



# WATER-INSIGHT

## Application Notes

### AN34 - Upgrading IMS Sites to use Water-Insight Farm-ID

Rev 02

#### Introduction

Water-Insights's Irrigation Management System (IMS) utilises an array of IPC devices connected via a mesh radio network to an INC network controller. Individual IPC devices can be programmed using an EP3 handheld unit and sites can be automatically polled for status information or schedule distribution using the INC. Smaller sites are managed using solely an EP3, whereas larger sites can include an INC and the IMS software.

Version 5.00 of the system (including INC V5.00, EP3 V5.00 and IPC V5.00) provides a range of new features and also introduces the concept of a Farm identifier (FarmID), designed to constrain radio communications, not just to the radio channel assigned to the farm but also to devices within the farm or within a block on the farm. FarmID has been introduced to enable radio functions in more densely irrigated areas where radio channel separation and diversity is insufficient to avoid potential radio interference from adjacent sites.

This note is intended for users and installers who are familiar with Water-Insight's IMS products and in particular have experience with using an IPC and EP3. It is technical in nature and if you need assistance in upgrading your site **please contact Water-Insight support**.

This document describes the steps to take when upgrading IPCs from older firmware versions to use the FarmID feature.

**Important.** This document provides guidance for those that intend to upgrade their entire site. For installers planning on operating mixed V3 and V5 sites there are some considerations to be made in terms of configuration of the site. Consult Water-Insight for more information.

#### What is a FarmID?

The FarmID is a unique number assigned, issued and managed by QTech. It uniquely identifies sets of IPCs deployed in a specified area of land (block) and it is issued to the farmer when new IPCs are deployed to the block. When IPCs are deployed to a site they are configured with several parameters:

1. A radio channel for communications to an EP3 or INC
2. A name which usually is a post or pod reference to assist the farmer in finding an IPC
3. A schedule to define watering times
4. A FarmID to restrict communications to the block

In version 5 of the system, once upgraded, IPCs without a FarmID configured will not communicate to an EP3, so part of the deployment process will include applying to Water-Insight for an ID. Water-Insight will maintain a database of IDs and where they are used. Water-Insight can programme the ID on behalf of the farmer for new production or issue the ID to farmers or installer, so that units on their site can be configured. Currently, farmers (or agents and installers) will apply for an ID by contacting QTech. In future the ID will be issued using a self-service web site.

You cannot mix FarmIDs (use more than 1) within a block because this will degrade the effectiveness of the mesh radio communications system that Water-Insight employ to route radio traffic over wide ranging terrain and IPC topography.

#### About the IPC software

Each IPC has two major software components: a) the IPC Application which constitutes normal operation, managing the programmable timer for watering operations and b) the bootloader which is a small programme that runs when the device enters a mode of operation (called bootloader mode) that handles the process of upgrading the application software part.

Normally only the application software gets upgraded but occasionally the bootloader also needs to be upgraded in order to introduce new programming features. In the case of the latest bootloader from QTech, the facility has been added to enable the EP3 to remotely set an IPC into bootloader mode, ready for an application update. Previously one had to put the IPC into bootloader mode by applying a magnet to a reed switch in the IPC device, to force it into bootloader mode.

With the latest bootloader an installer does not need to visit each post to do an upgrade and as long as the EP3 is in radio range of an IPC, it can do the update remotely and automatically.

In special cases one may need to update both the bootloader and the application. In this situation, a programme called a meta-loader is programmed into the IPC first, then the bootloader can be upgraded, then finally the new application is programmed using the new bootloader. When upgrading sites to version 5.00 this process will need to be followed on IPCs running firmware prior to version 3.13.

## Upgrading Older Sites

The general process for upgrading a site is as follows:

- a) Contact Water-Insight and apply for a FarmID, Water-Insight will issue one after gathering the necessary details.
- b) Regenerate the pod list (IPC configuration file) for the site to include the FarmID,
- c) Upgrade the firmware in any EP3 or INC devices that you have to V5.00 (or later versions if they are available),
- d) Upgrade each IPC to version 5.00,
  - a. IPCs on firmware versions prior to version 3.13 will require the bootloader on the IPC to be updated beforehand.
  - b. IPCs on version 3.13 or later can be updated using the “Over the Air” (OTA) programming function on the EP3 which does not require visiting each IPC to put the device into bootloader mode with a magnet.
- e) Set the time on the IPCs,
- f) Reissue each IPC schedule.
- g) Take the time to check that the battery level on the IPC is ok.

Recommended reading:

- The EP3 User Guide
- The INC User Guide
- Application Note - Upgrading Firmware on the INC
- Application Note - Upgrading Firmware on the EP3
- Application Note - QIMS Firmware Upgrade Guide for IPC
- QIMS INC Firmware Installation Guide V1.2

## Step 1 – Apply for a FarmID

The FarmID is a number in the form NN:NN where N is a hexadecimal character, for example 1F:3A. Its enough to know that the number must be unique to the network of IPCs you are going to use it on. When you contact Water-Insight to obtain the number we will ask you to supply some information including:

1. The Name of the Farm (if any)
2. The Farm Owners Name (first, last)
3. The Farm Managers name (or the person most likely to be contacted for day to day operational matters)
4. A contact number (preferably cell phone) for the Farm Manager (the person in item 3)
5. A contact email address for the farm manager.
6. The nearest road which accesses the block, preferably with a street address (if any)
7. The Fonterra number, if any. Many farms have the same point of access as the milk shed and the Fonterra number usually identifies this point so it's useful.
8. A GPS location for the block. This can be done with google maps on your phone or PC and Water-Insight can assist with this.

This will go into the Water-Insight database and the FarmID will be generated and sent to the Farm Manager contact. It will be handy to keep a record of this but if you lose it then Water-Insight can look it up against the details supplied above.

## Step 2 – Regenerate the Pod List

Currently every IPC in a block is defined in a file called the pod list (often written as pod-config.ini) which is loaded into an EP3 or INC to communicate with the device. Each Entry looks like this:

```
[pod1]
name=BK01
serial=7054
address=00:1E:C0:98:C7:C1
schedule=1
channel=1
x-coordinate=1588590.58532962
y-coordinate=5268693.73952957
mode=Mesh
sublateral=1
FarmID=1F:3A
```

Older configuration files do not have the last line (FarmID). The pod list can be edited with a text editor to add the last line (using the supplied FarmID number) to each IPC entry. This prepares the site configuration file for the upgrade.

Alternatively, if pod scheduling software is used for your farm (e.g. IPC Manager from QTech, or Pod Scheduler from RX Plastics), then this software can be used to automatically regenerate the pod list with the FarmID included. Usually only the pod list needs to be regenerated but schedules files may also need to be regenerated if they currently do not include the cycle\_length parameter. If in doubt check with Water-Insight or your scheduling software supplier.

## Step 3 – Upgrade the EP3 and INC firmware

Next you must upgrade the firmware in any control devices (EP3 or INC) that you may have. The procedure is straightforward and you can find it in the User Guides for the EP3, or INC. Contact Water-Insight if you don't have these manuals. Also, you can read these documents available from Water-Insight, which a shorter and supply only the information you need to upgrade the devices.:

- Application Note - Upgrading Firmware on the INC
- Application Note - Upgrading Firmware on the EP3

Not all EP3s can be upgraded using these processes, consult this guide:

Device Version	Strategy
<b>EP3 version 2.xx</b>	Return Device to Water-Insight for upgrade before proceeding
<b>EP3 version 3.xx</b>	Return Device to Water-Insight for upgrade before proceeding
<b>EP3 version 4.xx</b>	Can be upgraded to version 5.00 using the SDcard based upgrade process.
<b>INC version 2.xx</b>	Return Device to Water-Insight for upgrade before proceeding
<b>INC version 3.00</b>	Can be upgraded to version 5.00 using the SDcard based upgrade process. Load defaults during upgrade to reformat INC configuration memory
<b>INC version 3.01 or later</b>	Can be upgraded to version 5.00 using the SDcard based upgrade process.

## Step 4 - Upgrade each IPC

There are some decisions to make before undertaking this step. Firstly, consider if the bootloader firmware on the IPCs on your site is older (predating version 3.13 application and/or V1.09 bootloader). If this is the case it is best to record which version (or versions, if you have added more IPCs over time) of firmware your site is running. This can quickly be obtained by checking the status of your IPCs, which always report the firmware version in the response.

Avoid programming a site with more than one EP3, they can interfere with one another.

Use this guide to determine the upgrade strategy:

Device Version	Strategy	Firmware Upgrade Method
<b>IPC version 1.xx</b>	<ul style="list-style-type: none"> <li>• Consult QTech, these units will be near end of battery life.</li> </ul>	<ul style="list-style-type: none"> <li>• Apply magnet</li> <li>• Programme Metaloader</li> <li>• Programme Bootloader</li> <li>• Apply Magnet</li> <li>• Program Application</li> <li>• Configure with EP3</li> </ul>
<b>IPC version 2.xx</b>	<ul style="list-style-type: none"> <li>• Upgrade bootloader to V1.09</li> <li>• Upgrade Application to V5.00</li> <li>• Re-programme radio channel if using any channel other than channel 3.</li> <li>• Set Farm ID</li> <li>• Send timeset</li> <li>• Send schedule</li> </ul>	<ul style="list-style-type: none"> <li>• Apply magnet</li> <li>• Programme Metaloader</li> <li>• Programme Bootloader</li> <li>• Apply Magnet</li> <li>• Program Application</li> <li>• Configure with EP3</li> </ul>
<b>IPC version 3.08 or less</b>	<ul style="list-style-type: none"> <li>• Upgrade bootloader to V1.09</li> <li>• Upgrade Application to V5.00</li> <li>• Re-programme radio channel</li> <li>• Set Farm ID</li> <li>• Send timeset</li> <li>• Send schedule</li> </ul>	<ul style="list-style-type: none"> <li>• Apply magnet</li> <li>• Programme Metaloader</li> <li>• Programme Bootloader</li> <li>• Apply Magnet</li> <li>• Program Application</li> <li>• Configure with EP3</li> </ul>
<b>IPC version 3.09 to 3.12</b>	<ul style="list-style-type: none"> <li>• Upgrade bootloader to V1.09</li> <li>• Upgrade Application to V5.00</li> <li>• Set Farm ID</li> <li>• Send timeset</li> <li>• Send schedule</li> </ul>	<ul style="list-style-type: none"> <li>• Apply magnet</li> <li>• Programme Metaloader</li> <li>• Programme Bootloader</li> <li>• Apply Magnet</li> <li>• Program Application</li> <li>• Configure with EP3</li> </ul>
<b>IPC version 3.13 or later</b>	<ul style="list-style-type: none"> <li>• Upgrade Application to V5.00</li> <li>• Set Farm ID</li> <li>• Send timeset</li> <li>• Send schedule</li> </ul>	<ul style="list-style-type: none"> <li>• Use OTA method</li> <li>• Program Application</li> <li>• Configure with EP3 (farmid, timeset, schedule)</li> </ul>

### Notes on IPC Upgrade processes.

Its is best to have two podlists on hand: one with all the units but without the FarmID (old list) and one where all the units have the FarmID (new list).

If you are upgrading the whole site use the new list. Select "use broadcast header" when using EP3 comms. Set the radio channel first (if it needs it), then farmid, then issue a timeset and the schedule.

If you intend on only upgrading some IPCs then the system essentially will run older firmware and be susceptible to interference on the same channel. Just modify the podlist for the units that are being upgraded to add the farmID and update those.

**Important.** The INC makes decisions as to which protocol to use based the configuration entry of the **first** pod in the podlist (usually called [pod1]). If this pod has a FarmID then all timeset messages will go out with the FarmID and any units on old firmware will not receive them. To avoid this, leave the first pod entry without a farmID. Timeset will be broadcast n the traditional manner but other podlist entries that have a farmID will be recognised and the new format timeset will be used. For the EP3 the broadcast timeset can be forced to use the new or old format.

Deselect “use broadcast header” option when attempting to communicate with units on older firmware and once the FarmID has been set for units on newer firmware.

**Developers please Note.**

Software that automatically creates podlists needs to accomodate that the first entry in the podlist may or may not require the farmID in order to provide backwards compatibility on older sites. If in doubt upgrade pod1 on a site last.

This table can be used to determine whether communications will occur:

EP3 - Broadcast header not enabled	IPC fw < 5.00	IPC fw >= 5.00
no Farmid in config	YES	NO
Farmid in config which matches the IPC	NO	YES
Farmid in config which is different from the IPC	NO	NO

EP3 - Broadcast header enabled	IPC fw < 5.00	IPC fw >= 5.00
no Farmid in config	NO	YES
Farmid in config which matches the IPC	NO	YES
Farmid in config which is different from the IPC	NO	YES

See below for more information on broadcast header.

## Step 5 – EP3 configuration, Set the time and reissue schedules

The final steps involve using the EP3 and communicating with each IPC. Alternatively, some of these steps can be performed with an INC.

You must be located within radio range of the IPC when using an EP3 (typically less than 400m, but best if you are nearby).

*Before Starting*

1. Load the new pod list from the SD card into the EP3 (with FarmID) [IPC files > (select file e.g. pod-config.ini) >load]
2. Load the schedules files from the SD card into the EP3. [Sch files > (select folder e.g. default) >load]



Figure 1: Load IPC Configuration List

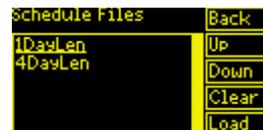


Figure 2: Load schedule files

*Broadcast header*

The broadcast header is used to communicate with IPCs which have not had their FarmID set or have a FarmID which is unknown. It enables an EP3 to communicate with an IPC in order to set the correct FarmID as prescribed in the config file entry in the podlist for the IPC.

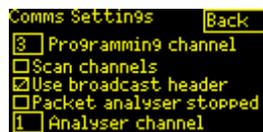


Figure 3: comms settings

When finalising upgrades to IPC it pays to select “Use Broadcast header” once the Farmid is set then further comms to the IPC can continue with or without the setting checked. Note you cannot communicate to units on older firmware with the setting selected (checked).

*Programme Radio Channel*

IPCs that require the radio channel to be reprogrammed should follow these steps:

1. In comms settings [main > settings > comms] set the programming channel to 3
2. In IPC list select the IPC to reprogramme [main > ipc list > (IPC name) > view] to view the IPC details
3. Send the channel message [IPC details > comms > channel > send] to programme the assigned radio channel per the pod list entry

**Note.** Even if your normal radio channel is 3 the channel must be programmed.

**Note.** Do this first after upgrade, if the upgrade process requires it because no communications to the unit can be achieved until it has the radio channel assigned.

Sending the channel means selecting the checkbox on the comms page marked “channel”, selecting checkbox for “local” communications then tapping the “send” button.

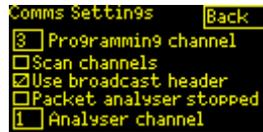


Figure 4: set radio programming channel

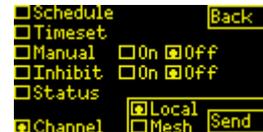


Figure 5

#### Programme the FarmID

To programme the FarmID follows these steps or simply continue from the previous step (programming the radio Channel) on the same screen:

1. In IPC list select the IPC to reprogramme [main > ipc list > (IPC name) > view] to view the IPC details
2. Send the FarmID message [IPC details > comms > FarmID > send] to programme the assigned FarmID per the pod list entry

Sending the FarmID means selecting the checkbox on the comms page marked “Farm ID”, selecting checkbox for “local” communications then tapping the “send” button.

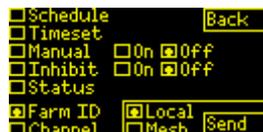


Figure 6: Send FarmID



Figure 7: IPC Response to Status message

#### Set the time

To set the time on an individual IPC follow these steps or simply continue from the previous step (programming the FarmID) on the same screen:

1. In IPC list select the IPC to reprogramme [main > ipc list > (IPC name) > view] to view the IPC details
2. Send the Timeset message [IPC details > comms > Timeset > send] to set the time per the pod list entry

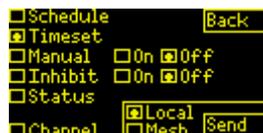


Figure 8 send time to currently viewed IPC



Figure 9 Broadcast option

Sending the Timeset means selecting the checkbox on the comms page marked “Timeset”, selecting checkbox for “local” communications then tapping the “send” button.

#### Other ways of setting the time

The INC can also be used to issue a timeset or schedule the time to be updated on a periodic basis. This is the preferred method for larger sites. But if you are upgrading units one by one then it is convenient to send the timeset individually because then the next schedule operation time is immediately calculated.

The EP3 can also broadcast a timeset to the whole site but there is no guarantee that every IPC will receive the message so global broadcast timesets may need to be repeated at various positions around the site to ensure coverage.

In version 5 firmware the cycle period is defined in the schedule file and is not adjusted in the global timeset function on the EP3. Version 5 firmware also automatically calculates the day of the cycle. In this manner it is no longer necessary to manually define the day of the cycle in the time editing function.

The broadcast time can be set to units on older firmware by deselecting the “use FarmID” checkbox. Conversely the newer protocol for V5 units can use the broadcast timeset by selecting the “use FarmID” option.

*Issue the Schedule, check the battery*

To finalise the IPC upgrade follow these steps or simply continue from the previous step (programming the time) on the same screen:

1. In IPC list select the IPC to reprogramme [main > ipc list > (IPC name) > view] to view the IPC details
2. Send the Schedule message [IPC details > comms > Schedule > send] to send the schedule per the pod list entry



Figure 10



Figure 11

Sending the Schedule means selecting the checkbox on the comms page marked "Schedule", selecting checkbox for "local" communications then tapping the "send" button.

Sending the schedule also elicits a status response from the IPC which can be used to verify that the unit is operating on the correct frequency, with correct firmware and the battery level is ok on the unit. Do this if it is convenient and you are by the IPC.

If the battery appears low (less than 40%) then check that the solar panel is clean and that there are no obvious signs of damage. Remove bird fowling and excessive dust with a damp cloth. Sometimes placing a dark cloth over the solar panel can cause the voltage to drop further (request the IPC status to get the voltage level), this is an indication of a possible solar panel fault if the voltage drop in 30s is dramatic.

Occasionally batteries that are at the end of their useful life or are faulty will exhibit "bloating" where the casing on the battery swells. This can be difficult to spot because the battery normally fits into a narrow space. If in doubt, note the post position of the unit and the serial number of the IPC and the battery level (%) for a future maintenance round on the site. If the level does not recover of its own accord after a week, then it may require service attention. Contact your installer for advice.

Note that in winter months with low sunlight levels IPC battery levels can naturally fall but will recover in time. If it is a concern, try inhibiting the IPC so that it doesn't attempt to operate the sprinkler valve.

For larger sites the schedule distribution can also be done using the INC which will automate the process of send the schedules to all units.

## Upgrades requiring bootloader update

An overview of the Magnet method described above is provided here. The full method is described in the application note referenced above or in the EP3 User Guide. Allow about 2-3 minutes per unit to programme (roughly 25 units per hour). This method requires IPCs to be upgraded one at a time:

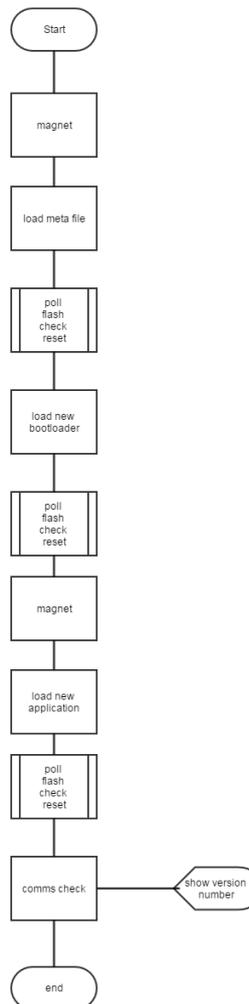


Figure 12: Traditional upgrade process with magnet

The comms check procedure is described here in more detail usually involves a status check (comms > status). However, step 5 above must be completed first and the process of sending a schedule to an IPC will respond with the complete status of the IPC device, so requesting the status of the unit is superfluous. If you can communicate with the IPC and send a schedule this is sufficient.

## Upgrades requiring only the Application update

For units that are eligible for upgrade of the application using the OTA method then an overview of this method is described here. Alternatively, the traditional magnet method can be used. The full process is described in the application note and in the EP3 User Guide.

This method can be used to upgrade multiple IPCs (within radio range of the EP3) at a time. The sequence is automated but allow about 1 minute per unit for programming time.

Try to establish a high point overlooking the IPCs when programming as it maximises the opportunity to upgrade many IPCs at a time.

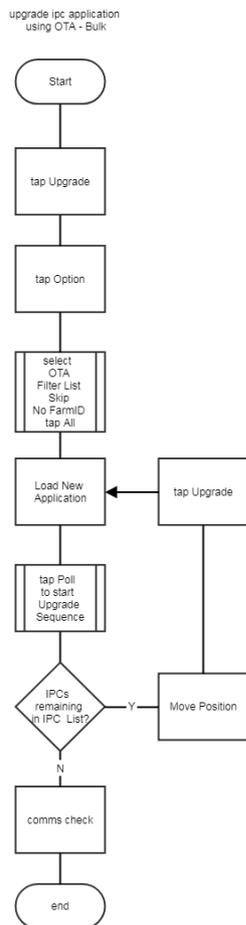


Figure 13: Upgrade All

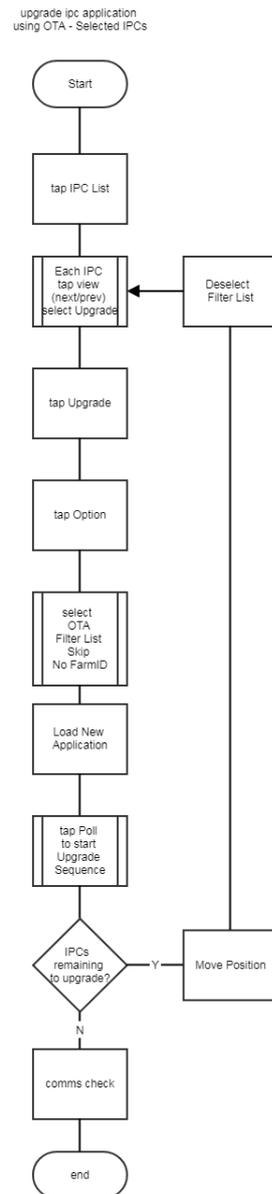


Figure 14: Upgrade Selected

It is useful to use both the “Filter List” options and the “Skip” options when using the OTA method. The method will sequentially address all IPCs in the IPC list that have had their upgrade checkbox ticked. When the “filter list” option is applied then only those IPCs appear in the list. As the units are programmed the list will reduce until eventually none are displayed. This provides a handy reference of the number of units remaining to programme. The skip option, when ticked, means that if the IPC is already programmed to the required version it will be skipped over and the process will proceed to programming the next IPC in the list.

“Comms check” in the context of this document means after the firmware upgrade process is complete then programme the FarmID for each unit and reissue the time and schedules. This will involve communicating with IPCs one by one.

When upgrading a site using OTA do the following:

1. Load a “new” podlist with FarmIDs
2. Select “use Broadcast header”
3. In OTA options select “OTA”, “Filter List”, “Skip”, “No FarmID”
4. Tap All (**IMPORTANT ONLY USE THIS OPTION IF YOU ARE SURE YOU HAVE GOOD COMMS TO ALL IPCS**)
5. Load the application file and proceed. Mark off on a paper copy the units (name/serial number) you have programmed .
6. Now go through the IPC list one at a time (using next prev) and set the FarmID for each unit. You will need to untick the “filter list” first

### *Upgrading all units using iterative approach*

One useful strategy (if there are NO IPCs out of radio range) is to select "All" in the OTA upgrade options. The entire pod list will be marked for upgrade and displayed. With the filter and skip options turned on then the entire pod list will be upgraded in sequence. Any units that fail to upgrade will remain marked for upgrade. You can then move to another position (without changing any options or selecting more IPCs) and commence the upgrade sequence again. Only the remaining units in the list will be addressed and even then, if they have the right firmware version they will be skipped. Repeating this process a few times will eventually upgrade the entire site, hopefully with only a few changes of position with the EP3.

If you need to clear all the marked IPCs so that none are set to upgrade tap the "none" button in the upgrade options screen. If you do not tick the OTA option in the upgrade options, then it is assumed you are using the magnet method and only the one IPC is updated at a time.

**Note. If any units fail during this process you may end up having to walk to each failed upgrade and upgrade them using the magnet method.**

### *Upgrading a few units at a time*

A better strategy involves selecting only a few IPCs at a time from the IPC list. Tap the "view" button for each IPC in the list then check the upgrade checkbox to select it for upgrade. Use the "next" and "prev" buttons to move through the list. Make sure a "new podlist" is loaded (with FarmIDs) .Then do the following:

1. Select "use Broadcast header"
2. In OTA options select "OTA", "Filter List", "Skip", "No FarmID"
7. Load the application file and proceed. Mark off on a paper copy the units (name/serial number) you have programmed .
3. Now go through the IPC list one at a time (using next prev) and set the FarmID for each unit. You will need to untick the "filter list" first.

Important. Make sure you are close to the units you want to upgrade (within good radio range.)

**Note. If any units fail during this process you may end up having to walk to each failed upgrade and upgrade them using the magnet method.**

### *Upgrading by splitting up the pod list*

A third strategy involves editing the pod list and creating a number of pod config files each with a subset of the full list. These files would normally have groupings of IPCs that are physically close to one another so that the opportunity to upgrade them from an EP3 within radio range is maximised.

This approach needs more preparation work but limits the number of IPCs attempting to be programmed. When used in conjunction with selecting "All" units this approach offers a shorter overall programming process time because IPCs that are out of range will not be attempted, therefore you don't have to wait for attempts to programme a unit that is likely to fail the programming step.

This approach is best if you plan on upgrading a site according to its layout an area at a time.

The same effect is achieved by manually selecting the IPCs for upgrade, based on knowledge of where they are.

For more information email [support@waterinsight.co.nz](mailto:support@waterinsight.co.nz)