DIY HYBRID SYSTEM 1200 CABINET / HPD 315 DRIVER
BUILT BY LEWIS

In 2003, I had the good fortune to discover five vintage Tannoy drivers for sale in a pro-audio second hand store. The five drivers included one HPD385, three HPD315, and one 12 inch Monitor Gold, but with only two crossover networks. I immediately used the HPD385 and one of the two crossovers to become the center speaker of my home theatre which you see later in Figure 14.

I kept the other four 12 inch Tannoy speakers in storage until I could decide what cabinet design to build. The 12 inch Monitor Gold had already had its cone replaced with a ribbed type identical to the HPD315 model, so in spite of the difference in magnet characteristics, I felt that any cabinet suitable for the HPD315 would also work well with this Monitor Gold with its upgraded cone.

Factory built bass reflex cabinets for many Tannoy 12 inch drivers have always been six sided with the exception of the System 1200, which is a ten sided cabinet of 74 liters and designed for the 3139 DC driver. The System 12 DMT generation followed the System 1200 and had a volume closer to 55 liters for the 3133GG driver.

Like its older Monitor Gold brother, HPD drivers have always worked best in large volume cabinets. However, HPD315 drivers have appeared in small factory built cabinets like the Cheviot at 65 liters and the Devon at 42 liters. I was determined to build a 75 liter System 1200 cabinet for the HPD315 driver primarily because I believe that a cabinet with ten sides reduces the amount of internal standing waves better than a cabinet with only six sides. I also felt that my four small DIY cabinets would eventually end up in an environment where a sub-woofer would be handling all the bass.

My cabinet is built entirely with MDF (Medium Density Fiberboard) and all outside dimensions reproduce the factory built System 1200 (648 mm. x 396 mm. x 407 mm). The front baffle is 38 mm. thick and is composed of one layer of 25 mm. and two layers of 6 mm. The side and rear walls are all 19 mm. thick. The factory model uses shelves for internal bracing. I chose to use thick ribs and one large cross-brace between the front and rear panels. My total cabinet weight with driver is around 34 kg., compared to the factory version at 27 kg.

Finishing this cabinet was a real challenge as I wanted to use a natural Ash wood veneer instead of the factory finish that Tannoy calls "Spray 'F' Vinyl", which is a soft finish spray paint. The veneer was applied after the cabinet was built and I wanted the wood grain to flow continuously from one side panel to another. To do this, a single long piece of veneer was used to wrap continuously around the eight sides without it being pre-cut into eight segments.

I chose a veneer with a hot glue backing which allowed me to cover one of the eight surfaces at a time. In order to bend the veneer over the 45 degree corner, I lightly scored the outer surface of the veneer at each bend with a raser knife. This allowed the veneer to bend over the edge without splintering. Then a hot clothes iron was used to bond the veneer to the next surface. I later used plastic wood to fill the micro grooves left by the raser knife.

Painting MDF is a problem because this composite wood is porous especially on the cut edges. There are many home made recipes for MDF sealers posted on the internet, but I chose a commercial MDF primer product manufactured in Italy by MILESI SPA. The Ash wood veneer is blond colored and I stained it black with "Jel'd Stain 550", a gel stain manufactured by WOOD-KOTE. The veneer was covered with MILESI non-yellowing varnish with a very low gloss finish of 15 percent reflection. The front baffle was painted with grey colored Dupont Nason Full-Thane high gloss auto paint. All of these primers, gels, paints, and varnishes are urethane based, and with the exception of the gel stain, they all use a highly toxic two part catalyst known to cause death to some people who are allergic to the molecule. The gel was applied by hand, all other coatings were sprayed.

In figure 1 below, we see one of my four my finished speaker cabinets next to a printout of the factory publicity for the genuine Tannoy System 1200.

Figure 1

At some point during the 1970's, Tannoy started manufacturing their drivers with metal flanges permitting the driver to be mounted on the outer surface of the cabinet rather than bolted from the rear of the front baffle with the traditional foam rubber gasket.

Not only were front surface mounted drivers more elegant in appearance, but they also reduced the so-called diffraction effects. We often see Monitor Gold and early HPD drivers mounted on the front surface of the baffle in DIY cabinets even though these same drivers were designed only for rear surface mounting.

I was determined to have a front surface mounting for my four drivers but I wanted to hide the foam rubber gasket and speaker mounting bolts. To do this, I built a black colored trim ring from 6 mm. MDF to create an illusion that the driver has the style of flange that is front surface mounted. This trim ring which has rounded edges, is held in place by four decorative hex key bolts that connect to brass inserts embedded in the front baffle. In figure 2 below we see the trim ring and hex bolts removed from the cabinet and set aside with the hex key.

Figure 2

All ten panel surfaces of the cabinet are permanently glued together. The driver can only be removed by lifting it out of the cabinet vertically after all the four mounting bolts have been removed. In order not to scratch the painted surface, I used a tool to add threads in the smooth mounting holes of the driver's flange. By partially inserting two (5/16 inch diameter) bolts into the driver flange, the driver can be lifted out of the cabinet without difficulty. See figure 3 below.

Figure 3

In figure 4 we see the driver removed from the cabinet. The wire cable which connects the factory crossover to the driver is usually three wires with one of the three wires being used as the ground wire for both the low frequency and high frequency voice coils. I was lucky to already have four spare factory cables. Since I use four custom made crossovers with bi-wiring, an extra wire was attached to the factory cable to allow each voice coil to have its own independant ground wire. The cabinet you see in figure 4 is slightly different from the other three in that it can accept either a Monitor Gold driver or a HPD315 driver. These two drivers do not have the same mounting hole diameters, so I added a set of 4 holes for the Monitor Gold and another set of 4 holes for the HPD315, for a total of 8 holes. There is a thin layer of black wool felt attached with silicon glue which acts as a dampening interface between the metal flange and the MDF mounting surface. The bolts, which secure the driver to the front baffle, connect to metal inserts located in the rim of the cabinet's round opening. To maximize the strength of these metal inserts, part of the edge of the mounting hole is sculpted to 45 degrees in order to closely follow the profile of the driver frame so that the maximum amount of wood is present in the rim area.

Figure 4

Figure 5 shows a close-up of the port area. Each port is a commercially molded black plastic tube which has a sculpted flange. Since the cabinet's front baffle was built up from three different layers of MDF, it was possible to use a router to create the necessary cavity cut into the middle layer so that the port flange was flush with the surface of the MDF. After the third decorative octagonal shaped layer was glued on, the port tubes became permanently sealed within the cabinet. My ports are each 70 mm. in diameter and 125 mm. in length.

According to Alexander's DIY 1200 SE project, 155 mm is the proper port length for the factory built System 1200 when using the 3139 DC driver. Often builders will tune their cabinets to the same resonant frequency as the free air resonance of the driver. When this happens, the size of the two impedance peaks, (the double camel humps) is identical. With the HPD315 driver in my cabinet, I have a small high-frequency peak and a large low frequency peak, indicating that my port length is too short. I purposely did not lengthen the port tubes because it can be desirable to keep the high-frequency impedance peak as low as possible so that the "bass response is smooth and efficient all the way to the cutoff point".

Figure 5

In figure 6, we see the rear of the cabinet showing the bi-wiring terminal posts. The back of the cabinet has the same wood veneer as the sides. Sitting on this cabinet is a wood sample of how the cabinet's 45 degree corner joint was made. This is discussed in greater detail later in this document.

Figure 6

In figure 7 we see an image of my custom made crossover. Factory made HPD315 crossovers have iron core inductance coils. I used air core coils which are much larger. The coils, capacitors, and resistors are all made by SOLEN of France. These components are all hand soldered and mounted on a black colored Plexiglas sheet 400 mm x 150 mm. Because the crossover is so large, part of it had to be mounted directly under the driver. This resulted in two of the inductors being located within 75 mm. of the magnet structure. To reduce the effect of the stray magnetic field from the driver entering into the crossover inductor coils, I covered two of the coils with a mu-metal foil glued to a Plexiglas backing.

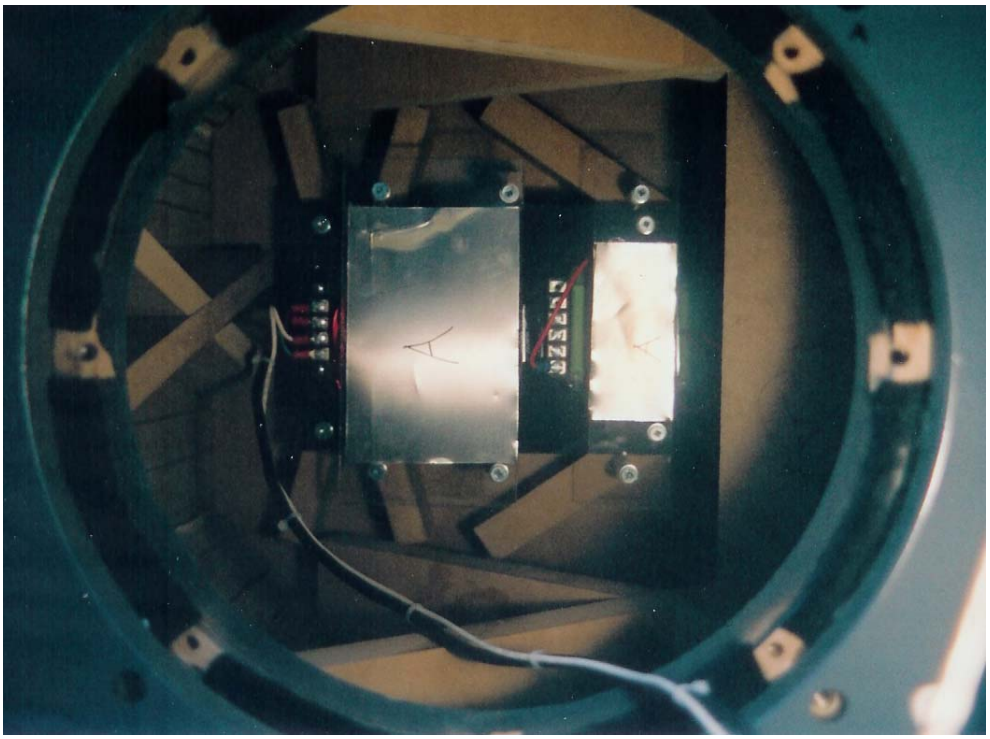

Figure 7

In figure 8, we see that the two mu-metal foil plates have been removed showing two of the three coils. There is a third larger coil hidden. This coil has four additional taps connected to it so that the volume of the high frequency driver can be adjusted at 1.5 db steps, just like the factory crossover. The SOLEN Company in Canada is located near where I live and they examined my Tannoy factory crossover for the HPD315 and determined that the measured inductance of two Tannoy coils did not match the specifications listed on the Tannoy schematic. SOLEN told me what size air core inductor to buy and where to solder the four tap wires on the coil so that I would have a perfect match to the factory built crossover that I purchased with the drivers.

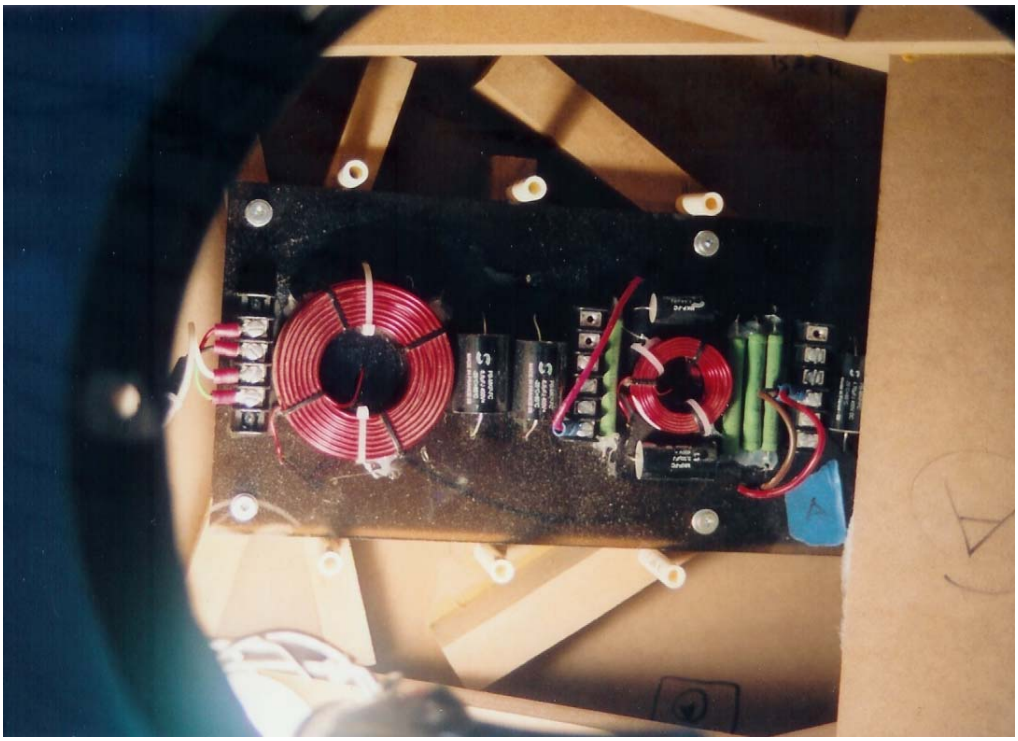

Figure 8

Inside each of my four cabinets are the instructions (figure 9) which describes how to select the different energy and roll-off levels for the high frequency driver. Instead of using a two-pole/multi-throw rotary selector switch like the factory model, I use terminal strips which have 4 to 5 screws for securely attaching the spade connectors which terminate each wire. The chart describes all the positions that the wires must be placed in order to do the desired programming. My custom made crossover fully duplicates all the features of the Tannoy factory built crossover.

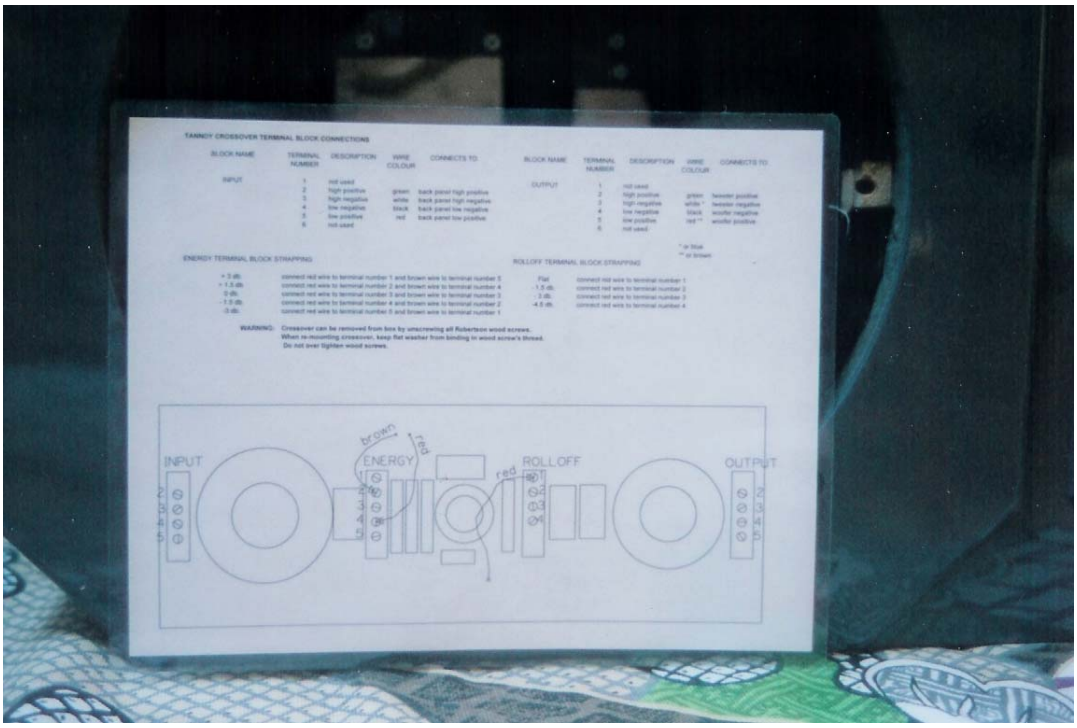

Figure 9

Figure 10 below shows the sliding compound miter saw used to cut a 22.5 degree edge on each of the side walls. The custom saw fence had to be calibrated in order to get nearly perfect 90 degree corners on each panel.

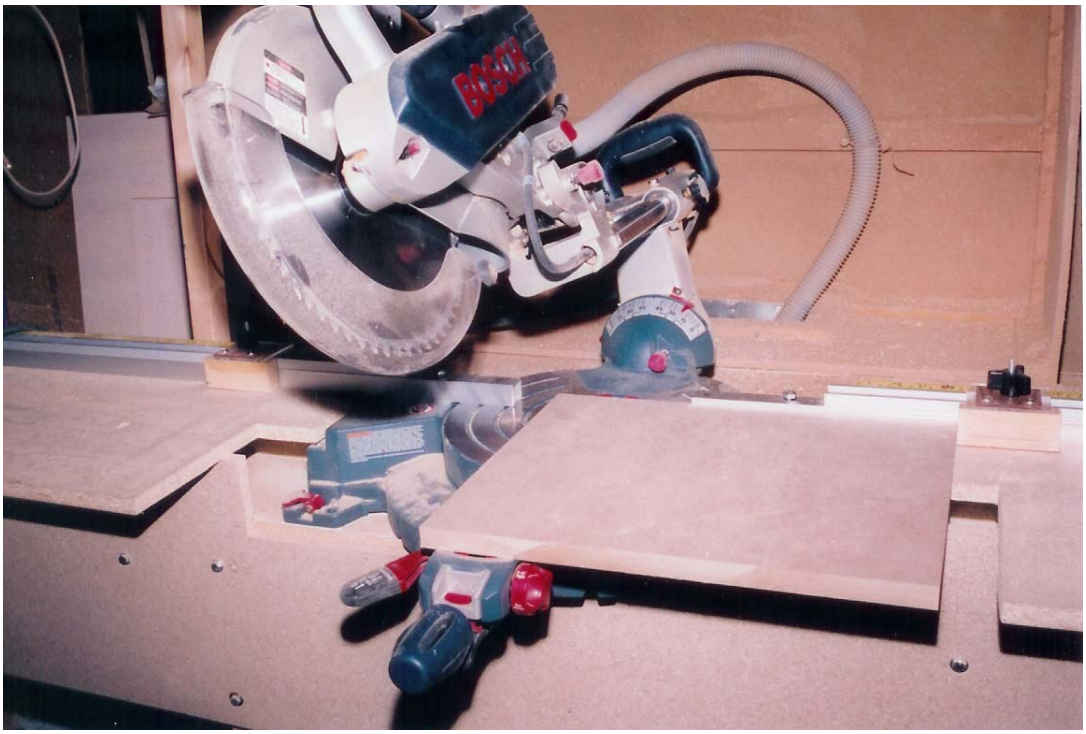

Figure 10

In the previous figure 10, it shows that the miter saw is set to cut a 22.5 degree bevel cut. The Tannoy factory built System 1200 uses only glue to create the 45 degree corners. I wanted to add additional robustness to each corner joint by including a cutout slot in each beveled edge to receive a hardwood tongue (key). The slot was cut with a cutting blade attached to a router mounted into a work table. Figure 11 below shows the empty jig used to hold the pre-cut side panels at the proper 22.5 degree position. There is an aluminum track embedded in the table surface to allow the jig to slide forward.

Figure 11

In figure 12 below we see samples of a side panel with its 22.5 degree bevel cuts and a hardwood tongue. We also see the grooves cut in the panel edges, as well as the finished glued joint. An additional jig (not shown) was needed to allow all 8 sides to be held in the proper vertical position while they were all glued together at one time. A strap clamp surrounded the 8 panels and held all the joints firmly together while the glue dried. I used yellow wood glue which set faster than I preferred. It is better to use white wood glue which is not quite as thick. This was a very critical step because all 8 panels must end up positioned perfectly on all axis before the glue dries.

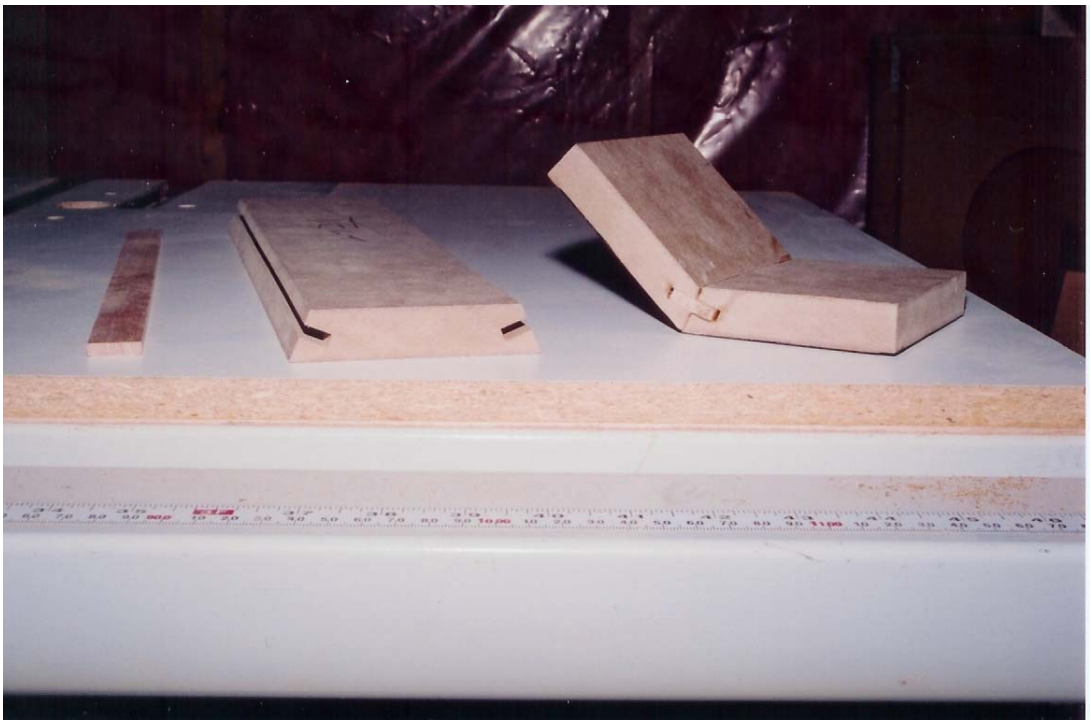

Figure 12

Since there is already a 6.0 home theatre in the basement of my house (see figure 14), I wanted to bring the same music to the main floor, so figure 13 shows 3 of the 4 cabinets at one end of my dining room sitting on the floor. These 3 speakers are connected in parallel to my home theatre loudspeakers (left, center,and right channels). Most of music I listen to is 2 channel stereo and my basement home theatre receiver normally converts these two stereo channels to 3 distinct channels. I use the pre-outs on this low power receiver to drive separate high power amps (Crown and Alesis). There is enough power to drive the six home theatre speakers plus the three HPD315 cabinets that you see in figure 13. The forth speaker cabinet (not shown) is located in my bedroom and contains the 12 inch Monitor Gold driver. It is also connected to the center channel of the home theatre system and it alone is able to project most, but not all, of the content of the 3 channels.

The mid range and upper range of these HPD315 drivers mounted in my DIY System 1200 cabinets sound very much like the same drivers would sound if mounted in cabinets having volumes many times larger. With my cabinets having a net volume of about 70 liters, this being the lower limit of what these drivers can support, I am satisfied with the smoothness of the bass. In the future, I will be experimenting with the port length and cabinet placement in the room in order to optimize the bass response.

Figure 13

In figure 14 below, we see the 6.0 home theatre located in my basement. I built the wall system which incorporates the speaker. The three drivers you see are all 15 inch diameter Tannoy. The left and right are Monitor Gold which I purchased new in 1972. The center speaker is a HPD385 bought second hand in 2003. With three front speakers of this size, I decided not to use a sub-woofer. The three rear surround speakers (not shown) are all Tannoy Saturn (two 6 inch and one 8 inch).

I found that DVD movies use the front center speaker the majority of the time and unless the center speaker is large, the dialog in the movie sounds weak compared to the musical soundtrack that gets transmitted to the front left and right speakers.

In the figure 14, the three 15 inch Tannoy drivers are mounted in wedge shaped cabinets to focus the sound to one central listening area. These three wedges are further connected to large volume cabinets that make up the sealed wall system furniture offering 8 cubic feet (226 liters) of cabinet volume for the center channel and 12 cubic feet (340 liters) each for the left and right.

The TV screen is a 34 inch Sony CRT purchased in 2002, before large flat screen televisions became affordable. I had to install many special layers of shielding material to keep the magnet force from the center speaker from entering the television. The wall system closely hugs the profiled art-deco ceiling, but all the wall system and speaker cabinets can be removed. I would never want to move to a new residence without all my Tannoy speakers.

Figure 14

By Lewis from Canada.

Published on “The Tannoy Monitor Gold Website” by Hans Hilberink PE1MMK.