

Experiment No.: 03

Square-Root Extractor

Academic Year : 2022-23 **Sem** : I

Class : TY BTech Instrumentation & Control

Course Name : Process Instrumentation

Course Code : IC3231

Name :

Division : IC-

Roll No. :

G.R. No. :

Experiment No.: 4

Square Root Extractor

Aim : Demonstration and study of Square Root Extractor.

Apparatus : Square root extractor, Current source (4-20mA), Digital Multimeter, Connecting wires, Power Supply, etc.

Theory : Square root extractor is used in flow applications where orifice, venturimeter is used. These variables used head or differential flow meter operate on a principle that, restriction in line flowing fluid introduced by an orifice plate or venturimeter produces differential pressure across restriction elements which is proportional to the flow rate. The proportionality is not linear but flow rate is proportional to the square root of differential pressure.

Square root extractor can be used so that output of orifice can be read on linear scales. Linear signals are preferred when flows are added, subtracted or average and when other computing and characterizing requirements exist. Linear characteristic is required because it gives better reliability and control Rangeability. Square root extractor is used so that output of restriction type flowmeter can be read on liner scale, as linear signals are preferred in control system.

Hence differential pressure transmitters convert output of orifice of proportional current.

Input current : 4-20 mA

Output current : 4-20 mA

$$\text{Here, } Q \propto \sqrt{\Delta P}$$

$$Q^2 \propto \Delta P$$

$$\text{Log } Q^2 \propto \text{Log } \Delta P$$

$$2 \text{ Log } Q \propto \text{Log } \Delta P$$

$$\text{Log } Q \propto \frac{1}{2} \text{ Log } \Delta P$$

Taking Antilog on both sides,

$$Q \propto \frac{1}{2} \text{Antilog log } \Delta P$$

$$Q = k \text{Antilog log } \Delta P$$

where K is scaling factor.

Observation Table :

Sr. No.	Input current (mA)	Observed output current (mA)	Calculated output current (mA)	% error
1				
2				
3				
4				
5				

Calculation :

$$Y = 4 * [\sqrt{(X-4)}] + 4$$

Steps :

1. Subtract Δ from input to shift the scale
2. Convert it into %
3. Take square root of this
4. Multiply this by 4
5. Convert to mA
6. Add 4 to it to shift to original scale

Conclusion :

2. ASSEMBLY DETAILS

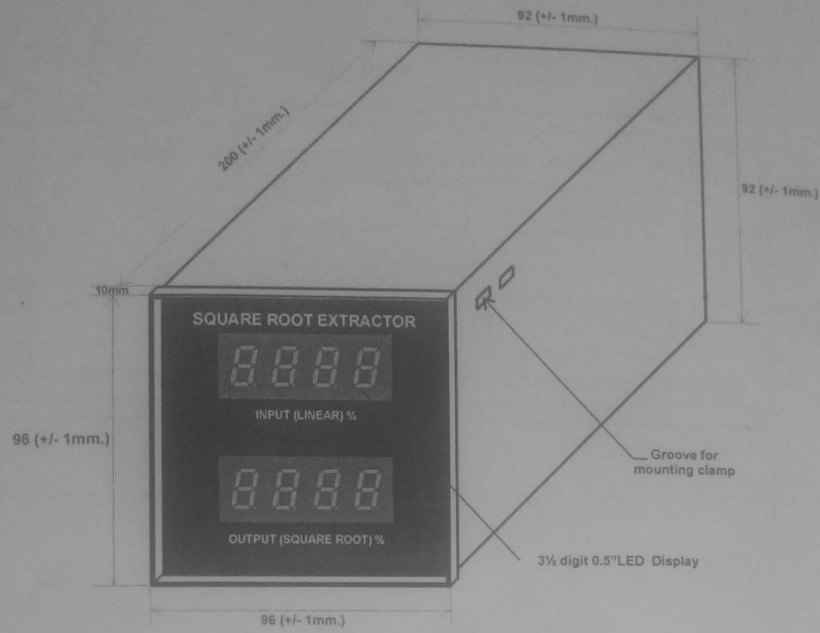


Fig:1.Front View

3. TERMINATION DETAILS

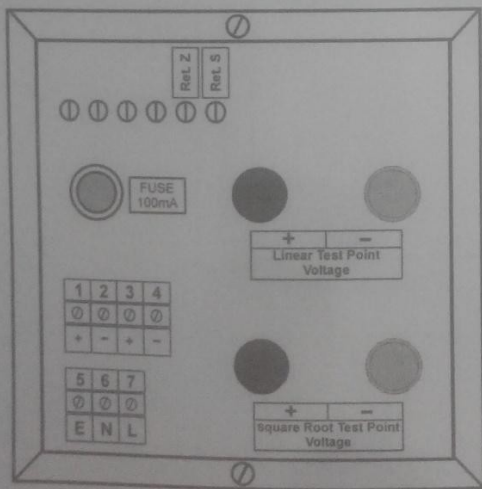


Fig:2.Rear View

TERMINATION DETAILS					
1	+	Input 4 -20mA DC Linear	5	E	230V AC Power Supply
2	-		6	N	
3	+	Output 4 -20mA DC Square Root	7	L	
4	-		FUSE :500mA		

Implementation of Square Root Extractor :

Observation Table and Characteristics : (Screenshot of Excel sheet)

About Pneumatic Square Root Extractor :