1 Assembly Plan and general instructions

1.1 Errata (Watch out for non-obvious steps and design errors listed here!)

- LEDs must be inserted with correct polarity, pin1 (square pad normally) is the cathode and all of them should be connected together within a digit row.
- holes for the side pins of the delay line select rotary switch are too small - either cut off these unused pins or make the board with bigger holes (say 2mm?).
- The printer shipped with a cable slightly different from the description, the power and ground pins are next to each other rather than separated by an unused pin. The piconnect board is laid out to not connect the middle pin of a 3 pin connector, therefore the shipped 2 pin connector will not fit directly. The easiest option might be to make a new 3 pin connector and tie/solder that to the wires coming out of the end that attaches to the printer.

Some other potential issues to be aware of:

- IDC Connectors: Assemble them so that pin 1 is the black wire. Pin one should be on the inside for the pi-connect side, and the outside for the LED boards. I would leave off the strain relief for them.
- All LEDs: height of assembled IDC connectors may require longer mounting screws and the LEDs being quite far from the board. It would be desirable to mount the LEDs on the other side of the board, but this might make the physical mounting of the flipped boards impossible - check this before soldering.

1.2 PCB in general

I used the KiCAD schematic capture and pcb design suite. It works on Mac and Windows. Open up the main program, and load the .pro project file first. Then open the schematic or pcb layout files from the sidebar. Might have to set the library paths if it complains on loading a schematic or PCB (only custom libraries are in our repository, in hardware/kicad libs) - but viewing the layouts should be possible without these, just modifying might be an issue!

Some sheets are nested within others and used in multiple projects, so it's best to always open up the required top level project first, and then open the top level sheet, and double click the nested sheet to go into it (right click, leave sheet to get back up one level).

A few boards were made on the milling machine in the socshop workshop. These do not have plated holes or solder mask so may be a bit harder to assemble. These boards should not require any vias (which would need a piece of wire inserted and soldered on both ends), all solder points should be on the same side. This is why the connectors for the IDC cables are on the same side as the LEDs...

1.3 Pi-Connect board

Resistors (10K and 47K are needed I think) and capacitors should be available in Julie's workshop, see the schematics in v1/piconnect.sch. The capacitors are just to smooth out the power supply for the MAX7221 display drivers so it would work fine without them probably.

1.4 Printer

The printer needs its own power supply. The piconnect board has a connector for this (see Errata - it does not exactly fit the actually supplied cable because the pin layout on the supplied connector is different).

A second 3 pin connector is provided for signal ground, RX, and TX pins.

Interfacing is described in the document in the repository and on sparkfun. According to sparkfun, it ships configured for a baud rate of 19200bps.

An Arduino sketch showing the special characters for configuring settings is on github. But other than that, open a Serial port, and send it text at 192000bps, and it will print with the default settings, whenever a linefeed (\n) is received.

The rolls of paper it uses are slightly smaller than the default ones sold in the UK, and can be bought from e.g. coolcomponents or protopic.

> The thermal printer takes 2.25" (57mm) wide thermal paper with a max roll diameter of 1.5" (39mm). Thermal paper is inexpensive and commonly found in most office supply stores in 85ft lengths. You may have to remove some paper from these rolls in order for it to fit into the printer.

Physically, the printer fits into the control panel rectangular cutout and is secured with two spacers and long screws on the back.

I have not made plans for how exactly the "printed" cards should be represented. Maybe we can experiment with bitmap drawings and such, too! (there is a QR code drawing example in the git repo linked above).

1.5 Lamps

The LED boards usually have a ribbon cable connector on them for 16 LEDs. I think the best way to solder and mount these is to plug in the connector and put (but not solder) the LEDs on the board. Then we can screw the board to the front panel with appropriate spacing and thread the LEDs into their respective holes and then solder them???

Take care to solder in LEDs the right way round. The silk screen labels *should* be correct, but best confirm that all the cathodes (short legs) of a digit row are connected together to be sure.

1.6 Switches

A switch takes a nut, then a spring ring (?), then the control panel, and on the other side the direction notched ring, and another nut. Most switches are screwed in now, but nuts may need to be tightened (I did not have a suitable tool for this).

Switch boards should fit directly on to the switches screwed into the control panel. Solder the IC (with holder) and rectangular headers for the 4-wire connections to piconnect first. There are three jumper connections for defining the I2C address. These must be different (and on a few boards they are fixed) for all of those plugged into the same row on piconnect, of course.

We should also probably order 12 more of the simple on-off switches and use these for the IS switches to stay closer to the original. We ordered (on)-off-(on) switches previously but as the newly obtained documents point out, these would not make sense here as they do not directly influence any lights, as the ID keys do. The document suggests on-off-on switches instead, but I don't understand how we would deal with the middle position then.

1.7 Delay Line Select Rotary switch and MC Slip button

The rotary switch provides a 4 bit output that is connected to an input expander just like the other switches. Only values 1 - 13 should be although the switch allows 16 positions.

The shaft is very long and could be cut off if desired. Maybe a dial can be 3D printed and glued on to it, or purchased.

The mc slip button two wires are supposed to be soldered to the two spare pads on the edge of the delay line select board.

1.8 Screen (Delay line display)

The screen itself if attached with 4 M3 screws. Spacers fitting these screws were shipped with it. One hole may have to be re-drilled to align with the screen, or stick with 3 screws.

The screen connects to the Pi with the HDMI cable, and there is a USB cable for supplying power to it. As explained in the datasheet, special configuration or a separate power supply is required. We are not using the touch screen functionality, and therefore no drivers should be needed.

In particular, the resolution needs to be set to 1024 x 600, and a higher USB current output needs to be allowed. As per the wiki page, add this to /boot/config.txt:

```
max_usb_current=1
hdmi_group=2
hdmi_mode=87
hdmi_cvt 1024 600 60 6 0 0 0
```

The datasheet is in the repository and at wiki, product page.

The circular holes for the delay line display are deliberately bigger than the screen. A square (or tall rectangular) display area is used in the original. I recommend cutting out such rectangles from a black piece of cardboard and putting that between the screen and front

panel.

I have not researched desktop environments and related settings, such as making sure the screen does not turn off after a while, and that our graphical UI program is started in fullscreen mode, after auto login on boot.

1.9 Dial

We have not purchased a GPO Telephone dial yet. The circular cut out for it is 77mm diameter, it may need some sanding or hot glue to fit the actual dial.

I believe the dial will send one pulse per number, and an 'engaged' pulse during the dial process. I have not researched this further.

The pi connect board provides a connector for two GPIO pins (17, 27) with weak external pull-up resistors for this (see piconnect schematic). It should be trivial to configure these as interrupts using the python GPIO module.

1.10 Box assembly

I have not made plans for a box assembly. The intended layout of the control panel is as follows:

- To the left: The printer, vertically mounted.
- Middle: The big main panel.
- Right: The Delay Line display, and above (or below it) a horizontal cover (no

cut outs).

There is a spare empty cover, and a spare cover originally designed to go above the delay line display. However it turns out the lights there were mainly fuse and power supply indicators so I have not produced those lamp boards.

All panels have 5mm mounting holes intended to fit M5 machine screws. These have not been purchased.

A structure to hold everything in place (and possibly, beams to stabilize it) needs to still be devised.

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