

Building my FreETarget (so far)

Here is how I built my free target without using witness paper to start with just to see how it worked without using it, witness paper is used to do three things, 1. produce a reliable sound signal for the microphones to pick up 2. using a gauge to enable the score to be calculated when the electronics have failed 3. Identify cross shots using the witness paper and electronic score in unison. I'm curious to see how sensitive it is and can it really pick up the flight of a pellet.



2mm laser cut steel target face

I will explain what I'm using for my build to start with, I'm using electronic target cards (mine are from Kruger for the Suis target) they do not have scoring rings on them but have a hole the size of the black and this dark hole is what you see when on aim, the target box will have a 13mm ply back and front. The front will be cut to produce a frame to hold the steel target face. The front will also be cut so there is a door to open at the bottom to enable the later addition

of the witness paper feed to be adjusted without moving the upper part that is the target face and frame. The steel face plate will have a 170mm square hole in it to represent a full paper target, this hole will be accurately cut using a laser. This creates a problem as the steel face plate will not completely protect the sensor so a secondary shield will have to be made to do this.



Electronic target cards

I really don't think I need to tell you how to make a box or give you sizes as it is simple to make it from what you have and by taking measurements of the components and referring to the spacing of the sensors and electronic board. I made mine so there was room to add a witness drive and slim so the target cards are 10mm in front of the microphones giving space to run witness paper at a later date.



Drawn brass hinge

Now this is how I made the placement of the sensors in relation to the target as accurate as possible. For my datum that everything else is measured from I took the laser cut aperture of the target, now this throws up a problem straight away as the target is on the door and it can move. A better option is to mount the target as others have done in front of the sensors but held in the box and not the door. But I was committed to get the thing up and working as fast as possible to see if it worked, and to make a MK2 version would not take too long anyway. To reduce the lateral movement of the

door up and down and side to side due to loose hinges I chose to use long drawn brass hinges with steel pins and to hold the door shut firmly using a toggle over cam catch. The hinges hold it so firmly that I am not now going to drill through the front door and into the frame and insert an indexing dowel, also the rear door is a good fit below it and supports it and this is also held in place with drawn brass hinges and a toggle catch. I have a lifetime of fitting little hinges on projects and I have finally bought some drill guides that stop the



Hinge pilot hole centre drill

pilot hole wandering off centre as I drill the holes for the hinge and making my life at times really annoying, they need to be used on counter sunk hinges and are of no use on cheap punched sheet metal hinges. Oh and I do not use an electric drill on pilot holes as I have more control of the outcome using a wheel brace. I wish I had discovered these hinge pilot hole centring drills years ago. The toggle catch went on fine but you have to plan to give it some tension so you have to guestimate how much when you drill the pilot holes for these. I took the opportunity to then paint the steel face and the plywood frame with oil paint to prime it as the matt paint I had for the final colour was water based and that does not go too well over steel.

The nice hinges worked very well and held the door firmly so closed it securely with the catch and proceeded to use a square to project the edges of the target area down to the back of the target, I used an American speed Square but a try square wood or engineers would do the same job. Now pencils – it is pointless trying to be accurate if you're using a pencil that is blunt use a clutch pencil or sharpen it after every line with a proper table mounted jobbie.

I then drew a square by joining the marks. I drew an X from corner to corner and checked the diagonals as this shows up easily if things are not square. To check I used steel dividers so no interpretation of measurements was needed. I set the dividers using a steel rule and a magnifying glass to 115mm and went from the centre of the cross out along each leg of the cross and made a witness mark with the point. This will be the face position of the microphone on each sensor board. I then drew a line 90 degrees to the X line through the witness dot to help me get the sensor board square.



Steel face and frame painted



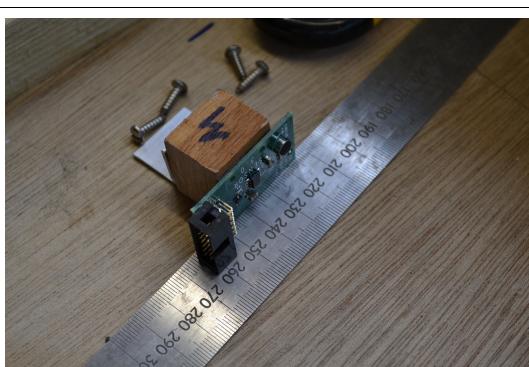
Projecting down from target face



You can just make out pencil lines and the sensor position witness marks if you zoom in.



3M tape, blocks and brackets



Gluing sensor on block using rule as a spacer under board

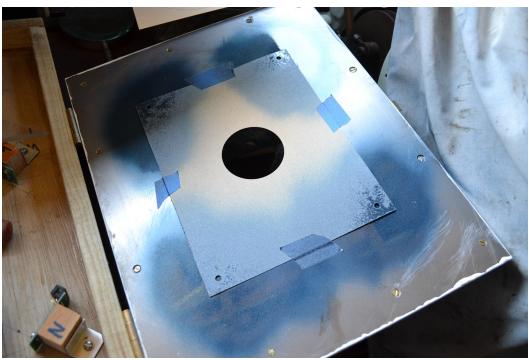


Assembled sensor block showing screw and double washers



Aligning sensor using engineers square pencil lines and divider witness dot, note corner of alloy bracket filed to fit frame.

To mount the sensors I used hardwood blocks (beech) but I baulked at fitting them using screws due to the little pips of solder on the back of the boards, as this may well throw the angle out as pressure is applied to the screws. So I used my favourite go to tool for this kind of thing, 3M sticky foam tape of about 0.75 mm thickness. This stuff sticks like there is no tomorrow and is the same stuff they stick rear view mirrors on to windscreens with in cars. I also stuck the extruded alloy brackets I made to the back of the blocks with the 3M stuff as there is no screw alignment problems with the sticky foam tape. All you do is slide the two things to be joined together on a flat surface and you are done. When I attached the sensors I double, double checked their orientation as there is no way back if you get it wrong! I did not fit the sensors flush with the base as I wanted to acoustically keep them clear of conducted sound as far as possible also helped by foam mounting of them. To fit them after again checking the orientation I placed the block on a flat surface and then used a steel rule against the flat surface to act as a spacer and then applied the board to the block. The mounting holes for the screws in the alloy brackets were drilled 1.5 mm larger than the mounting screw to allow some alinement movement, it is important to remove all burrs from the drill holes using a file. The screws have two washers on them one spring washer and a larger plain washer to allow me to nip up the sensors and move them to get them spot on then to finally tighten them. Adding washers also helps to stop them going for a walk and moving as you tighten up the mounting screw. Once I was confident all was aligned perfectly using a small engineers try square on the witness mark and the pencil lines I used a sharp pencil to draw around the mounting bracket to speed up realignment. I cut out the hole in the back of the target, I removed the sensors to do this task as I did not want to risk damaging them in any way. Putting them back in was a simple task and upon checking with the try square only one needed about 0.25 mm of movement – I use a magnifying lens for lots of stuff like this. Connecting up the sensors with the ribbon cable failed as I had not accounted for the space taken up by my wooden blocks and the cable was not long enough to go around them, and as I had stuck the sensor blocks together I was scuppered for the time being. I found there was no 12 strand



Target mounted accurately on the rear of the steel target face, note spray paint used to create a shadow to allow accurate replacement of targets.

in the country (UK). I ordered some direct from China and another lot on back order from the biggest electronics supplier in the country just to make sure. I found some plug connectors though which was pleasing.

The paper target was measured up and lines put on it to resemble the hole in the steel face plate. It was then mounted on the back of the faceplate with waterproof masking tape and the edges sprayed with car paint to give a witness shadow. This enables targets to be aligned quickly but this is only a temporary measure as the target will be mounted differently after I'm happy with everything else. I will add to this as I continue the build.



Prototype target painted in matt



Target from side showing how thin it is, also showing catches for main upper door and lower door. Lower door is so that the upper door does not have to be opened to adjust stuff as it has to index in the same spot every time, I will mount the target in front of the sensor but in the rear portion of the box later.