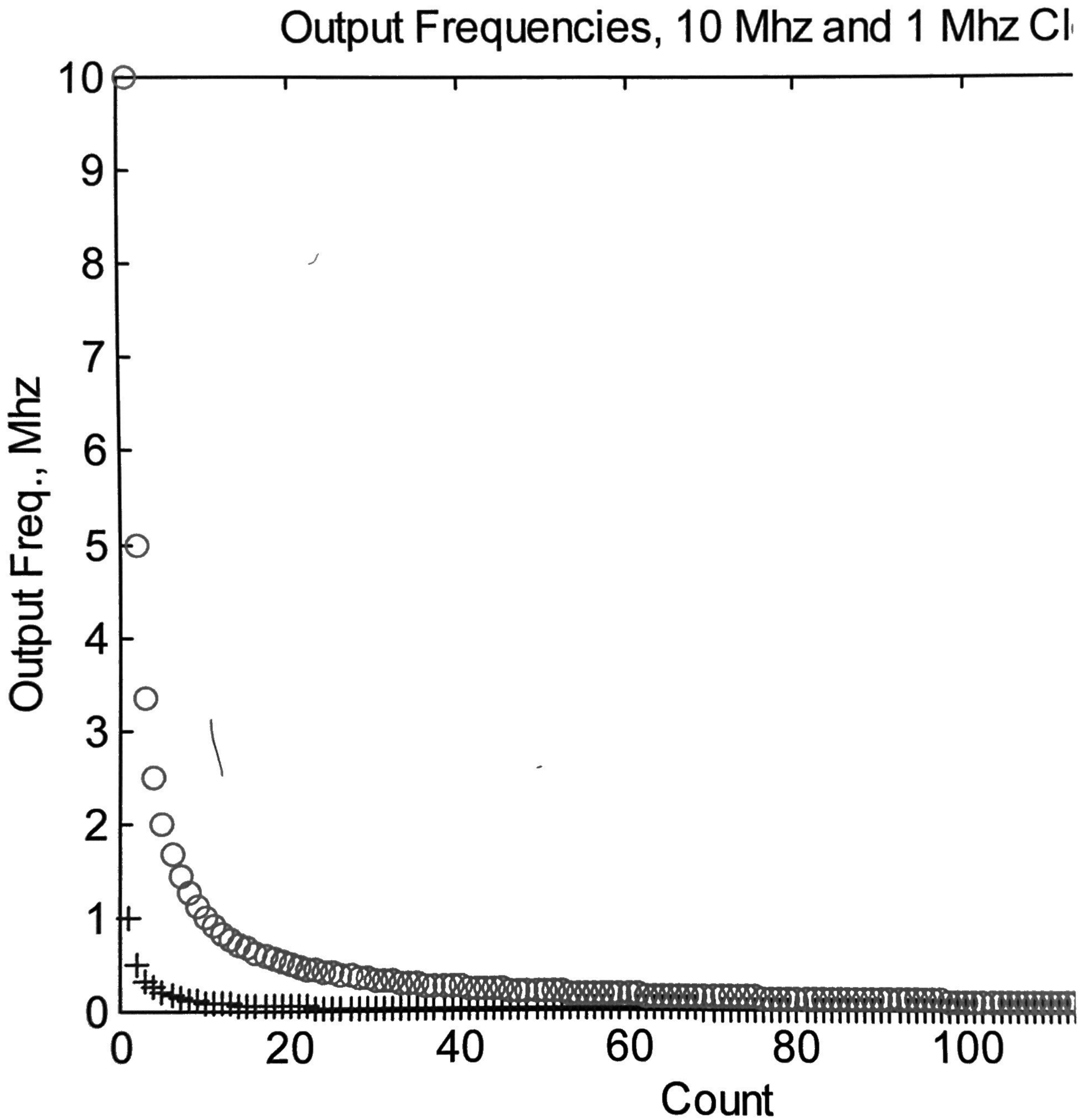
8254-Style Frequency Calculation:

$$\text{Output Frequency} = \frac{\text{Clock Frequency}}{\text{Counts}}$$

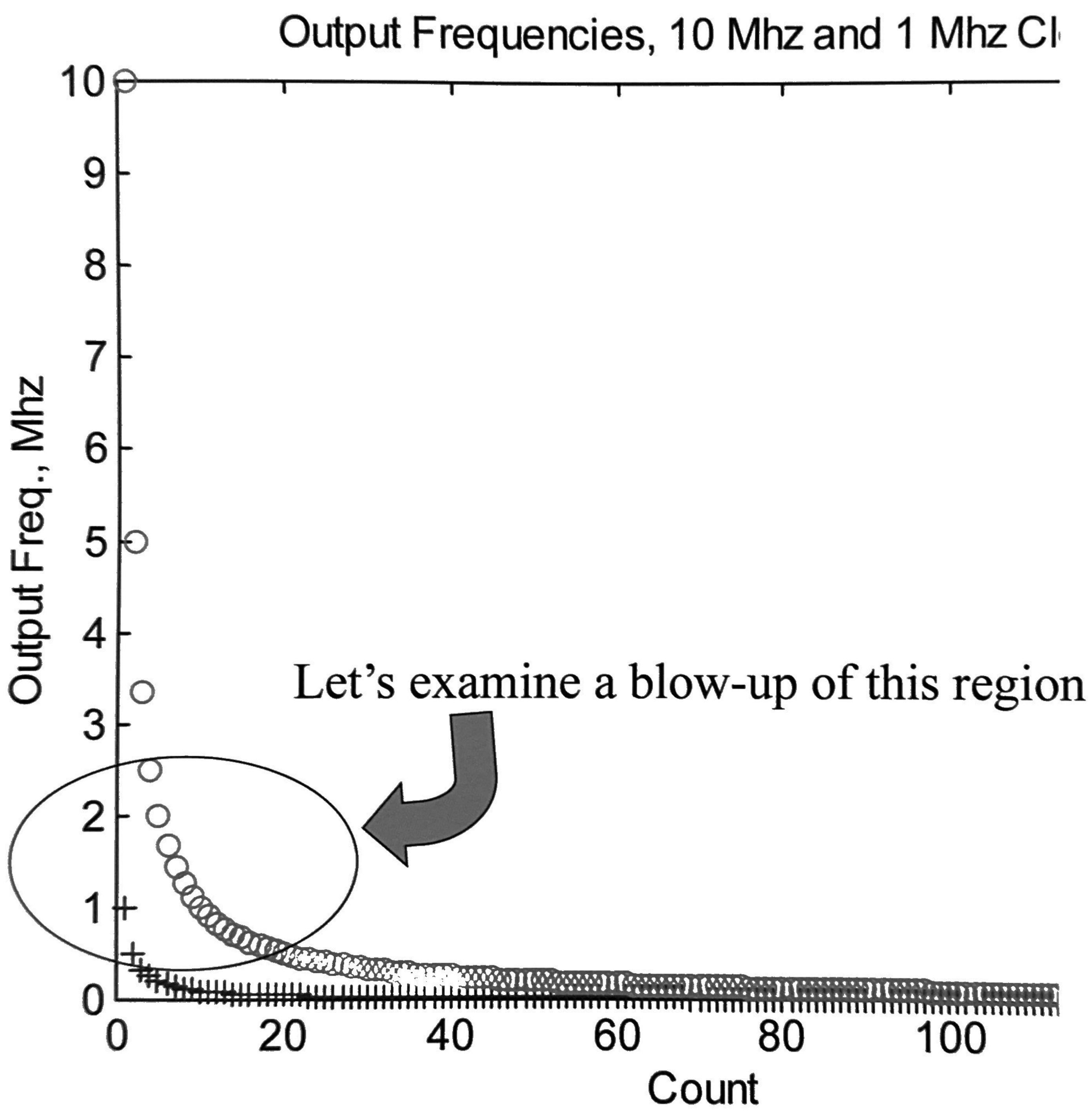
$$\text{Maximum Output Frequency} = \frac{\text{Clock Frequency}}{\text{Minimum Count}}$$

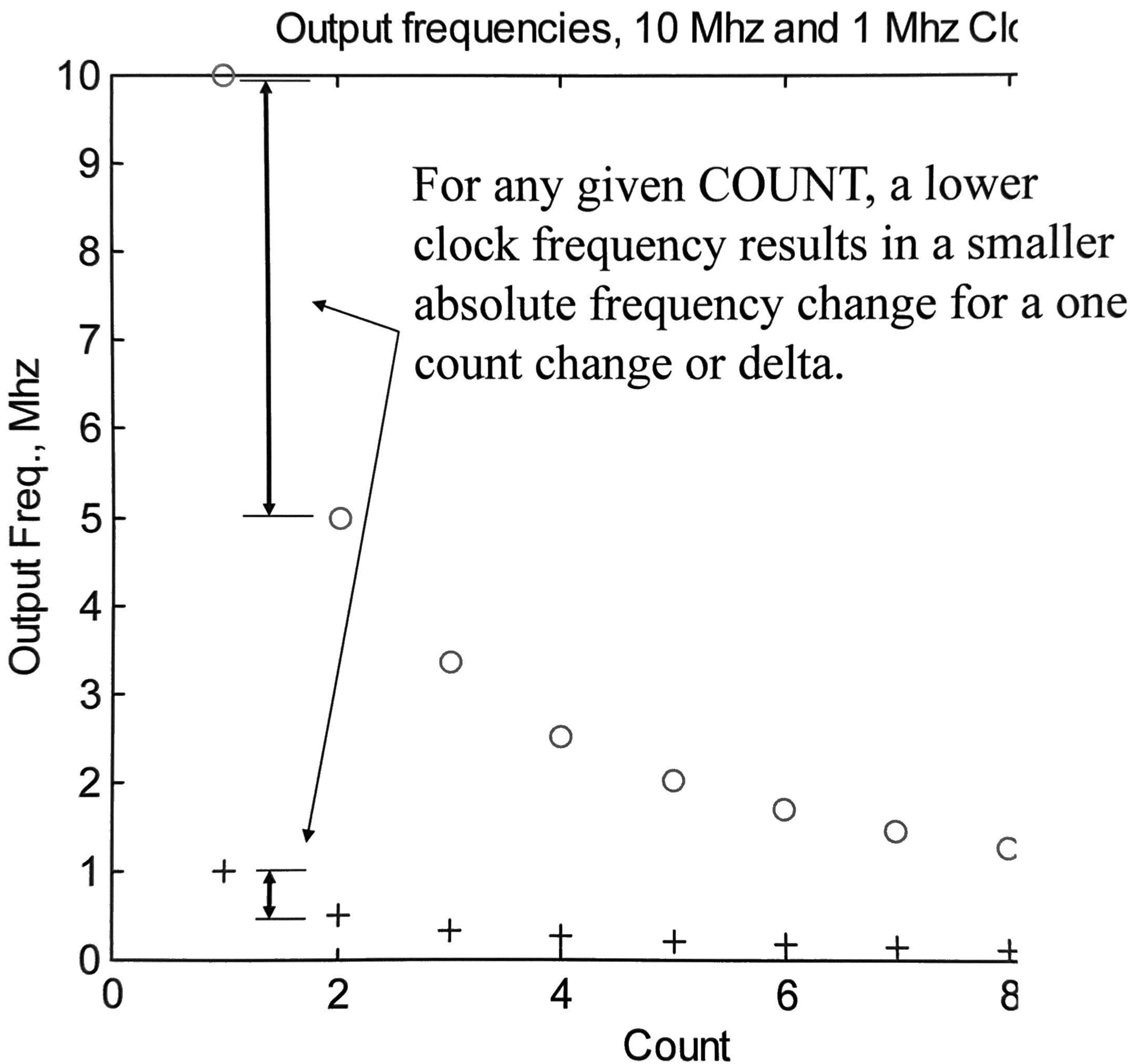
Count RANGE

$$\text{Minimum Output Frequency} = \frac{\text{Clock Frequency}}{\text{Maximum Count}}$$

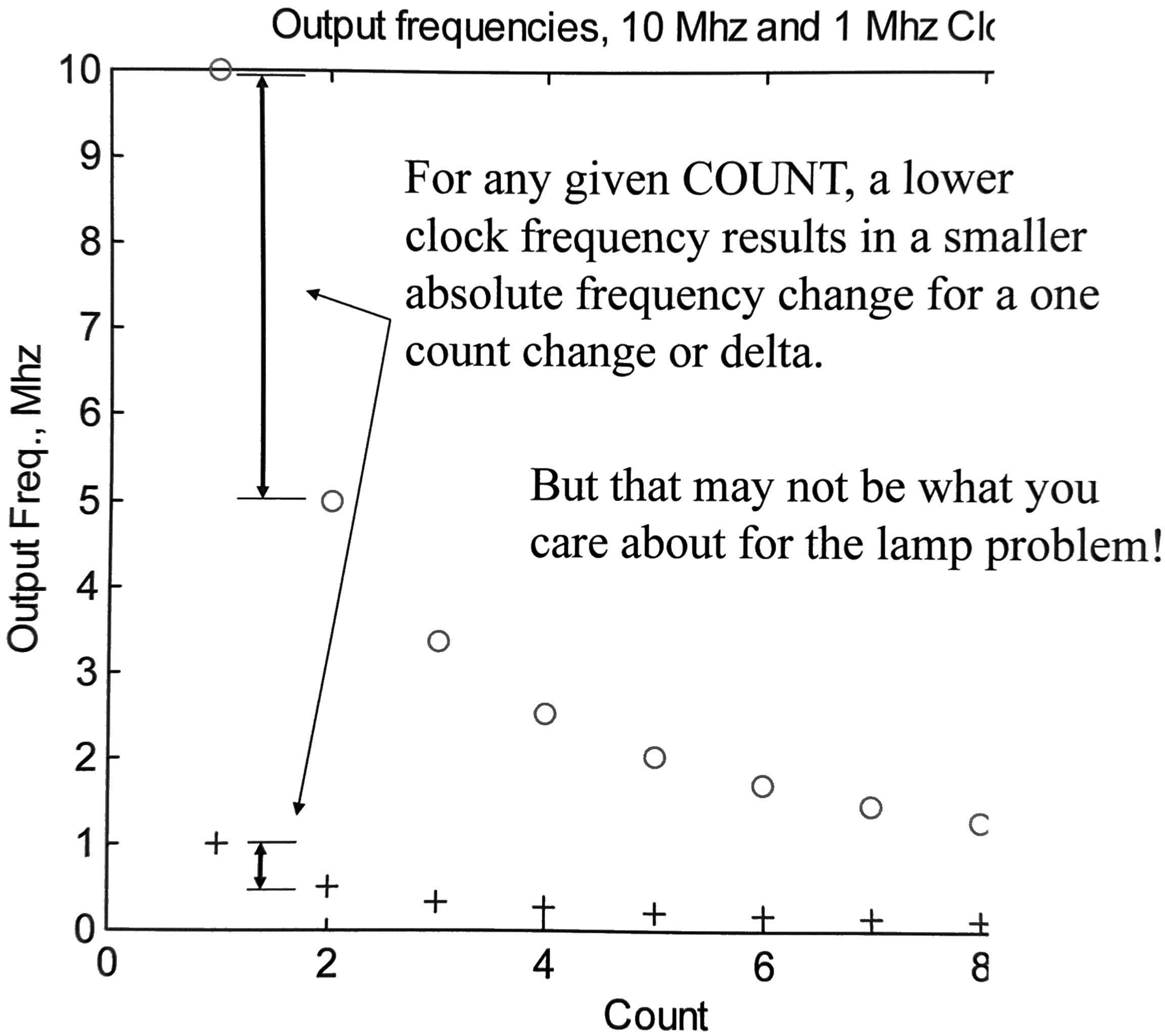


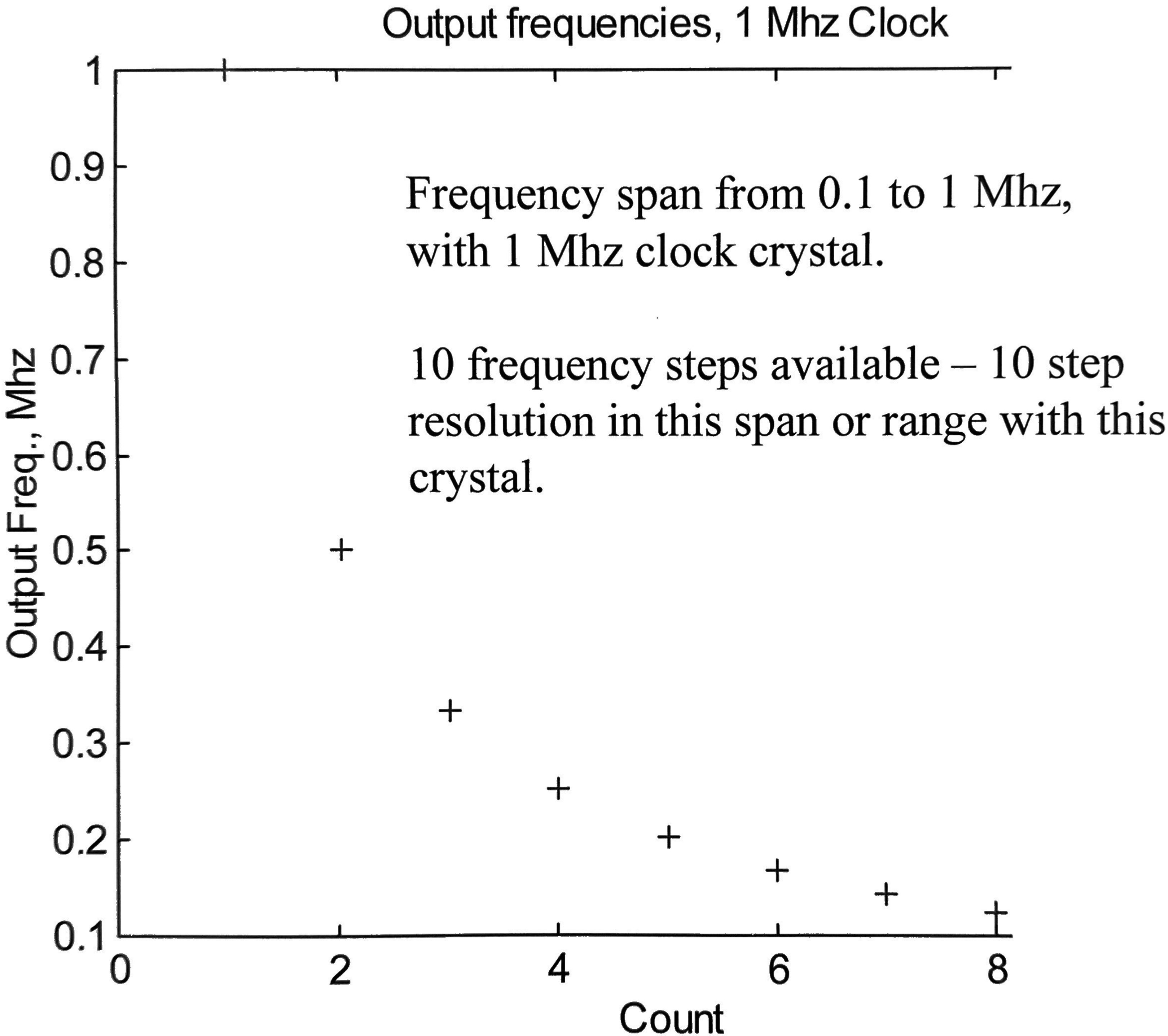
Output Frequencies, 10 Mhz and 1 Mhz Cl
Output Freq., Mhz
Count
0
20
40
60
80
100
10
9
8
7
6
5
4
3
2
1
0

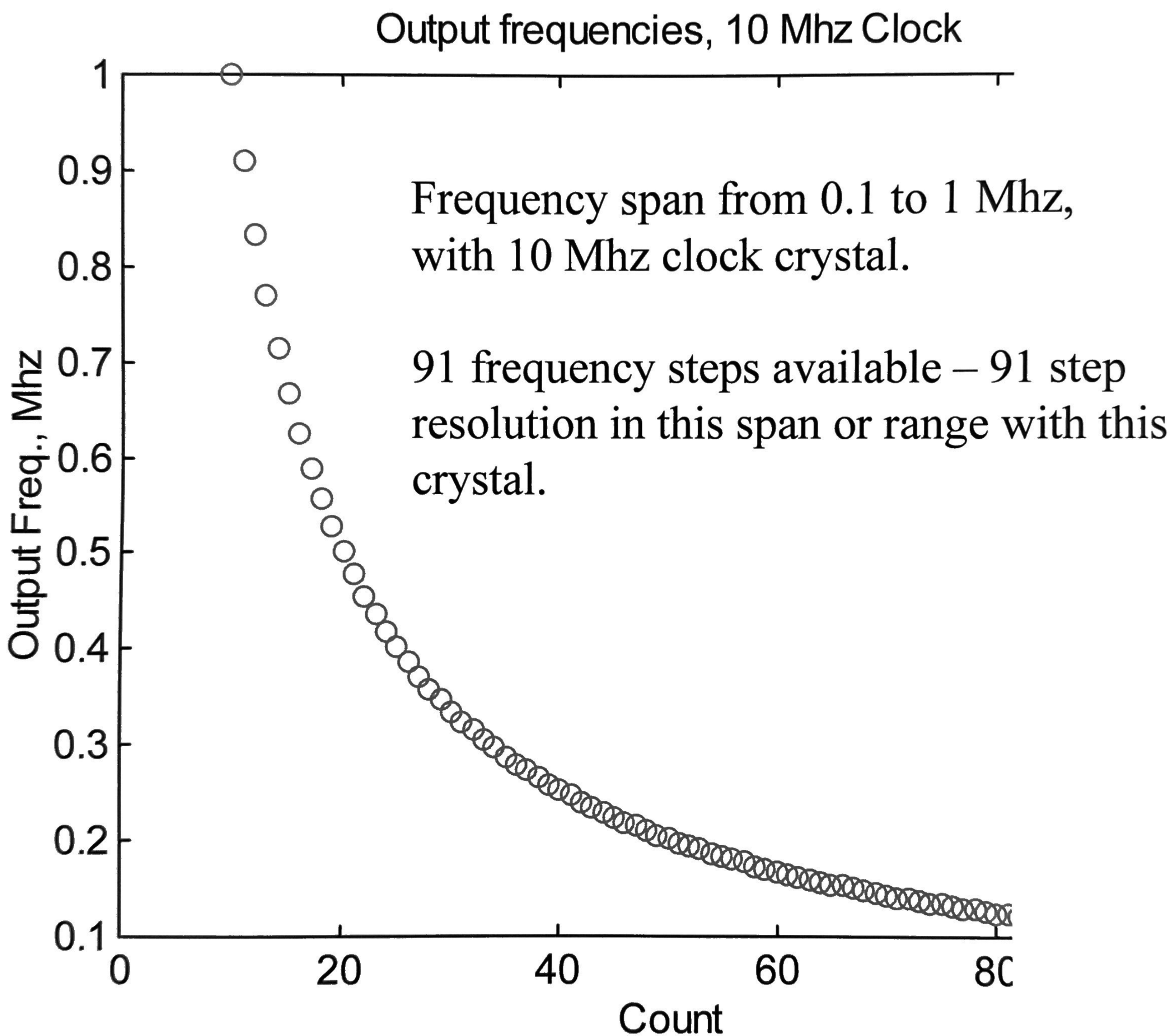

Output Frequencies, 10 Mhz and 1 Mhz Cl
Output Freq., Mhz
Count
Let’s examine a blow-up of this region
0
1
2
3
4
5
6
7
8
9
10
20
40
60
80
100

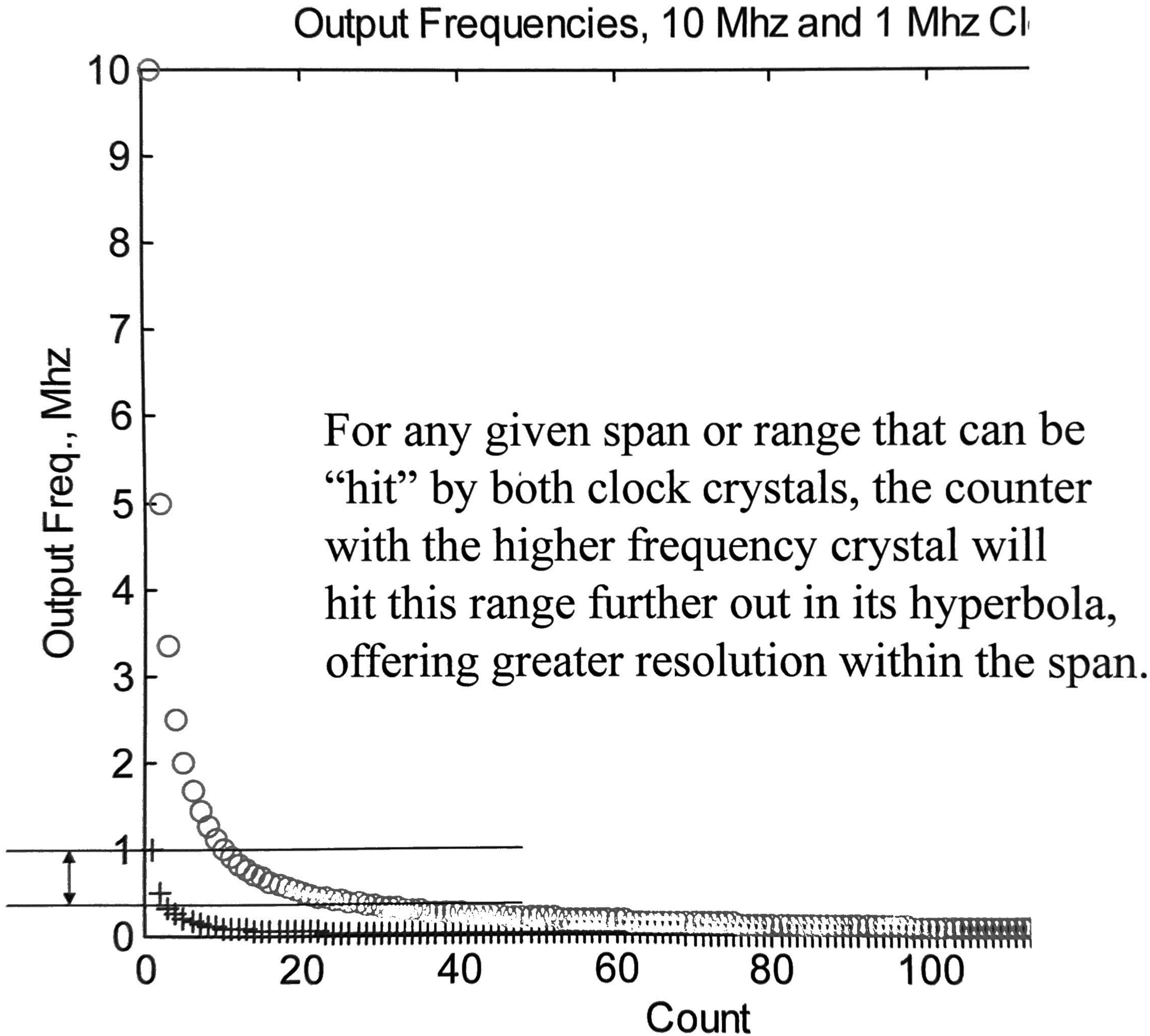


Output frequencies, 10 Mhz and 1 Mhz Clo
Output Freq., Mhz
Count
0
1
2
3
4
5
6
7
8
9
10
0
2
4
6
8
For any given COUNT, a lower clock frequency results in a smaller absolute frequency change for a one count change or delta.


Output frequencies, 10 Mhz and 1 Mhz Clc
Output Freq., Mhz
Count
0
1
2
3
4
5
6
7
8
9
10
0
2
4
6
8
For any given COUNT, a lower clock frequency results in a smaller absolute frequency change for a one count change or delta.
But that may not be what you care about for the lamp problem!


Output frequencies, 1 Mhz Clock
Frequency span from 0.1 to 1 Mhz,
with 1 Mhz clock crystal.
10 frequency steps available – 10 step
resolution in this span or range with this
crystal.
Output Freq., Mhz
Count
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2
4
6
8


Output frequencies, 10 Mhz Clock
Frequency span from 0.1 to 1 Mhz,
with 10 Mhz clock crystal.
91 frequency steps available – 91 step
resolution in this span or range with this
crystal.
Output Freq., Mhz
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
20
40
60
80
Count


Output Frequencies, 10 Mhz and 1 Mhz Cl
Output Freq., Mhz
10
9
8
7
6
5
4
3
2
1
0
0
20
40
60
80
100
Count
For any given span or range that can be "hit" by both clock crystals, the counter with the higher frequency crystal will hit this range further out in its hyperbola, offering greater resolution within the span.

ANALOG DEVICES

DACPORT Low Cost, Complete μP-Compatible 8-Bit DAC

AD558*

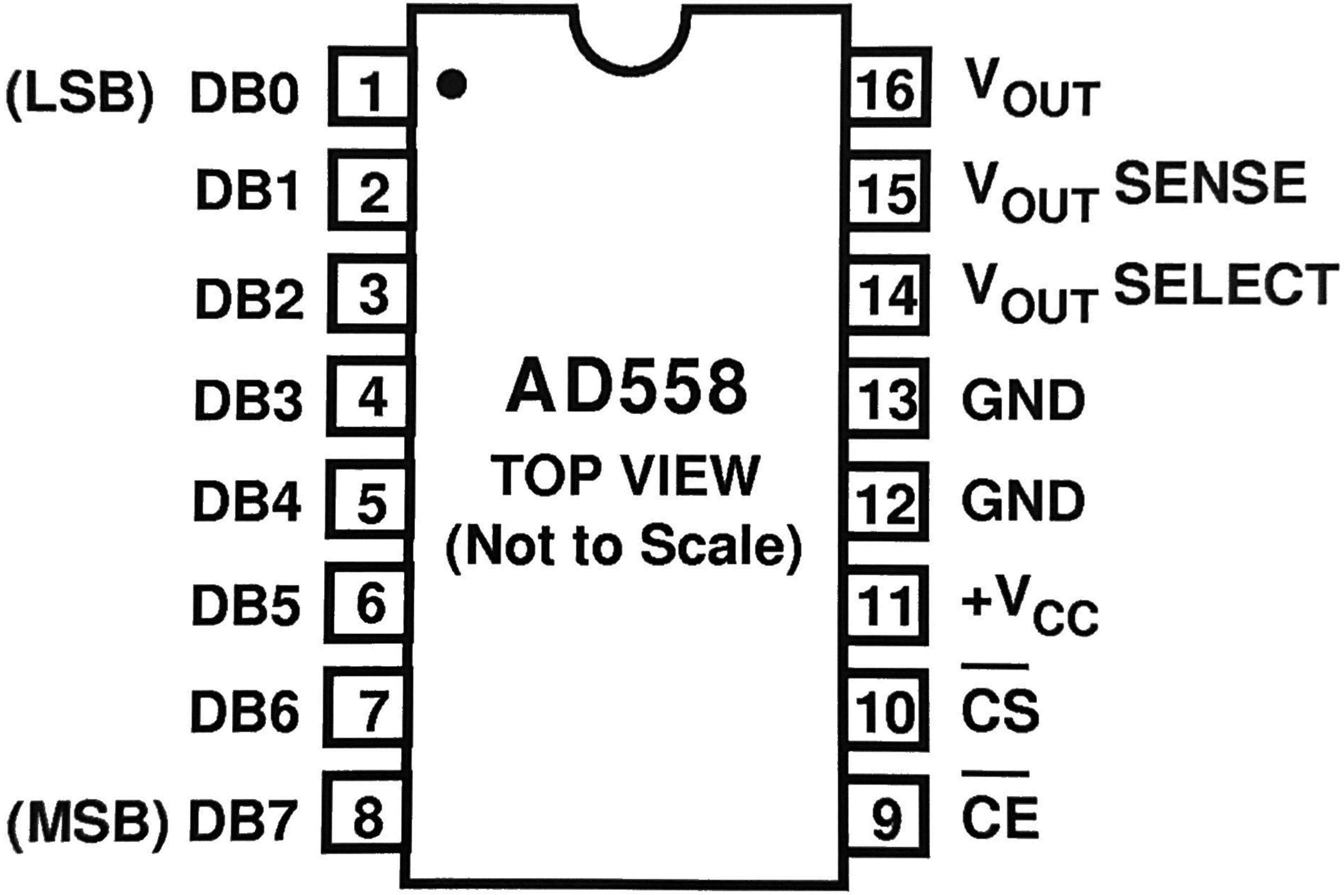


Figure 1a. AD558 Pin Configuration (DIP)

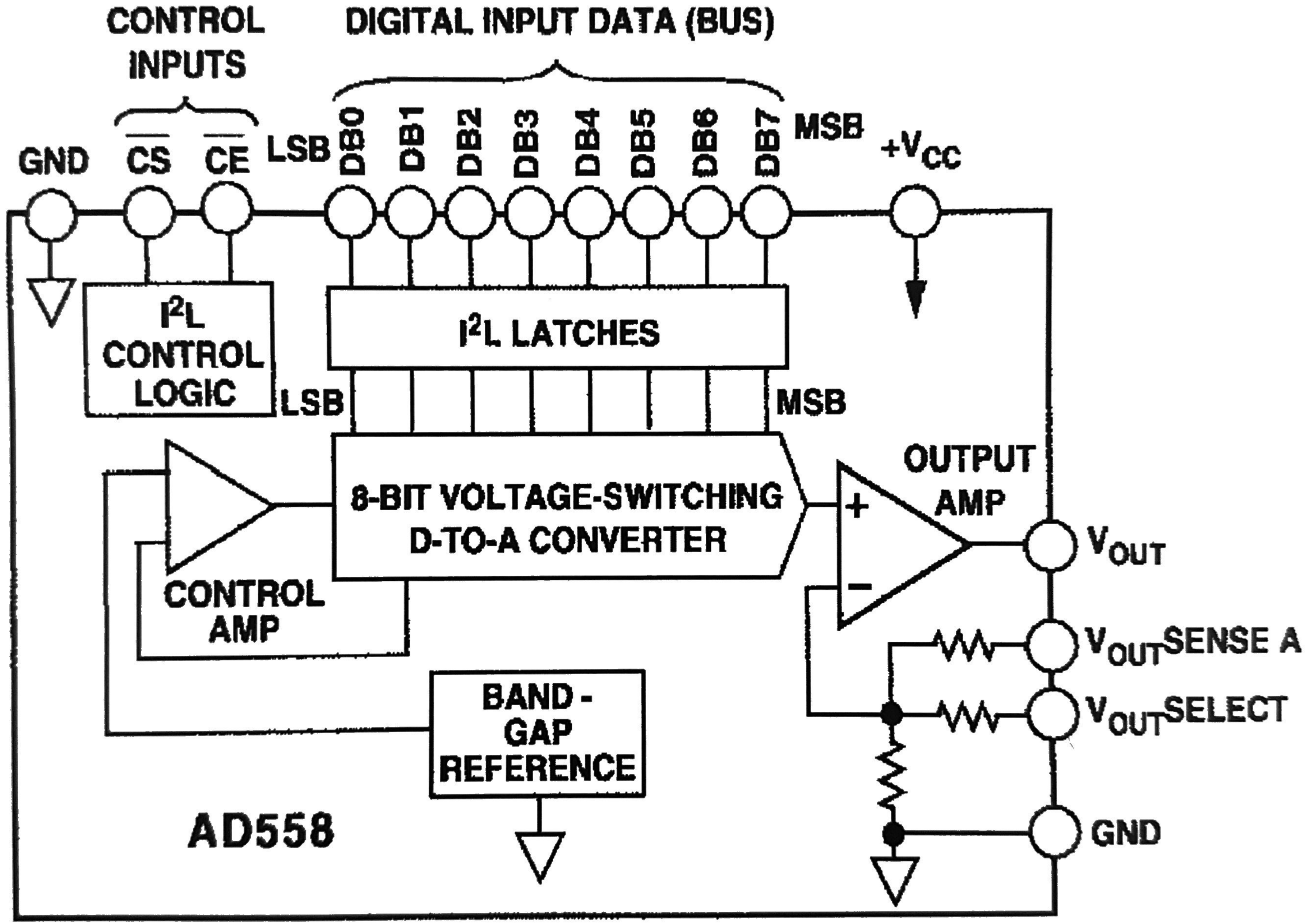
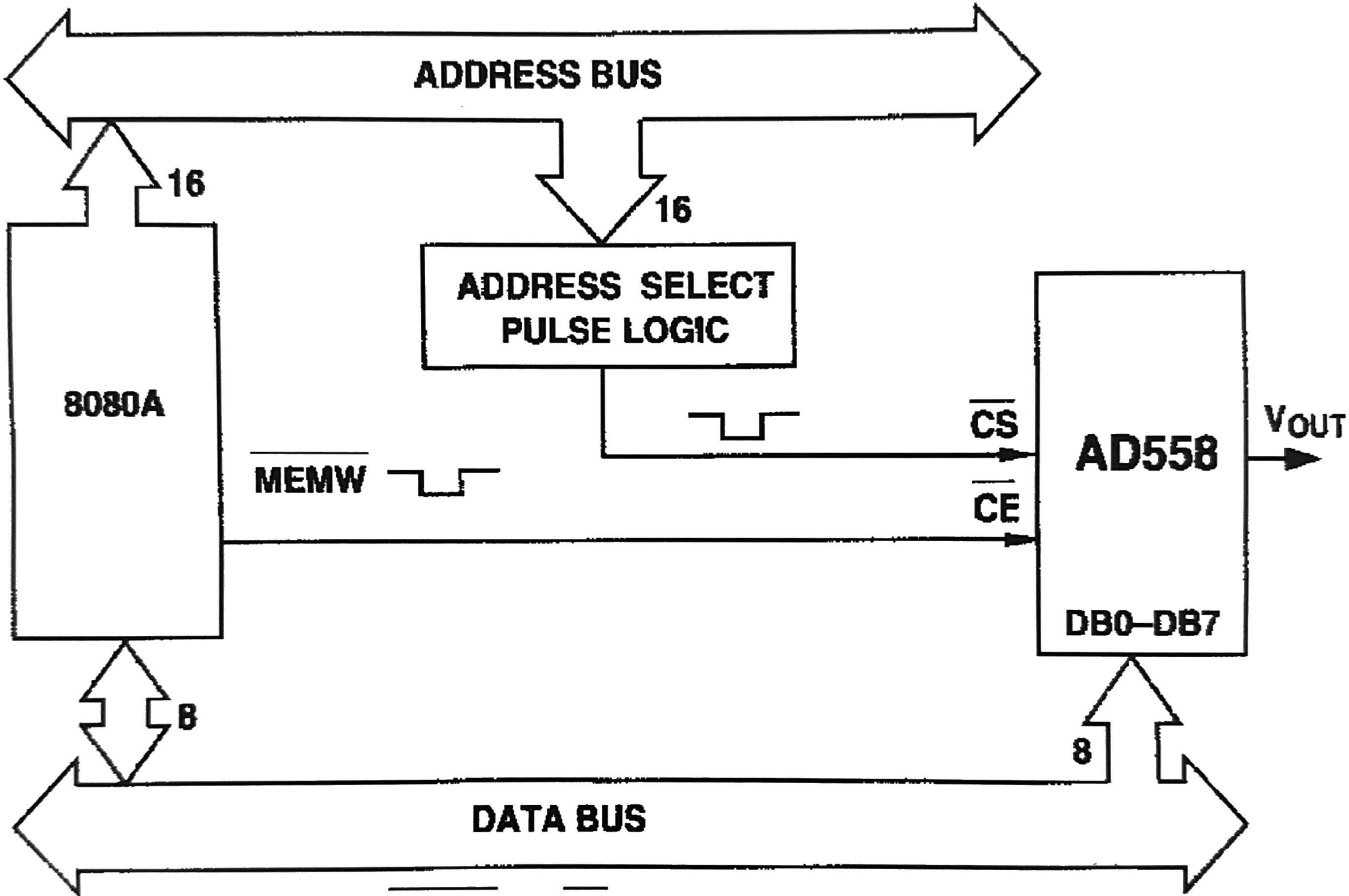

CONTROL INPUTS
DIGITAL INPUT DATA (BUS)
GND
CS
CE
LSB
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
MSB
+VCC
I2L CONTROL LOGIC
I2L LATCHES
LSB
MSB
8-BIT VOLTAGE-SWITCHING D-TO-A CONVERTER
CONTROL AMP
OUTPUT AMP
VOUT
VOUT SENSE A
VOUT SELECT
BAND-GAP REFERENCE
GND
AD558

Table I. AD558 Control Logic Truth Table

Input Data	$\overline{\text{CE}}$	$\overline{\text{CS}}$	DAC Data	Latch Condition
0	0	0	0	"Transparent"
1	0	0	1	"Transparent"
0	g	0	0	Latching
1	g	0	1	Latching
0	0	g	0	Latching
1	0	g	1	Latching
X	1	X	Previous Data	Latched
X	X	1	Previous Data	Latched



$\overline{\text{MEMW}} \rightarrow \overline{\text{CE}}$

DECODED ADDRESS SELECT PULSE → CS

Table Entry Number:

	0	1	2	3	4	5	6	7
Analog Sinewave:	0	0.707	1	0.707	0	-0.707	-1	-0.707
Offset Analog:	1	1.707	2	1.707	1	0.293	0	0.293
Times 255/2, converted to hex…	7Fh	DAh	FFh	DAh	7Fh	25h	00h	25h

- Eight (8) entries in the sinewave data table
- Limit timer interrupts to an advance every 1/8th second
- Determine the counts/advance of the table counter:
- First, try a 3-bit table counter to make a 1 Hz sinewave:

$$2^3 \frac{\text{counts}}{\text{period}} \bullet 1 \frac{\text{period}}{\text{second}} \bullet \frac{1}{8} \frac{\text{seconds}}{\text{advance}} = 1 \frac{\text{count}}{\text{advance}}$$

- Eight (8) entries in the sinewave data table
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- Now, try a 3-bit table counter to make a **1.5 Hz** sinewave:

$$2^3 \frac{\text{counts}}{\text{period}} \bullet 1.5 \frac{\text{period}}{\text{second}} \bullet \frac{1}{8} \frac{\text{seconds}}{\text{advance}} = 1 \frac{\text{count}}{\text{advance}}$$

(with integer rounding)

- Eight (8) entries in the sinewave data table
- Limit timer interrupts to an advance every 1/8th second
- Determine the counts/advance of the table counter:
- First, try a 3-bit table counter to make a 1 Hz sinewave:

$$2^3 \frac{\text{counts}}{\text{period}} \bullet 1 \frac{\text{period}}{\text{second}} \bullet \frac{1}{8} \frac{\text{seconds}}{\text{advance}} = 1 \frac{\text{count}}{\text{advance}}$$

- Now, try a 3-bit table counter to make a **1.5 Hz** sinewave:

$$2^3 \frac{\text{counts}}{\text{period}} \bullet 1.5 \frac{\text{period}}{\text{second}} \bullet \frac{1}{8} \frac{\text{seconds}}{\text{advance}} = 1 \frac{\text{count}}{\text{advance}}$$

(with integer rounding)

- Now, try a **4-bit** table counter to make a **1.5 Hz** sinewave:

$$2^4 \frac{\text{counts}}{\text{period}} \bullet 1.5 \frac{\text{period}}{\text{second}} \bullet \frac{1}{8} \frac{\text{seconds}}{\text{advance}} = 3 \frac{\text{count}}{\text{advance}}$$