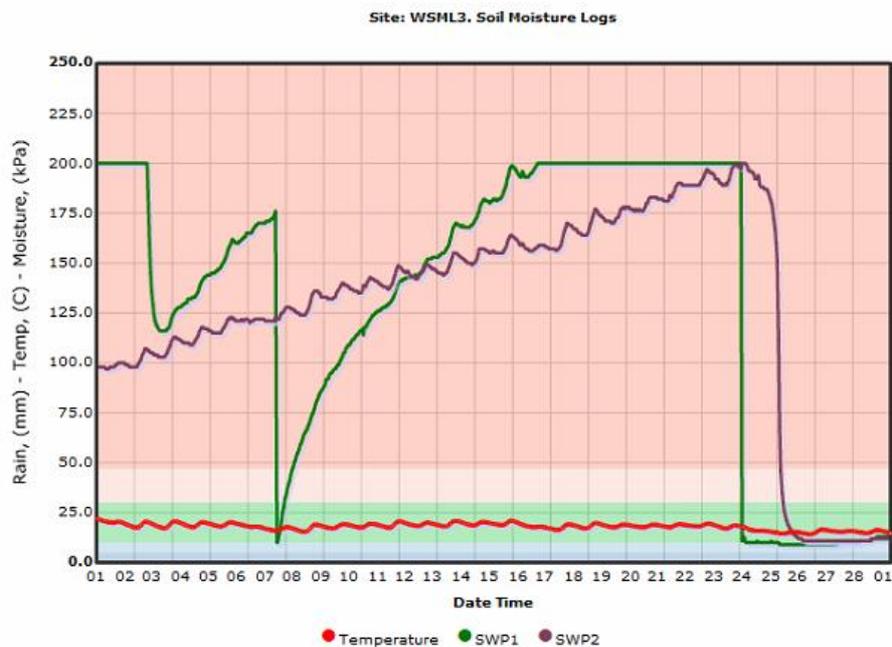
In the example above the soil temperature is approximately 20 degrees C. In this example the green probe (SWP1) is at inserted at 200 mm in the ground and the purple probe (SWP2) is inserted at 400 mm.

The green probe significant water events on the 3rd, 7th and 24th of the month. However, all but the event on the 24th have had an effect on the water content at 400 mm. The soil type in this example is clay and it would appear that the event on the 24th has turned the ground from very dry to very wet overnight (this is consistent with rainfall of the order of some tens of mm).

Since the probes measure water tension, a high pressure indicates high tension or a lack of water in the ground, vice versa a low pressure.

In clay the deeper probe is likely to track the shallower probe but with some lag as it takes time for the water to seep down.

The soil moisture plot is also a function of soil temperature so variations in soil temperature are reflected as variations in soil moisture. Variations in temperature can be caused by day/night conditions sensed by the soil temperature thermocouple.

Site calibration

Once the normal variations of the soil probes are established over time (a month or two in different soil conditions, then the threshold levels can be adjusted to best describe the ground conditions. The user should also account for root levels in the ground and overall pasture performance when calibrating the site.

Technical Specifications

Note. Specifications are subject to change without notice.

WSML Device Specifications

Item	Parameter	Specification
General		
	Dimensions	Approx. 110 x 70 x 25 mm Mounting holes 4 x M3
	Weight	250 gms
	Temperature	Operating: 0-65 degrees C Storage 0-65 degrees C
	Humidity	0-90% non-condensing
	Ingress Protection	IP20 Water contact should be avoided.
	Power	Input voltage: 12V (13.8V max) Current: 0.2A Max.
	Device Management	Via USB
I/O		- 4 x soil moisture probes to fit Irrometer Watermark Soil Moisture Sensor - model 200SS - 1 x Soil temperature probe 10k ohm thermistor 10K3A542I from Betatherm - 1 x rain gauge input 0.2 mm tip (contact switch type)
Radio	Regulatory	ISM band, AS/NZS 4268
	Antenna	Detachable SMA
	Operating Frequency	915 – 928 MHz
	Output power	18 +/- 2 dBm
	Receiver Sensitivity	-121 dBm
	Modulation	GFSK
Communications		
	USB	USB 2.00, Type Mini-B connector Interface (configuration and firmware upgrades)
	Data Retrieval	EP3 Data Manager (Secure Digital card SDA 2.0)
	Configuration	Water-Insight Workbench (via USB)

SD Card Specification

The INC uses an SD card interface for file transfer. The memory card should be formatted as FAT32. Typical memory device specifications are:

- Capacity: 8GB/16GB
- Standard: SDA 2.0
- Dimensions: 24 x 32 x 2.1mm (W x H x D)
- Weight: 2g
- Voltage: 2.7~3.6V
- Performance: Approximate Speed (read): 10~14 (MB/s), (write): 4~5 (MB/s)
- Speed Class: Class 4

Other card specifications may work but the user should verify that the EP3 can read the memory card correctly.

> **Warning**. Performance of SD cards from some manufacturers may vary. If problems occur loading files then try using a class 10 SD card instead.

Warranty

The hardware and software for this product is covered by the Water-Insight Limited Warranty Agreement and software End User License Agreement, respectively.

Please refer to the Water-Insight Limited Product Warranty Agreement, which may be downloaded from the Water-Insight website: www.Water-Insight .co.nz

Water-Insight Data Systems Limited does not warrant the suitability of this product for any particular application as the conditions in which it is used are beyond our control. This is not withstanding warranty of merchantability.

Additional Information and Support

If you have problems try the following:

- Visit the Water-Insight web site for application notes and guides
- Refer to the troubleshooting section if one is present in this document
- Contact the support desk at support@waterinsight .co.nz
- Phone the support desk, contact details at beginning of this document