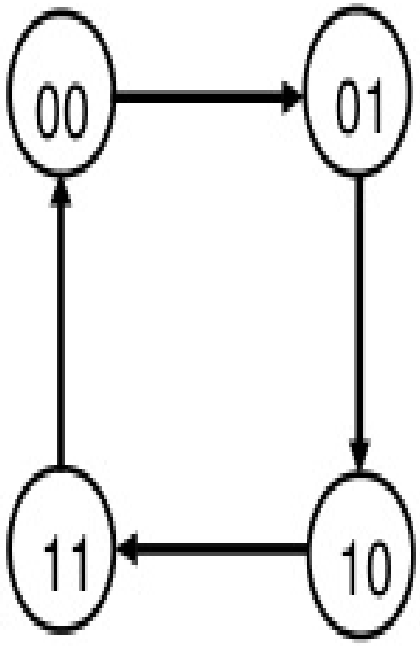
Guess Today's Topic????



- Overview of Counters
- Characteristics of Counters
- Ripple Up Counter
- Ripple Counter with Waveforms
- Ripple Down Counter
- Self-stopping Counter
- Frequency Division using Counters
- Using Counter ICs
- Magnitude Comparators
- Troubleshooting Equipment
- Troubleshooting Hints

OVERVIEW OF COUNTERS

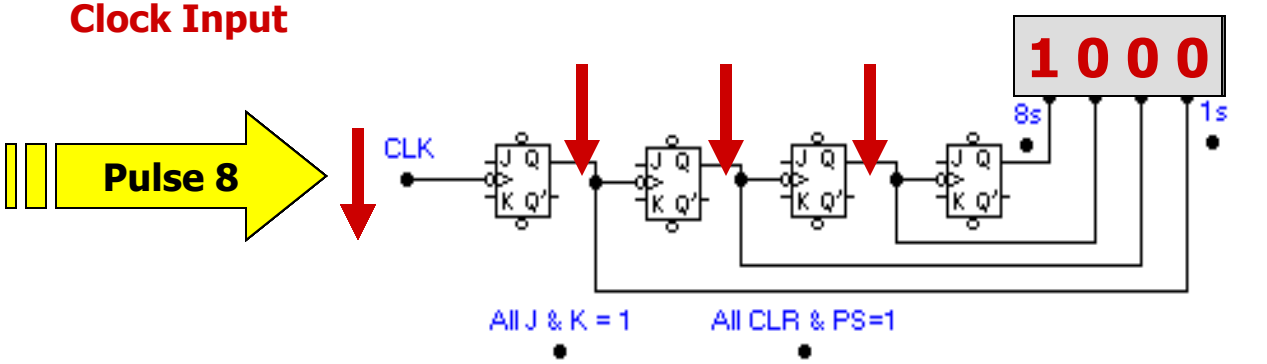
- **Counter-by definition**
  - One input (clock)
  - Outputs follow defined sequence

- **Common tasks of counter**
  - Count up or down
  - Increment or decrement count
  - Sequence events
  - Divide frequency
  - Address memory
  - As memory

CHARACTERISTICS OF COUNTERS

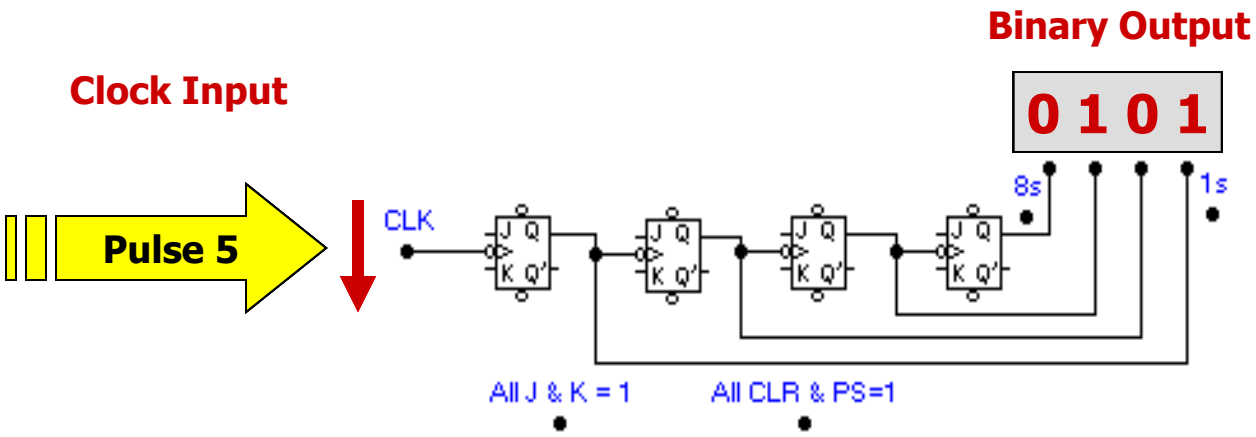
- Number of bits (4-bit, 8-bit, etc.)
- Maximum count
  - 4 bit = 2^4 = 0000 to 1111 in binary
  - 8 bit = 2^8 = 0000 0000 to 1111 1111 in binary
- Modulus of counter-number of states
  - Decade counter
  - 4-bit
  - 8-bit
- Up or down counter
- Asynchronous or synchronous counter
- Presettable counter
- Self-stopping counter

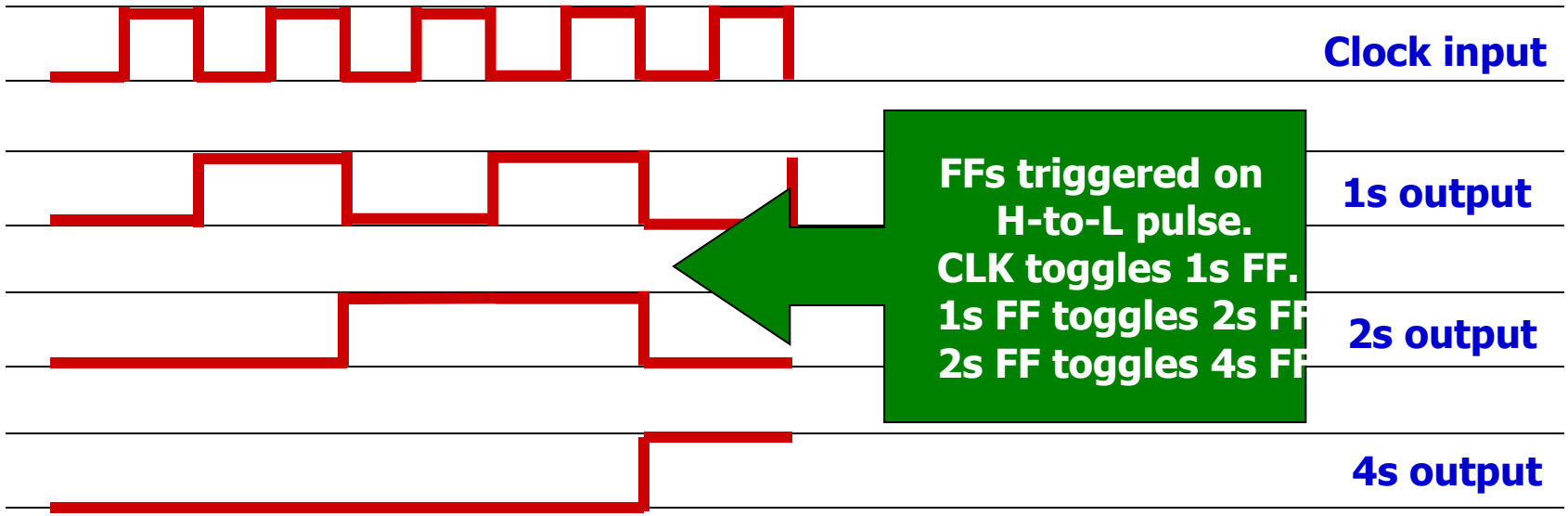
RIPPLE COUNTER



This 4-bit counter has 16 states and will count from binary 0000 through 1111 and then reset back to 0000.
The counter has a modulus of 16.

RIPPLE COUNTER WITH WAVEFORMS



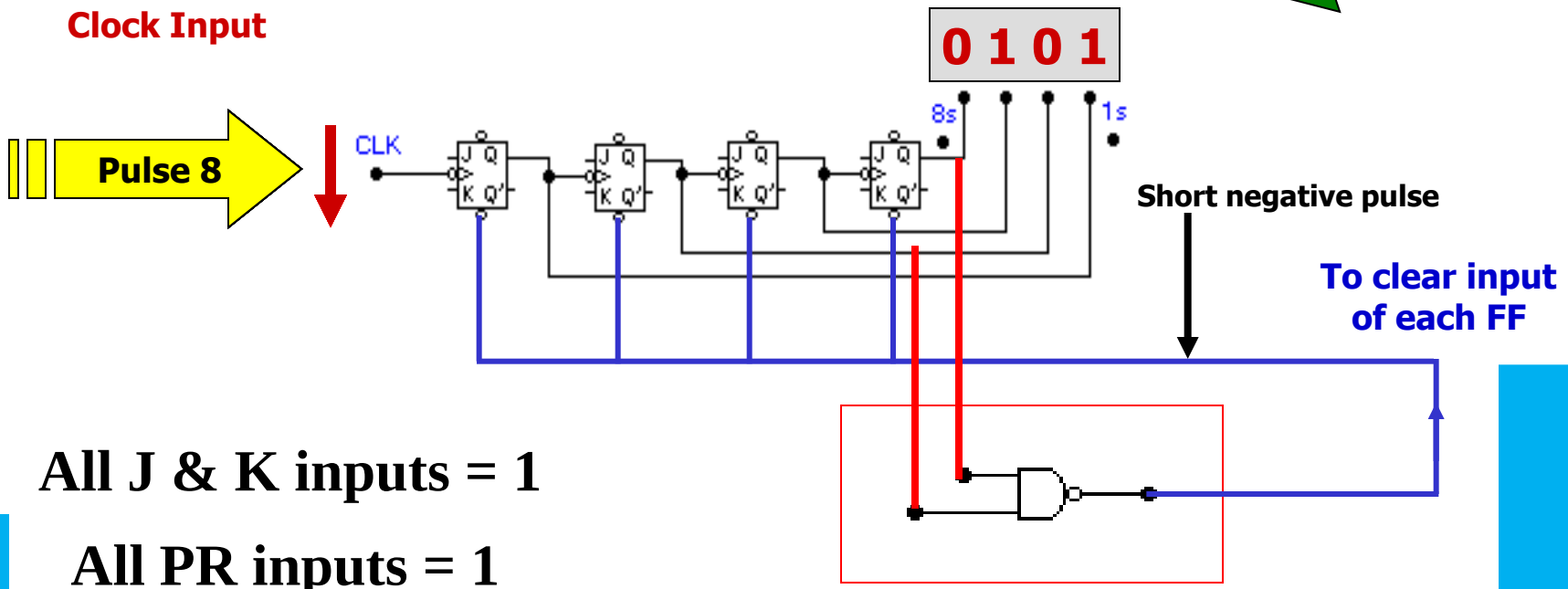


DECADE COUNTER

Initial count at 0111

Binary Output

Clock Input



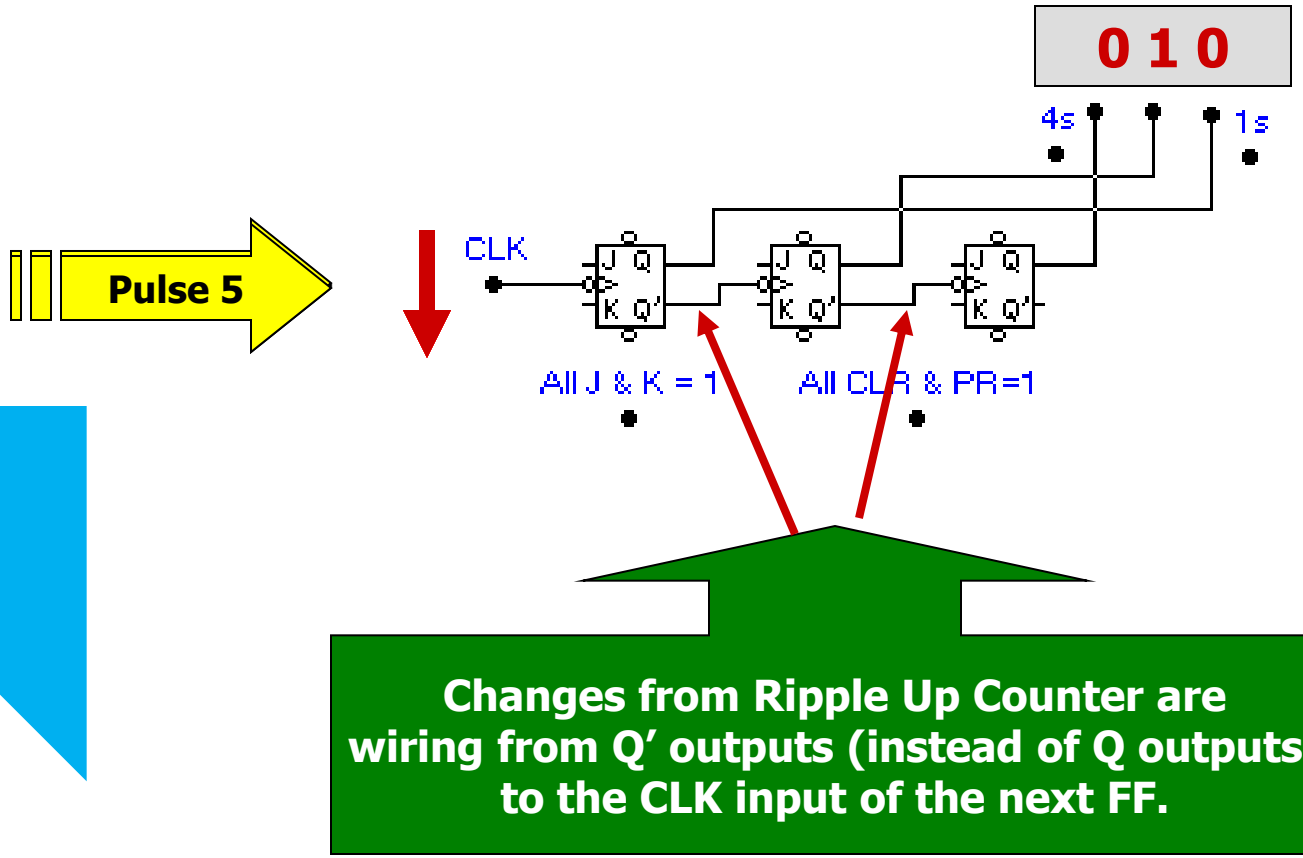
All J & K inputs = 1

All PR inputs = 1

Count is at 1001.
Next clock pulse will increment counter for a short time to 1010 which will activate the NAND gate and reset the counter to 0000.

DOWN COUNTER

Initial count set at binary 111

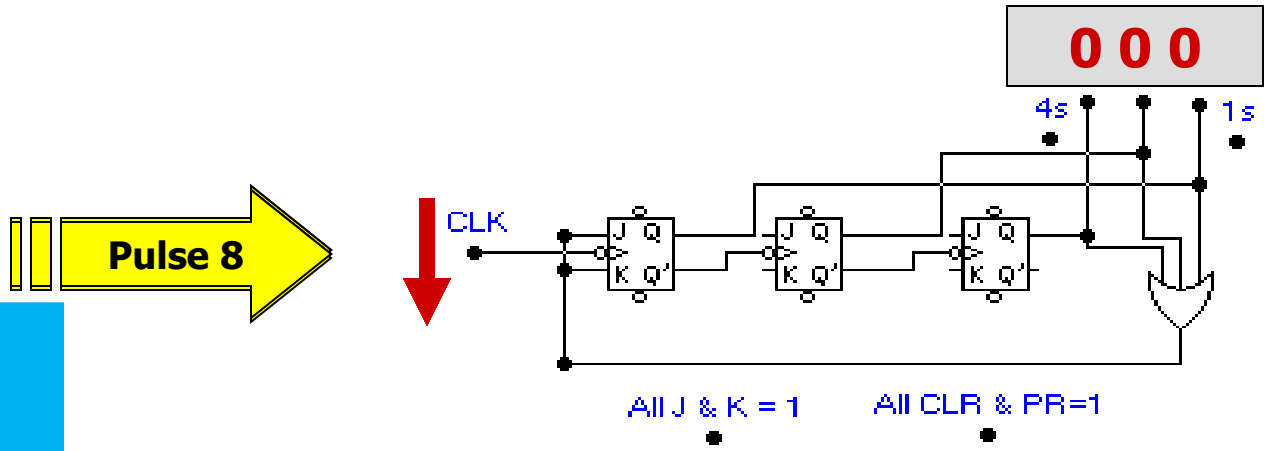


Changes from Ripple Up Counter are wiring from Q' outputs (instead of Q outputs) to the CLK input of the next FF.

SELF-STOPPING DOWN COUNTER

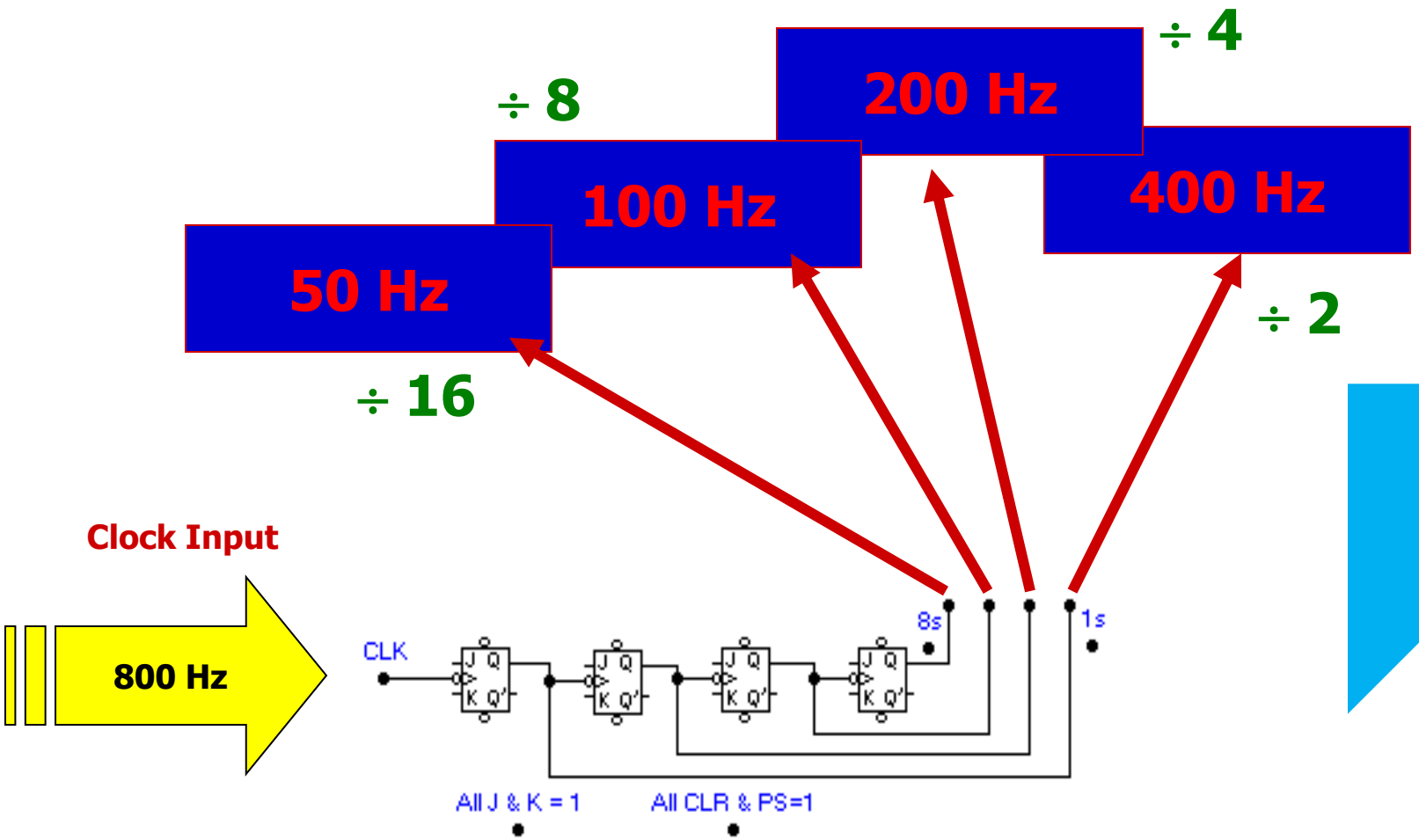
Watch count on Pulse 8.

The count remained at binary 000.



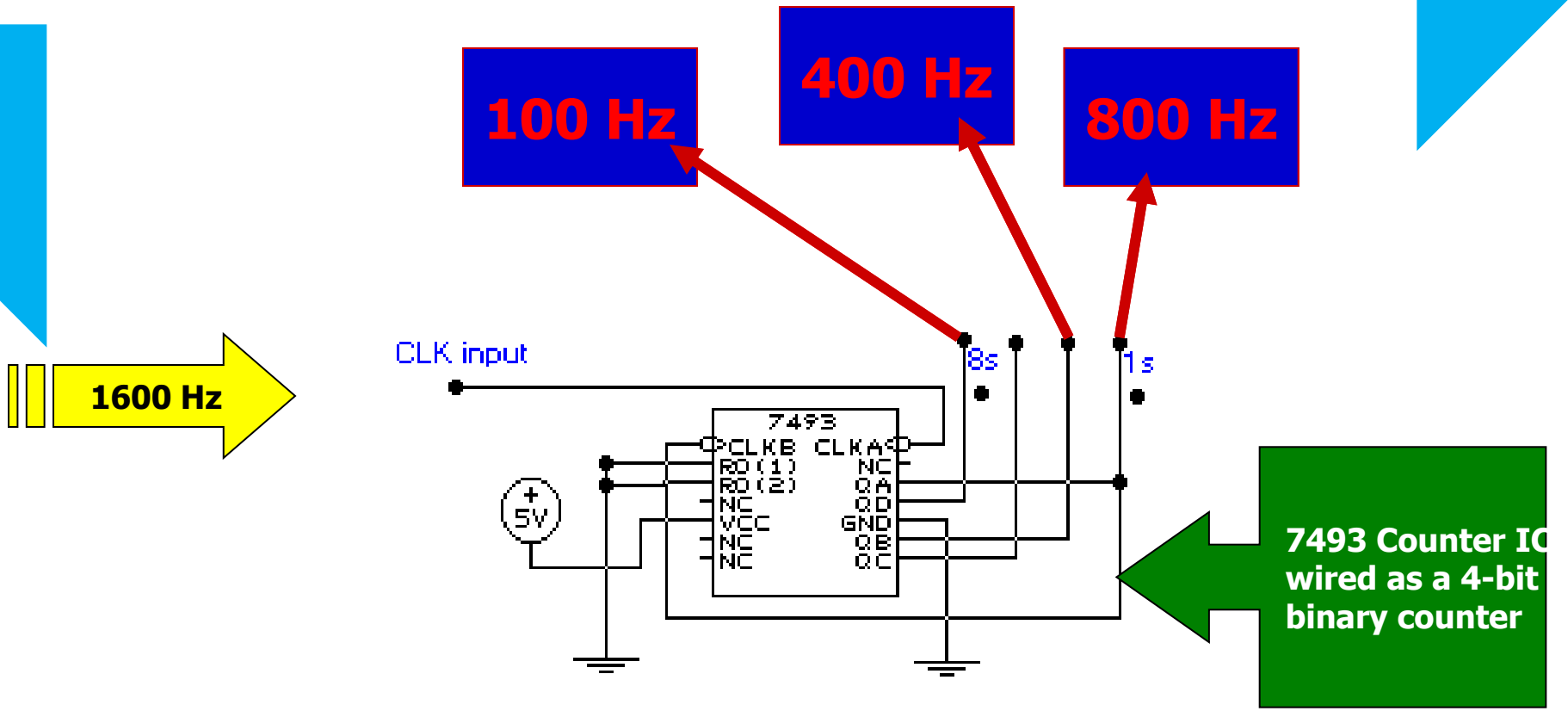
This is a 3-bit down counter.
The 1s FF is in TOGGLE mode when counting (J & K = 1).
The 1s FF switches to HOLD mode when the J and K inputs are forced LOW by the OR gate when the count decrements to 000. The count stops at 000.

USED FOR FREQUENCY COUNTER DIVISION



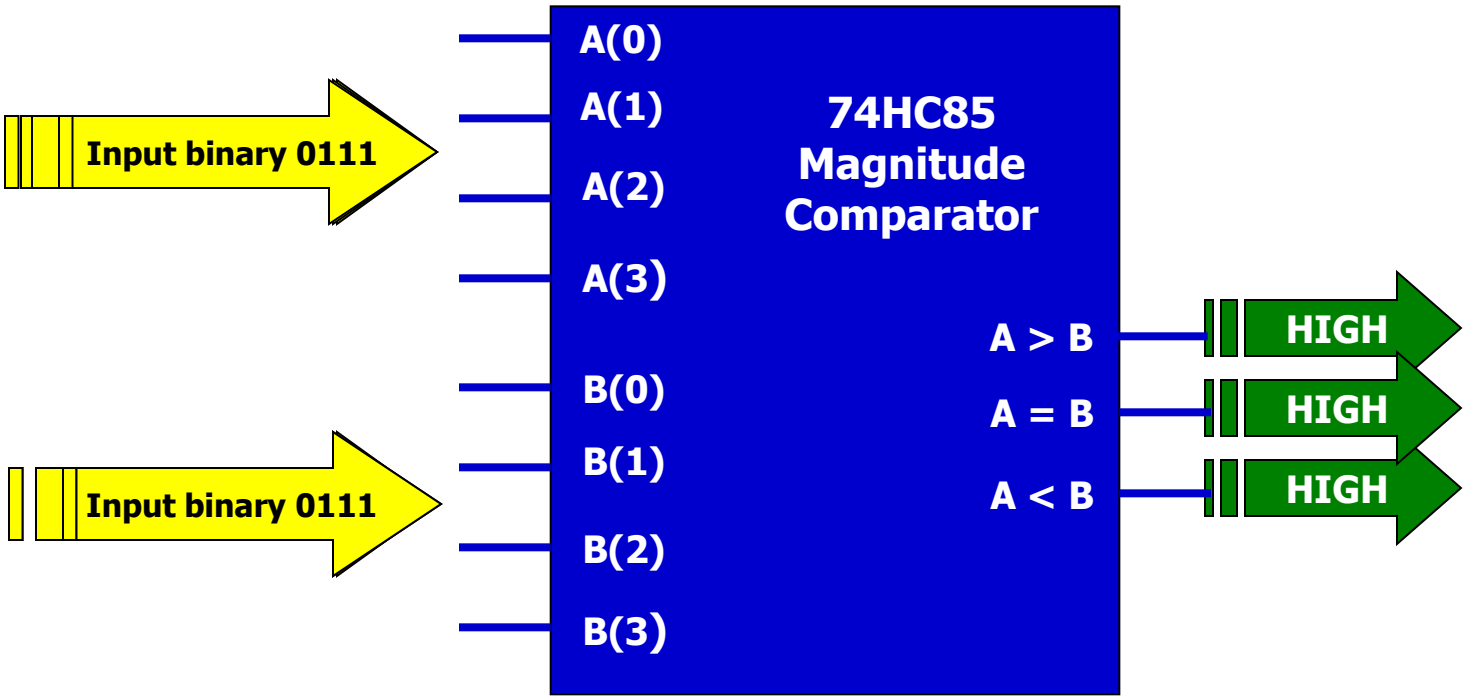
USING THE 7493 COUNTER IC

- Counters are available in IC form.
- Either ripple (7493 IC) or synchronous (74192 IC) counters are available.



MAGNITUDE COMPARATOR

A magnitude comparator is a combinational logic device that compares the value of two binary numbers and responds with one of three outputs (A=B or A>B or A<B)



TROUBLESHOOTING EQUIPMENT

- Logic Probe
- Logic Pulser
- Logic Clip (logic monitor)
- Digital IC Tester
- DMM/Logic Probe
- DMM or VOM
- Dual-trace Oscilloscope
- Logic Analyzer

SIMPLE TROUBLESHOOTING HINTS

- *Feel* top of IC to determine if it is hot
- *Look* for broken connections, signs of excessive heat
- *Smell* for overheating

Check power source

Trace path of logic through circuit

- *Know* the normal operation of the circuit


Thank
you