Electronics Equipment Integration and Prototype Building

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Lecture - 13
Stacking of equipment to make a system

I am continuing a little about how do we determine the basic size of a electronic equipment. Obviously, let me repeat what I have been showing you earlier.

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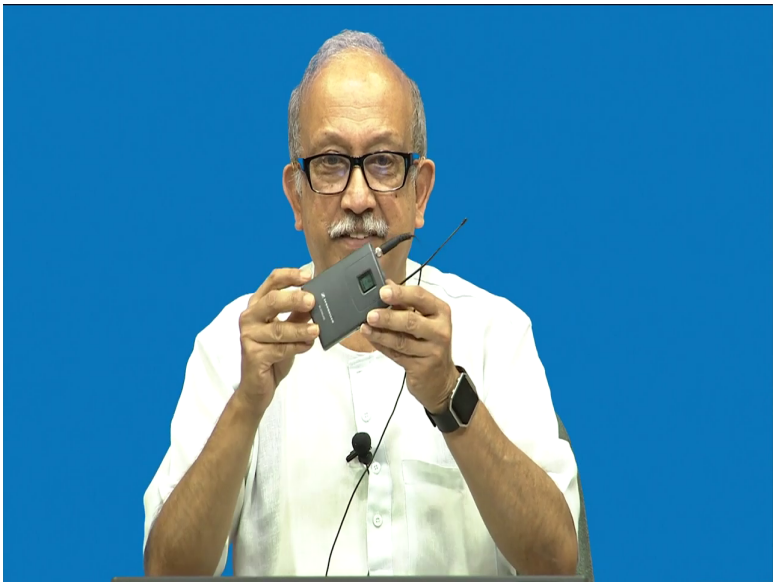

We have this device. I think all of you know this know. It is nothing it is connected to my microphone and in this case the requirements are you have to make something which is compact, something visible then choice of this connectors this is an antenna then this and then a choice of how do you wear it and all that end. This being generally a 6 sided cuboid thing,

distribute all of the things conveniently such that you can probably carry it in your pocket or in the case of news casters, it is hidden at the back.

It may sound crazy, but even it was to be what you call MTV grind people will have to hide it somewhere all the time. Leave that apart, that is just what you call wise crack. The issue is this things take a natural course, saying the idea is you need to optimize available space and at the back you will also have a place for keeping batteries here.

So, if you take the power supply cells then if you take the displays and all these, this follows a natural shape, loosely this dead called foot print I will not call it a foot print, but it just comes into a natural form and the older days form follows function, while it looks obvious it is not as easier as we think we are.

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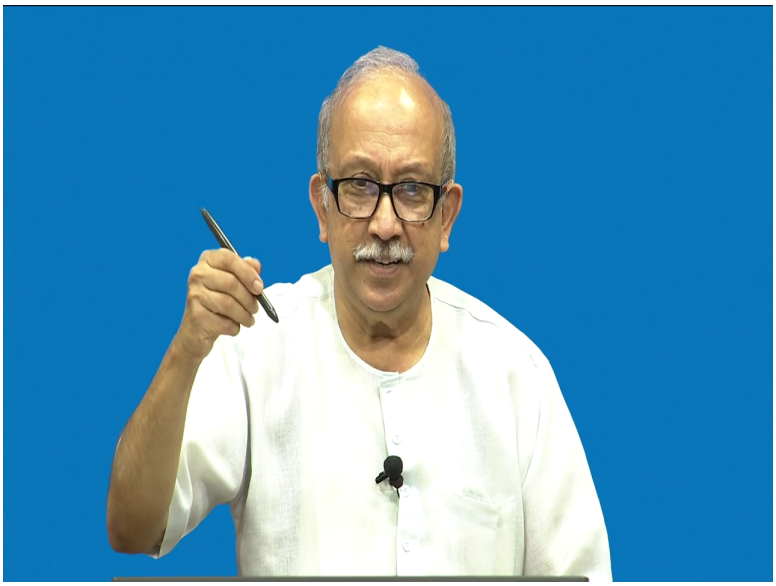

I am sure some of you have seen things like this. This is a writing instrument and in fact, it is not just a writing instrument, this one as a stylus and something else here I am not sure probably it is powered and there are switches and all this I can form follows function. We are not chiseling it. May be if you are in asterisk times people will hold it like this and start chiseling it, again another wise crack, ignore it. This basically follows function. We have a place to hold we have something to hold here. Most people well probably have to learn how to use this things, will leave it again.

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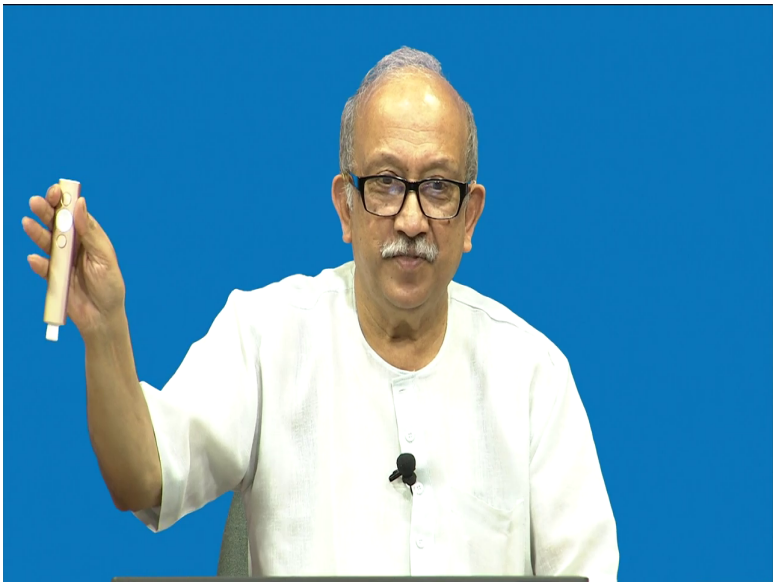

Now, you have very very interesting equally interesting things. Shocked? I do not even know what I am shocked with. What I am shocked with is see here this has something which is goes inside. So, from here to here there is a place there is something here this is not for hanging and

very very interesting this part of it is a USB dongle which goes into the computer and this is something to is and we have very very interesting looking keys.

We have on off key then we have forward and this thing, this one is a pointer meant for pointing towards a monitor or anything class pointer, saying if you have a power point loaded you need to use this and use it.

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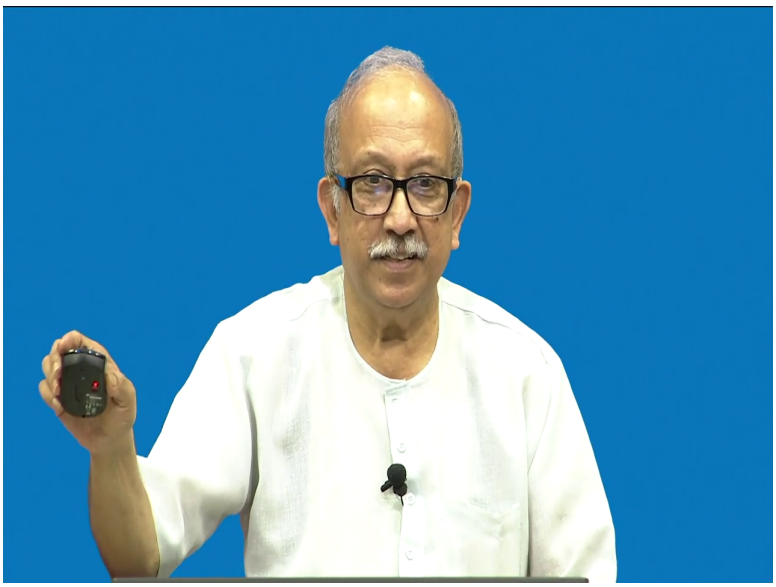

By default people try to use this, mouse, not the best thing, not the very good thing and this has some special things in the end if possible I will try to show you again because I honestly I do not know how to operate it its lying in the studio.

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And we have ended up with this, (Refer Time: 04:49) cell phone. I think we know about it know, in the cell phone what started as a basic communication device, it ended with now a camera and not been happy with the camera we also end up with having to use it as a monitor. So, we try to keep it like this and then may be watch some content is important.

A small thing and you watching a sports is probably not unsafe for work it cannot come as safe for work, but not unsafe for work. So, in the end we end up with several accessories including this small stand for a double tend stand close. Now comes the what you call how do you organize all these elements. So, we have a finger print sensor then we have a camera. Now, do we need all this things here, do we need a lens here we have a lens here? I will ignore it and even in this case now loosely form follows function.

Again I said loosely because another is it is a new public which is learning all this things saying, we cannot call it a full fledged population stereo type, but still left handers right handers and peculiarly people who cradle their set like this, set like this I will not know how it has come about it is still useful. Got I know.

A little about that new stereo type which works, but then it seems to be for most conditions otherwise you have the cordless wired hands free set or pure cordless thing, I am an unfortunate person who is forced to wear this things, but then I am surprised that these days no young people wear some white colored stuff here white colored stuff here and appear to be talking to themselves.

Again wise crack apart, the issue is saying all these devices have various ways of connecting themselves to that. Then two important things one is so far I have talked about deform interconnection something for a charging porter I talked and a fantastic layout on the front panel, you understood know.

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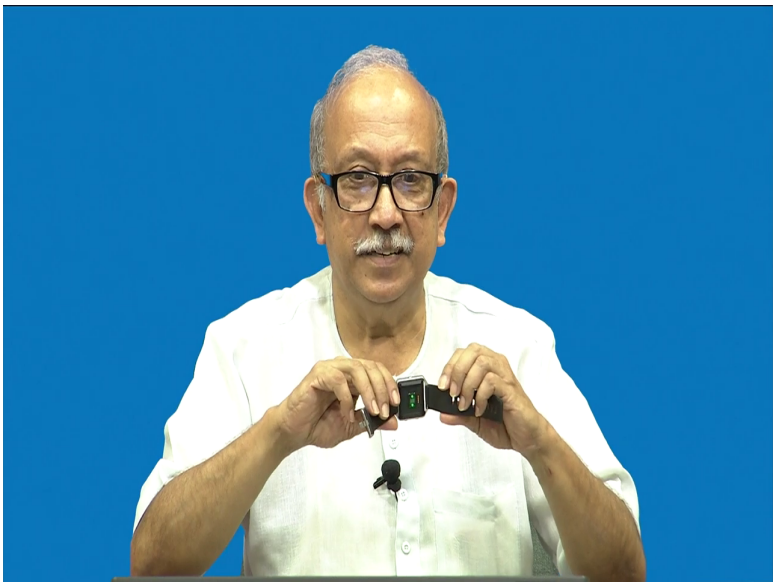

We come to intentionally I am showing, I think I am several of you have this, smart band for dumb characters while there is a little novelty issue about it I am still trying to most people are trying to find out what to do with it. Here again we get into a very peculiar problem. This part of it is no problem, we wear it. Now, when you charge it how do you do it? Every time the designers or manufacturers are trying to learn. In this case there are small there is a sensor some lighting and then there are contacts here.

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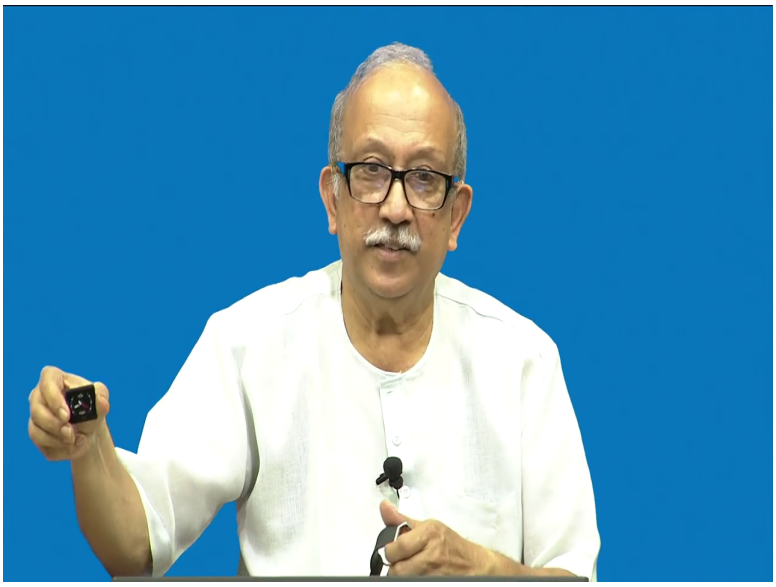

So, very peculiarly they expect people to disengage with this and put it on to a charging a thing because that ensures two or three things. First of all most important is you will not be using it while its being charged ok, then so, depending on variants of it, you are supposed to take it out like this and then you have a not strictly a doc there is a charger on which it sits. I still consider it as a minor inconvenience and a nuisance and as I push it inside, now comes the actual real problem. There are keys here there are keys here which are supposed to interact with it.

I am not digressing or I am not what you call trying to by time, the issue here is now we end with the saying this external button, should go and engage with the key properly while it is in the deployed state. Same thing I have keys here once again little bit of population stereotype, saying from the earlier digital watches we have this something here and most digital watches

were octagonal. So, we had three case here and three case I mean three buttons to push and so on.

Now, it has two different states: one is while deployed another is during charging. In charging we need to take it out, but then things are changed a little and even for this you now have a doc; meaning, without having to take it out of this we need to put it inside something clips inside, you take it out and use it like that.

Now, we are coming to a product now, probably next level of product we will have all those things built inside. I hope you are with me. Now, let me get on to the actual lecture here. Now in the case of industrial products, we do have a you see this.

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Obvious what it is a lab equipment. I will not what you call venture out to call it anything, but at the moment I think it is enough if I say it is a good old tectonics oscilloscope. Something have you noticed very peculiar about it. These were all original laptop equipment and finally, when somebody had to use it has part of a larger system they had to stuck one over the other and when you attempt to stack one over the other, we end up with a peculiar situation saying not all of them can be or designed for been stacked and if you make them stackable, the bottom was takes all the load.

The bottom was to may not and then putting a sticker there or do not stack more than something is not that effective because people are desperate and they may want to anyway stack them.

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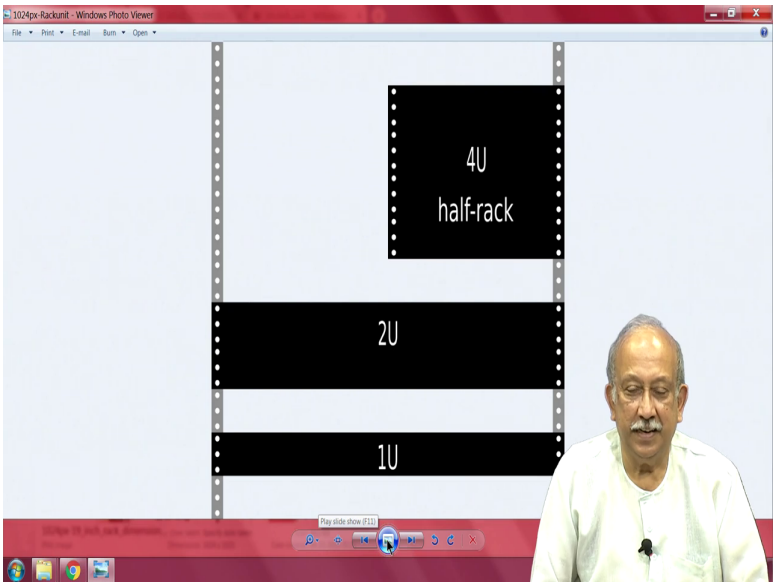

So, all the stacking eventually lead to what is called the rack system. Rack is not the one that is used know. Where enforcing your political correctness it was used a rack means anything which is vertical and another thing is it has regularly pitched openings here.

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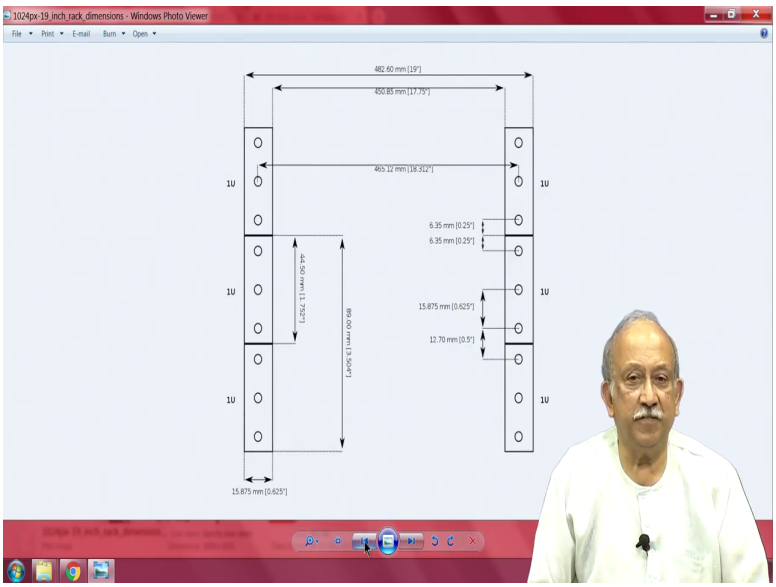

So, in the course of building systems this so called 19 inch rack came about. You see here, you will see 19 inch and the 19 inch they refers to total width of the support structure. And in this case two things which are important one is you have mounting openings and the other is the extreme width of the front panel. So, if we go back here you will notice that this represents a height and this two represent the mounting openings. Now, we wanted relatively universal.

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How do you make it universal? This is how after lot of consideration, I would not call it a trial and error, empirical standing this thing came about; saying, we have a pitch of something here than we have a pitch of something here. So, a very uneven odd number pitch saying odd numbers will have half inch and the other numbers you know come with one and a quarter inch.

So, it came about one and the quarter inch plus half inch one and the quarter inch plus half inch, this seen that two of them close together two of them and then in between two of them further aware this thing came about. This is slightly misleading, but; however, the next picture shows you what it is. This distance between one pitch that is a one and a quarter inch plus half inch came to be known as 1U. So, 1U typically is 44.45 millimeters.

So, one rack unit of 44.45 millimeters another rack unit of 44.45 comes to some 48 point something and such things came to be very very popular and wide spread. Do not worry about why it is hanging like this. I will try to go back and see if I can locate it, see.

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You see here. Finally, in an actual installation and not standalone, in an installation we end up with having to choose the vertical pitch and horizontal width. It will be a waste of space if we use a one rack unit like this and stack one over the other. So, the next thing came about saying why cannot we divide horizontally. Very rarely it is understood that you know this is an option. So, I will just go back with little back into history.

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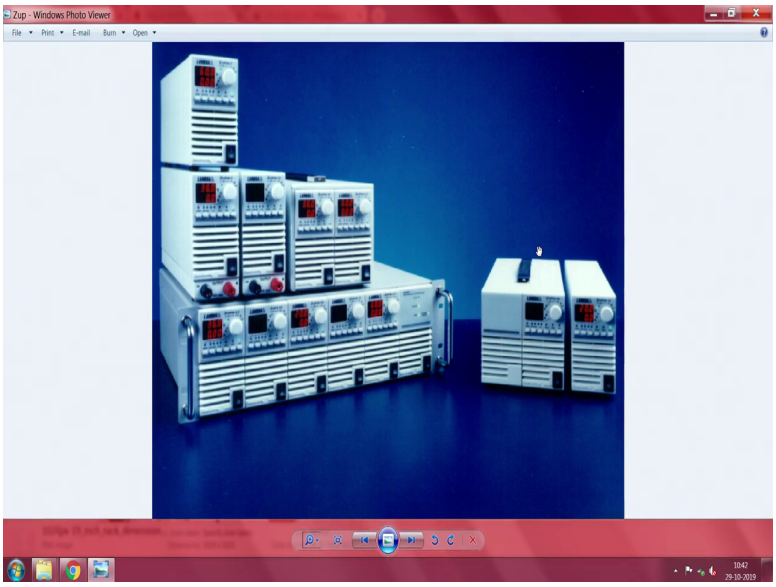

See here these are all power supplies. So, we have something which has been spilt instead into to 6 parts. So, one part here two here two here and then you see here this is about one third this is another is one third and then after that you have another one third like this. So, important thing what you can notice here is I can take any of these unit, single or one more and also use it on the table as a bench for supply. Except the main issue in this case is you have only two of the face is available for you for any interaction; sides and top are already occupied.

Top is used for stacking, in this case they have added a handle and the horizontally you cannot afford to have anything on this faces. So, we have a little bit of a control element display element here and then possibly this is an on off switch unless I look closer I cannot make out,

it does look like an on off switch. We have switch here we have this end, we also have openings here for a cooling arrangement of fan.

So, something can come forward something can go backward; main thing is they can all continue to be mounted one next to each other. Let me go off a little fast. See here we started here. So, this is actually a retro fit type of thing meaning they have purchased a good oscilloscope and then they have made a box around it.

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Another variant of it, have you seen this? In this case, I am not sure whether they which is the front and back and why it is mounted like this.

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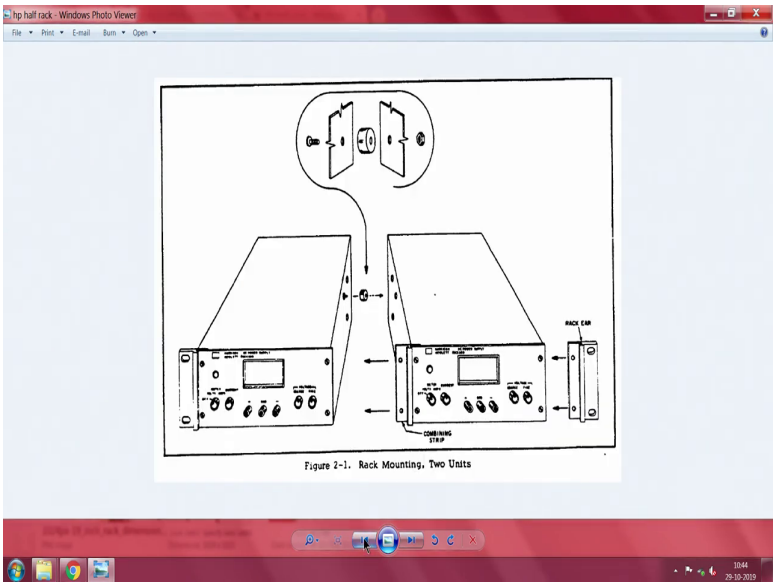

This is taken from a just around what you call 40s 50s, possibly in the 50s when this people where the standard equipment to be mounted into a rack. So, add a pressure here and take the front panel add a adapter plate here, adapter plate here and then join this two and then we can have a rack mounted 2 units on one thing.

Why I am slowly leading to you is this is the one that determines, the aspect ratio of our industrial equipment and typically most lab equipment are likely to end up as a professional industrial equipment. Say it is with your audio equipment, so, it is with your mixer. So, many people have home audio home video home everything. While cellphones will continuity there after a capture some the things from the cellphone, you will probably have to make things here.

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This is one of the what you call power supplies. Now, when you build a whole system, it is very easy for you. All you have to do is attach two of them together make a adapter plate and put two of them into a rack and you are on your way. So, any standard stackable device will eventually have this things.

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I am not sure what it is. I expect that it is either a dummy load or it is a some other power supply which is remotely addressed and controlled. Three of them are mounted in a possibly what looks like a 3U sub rack. Seen that again mounting holes and something here you come to a very very important things. Heavy items cannot be directly mounted with the flanges, so, end up with a tray instead.

Most likely this external device is a tray and you will just need to part this things here and essentially somebody can do a hot swap. Meaning, two power supplies are in action and if you want you can now put a spare power supply and then you can switch things and do something and remove it and add one more device to this. Interesting, is it not? At least to meet is interesting.

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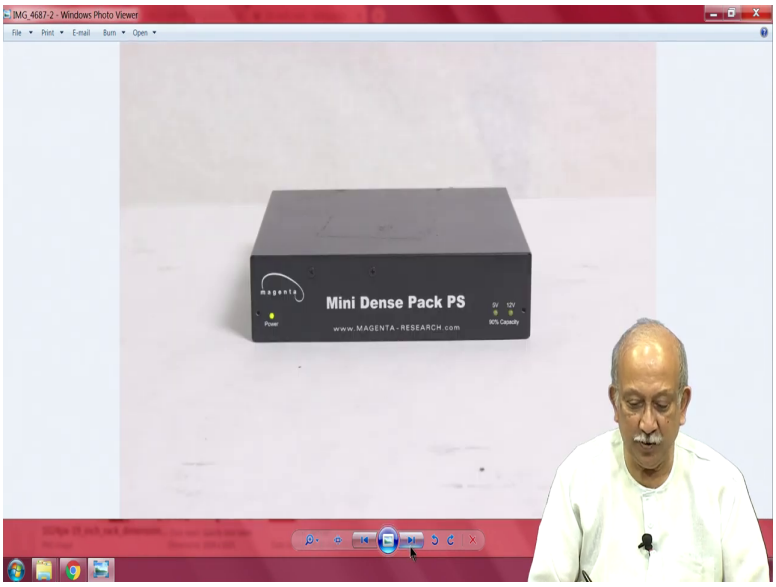

I am sure end your course you will learn this. I have no interest on what it is, but I have an interest in saying.

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When you make such equipment, you probably have usually 1U that is 44 millimeters available and the full width of external is 482, inside up to 450 mm back is 450 m. So, typically safely you can take 440 mm, where you need to use; seen that what determines the front panels what determines. This now another detail, it may be useful for you here. Notice something here, there are again two screws or I will call it some thumb (Refer Time: 22:21).

So, somebody can use their thumb loosen them then there is a release and you can plug it out. Same thing here saying, imagine we have a large number of them stacked one over the other. If one of them fails, if we have an extra this no problem; otherwise the whole thing can be pulled out and replaced. Why I am showing you these examples is this is the new modern rack which are likely to find in your laboratories or some communication devices.

See again we have something here, I have no clue what these are and then you have something here and then various types of. So, in this case depth, width and height in this case are determined. So, lay by application.

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Similar equipment like this; however, this is made into a single device. There are advantages and disadvantages of it is full area is there and then the hardware need not be duplicated. And what serves as a tray, this can have a support at the back and you see here there are some openings here. So, you can use them as you all prefer.

And you will notice here even the way of you see this is mounted in this that releasing leg of this is mounted with releasing leg down then we have releasing leg here up on the right side. Why it is probably, they are daisy chained; meaning, there is something here which goes to the

one immediately. So, there is no chance of twisting anything. You should not twist the wire. Something here goes down, something here probably now either goes up or goes down.

So, we end up with this what look like anomalous objects. Now comes to the original place where have started up. We have 2U, we have 4U and typically 40 42 44 U, total racks are standardized and they are used everywhere and depending on the number of U you can play with it and mount things. Let me just you know what you call go a little back and work little faster.

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See here this is one of the earliest ways rack mounted devices where made. It is not except. You see this those two physically are compatible, but this device is a very different device compared to this; this is something else this is something else. So, but purely from the point of

view of or understanding the this modeling and software thing, I just wanted to show you that this height is very critical.

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And I am sure you would have seen such things. Makes sense, somebody has made some I wanted to know the word some small k and big V is there; something called m and A is there and then there on and off and something here. One of the few things you will also discover here is chances are you will be blocking the this things when you put it. So, is there a better way of organizing the front panel?

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See here again, at least interesting to me. In the case of racks, we have only the front and rear access. So, you remember the earlier rack we had those screw, similar things are mounted here. So, this is probably an enclosed tray in which somebody can remove it and this could possibly be a power supply or it could be an inverter or it could be anything, but which needs cooling.

So, you have fan which are mounted here in the front and generally fan sizes are limited. So, you have 4 inch fans, 5 inch fans that is you have 88 mm fans and you have now 120 mm fans and so on. So, depending on the system requirement the amount of cooling that is required and amount of all these size is a constraint and where you locate all these are also a constraint. So, let me come back to that later.

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Looks funny here, is not? They have taken a equipment and then they try to add a extension and then try to place it. So, very rarely unless the equipment is very light or directly a dummy panel is attached. Dummy panel is attached this is all attached and all, but probably mounted together in a tray or supported on a rail at the back.

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Plate, heat spreader and probably this the this view is of this from the back and this loosely called heat sink is in the middle portion and what is this is not shown here that is this one here. Now, you see here we have an output and we have the mains input and in the front you only have switch belonging to this and then you have this small fan which probably takes air from probably from the bottom and spreads it out and the main power devices are mounted on this heat spreader.

Conveniently done, it looks a lot like a very simple our power supply which we have taken from our normal PCC system units, shown you earlier.

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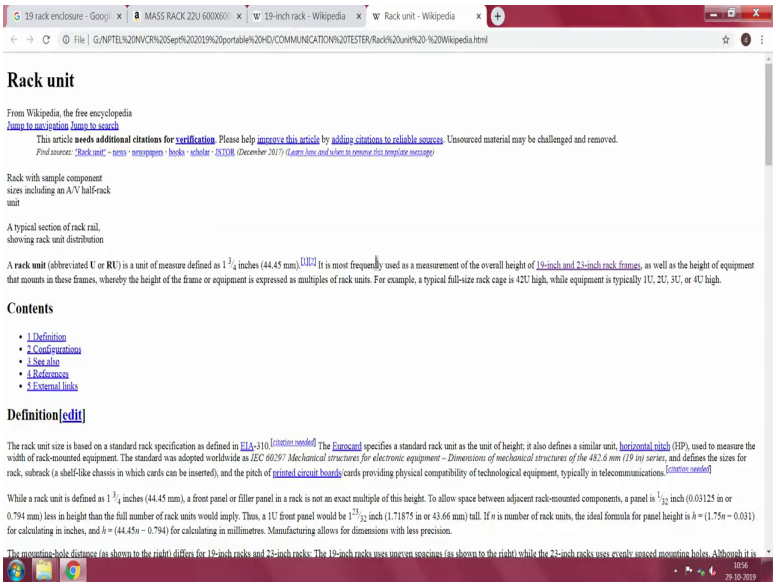

Now, starting at this point, I wanted to show you how this rack units and all I have got derived. It is a little difficult to read. I will see if I can.

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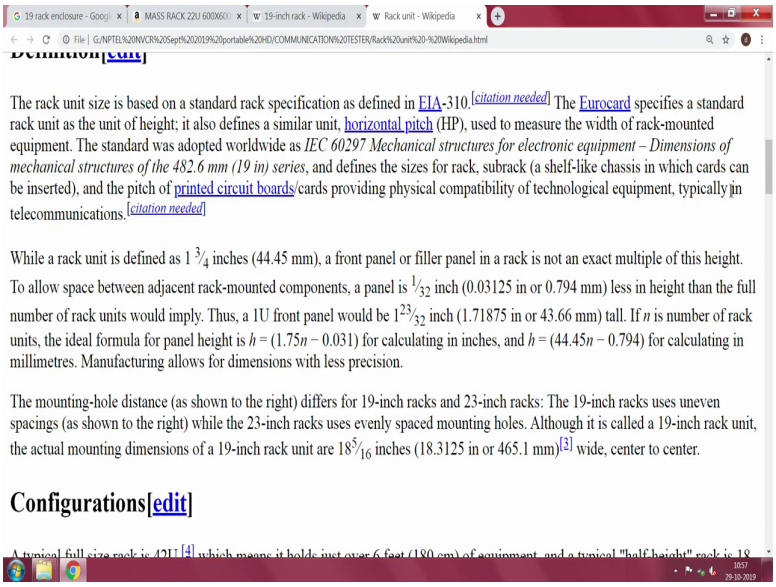

Remember, just a little while ago was reeling out what look like a funny numbers which yes, in this when I showed you about the openings, two set of holes are 1 and 3 quarter inches apart and there is a what you call half inch height to the next one.

So, all these put together we end up with this peculiar 44.45; width is here 1 and 3 quarter inches is correct one and I think one and the quarter inches plus half inch, then this front panel heights are generally something that is 1U into n minus 0.8 mm. This is what is used when they determined the height of front panels.

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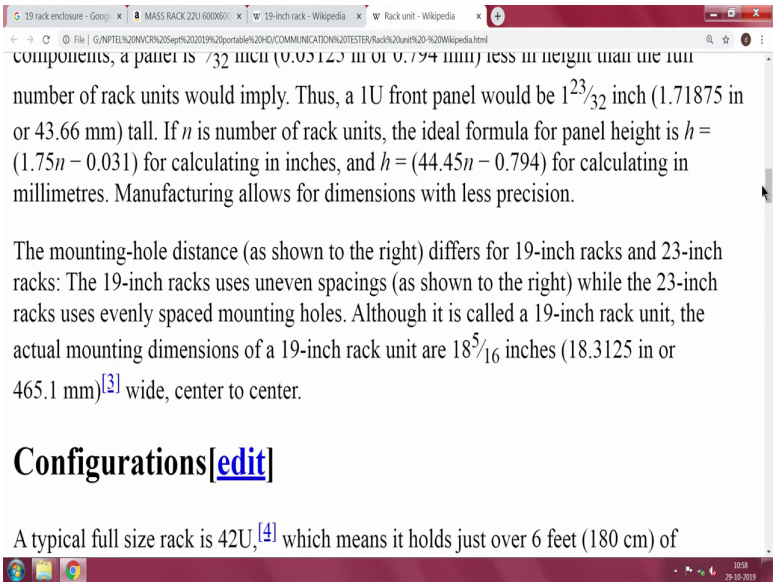

So, often there is a question here saying what exactly is it; is it only 19 inch rack? Actually in reality two are very much possible, this is an 19 inch rack and a 21 inch rack and something approximately equals to 23 inches also is available.

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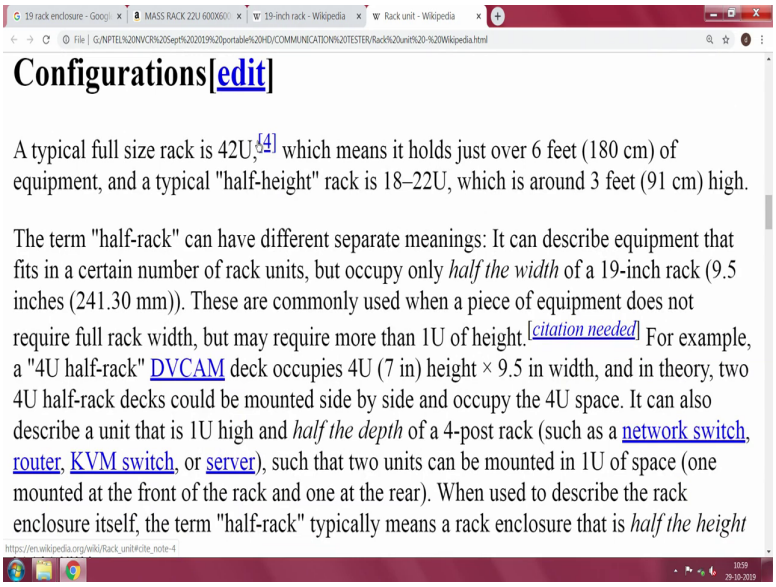

And more out of common practice, around 42U is a standard 6 foot high rack which is mounted.

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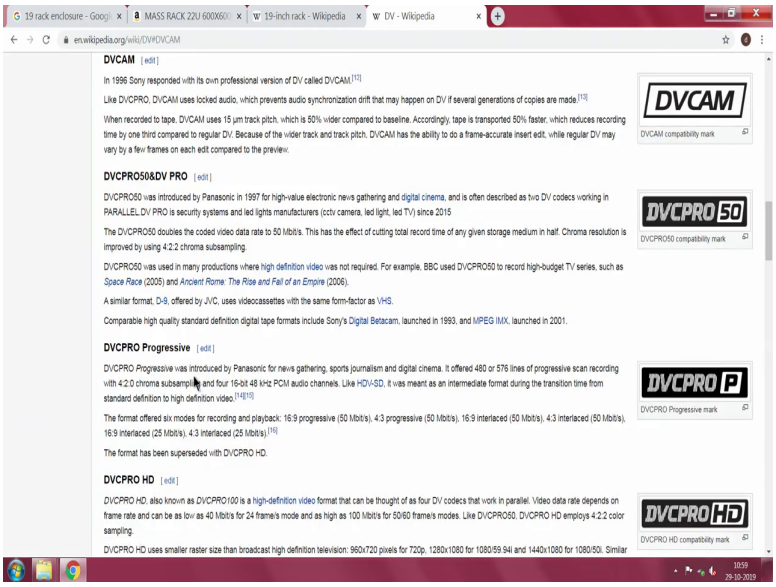

So, we have here a way of finding out typically why for example, why does a DVCAM you know come with this peculiar configuration.

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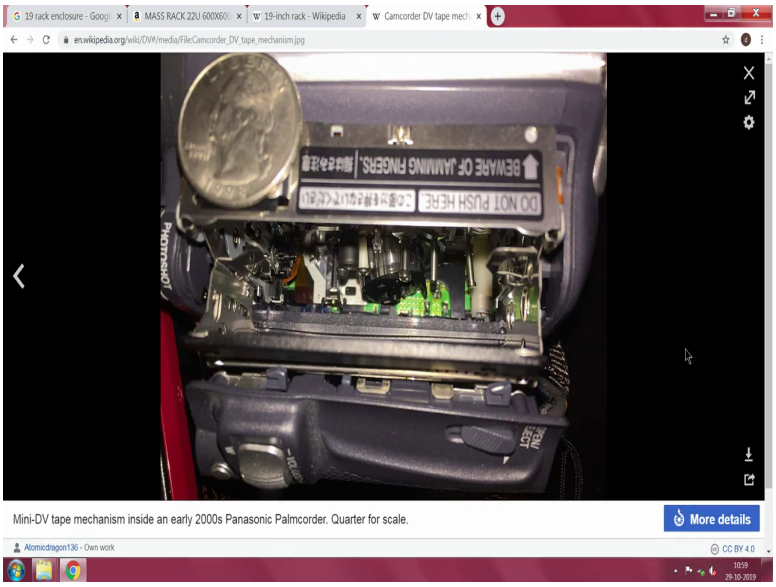

Not very much visible.

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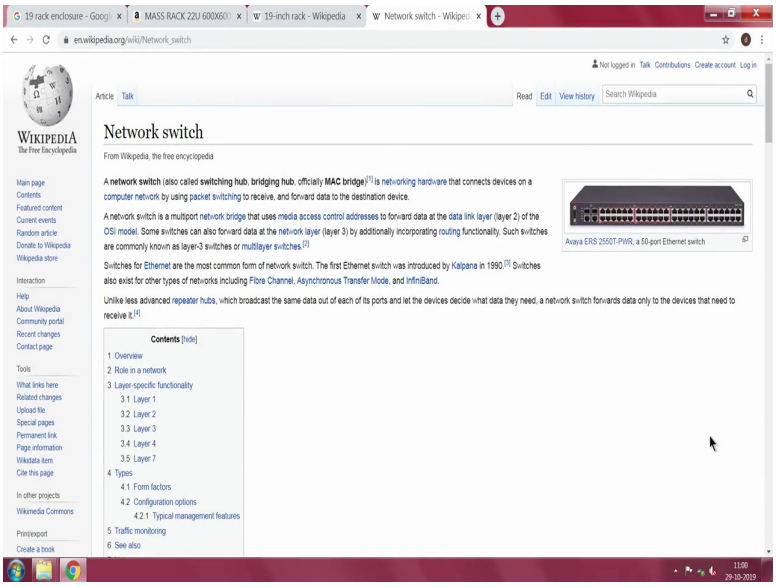

A lot of it depends on things like this network switch which I have already shown you various configurations and things which are there and how this network switches end up in a rack.

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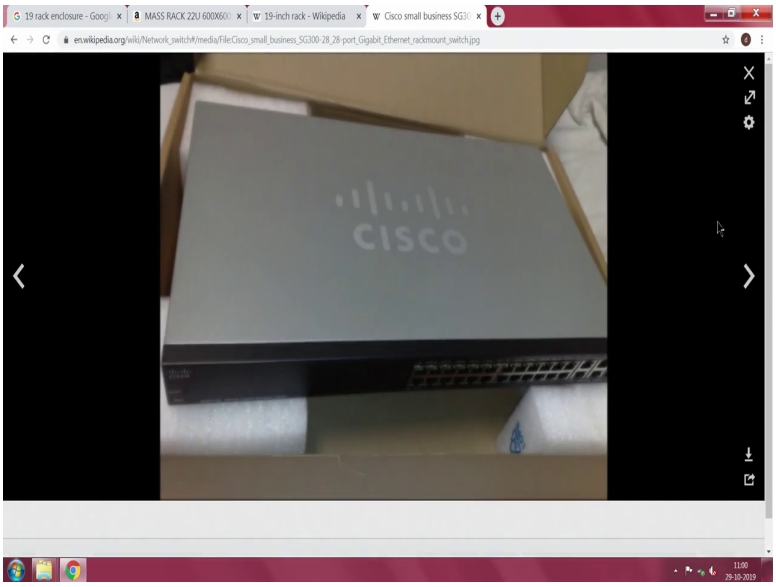

And once again with the little what you called apology of been digression or something.

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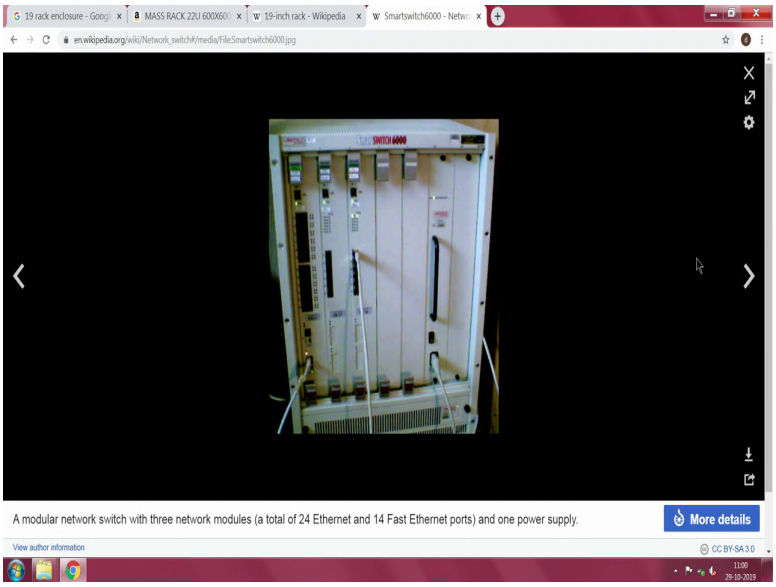

You will notice that the vertical pitches all these things still continue to follow whatever we have mentioned here and some of these cards are made like this. So, there is a card release lever.

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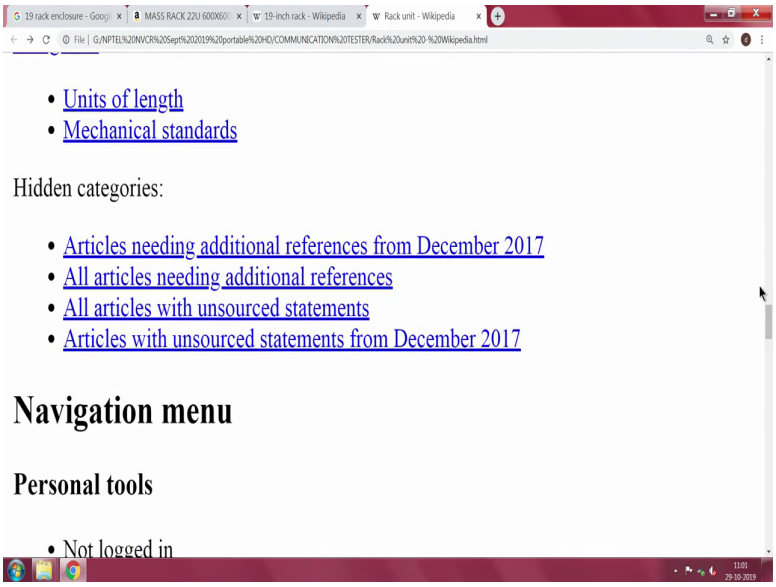

Then there are several things like, how do we go about it.

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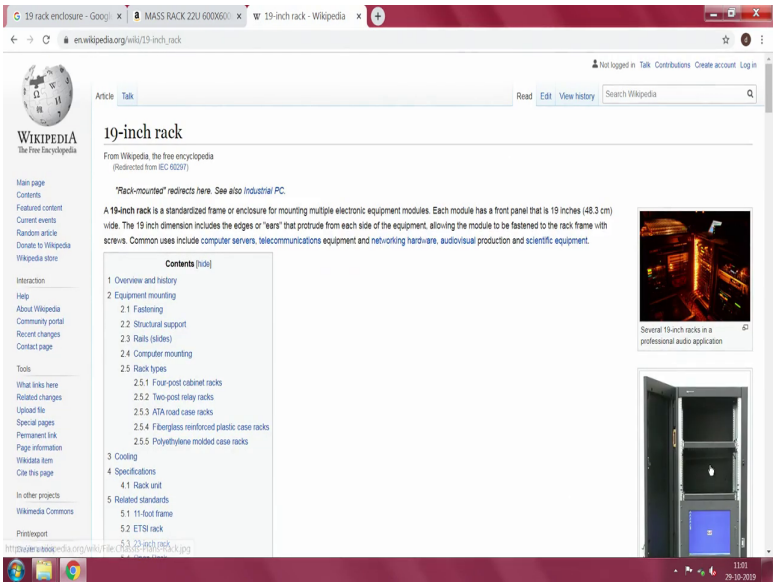

So, at this point, let me just see this is typically a probably a fully configured industrial system. Two things you will notice here is if you see it a little closer here, there is a bottom I am not sure it is may be a power supply then there is a nice display here and you get things get quite interesting.

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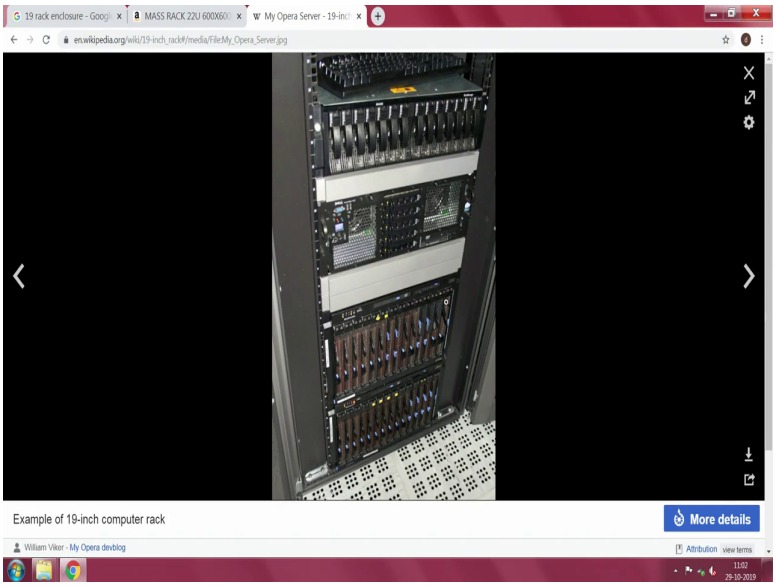

And every system gives you a reference of this things and when something like this is mounted, it is only meant for something you install in the beginning and then after that every time you do not need to middle with this things. Can you see there something which is mentioned here? I do not know my topic here is only about saying, all industrial items require this height being a multiple of U, width being outside is typically 482.6, inside the width can be up to around 440 mm, depths can be 200 minimum of 100 with steps of every 20 mm.

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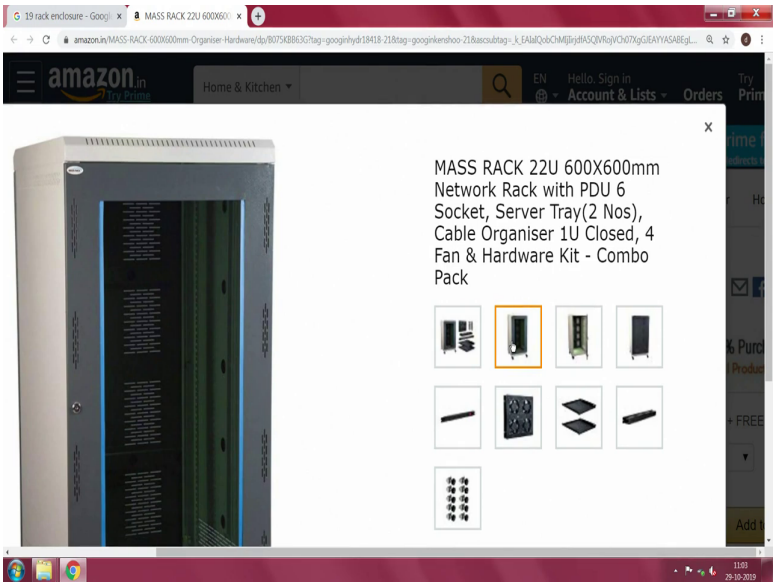

So, I will now lock this. Typically, now when you go, these are commercially available. Seen this? 22U; 22U is a half rack.

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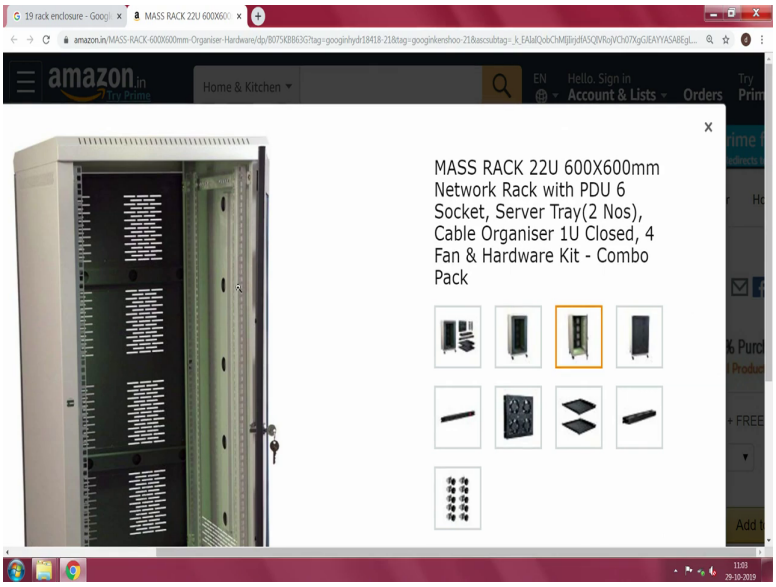

And this is rear, but often we have provision here even for probably passing a wire harness or wiring, so that in the closed condition still you have a option of being able to operate the device.

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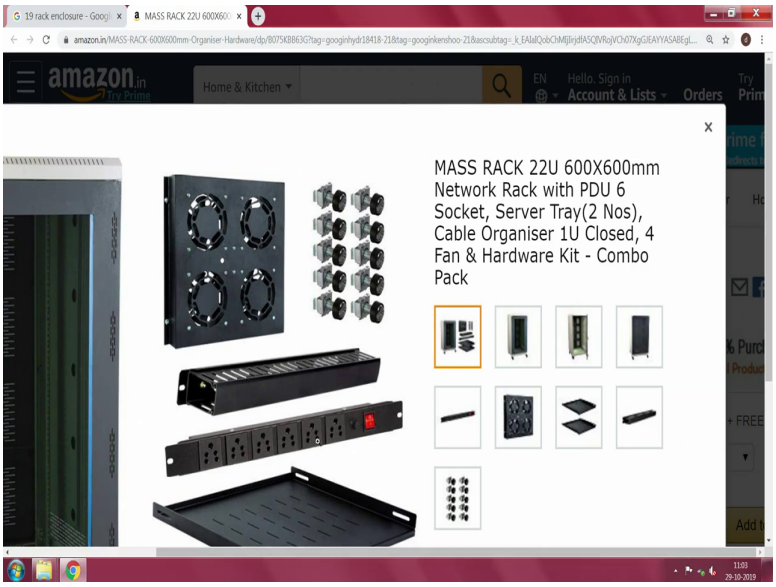

So, this is other accessories and most interesting accessory you see here. We have 6, what you call 6 U I am sorry 6 slot for distribution unit with the nano switch and diffuse and mounted with a single hole.

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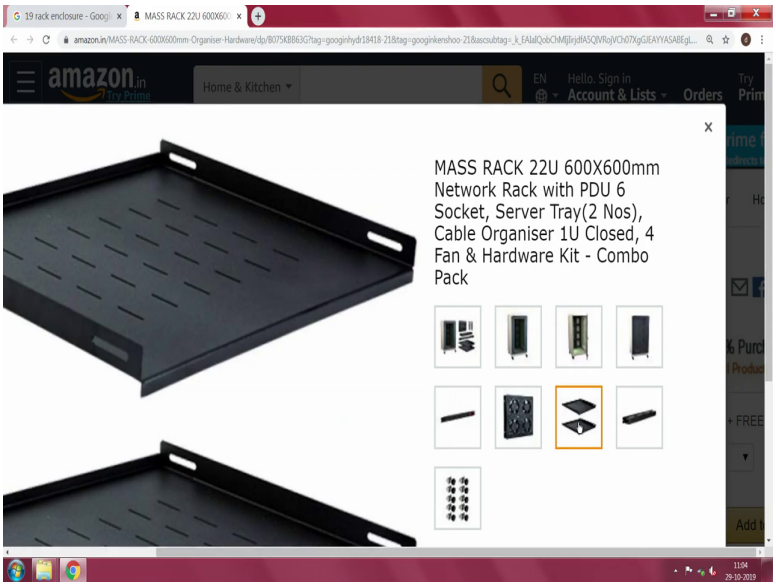

And see this very interesting thing then you have this beautiful tray. We can put the trays one underneath the other and carry anything you want depending on, see one is turned up one is turned down depending on how do you do it. So, that is for you to choose. I expect that usually this depending on a equipment it is there.

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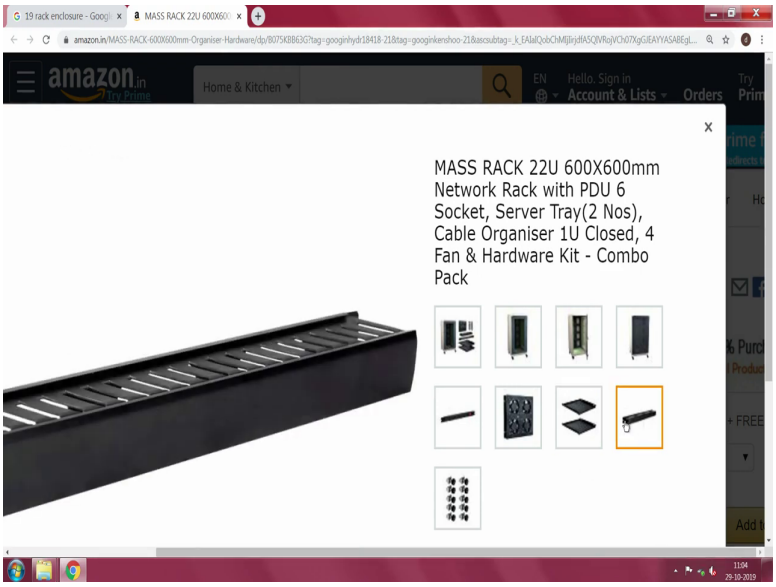

And you see here, this is a cable organizer. This cable organizer can be in one of the slots in the front or it can be the backend. Very interesting is you have a fan unit. So, here hole rack you just you need to buy a minimum kit.

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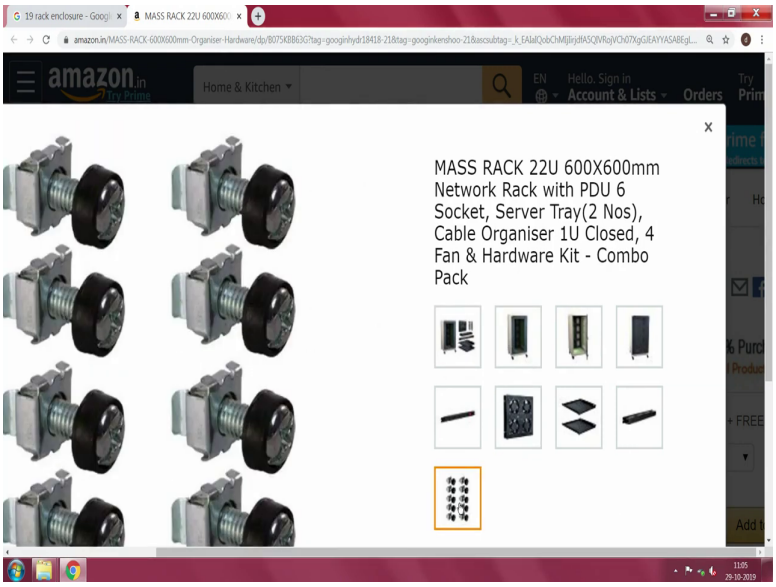

And this looks a little what you call very peculiar, but what it is all the openings that you have seen very rarely are actually settler openings. Usually, there will be a square and this is a captive nut which is kept inside. So, this you would not be visible, this is the front what you see. The front is this side. They sits in the that what you call that square opening and this nut is floating inside and this point usually is on the other side and then this is the one that is used for holding all this things here and it has evolved over I will say century. It is not you know, it will not just accidental.

So, you have here you know all shots of very very interesting things. I have shown you up to a point where the devices retating to an industrial application where it is mounted in something which is very very familiar with you. Now, if you me wondering why all this is required at this stage, I had skipped one some very interesting pictures a little earlier saying, how we have arrived it one particular testing unit which can be both use and the table without having it will

make to look like a rack mounted unit which used on a table or it can be used comfortably in a rack without looking like taking a some table unit and then mounting in a tray and push it to the rack.

So, I will show you a little more detail about one of the examples, when I continue this lecture ok. We will stop here for the while.

Thank you.