

# FCD App

User Manual

# Table of Contents

I	Disclaimer	3
Part I	Introduction	4
1.1	Features .....	5
1.2	Tablet or Phone Requirements .....	5
Part II	Configuration	6
2.1	Bluetooth Device Connection .....	6
2.2	TBRG Setup .....	11
2.3	Field Stations .....	13
Part III	Operation	17
3.1	Opening the FCD_App .....	17
3.2	Viewing Field Calibration History .....	19
3.3	Performing a TBRG Field Calibration .....	20
3.4	Retrieving the Calibration Data .....	21
Part IV	Troubleshooting	23
Part V	Appendices	25
5.1	Theoretical Bucket Volume Calculations .....	25
5.2	Warranty .....	25

# I Disclaimer

The information provided in this manual was deemed accurate as of the publication date. However, updates to this information may have occurred.

This manual does not include all of the details of design, production, or variation of the equipment nor does it cover every possible situation which may arise during installation, operation or maintenance. HyQuest Solutions shall not be liable for any incidental, indirect, special or consequential damages whatsoever arising out of or related to this documentation and the information contained in it, even if HyQuest Solutions has been advised of the possibility of such damages.

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# 1 Introduction

Thank you for choosing our product. We hope you will enjoy using the device.

HyQuest Solutions manufactures, sells, installs and operates quality instrumentation, data loggers and communication technology. Products are designed with passion for environmental monitoring and with a deep understanding of the quality, accuracy and robustness needed to fulfil the requirements of measurement practitioners in the field.

The present User Manual will help you understand, install and deploy the device. If, however, you feel that a particular information is missing, incomplete or confusing, please do not hesitate to contact us for further support!

The FCD\_App is free software developed and supported by HyQuest Solutions which operates on any Android platform (customer's own Tablet or Phone) which is used to collect data when performing a Tipping Bucket Rain Gauge Field Calibration.

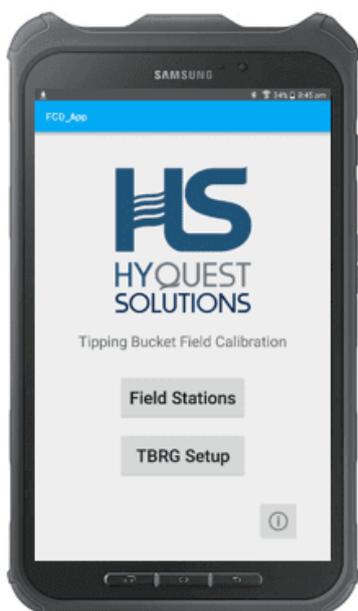
The Application communicates via Bluetooth to the HyQuest Solutions' CMCbt which in turn is connected to the switch contact inside a Tipping Bucket Rain Gauge. When the Gauge is calibrated in the field, the tipping bucket count along with any notes is saved into a historical file.

TBRG Field Calibration checks are usually performed by either:

- Listening for the TBRG bucket tips and counting them, (not easy when the environment is noisy or you get distracted) OR
- Using the data logger to count the tips, which messes up the station data.

Using the FCD\_App and the CMCbt solves both of these problems.

**FCD\_App on a Samsung Galaxy Tab Active**



OR



**Android Mobile Phone**

Bluetooth Comms

CMCbt Bluetooth Counter (Fits inside TBRG while Calibrating.)



**Tipping Bucket Rain Gauge with FCD (Field Calibration Device)**

## 1.1 Features

- Standard and Custom Rain Gauge models can be configured.
- Unlimited number of Sites.
- Unlimited number of Field Calibrations at a site.
- Record the TBRG Serial No at a site to allow tracking.
- Notes can be made during the calibration.
- Software can be upgraded as new features become available.
- CMCbt easily fits inside the rain gauge while doing the field calibration.
- Bluetooth does transmit through the metal rain gauge cover.

## 1.2 Tablet or Phone Requirements

- Android operating system Version 4.3 or higher (JellyBean or higher)
- Bluetooth available (No need to be Bluetooth Low Energy compatible)

(For communications to the CMCbt counter)

### **\*\*\*\* PLEASE NOTE \*\*\*\***

The latest Android Operating System has a security feature that prevents Bluetooth from operating unless you allow access to the FCD\_App “Location” services. When the version v1.00.11 (and greater) starts, it will check permissions as ask to “Allow access while App is running” – you **MUST** allow this so that Bluetooth will operate properly!

## 2 Configuration

This chapter contains the following subsection:

- Bluetooth Device Connection [67](#)
- TBRG Setup [117](#)
- Field Stations [137](#)

### 2.1 Bluetooth Device Connection

When the tablet or phone requires a Bluetooth connection with the CMCbt Counter, it will pop up a list of the devices found nearby – simply select the required device and operation will begin.

**Note:** The Bluetooth device should have been paired with the tablet or phone in the Bluetooth Manager previously.

The pairing function can be started by going to the Tablet Settings as follows:

1. Click on the Tablet Settings icon.

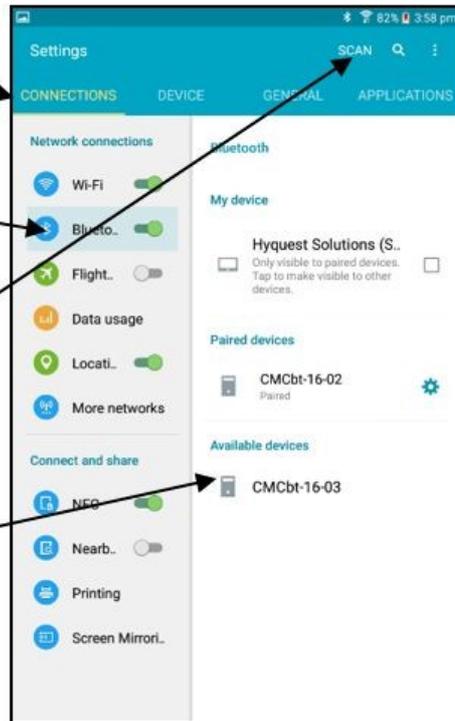


2. Click on Connections.

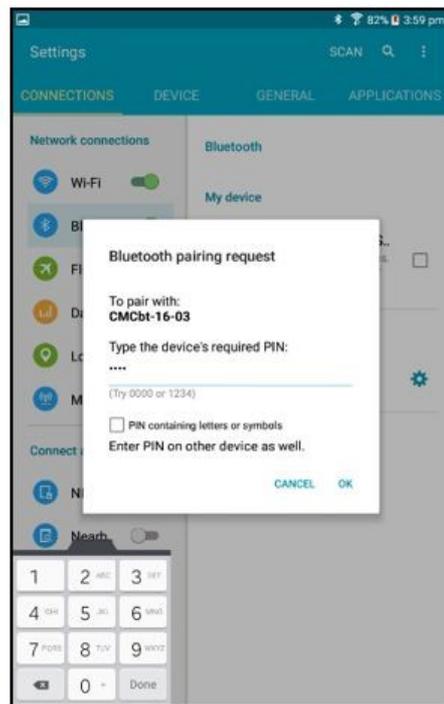
3. Click on Bluetooth.

4. Click on Scan.

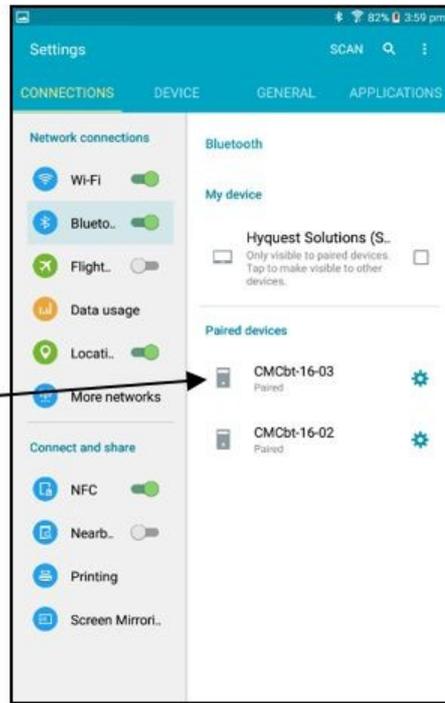
5. Select the device you wish to pair.



6. Enter the device PIN 1234 and click OK.



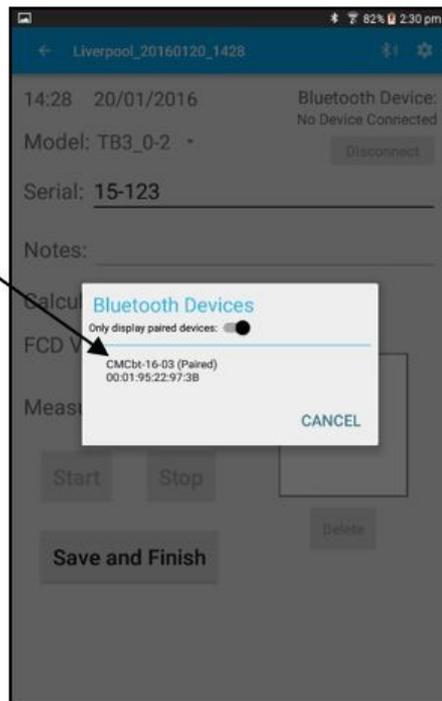
7. The new device will appear in the "Paired" list.



Now that the desired device is "paired" with the Tablet or Phone, the FCD\_App will bring up a list of devices if it requires a Bluetooth connection - be patient, sometimes this may take 30 secs or more depending on your device - select one to make the connection.

Select the CMC Bluetooth device.

The blue Discovery LED on the device should stop flashing, and turn on steady.



Press here to return to previous dialog.

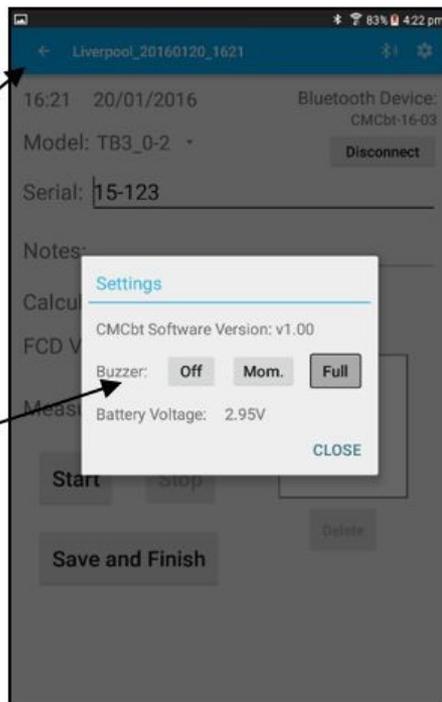
Select the CMCbt Settings (see dialog below)

Bluetooth device we are connected to (CMCbt-16-03)



Press here to return to previous dialog.

CMCbt Settings in the device we are connected to.

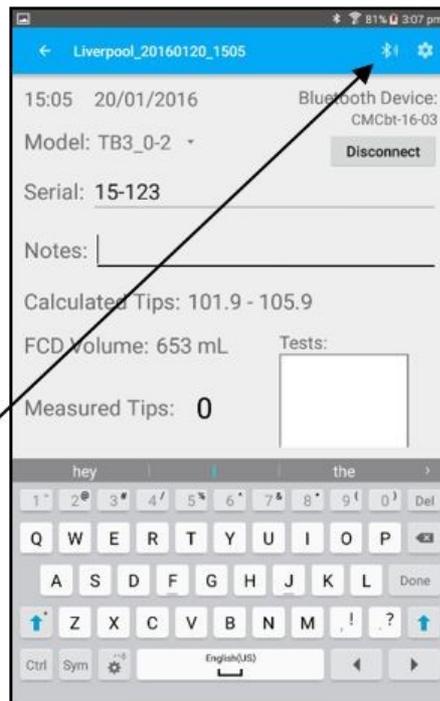


Setting the Buzzer to "Full" is preferable.

## Bluetooth Connection Lost or no Devices Found

If the Bluetooth connection is lost during normal operation, the FCD\_App will pop up a dialog and attempt to reconnect to the same device automatically.

If you cancel this cycle, you must press the Bluetooth icon to restart Bluetooth discovery.



### \*\*\* NOTE \*\*\*

If Bluetooth devices are not found after say one minute, either power cycling the Tablet, or turning off then on the Bluetooth in the Tablet Settings menu may help.  
Make sure the CMC Bluetooth device is on and the blue discovery LED is flashing.

## 2.2 TBRG Setup

After opening the FCD\_App  you can configure it with many Tipping Bucket Rain Gauge settings, so they can be selected when a Field Station is created. Create a name to easily identify the Rain Gauge.



Press here to return to previous dialog.

A list of existing TBRG's will be displayed.

Touch and hold a TBRG in the list and the "Delete" option will appear.

Press the '+' to add a new TBRG to the list.

The Volume of the Field Calibration Device (FCD) is entered here.

The screenshot shows a mobile application interface titled "TBRG Setup". At the top left is a back arrow and the title. At the top right is a plus sign. Below the title is a list of TBRG items: TB3\_0-01in, TB3\_0-2, TB3\_0-5, and TB4\_0-2. A "Delete" button is visible over the TB3\_0-5 item. At the bottom of the screen, there is a field labeled "FCD Volume: 653 mL".

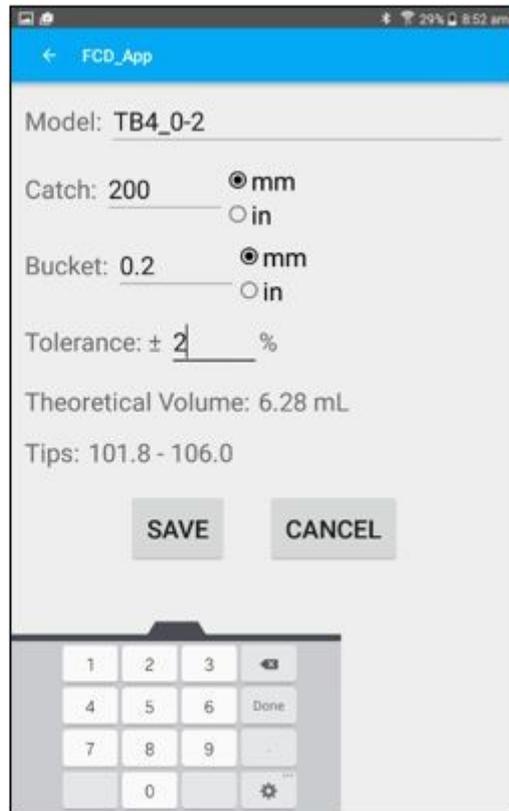
When + is pressed, a blank TBRG config appears. (Enter the model without using decimal points as this becomes the filename.)

The screenshot shows a mobile application interface titled "FCD\_App". It contains several input fields and radio buttons: "Model:" with a text input field; "Catch:" with a text input field and radio buttons for "mm" (selected) and "in"; "Bucket:" with a text input field and radio buttons for "mm" (selected) and "in"; "Tolerance: ± \_\_\_\_ %"; "Theoretical Volume:"; and "Tips: N/A". At the bottom are "SAVE" and "CANCEL" buttons.

Information can be entered as metric (mm) or imperial (inches).

The theoretical volume of the bucket is calculated in mL.

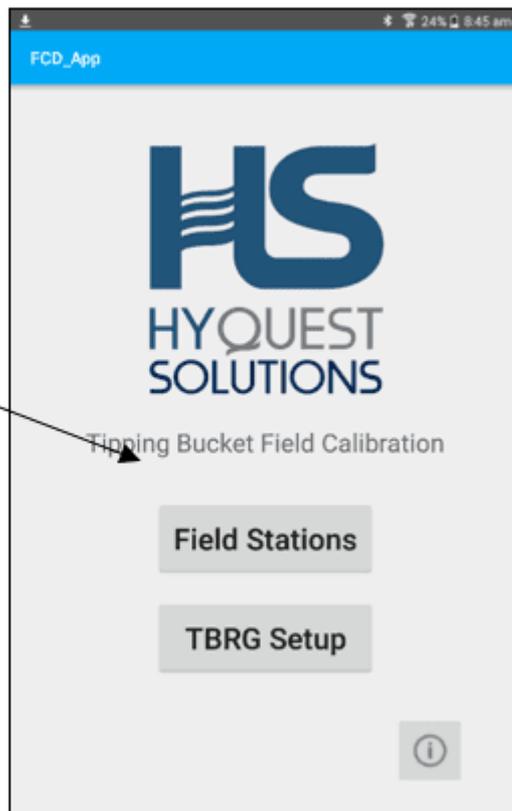
The TBRG tolerance determines the acceptable Tip range.



### 2.3 Field Stations

The Field Stations menu allows you to View the list of stations and then Edit, Delete or Add a Field Station. You can also step further to perform a TBRG Field Calibration, or View or Delete an historical calibration.

Press “Field Stations” from the main menu.



Press here to return to previous dialog.

List of Field Stations.

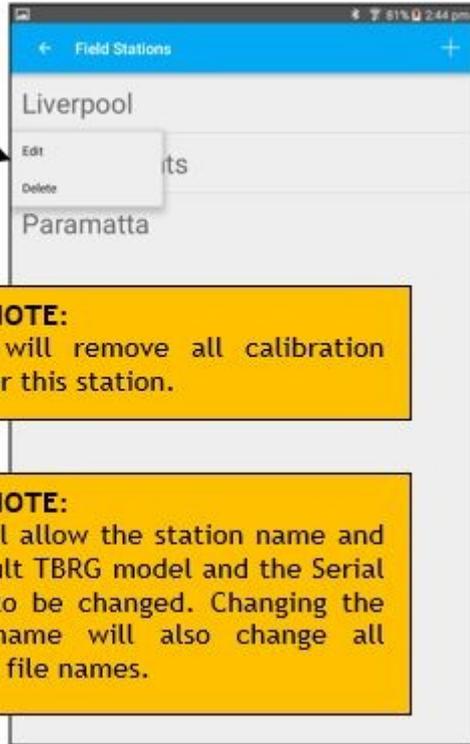
Press on a field Station to view the historical data.

Press '+' to create a new Field Station.

When Adding a Field Station, enter the station name, select the TBRG Model from the list of previously entered models and its serial number.

The customer can decide how to name the field stations - by name or by number or a combination of both.

Press and hold on a Field Station to make the Edit and Delete options appear.



**\*\* NOTE \*\*:** The default TBRG model and serial number entered when creating a Field Station, will automatically appear when a Calibration at that field station is performed.

**Note:** It is up to the customer to create Field Station Names that reflect the exact location of the station. Some organisations use an ID number to identify the station, some use the name descriptor and some use a combination of both.

For example:

Field Station Name = Liverpool or

Field Station Name = Liverpool\_West or

Field Station Name = Liverpool\_12345 or

Field Station Name = 12345

For example:

Field Station	FCD history = Field Station Name + Date + Time
Liverpool	Liverpool_20150517_1115 Liverpool_20150803_0912 Liverpool_20151219_1402 Liverpool_20160215_0845
LuasHeights	LucasHeights_20150417_1204 LucasHeights_20150603_1033 LucasHeights_20150928_0949

Field Station	FCD history = Field Station Name + Date + Time
Paramatta	Paramatta_20150515_1003 Paramatta_20150730_0755 Paramatta_20151127_1139 Paramatta_20160117_1332

### 3 Operation

This chapter contains the following subsection:

- [Opening the FCD\\_App](#) <sup>17</sup>
- [Viewing Field Calibration History](#) <sup>19</sup>
- [Performing a TBRG Field Calibration](#) <sup>20</sup>
- [Retrieving the Calibration Data](#) <sup>21</sup>

#### 3.1 Opening the FCD\_App

Once the Tablet or Phone is awake, the FCD\_App is started by pressing the FCD\_App icon in the Home screen. The application operates in Portrait mode. Most screens have been created using black text on a white background, with a large text size to make it more easily readable when in the field.



1. Press the Home button to Wake Up the Tablet or Phone.

2. Swipe the screen to open the home screen.



3. Press the FCD\_App Icon to start the Application.

Press to show other Apps available on the Tablet.



Recents Button

Home Button

Back Button

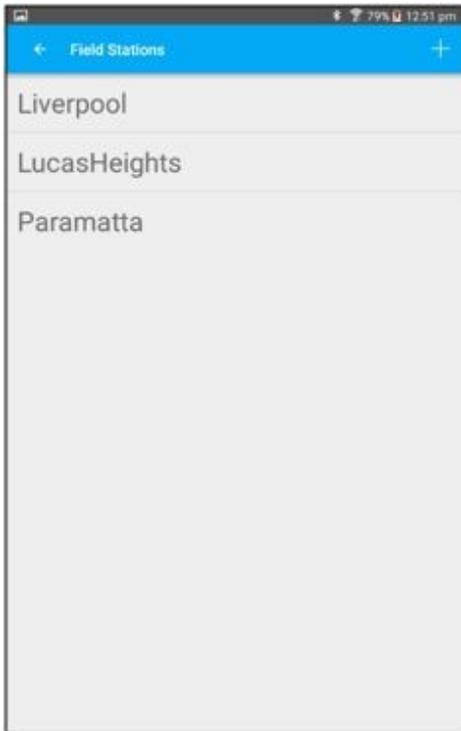
### Basic Tablet Functions.

To close an App on a Tablet, press the **RECENTS** button, and the active Apps are displayed – swipe the App upwards and it will be closed.

To change to another active App, press the **RECENTS** button and click on another active App.

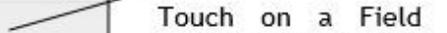
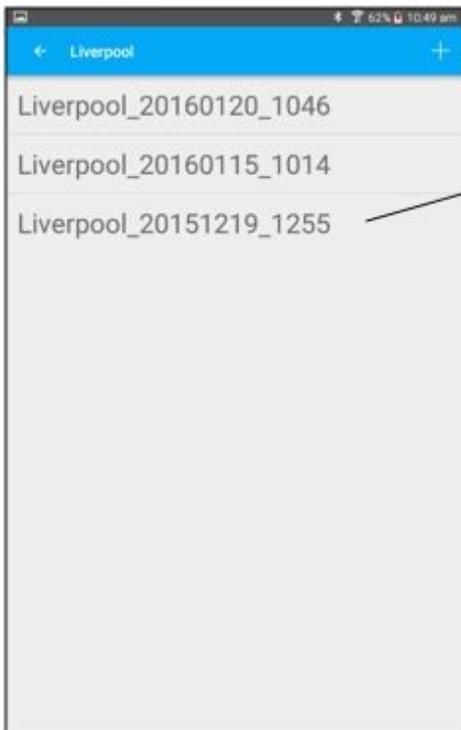
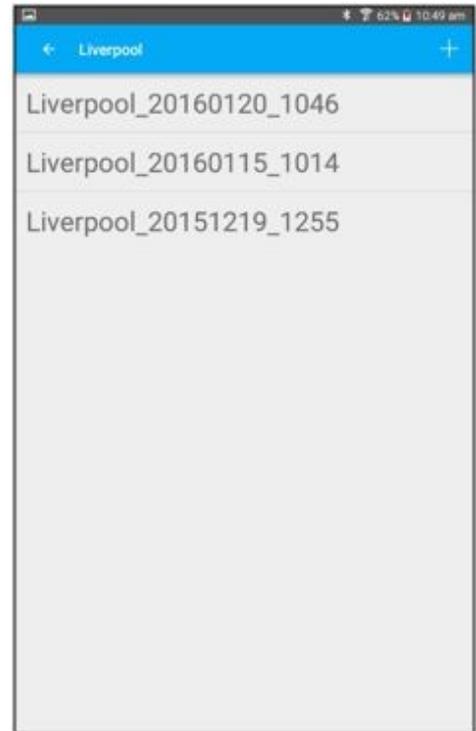
To change to another App that is not active, press the **HOME** button, and select the App you wish to open.

### 3.2 Viewing Field Calibration History



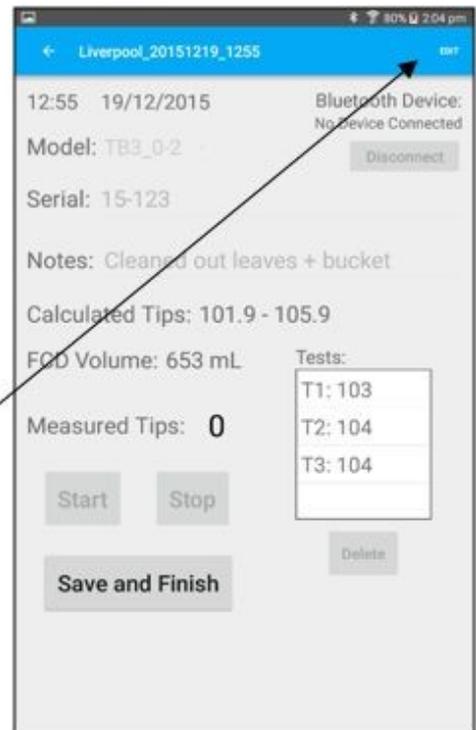
Touch on a Field Station name to view the calibration history of that Field Station.

The filename is made up from the station name, the year month day hour and minute, to create a unique name whose alphabetical order is also the date order.



Touch on a Field Station calibration history item to view the data collected at that time.

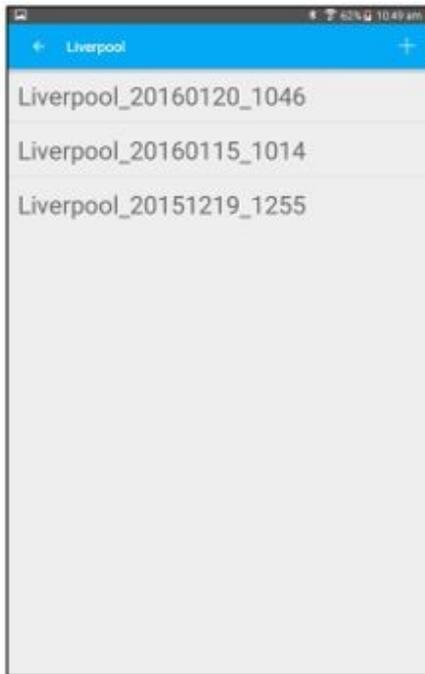
The historical data is locked, but can be edited if "Edit" is pressed.



### 3.3 Performing a TBRG Field Calibration

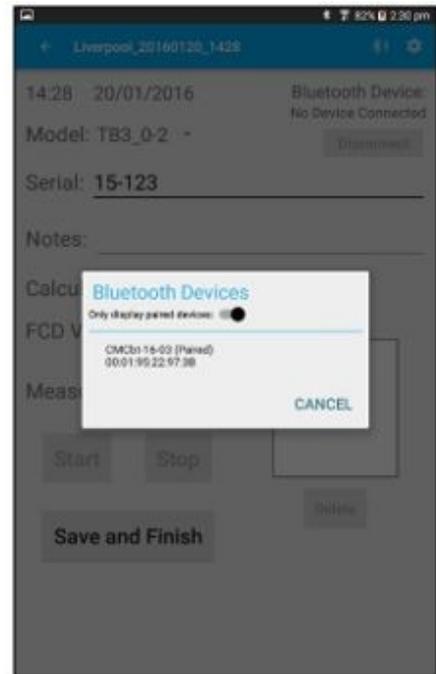
Connect the CMCbt to the TBRG reed switch contacts, switch it on and refit the TBRG cover.

A Field Calibration Device (FCD) is also required to dispense the exact amount of water through the TBRG.

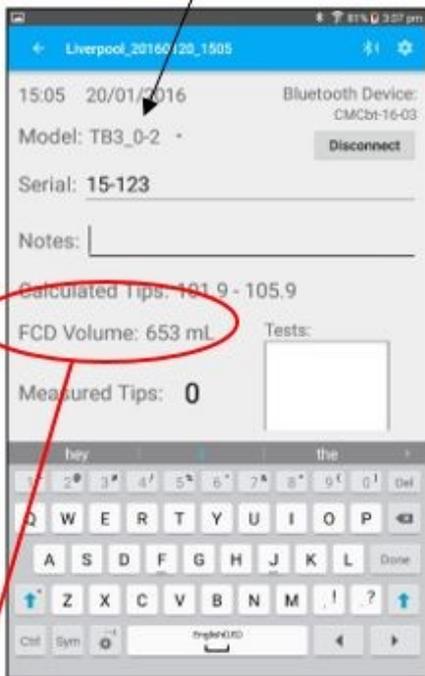


Touch on the '+' to create a new TBRG field calibration at this Field Station.

The FCD\_App will try and connect to the CMCbt bluetooth device and so the Bluetooth Devices dialog will appear - select the appropriate device from the list.



Default TBRG Model and serial number are automatically entered, but can be changed.



**NOTE:**  
If the TBRG Model and Serial No are changed, they now become the new default for the site.

Enter any useful comments pertinent to this calibration.

Bluetooth device we are connected to.



**NOTE:**  
Ensure the FCD Volume matches the FCD you are using!! This is changed on the TBRG Setup dialog. (Section 3.1)

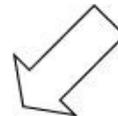
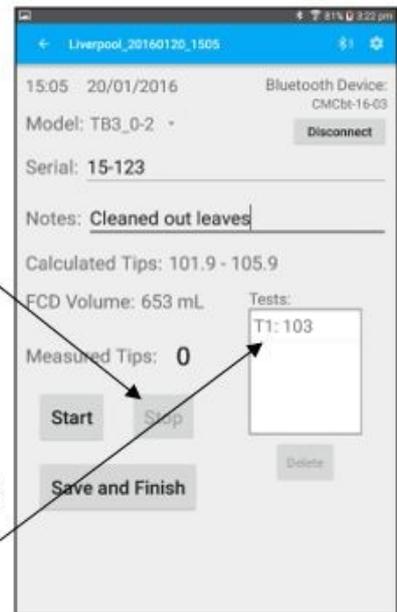
1. Press Start to commence the calibration.

2. Dispense the water through the TBRG.

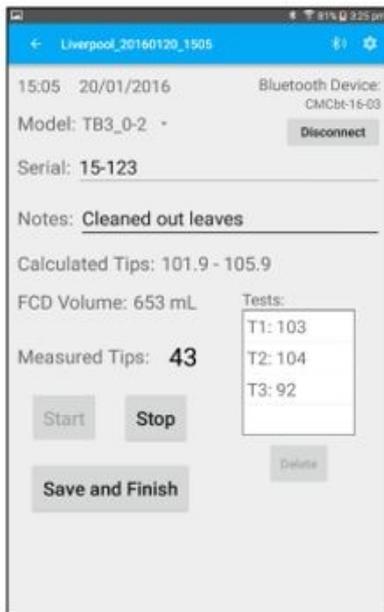


3. Press Stop when the water has dispensed and the bucket tipping stops.

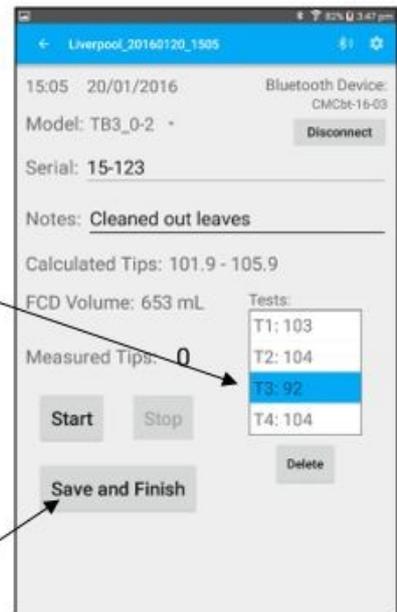
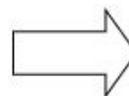
4. The bucket tips will be transferred into the test log.



Repeat the above procedure if more tests are required.



If a test gives an irregular result for a known reason, it may be deleted by selecting it and pressing Delete.



Press "Save and Finish" to save the test results.

### 3.4 Retrieving the Calibration Data

To retrieve the calibration data collected in the field, you can either :

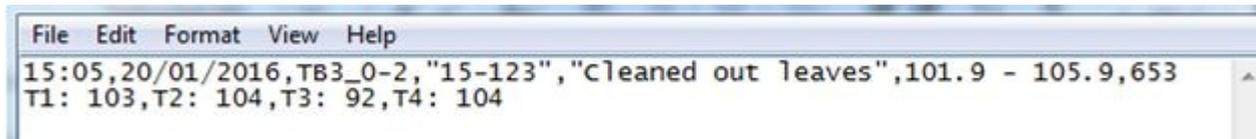
- Step through the Field Station History and write down the TBRG tips for each field calibration.
- Plug the tablet or phone into your PC using a USB lead. Once the drivers have been installed, the tablet or phone will appear as a device on your PC. Using Windows Explorer on your PC, navigate to the "FCD\_App\Sites" folder, select the appropriate Field Station folder (eg. "Liverpool") and then copy the required files. (Data files (.csv) can be opened in Notepad or Excel)

If the file is opened using Excel, it will look like :

	A	B	C	D	E	F	G
1	15:05	20/01/2016	TB3_0-2	15-123	Cleaned out leaves	101.9 - 105.9	653
2	T1: 103	T2: 104	T3: 92	T4: 104			
3							

It is obvious that the data from the calibration screen is transferred directly into the Excel fields with Time, Date, TBRC Model, Serial No, Comment, Tip Range, FCD Volume, and then the tests performed on the second line.

If the file is opened using Notepad, it will look like:



```
File Edit Format View Help
15:05,20/01/2016,TB3_0-2,"15-123","Cleaned out leaves",101.9 - 105.9,653
T1: 103,T2: 104,T3: 92,T4: 104
```

Again the data is in the same order described above, but separated using commas.

## 4 Troubleshooting

Please have a look through this list to solve possible problems before contacting the factory.

### No Bluetooth devices appear when trying to “Discover” them?

- The new Android Operating System has security features that prevent Bluetooth from operating unless you allow “Location” services. This is checked automatically in FCD\_App v1.00.11 or greater. Otherwise you can “allow” them by going to **SETTINGS > APPS > FCD\_APP > PERMISSIONS**.

### The date and time on the tablet isn’t correct!

- Go into the tablet settings, and select the **GENERAL** tab, and then touch the **DATE AND TIME** selection. If the **AUTOMATIC DATE AND TIME** option is ticked, then you must be connected to a WiFi network for the date and time to be updated. (After disconnecting from WiFi, the date and time stay correct!)
- If you un-tick the **AUTOMATIC DATE AND TIME** option, then you can enter the date and time manually in the fields that appear.

### The CMCbt Counter doesn’t appear on the list of Bluetooth devices?

- Wait about 1 minute to make sure, sometimes the Bluetooth discovery takes a while for the device to appear, and sometimes it appears instantly!
- Very occasionally the Bluetooth connection between the CMCbt and the Tablet gets confused. Turn off the CMCbt, and power down the tablet – then turn them both on again and retry.

### There are so many Bluetooth devices, which one is mine?

- The Bluetooth name that appears should match the HyQuest Solutions counter model and serial number (eg. CMCbt-16-01).
- If the Bluetooth device has been previously paired with your tablet, slide the **ONLY DISPLAY PAIRED DEVICES** selection to the **ON** position to reduce the list of devices.

### The App asked me to pair the Bluetooth device – what device PIN do I use?

- Use the PIN 1234 and press **DONE**.
- The newer CMCbt does not ask for a PIN, it just connects.

### When I try to install the FCDApp on my device it wont install?

- Make sure you “Enable 3rd Party Apps” in the security section of the settings in your device. It is difficult to give the exact location of where this option is located, as most Android devices have quite different settings arrangement. (This is usually disabled by default in most devices as a security measure.)

### How do I return from the tablet Bluetooth Settings to the FCD\_App?

- Press the **RETURN** key beneath the tablet screen.



- **Note** that different Android devices may have a different way to return.

### The FCDApp opens OK, but there are no default TBRGs when I press the TBRG Setup button?

- You need to “Enable the FCDApp Access to Storage”. This may be disabled automatically by your device after the App is installed. Go to the Settings of your device – and navigate to the Security section – find the FCDApp in your list of Apps – and then “Enable Access to Storage”.

### When I try to add a TBRG to the list of TBRG’s by pressing the ‘+’ button, it just takes me back to the main display?

- You need to “Enable the FCDApp Access to Storage”. This may be disabled automatically by your device after the App is installed. Go to the settings of your device – and navigate to the Security section – find the FCDApp in your list of Apps – and then “Enable Access to Storage”.

### **I just created a new Field Station, and when I click on it the screen is blank!**

- You haven't done any field calibrations yet, so there are none to be displayed in the list. Click on the '+' in to top right corner to start a TBRG field calibration.

### **The TBRG tips into the CMCbt Counter do not seem to be recognised?**

- Maybe the counter buzzer is turned off - go into the FCD\_App settings (See the end of section [Bluetooth Device Connection](#)) and press the Buzzer **FULL** button.
- Check the TBRG is actually tipping and is not jammed.
- To check the counter operation - remove the banana plugs from the counter, and using a piece of wire, or metal paper clip, short the red and black banana plug sockets on the counter and check the pulses can be recognised.
- Check the TBRG cable - plug the TBRG cable into the counter and remove the connection from the TBRG screw terminals - short the bare wire end connections and check the pulses can be recognised.
- Check the TBRG reed switch contacts - using a multimeter in "continuity mode", touch the probes onto the TBRG screw terminals, while tipping the bucket - the multimeter should "beep".

### **I just created a new Field Station, and when I click on it the screen is blank!**

- You haven't done any field calibrations yet, so there are none to be displayed in the list. Click on the + in to top right corner to start a TBRG field calibration.

### **The screen goes dim while I am using it?**

- This is a tablet or phone setting - to change it, go to the tablet or phone "Settings" (on the tablet or phone Home screen), select Device, Display, screen Brightness and turn "off" automatic brightness, then set the brightness level you desire.

### **When I'm not using the screen, it times out and turns off?**

- This is a tablet or phone setting - to change it, go to the tablet or phone "Settings" (on the tablet or phone Home screen), select Device, Display, screen Timeout, and select the desired timeout from the options available.

### **When I select another language, the FCD\_App stays in English!**

- The FCD\_App has been written in English only. Other translations may be available in the future. Any language selected on the tablet or phone that is not available in the App, will cause the App to operate in English.

## 5 Appendices

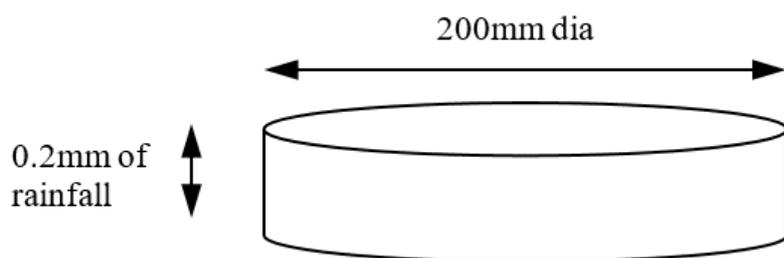
This chapter contains the following subsection:

- [Theoretical Bucket Volume Calculations](#) <sup>[25]</sup>
- [Warranty](#) <sup>[25]</sup>

### 5.1 Theoretical Bucket Volume Calculations

A Tipping Bucket Rain Gauge (TBRG) is usually defined by the smallest amount of rainfall it can measure. For example a 0.2mm TBRG can measure rainfall in 0.2mm increments.

The “catch” is TBRG collection area. A 200mm catch is the diameter of the TBRG - and so the volume of water to cause the bucket to tip is calculated as follows :



1 mL of water = 1 cm<sup>3</sup> (so convert dimensions to cm)

$$\begin{aligned}
 \text{Volume} &= \pi \times (\text{Radius})^2 \times \text{depth} \\
 &= \pi \times (\text{Diameter}/2)^2 \times \text{depth} \\
 &= 3.1416 \times (20\text{cm}/2)^2 \times 0.02\text{cm} \\
 &= 6.28 \text{ mL}
 \end{aligned}$$

So the theoretical volume of the bucket to measure 0.2mm of rainfall in a 200mm dia TBRG catch is 6.28mL

### 5.2 Warranty

The FCD\_App can be loaded onto any Android tablet or phone meeting the minimum system requirements. New versions will be made available from time to time to fix bugs or add features.

There is no warranty on this product as it is free. HyQuest Solutions will endeavour to fix any reported bugs in a timely manner.

# Contact Data

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