1 Analog2.0 Synthesizer Mechanism and How to Make

1.1 What is Analog 2.0?

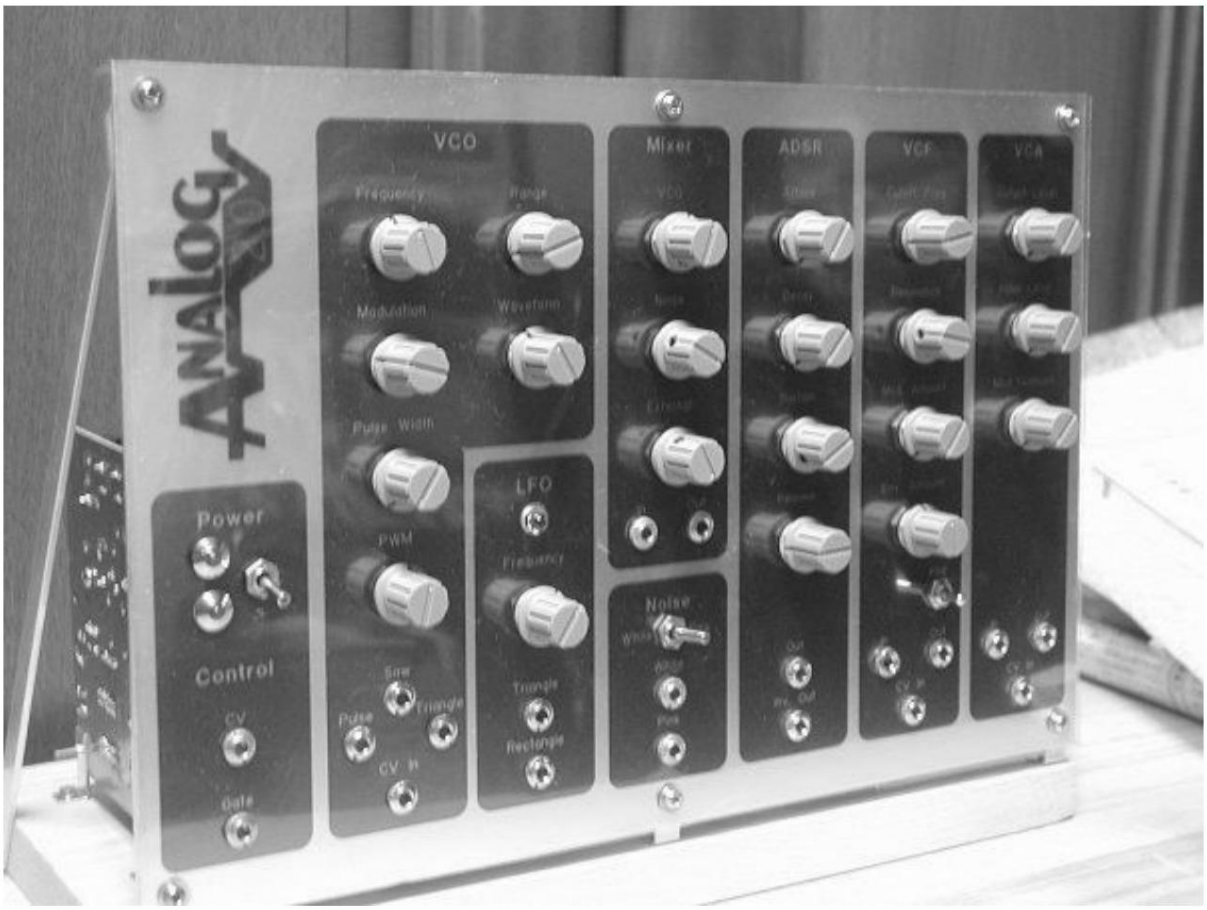


Figure 1: Appearance of Analog2.0

Analog2.0 **is a modular system synthesizer designed to be easy to make even for first-time users.**

It's analog.

The board is divided into modules for each function.

The circuit was designed to be as straightforward as possible, avoiding quirks.

The board is made as large as possible to make it easier to make. Thanks to that, it is easy to modify.

Ordinary modular synthesizers don't sound just when you turn them on, and they require patchwork to make sound,
Analog2.0 **is internally connected so that sound will be output as soon as the power is turned on.**

But patching is more interesting.

1.2 Panels and configurations

The design of the panel looks like this.

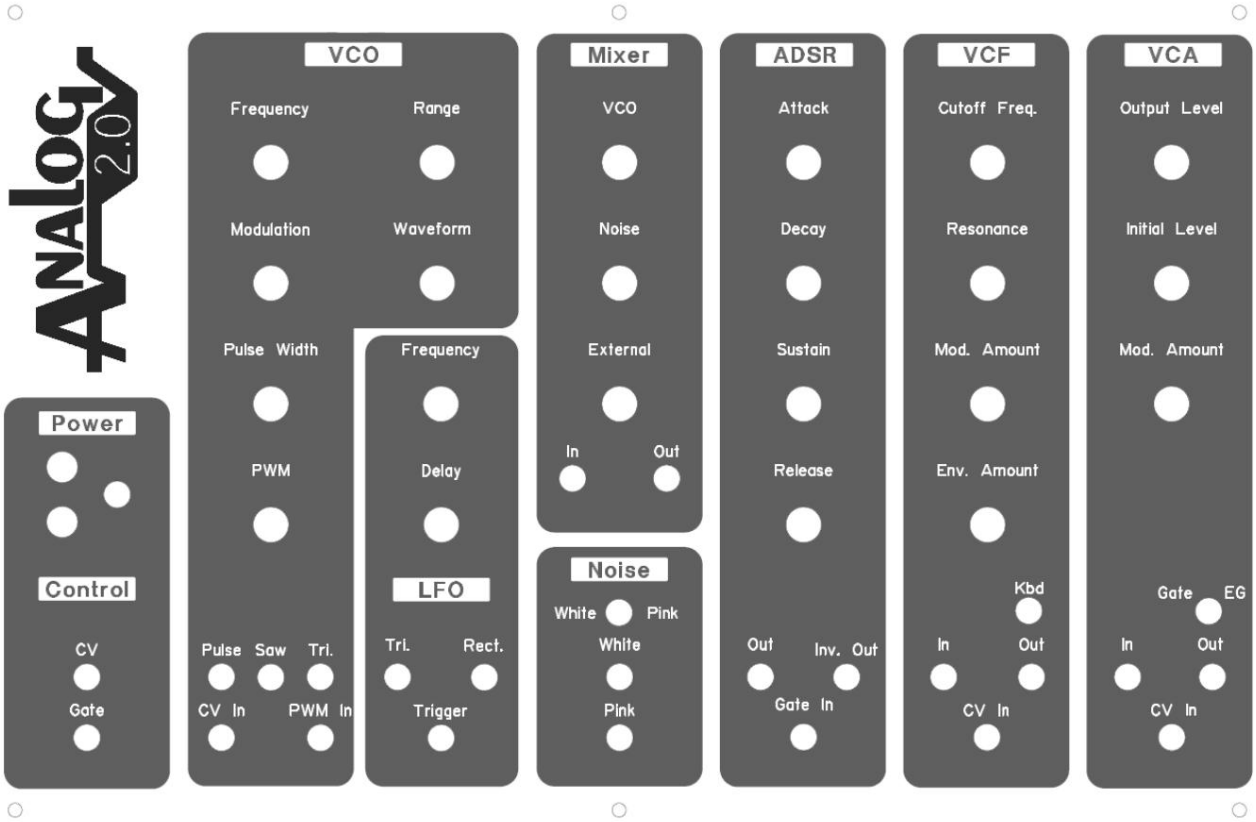


Figure 2: Panel design of Analog 2.0 panel design

It consists of one VCO, one VCF, one VCA, one LFO, and one envelope generator. **The starter kit includes a power supply and a lifeline.** An **optional** Gate / CV **generator is connected.**

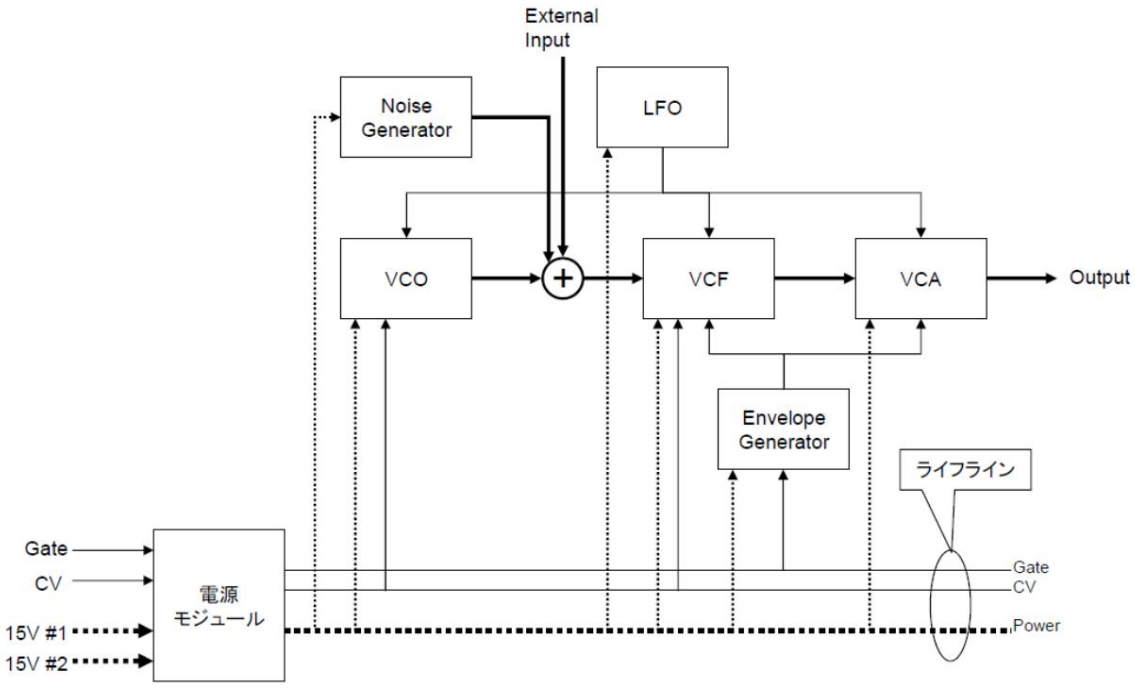


Figure 3: Analog 2.0 configuration

1.3 How the system works

The Analog2.0 **system consists of a base system and functional modules.**

The base system consists of a panel and a lifeline cable that supplies power and power and control signals to functional modules. This is the foundation for building a modular synth.

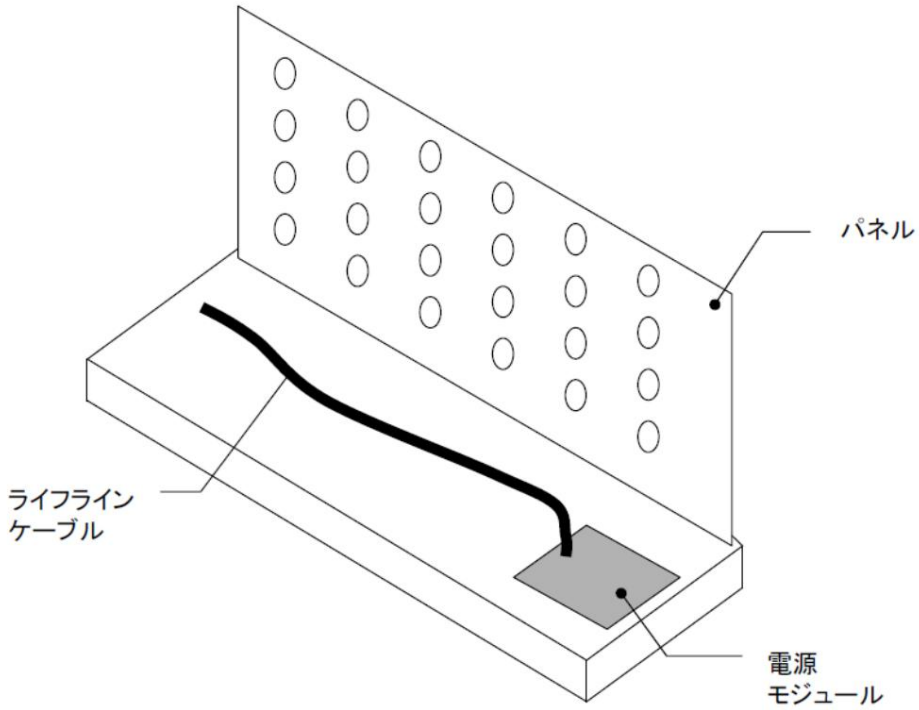


Figure 4: Base system of Analog 2.0 base system

Functional modules are **the "sound-making" components of synthesizers such as** VCOs, VCFs, and VCAs .

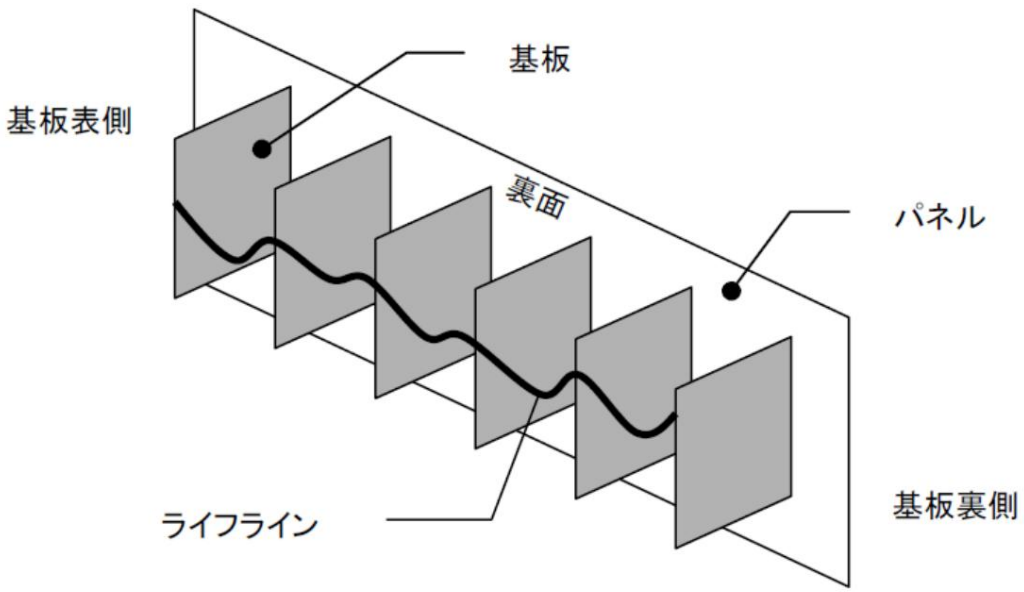


Figure 5: Panel with functional modules attached to

There are 6 types **of functional modules of** Analog 2.0 :

- VCO
– VCF
– VCA
– **Mixer and noise generator**
– **Envelope generator**
– LFO

The Analog 2.0 **starter kit includes base system components and a functional module board.**

However, the starter kit does not include the case and functional module parts.

1.4 How to make an Analog 2.0 system

First, assemble the base system. The base system is the foundation of the synthesizer, the power supply and the panel.

Once the base system is assembled, assemble the functional modules one by one and attach them to the panel. When all the modules are installed, it functions as a synthesizer. The documents are written on the assumption that they will be created in the following order.

1. **Mixer and noise generator**
2.VAC
3. VCO
4. **Envelope generator**
5. LFO
6. VCF

2 What is included in the starter kit and what is included in the starter kit

– Analog 2.0 **board set** (8 sheets)
  – **Power supply**
  – MInI Board II (CV / Gate **generator)**
  - VCO
  – VCF
  – VCA
  – **Noise generator and mixer**
  – **Envelope generator**
  – LFO
– AC **adapter** 15V x 2
– **Power supply module parts**
– **Lifeline cable parts**
– MInI Board II **parts**
– **Resource** CD

– **Special parts set**

– CA3046 **Transistor Array** (used by VCA)

– **Temperature compensation resistor** (used by VCO)

3 What is not included in the starter kit What is not included in the starter kit

- **The base system includes the power supply, panel, and lifeline cable, not the case. set**
  When standing **up, it is easier and more convenient to stand the** panel on a wooden base with L -shaped metal fittings **rather than the case.**
  However, this base tree is not included in the kit either.
- The **functional module is the board only. Does not include components.**
- **The power module does not attach to the panel, but does not include the screws and spacers to secure it to the case.**
  Please obtain it according to the case.

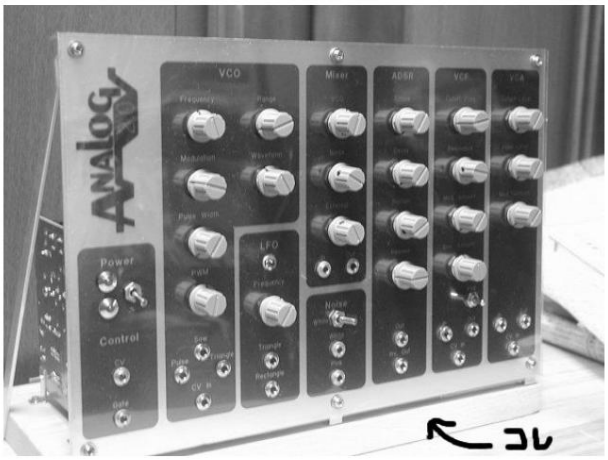


Figure 6: Base tree

4 Scope of description in this document

This document describes how to assemble the base system. For functional modules, see the following See the cure.

Functional module	**Document file name**
MInI Board	miniboard.pdf
Mixer and noise generator mixer_noise.pdf	
VCA	vca.pdf
VCO	vco.pdf
Envelope generator eg.pdf	
LFO	lfo.pdf
VCF	vcf.pdf

5 Production of base system

5.1 Panel production

First, make a panel out of the panels, power supplies, and lifelines that make up the base system. As an option, if you purchased a drilling panel, all you have to do is make an OHP sheet of **artwork and assemble** it . Skip **sections** 5.1.3 , **5.1.4 and 5.1.5.**

5.1.1 Outline of the panel to be manufactured

The structure of the panel is as shown in Fig. 7 .

The OHP sheet is sandwiched between a 300mm x 200mm x 1mm **aluminum plate and a transparent acrylic plate . Print panel artwork on transparencies . The mounting holes for the parts are stacked and the drill is passed through. Although it has a simple structure as a panel, it has the following merits.**

- **Eliminates troublesome painting and lettering.**
- **You can drill holes using** transparencies **with marks ,** so you don't have to scribble.

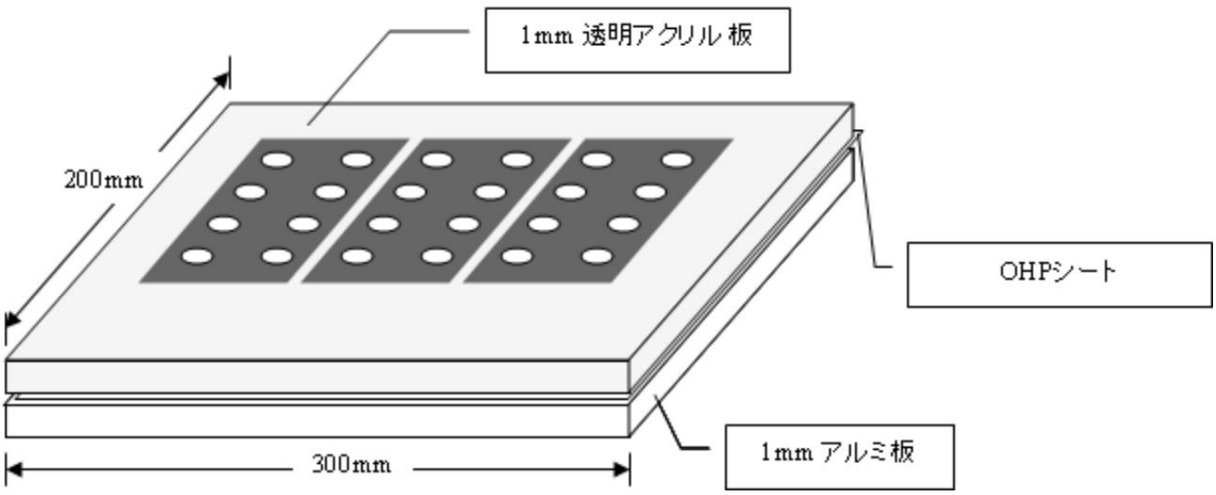


Figure 7: Analog 2.0 Prototype Panel Structure

Based on such a panel design, the production is performed in the following order.

1. **Disconnect**
2. OHP **sheet printing for drilling**
3. **Drilling**
4. OHP **sheet printing and processing for artwork**

5.1.2 What is required for panel production

props:

- **Acrylic cutter (if needed)**
- **Drill**
- **Tapered reamer**
- **Driver pliers**
- Printers **that can print on** transparencies **such as inkjet** printers

Material:

- 300mm x 200mm x 1mm **aluminum plate**
- 300mm x 200mm x 1mm **transparent acrylic board**
- 2 A4 **transparencies**
- 6 3mm x **10mm screws**
- 6 3mm **nuts**

Select an OHP sheet that can be printed by a printer. Transparencies **for each printer type, such as inkjet printers and laser printers, are on sale.**

Screws and nuts are used to fix stacked aluminum plates, acrylic plates, and transparencies.

5.1.3 Material cutting

When making a panel, first of all, cut the aluminum plate and acrylic of the material to the desired size. The best way to do this is to get a board that has been cut to the desired size from the beginning. No need to use tools for cutting, easy and reliable. If you can't get the one you want, you can ask the home improvement store to cut it.

You can easily think of a method using a gold saw to cut an aluminum plate, **but you can also cut an aluminum plate with a thickness of** about 1 mm with a cutter knife.

The size of **the A4** OHP **sheet is** 297mm x 210mm , which **is slightly different from 300x200. It is necessary to cut the sheet of the protruding part. This is easier to work with if done at the finishing stage.**

5.1.4 Transparency printing for drilling

Next, drill holes in the panel. Follow the procedure below to make a hole.

1. **Print the artwork marked with the drilling position on the** transparency .
2. Place **the printed** transparency **between the aluminum plate and the acrylic plate.**
3. **Make a hole at the mark position of the artwork.**

First, print an OHP sheet **for drilling . Figure** 8 **shows the panel layout.** Print the panel_with_reference.pdf file **inside the resource file .**

The following are notes on printing.

- **Select an OHP sheet in the paper selection when printing .**
- **Select high image quality. (Because the darker the color, the easier it is to work)**
- Print at 100% **scale .**
- **Do not touch the printed surface immediately after printing.** When printing on **transparencies , the ink does not dry easily.**

Often there is something wrong.

- **After printing, be sure to check whether the print was made to the correct scale. The method will be explained in detail later.**
  To do.

For **reference, the option settings when printing from Adobe** Reader 8 **are as follows. If it is underlined**
The time is where you need to change from the default.

Print range	**all**
Number of pages	1
Page enlargement / reduction	**none**
Automatic rotation and centering	**can be**

Select paper according to page size None

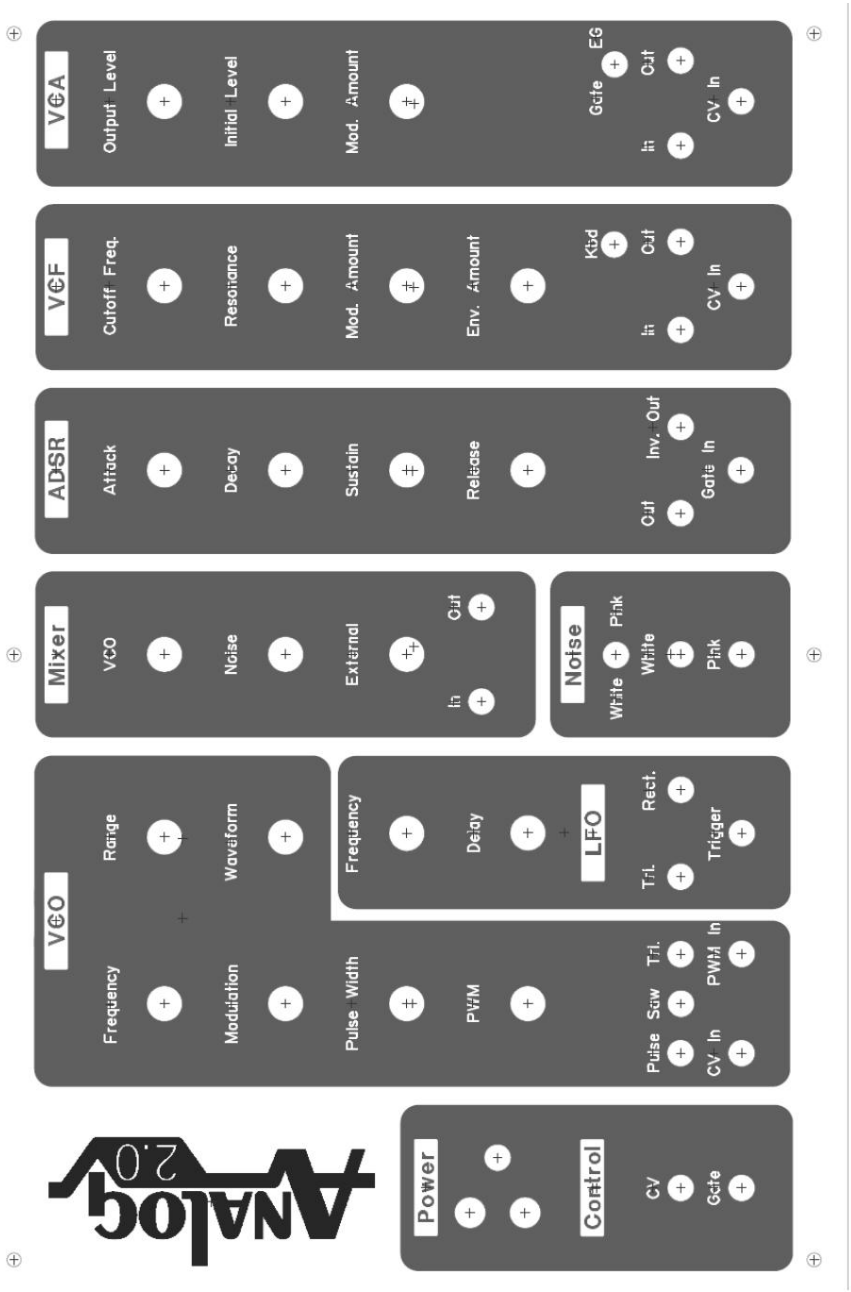


Figure 8: Drill Guide Transparency for Drill Guide

When you print, the layout shown in Figure 8 **is printed. This layout has a center mark (red plus mark) at the drill position, so it cannot be used as the final panel sheet. However, it is used for positioning when drilling by sandwiching it in the panel. This eliminates the need for scribes on the panel and simplifies drilling operations.**

Now, when the transparency **is printed, check if it was printed to the correct scale.**

Measure the distance between the frequency **and** PWM center marks **in the VCO frame of the printed sheet .** It is OK **if it is 84 mm (Fig. 9). If they are different, check if there are any differences in the settings and reprint.**

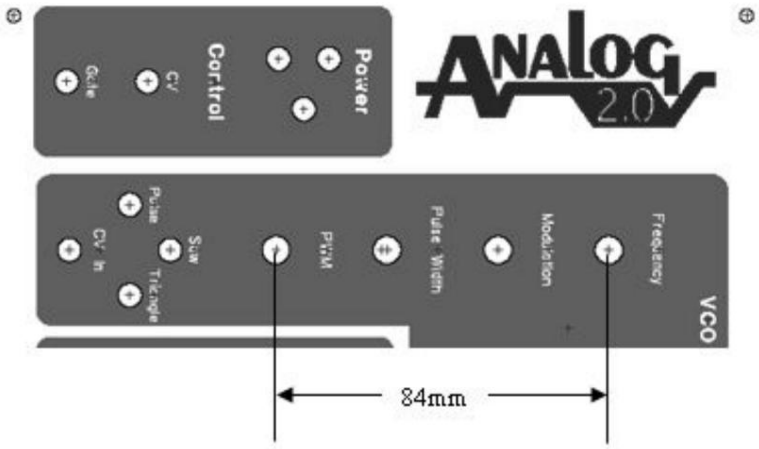


Figure 9: Transparency confirmation of OHP sheet scale confirmation

5.1.5 Drilling

After printing the transparency , **it's time to start drilling.**

To make a hole, follow the procedure below.

1. Sandwich the OHP **sheet between the aluminum plate and the acrylic plate**
2. **Make holes in the screw holes at the four corners and fix with screws.**
3. **Make holes for panel parts**

Fixing transparencies

The first task of drilling is to sandwich the transparency between the aluminum plate and the acrylic plate. Place the sheet in the correct position and pinch it firmly. It is easier to align the screw holes at the four corners so that they are equidistant from each corner. The layout determined here will be the finished layout, so work carefully.

If the acrylic protective sheet is transparent, leave it on. Leave the protective sheet on the aluminum plate still affixed.

When fixing the transparency , **it may be easier to proceed by sticking double-sided tape on both sides of the sheet. This is because it can prevent deviation from the determined position.**

Drill screw holes

After fixing the OHP **sheet, start drilling work. First, make a hole from the screw hole in the corner.** Drill the **screw holes with a** 3.2 mm **drill.**

If **you make screw holes first and fix the acrylic plate, OHP sheet, and aluminum plate, they will not shift from each other after that, so it will be easier to perform the subsequent work. On the contrary, if 3 sheets are misaligned in this work, it will be difficult to recover, so please work carefully (Fig.** 10).

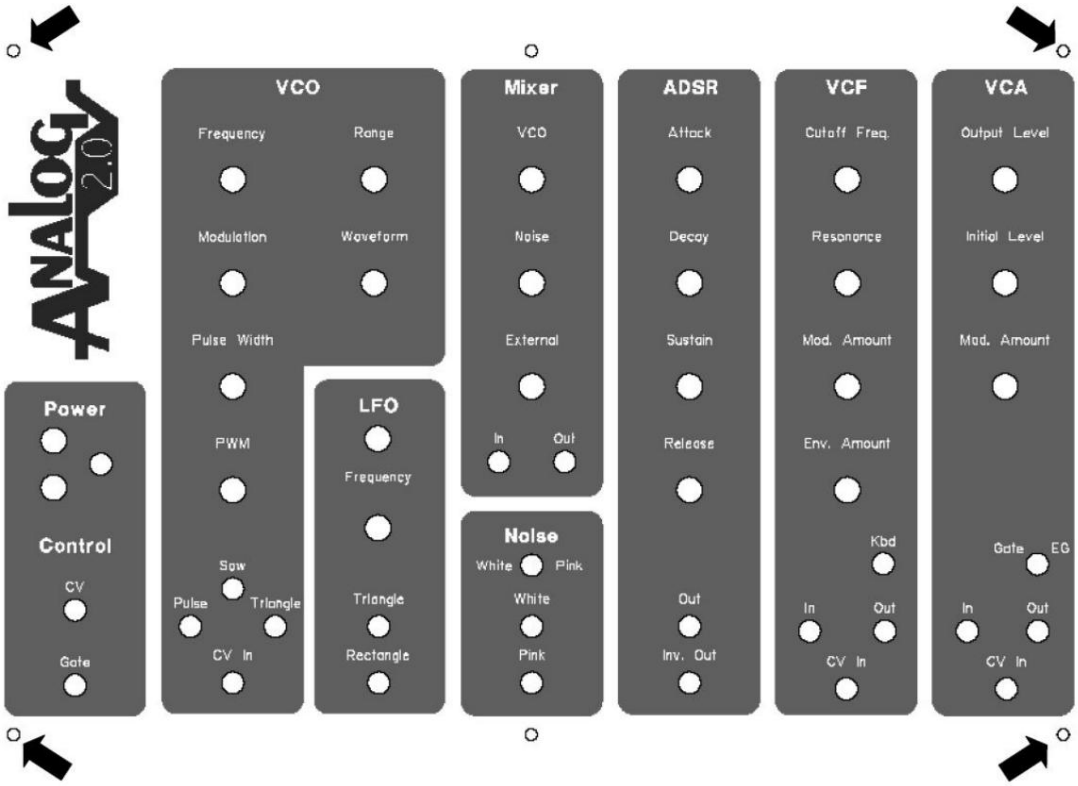


Figure 10: Drill screw holes first to fix acrylic plates, transparencies, and aluminum plates.

Drill a panel hole

After making screw holes and fixing the four corners with screws, make holes for the panel parts. See Figure 11 for **the number of millimeters of holes to drill . Since the drill diameter is large this time, be careful not to cause misalignment. If you use the following method, you can make a hole with relatively few mistakes even if you use an inexpensive tool.**

1. **Hit the punch according to the center mark of the hole to be drilled**
2. **First, make a small hole using a drill of about 1.5 mm. It is better to use a hand drill for this work**
   It is hard to cause this.
3. Use a 5mm **drill to make a large hole.**
4. **Use a taper reamer to widen the hole to the required size.**

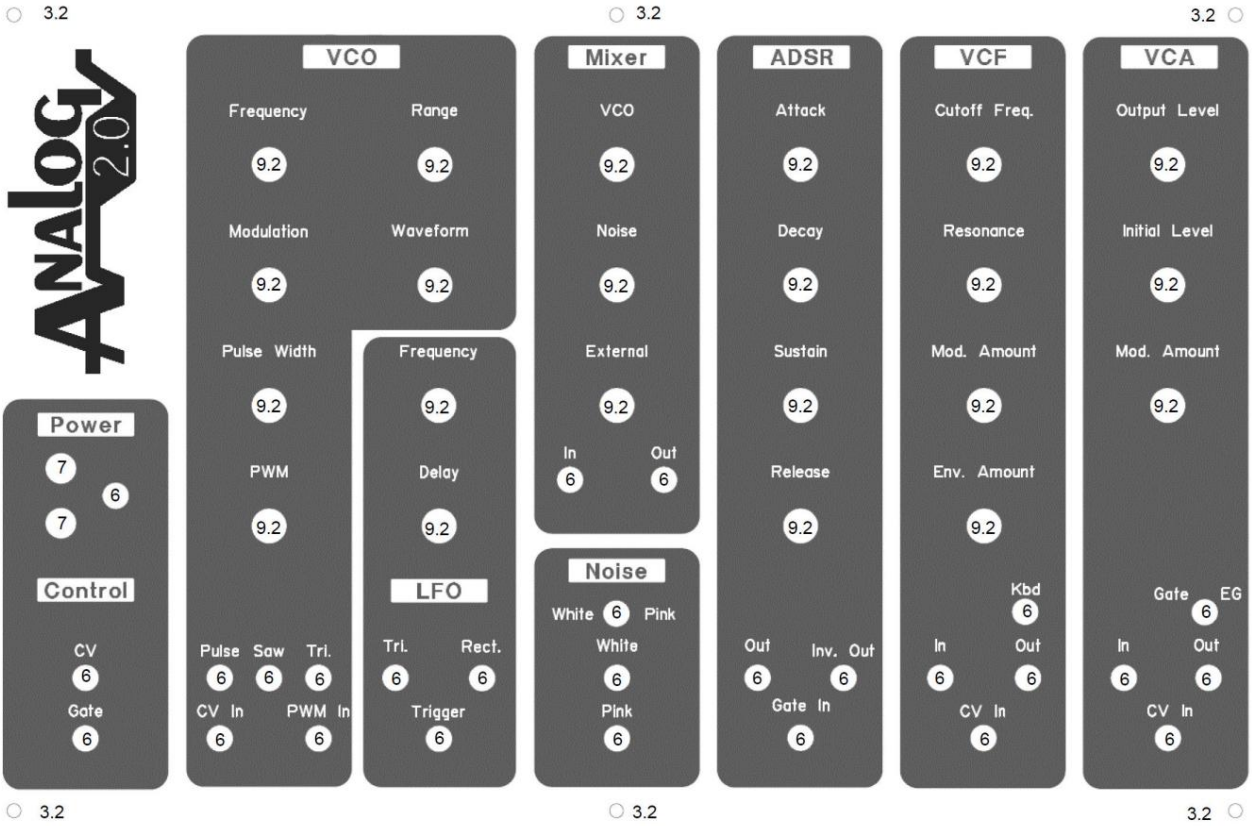


Figure 11: Panel drilling dimensions

If you can do it so far, the drilling work is completed.

5.1.6 For artwork Printing and processing OHP sheets for artwork

After drilling, it's time to finish.

The transparency **used for the drilling guide so far will be damaged throughout the work. Discard this sheet, print another** OHP **sheet, and use it for finishing.**

You can download the pdf file **for the artwork** from the Analog 2.0 support site. The **file name is** panel.pdf . **Print this out (Figure 12). The printing procedure is the same as for drills. The method for checking the scale is the same, but since there is no center drill this time, measure the drill hole spacing using the edge of the drill hole.**

Next, **remove the hole in the** transparency . **To punch holes, use a leather punch to get the job done quickly and cleanly.**

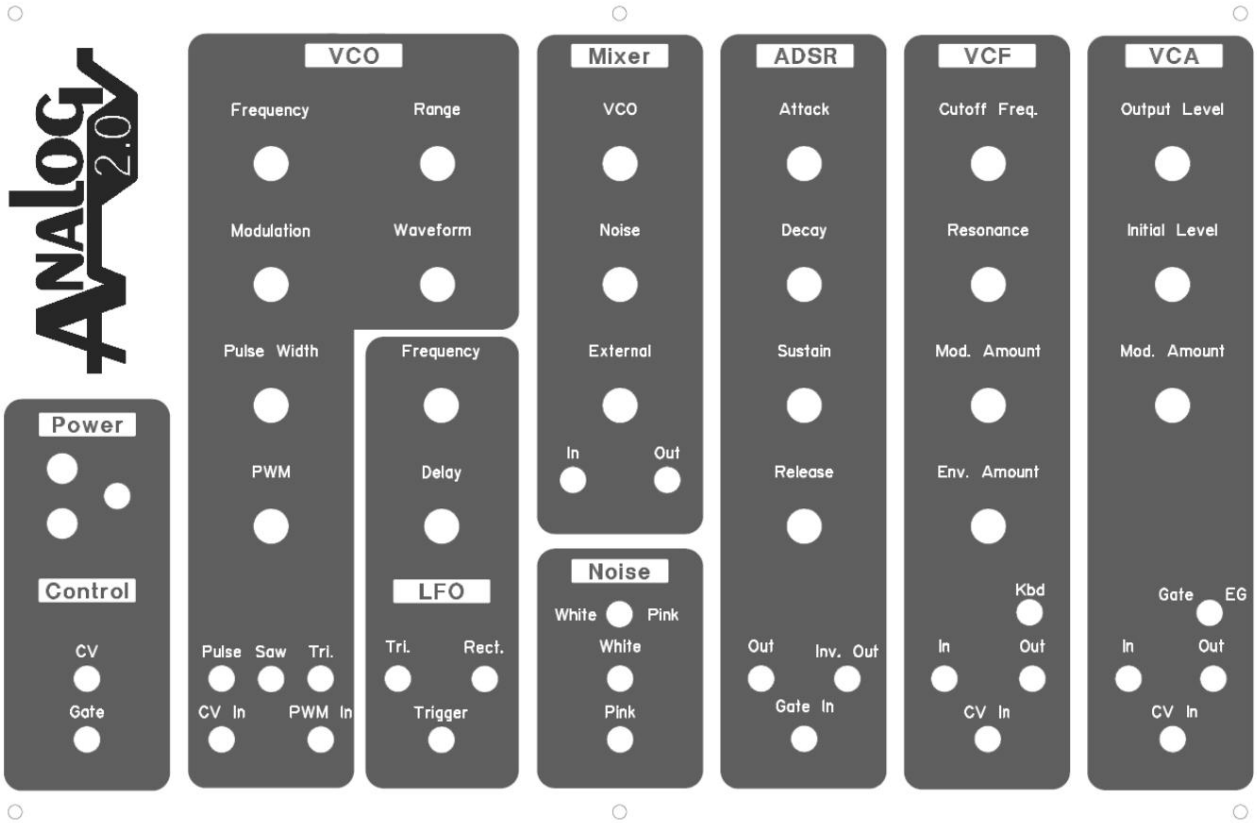


Figure 12: Artwork Transparency Layout for Artwork

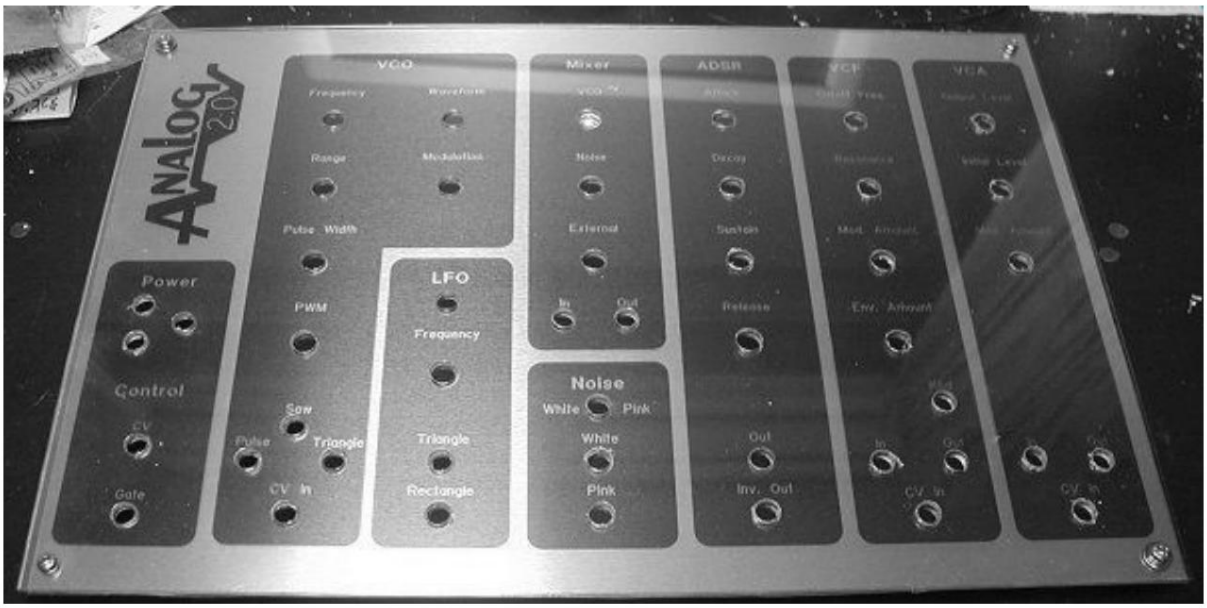


Figure 13: Completed panel

5.2 About the case

The Analog 2.0 **kit does not come with a case. It is absolutely necessary for practical use, so please make your own with your favorite design.**

When designing the case, the inner depth should be about 100 mm **to accommodate the functional module board .**

If possible , it is safer to have about 120 mm .

During production, **it may be easier and more convenient to stand the panel on a wooden base** using L -shaped metal fittings.

The power module cannot be mounted on the panel, but it must be secured to the case or base for safety.

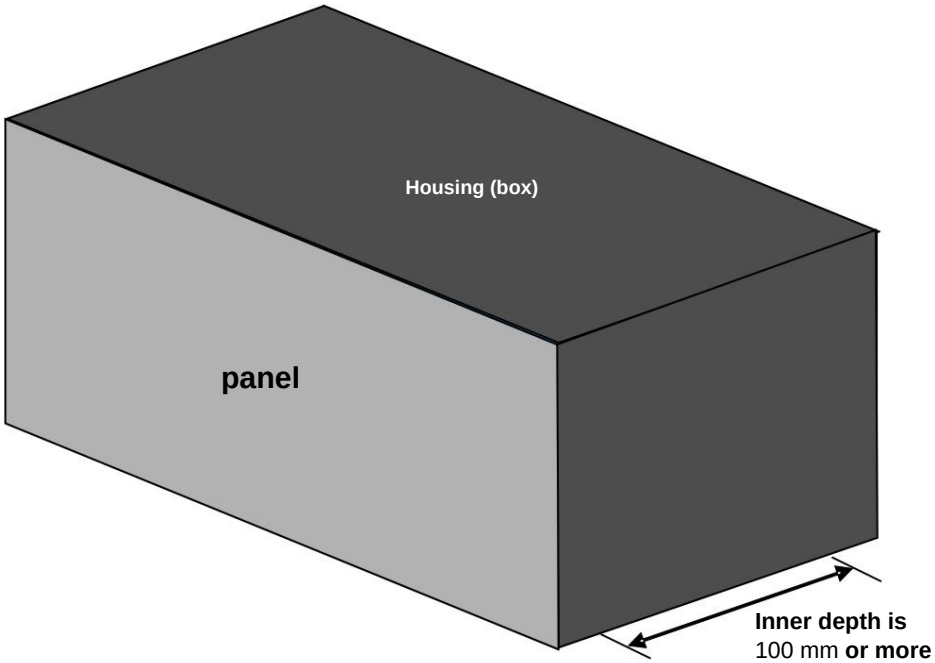


Figure 14: Image of housing

5.3 Manufacture of power supply module

5.3.1 Production flow

The power supply module is the first module you make. In the **Analog2.0 document, the explanation of module production will be in the following order.**

- **Get an overview of the modules you are building**
- **Get parts**
- **Prepare the board**
- **Attach parts to the board (soldering)**
- **Incorporate the board into the base system**
- **Check the wiring on the board**
- **Operation check**

5.3.2 Module to be manufactured Outline of the module to be manufactured

The power supply module is responsible **for supplying power to other functional modules such as** VCOs , VCFs, and VCAs **that make up** Analog 2.0. It **is also responsible for redistributing** the Gate **and** CV signals **received from the outside to the** functional module. The source of the power supply is obtained from two **switching** AC **adapters with 15V** output . **It's in the image of Figure** 15 .

In this way, the power supply, Gate, and CV **are sent to each module at once, and on the module side, only the necessary ones are pulled out and used. The power supply voltage output from this power supply module is ± 12V and the rated current is** 0.4A .

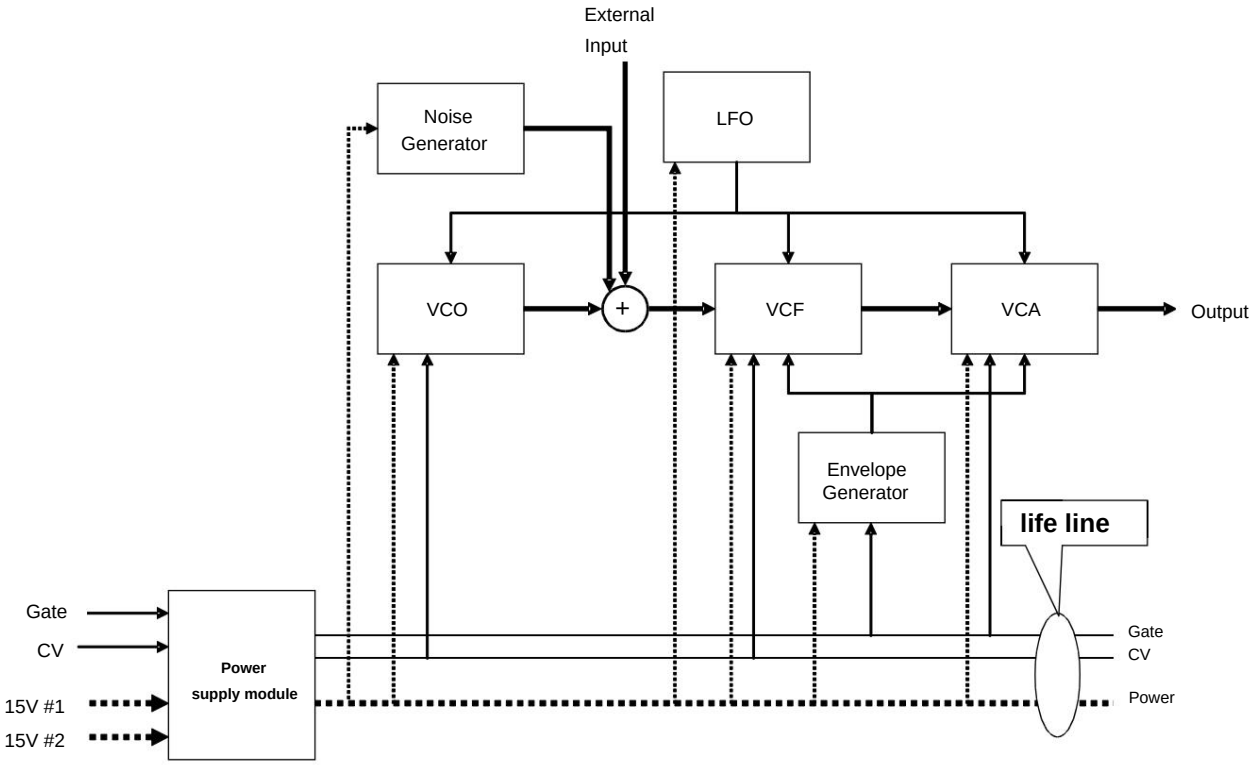


Figure 15: Power supply / control supply image of power supply module

Figure 16 **shows the power supply panel. It consists of a power switch, a power indicator, and a CV / Gate** input.

Figure 16: Power supply panel

Power and control functional modules are supplied via a flat cable with a connector called a lifeline cable. (Fig. 17)

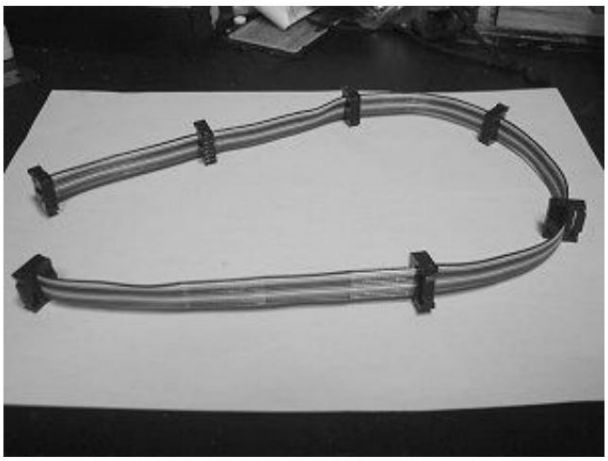


Figure 17: Lifeline cable

Figure 18 **shows the circuit diagram of the power supply circuit to be manufactured . The main purpose of this power supply circuit is to remove the noise component contained in the power supply supplied from the AC adapter, to obtain a higher quality power supply, and to reduce the output in the event of an overload.**

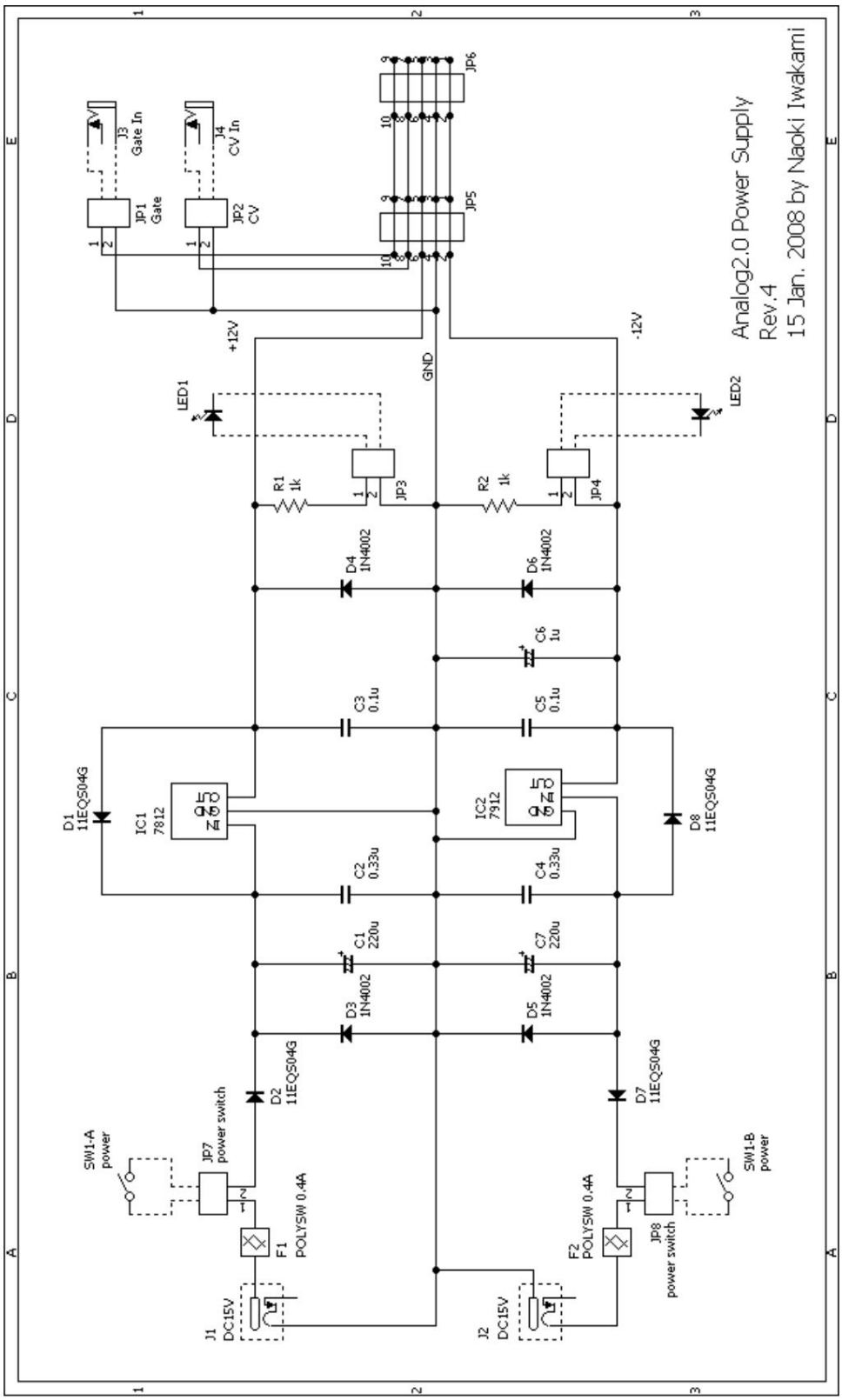


Figure 18: Power module schematic

5.3.3 Obtaining parts

The parts required for production are as follows. Please obtain these parts first when making. child
The parts list includes not only the parts to be mounted on the power circuit board, but also the LEDs **and switches** to be mounted on the panel.
It will be rare. It also contains the parts needed to make a lifeline cable. Get parts after the table
The notes on this are written.

surface *1*: **Parts required for manufacturing the power supply module**

parts number	Device name	Value / model number	remarks
C1	**electrolytic capacitor**	220μF 35V	
C2	**Multilayer Ceramic Capacitor**	0.33μF	
C3	**Multilayer Ceramic Capacitor**	0.1μF	
C4	**Multilayer Ceramic Capacitor**	0.33μF	
C5	**Multilayer Ceramic Capacitor**	0.1μF	
C6	**electrolytic capacitor**	1μF 25V	
C7	**electrolytic capacitor**	220μF 35V	
D1	**Schottky diode**	VS-11DQ04	
D2	**Schottky diode**	VS-11DQ04	
D3	**Schottky diode**	VS-11DQ04	
D4	**Schottky diode**	VS-11DQ04	
D5	**Schottky diode**	VS-11DQ04	
D6	**Schottky diode**	VS-11DQ04	
D7	**Schottky diode**	VS-11DQ04	
D8	**Schottky diode**	VS-11DQ04	
F1	**poly switch**	0.4A	
F2	**poly switch**	0.4A	
IC1	**positive power supply 3-terminal regulator**	LM7812	12V
IC2	**negative power supply 3-terminal regulator**	LM7912	-12V
J1	DC **jack** 2.1mm		
J2	DC **jack** 2.1mm		
JP1	**pin header** 2.5mm **pitch**	2 **pins**	**Cut from a single row pin header**

JP2 **pin header** 2.5mm **pitch**		2 **pins**	**Cut from a single row pin header**
JP3 **pin header** 2.5mm **pitch**		2 **pins**	**Cut from a single row pin header**
JP4 **Box** Pin Header 2.5mm **Pitch** 2x5 **Pin**			
JP5 **Box** Pin Header 2.5mm **Pitch** 2x5 **Pin**			
JP6 **pin header** 2.5mm **pitch**			**Cut from a single row pin header**
JP7 **pin header** 2.5mm **pitch**			**Cut from a single row pin header**
JP8 **pin header** 2.5mm **pitch**			**Cut from a single row pin header**
R1 **carbon resistance** 1 / 4W 5%		1kÿ	
R2 **carbon resistance** 1 / 4W 5%		1kÿ	
Off-board parts			
LED1 **panel mounting type** LED			**Wiring from** JP3
LED2 **panel mounting type** LED			**Wiring from** JP4
SW1 6P **toggle switch**			Wiring **from** JP7,8
J3	3.5mm **mini jack**		**Wiring from** JP1
J4	3.5mm **mini jack**		**Wiring from** JP2
	Lead		**Some need for panel component wiring**
	Switching AC **adapter**	15V	2 **necessary**
	Center Plus	**Above** 0.8A	
Heat sink related			
	heat sink		
	heat sink		
	Pan head machine screw	3x10	2 **this is necessary**
	nut	3mm	2 **necessary**

surface *2:* **Parts required for lifeline cable production**

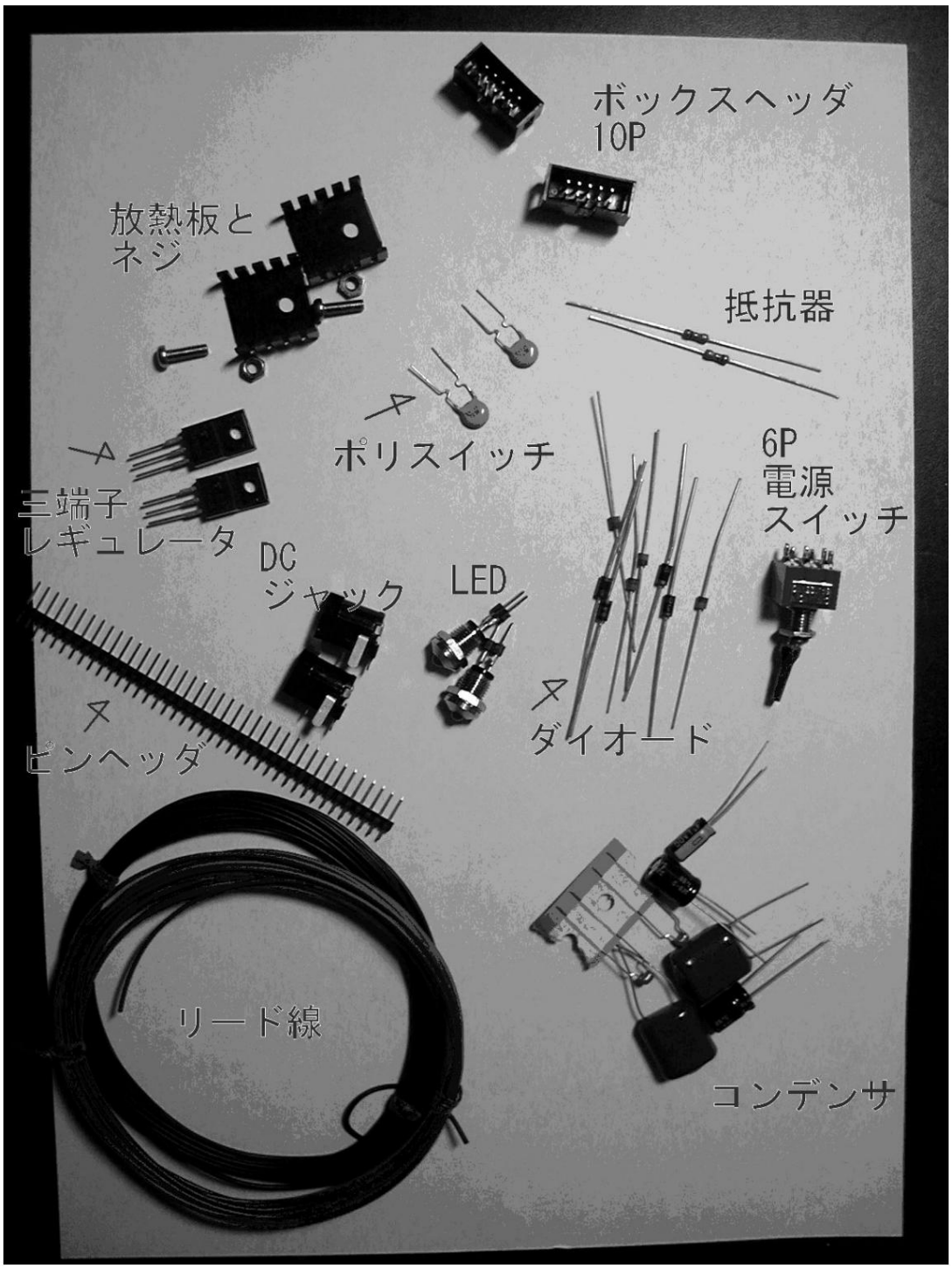
Part name	**Spec number**	**Remarks**	
10 **-core flat cable**	1m	1 **lifeline cable**	
Header socket 2.5mm **pitch** 2x5		7	

5.3.4 Precautions when obtaining parts

3.5mm mini jack The 3.5mm **mini jack is attached to the panel, so the "neck" part must be long to some extent.**

AC adapter **It can be used with** a 15V AC **adapter, Center Plus, and a capacity of** 0.8A or more .

Box pin header 5 **pins** 2 **rows are used. After this, I will use it in the function module as well. The straight type is used for the power supply module, and the** L **-shaped type is used for the functional module.**



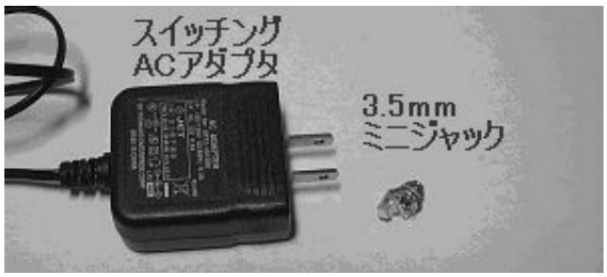


Figure 19: Parts required to make a power supply

5.3.5 Prepare the board

If you make your own power module board, the print pattern uses the power_brd.pdf file in the resource file. The kit comes with a board, so you can use it as it is .

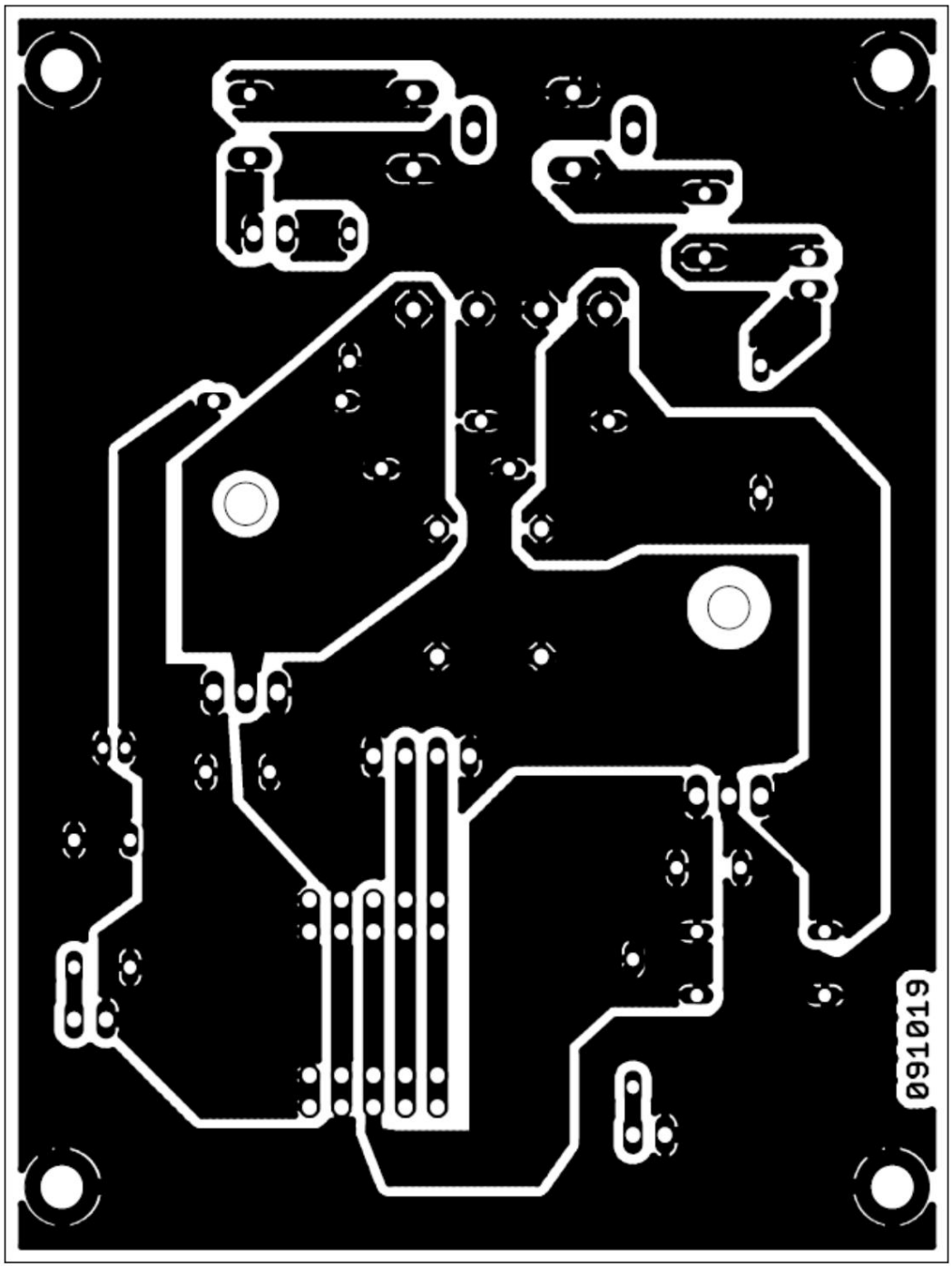


Figure 20: Print pattern of power supply module board print pattern

5.3.6 Attaching parts to the board

Refer to Fig. 21 for wiring.

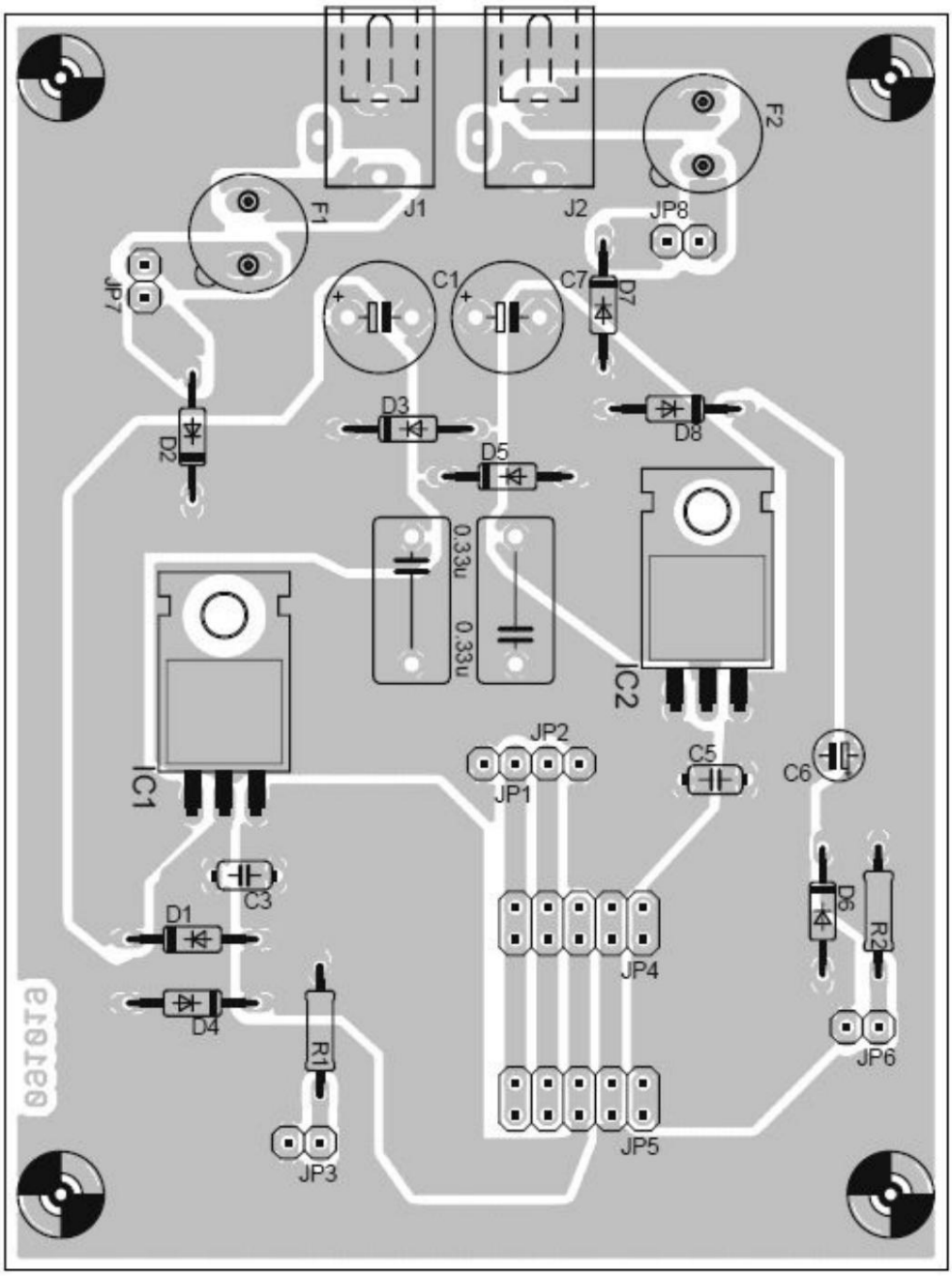


Figure 21: Wiring diagram of the power supply module board

5.3.7 Checking the wiring on the board

Check the wiring by referring to the checklist below.

[] Is the resistor installed in the correct place and with the correct value?

[] Is the diode installed in the correct place and in the correct type?

[] Is the diode installed in the correct orientation?

[] Is the correct type of capacitor installed in the correct place?

[] Is the electrolytic capacitor installed in the correct orientation?

[] Is the poly switch installed in the correct place?

[] Are IC1 and IC2 **installed in the correct place and in the correct orientation?**

[] Is IC1 = TA7812, IC2 = TA7912 ?

[] Is the jack pin header installed in the correct place?

[] Turn the board over and check the soldering points. Is there a solder bridge in which adjacent copper foil patterns are short-circuited by soldering?

[] As shown in Fig. 22 , **there is no point where the solder touches the substrate or copper foil, which is called immo solder. mosquito? If the body of the part is shaken and the lead at the soldering point moves, it is almost certainly immo-soldered. Immo solder will peel off over time, so if you find it, re-solder it.**

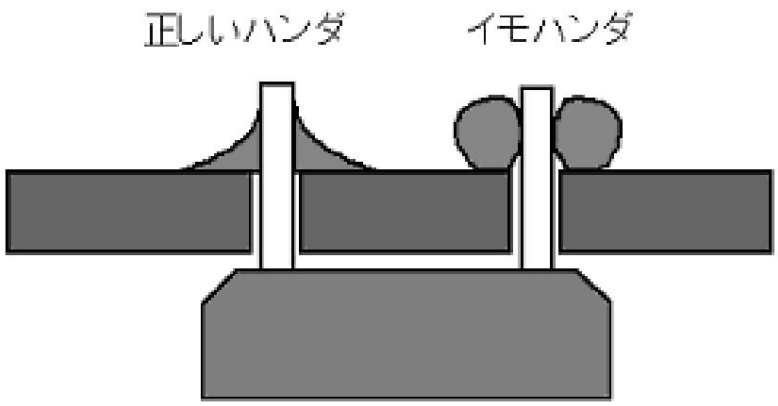


Figure 22: Correct solder and immo solder

5.3.8 Wiring of panel parts

Finally, wire the off-board components of the power circuit and attach them to the panel. Refer to Fig. 23 and Fig. 24 for wiring.

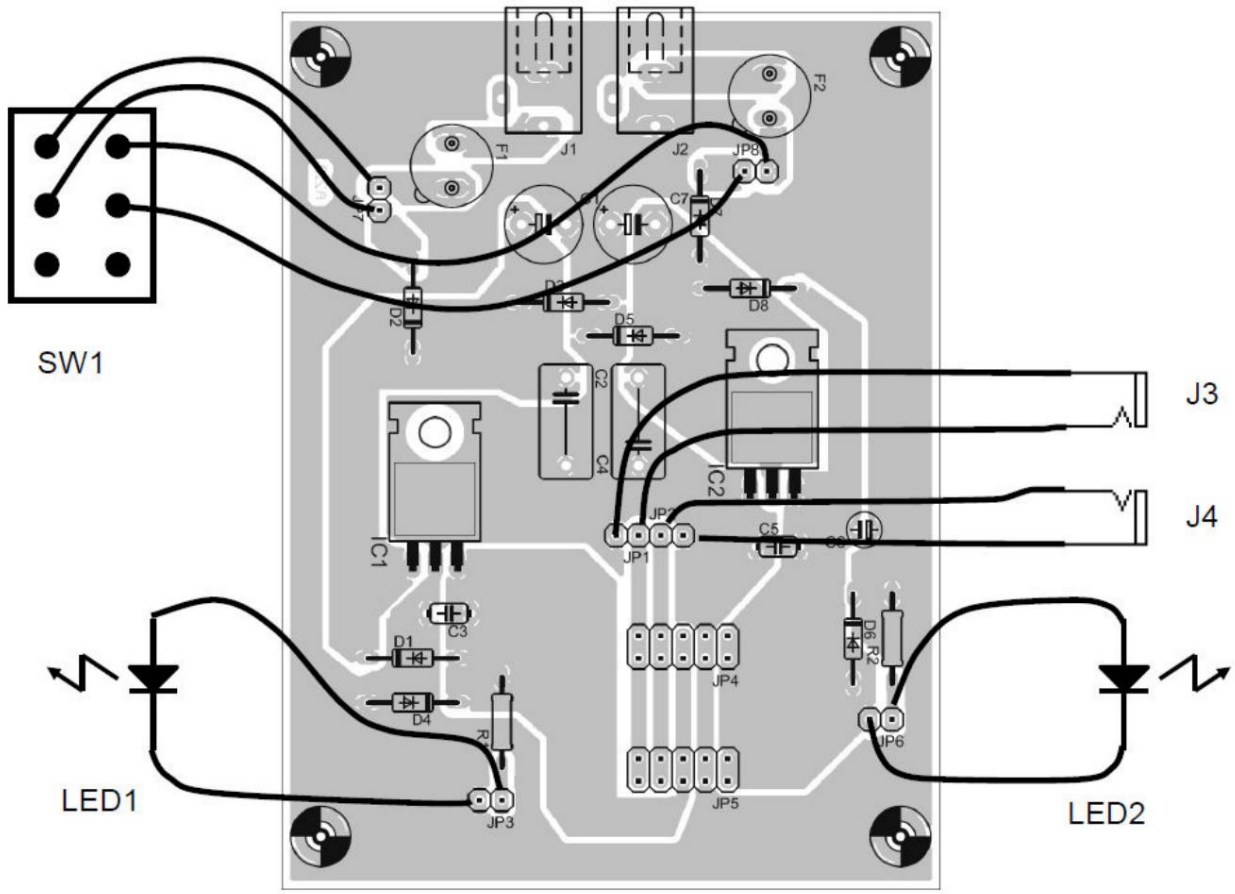


Figure 23: Wiring of panel parts

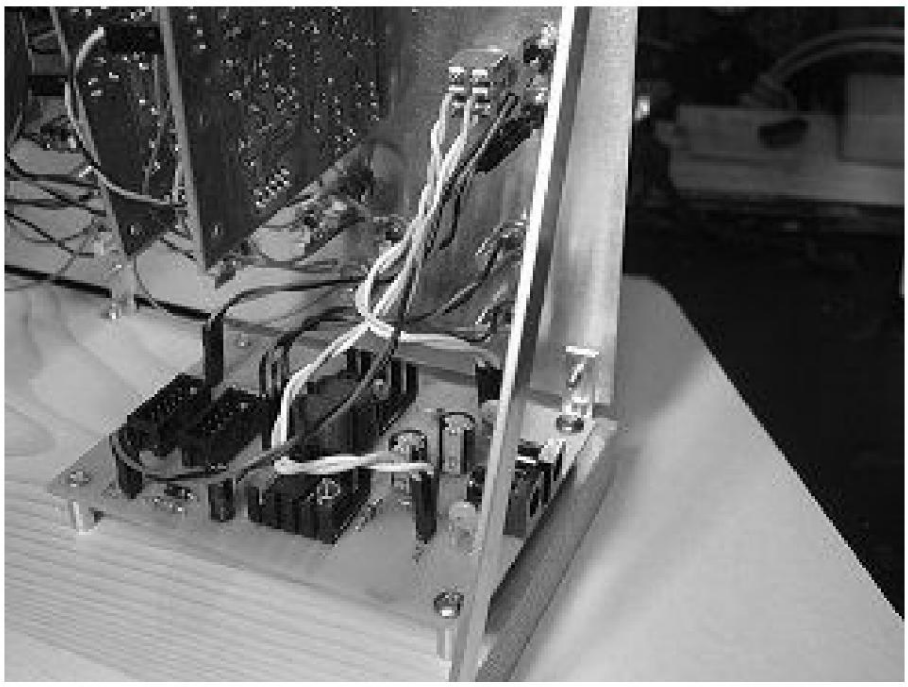


Figure 24: Power supply board mounting

5.3.9 Energization check

Now, let's check the operation.

Make sure that the power switch is turned off , connect the **two** AC **adapters to the jack, and finally turn on the power.**

Follow the procedure below to check the operation.

1. Check if both **of the two** LEDs **are lit.**
2. With reference to **Fig.** 25 , apply a tester to each pin of the output box header and **check that the voltage is correctly supplied to the + 12V and** -12V terminals.
3. Check the continuity between the Gate **and** CV **terminals and the input jack.** If possible , **voltage the Gate and** CV inputs **Give it and check if the voltage is transmitted to the terminal of the box header.**

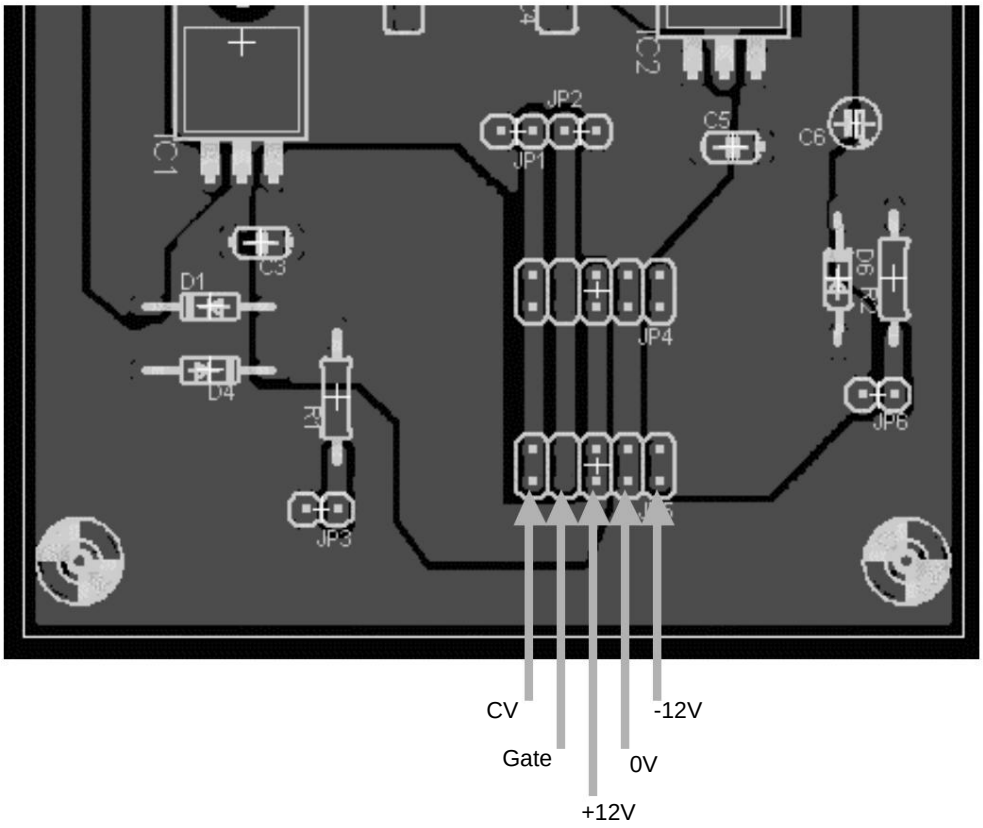


Figure 25: Output confirmation location

5.4 Lifeline cable Manufacture of lifeline cable

This section explains how to make a lifeline cable. A **lifeline cable is a cable that supplies power and** Gate / CV from the power supply module to each functional module . **It is made up of flat cables and connectors, as shown in Figure** 17 .

5.4.1 Cable to be manufactured

Here, only the circuit diagram is shown.

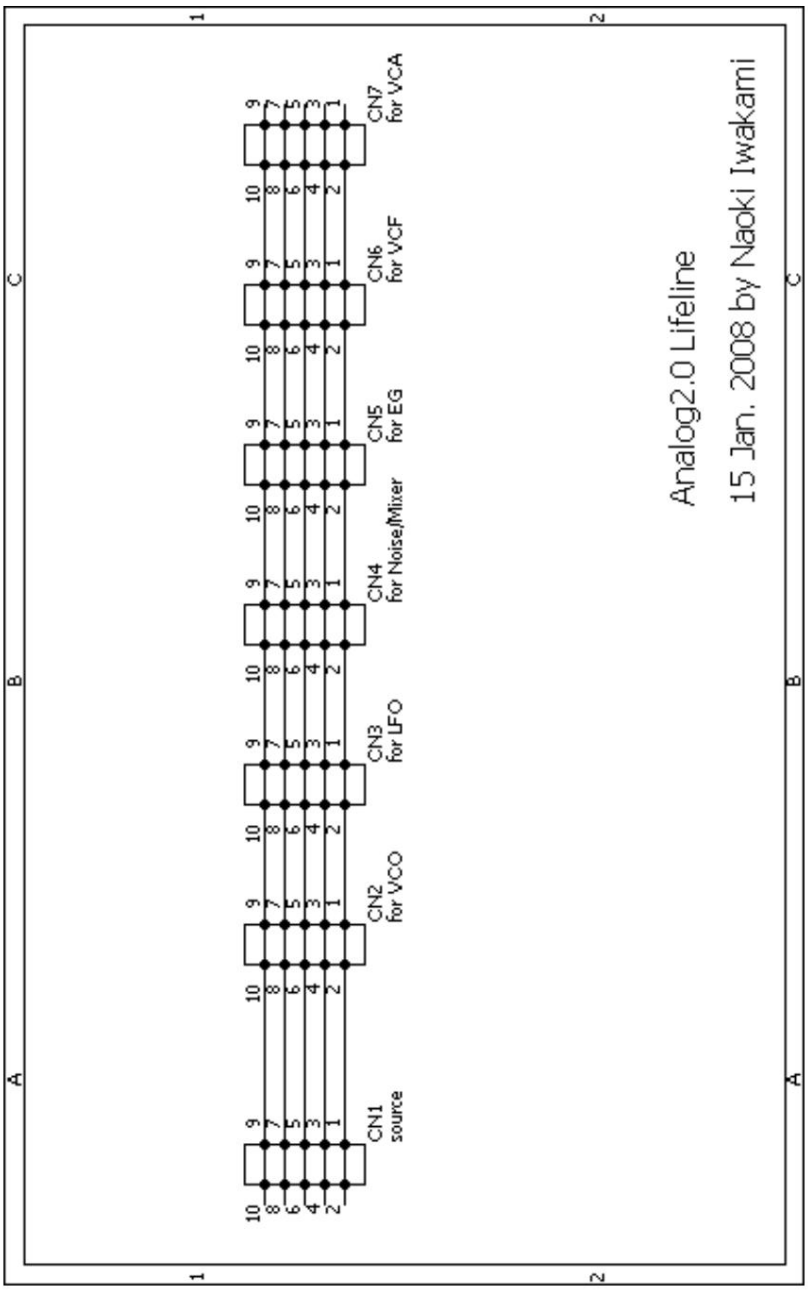


Figure 26: Lifeline cable schematic

5.4.2 Obtaining parts

There are only **two** types of **parts, as shown in Figure** 27 . **Figure** 4-2 **is a photo of the required parts. For reference when obtaining parts give me.**

surface3: **Lifeline cable parts list**

Part number	**Device name**	Value / model number	**remarks**
CN1-7 **Header**	**Socket** MIL **Standard** 10P (2x5)		7 **necessary**
	Flat cable 10 **cores**	55cm	

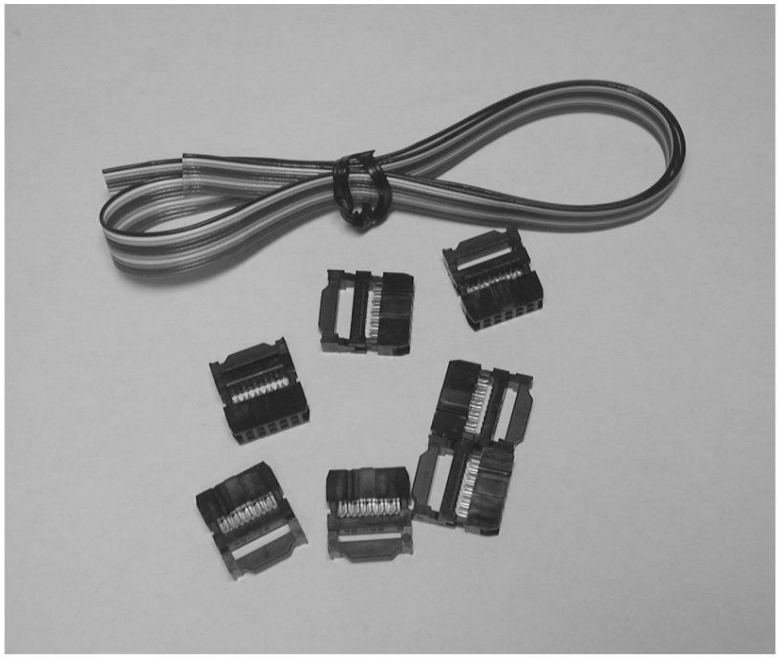
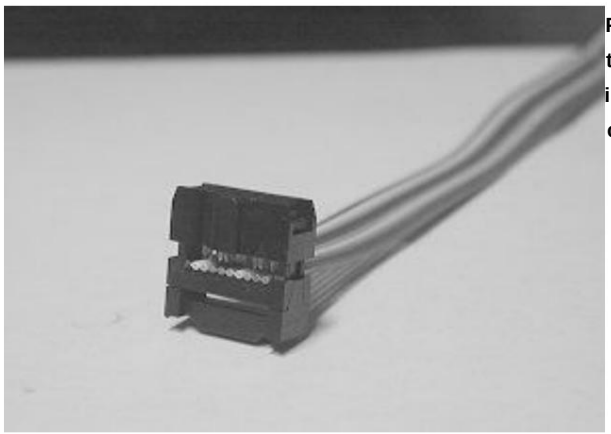


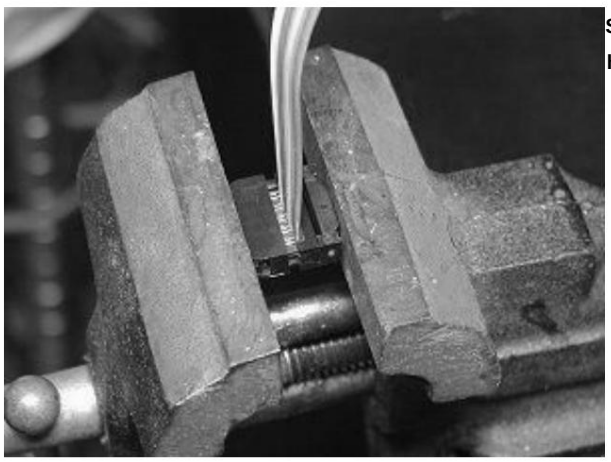
Figure 27: Parts required for lifeline cable production

5.4.3 Precautions for production

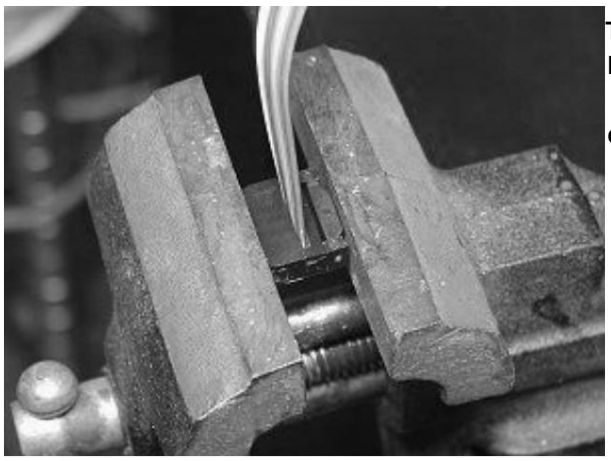
To make it, just attach the header socket to the flat cable. Please refer to the following procedure.



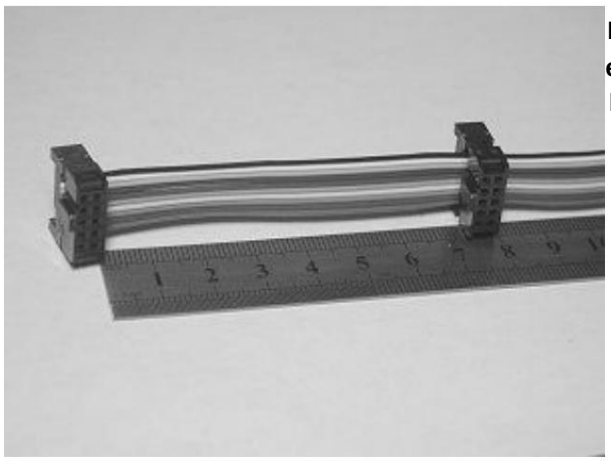
First, attach the header socket from the end side opposite to the power supply module. Gently bite the header socket into the flat cable so that the potch is on the outside of the cable (in front of the photo) to determine the mounting position.



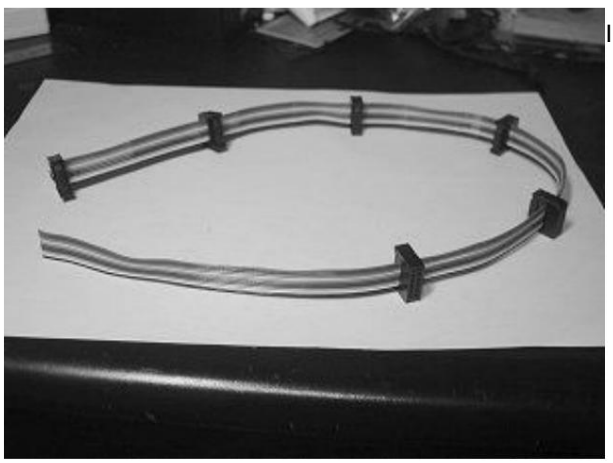
Secure the cable by tightening the top and bottom of the header socket with a vise.



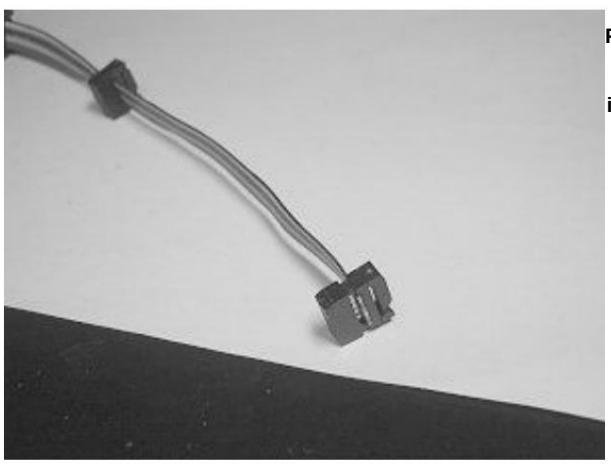
Tightening is complete when the claws of the header socket make a clicking sound and bite. If you overtighten it, the header socket will crack, so be careful and tighten it slowly.



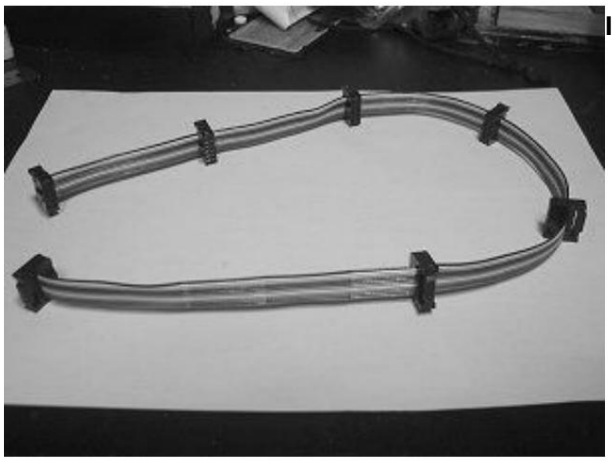
In the same way, attach the header socket every 8 cm of the flat cable. **Be sure to align the header socket potches in the same orientation.**



Install 6 **header sockets at** 6 cm **intervals .**



Finally, attach the header socket to the end on the power supply module side. The orientation of the potch is still the same, facing the inside of the cable (the other side of the photo).



Install the last header socket and you're done.