

Instruction Manual

for

Biasing Of Transistor for Class 'A' operation

ME- 623

The instrument comprises of the following built-in parts:-

1. One DC Regulated Power Supply of 0-15V DC.
2. One DC moving coil Voltmeter of 0-15V DC range.
3. 3 different values of RL & RE selectable using band switches provided on the front panel.
4. Circuit diagram is engraved & connections are brought out at terminals.

Theory

We are using the most commonly used biasing called voltage divider-bias. The name voltage divider comes from the voltage divider formed by R_{B1} and R_{B2} . The voltage across R_{B1} forward biases the emitter diode. The Vee supply reverse biases the collector diode.

Biasing means the establishment of suitable D.C. values of the different currents and voltages of a transistor by connecting it to external batteries via suitable circuits.

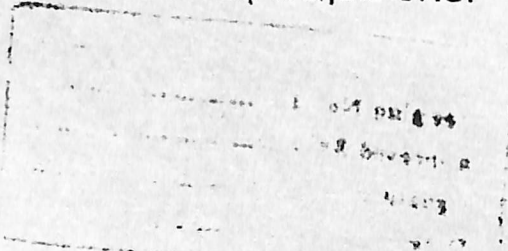
All operating points between cut off and saturation are the active region of a transistor. In the active region, the emitter diode is forward-biased and the collector diode is reverse biased. If throughout the A.C. cycle the transistor remains in active region, then it is said to be in class A operation. In terms of the A.C. load line, class-A operation means that no clipping occurs at either end of the A.C. load line.

In a class-A operation, the best place to locate the Q-point is in the centre of the A.C. load line. In this case we get to largest possible unclipped output signal.

Procedure

1. Connect Audio Frequency Function Generator at the input points. Also connect CRO at the output terminals.
2. Connect 15V DC voltmeter to the Power supply.
3. Switch on the instrument by using toggle switch provided on the front panel.

4. Adjust the Bias voltage to 15V DC & also adjust the Sine Wave Input Signal from the Function Generator to 50mV by using fine & course controls of the function generator.
5. Adjust R_E at 3KOhm & R_L at 25KOhm for class 'A' operation.
6. Check the output on the CRO.



Calculations

$$V_{CE} = V_{CC} - I_C (R_C + R_E)$$

When $I_C = 0$, $V_{CE} = V_{CC} = 15$ Volts

when the transistor operated in the saturation region, it appears shorted & all the supply voltage appears across the series connections of R_C & R_E

$$I_C(\text{Sat}) = V_{CC} / R_C + R_E = 15/28 = .535 \text{ mA}$$

Voltage Across R_2 (4.7K) base resistor is .72 V. For silicon Transistor $V_{BC} = 0.7$ Volts.
So the potential across emitter of transistor $R_C = .72 - .7 = .02$ V.

$$I_E = .02/3K = 6.6 \mu\text{A}$$

Because β is close to unity. Therefore $I_E = I_C = 6.6 \mu\text{A}$

The collector emitter voltage is $V_{CE} = V_{CC} - I_C (R_C + R_E)$

$$15 - 6.6(1/1000000)(28000) = 14.81 \text{ V}$$

So the co-ordinates of Q points are (14.81, 6.6 μA)

Repeat the experiment for different values of R_C & R_E