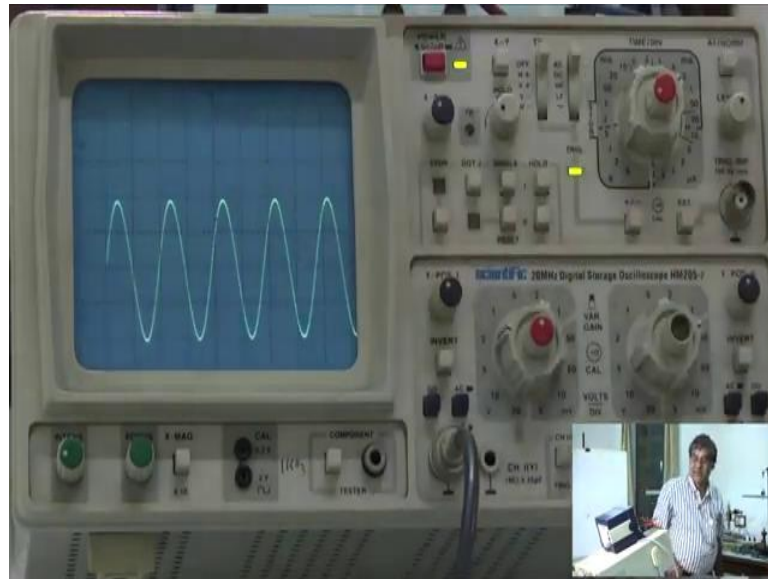


Experimental Physics - III
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Lecture – 02
Basic Tools and Instruments in the Laboratory (Continued)

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it should be 1, 2, 3, 4 I will put here then this see yes. Now this it is now 4th division, I have put 0.5 this per division it is 4 it is 2 volt. this is my signal here so now, it is calibrated 1 Now, it is calibrating to 1 let me take out, where is the signal 1? This one my signal 1 I will put here ok.

yes, now it is you see I kept it at 1 1 1 no 2, 2 it is kept at, but it is at 8 volt ok; it is at 8 volt I have kept at 2. it should be per exact for 4 you see now 1, 2, 3, 4 now we see this is how important it is. If I do not take if this function generated is very good function generator.

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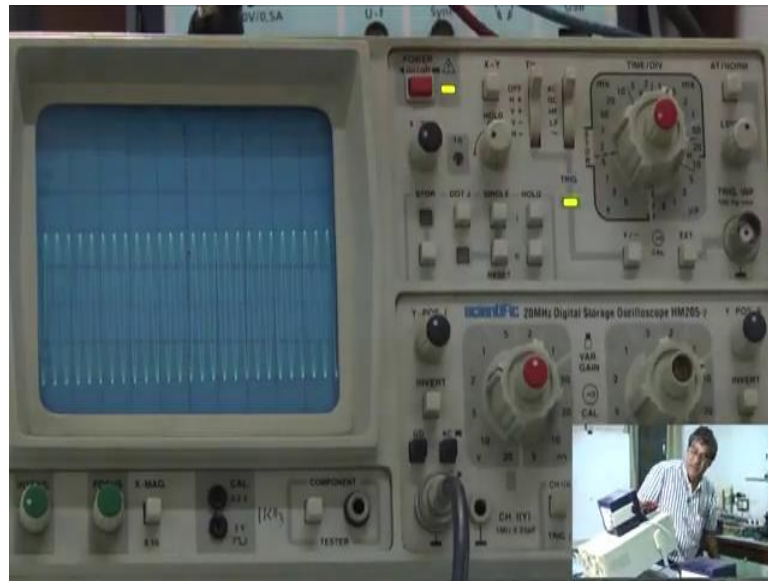


whatever reading it is giving exactly I should get it but when I saw that I saw the no when it is 5 then it is showing 4.5 volt, when it is 8 then it is showing 7.5. So that means, either this 1 may be having problem or the calibration is having problem, but I know this one is correct.

I have to check the calibration 1 for known voltage and this I think it is 1 kilo Hertz this signal this is 1 kilo Hertz If a frequency as well as frequency as well as the time to frequency as well as the time period; corresponding time period corresponding frequency you can find out you can calibrate as well as you can calibrate the voltage. That means, you can calibrate the x scale and you can calibrate the y scale; x scale is for voltage sorry y scale is for voltage and x scale is for time ok.

here it is telling the frequency is 5 kilo Hertz if frequency is 5 kilo Hertz now this for y axis you know for channel 1 and channel 2 and this is for x axis for both channel 1 and channel 2. here time per division is given in millisecond now, it is we have 2 we have put at I have put for this signal say it is at this black one; here it is so black line is here. I have kept it at millisecond 0.2 millisecond or 0.1. that one has to be careful it is the 1 millisecond, but it is the 1 millisecond is ok.

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If I kept at 1 millisecond, then I think it will be slightly difficult to x shift slightly difficult. I should 0.5 yes 0.5 each division is 0.5 millisecond ok; 0.5 milliseconds. now, let me see the division for division for just check it I will keep I will measure this to this you know this to this. this will be 1 if this peak and then down and then up and then going down.

this will be 1, so from peak is down, so if I start from 1 period I have to find out 1 period I have to find out. this this to this it is a 1 division you see it is 1 division exactly 1 division Here time period T capital T it is 1 division and 1 division here scale I have put at 0.5 millisecond; 0.5 millisecond means 0.5 millisecond means time period 0.5 millisecond then 1 division into 0.5 it's the 0.5 millisecond.

1 by T is the frequency 1 by T is the frequency. 1 by T 1 by T, T is 0.5 T is 0.5, then 1 by T will be it is in millisecond; that means, it will be kilo Hertz it is becoming 2 kilo Hertz; it is becoming 2 kilo Hertz, but there it is showing 5 kilo Hertz so; that means, that it is also not calibrated. This frequency part also not calibrated or I am doing mistake let me check it ok.

here now I have put at 0.2, I have put at 0.2 yes 0.2 millisecond per division. how many divisions are there? For 1 wave these this now, I am getting 2, it is the I am getting 2 more or less 2. Why? 2. we have to take a middle for calculating time period that is very

important yes. I think we have to take in middle otherwise there will be mistake ok, I have taken in middle.

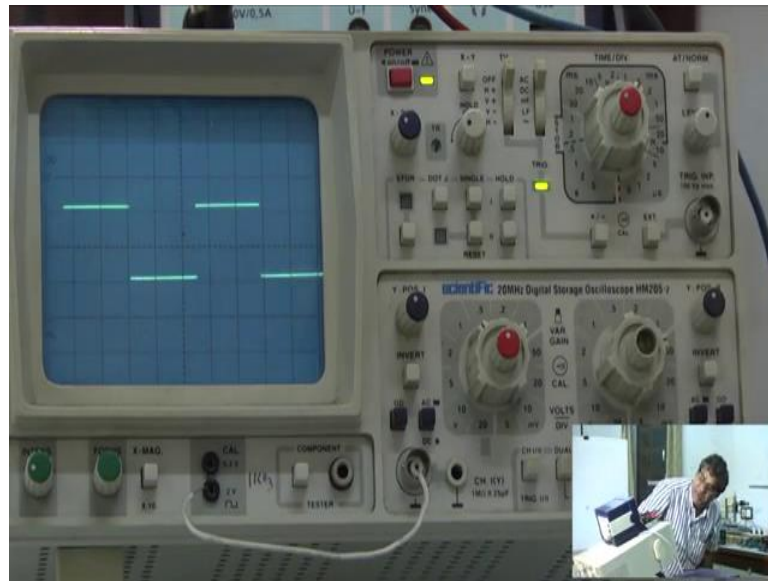
now, these to these or here 0.5 (Refer Time: 07:29). I can see these 2 division or these to this 2 division slightly yeah; more or less 2 divisions slightly less than 2 divisions; since it is point it is a less than 2 divisions. it is a 0.2. it is I think 2.5 it should be 2.5 then it could be 0.5 millisecond. I think it is also not calibrated.

I have to do calibration this 1 also this time 1 also I have to do calibration you see; this is the calibration knob. If we change this it is a calibration change ok, now in this position actually it should be calibrated, but somehow in this oscilloscope this is not calibrated some we need to change something. if that is it that is correct 5 kilo Hertz 5 kilo Hertz means 1 by 5 that should be 0.2 that is why 1 by 5 means 1 by 5 means 0.2 ok.

each division not each division this time period has to be 0.2. here time period when it become 0.2 I have kept this at 0.2 millisecond. it should be 1 division only. wavelength so should be 1 division. ν is $1/T$ equal to $1/\nu$. 1 5 kilo Hertz means millisecond should come millisecond in 1 by 5 means 1 by 5 means 0.2 millisecond.

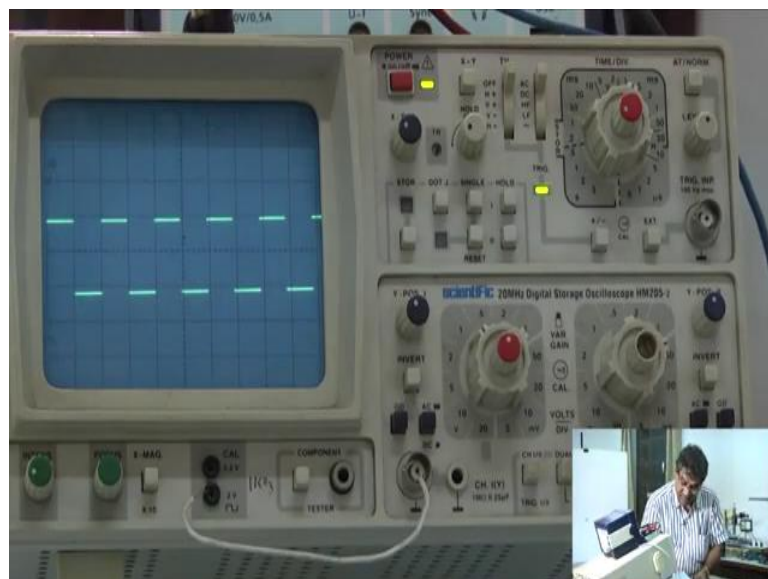
I have kept at 0.2 millisecond here but only I am confused whether this knob is 0.2 or point yes it is a 0.2 no so I think I have to do the calibration ok, with known source I think this is the source. let me 2 and it is 1 kilo Hertz. one has to calibrate I think one has to calibrate ok.

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from here I can see calibration if I put this way, then how many division? So starting this; up to this or this I think starting from this to this this one let me x position let me put this here, 1 wave 1 this 2 this is the full wave. from here down so from here 1, 2, 3, 4, 5; slightly less than 5 I have seen. I have to increase it, you see I am able to change with 2. how much I am expecting this is 0.5.

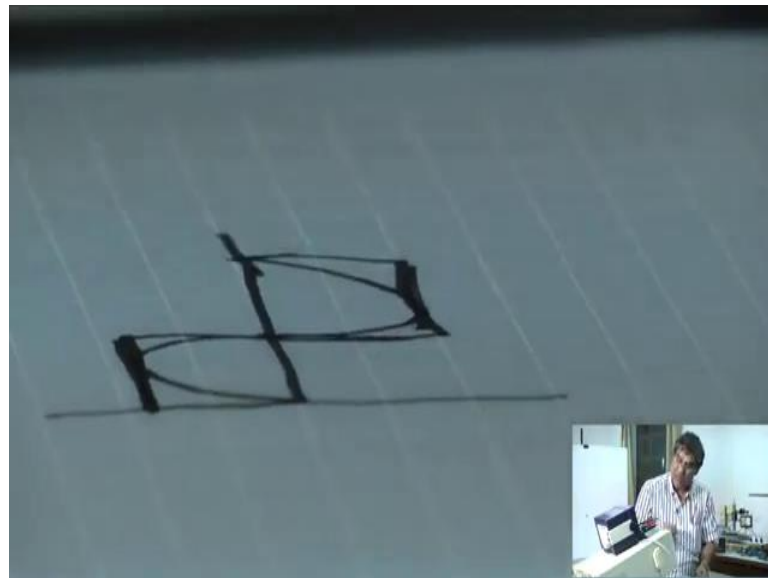
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I am expecting it should be it should be 1 it is a 1 kilo Hertz sorry, it is the 1 kilo Hertz means 1 millisecond if I put 1 millisecond yes, if I 1 millisecond if I put. 1 kilo Hertz it

will be 1 kilo Hertz if it is 1 no if I put this as 1 division should be 1 millisecond then it will be 1 kilo Hertz yeah, it's some more or less its fine its looks fine it looks fine, it looks fine this is 1 no 1 from here actually square let me just think over it

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That means, this so 2 ok, so it should be 1, 2; 1, 2 so 1, 2 2 divisions 2 division; but it should be 1 division. if it is 1 kilo Hertz it should be 1 division. Anyways, so I think its loops it is the 0.5 what I will think that knob has some shifted 1. it if it is I have kept at I am thinking it is 1 if then here I am getting 2 divisions basically; I am getting 2 division means 2 ok 2 milliseconds. But, it is 1 kilo Hertz 2 millisecond it is not giving 1 kilo Hertz it is giving 500 1 by 2-time period is T 1 by T 1 by 2 millisecond 0.2, it is giving 0.2 kilo Hertz.

I have to know if it is for 1 millisecond I think for this other way I put 1, 2, 3, 4, 5, 6 now if it is 6. looks to me 2, 2 divisions, 2 divisions and here it is 1 millisecond per division time is 1 millisecond [FL]. 2 milliseconds 2 millisecond time period is 2 milliseconds. If time period is 2 milliseconds it should be 5, it should be 5 2 milliseconds its 1 by 2 means 0.5 kilo Hertz, but here it is 1 kilo Hertz.

but I do not know whether I am doing any mistake. actually this is one complete one whether if I take; if I take middle one. this way it will go instead of this will go and then it will come here yes it is 2 anyway. one has to calibrate somehow I think it may be I think knob has some problem here.

If I take 0.5 I am thinking here it is at 1 millisecond but this is not the case, it is at 0.5 millisecond I think this knob is not at the yes I think I was doing mistake for seeing this one or this knob is not placed properly. it is what about 1 it is showing, but it should be this 0.5, if 0.5 then this 2 division then it will be 1 millisecond. If 1 millisecond, then if 1 millisecond then it will be 1 by 1 millisecond it will be 1 kilo Hertz ok.

I think this knob it is a when I am seeing this is at 1 millisecond it is not the case it is at 0.5. 1 has to be careful that is why this calibration is important; I think one should rectify this one. Anyways that way one has to one can calibrate, now you put your signal now that is the calibrated position ok.

Now, in this case just you check it, I have put here it looks to me 0.2 but it should be 0.5, if it 0.5 then how many divisions are there? 1 in this ok, so I have to keep at exact at middle slightly up I will put 1, 2 divisions ok; 2 divisions each division is 0.1, but here it is showing 0.2, but it has to be 0.1, 0.1 millisecond into 2 divisions.

Then 0.2 millisecond ok, 1 by 0.2 is 5 1 by 0.2 milliseconds is 5 kilo Hertz; is 5 kilo Hertz so that is the case; 5 kilo Hertz you see this is my old oscilloscope. We just if unknown source is there, you see intentionally I have taken this oscilloscope. This oscilloscope has some problem, calibration problem, to tell you these are the fact it is not that just signal is coming and just we have seen whatever taking, reading it is not the case.

You have to; you have to check properly The calibration is main parts for that it is given this calibration signal, this signal for calibration. how to do that? I was doing so but that way also I was puzzled because this function generator cannot give the wrong reading. it is correct it is best one, best function generator.

So but I was not getting that one although; I found that this knob is not at an it is displaced by 1; its displaced by 1 knob to this towards this. when it is 0.2 then I have to it is it has to be 0.5 I think this have some wrong things that one should rectify anyway.

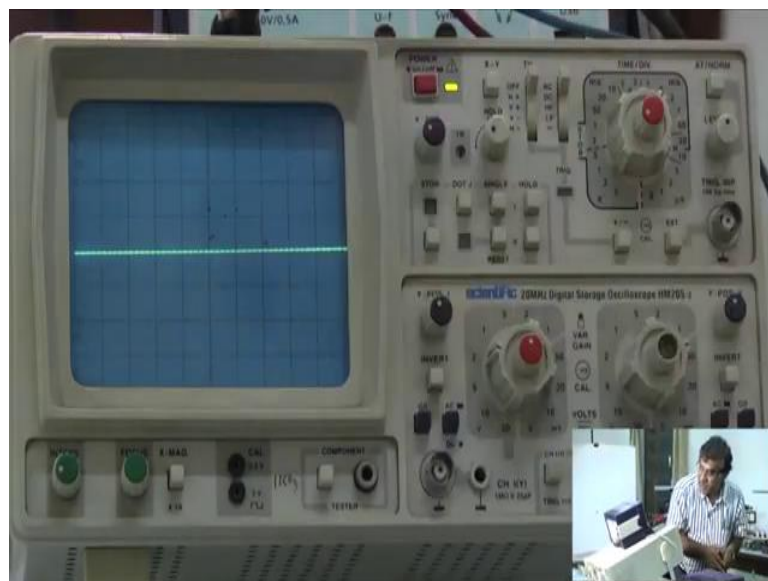
thus we can measure the frequency of a signal and you can measure the voltage of the signal then there are many other say these 3 knobs are very important x shift y shift as I told you. Now, I will here there you see there are lot of other things triggering are there

at triggering level, you can see this triggering level anyway. here I think here it is just fine.

now, these are not the acting working because this one is for I think for dual channel, it can act or let me just check it Now, here you see there is a ground if ground if it that signal is grounded if I put this grounded this also you can check you have signal and it is grounded is a AC now it is in AC and DC also if you see ok; press it then is in DC mode, it is in AC mode if DC and AC only DC you will DC or DC plus AC.

you will see the shift of the whole ground it should be in middle you know it should be exactly it is in middle now, to check it if it is not middle say if like this. ground you can check; this is not in middle. it should not be in middle it should be in so you push it, make it in middle that way you can make ground can be used then your signal it is in middle this middle position is very important when you are measuring the frequency time period ok.

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similarly, for other channel if you this there are second channel ok, this same thing is there whatever here if I put this signal in second channel here it is not showing. what is the problem then? This signal I am not able to show see there, what is the problem ok? this channel 2 but signal is not coming although it is coming here ok; same signal in this channel it is coming and this channel it is DC, AC.

I have put at DC AC mode AC signal see, if I put here but some are triggering its triggering so I have we have its not. I am not able to catch this signal. we need to trigger it, external trigger this calibration ok, so where is that triggering function. I need triggering function store there is, no external, internal (Refer Time: 25:53) but what is the problem?

I am not able to see this keep it something one has to search you know high frequency DC AC line, because this is xy, I will tell you xy where this triggering. But, what is channel 2 I have to see it probably Triggering I think this yes this I got it. here there is the option channel 1 or channel 2.

it was in channel 1 trigger 1 or 2, now trigger I is there are many things but I this problem was this it was in channel 1; I have to select channel 2 now, I have selected channel 2 then it is coming same one you see here it is at point it is at 2 volt. I have to get this at 2 volt same signal you are getting same. this also you can check this is showing voltage and 1, 2, 3, 4 I think what is the, this is 8 volt it should be 4; 1, 2, 3, 4 that you have to this problem is here calibration knobs ok.

I have taken this rough having problematic CRO, having problematic CRO. here you see here so there will be channel 1, channel 2 we calibrated once then everything fine is not the case, we have to be careful. now, here I am seeing it is the 1, 2, 3, 3.5 I have kept it is at 2 it is 7 volt peak to peak amplitude, one it is showing here 8 volt; that cannot be the wrong something wrong here.

I need to calibrate this one, this one also I check this calibration, but here calibration knob is broken you know, no it is there red part is not there, but indicator is not there. it is now broken. calibration part I think I will take it if it 1, 2, 3, 4; it is a 2 2 volt per division it is 8. one can do the calibration using this one also.

this channel 1 is completely independent from the channel 2 both channel has to be calibrated. since this signal is already calibrated from the reliable source that is why I use this one not without using this one this is now calibrated this now my system again is the channel 1 and channel 2 ok.

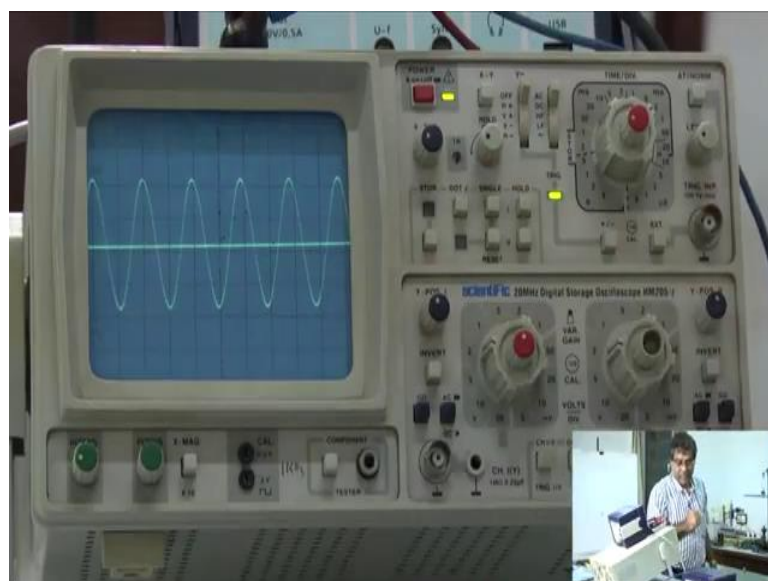
Now when you want to know about the signal, so you switch on the oscilloscope, the intensity focus After doing this you will see the stress of the beam and then you can shift

along the x and y position of that beam; now x position x and this is the time axis and y position is the voltage axis both are has to be calibrated. calibration options are there that I told you ok.

So this one and this is another channel 2. now, there are some application you know you need to dual channel like (Refer Time: 30:41) like if you want to; if you want to measure the phase difference of 2 signals; if you want to measure the frequency relation of 2 signals, so you need 2 input to the oscilloscope.

then we tell 1 input one will be for x input and another will be for y input, both will be in voltage then this both 1 ok because, this 2 is it will be independent of time. if I take this another signal, then we can compare these two signal; so that time we have to use the channel 1 and channel 2; here we have you see I think channel 1 channel 2 dual mode. either you can use channel 1 or channel 2 or you can use both dual mode, then I have to paste this one ok.

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here you can see that one is having signal, one is having signal and another one I have not given any signal. another one you see here you see. this the signal and this is the I have not given any signal. you give similar another signal then compares these two. we have to keep in dual mode, we can add this way the add mode there some chopper, some triggering 1, 2. there are various mode function is there.

just preliminary few knobs about few knobs I told you, how to just check the signal, measure the frequency and then their voltage, how to calibrate the system now, I think I will stop and I will just continue for showing you the for comparing the two signal at a time in next class.

Thank you.