Electronics Equipment Integration and Prototype Building
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Lecture – 31
Complexity of 3D Assemblies with Wiring

Let me continue with that small demonstration on how to make solid models for electronics products, specifically on how to organize the various elements on a panel. And, when you organize the elements on a panel you have various things saying something is which is visible on the outside, so that in the layout of the panel you can say what is visible outside.

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Then I have given you an example of a switch. So, kindly have a look at this thing here.

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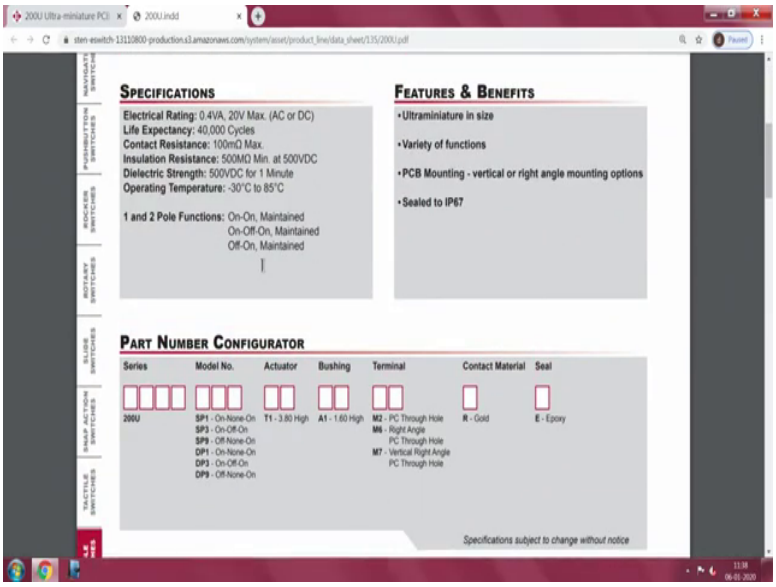

One of the things you will notice is this is taken from one of the catalogues.

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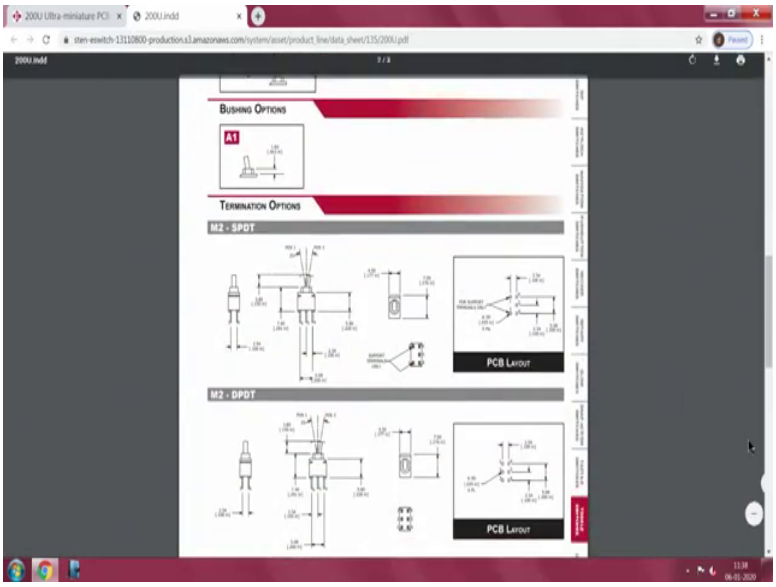

I have intentionally included here, so that you see here these are all details of the what looks like a very simple ubiquitous switch here.

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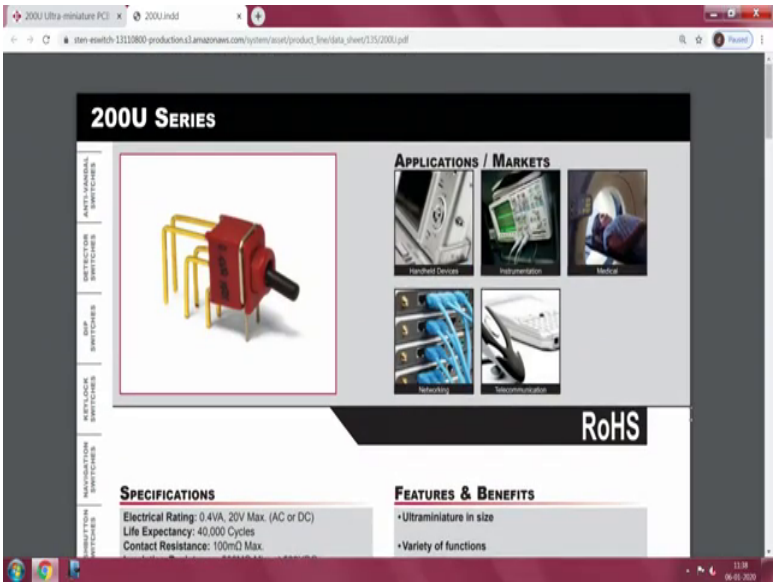

So, on the top you can see the switch. I mean it is just like anything else an element except one small thing you will notice here is that the part that is visible outside, it also has a probably a basil which is having a some sort of fixture and depending on the method of fixing you can have only that small portion of it is visible on the outside.

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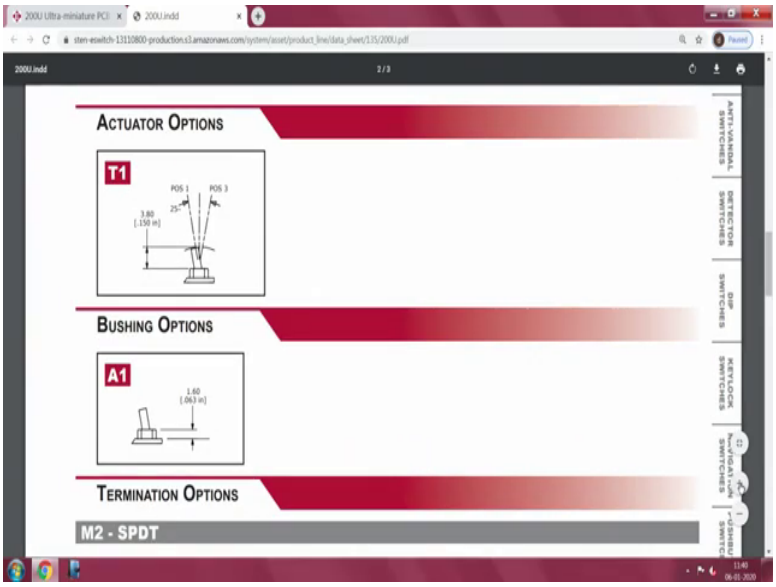

Now, when we organize this elements on to a front panel and then when you start doing the actual design of it one of the first thing you will need to do is to see how well you make the what do you call various how you make a selection and then finally, how does it actually reflect on the solid model. Why the solid model is required at all in the first place?

So, I hit upon this you can yourself go and check on this. One of the first thing you will notice is you see the small bush and the part that is projecting out. In this case of course, they have not given the other options saying whether it is a metallic is a plastic and then is it you know what is the colour and so on, but generally the mechanical details especially regarding the two positions. It has a center position and then you have a position 1 and if you notice a drawing it is as position 3, have you seen it? Here it is as position 3.

That means, there probably there is a option for you to probably have a middle position also, you understand? Position 1, position 2, position 3 not all of them have that. And, very important thing what they have given here is one is approximately 25 degree include an angle that is 12 up and 12 down and around 4 millimeters it projects from the bush and the bush option itself saying how much of space is required for the bush.

Now, we come to the perhaps you know what I keep on insisting the equally important thing of the terminations and external appearance. So, if you see the terminations here they are directly inline. So, in this directly they are inline. So, and the numbers are also indicated here 4, 5, 6, it may feel what do you call slowing down the I mean the movement of this the flow of the information, but it is important. Kindly remember that instead of getting stuck about it every time if you can somehow take this simple 2-dimensional drafting specification what they have given you and you can make a 3D model out of it very much possible for you to make it permanent.

And, you see here one more important thing know the numbers 4, 5, 6 and the number 1 and 2; 1 and 2 are only for support. It looks contrary to a normal, what do you call, intuitive I mean intuitive way of looking at this, but it is very very critical. So, in your drawing here in this case know very nicely he has given the word PCB layout, life cannot be better than this. You have seen this nicely PCB layout is meant. Why I am saying it is here in this case this can be mounted directly on the PCB on the flat.

So, coming back to my this thing which I will come back later it may make sense I can mount other LEDs, I can mount other things here and one printed circuit volt is enough for me. So, they have given if you see the options here for example, here we have the single pole double throw, next one is double pole double throw good enough.

Now, you come to the other thing then what happened to the support terminals. You see here in this case that same thing is used for support terminal. Why this is in general from a mechanical point of view unless at least two of the terminals are mounted as far as apart in the corners of the unit chances are it will get damaged. To make it universal mounting and all

that they have in fact, made this for the double pole double throw also it is there. Now, you see here very nicely know the whole thing is mentioned here.

So, again with the risk of I mean with your permission and with your patience. See here something which is in the earlier my lecture I have taught to about saying the due to various historical reasons 0.1 inch pitch that is 2.54 mm pitch for the printed wiring boards has become standard. And, later on know they use the word mills and all that, but I would rather say 0.1 inch and 0.05 inch. So, 1.27 and 2.54 are the standard.

So, especially if you are going to have a large number of components and all of them are going to be mounted on a printed wiring board, and the printed wiring board is likely to be laid out automatically. It is much better to look for devices which will give you these things this 0.1 inch which is given here that is that is the reason why in spite of very this thing I keep showing you this. You have seen this is a beautiful 2.54 and similarly this is 0.2 inches.

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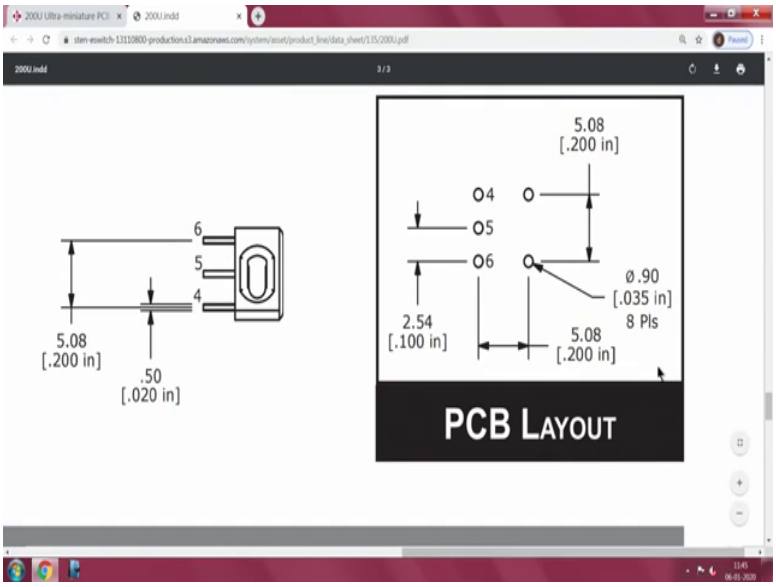

Now, if you go down further this is something else, you have seen that.

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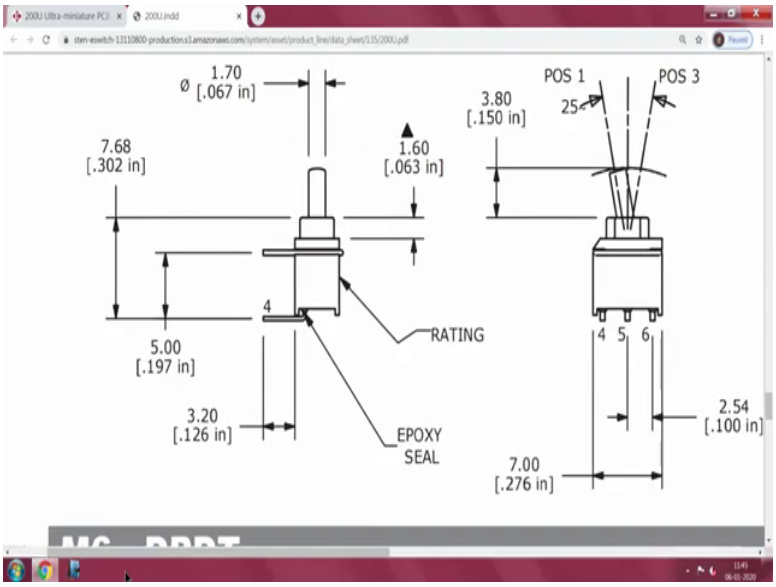

What look quite there, suddenly things are changed here. And, this is most suitable if you have a edge mounted devices occasionally this happens. For example, if you are to have a thin flat thing a large PCB which is going into a 19 inch rack probably would prefer things like this. And you remember the basic this the basic thing here is common, whatever shown here is common nothing is changed in that, but the side these operations have. And, you see here once again same detailing including the termination is all shown here.

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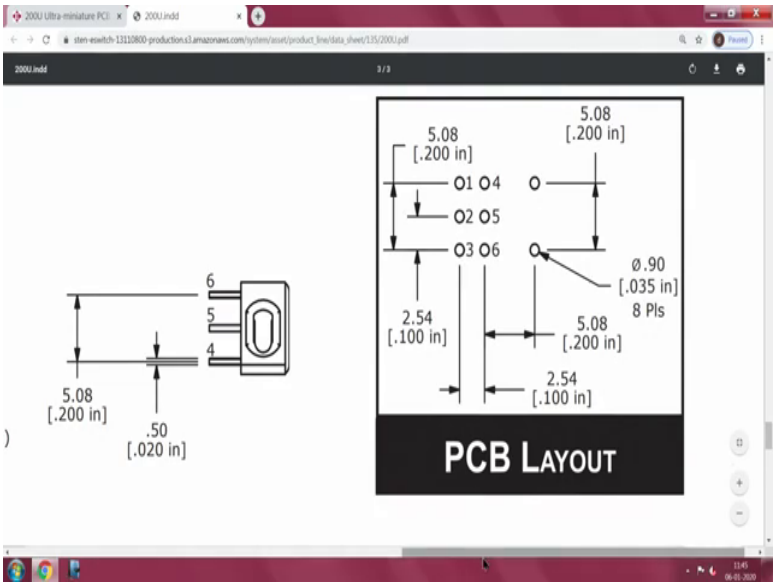

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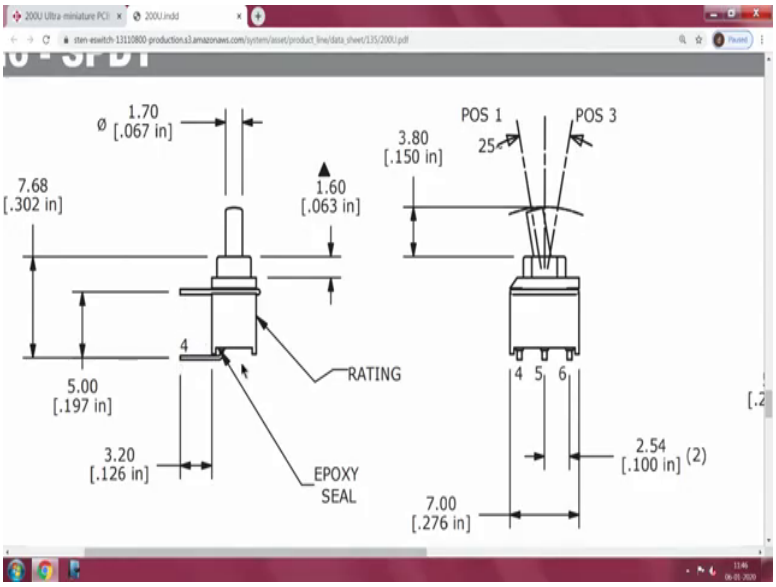

Now, if I go to the this is the double pole double throw or duel throw switch. Now, we are coming into slowly see while the top one was directly these are all molded and coming out of the case like this. Now, when you want to have a second row, the second row comes here which is what the next picture is going to show you about. So, you have here to rows about it you seen this here. So, we have 1, 2, 3, 4, 5, 6 plus these mounting holes. So, it is worthwhile paying attention on these details when you are making the first time when you are making the model.

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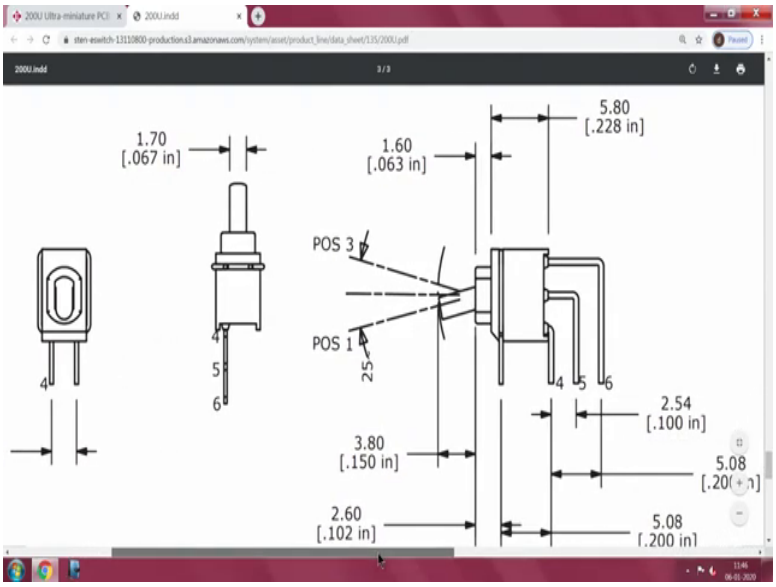

So, I think probably know this is come to the end and you have seen something else here. Let us say you need to stack them horizontally together. You need to stack them horizontally together close. The earlier one the movement was different it if it is in the another direction and this staking will be a problem, in this case that is been vertical and they can be stacked close together. This staking close together is done if initially during installation you need to set a few switches.

Very simple example I can tell you if you remember the old telephone systems we had; we had the rotary dial and after that we had the push button telephone. Rotary dial was pulse dialing and push button was called the DTMF. So, you would have remembered somewhere at the back of the that base station if you remember you can adjust either DTMF or pulse dialing and why do you need a switch at all the first time when it is installed in your house you can probably set it yes and no. Yes, if you are setting this to match your telephone

exchange and let us say it is the old pulse dialing telephone it will not allow you to access unless you give the pulse dialing with the gaps.

And, now if you open the instrument the amount of delay between the pulses or duel period is also settable; some places is 300 milli seconds, some places it is you know or a standards are there at this point I am not talking about the standards except that it is about the variability of the delay. So, if you open it and see delay also can be set.

Now, in why in that case do we require a switch on the outside at all? Let us say you are in one of those things we still use as the DTMF I mean the pulse dialing scheme, but you need to dial in numbers or push button, so that you can the very irritating you are kept on hold thing of late which has happened somebody is fix. And then now press one and it says sorry we are all busy and all that those things by default work only on DTMF things.

In that case you can you can access the what do you call dialing by one system and then put it in the other DTMF mode and send out the pulses, so that the person can now hold you about the same time. In those cases, usually the switches are stacked together.

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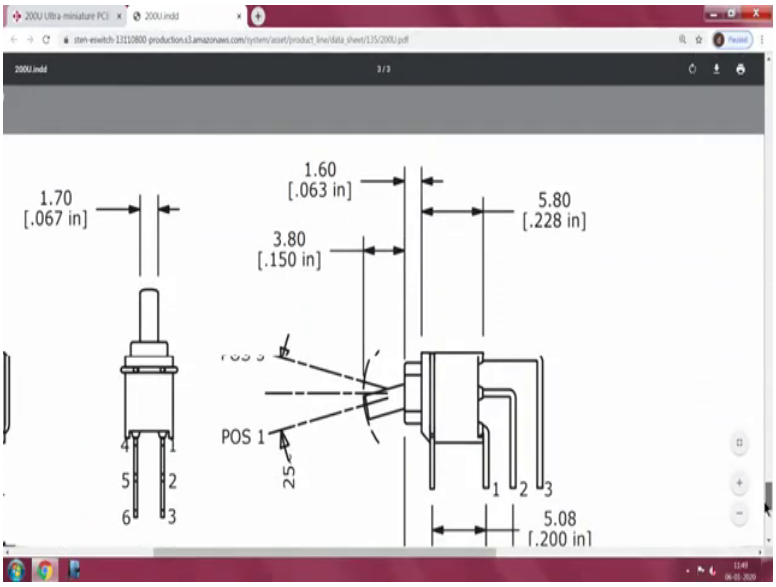

So, if you go by this actual space of I think somewhere I have shown you it is some 7 mm by something which is given on the top. In those cases the way you stack them also becomes very very critical. You have seen that, this is vertical. So, it is possible for us to make it move. Same thing in the vertical mode when you have double throw toggle switches.

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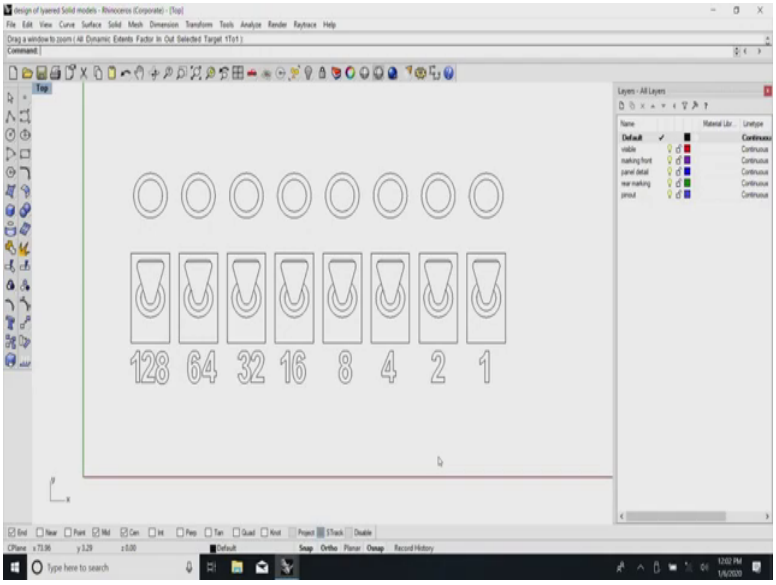

Now, let me jump to the model which I am trying to create. In this case I have just now started this drawing here. The thing you will notice here is just I randomly created this saying I will now try to make a small equipment where I have a row of one 8-bit switches there. So, I what do you call put a switch up and down and then I have a display on top of it which shows the display.

The issue is not about the functionality of equipment and the issue is not about anything to do with the why this survived and the issue is saying in a simple way how do I create a small group like this using, on the right side you will notice that I have a layers comment and this layers comment takes care of which are the layers which I need to make visible or which are the layers I need to hide.

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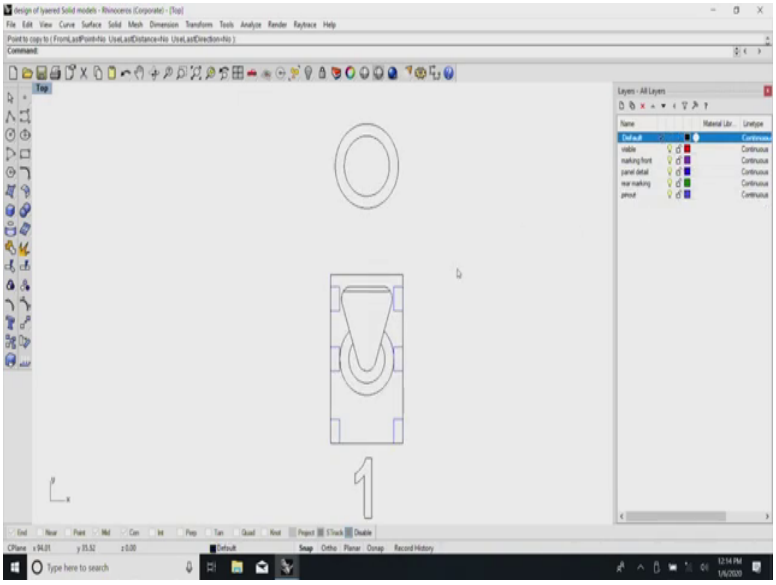

So, I have a nice device here the idea being that finally, this is probably what is going to be visible. So, on the right side may be I will just check whether my normal no it is not enabled. So, here it is possible for me to now place all these various devices here on to a different layer. So, in the on the right side allow me repeat what I have repeated earlier.

Now, I have a layer which show all the items that are visible and then I have also a front panel marking then I will also saying a panel detail. In the case of panel detail in the last session I have talked to you about how if you have a switch to prevent it rotation because it is a hexagonal tightening thing in the front and does not have a printed circuit board at the back you need to also make details of the opening that you need to create.

Then further down the actual what do you call marking at there are which gives you hints such that you can eventually use it for two cases. In the case there is the printed wiring board

these numbers including a switch number and the termination number which I have shown you can be copied there alternatively; in case you are going to make a what do you call cable harness the details of the cable harness.

So, though what look like pins which are part of the printed circuit board need not be pins which are part of the printed circuit board. You can easily have a small connector and most of these connectors are also compatible with various powermate connectors and all that. You can have a small connector bushing which can go in directly to that.

So, that same detail which has been kept there can also be used for making a part of a wiring harness. And, when you have a large number of things especially if you take a mixer or if you take the other extreme, I showed you is a probably something from a very large assembly.

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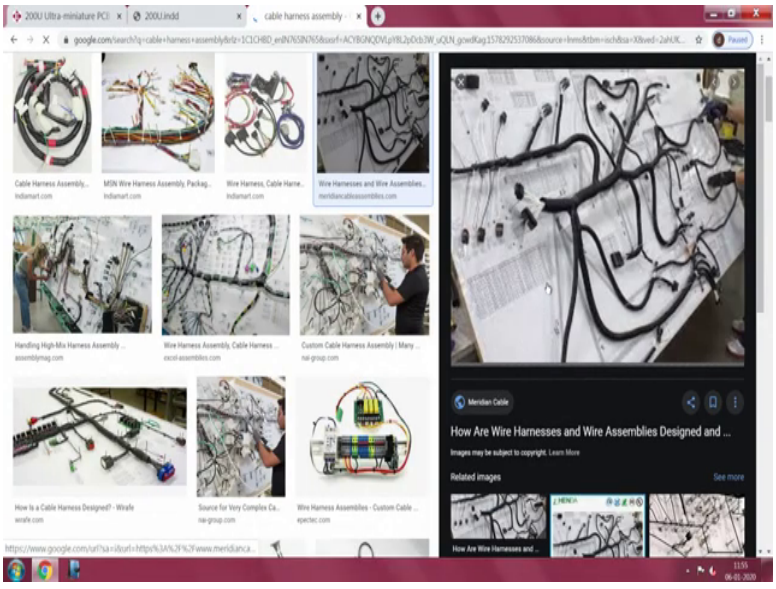

I will one more time I will see if I can get it saying though it is from of the manufacturers you can say hereby I acknowledge that you know it is their effort.

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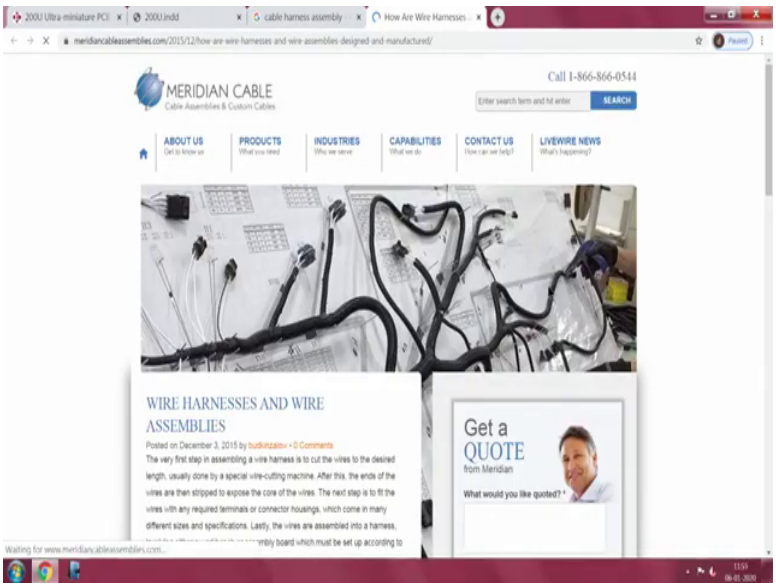

So, you see here that this large you have look at it here, please. Wire harness and wire assemblies somebody meridian cable has given.

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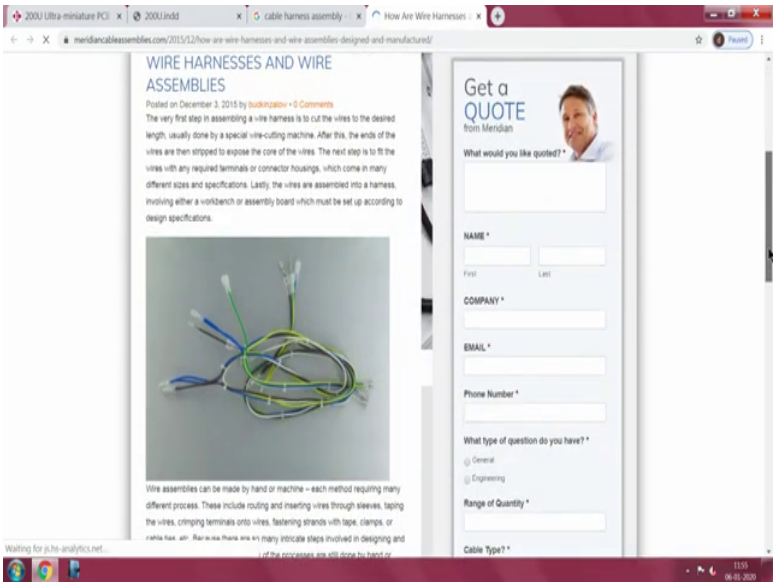

One of the things have been noticed at the end of each of them we already have a designation and these assemblies are the ones you know that are generally directly accessible for you.

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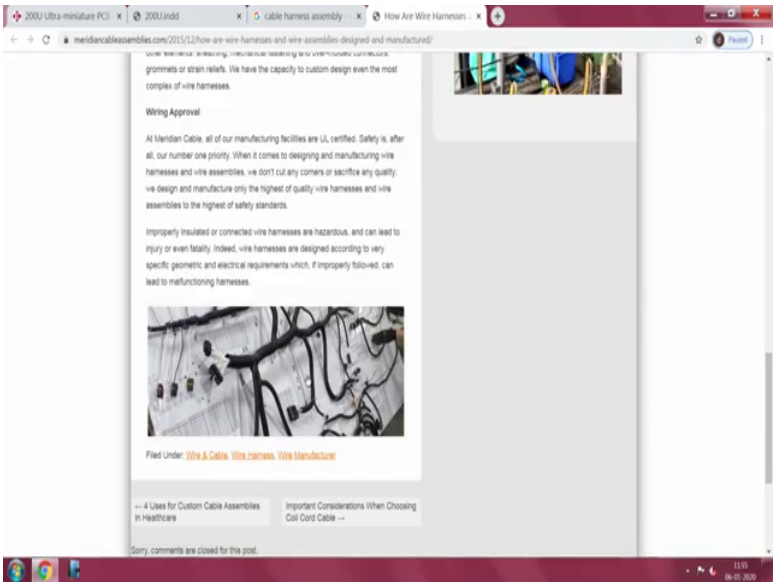

So, we have all these and then most important is here you see here one designation has been given. For example, the group and then the sort of what do you call the ones you spread it out just like earlier I told you about development drawing that is you have a enclosure and then after that I open the enclosure and then make a development drawing. A very similar thing like this also happens in the case of equipment.

So, I have a front panel so, front that side; rear is to me, then you have the side panels you have the top. Now, once you remove the cover at least imaginatively you remove the cover and you spread out all the panels and all the sides it is again flat. So, there you probably need to have this cable harness or cable form running in all the along all the corners and all and you need to spread it in all the directions and then get it ready. So, this is typically one of those flat end harnesses which has been eventually spread out.

And, now comes the other thing that is suppose there is the front panel and something goes up and all that know all the extra dimensions have been I mean allowances have been given here saying where is it likely to be yanked and where is the extra this part is where the twisting has to be done. Though it looks very easy saying it is not that easy as it looks you see here it is tough.

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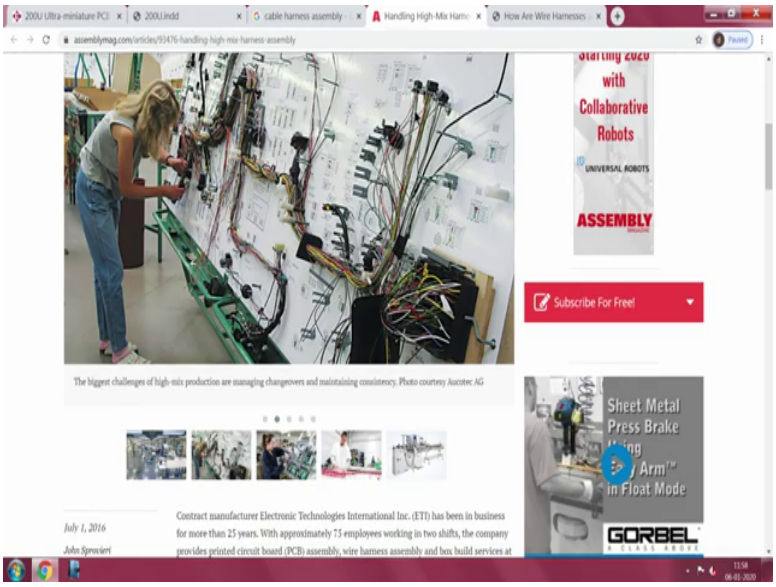

And, the magic is if each component you make original in the initial stage itself if you make all these details this much of stuff goes in probably a medium complexity any system. The only thing what I wanted to point out it is that if originally if you had made enough of detailing here all of them the next life will become easier while there is a very simple thing what I have shown you that switch there these probably refer to very very complex devices here.

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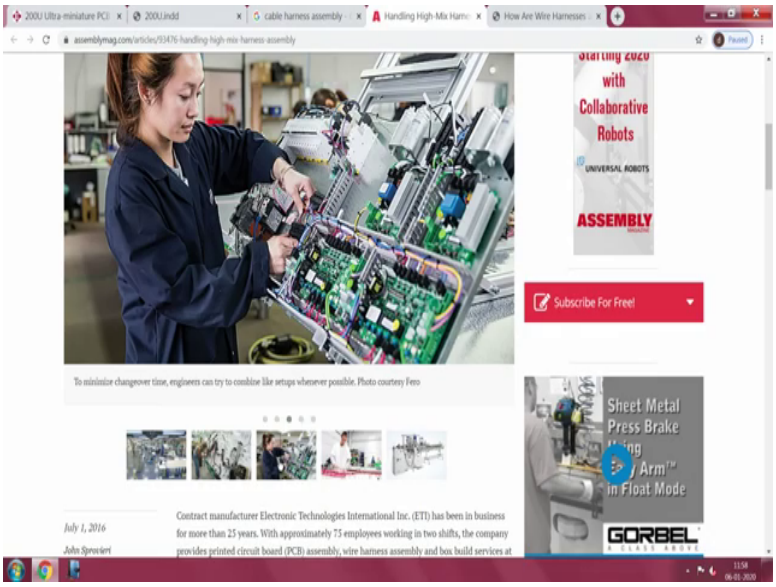

See the next level is going on having finished that now all these what do you call printed wiring boards are now being taken to the next level somebody has put it on a gig and this is probably part of a panel which I have shown your earlier. Earlier remember I have shown you a closed panel with a few colored lights on top of it. This is probably what is behind that. I have a picture of it I will open and show you inside is a tremendous amount of wiring and finally, everything is made to look simple.

In that case because of various I mean the people are using or trend operators. Actually there are a doctoral students it has been made in one way, but it is supposed to be it is supposed to suppose to go to a machine tool they are all configured in a different way. The electronics main per units are one wire, the motor controls and all are one more place, then the

programmable part is on one wire and it may not be in the front some of the maybe in the back and so on.

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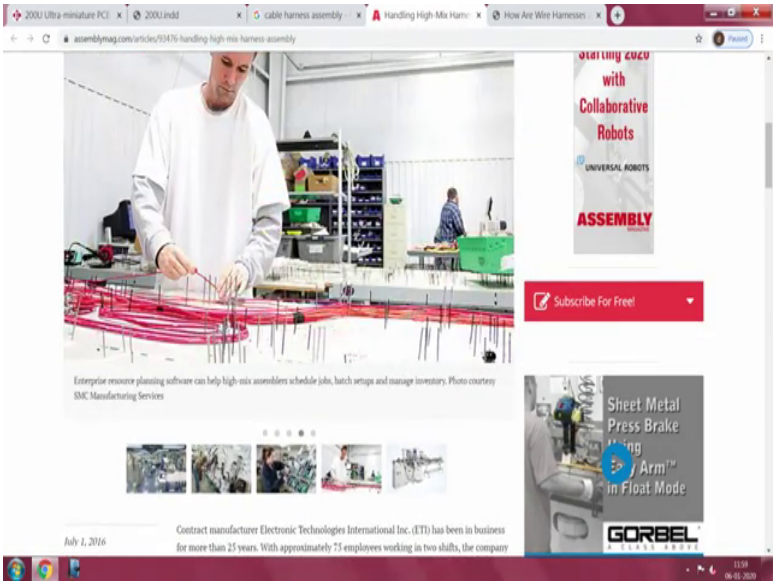

So, please have a look at even this. Why this particular one is the routing is also very very important? Is it relevant or relevant? Yes, it is relevant to this because once when you make these things even the front panel layout how close you keep the various elements and eventually how do you require all these. These pins ensure that they are all you know sent through this.

Now, it comes to the next thing saying even cable assemblies including RF, including generally know how to may be the usual 3 or 4 giga Hertz their small wires which are all routed like this there where the length also is very important. Now, please look at my other monitor. You see here I have made a set of things. So, what is done here is in one of the

things at the back, I can selectively switch off and switch on these items. So, I have the visible all these components are visible inside and at this point they actual layout is only done in 2-dimensions.

The contacts and pinouts are all at the back I will now just like that no I will well, I mean I have kept them to the extreme corners just as a starting point. So, I will now try to copy them. See this, I have four of them, now allow me to. Now, if you see here these are the basic pinout diagram. Now, it is possible for me to right now I have used only the basic simple millimeter grid.

So, if I now say switch off the default layer, I have the pinout that is written there and at this point I have not put be marking.

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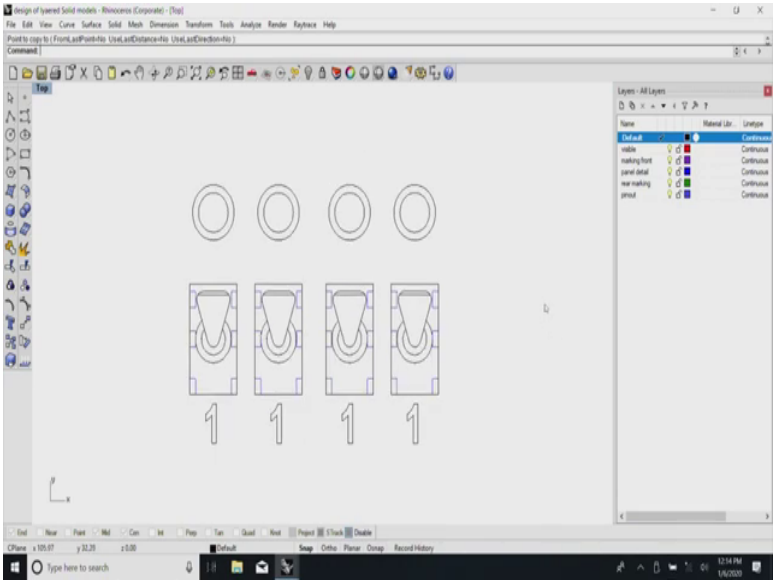

So, when I get this visible and group the whole thing together as 1 unit seen here, I have three of them except one small thing have you noticed the text one only has got copied there. So, it is possible for me. Imagine I am going to make a simple tense count this thing. Generally, tense counting they make 4 into 3 and then keep two of them dummy.

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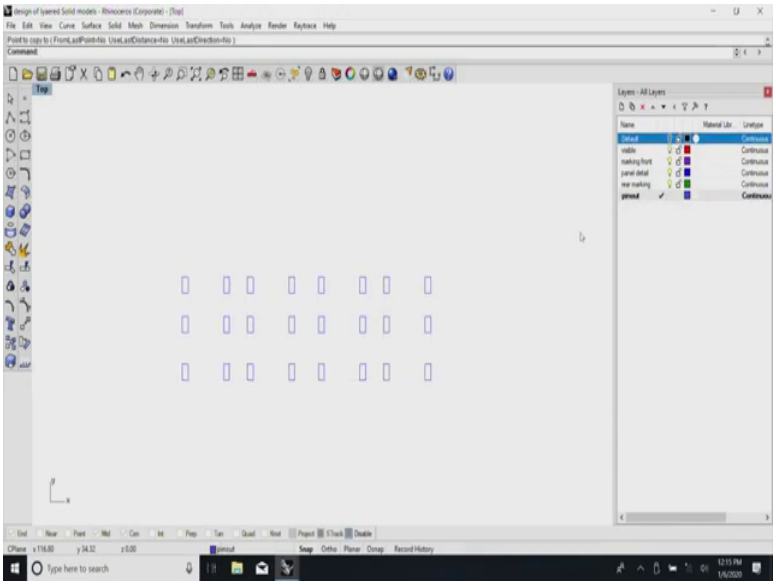

So, it is possible for me now to, if I switch off I have got all these things directly ready except that the marking which I have shown there is not here. So, it is possible for me if I now send this up change all these marking to appropriate marking with what do you call with your permission and what do you call your patience, kindly allow me. I will remove this.

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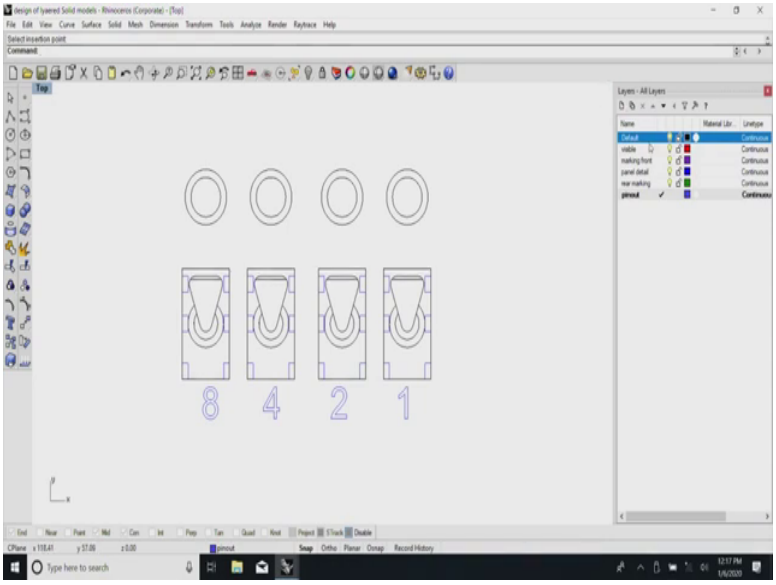

Now, I put fresh text here again. Looks good enough, is it not? This looks extremely good enough except that they are now going and they are sitting out in the pinout drawing.

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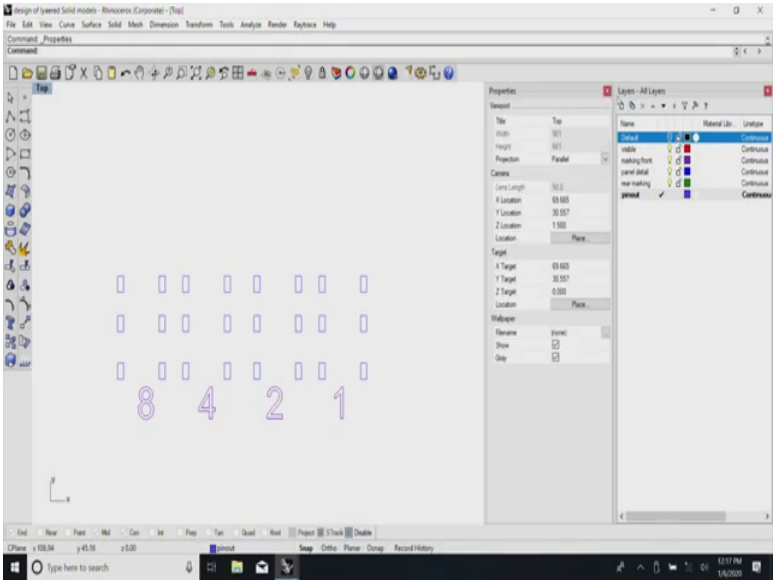

Why I left it in the pinout is if I now switch it off you see here these numbers are visible here. Now, if it is to be printed circuit board or printed wiring board it is probably quite in order if these things are left there, it does not make any there is no objection to or leading them there because the corresponding what do you call the control element in this case a simple toggle switch can be put there.

Now, let us say I want them directly on the front panel. So, all I need to do is take this group of these things and move it out to the front panel marking. Now, if I switch off the they are gone, I have only the printed circuit terminations at the back.

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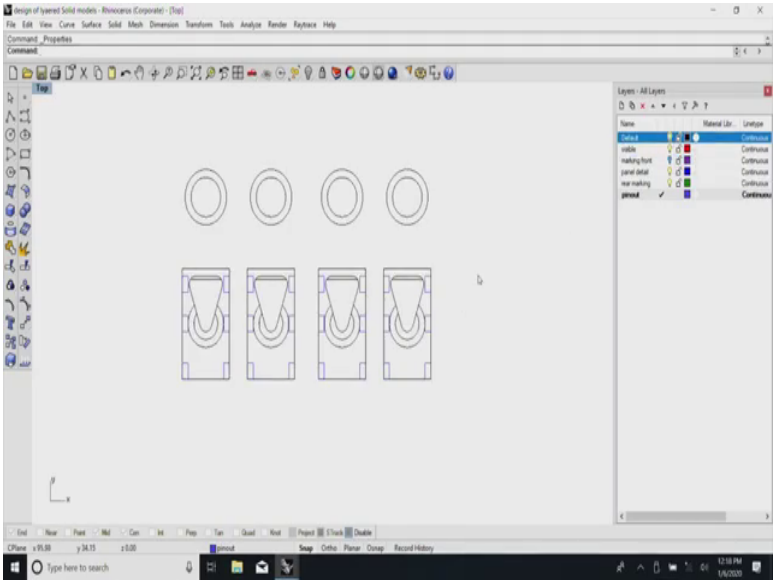

Now, coming back once more to unlocking everything this one the visible point of this has a small squarish block on the outside plus it also has this all these devices. All these can probably directly go under visible portions and the other thing can be happily switched off. These are switched off and these numbers are visible here.

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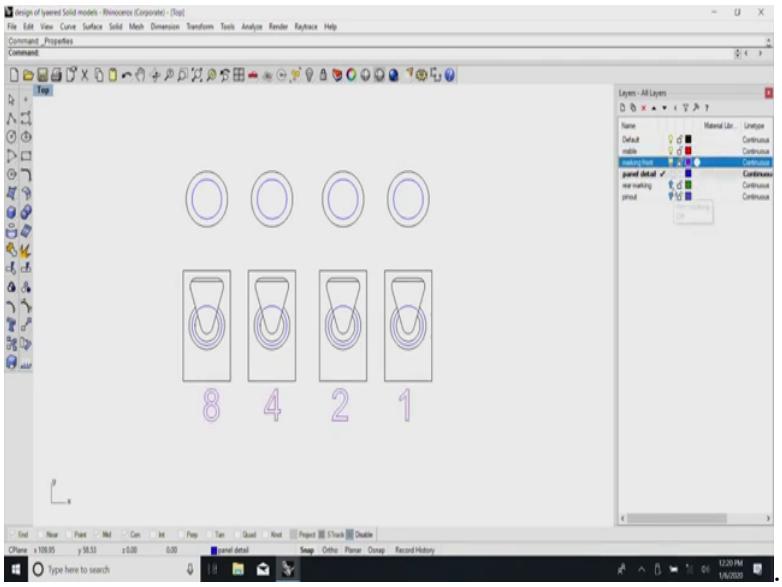

And, this now I can form part of the panel with this, you have seen this know. The point is being that by just now I will come to the drilling detail. Sorry, this does take time.

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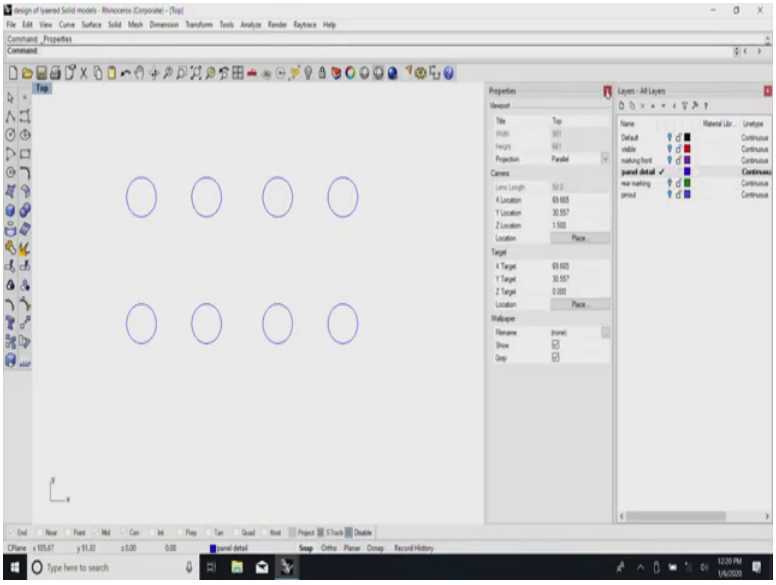

See here this now forms the panel and mind you all this have been done in switch itself. So, when I make the first that switch assembly, now it is possible for me to move it wherever I want I can make it into a 4 by 3, 12 or we can make it 4 into 4, 16 make a hexadecimal thing and you need to make it only once in your lifetime. Once if you make it in your life time now placing it wherever your like is easy and you can make a generic device by which know you can go ahead and make whatever you want to do.

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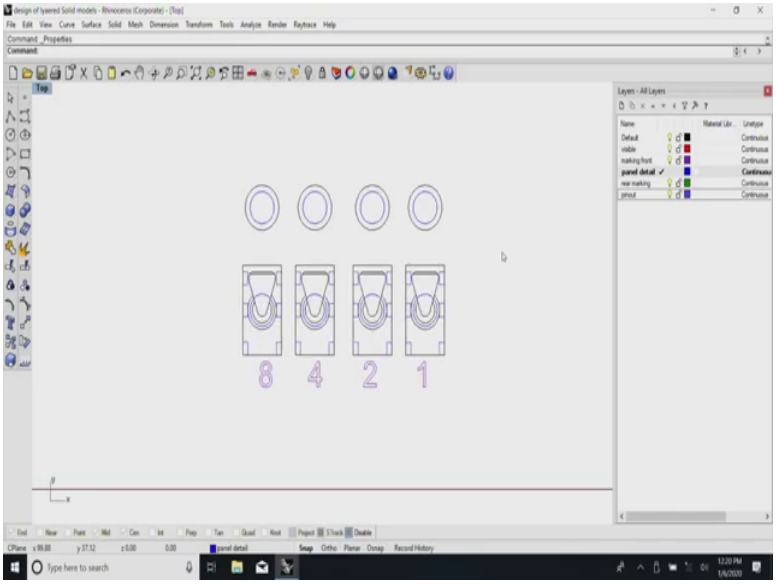

Right now, what I will do is, I will what do you call break the lecture here. So, that see in this here all I need to do is if I now group all the elements properly and more them wherever I like I will get this various characters and everything back in place. So, I will I can stop this session here next time I will come back with a pre prepared one of the modules in fact, all of them saying I have a few of these elements and then try to adjust them everywhere ok.

So, thank you. I will continue it next time.