pfodApp™ V3.0.414+ for Android™ V4.4+

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12th October 2022

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Revision History

V1.0 – First Release - 12th August 2012

V2.0 – Revised Connection Instructions - 13th April 2013

V3.0 – Added WiFi and security - 10th August 2013

V4.0 – Added note about native language display.

V5.0 – Added plotting. - 18th November 2013

V6.0 – Added Single Click connection – 19th March 2014

V6.1 – Added note about plots – 15th May 2014

V6.2 – Added note about raw data file – 13th June 2014

V6.3 – Added Unicode escape sequence for String Input screens – 24th June 2014

V6.4 – Added note about WiFi file transfer – 7th July 2014

V6.5 – Added Toggle Button – 20th August 2014

V6.6 – Added SMS Connections – 30th December 2014

V6.7 – Revise screen shots for new toolbar – 17th March 2015

V6.8 – Removed password option for Bluetooth connections – 29th April 2015

V6.9 – Added QR scanning for passwords – 9th June 2015

V6.10 – Minor text corrections. – 4th August 2015

V6.11 – Added Sound Selection,
removed confirm selections from Bluetooth and WiFi Connections – 8th August 2015

V6.12 – Added BLE (Bluetooth Low Energy) support – 26th January 2016

V6.13 – Added notes about local and non-local IP addresses

V6.14 – Added clearing menu and image caches

V6.15 – Revised new connection screen shots

V6.16 – Added note about plot freeze

V6.17 – Remove “Clear Image Cache” button

V6.18 – Added IPs in the range “172.16.x.x” to 172.31.x.x” as private network IPs – 12th July 2017

V6.19 – Minimum Android version supported is now V4.0 – 18th February 2018

V6.20 – Added details on Permission usage. – 7th June 2018

V6.21 – Added note on SMS menu refresh. – 10th August 2018

V6.22 – Added keepAlives to BLE, Bluetooth and SMS. – 23rd August 2018

V6.23 – Added note about turning Location ON for Android V6.0+ – 2th November 2018

V6.24 – Added {@} setting – 17th April 2018

V6.25 – SMS {@} default false for new connections – 22nd April 2019

V6.26 – Added Log Save / Delete buttons to work with Android 10 and greater – 22nd March 2022

V6.27 – Added notes on Location permissions to the App Permissions section – 12th October 2022

Introduction

Note: See Permissions for why pfodApp still asks for Location permissions it does not actually need.

This document describes how to use the pfodApp™ for Android™ V4.0 and above. pfodApp can connect to pfodDevices via either bluetooth or WiFi/internet or SMS. For each connection you can specify 128bit security to protect against hackers taking control of your pfodDevice, if the pfodDevice supports it.

pfodApp is a universal micro-browser that connects to pfodDevices and requests micro-pages. All the programming/customisation takes place in the pfodDevice. The pfodApp just displays the micro-pages returned by the pfodDevice and sends back the commands the pfodDevice has linked to the menu buttons and input pages.

pfodApp allows you to control any pfodDevice™. pfodApps and pfodDevices communicate using pfod (Protocol For Operations Discovery). See www.pfod.com.au for the complete pfod Specification.

To get started programming pfodDevices using Arduino, download the free pfodDesigner app which will let you design custom menus and then generate the Arduino code for you.

Many more detailed example hardware projects are also available at www.pfod.com.au

Arduino libraries to support 128bit security and SMS connections are available from www.pfod.com.au

The free pfodDesigner code generator app.

pfodApp expects to connect to a device that follows the pfod Specification. The free pfodDesigner app lets you design menus on your Android mobile and then generate the Arduino code (or C code) that can be loaded into your microprocessor to serve that menu to pfodApp and let you control your device and log and plot data from it.

pfodGUIdesigner and code generator

There is now a GUI designer for pfodApp that lets you draw Graphical User Interface components for pfodApp and add touchZones and touchAction via a WYSIWYG (what you see is what you get) interface on pfodApp. You can then generate the Arduino class files for the component and position and scale it in your final interface.

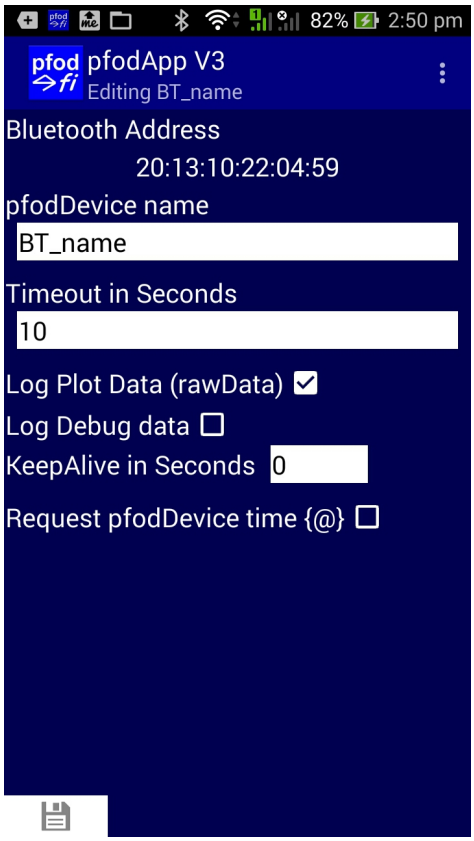
SMS Version of pfodApp

In March, 2019, Google Play started removing apps that included SMS permissions. Apps can apply for exemptions, but Google Play rarely grants them. Although pfodApp provides a legitimate use of SMS for connecting to pfodDevices over 2G/3G SMS networks, Google Play refused to host pfodApp with SMS capabilities.

pfodApp still supports SMS, but the version available from Google Play has it disabled. If you want to control your devices via SMS, or you want to update your existing pfodApp to the latest version, but including SMS support, then install pfodApp from Google Play and then contact pfod.com.au via support email to obtain pfodApp with SMS support.

Help pfodApp has stopped working when I changed phones / recreated the connection

When you change phones and re-install pfodApp on your new phone, you will need to re-create the connection to your pfodDevice. If you find pfodApp is now just repeatedly re-connecting then open the new connection you have just created and
un-tick the "**Request pfodDevice time {@}**" option AND
set the "**KeepAlive in Seconds**" to 0
as shown below



The pfodApp connection will now operate as it did in your old version.

By default, new connections on the latest versions of pfodApp, send a 'Current' time request, **{@}** on connection AND send KeepAlive cmds, **{ }**, every 5sec when idle.

The pfodSpecificiation says ALL un-recognized commands must be responded to to prevent the connection timing out. The pfodDesigner generate code that sends back an empty response, {}, for all un-recognized commands.

However some pfodDevices are coded to only handle their expected commands and just ignore all others, not sending any response.

These pfodDevices will timeout about 10 secs after connection and start re-connecting, without displaying the main menu, due to pfodApp sending the {@} command to enable Date/Time plots and the pfodDevice not responding to it.

To fix this, open the Connections screen and select Add/Edit and open your new connection. Then un-tick the "**Request pfodDevice time {@}**" option.

You will then be able to connect and display the main menu, however after about 15sec of doing nothing the pfodApp will disconnect and start re-connecting again. This is due pfodApp sending a KeepAlive message after 5 secs on idle to see if the pfodDevice is still in range.

To fix this, open the Connections screen and select Add/Edit and open your new connection. Then set the "**KeepAlive in Seconds**" to 0 to disable KeepAlive messages.

pfodApp Requirements

This pfodApp requires an Android device with WiFi running Android V4.4 (Api level 19) or higher.

Not all Android devices support Bluetooth, BLE (Bluetooth Low Energy) and SMS connections.

To make bluetooth connections your Android device needs to support Bluetooth V2.1 or above.
To make SMS connections your Android device needs to have a SIM card installed.
To make BLE connections your Android device needs to support Bluetooth V4 or above.

The 

button will only be displayed if your device supports BLE
NOTE: On Android V6.0+ you need to have Location turned on in your phone's settings in order to scan for new BLE devices.

This version of pfodApp, V3.0.391, has been tested on a Nexus 6P running Android 8.1.0, an Asus Zenfone 5 (ASUS_TOOJ) running Android V4.4.2 and Nokia One (TA-1079) running Android Go 8.1.0

The pfodApp is available the Android app market places:-

(https://play.google.com/store/apps/details?id=au.com.forward.pfodApp)
To download from the Google Play Android market place, your mobile needs to have Google Play pre-installed.

An Internet connection is needed to download pfodApp. After downloading, an intermittent Internet connection is needed for periodic licence checks. Due to licence caching, you do not normally need an internet connection to connect to the bluetooth or SMS pfodDevice you are controlling with pfodApp. However you will need an Internet connection the first time you try to connection to a new pfodDevice. See Licence Check on First Connection Attempt below for details.

App Permissions

pfodApp requires some permissions to run. If your mobile is running Android 6.0 or higher, you will be prompted to approve the permissions as needed. pfodApp V3.0.414+ no longer needs Storage permission to write its log files.

If your mobile has an earlier version of Android (<V6.0) installed then you will be prompted to accept all permissions when you install the pfodApp.

See section on Permissions for more details on which permissions are needed and why.

KeepAlive Commands

pfodApp V3.0.338+ adds support for sending KeepAlive commands for Bluetooth, BLE and SMS connections. WiFi connections already sent KeepAlives.

KeepAlive commands are { }, i.e. { space }. Space is never a valid command so the pfodDevice is expected to replay with just {}, and empty response.

NOTE: Every pfod command, { … }, sent to the pfodDevice MUST be responded to, even if the pfodDevice does not recognise it. The code generated by the free pfodDesigner app. Includes a catch all at the bottom of the command processing to send back an empty response, {}, if the command is not recognised.

```
uint8_t cmd = parser.parse(); // parse incoming data from connection
// parser returns non-zero when a pfod command is fully parsed
if (cmd != 0) { // have parsed a complete msg { to }
.....
  if ('.' == cmd) {
    // pfodApp has connected and sent {.} , it is asking for the main menu
    if (!parser.isRefresh()) {
      sendMainMenu(); // send back the menu designed
    } else {
      sendMainMenuUpdate(); // menu is cached just send update
    }
  // now handle commands for button/sliders
  .......

  } else if ('!' == cmd) {
    // CloseConnection command
    closeConnection(parser.getPfodAppStream());
  } else {
    // unknown command
    parser.print(F("{}")); // always send back a pfod response
    // otherwise pfodApp will disconnect.
  }
```

Your Arduino code for your pfodDevice must include this final **} else {** block to handle KeepAlive messages. If you use the free pfodDesigner app to generate your code it will be automatically included for you.

KeepAlives can be disabled in the edit connection screen by setting the KeepAlive time to 0.

'Current' time request

pfodApp V3.0.359+ added the 'Current' time request, **{@}**, immediately after the connection is made. The command give the pfodDevice the opportunity to let pfodApp know what the pfodDevice thinks the 'current' time is, either in milliseconds or date/time or both. The pfodApp can then log this information, for later processing by the user, as well using it to plot rawData against date and time.

As with the KeepAlive message above, if the pfodDevice does not support this command it should respond with an empty, **{}**, response.

'Current' time requests can be disabled in the edit connection screen by un-ticking the '**Request pfodDevice time {@}**' option.

Setting up a Bluetooth, BLE, WiFi / Internet or SMS Connection

This version of pfodApp supports Bluetooth, BLE WiFi/internet and SMS connections. The WiFi/internet and SMS connections can have a 128bit passkey specified to provide protection against hackers.

The following sections cover setting up these connections.

Setting up a Bluetooth Connection.

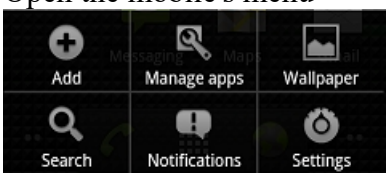
Pairing pfodDevices with your Android Mobile

Before you can connect to a pfodDevice via Bluetooth, you need to pair it with your Android Mobile as follows:-

i. Position yourself within arm's reach of the pfodDevice (some mobiles have very limited Bluetooth range)

ii. Turn off the pfodDevice.

iii. Open the mobile's menu

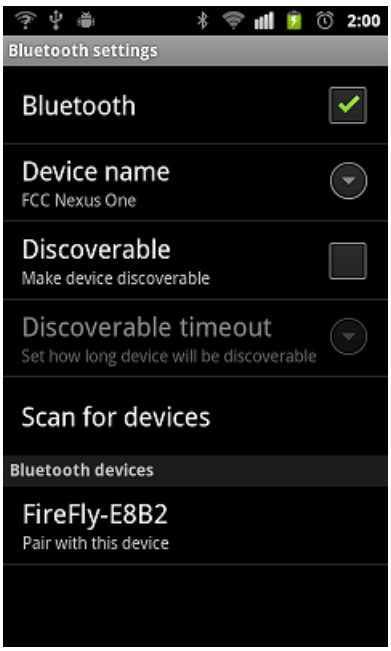


and choose Settings → Wireless & networks

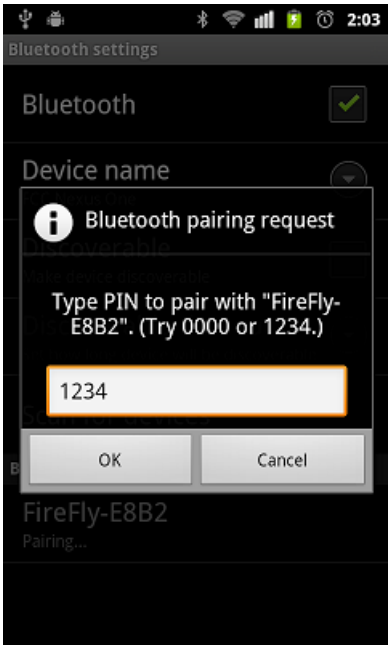
iv. Make sure Bluetooth is ticked (enabled)

v. Open the Bluetooth settings. Turn on the pfodDevice. Then select “Scan for devices”. Your pfodDevice may be set to only be Discoverable for a short time after it powers up, so turn it on just before you “Scan for devices”.

vi. Check the Bluetooth Address of your pfodDevice and match it to one of the devices your mobile has found. For example if the address ended in E8B2 it would match with the bluetooth device shown here



vii. Click the device to pair with it and enter the device's pairing code (refer to the documentation that came with the pfodDevice for the correct code).



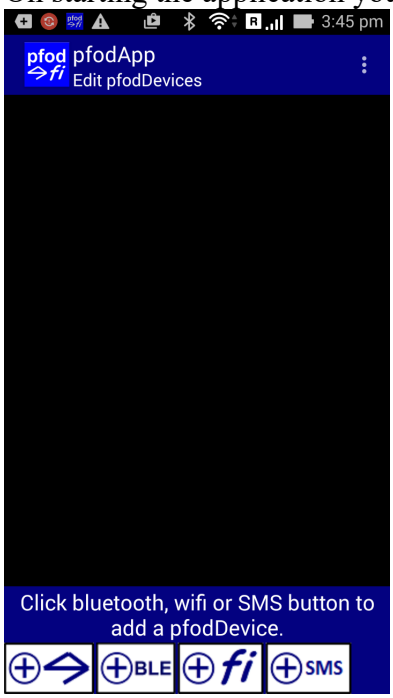
viii. Press OK to complete the pairing. The bluetooth is now “Paired, but not connected.

ix. Continue to the next section to start the pfodApp, assign a meaningful name to this pfodDevice and connect to it.

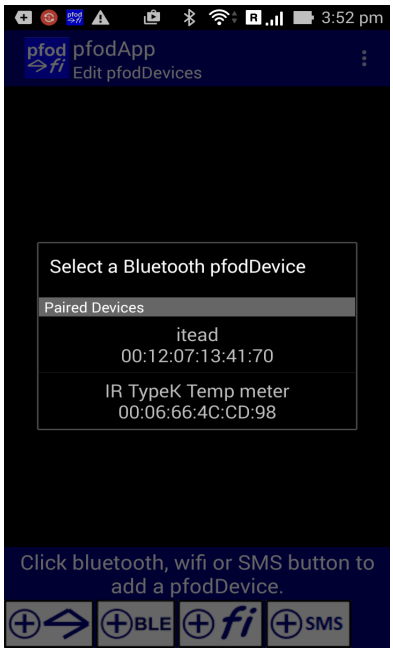
Adding a Bluetooth connection to pfodApp

Bluetooth connections are only possible if your mobile device supports it. After downloading the pfodApp to your phone, it will appear in the list of applications. From there you can drag it to the Home icon at the bottom of the screen to place it on one of your front pages.

On starting the application you will be presented with an initially empty connection screen.



Press the  button to add a Bluetooth pfodDevice.

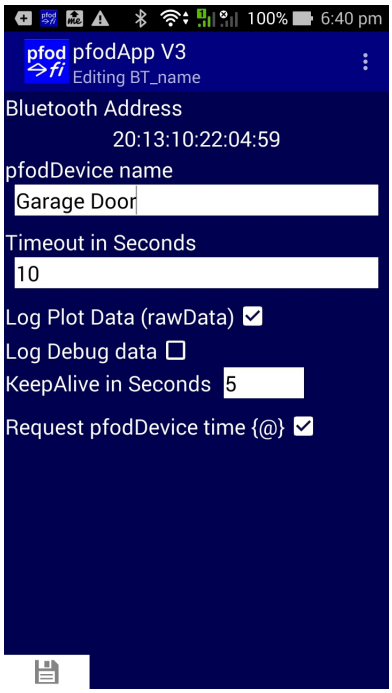


Choose the pfodDevice from the list of bluetooth devices that have been paired to this mobile. You can check the bluetooth address against the address of your pfodDevice.

Note: If you have disabled your mobile's Bluetooth or if your mobile does not support Bluetooth, pfodApp will not show any paired devices.

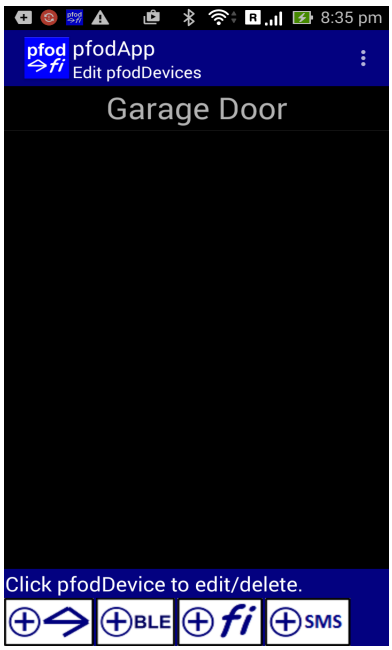
Note: Any Bluetooth devices that you have already set up a connection for, will not be shown.

Choosing a paired device opens the pfodDevice Edit screen on which you can assign a meaningful name to this pfodDevice and a time-out. The default time-out of 10sec is usually sufficient. Setting a time-out of 0 means that once the pfodApp has connected it will never disconnect waiting for the pfodDevice to respond.



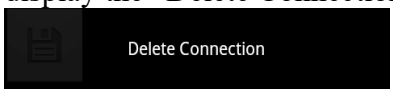
The default KeepAlive setting is 5sec. If there has been no command sent within this time since the last response was received, then pfodApp will send keepAlive cmd, { } (i.e. { space }). The pfodDevice should respond with {} since space is never a valid command.
You can set the KeepAlive setting to 0 to disable KeepAlive commands.
You can un-tick the **Request pfodDevice time {@}** to prevent sending the {@} command after connection.

Press the Save button  to save your changes.

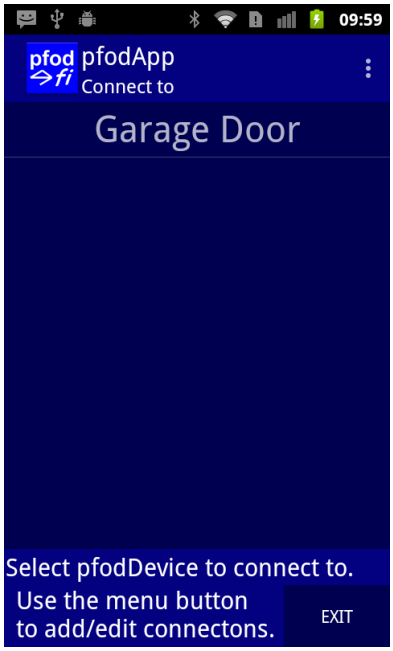


If you want to edit the name or time out settings, click the pfodDevice name.

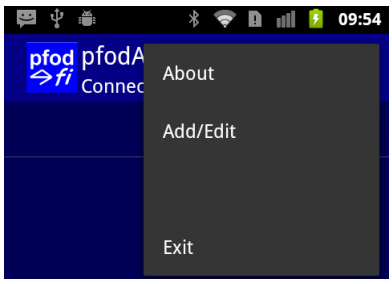
If you want to delete a connection, open it for editing and then click the app's menu button to display the “Delete Connection” option menu.



When you have finished editing your pfodDevice connection use your mobile's back button to go back to the “Connect to” screen



This displays a list of pfodDevice connections you have set up. You can now select this device to connect to.
You can get back to the Edit Connections screen using the Add/Edit button on app's menu.



See also, Single Click connection

See also, Licence Check on First Connection Attempt

Adding a BLE (Bluetooth Low Energy) connection to pfodApp

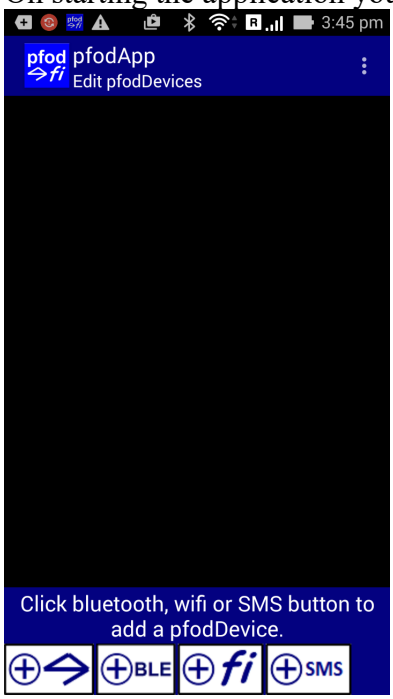
BLE connections are only possible if your mobile device supports it.

If you device does not support BLE then the 

will not be displayed.

PfodApp V1.2.101+ recognises the following BLE devices:- ***RedBear***, ***RFduino***, ***HM_10***, ***Adafruit's Bluefruit LE*** and boards using the ***Nordic UART*** service. The ***Arduino/Genuino 101*** board can be configured to use one of the services that pfodApp recognises.

On starting the application you will be presented with an initially empty connection screen.



Scanning for Bluetooth Low Energy devices

Press the 

button to add a BLE pfodDevice. That will start a scan of BLE devices near your mobile.

NOTE: On Android V6.0+ you need to have Location turned on in your phone's settings in order to scan for new BLE devices and you will also be prompted to allow pfodApp to access your Location. Once you have set up the BLE connection in pfodApp you can turn off the phone's Location setting and the Location permission for pfodApp.

The scan runs for about 30 secs to give you time to power up your device. If no extra BLE devices are found, pfodApp shows

Note: Any BLE devices that you have already setup a connection for, will not be shown.

Some devices like, RedBearLab shield, are more difficult to find, if your BLE device is powered up and is not found in 10 sec, try restarting the scan by either using the mobile's back button to stop the scan and then clicking on the 

button again, or you can use the mobile's home key to return to the home page and then select the pfodApp icon again. The scanning works better if there are only a few BLE devices active, so move away from other other BLE devices when setting up a new connection.

Tips for Connecting to BLE devices

If you have trouble connecting to your BLE device try these steps:-

i) Move closer to your BLE device, you may be out of range.

ii) Turn off all other Android devices. One of them may be holding the connection.

iii) Open Settings on your Android mobile and click on the Bluetooth option (make sure Bluetooth is turned on) and then “Search for Devices” OR “Pair new device”. NOTE: You don't want to pair a BLE device, just have you mobile find it. If you cannot see your device there, the you cannot connect, see points i) and ii) above. If the Bluetooth Setting finds your BLE device, go back to pfodApp and connect to it.

iv) Try turning Bluetooth OFF, restarting your mobile and then turn Bluetooth ON again. This clears out the mobiles bluetooth software.

v) Install Nordic's nRF UART V2.0 app from Google Play and see if it can connect.

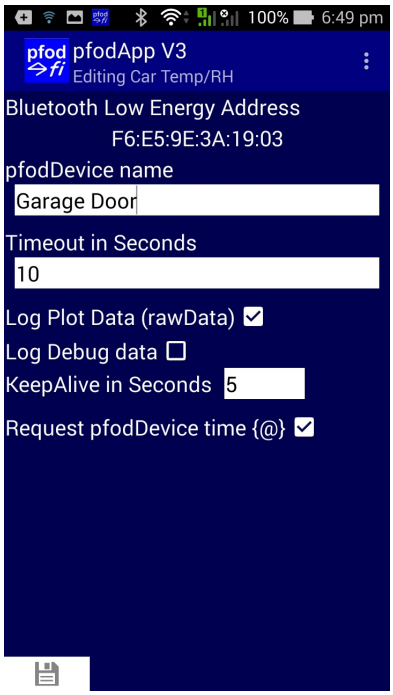
Choose the pfodDevice from the list of discovered BLE devices that have been found. You can check the address against the address of your pfodDevice.

Note: Any BLE devices that you have already setup a connection for, will not be shown.

Choosing one of the BLE devices, will start a connection to it and checks that it has a UART service

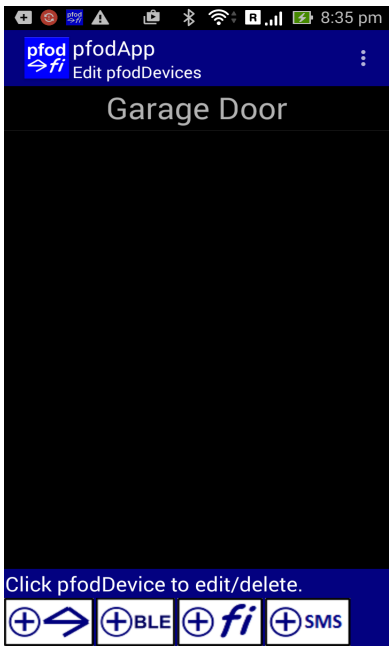
that pfodApp recognizes. Each BLE board manufacture defines its own service UUID and boards from new manufactures' may not be recognized until pfodApp is updated with their details.

If the BLE device has a UART service that pfodApp recognizes then pfodApp opens the pfodDevice Edit screen on which you can assign a meaningful name to this pfodDevice and a time-out. The default time-out of 10sec is usually sufficient. Setting a time-out of 0 means that once the pfodApp has connected it will never disconnect waiting for the pfodDevice to respond.



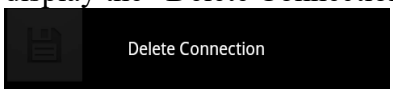
The default KeepAlive setting is 5sec. If there has been no command sent within this time since the last response was received, then pfodApp will send keepAlive cmd, { } (i.e. { space }). The pfodDevice should respond with {} since space is never a valid command.
You can set the KeepAlive setting to 0 to disable KeepAlive commands.
You can un-tick the **Request pfodDevice time {@}** to prevent sending the {@} command after connection.

Press the Save button  to save your changes.

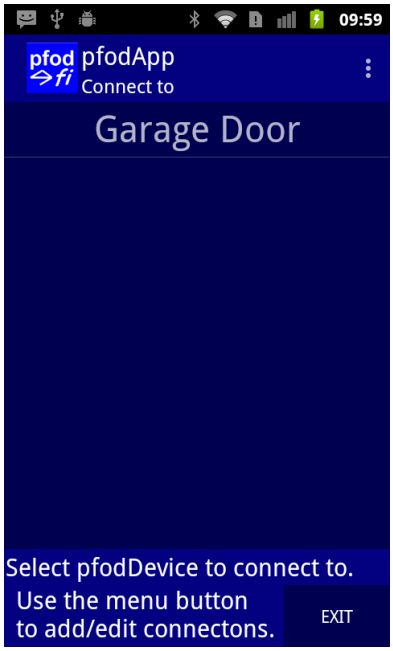


If you want to edit the name or time out settings, click the pfodDevice name.

If you want to delete a connection, open it for editing and then click the app's menu button to display the “Delete Connection” option menu.

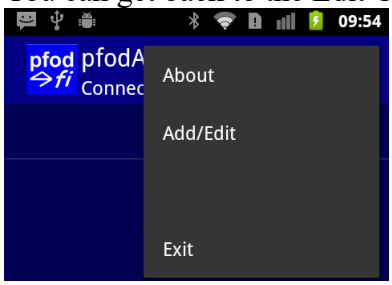


When you have finished editing your pfodDevice connection use your mobile's back button to go back to the “Connect to” screen.



This displays a list of pfodDevice connections you have set up. You can now select this device to connect to. Note: You don't need your phone's Location turned on, in order to connect to a BLE device. Location is only needed for scanning for new devices.

You can get back to the Edit Connections screen using the Add/Edit button on app's menu.



See also, Single Click connection

See also, Licence Check on First Connection Attempt

Setting up a Wi-Fi/Internet connection

Before starting to set-up a WiFi/internet connection you need to know the hostname or IP address of the pfodDevice and its port number. If your pfodDevice has a 128bit password you will need that as well. Usually the password will be attached to the device as a QR code for ease of entry.

This example will assume the pfodDevice's ip address is 10.1.1.100 and the port is 4989. In this case the pfodDevice is on the local network. For connection via the internet use the pfodDevice's internet address, either hostname or ip address.

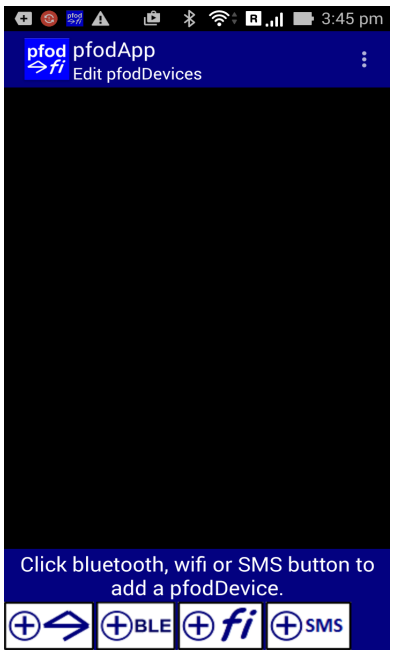
It will also be assumed that the pfodDevice has the following 128bit password, but generate your own using the SecretKeyGenerator

b0Ux9akSiwKkwCtcnjTnpWp

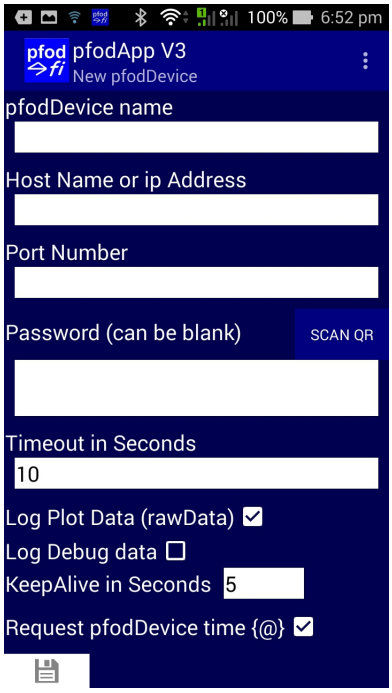
Adding a WiFi connection to pfodApp

After downloading the pfodApp to your phone, it will appear in the list of applications. From there you can drag it to the Home icon at the bottom of the screen to place it on one of your front pages.

On starting the application you will be presented with an initially empty connection screen. To setup the wifi connection, start pfodApp and select the + wifi button,



This will open the WiFi connection screen where you can enter the host and port number



You can also enter a name for this connection if you wish.

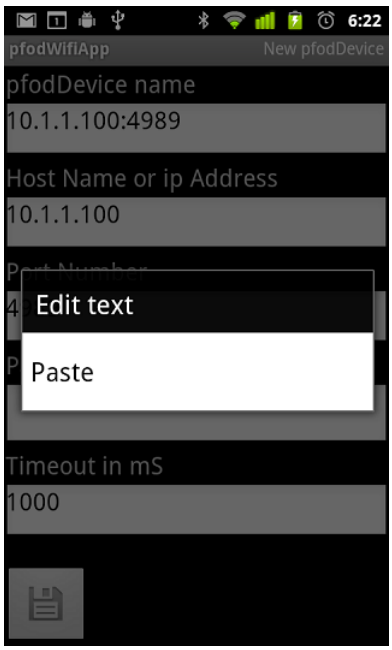
To add the password, your can either type it in by hand or click the Scan QR button to open a QR reader to read the QR code into the Password field.

The QR reader recognises two formats:-

i) Password on the first non-blank line scanned. You can generate this QR codes using the free SecretKeyGenerator program (http://www.forward.com.au/pfod/secureChallengeResponse/keyGenerator/index.html)

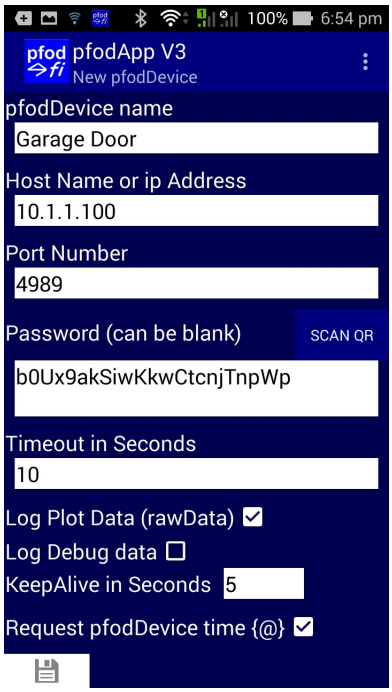
ii) A pfodWifiConfigV1 QR code, which contains pfodWifiConfigV1 on the first line and the password on the third line. You can generate this QR code using the free pfodQRpsk program (http://www.forward.com.au/pfod/pfodWifiConfig/pfodQRpsk.html)

If you use your own QR reader app, you will need to copy and paste into the password field into the connection screen, press and hold the password field and a Paste button will show.



Only the first line of text copied will be pasted into the password field.

Using the SCAN QR button is easier. It opens a scanning window for you to position over the QR code generated by SecretKeyGenerator. The password is then automatically copied to the password field.



The time out defaults to 10sec . This is the time allowed between the pfodApp sending a message and the pfodDevice responding. This default time out is usually sufficient. Setting a time-out of 0 means that once the pfodApp has connected it will never disconnect waiting for the pfodDevice to respond.

The default KeepAlive setting is 5sec. If there has been no command sent within this time since the

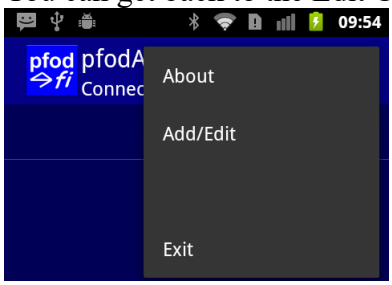
last response was received, then pfodApp will send keepAlive cmd, { } (i.e. { space }). The pfodDevice should respond with {} since space is never a valid command.
You can set the KeepAlive setting to 0 to disable KeepAlive commands, but for WiFi connections that is not recommended as the code generated by the free pfodDesigner app includes an idle timeout which closes the connection after 10sec if there are now commands received. This is to avoid the TCP 'half-open' connection problem.

You can un-tick the **Request pfodDevice time {@}** to prevent sending the {@} command after connection.

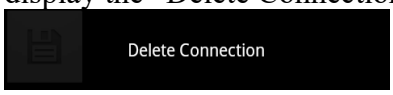
Press the Save button  to save your changes.

If you want to edit the connection, click the pfodDevice name.
Use your mobile's back button to close the “Edit Connections” screen and return to the “Connect to” screen.

This displays a list of pfodDevice connections you have set up. You can now select this device to connect to.
You can get back to the Edit Connections screen using the Add/Edit button on app's menu.



If you want to delete a connection, open it for editing and then click the app's menu button to display the “Delete Connection” option menu.



See also, Single Click connection

See also, Licence Check on First Connection Attempt

Local and non-local IP addresses

Your local WiFi network uses a range of local IP addresses, either starting with “10.” or starting with “192.168.” or in the range “172.16.x.x” to 172.31.x.x”

If you create a WiFi connection with one if these addresses then pfodApp will try can connect via your local WiFi network.

However if your connection has an internet address or any other non-local IP address. i.e. not

starting with “10.” or “192.168.” or in the range “172.16.x.x” to 172.31.x.x”, then pfodApp will assume it needs to connect over the internet and will use moble data on your phone, if available. If mobile data is not available or switched off, pfodApp will fall back to using its WiFi connection.

pfodApp operates in this way to provide seamless connections to your home devices that have configured to be available from the internet. For example to access your garage door control from the internet, you need to configure your internet router to map an incoming portNo to a the local IP and port of your garage door control. Then you create a pfodApp connection for the global IP of your router and the incoming port No.

This works well if you are away from home. pfodApp connects to the global IP and finds your router and then connects to the portNo and is mapped through to your garage door on its local IP:port.

However if you try to connect via your local WiFi network when you are at home, your router will block you as part of it's built it security. Your router will not let you connect from your phone on the home WiFi network out through your router and back in to your local network.

To avoid this issue, pfodApp automatically turns off its local WiFi connection when trying to connect to a non-local IP address, or any internet address, and uses the phone's Mobile Data connection instead. So it connects not to your router but to your phone's service provider and then via their network back to your router and to your garage door.

This allows seamless connections internet addresses whether you are at home or away.

How to uses a local WiFi connection when you are away from home.

If you are away from home, but connected to a local WiFi network, and you want to avoid using your mobile data. Then just turn your phone's Mobile Data off. As mentioned above if you turn off your phone's Moble Data, pfodApp will fall back to trying to connect via its local WiFi connection out through the internet and back to your home.

Setting up an SMS connection

For an SMS connection you need the phone number of the pfodDevice If your pfodDevice has a 128bit password you will need that as well. Usually the password will be attached to the device as a QR code for ease of entry.

This example will assume the pfodDevice's phone number is 041922.

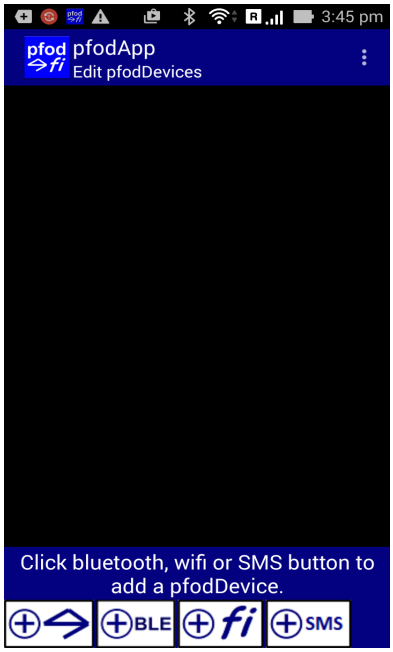
It will also be assumed that the pfodDevice has the following 128bit password, but generate your own using the SecretKeyGenerator

b0Ux9akSiwKkwCtcnjTnpWp

Adding an SMS connection to pfodApp

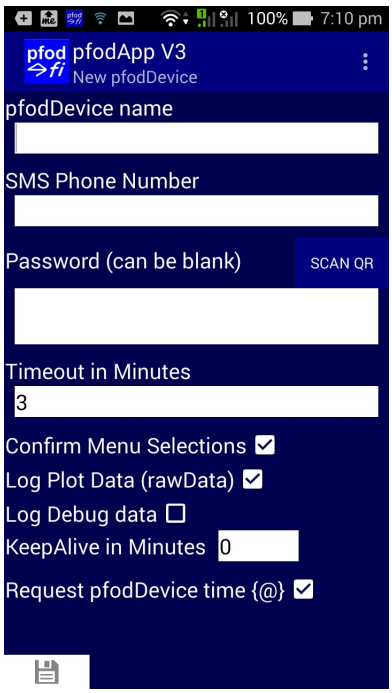
After downloading the pfodApp to your phone, it will appear in the list of applications. From there you can drag it to the Home icon at the bottom of the screen to place it on one of your front pages.

On starting the application you will be presented with an initially empty connection screen. To setup the WiFi connection, start pfodApp and select the + SMS button, 



This will open the SMS connection screen where you can enter the phone number.

You can also enter a name for this connection if you wish.



To add the password, click the Scan QR button and scan the QR code. It will be pasted into the password field.

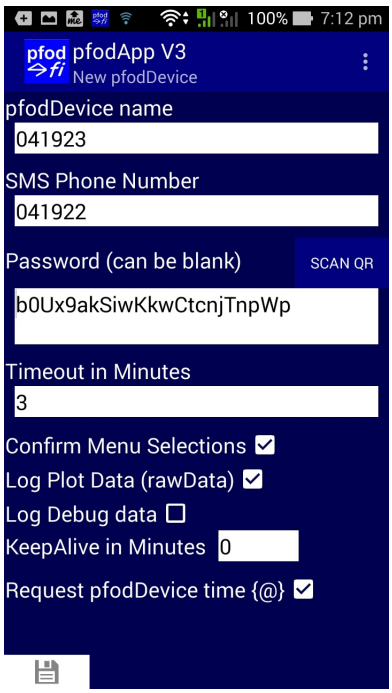
The QR reader recognises two formats:-

1. Password on the first non-blank line scanned. You can generate this QR codes using the free SecretKeyGenerator program (http://www.forward.com.au/pfod/secureChallengeResponse/keyGenerator/index.html)
2. A pfodWifiConfigV1 QR code, which contains pfodWifiConfigV1 on the first line and the password on the third line. You can generate this QR code using the free pfodQRpsk program (http://www.forward.com.au/pfod/pfodWifiConfig/pfodQRpsk.html)

If you use your own QR reader app, you will need to copy and paste into the password field into the connection screen, press and hold the password field and a Paste button will show.

Only the first line of text copied will be pasted into the password field.

Using the SCAN QR button is easier. It opens a scanning window for you to position over the QR code generated by SecretKeyGenerator. The password is then automatically copied to the password field.



If you want to copy and past the password into the password field, press and hold the password field and a Paste button will appear. Only the first line of text copied will be pasted into the password field.

The time-out defaults to 3mins . This is the time allowed between the pfodApp sending a message and the pfodDevice responding. If no response is received in this time then the pfodApp resends the SMS message. After 5 retries, the pfodApp notifies you the connection has been lost.

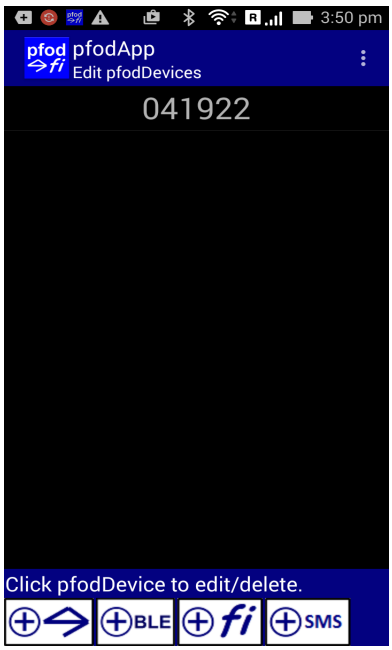
You can increase this time-out but you should NOT set this time-out to 0 as lost SMS messages are not uncommon.

For SMS connections the Confirm Menu Selections is ticked by default. You will be prompted to confirm each menu selection you make when you are connected to the pfodDevice before the SMS command is sent. ***NOTE: However if the pfodDevice menu, or image, specifies a re-request interval, you will NOT be prompted for each re-request.***

The default KeepAlive setting is 0mins. That is by default no KeepAlive cmds are sent for SMS connections. If you set a non-zero value here then if there has been no command sent within this time since the last response was received, then pfodApp will send keepAlive cmd, { }
(i.e. { space }). The pfodDevice should respond with {} since space is never a valid command.

The default for new SMS connections is to NOT send the {@} command after connection, due to the extra messages/time it adds to complete the connection and get the main menu.
You can tick the **Request pfodDevice time {@}** if you want to send the {@} command after connection, for date/time plots or data logging.

Press the Save button  to save your changes.

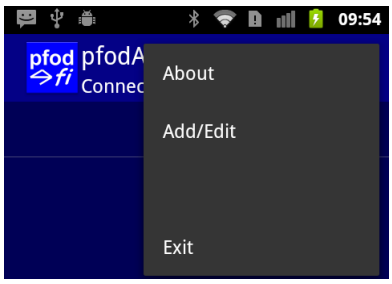


If you want to edit the connection, click the pfodDevice name.

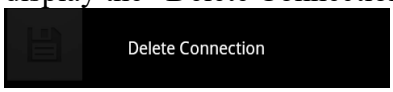
Use your mobile's back button to close the “Edit Connections” screen and return to the “Connect to” screen.

This displays a list of pfodDevice connections you have set up. You can now select this device to connect to.

You can get back to the Edit Connections screen using the Add/Edit button on app's menu.



If you want to delete a connection, open it for editing and then click the app's menu button to display the “Delete Connection” option menu.



See also, Single Click connection

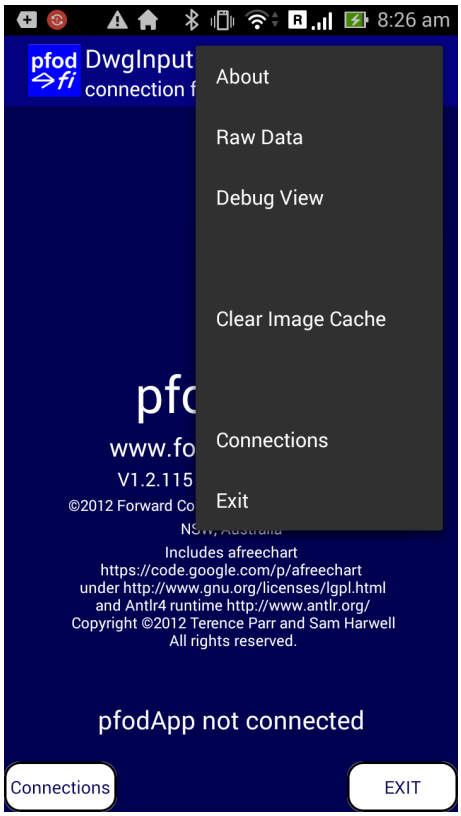
See also, Licence Check on First Connection Attempt

Connecting to a pfodDevice

Single Click connection

If you have setup just one pfodDevice connection, then when you start pfodApp it will automagically start connecting to that pfodDevice.

If you want to add another connection or edit the existing connection, start pfodApp and then just use the app's menu button to display the application's menu and then select “Connections”



If you only have one connection setup and want to edit it or setup another on but the pfodApp is closed immediately by the pfodDevice sending a CloseCommand or due to an incorrect password, then to prevent pfodApp connecting, turn on Aeroplane mode on your mobile. Then restart pfodApp and when the connection attempt fails, close the Connection Failed dialog. Then you will be able to click the app's menu button and choose “Connections” from the options menu.

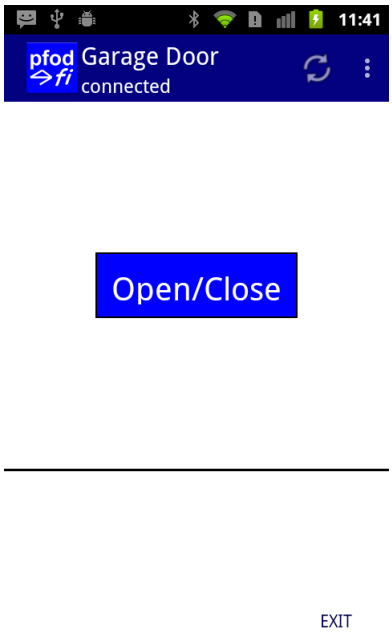
NOTE: You must be connected to the Internet, for a licence check, when you first try to connect to pfodDevice you have just added or edited., see Licence Check on First Connection Attempt.

Selecting from Multiple Connections

If you have more then one pfodDevice connection setup, then when you start pfodApp you will be presented with as list of pfodDevices to connect to.

To connect to the pfodDevice, just click it.

In this case the Garage Door pfodDevice only offers a simple open/close button. Other pfodDevices will present different options to you. In all cases the same pfodApp can be used to control different pfodDevices. It is the pfodDevice that determines what options are displayed.



SMS Connections

SMS message take some time to be sent and responded to. Once you have initiated the SMS connection you can leave pfodApp running in the background and continue to use other applications while you wait for the response.

The mobile will notify you when an SMS is received and you will see an odd collection of characters sent from the pfodDevice. Open pfodApp again to see the screen the pfodDevice has sent. Some screens require multiple SMS messages to be be delivered so the new screen may not be visible after the first message.

If an SMS message from the pfodApp is not responded to, pfodApp will resend it after the time out (default 3 mins). After 5 retries the pfodApp will stop with a 'connection lost' message.

This can happen in a number of situations. The pfodDevice SIM may have run out of credit. It may be powered down or another user may be connected to it.

Once you connect to the pfodDevice via SMS, you stay connected, BUT after a pfodDevice time out (typically 10mins), the pfodDevice can accept a new connection from another user. When the new user connects, the pfodDevice stop responding to you. After 10mins of inactivity by the new user you will be able to connect again.

Set a password on the SMS connection and program it into the pfodDevice to prevent unauthorised control of the pfodDevice.

Exiting pfodApp or Closing a Connection.

When you exit pfodApp or choose “Connections” from the app's menu, pfodApp first closes any current connection by sending the CloseConnection command, **{!}**, to the pfodDevice. It can take a few seconds for this CloseConnection command to be sent, particularly for SMS connections and pfodApp will appear to pause while this is happening.

Licence Check on First Connection Attempt

NOTE: You must be connected to the Internet, for a licence check, when you first try to connect to pfodDevice you have just added or edited. However you do not need to be within bluetooth range of your pfodDevice when attempting this first connection. On the first attempt to connect to a newly added pfodDevice, the pfodApp licence will be checked and cached even if the bluetooth connection fails.

So if your bluetooth pfodDevice is in a location where your mobile does not have access to the Internet, follow these steps:-

a) Pair your mobile with the bluetooth pfodDevice. You need to be within bluetooth range to do this. An Internet connection is not required to pair your mobile to the bluetooth pfodDevice.

b) Go to a location where your mobile has an Internet connection, start pfodApp and add the paired bluetooth device as described above. Then click on the new connection to attempt to connect to it. A licence check will be performed via the Internet and the result cached by pfodApp. It does not matter if the bluetooth fails to connect to the pfodDevice.

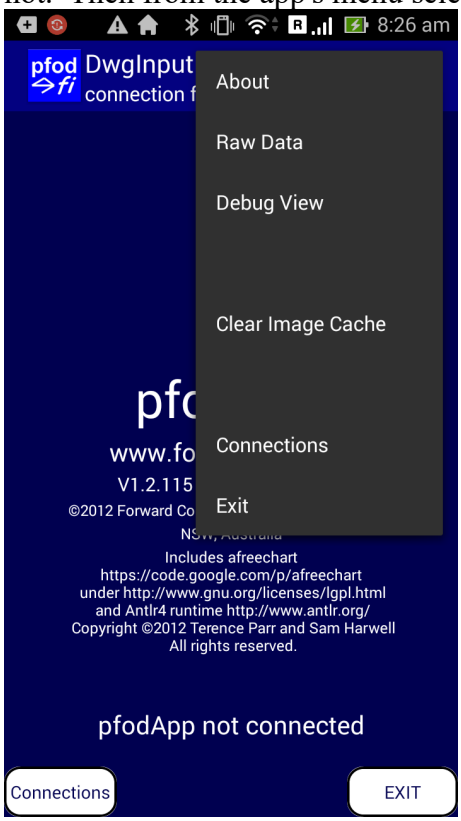
c) Go back to where your bluetooth pfodDevice is and you will now be able to connect to it and

control it using pfodApp.

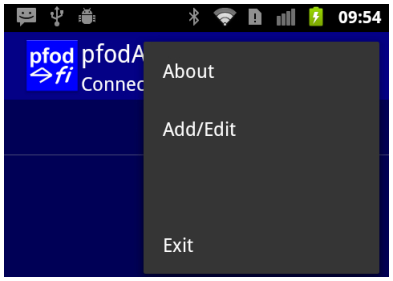
The pfodApp periodically checks the licence via the Internet, but due to licence caching, you do not normally need an internet connection when using the pfodApp to control a pfodDevice.

Adding, Editing or Deleting a Connection.

To add/edit a connection, first start pfodApp. It does not matter if you connect to a pfodDevice or not. Then from the app's menu select Connections.

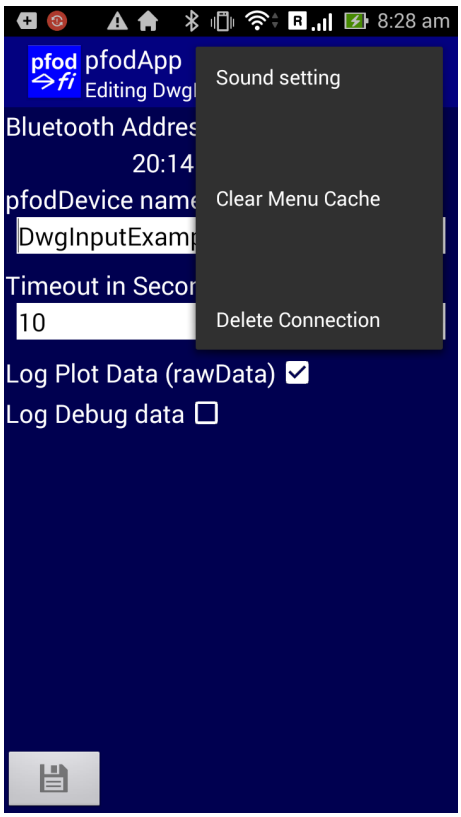


This closes any current connections and opens the list of currently defined connections. You can then either choose another connection or open the add/edit screen from the app's menu



From this screen you can choose Add/Edit to add a new connection or edit an existing connection.

While editing a connection the popup menu will display options for Sound Setting, Clear Menu Cache and Delete Connection.



NOTE: You must be connected to the Internet, for a licence check, when you first try to connect to pfodDevice you have just added or edited., see Licence Check on First Connection Attempt.

Changing the Sound Played by a Connection

A pfodDevice can request that a sound be played when a menu item is displayed by sending <ex s> as part of the text for that menu item. By default, the sound played is the default Notification sound for your mobile. You can choose another sound to be played when the pfodApp receives <ex s>.

The set the sound for a connection, open the connection for editing and then open the mobile's menu and select “Sound Settting” which opens a window of available Notification sounds.

If you think pfodApp should be playing a sound (check the Debug View for @) and it is not playing a sound, then a) turn up the volume on your mobile, b) change the “Sound Setting” to another sound.

Deleting the Menu Cache

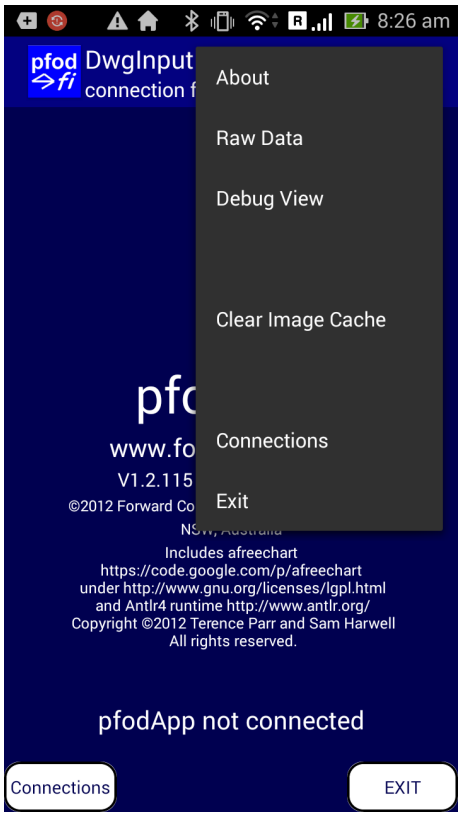
The pfodApp keeps a cache of previous menus and drawings and when they need to be redisplayed, pfodApp sends a request for the latest updates. Deleting the menu caches force the pfodApp to re-request the complete menu or drawing next time it needs to be displayed. You usually don't need to manually clear the cache because pfodApp keeps track of the menu version and will display the latest version if it has changed.

The main use for this command is to force a complete menu reload if the pfodDevice code has been changed but the pfodDevice menu version has not been changed.

Deleting the Connection

The last menu item while editing a connection lets you delete it.

pfodApp Menu Items



There are a number of menu items available on your app's menu button.

Connections

This closes any current connection and opens the list of available connections. You can choose one to connect to or use the app's menu to add/edit a connection.

Exit

The Exit menu item will close the current connection and exit pfodApp

Clear Image Cache

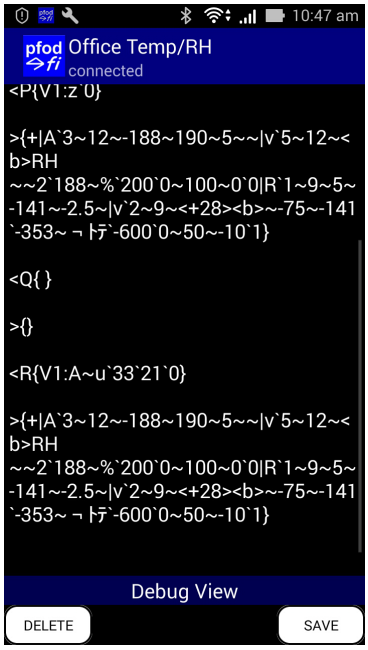
this option removed in V3.0.307+, use Delete Menu Cache instead

About

The About menu item will display a screen about pfodApp. Use the mobile's Back button to return from this screen.

Debug View

The Debug View shows the last 5K of messages and data that have been sent to and from the pfodApp. Use the mobile's Back button to return from this screen.



In this screen the text enclosed by { } are the pfod messages
< indicates a message sent from the pfodApp while
> indicates a message received by the pfodApp from the pfodDevice.

In the above screen the text outside the { } pfod messages is raw data sent by pfodDevice.

If you have enabled Debug Log in the Connection Screen, you can use the Save button to save this connection's Debug log to a directory of your choice or to your Google Drive. If the Debug Log is enabled, the debug data is appended to a private log file only accessible by this application. See Transferring Raw Data from your Mobile to your Computer. below.

Use the Delete button to delete this connection's Debug log. Un-installing the application will remove all debug logs.

Raw Data

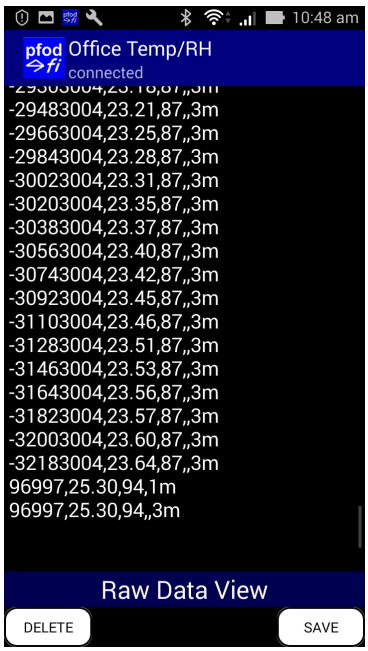
Raw Data is any characters that arrive at the pfodApp that are not part of a pfod message, i.e. not in { ... }. The pfodDevice can send raw data at any time.

Unlike the Debug View which shows both the pfod messages, {…} and any raw data, the Raw Data screen does not show the pfod messages, { }, just the raw data.

If you have enabled Log Plot Data (rawData) in the Connection Screen, when a connection to a pfodDevice is made, pfodApp will start saving the any raw data to a local file on your mobile.

If the file already exists the new data is appended to it.

The Raw Data menu item opens a screen that only show the last 4K of raw data (if any) that has been sent by the pfodDevice. Use the mobile's Back button to return from this screen. (Also see Plots below)



To avoid filling your mobiles memory with data, be sure to Exit pfodApp when you are finished.

If you have enabled Log Plot Data (rawData) in the Connection Screen, you can use the Save button to save this connection's RawData log to a directory of your choice or to your Google Drive. If the Log Plot Data (rawData) is enabled, the raw data is appended to a private log file only accessible by this application. See Transferring Raw Data from your Mobile to your Computer.

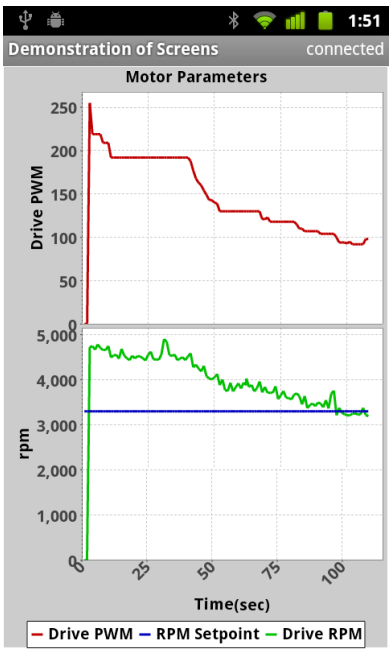
Use the Delete button to delete this connection's Raw Data log. Un-installing the application will remove all Raw Data logs.

Plots

As well as displaying raw data from your pfodDevice, the pfodApp can plot it. As with other screens on the pfodApp, the plotting is controlled by the pfodDevice.

The plot command must be programmed into the pfodDevice.

When the pfodDevice sends the plot version of the Streaming Raw Data command, {= . .. }, the pfodApp on your mobile will open a plot screen and dynamically plot the fields selected by pfodDevice.



When the plot screen opens, the pfodApp automatically starts saving the data to a file on your mobile. Once the pfodApp starts saving the data it continues to save it until you exit the application or loose the connection to the pfodDevice. See the section above on how to transfer this data to your computer.

Note: If the pfodDevice sends data faster then you mobile can process it, some of the data will be dropped from the plot, resulting in straight lines on the plot covering the missing data. However in all cases, all the data is saved to your mobiles storage and can be transferred later to your computer, as described above, to plot all the points in a spreadsheet or other plotting package.

Working with Plots

The pfodApp chart is updated about once per sec. You can freeze the plot by holding it down with your finger.

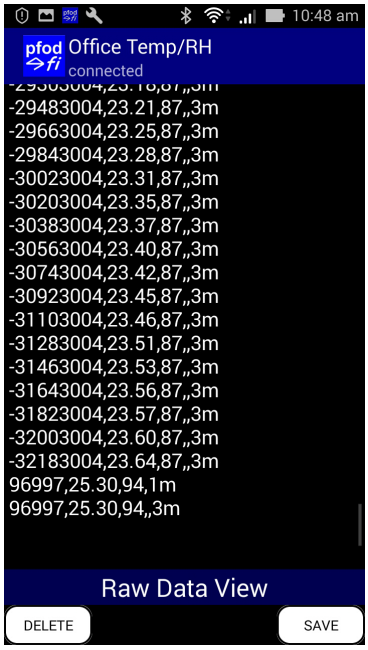
The plots can be panned and scaled on your mobile's screen.
To pan left or right, up or down, drag the plot with one finger.
To scale the plot, use two fingers to pinch or expand the scales.
To restore the plot to is default scaling, double tap it.

As mentioned above, plots will not be available unless one of the pfodDevice's menu item is programmed to send necessary command to your mobile telling it which data fields to plot and field names, scales, etc.

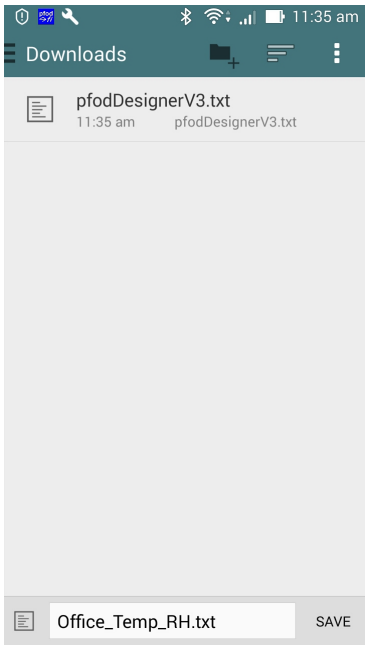
Transferring Raw Data from your Mobile to your Computer.

Having enabled Plot Data (rawData) in the Connection screen, you can open the Raw Data screen to save that rawData log file to a directory of your choice or your Google Drive.

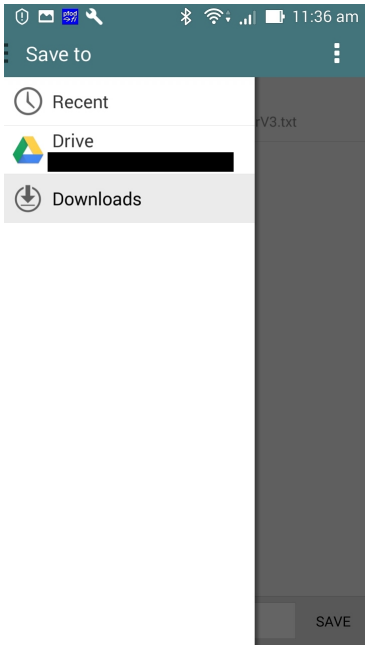
NOTE: You need to be connected to your pfodDevice in order to open that connection's Raw Data screen.



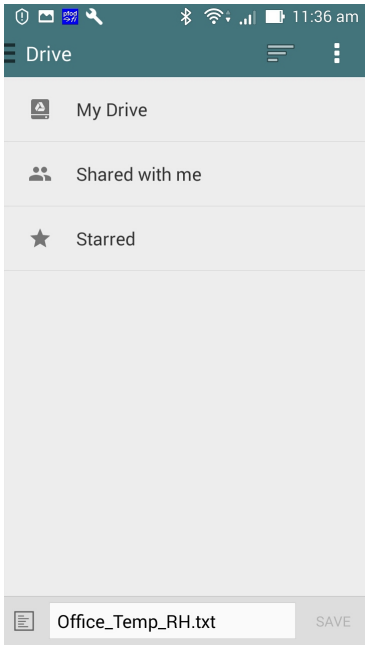
Clicking Save opens a file browser on your mobile at the last save location and with a suggested name for the file. You can edit the suggested name as you wish.



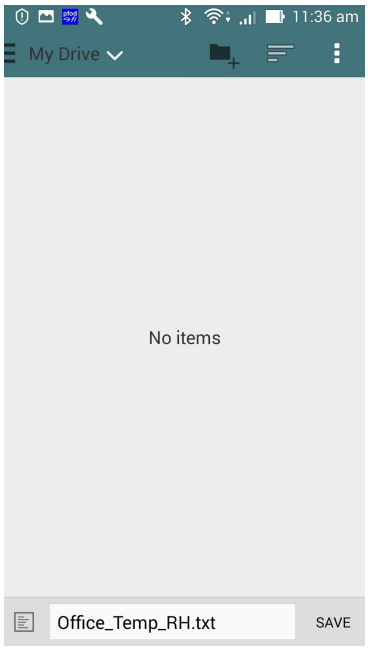
Clicking the top left most icon (to the left of Downloads in the above photo), opens the Save to list of directories.
To see more directories you can click on the right hand three dots, choose settings and click "Display advanced devices", but most commonly either Downloads or your Google Drive will be where you want to save the log file.



Choosing "Drive" opens Google Drive and gives you access to your Drive and other locations



Choosing “My Drive” lets you save the log file to your Google Drive



Display of Non-English Text

pfodApp can display screens in your own native language. See the pfodDemo for examples.

This non-ASCII language display depends on two things:-

1) the pfodDevice you are connecting to must send the text in your native language using UTF-8 encoding. The pfodApp just displays what is sent. The pfodDevice completely controls what is displayed. See Using Non-ASCII chars in Arduino for how to add your native text to Arduino's pfodDevice sketches.

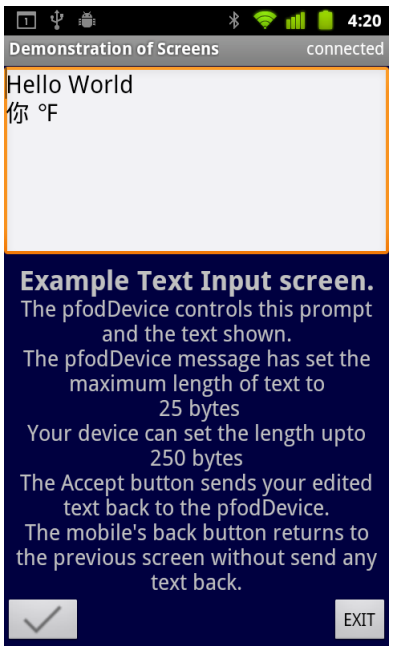
2) your mobile needs to have the appropriate font installed. If the font is not available the text will be displayed as small rectangles. You may be able to find your language's font on the web and download it to your mobile. This document does NOT cover updating your mobile with extra fonts.

Although pfodApp will display non-ASCII characters, the connection screen and error messages are still in English (at the moment). Contact www.pfod.com.au if you have a project that needs the connection screen translated to another language.

Inputting non-ASCII characters into Text Input Screens.

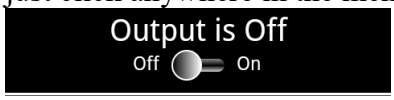
The pfod spec defines text input screens that consist of an input area and a prompt. This type of screen will only be displayed if the pfodDevice you are connecting to requests text input.

These screens will accept any Unicode char and display it if the mobile has the appropriate font. You can enter any Unicode character by using its escape sequence, \u.... i.e. \u followed by exactly 4 digits. E.g. entering \u2109 into the text box will be immediately replace with ℉



Toggle Buttons – Sliders with only two choices

If a menu item with a slider has only two possible choices then you can either slider the slider OR just click anywhere in the menu item to toggle the setting.



Unexpected Loss of Connections.

Connections between pfodApp on your mobile and the pfodDevice can be lost for a number of reasons. NOTE: Aeroplane mode prevents Bluetooth, Wi-Fi and SMS connections.

The pfodDevice may send a “Close Connection” command to the pfodApp which asks the pfodApp to close the connection and exit. In this case the pfodApp usually displays a final pop-up message sent from the pfodDevice.

Other reasons for loss of connection are:-
For bluetooth connections -- you have moved out of bluetooth range.

For WiFi connections -- the connection can be closed by the pfodDevice if an idle time-out has been set and you have not sent any commands for some time.

Connections can also be lost if the pfodApp is not visible on the mobile's screen and some other application requires more memory. In this case your mobile may shut down part or all of pfodApp. Then when you make pfodApp visible again it may not be connected or in some cases just stop running un-expectedly.

In all these cases, just close pfodApp and restart it and re-connect to the pfodDevice.

Permissions

pfodApp uses the follow types of permissions:-

Camera – to Scan QR codes for WiFi security secret keys
SMS and Phone – (only if using the SMS version) to allow connections via SMS
Location – to allow scanning for BLE devices.

If your mobile is running Android V6.0 or higher, you will be prompted to approve each permission as needed. If your mobile is a lower version of Android (<V6.0), you will be prompted to approve all the permissions when installing pfodApp.

Notes about permission usage on Android V6+

Location Permission :- pfodApp itself does not need or use your location. However Google insists on the app having this permission before it will scan for BLE devices or display the name of the WiFi network you are connected to. Once you have set up your BLE connection, you can go to your mobile's settings and disable the Location Permission for pfodApp.
NOTE: On Android V6.0+ you need to have Location turned on in your phone's settings in order to scan for new BLE devices.

Camera and Flashlight :- pfodApp only uses the camera to scan QR codes to read the WiFi security password. Once you have finished setting up your WiFi connection, you can go to your mobile's settings and disable the Camera Permission for pfodApp.

SMS and Phone :- These permissions are only needed for connecting via SMS. For other types of connections, i.e. WiFi, Bluetooth and BLE, they can remain disabled.

Notes about permission usage on Android V12+

On Android 12+ it is possible to avoid asking for the Location permission since pfodApp does not actually use , store or send any location information, but pfodApp which runs on Android V4.4 onwards currently does not take advantage of that. SO for now allow Location permission "**While using the app**" on Android 12+.
NOTE: ***Do not choose*** "**Only this time**" because pfodApp only checks for permissions on start up not everytime it is needed. So choosing "Only this time" will cause pfodApp to fail at some later time.

Android V4 Bluetooth Problems

With the release of Android V4.2, a new bluetooth stack was introduced in the Android Operating System. This new bluetooth stack has experienced a lot of problems which are continuing as of Android V4.4. Typical problems include being unable to pair bluetooth devices, unable to connect and loss of connection.

"A surprising number of people have cleared up a lot of their issues by disabling the 5 GHz Wi-Fi band, or shutting down Wi-Fi altogether. While unusual, this radio may be causing interference for the Bluetooth radio. I could make guesses as to how this would happen, but I'm not an expert in this area, so I'll leave that for somebody with more experience."
(http://www.androidpolice.com/2013/12/28/bug-watch-many-nexus-devices-still-suffer-from-assorted-bluetooth-issues/)

See the above link for more details and possible fixes for the problem.

Update: One of our test Bluetooth shields keeps disconnecting while another from the same supplier stays connected. So Bluetooth problems can also be due to individual Bluetooth module

problems.

Trouble Shooting Bluetooth Low Energy (BLE) on Android

If your mobile does not support BLE, then pfodApp will not display the 

button in the add/edit connections screen.

Not all Android mobiles support BLE. You can check if your mobile supports BLE with the free **Nordic nRF Master Control Panel** (BLE) android app.

The BLE hardware is still being ironed out. On the Android side, BLE support was introduced in V4.2 but that version and V4.3 was very buggy. V4.4 improved the BLE support and these modules were tested on an ASUS Zen Phone 5 running V4.4.2. Other phones may vary.

ASUS Zen Phone 5 running V4.4.2 worked fine apart from dropping the connection after 5mins and occasionally at other times. However pfodApp automatically reconnects within a few seconds and the data logging is appended to the existing log file so it is still very usable. If the menu display looks odd or has odd characters in it, just use the mobile's back button to re-request it. If it persists you may need to open the Connections menu and edit the connection to clear the Menu Cache.

On the module side, there are various chip sets that board manufactures use to provide BLE support. Some are better then others, some scan better, some have less drop outs etc.

If the Bluetooth connection seems to get stuck or will not connect, try exiting pfodApp and turning the mobile's Bluetooth off and on and turning the Arduino BLE module off and on. If that does now work try turning the mobile's Bluetooth off and restarting the phone and then turning the Bluetooth back on to completely clear the Android BLE stack.

Why is BLE so hard to use?

Bluetooth used to be easy to use, every Android and iPhone and most computers supported Bluetooth V2. The Bluetooth Serial Port Profile (SPP) was the standard way to get a general data connection via Bluetooth and all Arduino Bluetooth V2.0 shields supported it.

When Bluetooth SIG introduced Bluetooth Low Energy everything changed. For some unknown reason Bluetooth SIG did not define a standard general purpose serial service for Bluetooth V4. This means that each board manufacture defines their own connection service and your app has to recognize each one. pfodApp overcomes this by pre-configuring the connection details for a variety of common boards. If you have a board that is not supported, contact pfod.com.au at support to get its connection details added to pfodApp.

Bluetooth V4 does define a number of 'standard' connections, like heat rate and battery monitoring, etc. pfodApp does not connect to any of these. If you want to log and plot that data with pfodApp, send the data via the UART style service your board provides.

On the Arduino side there is no standard BLE library, each BLE board manufacture has their own library, each with its own particularities, to access their particular BLE chipset. pfodDesigner helps out here by generating a complete sketch for each of the supported boards to get you up and running quickly.

Given the issues outlined above why should you use BLE?

BLE was designed for low energy use so if you are building a device that needs to run on a couple

of coin cells for 6 months then BLE is ideal. On the other hand if you just want a shield to communicate with your Arduino then a Bluetooth V2 shield or a cheap WiFi shield.

Of course the other reason for using BLE is because you bought one (perhaps by mistake). In any case pfodApp and pfodDesigner will get you up and running with a custom control quickly and easily.

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