glasshouse

Shinkoh/Elma Stepped Attenuators
designed by Neville Roberts

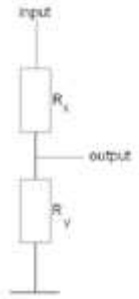
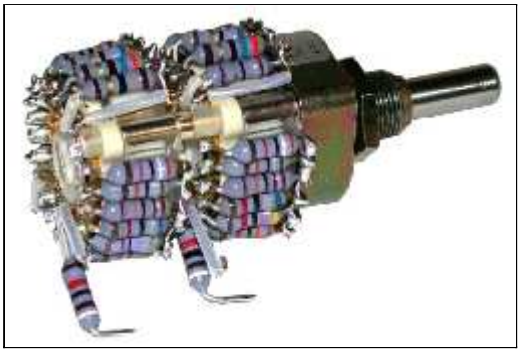


FIG.1
The potential divider

FIG.2
The Attenuator Steps

FIG.3
The Elma 2 pole 24 way switch



The stereo Shinkoh/Elma stepped attenuator

Introduction

With the great interest in all things passive on the pre-amplifier front, we decided to bring to you, probably the best resistor stepped attenuator in the World, using the best resistors - Shinkoh`s from Japan, the best switch - Elma`s from Switzerland, the best solder - Mundorf`s 9.5% silver supreme from Germany and the best wire - HGC`s 1mm diameter pure silver wire from England. You can now purchase the Glasshouse Passive pre-amplifier No.1 using the new Shinkoh/Elma stepped attenuators.

PRICE (exc. vat + carriage): available in 10K, 50K and 100K buy now!
Stereo stepped attenuator - kit **£170.00**, built - **£200.00**
Mono stepped attenuator - kit **£90.00**, built - **£105.00**

The Hi- Fi Collective stepped attenuator is based on a shunt design where the signal is fed through a fixed series resistor, Rx and the shunt resistor, Ry, is selected from 24 values ranging from zero to infinity by means of a selector switch. See **FIGURE 1**.

A simple ladder design has the disadvantage of having a number of resistors in the signal path. A switched ladder switches pairs of resistors, but this required two sets of switch contacts in the signal path, which is undesirable and a more complicated switch is required. Although a shunt design presents a variable input impedance to the signal source, this does not matter in practice and the benefits of a single resistor and switch in the signal path far outweighs this issue.

Choosing the steps of attenuation

The value of attenuation for each step has been chosen to provide a fine range at low volumes, getting increasingly coarser as maximum volume is approached. Commercial stepped attenuators tend to have a 60dB range (corresponding to the Step 2 attenuation), but I have found in the past that with higher output sources, this is not quite enough. As a result, I had used the additional attenuation available in the source device, but this does adversely affect sound quality. To overcome this, I added 3 higher levels of attenuation at steps 2, 3 and 4 and adjusted the other steps accordingly to give a smooth progression over the entire range. See **FIGURE 2**

Resistor packs are supplied to enable 10K, 50K or 100K attenuators to be constructed. The switch itself is a 24-way unit made by the Swiss company, Elma. It is a high quality, non-magnetic bodied switch with gold over silver-plated copper contacts. The wafers are ceramic with gold plated solder tags.

Building the Attenuator

FIG.4
The Elma switch dismantled

FIG.5
One channel (wafer) completed and fitted

FIG.6
The finished attenuator

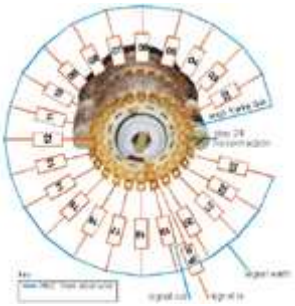


FIG.7
The resistor layout

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FIG.8
The Shinkoh/Elma attenuator fitted in the Glasshouse Passive Pre-amplifier No.1 chassis

The best way to construct the attenuator is to fit all the resistors to the rear wafer, dismantle the switch and swap the wafers around, and then built the other channel as shown in **FIGURE 5** and **FIGURE 7**.

This allows the terminals to be accessed easily and the resistors arranged neatly around the body of the switch. Start with position 2 and continue until position 11.
Next fit the resistor at position 13, then position 12 as this allows the step 12 resistor to be fitted neatly between the pillar and the step 13 resistor. Continue around until the last resistor at position 23 is reached. Position 24 is left open circuit corresponding to zero attenuation.

The other ends of all the resistors are joined together with a circle of wire, which will be connected to earth and also position 1 of the attenuator, which corresponds to infinite attenuation, i.e. zero volume, as the first step. The wire supplied is the HGC 99.99% silver solid core wire and all joints are soldered using Mundorf 9.5% silver solder. Personally, I am not a great fan of unleaded solder as I find it's flowing properties inferior to good old 60-40 multicore leaded solder. However, the Mundorf silver solder is every bit as good as leaded as far as solderability is concerned, but with far superior conductivity and sound qualities.

Finally, connect the input series resistor to the wiper of the switch. The input of the attenuator is input lead of the resistor and the output of the attenuator is the wiper or other end of that resistor. That completes the construction of one channel.

Now carefully dismantle the switch as shown in **FIGURE 4** and swap over the two wafers. Re-assemble the switch. You are now ready to repeat the process for the other channel. When that is completed, the attenuator is complete and ready for installation in your pre-amp see **FIGURE 6**.

Testing the Attenuator

It should be noted that this kit was supplied with Shinkoh resistors. Originating from Japan and no longer in production, Shinkohs are commonly regarded as the best resistors in the world!

For this review, the attenuator was installed in the Glasshouse Passive Pre-Amplifier No.1. The original pre-amp was fitted with the Dale-Vishay stepped attenuator and as the new unit is a smaller and more compact design, no difficulties were encountered. Indeed, the size of the finished unit compares favourably with many high quality potentiometers and can therefore be used as a replacement for these.

However, for the purpose of the listening tests, the new attenuator was installed alongside the Dale-Vishay and the output was taken to a separate pair of phono connectors to enable easy switching between the two attenuators.
So how did the new attenuator stand up against the Dale-Vishay unit?

Over the years, I have found that many upgrades make subtle changes to the sound and require repeated comparisons to enable the changes to be quantified. Not so with this unit. Although the Dale-Vishay is a significant improvement over conventional potentiometers, it was completely out-classed by the new unit.

One of my many standard 'test' recordings is a superb recording of Tchaikovsky Suites from Swan Lake and the Nutcracker by the Israel Philharmonic Orchestra conducted by Zubin Mehta on Decca 410 551-2. This CD has very quite tracks with solo instruments balanced by the full orchestra, complete with an almost sub-sonic bass drum. Both these extremes showed the limitations of the Dale-Vishay attenuator.

In comparison, the new unit has a far cleaner and more open sound. The high end was brighter but less harsh sounding. The bass was tighter and more controlled and the midrange was more balanced with the top and bottom ends of the spectrum. Without wishing to run down the excellent value Dale-Vishay attenuator, it is really a case of getting what you pay for. Overall, the Dale-Vishay sounded slightly tinny, harsher and had a woolly bass in comparison, as though there was a slight peak in the mid range and bass response.

As far as the sound image was concerned, some instruments in the orchestra, such as the string sections, were slightly more forward with the new unit, while others like the kettle drum were further back. This gives a much fuller and more realistic sound stage that is less constrained by the two loudspeakers in the listening room.

Further comparisons were made with other recordings from early baroque to jazz and light music recorded in the '60s, '70s and '80s which reinforced the above comments.
When the listening tests were completed, the new attenuator was fitted in place of the existing

FIG.9
The Shinkoh/Elma mono attenuator

Please read this before ordering

Do you need tools?

Dale-Vishay in the Glasshouse Passive Pre-Amp - see **FIGURE 8**

. All-in-all, this attenuator is a superb unit which oozes quality and will be at home installed in the finest audio equipment. ***designed and written by Neville Roberts***

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Resistor values of attenuators

All resistors supplied are Shinkoh 0.5Ws, except for the input resistor of the 10K version. We have kept as close to the recommended attenuation as our stocks have allowed.

Step Number	100K stepped Atten.(resistor values)	50K stepped Atten.(resistor values)	10K stepped Atten.(resistor values)
input resistor	110K	51K	10K 1W
1	0R	0R	0R
2	18R	8R2	2R
3	36R	18R	3R6
4	68R	36R	6R8
5	130R	62R	13R
6	220R	120R	22R
7	360R	200R	39R
8	620R	360R	68R
9	1K1	620R	120R
10	1K8	820R	180R
11	2K4	1K3	270R
12	3K6	1K8	360R
13	5K1	2K7	510R
14	7K5	3K9	820R
15	12K	5K6	1K1
16	16K	8K2	1K6
17	24K	12K	2K4
18	33K	18K	3K
19	47K	24K	4K7
20	68K	33K	6K8
21	110K	51K	9K1
22	180K	91K	18K
23	390K	200K	36K
24	infinity	infinity	infinity

PARTS LIST for Shinkoh/Elma stepped attenuator kits

Stereo Shinkoh/Elma Stepped Atenuator

1. Elma 2 pole 24 way switch
2. 46 off Shinkoh resistors
3. 1m off 1mm diameter HGC 99.99% silver wire
4. 2m off Mundorf 9.8% silver, supreme solder

Mono Shinkoh/Elma Stepped Atenuator

1. Elma 1 pole 24 way switch
2. 23 off Shinkoh resistors
3. 50cm off 1mm diameter HGC 99.99% silver wire
4. 1m off Mundorf 9.8% silver, supreme solder

TOOLS REQUIRED

1. Soldering iron (25 watt Antex)
2. Trimming knife
3. Snipe nose pliars
4. Cutters

all the above are available in the tools section of the hificollective **shop.**

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