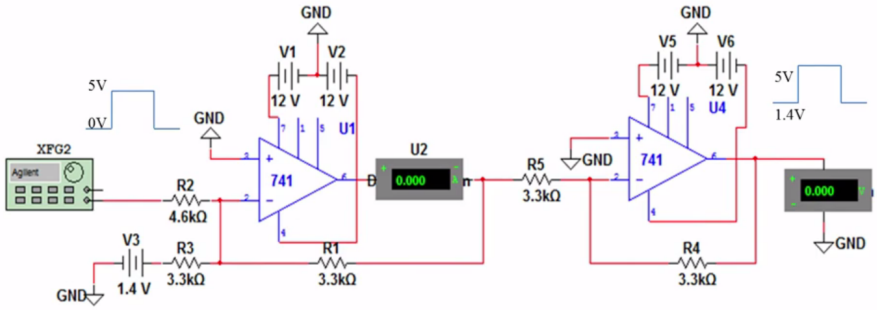
Circuit Design

The circuit is designed using op-amp for converting an input voltage of 0 - 5V from Signal generator to 1.4 - 5V

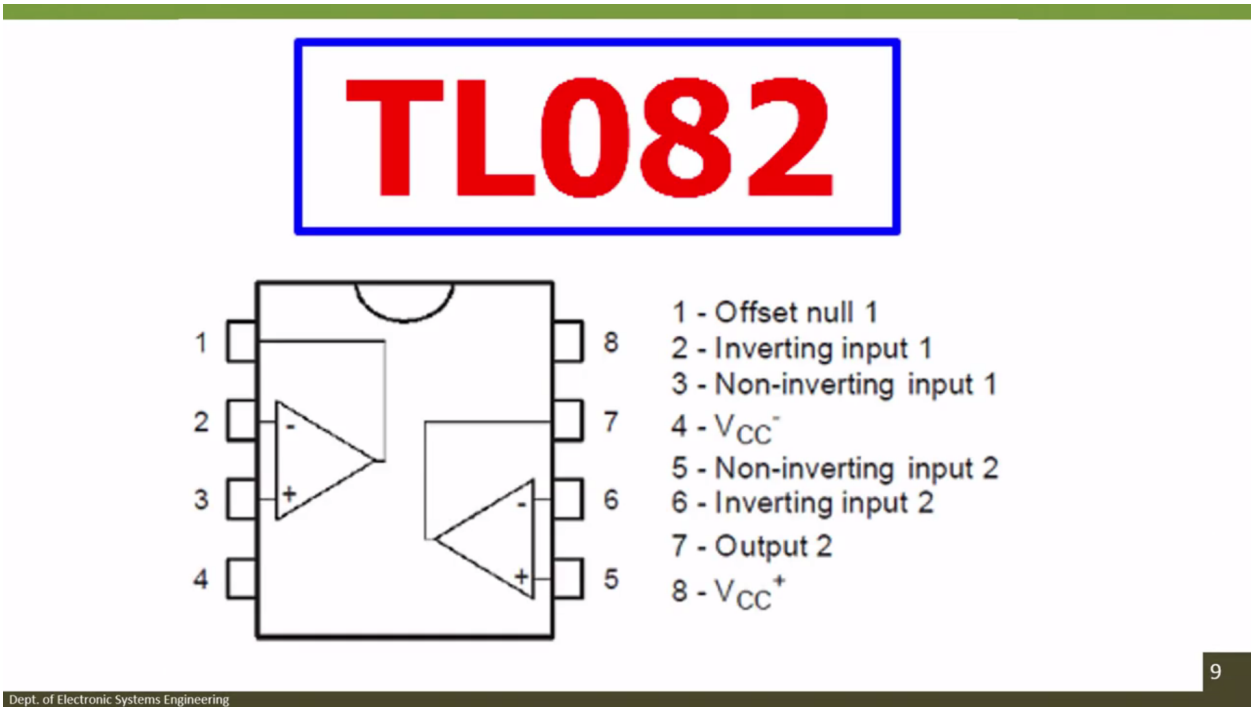


Scaling circuit using op-amp

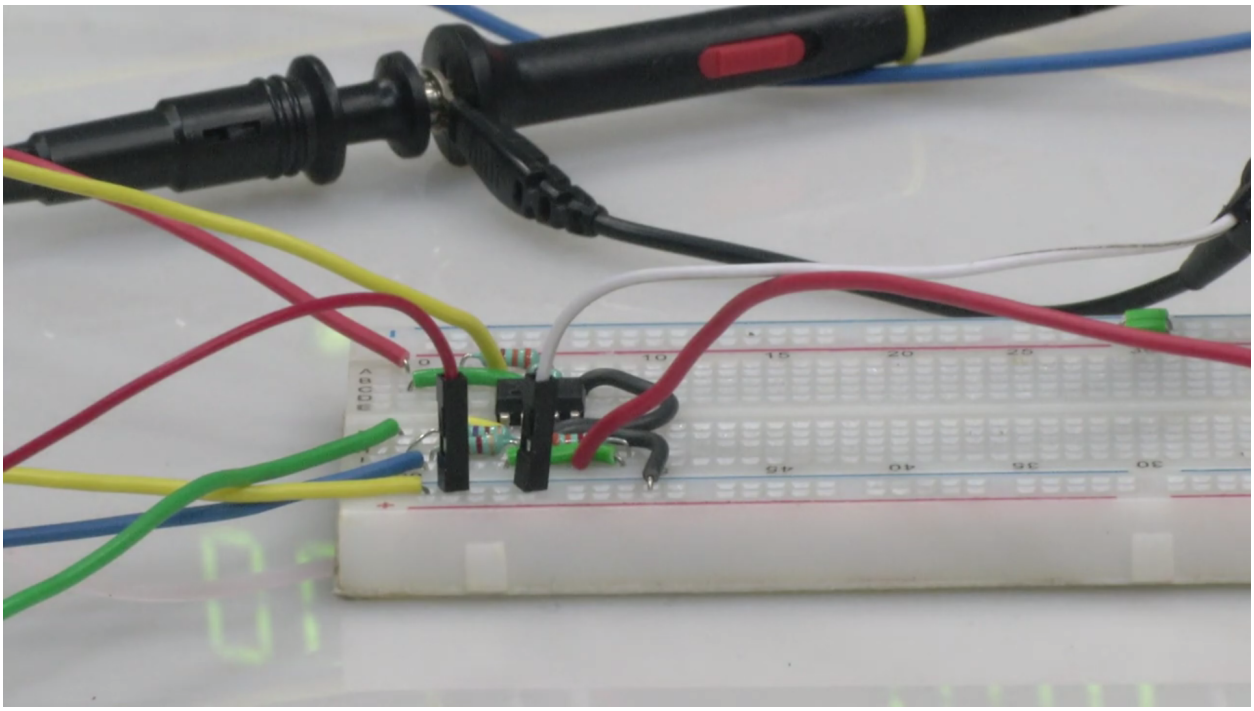
Female Speaker: Hello everyone. In the previous module, we've seen how an MQ7 gas sensor requires a signal conditioning system that is because it has a special -- the type of input what has to be given to the gas sensor as such that you cannot directly give input from a function generator. So the constant 0 to 5 volts is not really sufficient for the performance of your gas sensor. For applications where you cannot directly a constant power supply, there as we

have discussed, it requires a voltage of 1.4 volts for the given duty cycle, and then during the off period, it requires a different set of voltage. The on and off requires input voltage to be at different levels. So in our case, when we are talking about the MQ7 gas sensor, so it operates between two voltage levels, that is 1.4 volts and then 5 volts. So from a given constant voltage from a function generator, how do we set up this differential voltage input.

Coming the circuit, as we had already discussed so the op-amp could be connected, the feedback circuit could be given as such like however you are seeing in the slide here.

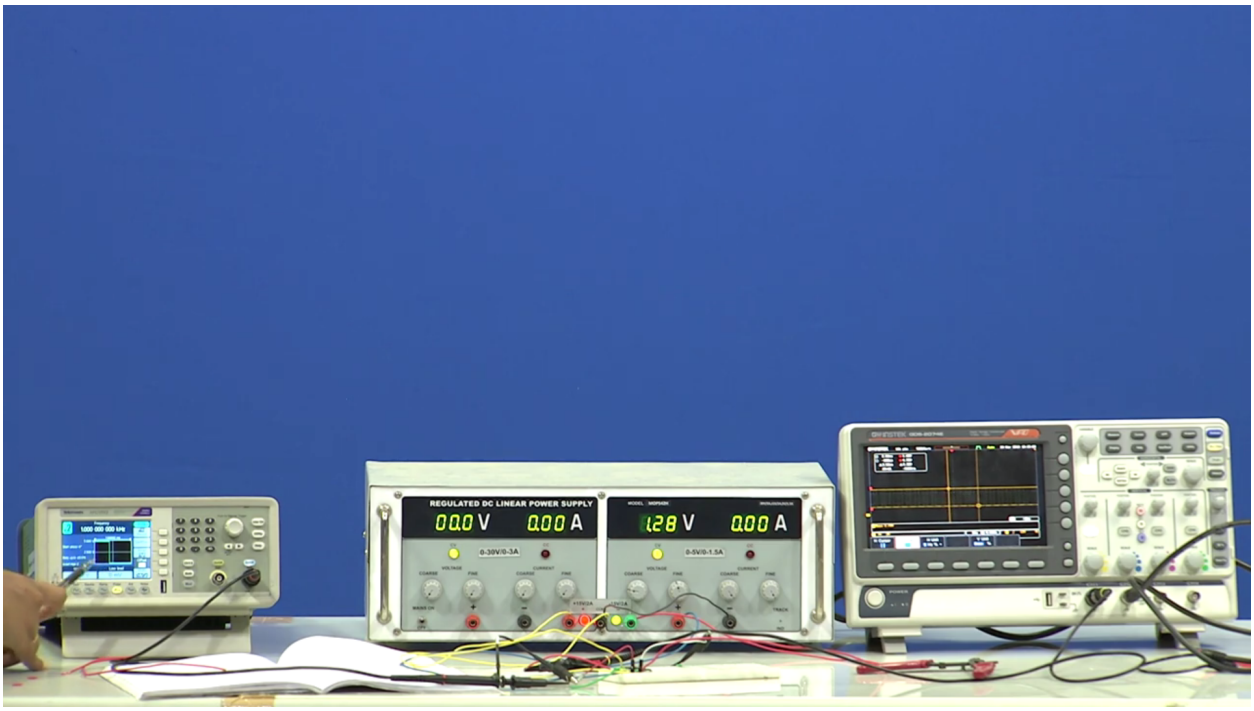


Now in order to build or rig up the entire circuit, I suggest you have a look at the TL082 pin out. So it looks something like this. So the two op-amps, the each pin, the VCC, the inverting, non-inverting inputs, and the other diagram -- I mean the diagram clearly depicts how each in can be connected so that you could integrate this with your circuit. Now considering I have a TL082, let's see how do I rig up the circuit and how do I achieve this 1.4 volts to 5 volts from a constant 0 to 5 volts DC, so that is what I get from the function generator.

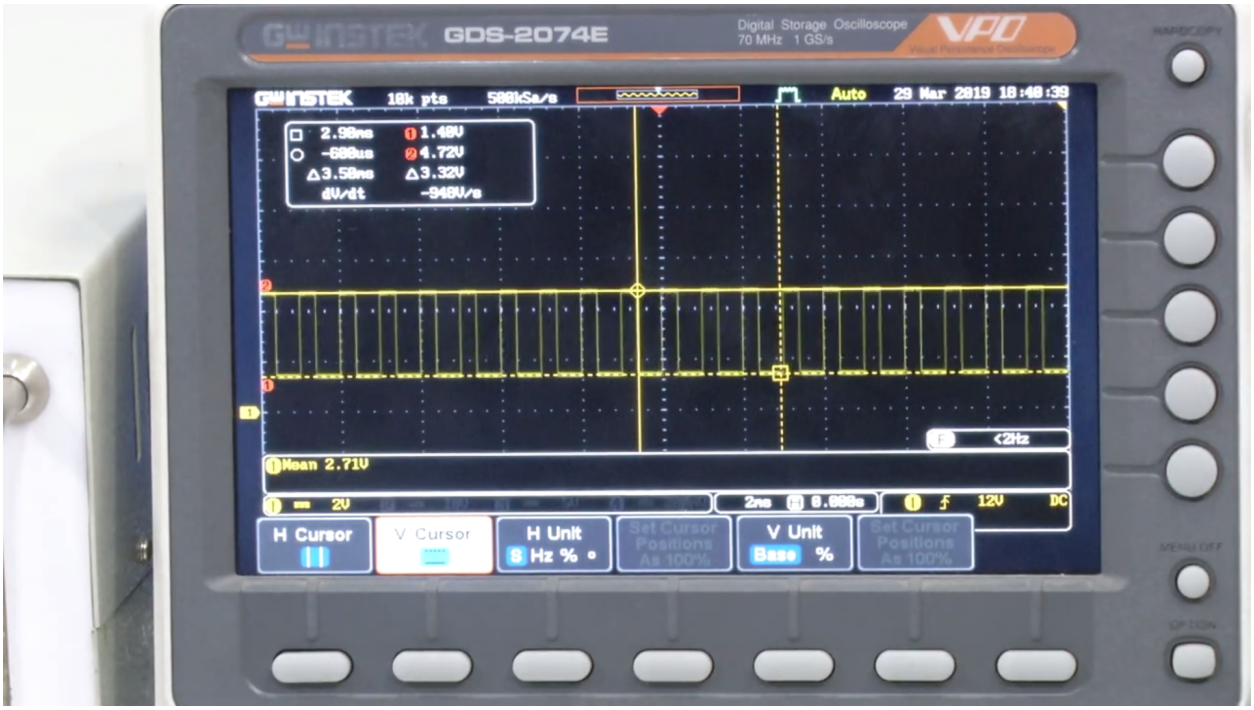


Now coming to the circuit. This here what I am point to a TL082 IC and it has 8 pins, 4 on each side. Each of the pins have been connected as per the slide what I have shown you, the pin outs. So you have pin 4 and in 8 which goes to plus VCC and minus VCC, and then you have the other pins connected, so 2 and 3 are the inputs to the op-amp and 1 is your output. Just following the pin out diagram what I have shown, the entire circuit has been rigged up. So the first resister here and then the 3.3 kilo ohm resister which is connected to your VREF, that is you require 1.4 volts. So this goes to your RPC where you have given the reference voltage.

Connecting the feedback just as the diagram what was shared with you on the previous slide. Once we rig up, say, I have given an input coming to the function generator here, I have set the duty cycle and given the input.



I have set the duty cycle and given the input. Now let’s see, I have given it o to 5 volts input in the function generator here. The frequency is set to 1 khz and then you set the duty cycle based on their requirement.

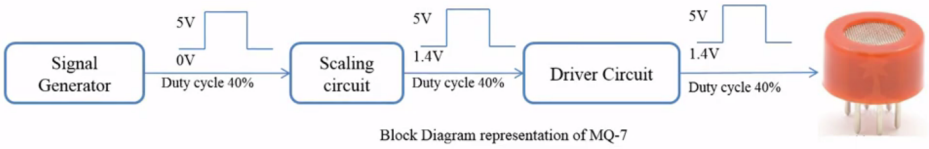


So once I set the input, let’s see how the output is generated. Now that we’ve given the reference voltage, 1.4 volts, and the input from the function

generator 0 to 5 volts, let's see how the output can be observed, as you can see here on the CRO. The lower limit reaches 1.4 volts, and then you see the upper limit which is 4.72 volts. So it's not exactly what you need, that is we wanted 1.4 to 5 volts. However, considering the internal offset or the tolerances of the resister, consider the losses, so we have the voltage at the output between 1.4 volts to 4.7 volt.

Signal Conditioning Circuit- Block Diagram

- Although the implemented scaling circuit convert the input signal, op-amps cannot provide required power to run the heater (unless it is a power op-amp)
- Therefor, it is necessary to have a driver circuit to provide enough current drive the sensor
- One way is by using a NPN transistor as discussed in the previous experiment or by using a MOSFET



Block Diagram representation of MQ-7

So this was the circuit for realizing how an MQ7 gas sensor, which runs on different duty cycles, that is during the on period, it requires certain voltage levels and then during off period, it requires this 1.4 volts and that is how you can achieve the scaling. How do you get a scaling circuit, this is one such example. So what we have done is from o to 5 volts for the given duty cycle, we have designed the scaling circuit and then given the -- now that you know how to design the driver circuit, we know how to get 1.4 volts to 5 volts, so that you can have your gas sensor working based for your application.

Thank you.