Time Delay Relays – Application Data

Definition:
Time Delay is defined as the controlled period between the functioning of two events. A Time Delay relay is a combination of an electromechanical output relay and a control circuit. The control circuit is comprised of solid state components and timing circuits that control operation of the relay and timing range. Typical time delay functions include On-Delay, Repeat cycle (starting off), Interval, Off-Delay, Retriggerable One Shot, Repeat cycle (starting on), Pulse Generator, One Shot, On/Off Delay, and Memory Latch. Each function is explained in the table below. Time delay relays have a broad choice of timing ranges from less than one second to many days. There are many choices of timing adjustments from calibrated external knobs, DIP switches, thumbwheel switches, or recessed potentiometer. The output contacts on the electromechanical output relay are direct wired to the output terminals. The contact load ratings are specified for each specific type of time delay relay.

Understanding the differences between all the functions available in time delay relays can sometimes be a daunting task. When designing circuits using time delay relays questions such as:

"What initiates a time delay relay?"

"Does the timing start with the application or release of voltage?"

"When does the output relay come on?"

must be asked.

Time delay relays are simply control relays with a time delay built in. Their purpose is to control an event based on time. The difference between relays and time delay relays is when the output contacts open & close: on a control relay, it happens when voltage is applied and removed from the coil; on time delay relays, the contacts will open or close before or after a pre-selected, timed interval.

Typically, time delay relays are initiated or triggered by one of two methods:
- application of input voltage (On Delay, Interval On, Flasher, Repeat Cycle, Delayed Interval & Interval/Flasher).
- opening or closing of a trigger signal (Off Delay, Single Shot & Watchdog).

These trigger signals can be one of two designs:
- a control switch (dry contact), i.e., limit switch, push button, float switch, etc.
- voltage (commonly known as a power trigger).

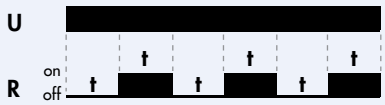
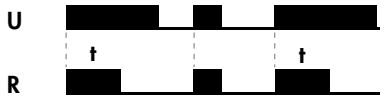
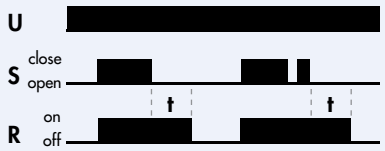
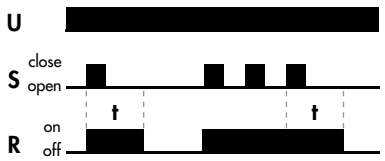
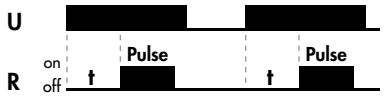
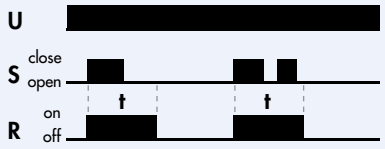
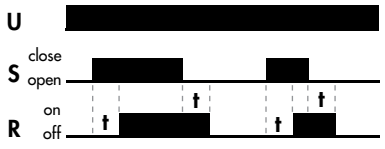
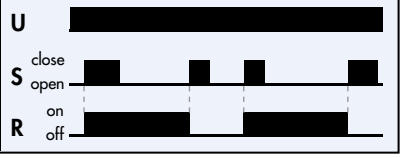
To help understand, some definitions are important:
Input Voltage: Control voltage applied to the input terminals (see wiring diagrams below). Depending on the function, input voltage will either initiate the unit or make it ready to initiate when a trigger signal is applied.

Trigger Signal: On certain timing functions, a trigger signal is used to initiate the unit after input voltage has been applied. As noted above, this trigger signal can either be a control switch (dry contact switch) or a power trigger (voltage).

Output (Load): Every time delay relay has an internal relay (usually mechanical) with contacts that open & close to control the load. They are represented by the dotted lines in the wiring diagrams. Note that the user must provide the voltage to power the load being switched by the output contacts of the time delay relay.

The following tables contain both written and visual descriptions on how the common timing functions operate. A Timing Chart shows the relationship between Input Voltage, Trigger Signal (if present) and Output Contacts.

FUNCTION DEFINITION TABLE

Function	Operation	Timing Chart
A. **ON DELAY** Power On	When the input voltage **U** is applied, timing delay **t** begins. Relay contacts **R** change state after time delay is complete. Contacts **R** return to their shelf state when input voltage **U** is removed. Trigger switch is not used in this function.	
B. **REPEAT CYCLE** Starting Off	When input voltage **U** is applied, time delay **t** begins. When time delay **t** is complete, relay contacts **R** change state for time delay **t**. This cycle will repeat until input voltage **U** is removed. Trigger switch is not used in this function.	
C. **INTERVAL** Power On	When input voltage **U** is applied, relay contacts **R** change state immediately and timing cycle begins. When time delay is complete, contacts return to shelf state. When input voltage **U** is removed, contacts will also return to their shelf state. Trigger switch is not used in this function.	
D. **OFF DELAY** S Break	Input voltage **U** must be applied continuously. When trigger switch **S** is closed, relay contacts **R** change state. When trigger switch **S** is opened, delay **t** begins. When delay **t** is complete, contacts **R** return to their shelf state. If trigger switch **S** is closed before time delay **t** is complete, then time is reset. When trigger switch **S** is opened, the delay begins again, and relay contacts **R** remain in their energized state. If input voltage **U** is removed, relay contacts **R** return to their shelf state.	
E. **RETRIGGERABLE ONE SHOT**	Upon application of input voltage **U**, the relay is ready to accept trigger signal **S**. Upon application of the trigger signal **S**, the relay contacts **R** transfer and the preset time **t** begins. At the end of the preset time **t**, the relay contacts **R** return to their normal condition unless the trigger switch **S** is opened and closed prior to time out **t** (before preset time elapses). Continuous cycling of the trigger switch **S** at a rate faster than the preset time will cause the relay contacts **R** to remain closed. If input voltage **U** is removed, relay contacts **R** return to their shelf state.	
F. **REPEAT CYCLE** Starting On	When input voltage **U** is applied, relay contacts **R** change state immediately and time delay **t** begins. When time delay **t** is complete, contacts return to their shelf state for time delay **t**. This cycle will repeat until input voltage **U** is removed. Trigger switch is not used in this function.	
G. **PULSE GENERATOR**	Upon application of input voltage **U**, a single output pulse of 0.5 seconds is delivered to relay after time delay **t**. Power must be removed and reapplied to repeat pulse. Trigger switch is not used in this function.	
H. **ONE SHOT**	Upon application of input voltage **U**, the relay is ready to accept trigger signal **S**. Upon application of the trigger signal **S**, the relay contacts **R** transfer and the preset time **t** begins. During time-out, the trigger signal **S** is ignored. The relay resets by applying the trigger switch **S** when the relay is not energized.	
I. **ON/OFF DELAY** S Make/Break	Input voltage **U** must be applied continuously. When trigger switch **S** is closed, time delay **t** begins. When time delay **t** is complete, relay contacts **R** change state and remain transferred until trigger switch **S** is opened. If input voltage **U** is removed, relay contacts **R** return to their shelf state.	
J. **MEMORY LATCH** S Make	Input voltage **U** must be applied continuously. Output changes state with every trigger switch **S** closure. If input voltage **U** is removed, relay contacts **R** return to their shelf state.	

U = Input Voltage **S** = Trigger Switch **R** = Relay Contacts **t** = Time Delay