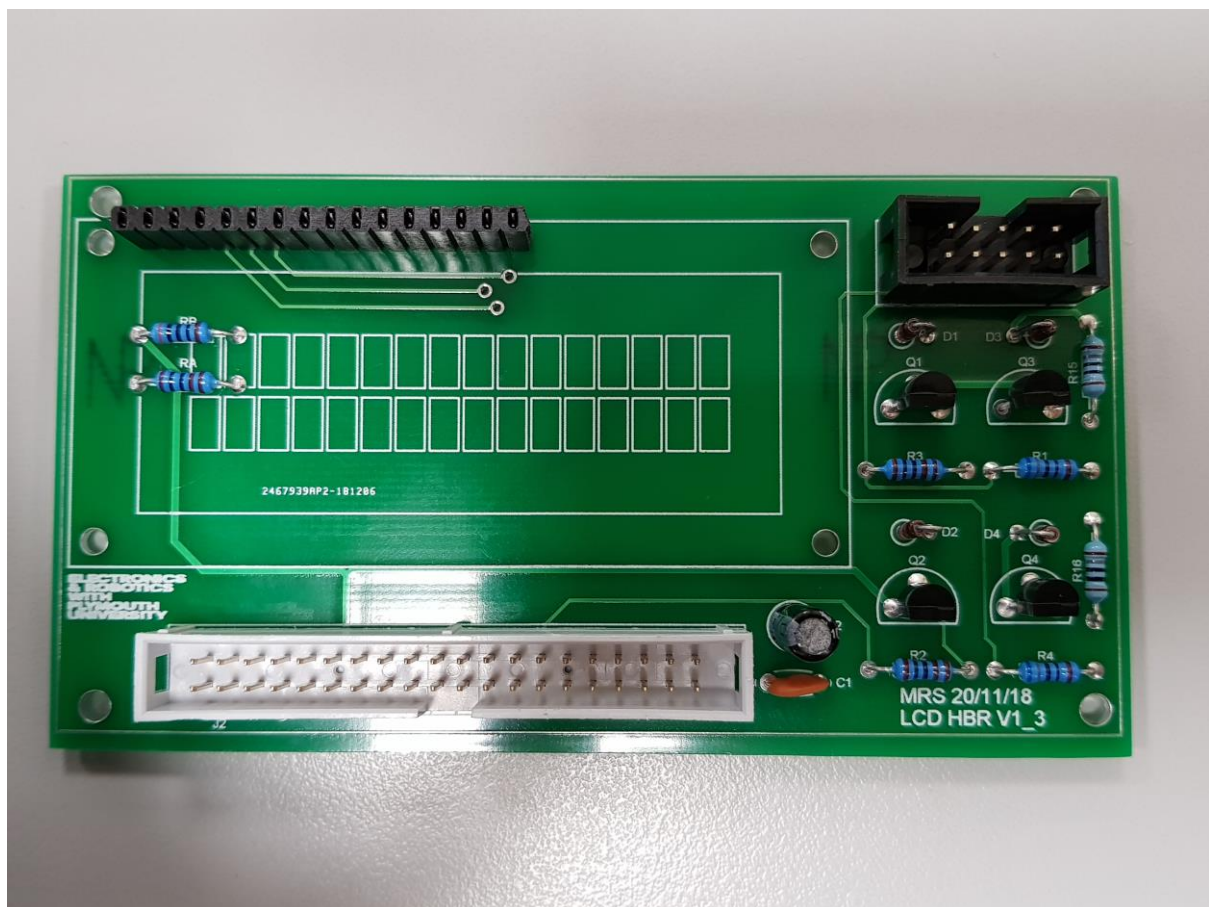


2x16 LCD and H-Bridge Module

Assembly Instructions

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(Rev 2.0)

The purpose of this document is to aid in the assembly of the LCD and H-Bridge PCB, which has been designed here at the University of Plymouth to be used with the DE0-NANO FPGA development board.

You should familiarise yourself with this document and component parts BEFORE assembly.

Parts List

Check that all listed parts (Fig 1) are available in the provided kit

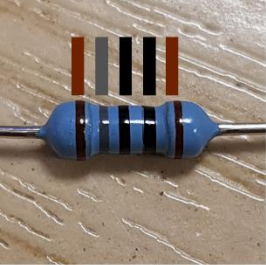
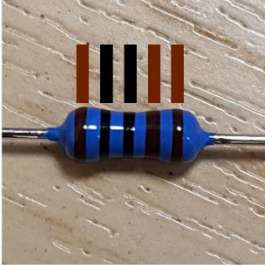
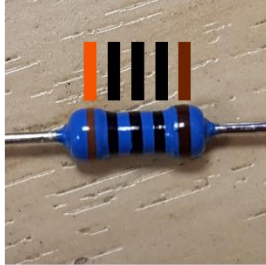
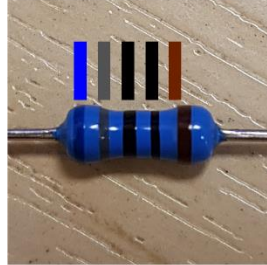



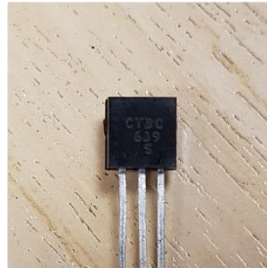




2x Resistor 180Ω 	3x Resistor 1KΩ 	1x Resistor 300Ω 	2x Resistor 680Ω 
1x 10uF Capacitor 	4x 1N4148 	2x BC640 	2x BC639 
1x 100nF Capacitor 	1x 16-Pin Connector 	1x 10-Pin Connector 	1x 40-Pin Connector 

Fig1: Table of Components

Assembly

The top side of the PCB (Fig 2) has **markings** to indicate the position and orientation of the components. This is the side where the components are mounted.

The bottom side of the PCB (Fig 3) has **no markings**. This is where solder will be applied.

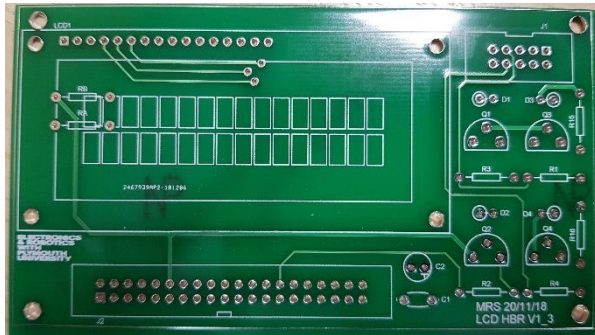


Fig2: PCB Top Side (Component Side)

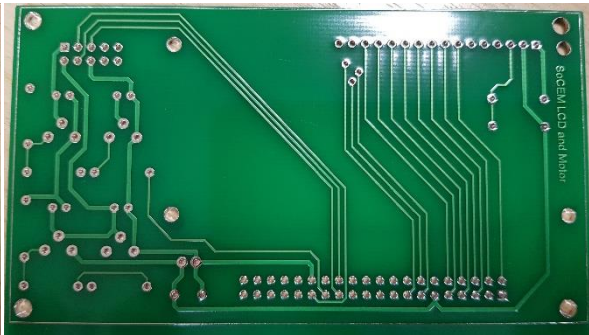


Fig3: PCB Bottom Side (Solder Side)

Below is a table of the component codes printed on the PCB, and which part they refer to:

RA, R2, R3	1K Ω Resistor
RB	300 Ω Resistor
R1, R4	680 Ω Resistor
R15, R16	180 Ω Resistor
D1, D2, D3, D4	1N4148
Q1, Q2	BC639
Q3, Q4	BC640
C1	100nF Capacitor
C2	10uF Capacitor
J1	10-Pin Connector
J2	40-Pin Connector
LCD1	16-Pin Connector

PCBs are usually assembled in order of height, so that components are pressed flat against the PCB by the work surface as they are soldered.

Resistors

First take the three 1K Ω resistors, and use needle nosed pliers to bend the leads at a 90-degree angle. Hold the lead close to the component body and bend away from the pliers (Fig 4). This is to protect the component body from damage and creates a clean bend.

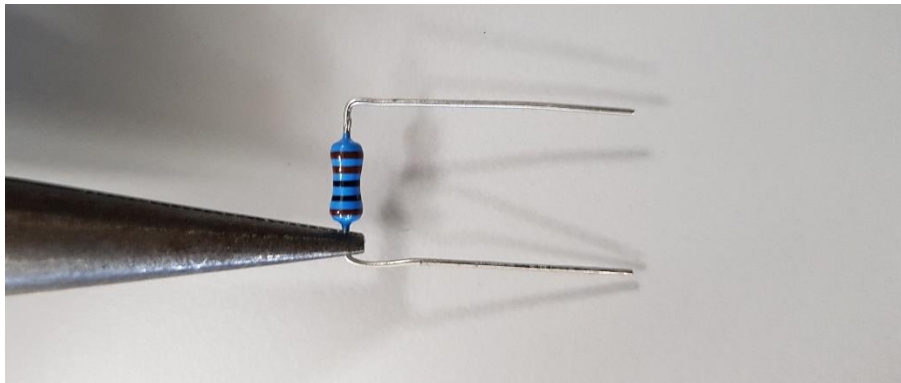


Fig4: Bending Resistor Leads

Place the first 1K Ω resistor onto the PCB, threading the leads through the holes marked RA. Assuring the component is flat against the PCB, spread the leads on the solder side of the circuit (Fig 5). This will affix the resistor to the PCB so that it can be soldered.

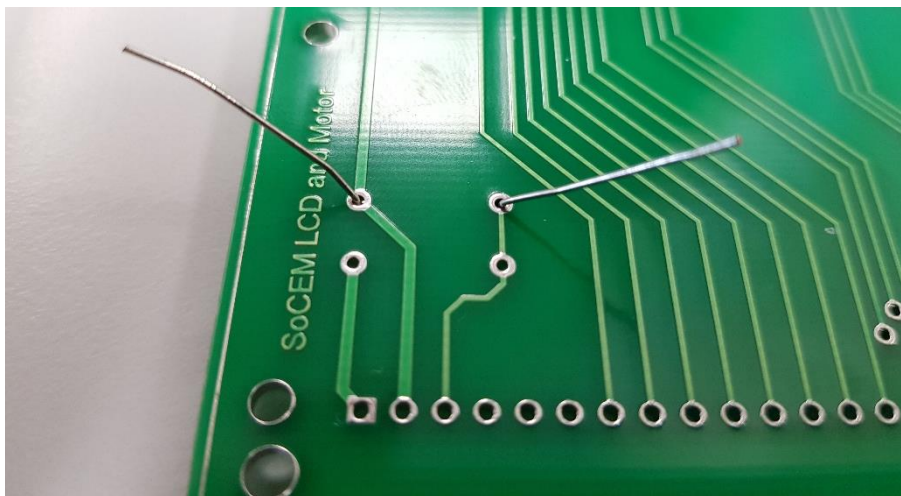


Fig5: Affixing The Resistor to The PCB

Next apply solder and crop component leads, so that it resembles Fig6.

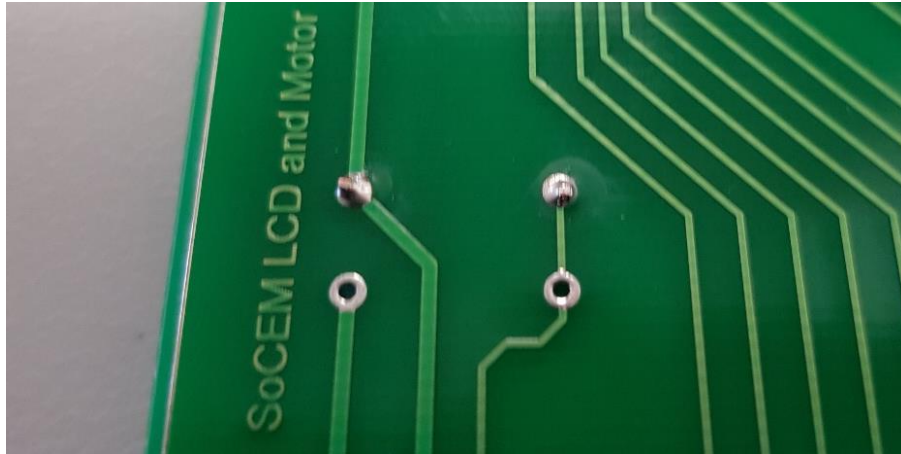


Fig6: Soldering the Resistor

Copy this process for the remaining resistors, using the chart below to select the correct values:

PCB Code	Component Value	Band Colour
RA, R2, R3	1K Ω	■ ■ ■ ■ ■
RB	300 Ω	■ ■ ■ ■ ■
R1, R4	680 Ω	■ ■ ■ ■ ■
R15, R16	180 Ω	■ ■ ■ ■ ■

The PCB should look like Fig 7 when all the resistors have been soldered.

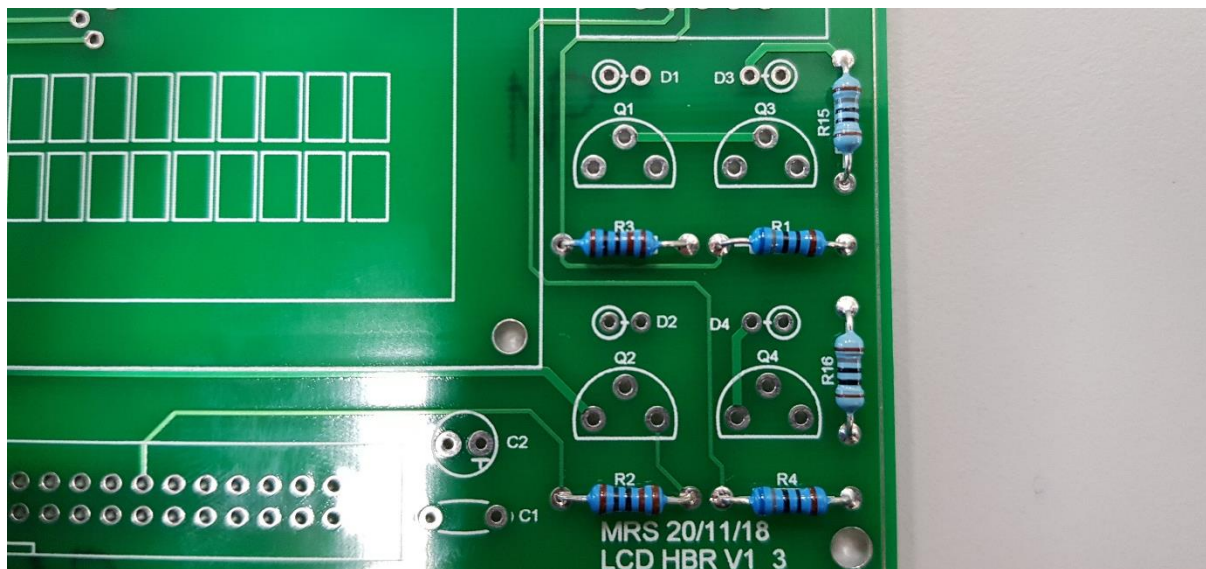


Fig7: Soldering the Rest of the Resistors

Diodes

Use pliers to bend one of the leads around 180 degrees (Fig 8). This lead is the one at the **black banded** end of the diode. **Please note that the body of the 1N4148 diode is made from glass, and damage will result in sharp shards.**



Fig8: Bending Diode Leads

Place the diode onto the PCB, **with the body of the component against the hole marked with a white circle, and the bent lead through the unmarked hole (Fig 9).**



Fig9: Diode PCB Placement

Bend the leads on the solder side of the PCB to affix it to the board, then solder and crop the leads. D1, D2, D3, and D4 all use the 1N4148, so repeat this process for the remaining diodes (Fig 10). **Pay attention to the polarity of the diode, and the orientation when it's on the PCB**

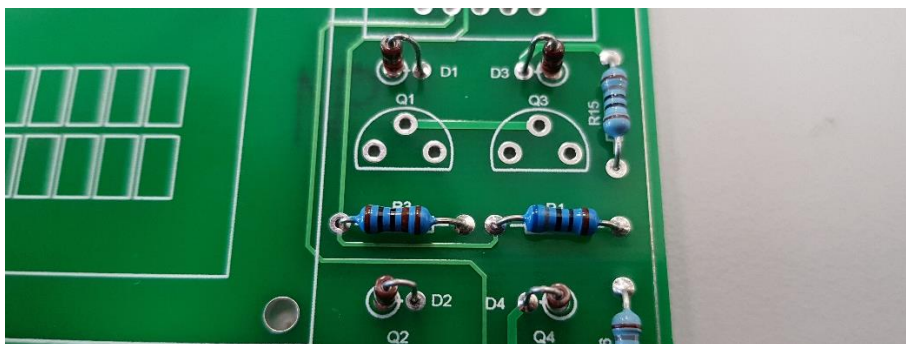


Fig10: All the Diodes Soldered

Capacitors

Solder the 100nF capacitor at the position marked C1 (Fig 11). This capacitor is ceramic and is not sensitive to polarity.

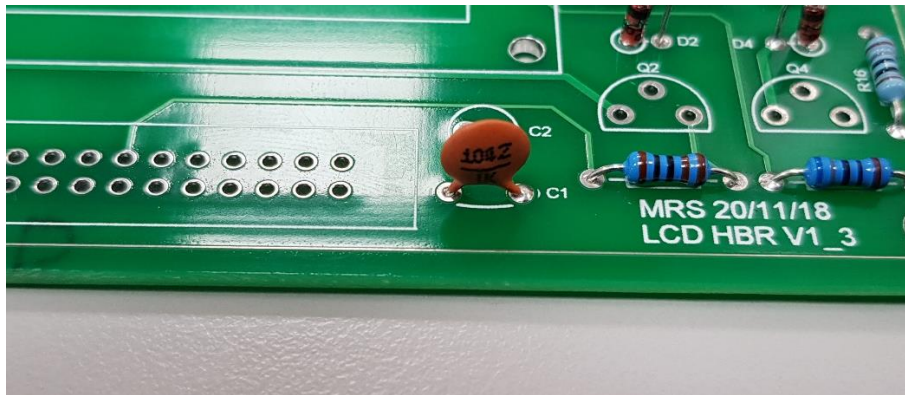


Fig11: 100nF Capacitor Soldered onto the PCB

Next identify the 10uF Capacitor, which is electrolytic, and place it on the PCB at the location position marked C2. **Note that this type of capacitor is sensitive to polarity, double check this before soldering (Fig 12).** The long lead of the capacitor is to thread through the hole marked with a plus symbol.

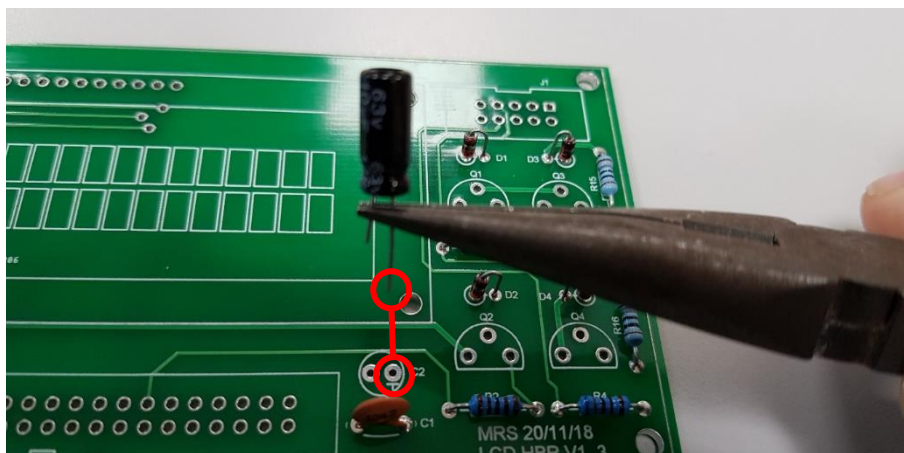


Fig12: Electrolytic Capacitor Polarity

Transistors

Take a BC639 transistor (which can be identified by the code engraved on its flat side) and slightly spread its leads (Fig 13).

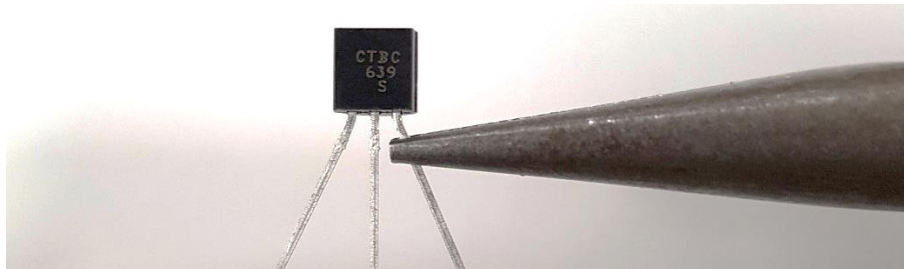


Fig13: BC639 Transistor with Leads Bent and Code Visible

Place it onto the PCB at code Q1 and **assure it's orientated correctly as indicated by the markings on the board (Fig 14).** Spread the leads on the solder side of the PCB to affix the component to the board, then solder and crop the leads.

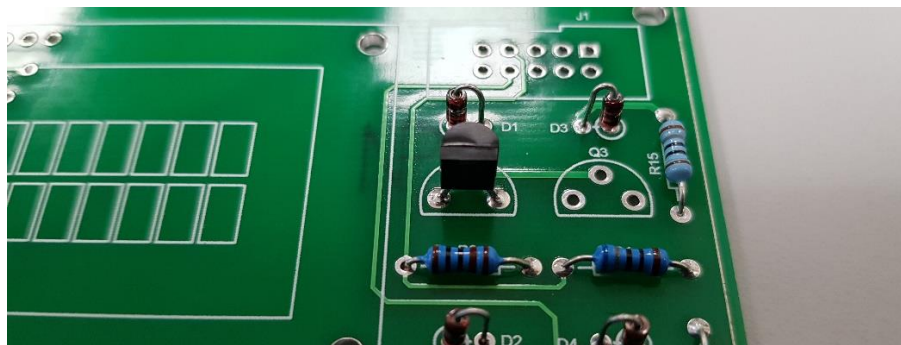


Fig14: BC639 Transistor Correctly Soldered in Place

Repeat this process for the remaining transistors, using the table below to select the correct the component. **Double check the transistor codes before soldering.**

PCB Code	Transistor Code
Q1, Q2	BC639
Q3, Q4	BC640

Connectors

Select the 40-pin connector, and **orient it so that the notch aligns with the marking on the PCB (Fig 15).**

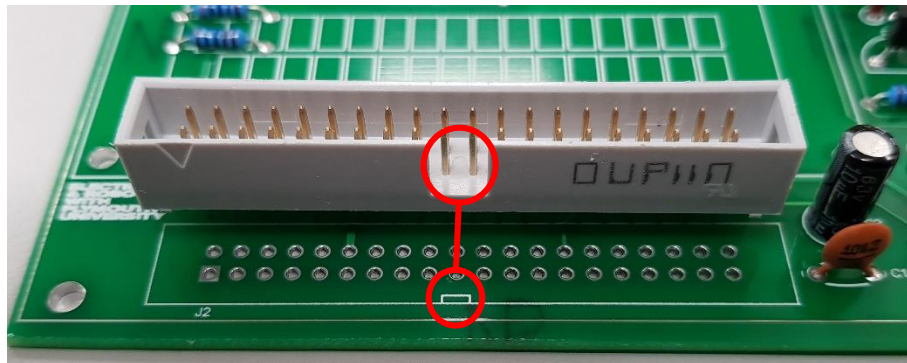


Fig15: 40-pin Connector Aligned correctly

Place onto the PCB and **solder only two pins at opposite ends of the connector (Fig 16).** This is to allow you to reseat the connector so that it sits flat on the board.



Fig16: 40-pin Connector Soldered onto the PCB via Two Pins

If the connector does not sit flat on the PCB, reheat one of the two soldered pins and press the component down so that it does. Once the connector is well seated (Fig 17), solder the remaining pins.

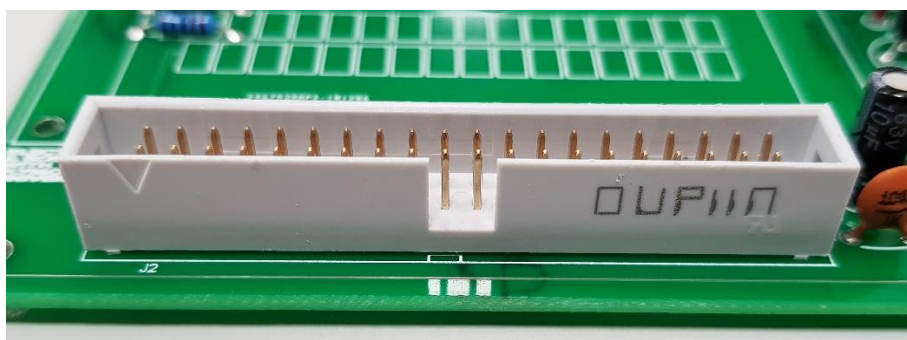


Fig17: 40-pin Connector Soldered onto the PCB

Repeat this process for the 10-pin connector and the 16-pin connector to finish the PCB (Fig 18). **The 10-pin connector also has a notch so make sure it is oriented to align with the PCB markings.**

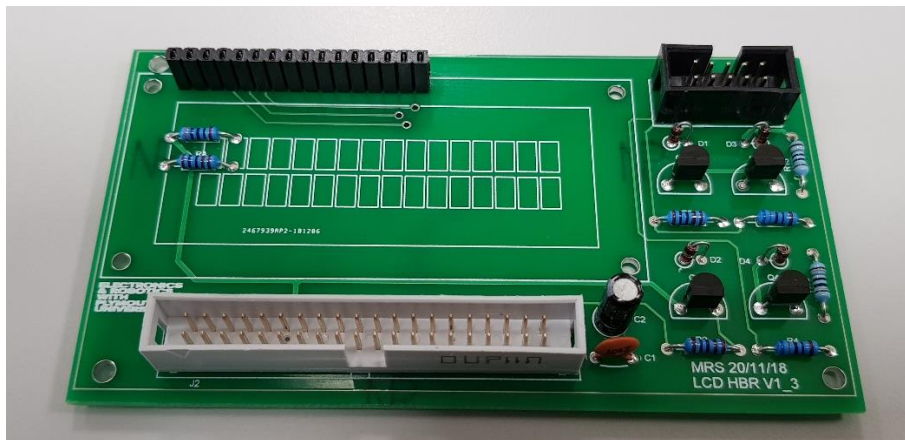


Fig18: Finished PCB

STOP

Double check your work and ask a member of staff to confirm assembly is correct before testing and connecting to the DE0-NANO FPGA development board.

Ribbon Cable

The cable described in these instructions is to connect “LCD and H-Bridge board” with the “Motor and Encoder board”. Included in your kit is some 10-way ribbon cable, and two IDC connectors (Fig 19).



Fig19: Cable Parts Included in the Kit

Two of the parts have exposed sharp metal contacts, these will cut into the rubber insulation and connect to the wires inside. To do so, **insert the ribbon cable into the connector so its flush with the end (Fig 20).**

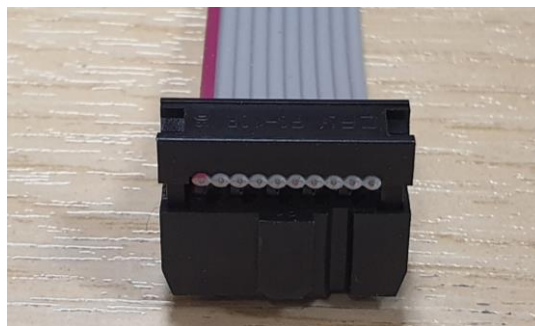


Fig20: Ribbon Cable Inserted into the IDC Connector

Then place the connector into the IDC crimping tool (Fig 21). **Double check the placement of the ribbon cable in the connector** before squeezing the tool to lock it shut.

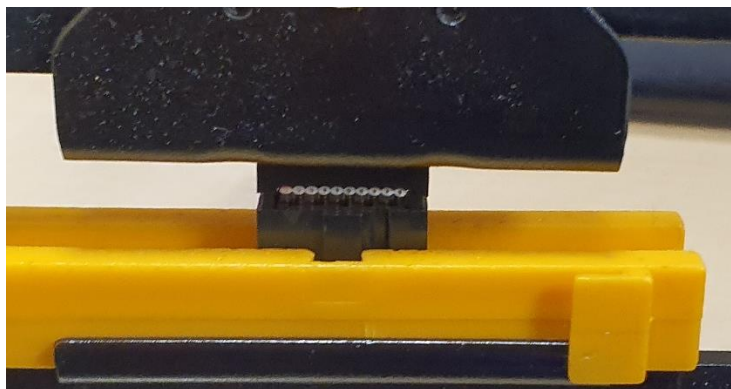


Fig21: IDC Connector + Ribbon Cable in the Crimping Tool

Complete this process for both sides of the cable. **However, double check the orientation of the two connectors. One will have the notch pointing out, the other will have the flat side pointing out (Fig22).**

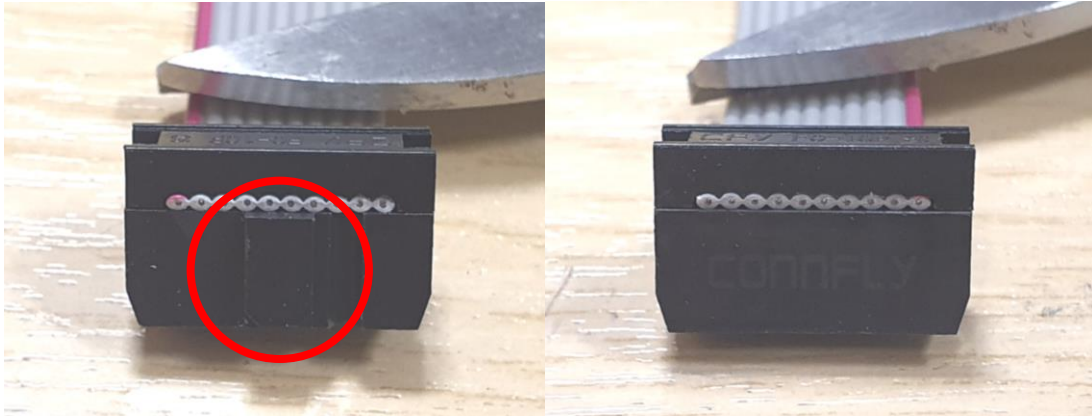


Fig22: Both Ends of the IDC cable. One with the Notch Facing Out, the Other with the Flat Side Facing Out.

Finally, fold the ribbon cable over the IDC connector, and clamp it down with the included cable fastener (Fig 23).

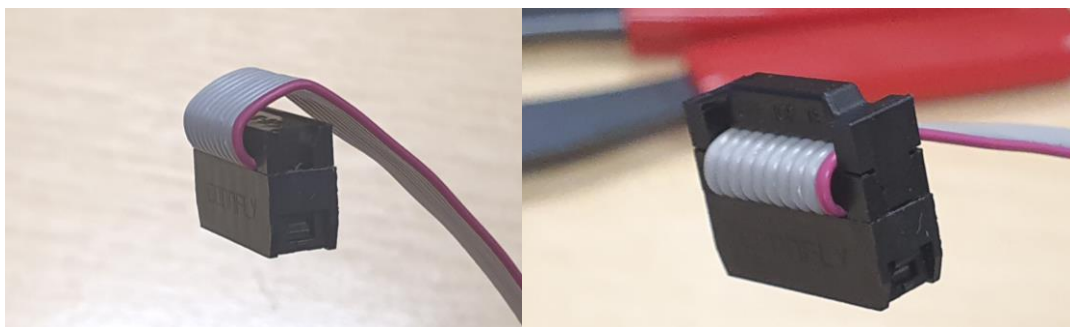


Fig23: Bending the Ribbon Cable Over the Top and Attaching the Cable Fastener.

Do so for both sides of the cable, and the finished product should look like Fig 24.



Fig24: Finished 10-way IDC Cable