



Application Notes

Rev 09

AN09 - IPC Firmware Upgrade Guide using the EP3

Introduction

This document provides the procedures for upgrading the firmware of the IPC using the EP3 handheld tool.

This document should be read in conjunction with the “Irrigation Point Controller EP3 Programming User Guide” V2.5 or later. It supplements the user guide with additional screen shots.

IMPORTANT – If upgrading from v3.xx to v5.xx firmware, you must also programme the Farm ID parameter before you can communicate with the IPC.

Prerequisites

- Ensure that the latest version of firmware is running on the EP3, consult the EP3 user guide for procedures to upgrade the firmware in the EP3.
- Latest IPC Firmware can be supplied by Water-Insight on application if required.
- The new firmware must be loaded into a folder on the SD card called “firmware” in order for it to be listed in the available upgrades on the EP3 user interface screen.

Setting Up Tools Required

- Always have a small magnet on hand to interact with the IPC (to put it into bootloader mode or power it on and off if required).
- Always carry spare batteries for the EP3.
- It is recommended that a stylus be used when interacting with the touch screen user interface of the EP3.

Firmware Upgrade Procedure

The IPC firmware can be upgraded from the EP3 via the on-board radios. The EP3 will communicate with the target IPC using the Bootloader communications method described herein.

The bootloader is a small programme that runs to handle the file transfer and programming of new IPC firmware applications. The bootloader must be activated before programming new firmware. This is described herein.


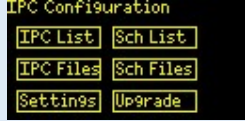
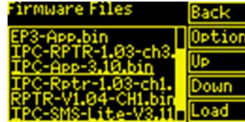
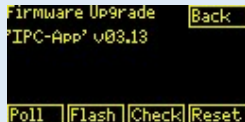






From time to time the bootloader itself may need upgrading. When this is needed a special application called a meta loader is first programmed into the IPC to facilitate upgrading the bootloader.


Note - The bootloader communications method is relatively simple compared to the other communications methods used by the IPC. It is therefore very important to ensure that only one IPC (within radio range) is operating in the Bootload ACTIVE mode at a time, or communications problems may occur.

A feature was introduced in IPC Application firmware v3.13 that allows fully “over the air” (OTA) firmware upgrades. It is recommended that you become familiar with the traditional upgrade process so that you understand the various stages involved before attempting to use the OTA upgrade process.

Traditional Upgrade Process

This process is to be followed if you are physically present at the IPC and wish to undertake a firmware upgrade.

Step	Action	
1	<p>Insert the SD card containing the IPC firmware and turn on the EP3. The main menu should appear</p> <p> Take care that the SD card is inserted with correct orientation, do not force.</p>	
2	<p>Tap Upgrade. The list of available firmware files will be displayed. Tap the up or down buttons to move the cursor to the filename of the new firmware. The selected file is underlined.</p>	
3	<p>Tap Load. Information about the firmware will be displayed including its name and version number.</p>	
4	<p>Place a magnet on the IPC housing at the position indicated by the "magnet" label for a few seconds then remove the magnet.</p> <p>The LED inside the IPC will start blinking, indicating that it is in firmware upgrade mode (Bootload ACTIVE).</p>	
5	<p>Tap Poll.</p> <p>This performs a handshake with the IPC to confirm that it can communicate with the IPC. The EP3 will now display the name of the bootloader application and the message "Handshake OK".</p> <p>If you receive a "No Response" message then ensure that the IPCs LED is still blinking and that the EP3 is in radio range of the IPC.</p>	  <p>(if no response)</p> 
6	<p>Tap Flash. The screen will now display a count of records being transferred to the IPC. This process will take about 20 seconds to complete.</p> <p>First the memory will be erased Then the memory will be programmed Once the IPC is successfully programmed you will receive the message "Programmed OK" proceed to the next step.</p> <p>If you receive the message "programming failed" Then turn off the EP3 and repeat the process from Step 1.</p>	 

Step	Action	
		<pre>Firmware Upgrade [Back] 'IPC-App' v03.13 Programming... Programmed OK Poll Flash Check Reset</pre> <p>(if programming fails)</p> <pre>Firmware Upgrade [Back] 'IPC-App' v03.13 Programming... Programming Failed Poll Flash Check Reset</pre>
7	<p>Tap Check. This will make the IPC verify that the new application image is correct.</p> <p>If the verification process passes you will receive the message "Firmware OK" proceed to the next step.</p> <p>If the verification process fails you will receive the message "Check failed". Turn of the EP3 and repeat from Step 1.</p> <p>If the problem continues please contact Water-Insight Support.</p>	<pre>Firmware Upgrade [Back] 'IPC-App' v03.13 Verifying... Firmware OK Poll Flash Check Reset</pre> <p>(if check fails)</p> <pre>Firmware Upgrade [Back] 'IPC-App' v03.13 Verifying... Check Failed Poll Flash Check Reset</pre>
8	<p>Tap Reset. The IPC will then restart, and the LED should turn off indicating that IPC is now using the new IPC firmware.</p>	<p>(led turns off)</p> 

OTA upgrade process


This process may be followed if you are not physically present at the IPC but are within radio range via the EP3. Use this process if the IPC bootloader firmware has already been upgraded (to V1.09 or later) and is ready to accept OTA firmware upgrades.

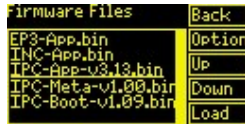

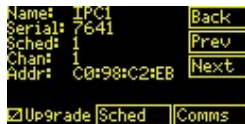

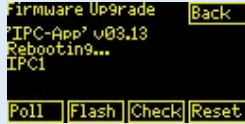

The OTA upgrade process was added to make it less labour intensive to upgrade many IPCs after they have been deployed in the field. The prerequisite firmware versions for the OTA upgrade process are:

- IPC Application >= v3.13 or later
- IPC Bootloader >= v1.09 or later
- EP3 Application >= v4.06 or later

When the OTA option is enabled the upgrade process is changed so that:

- Instead of you having to use a magnet, the EP3 will send the IPC a message telling it to go into Bootload ACTIVE mode.
- The EP3 will automatically step through the IPC list and perform the upgrade process on each IPC that has been selected for upgrade.

Step	Action	
1	<p>Insert the SD card containing the IPC firmware and turn on the EP3. The main menu should appear</p> <p> Take care that the SD card is inserted with correct orientation, do not force.</p>	<pre>IPC Configuration IPC List Sch List IPC Files Sch Files Settings Upgrade</pre>

Step	Action	
2	<p>Tap Upgrade.</p> <p>The list of available firmware files will be displayed.</p> <p>Tap the up or down buttons to move the cursor to the filename of the new firmware.</p> <p>The selected file is underlined.</p>	
3	<p>Tap Option. The relevant options are:</p> <p>OTA Enables the OTA feature.</p> <p>Filter List The IPC list will only show the IPCs that have their “upgrade” box ticked.</p> <p>Skip The EP3 will skip over upgrading the IPC if the IPC already has been upgraded to the desired firmware version.</p> <p>No FarmID Check this box to upgrade IPCs on V3.xx firmware to V5.xx firmware Note you must be running V5.xx EP3 firmware to see this option</p>	
4	<p>Enable the OTA feature, and select which IPCs you want to upgrade.</p> <p>The All and None buttons can be used to tick or untick the “upgrade” box of all the IPCs.</p> <p>So if you want to upgrade all the IPCs using the OTA feature you should just tap the All button, which will automatically enable the OTA option.</p> <p>Alternatively, you can tap None, and then select specific IPCs via the IPC list.</p>	
5	<p>Tap Load.</p> <p>Information about the firmware will be displayed including its name and version number.</p>	
6	<p>Tap Poll.</p> <p>This will trigger the EP3 to begin the automatic process, and you shouldn't need to do anything more until the EP3 has worked its way through the list of IPCs selected for upgrade.</p>	
7	<p>The EP3 will step through a process of rebooting the IPC, Checking the firmware version (skipping to the next IPC if the firmware version is the same and the “skip” option is enabled), Erasing, Programming, Checking, and Resetting, until all IPCs have been attempted.</p>	
8	<p>Once the EP3 has finished the OTA process you may need to reattempt the upgrade on some IPCs.</p> <p>Each time that the EP3 successfully upgrades the IPC it will untick the IPCs “upgrade” checkbox. IPCs that weren't successfully upgraded will be left with the “upgrade” box ticked, and you can use the “filter” option to show those ones.</p> <p>If the upgrade failed because the EP3 wasn't able to communicate with the IPC (to put it in Bootload ACTIVE mode), then if you can re-trigger the OTA process once you have moved to a position which has better comms coverage to that IPC or group of IPCs.</p>	

Step	Action
	<p>If the upgrade failed due to a comms fault part way through the upgrade, then the IPC will be sitting in Bootload IDLE mode, and you will have to visit those IPCs with a magnet and perform the traditional upgrade process.</p> <p>It's OK to turn off and on the EP3 as you move around because the "upgrade" checkbox states will be remembered.</p> <p>If you tap ALL or NONE but lose track of which units have been upgraded then checking the "skip" option may be useful. It is recommended that if you check ALL that you make a note of the units that successfully upgraded as you go.</p>
9	<p>Once all IPCs have been upgraded you should confirm that the upgrade was correctly applied to each IPC by sending it a status request and receiving a status message in response. This can be done with the EP3 or with an INC</p> <p>Note If you have upgraded to V5.xx firmware you must load a new podlist with FarmIDs for each unit and also programme the FarmID before you can communicate to the IPC.</p> <p>This is covered in a separate application note. Contact Water-Insight for assistance</p>

OTA Bootloader upgrade process

This process is to be followed if the IPC has firmware older than V3.13 and both the firmware (application) and the bootloader (which upgrades the application) are required to be updated in order to make the IPC device ready for OTA updates.

Here is an overview of the process:

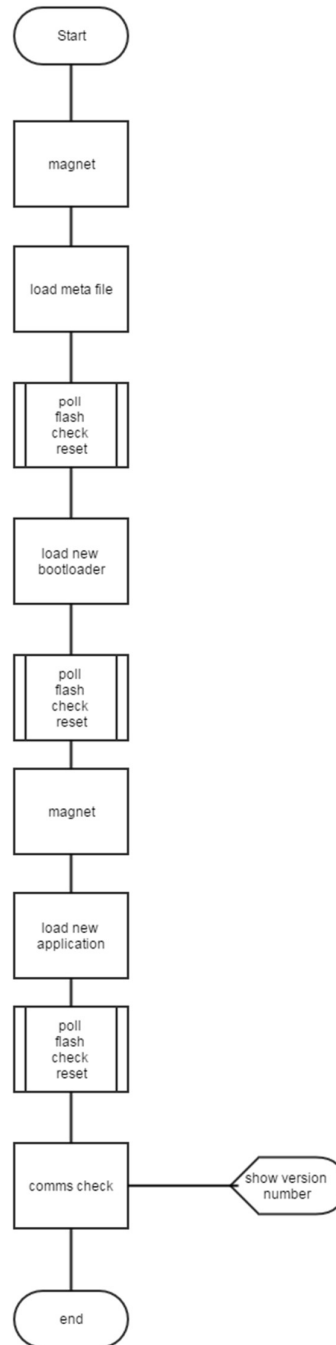


Figure 1. Overview of process

A three-part process is required for field upgrading the IPC. The first part is to load a special application called the meta-loader into the IPC. This puts the IPC into a mode whereby it will be ready to accept and upgrade the bootloader program. Once the bootloader program is updated then resetting the IPC will go into bootloader mode and the new bootloader will understand commands to initiate an OTA upgrade without needing the magnet to be placed on the unit. The final part is to upgrade the IPC application itself so that radio commands sent to an IPC while it is normally functioning will be recognised and the IPC can place itself in bootloader mode (again without needing a magnet to be placed on the unit).









To upgrade the bootloader in the field each IPC must be visited and a magnet is required. The flow chart above indicates the sequence of events, detailed as follows:

Step	Action	
1	The EP3 must be loaded with three files all stored in the firmware folder of the SDCard: 1. The meta-loader (IPC-meta-xxxx.bin) 2. The bootloader (IPC-boot-xxxx.bin) 3. The application (IPC-App-xxxx.bin). The main menu on the EP3 is called IPC configuration. Tap the Upgrade button to list the files.	Main>upgrade
2.	Select the meta loader (using up down buttons) to scroll to the correct file which will be underlined. Load the meta-loader.	Tap load
3.	Briefly place the magnet on the IPC to enter bootloader mode.	
4.	Follow the poll>flash>check>reset>process described above.	If issues, see troubleshooting below
5.	At this stage, there is no need to place the magnet again. Tap back to show the list of firmware files and scroll to select the (new) bootloader program. Load the bootloader.	Tap load
6.	Follow the poll>flash>check>reset>process described above.	If issues, see troubleshooting below
7.	Having loaded the new bootloader now program the application. Tap back to list the firmware files and scroll to the application program then then load it.	Tap load
8.	Having loaded the new bootloader now briefly place the magnet on the IPC to enter the new bootloader mode.	
9.	Follow the poll>flash>check>reset>process described above.	If issues, see troubleshooting below
10.	When the IPC is reset at the end of the last step in programming the application, after a few seconds you should here a click (if the sprinkler valve solenoid is wired up). This indicates that the IPC has been reset and is now in its normal operating mode. If the valve solenoid is not wired up then wait about 20 seconds to be sure.	
11.	Now verify that the unit is operational. Tap back until you return to the main screen.	Tap back
12.	Now list the IPC devices tap IPC list and either scroll to select the IPC you have just upgraded or a quick method is: a) note the IPC serial number (printed on the large silver canister (capacitor) inside the IPC b) on the IPC list tap jump c) enter the serial number and tap enter d) this selects the desired IPC tap view e) tap comms f) ensure the status and local checkboxes are selected (marked) g) tap send	Final verification

Step	Action
	h) The IPC will be polled and return its status including the firmware version that it is now running.

IPC LED Indications

The IPC LED is used to indicate status information as detailed below.

	Off	Good - Application running
	On	No Bootloader
	Fast flash	Bootloader Active
	1 flash every 5 seconds	Reed switch closed
	2 flashes every 5 seconds	Firmware blank
	3 flashes every 5 seconds	Firmware size wrong
	4 flashes every 5 seconds	Firmware CRC wrong
	5 flashes every 5 seconds	Radio Fault

Note: different error flashes can occur together e.g. Firmware blank followed by Radio Fault

Troubleshooting

1. If the IPC is flashing its LED very briefly every 10s prior to commencing the upgrade process then the IPC may be in hibernation mode due to a low battery. Confirm that communications to the IPC are available by interrogating its status prior to starting the firmware upgrade.
2. If the IPC is in hibernation mode then it can be forced out of hibernation by putting it into bootload mode (briefly applying the magnet). This may allow a firmware upgrade to be undertaken but if the battery voltage is very low then the unit will resume hibernation mode until the battery has been sufficiently charged. There is a risk that attempting to do a firmware upgrade when the unit is in hibernation may fail.
3. When upgrading the meta-loader and bootloader and new application occasionally the response to the poll and flash commands can be “no response” or “not erased” and the device appears to lose communications. Try going back, reloading the program then wait 1 minute until the current bootloader mode has timed out, then place the magnet on the device and repeat the poll step to start programming. If you still get no response turn off the EP3 and start from the beginning.
4. **Experts only:** If you still get no response after a poll (or some error response such as ‘no handshake’) try the next step (flash). Usually this step will commence in meta-loader operation even though apparently there is no response from the poll step.
5. The whole process appears to work best (i.e. avoids handshaking and response errors) as long as you wait a reasonable time between the (reset) from the last programming step to the (poll) of the next processing step. This allows enough time for the IPC to reset correctly and be ready for the next communication. If you wait too little time the errors may occur more frequently. About 15-20 seconds between reset and poll is normally enough.
6. If you can't get the IPC to go into bootloader mode try placing the magnet on the other end of the IPC where the reed switch for power on/off is situated for 30s then return the magnet to the other end briefly, to put the unit into bootloader mode.

For more information contact Water-Insight support@waterinsight.co.nz