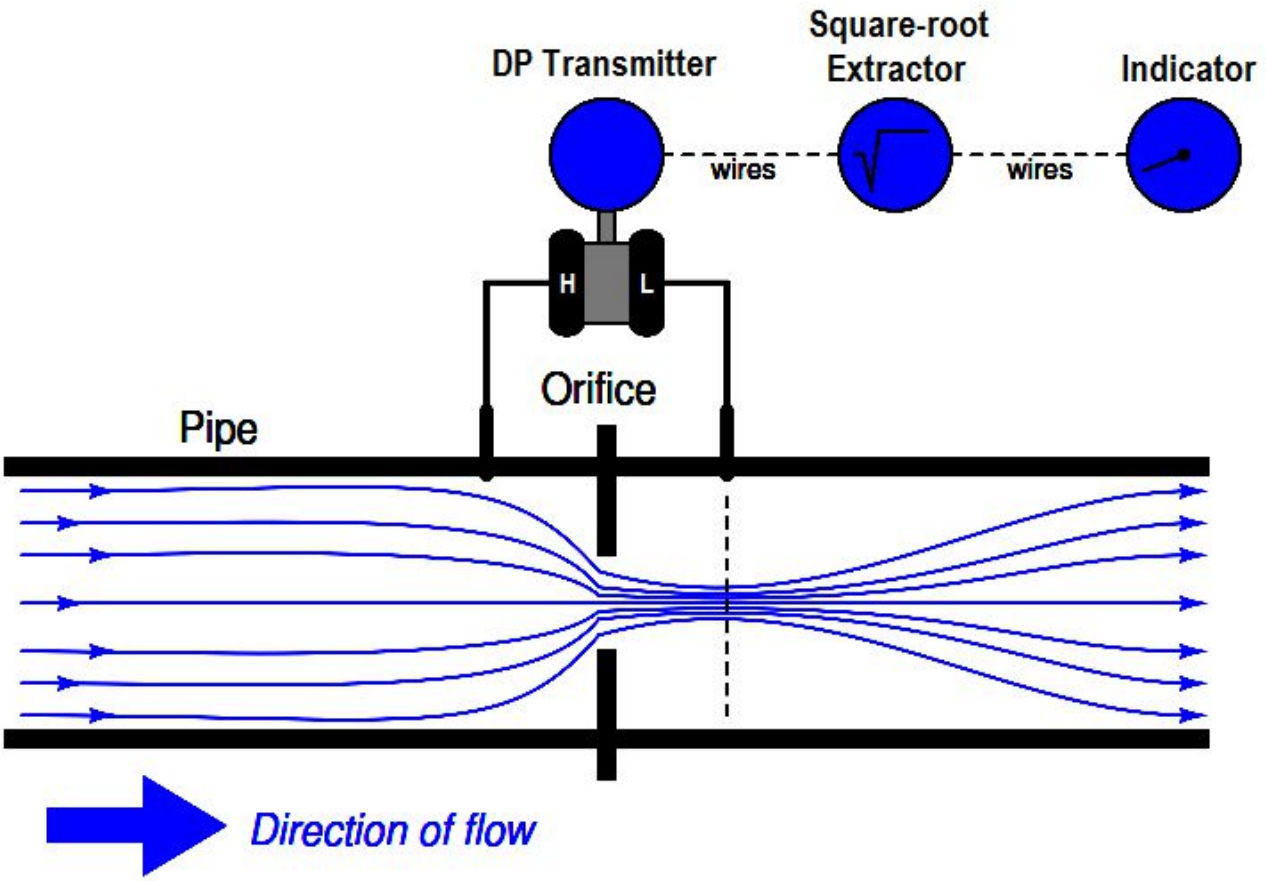
Eco-Line Square Root Extractor

Some measurements require square root extraction to linearise the primary measurement. Square Root Extraction is a mathematical process which is applied to a linear measurement scale to convert it to a non-linear square root scale. The square root scale is generated by taking the square root of the ratio between measurement reading and full span.

Over a fixed measurement range with a square root extraction applied, the square root measurement will rise faster than the linear measurement at first, and then steadily slow down as measurement readings approach 100% full scale.

For example, the flow of a gas or liquid through a closed pipe is proportional to the square root of the differential pressure. Therefore, you can use a differential pressure sensor to measure flow by applying a square root extraction to the linear output.



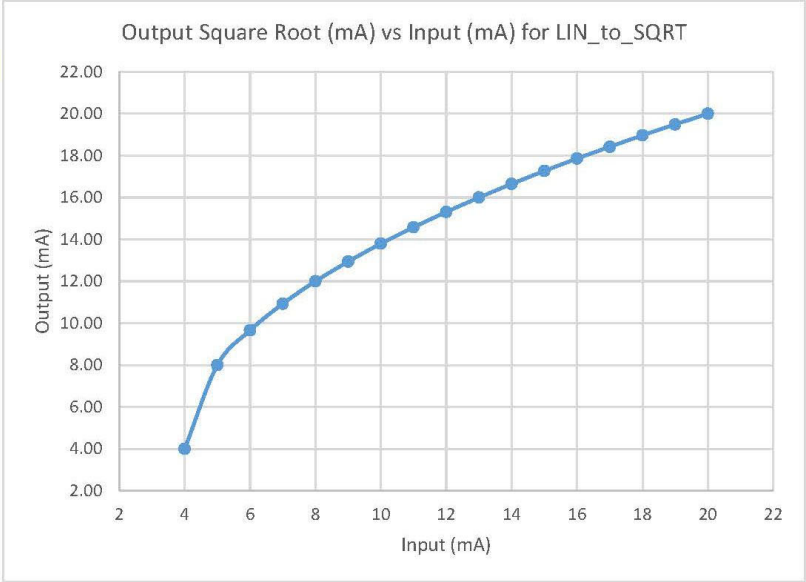
Linear → Sq Rt 4-20mA Conversion (LIN_to_SQRT)

The following formula can be used for converting a linear 4-20mA current loop signal to a square root extraction type:

OutputSqRt = 4mA + (4 x √ (OutputLinear – 4mA))

The following table shows values for linear to square root extraction 4 to 20 mA current loop signal:

Input Linear (mA)	Output Square Root (mA)	Calculated
2		2.00
4	4.00	4.00
5	8.00	8.00
6	9.66	9.66
7	10.93	10.93
8	12.00	12.00
9	12.94	12.94
10	13.80	13.80
11	14.58	14.58
12	15.31	15.31
13	16.00	16.00
14	16.65	16.65
15	17.27	17.27
16	17.86	17.86
17	18.42	18.42
18	18.97	18.97
19	19.49	19.49
20	20.00	20.00
21		20.49



Actual calibration results:

Product Test Report

danntech - PROCESS INSTRUMENTATION

Part Number: GB-SE/IA-IA/LSC *Supply:* 24VDC *Isolation:* yes

Description: Eco-Line Signal Converter *Tested By:* *Date:* 14-Jun-21

Special Function: Linear to Square Root Conversion

Serial Number:

		Adjusted at 5 & 20 mA in	
Input Linear (mA)	Calculated	Output Square Root (mA)	Error (%)
4	4.00	4.000	0.87%
4.5	6.83	6.800	-0.18%
5	8.00	7.987	-0.08%
6	9.66	9.647	-0.06%
7	10.93	10.924	-0.05%
8	12.00	12.003	0.02%
9	12.94	12.947	0.02%
10	13.80	13.804	0.03%
11	14.58	14.583	0.00%
12	15.31	15.320	0.04%
13	16.00	16.007	0.04%
14	16.65	16.665	0.09%
15	17.27	17.284	0.08%
16	17.86	17.867	0.07%
17	18.42	18.431	0.05%
18	18.97	18.973	0.04%
19	19.49	19.499	0.04%
20	20.00	20.005	0.02%
21	20.49	20.485	-0.03%