# PIL-IO Box Interfacing

# Contents

# Introduction

This document describes how a PIL-IO box was modified to create a fully connectable PIL-IO box for both development & normal 'plug n' play' purposes.

The modifications needed to provide an 'encapsulated' solution for permanent connection to HP-IL and to the GPIO & Serial inputs/outputs and to cater for an independent power supply. To this end it was decided to add a 3D printed HP-IL connector to the 'HP-IL' end of the PIL-IO box and a 9 pin D type connector for the GPIO/Serial end of the PIL-IO box. Although not absolutely ideal, batteries were decided to provide the power supply as it was the quickest and easiest solution to providing an independent power supply.
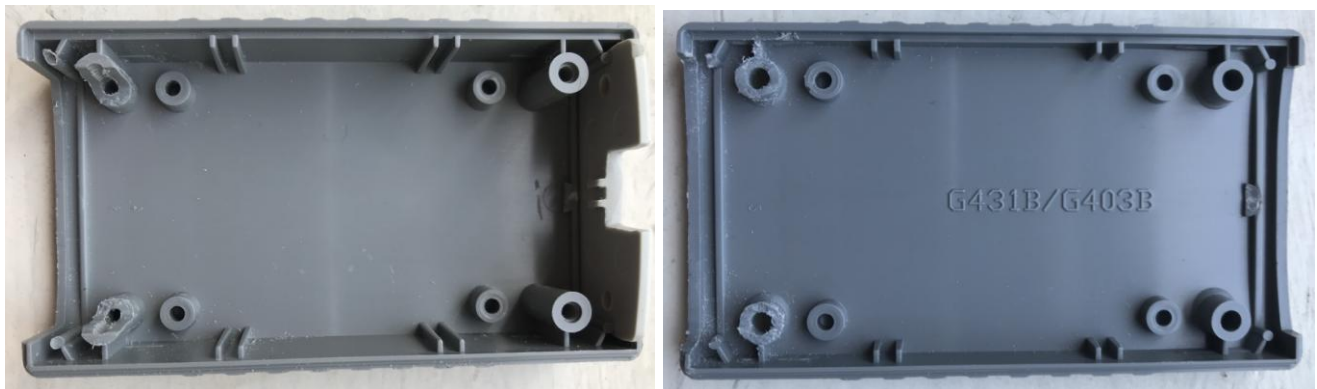
Note: The process assumes that a 3D printed HP-IL connector has already been assembled i.e. populated with pins & glued with the required length of leads for connection to the PCB.


# PIL-IO Box Modification

In order to accommodate the body of the 3D printed HP-IL connector, 2 modifications were required, one for the PIL-IO box housing and one for the PIL-IO PCB.

The PIL-IO housing needs the longer screw posts in the 'lower' half of the housing (at the HP-IL input end) modified and the shorter screw post counterparts in the 'top' half of the housing to provide clearance for the body of the 3D printed HP-IL connector.

These posts need to be completely or partially removed using a small model makers saw. The longer screw posts in the lower half of the housing are cut diametrically vertically down their centres to the level where the housing strengthening ribs met the screw posts then cut horizontally at that level to remove 'half' of each screw post.
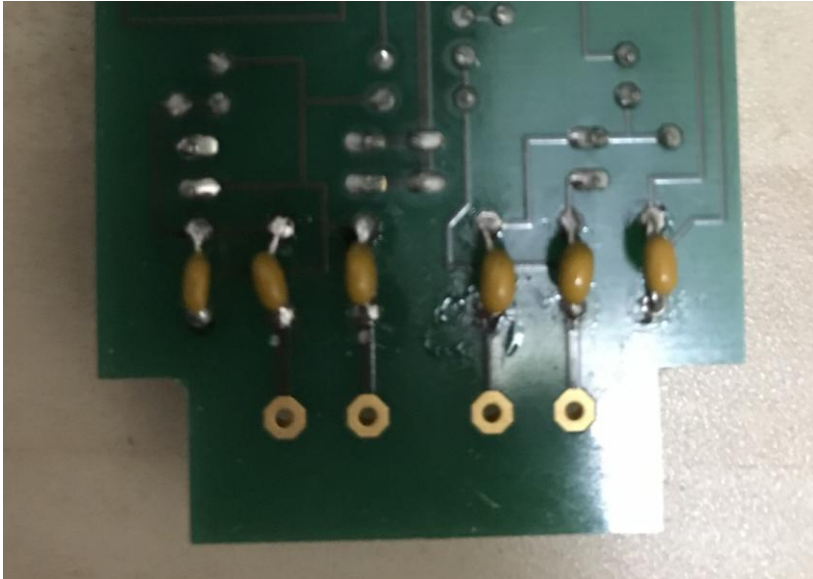


The pictures above show the 'long' screw posts (left picture) cut diametrically in parallel to the housing walls down to the level of the adjacent housing 'hole' and the 'smaller' screw posts in the 'upper' half of the housing cut off completely down to the level of the adjacent housing hole (right picture) and were then 'cleaned up' with a model makers file.

Note: All these operations could be performed with just a file but takes much more time.

# PIL-IO PCB Modification

To further accommodate the HP-IL connector body, capacitors (C1, C2, C3, C4, C5 & C6) on the PCB need to be moved. This requires relocating them from the 'component' side of the PCB to underneath the PCB. This modification also eliminates the previous 'bodge' of 'bending' these components out of the way.
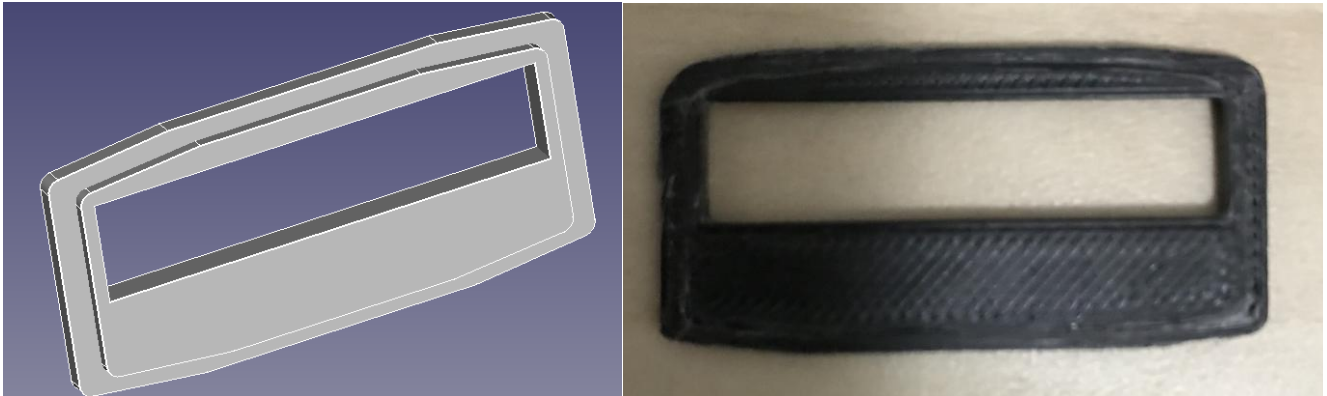
Note: Space is very limited, so make sure to solder as close as possible to the PCB.



The picture above shows the HP-IL input end of the PCB with the input capacitors re-located on the underside of the PIL-IO PCB. This then completes the housing/PCB modifications.

# HP-IL End Plate Modification

A new end plate for the HP-IL end of the housing was created using 3D printing in order to be able to mount the HP-IL connector.
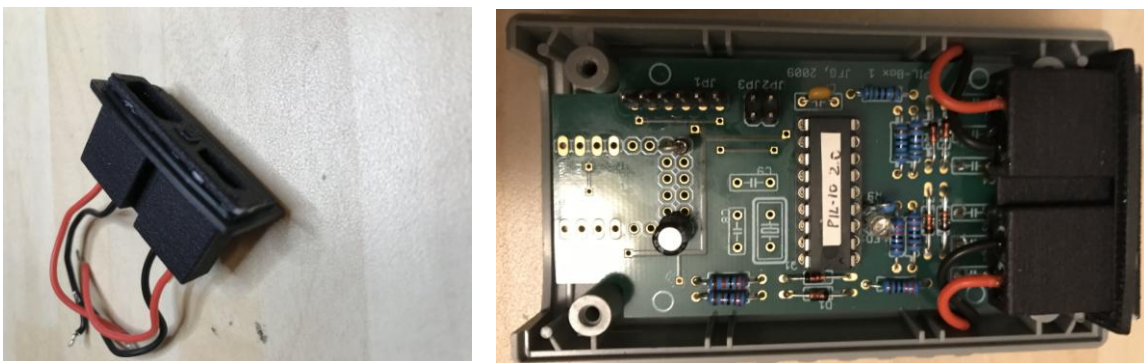


The pictures above show the 3D design that includes a step or 'lip' that fits in the PIL-IO housing groove and a slot that the HP-IL connector fits in.

The 3D printed end plate replaces the original end plate supplied with the PIL-IO housing. The HP-IL connector fits *very* 'snugly' into the slot in the end plate and requires gentle, but firm easing into the slot. The  connector needs to be aligned with the surface of the 3D printed end plate so that the front connector plate (part of the HP-IL connector assembly) can be located using the small lugs on the connector face and the corresponding location holes in the 3D printed front plate.

With the front plate placed in position check that it fits without interference with the housing casing, if not, trim the front plate with a model makers file or knife to fit.

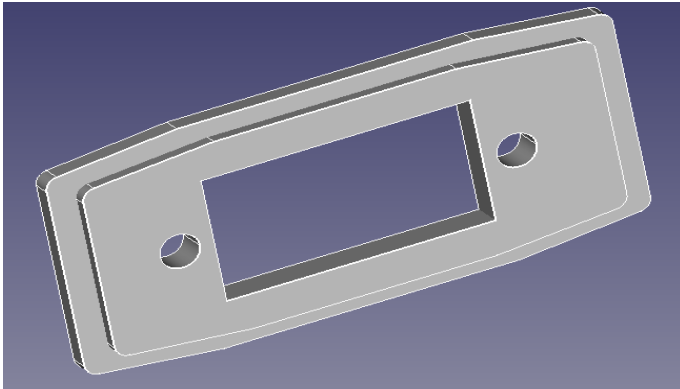Note: The material is quite hard so the front plate may need vigorous filing!

When satisfied the HP-IL connector is correctly inserted into the end plate, put the 3D printed front plate on the front of the end plate/connector assembly and glue in place with epoxy resin. At this stage all 3 parts (PIL-IO box end plate, HP-IL connector & connector front plate) should be bonded together to create a single assembly as shown below.



The pictures above show the bonded connector assembly (left) ready for mounting into the PIL-IO  housing. The connector leads are soldered to the underside of the PCB and positioned to prevent trapping by the housing walls as shown in the right picture.

# GPIO/Serial End Plate Modification

For the GPIO/Serial end of the housing, a new end plate was created using 3D printing to accommodate a 9 pin D type connector.
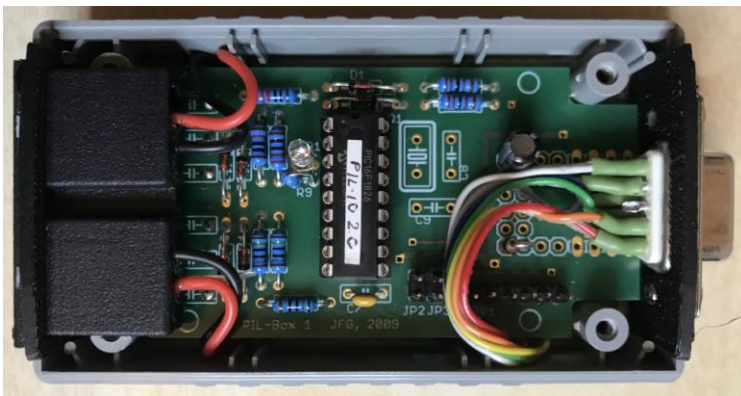


The pictures above show the 3D design that shows the step or 'lip' that fits in the PIL-IO housing groove and 2 fixing holes for the D type connector.

The 3D printed end plate replaces the original end plate supplied with the PIL-IO housing. The centre 'square' hole accommodates a D type socket with a very 'snug' fit and 2 holes either side for self tapping screw type fixings to hold the connector to the end plate. The 2 fixing screws were reclaimed from old desktop PC chassis fittings but as the 3D print ABS material is fairly 'soft' virtually any interference fit screw will bite into the end plate holes.



The pictures above show the 9 pin D connector mounted in the 3D end plate/housing and secured with 2 reclaimed screws (left) and the mounted HP-IL connector (right).



The picture above shows the 2 connectors installed in the PIO-IL housing. The IO pins on the PCB were a bit challenging to remove so the internal D type connector leads were soldered to the underside of the PCB.

# Power Supply

The power supply is provided by 3 AAA batteries in a plastic battery case. The case comes with an integral ON/OFF switch so the PIL-IO box can be easily switched on & off externally. The battery case also comes with an adjustable Velcro strap that enables the battery pack to be easily attached (strapped) to the PIL-IO housing providing a 'complete' package.



Note the very useful ON/OFF switch in the lower right hand corner of the right hand picture!



The picture above shows the completed housing with attached battery pack.

Modification/assembly is now complete and the PIL-IO module is now ready for use!

# Parts List

| Qty | Item | Supplier | Part No. | Cost |
|---|---|---|---|---|
| 1 | HP-IL End Plate | the3dprintshop.co.uk | - | ~£15 |
| 1 | D Type End Plate | the3dprintshop.co.uk | - | ~£15 |
| 5 | 9 Pin D Type Socket | RS Components | 554-3749 | £3.10 |
| 5 | 9 Pin D Type Plug | RS Components | 554-3727 | £3.10 |
| 5 | Battery Case | Amazon | KEESIN | £10.99 |
| 12 | AAA Batteries | Amazon | MN2400 | £6.69 |

## *Miscellaneous Parts*

2 x Self Tapping Screws
Connector leads as required

# Acknowledgements

PIL-IO Box - J-F Garnier
3D HP-IL Connector - Martin Hepperle
V41 - Warren Furlow