Three-Digit Timer / Event Counter:

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Introduction:

This project offers a simple and relatively inexpensive circuit for a three-digit timer / event counter for use in timing short events -or- counting event pulses generated by an external sensor (etc.). (Additional stages can easily be added if needed, simply by duplicating the cascaded counter sections shown in the schematic.)

How it works:

The heart of this circuit is the 7490 Decade Counter TTL IC(s). As configured, this circuit can be used either as a timer (by inputting periodically spaced timer pulses from an external pulse generator/clock circuit), - or- as an event counter (e.g. counting the number of times something has passed through an “electric eye”, depressed a micro switch, triggered a “gating event”, etc.).

The input clock or event pulses enter the counter at the top left of the circuit (assumed here as active high pulses as shown). Since the 7490 Decade Counter uses an active low input, we pass the input pulses through an NPN transistor (here a generic 2n3904 is used, however a 2n2222, etc. can also be used.). This buffer is used to both invert the pulse as well as debounce any dirty switch transients (i.e. the capacitor following the transistor inverter integrates the input pulse, smoothing out any “rough edges” on the input pulse). The first Decade Counter across the top of the schematic represents the Least Significant Digit (LSD) of the overall counter circuit. This counter counts the incoming pulses, providing a Binary Coded Decimal (BCD) output which is fed into its associated 7447 IC to drive the 7-segment LED display to its right.

The highest digit on this 7490's BCD output (pin 11) is “rippled forward” to serve as the input pulse for the next most significant digit, which is processed by the middle 7490/7447 IC's. The highest BCD digit on this counter is similarly “rippled forward” to the Most Significant Digit (MSD) 7490 counter at the bottom of the diagram. Pins 2 and 3 of the 7490 Decade Counters set the state of the counters, allowing the system count to be started or reset as needed.

Variations:

In this circuit, a toggle switch is shown attached to the run/reset pins, however this control input could easily be adapted to accommodate an automated process. For example, if one had a “gated” process on an assembly line (etc.) in which a group of parts/packages/people (etc.) moved past a given point while the “gate” was open, simply attaching a micro switch, sensor output, or TTL pulse generating circuit to the gate (which supplies a 0v / 5v output to this line) would allow the circuit to count the number of objects passing through a trip sensor (e.g. an electric eye) crossing the path controlled by the gate (etc.).

Alternately, instead of counting random “event” pulses through some gated process, one could also feed a train of periodic clocking pulses into the transistor inverter, coupled to a similar “gating” mechanism on the run/reset pins as a means of counting the time interval of

the “open gate event” (e.g. between a “start” and “finish” interval, etc.). Depending on the application, the periodic clock input can be configured for long duration events (i.e. 1 or 10 second pulse intervals), or short burst events (i.e. 1/10th or 1/1000th of a second pulse intervals), etc.

One possible example of this timer application might be to use this circuit to count the time it takes for an object to pass from sensor “A” at the “start” of a process, to sensor “B” at the other end of that process while simultaneously monitoring/controlling the operation of that process. Another example might be to count the interval time involved in a “drop test”, a time-of-flight ballistic trajectory test, etc..