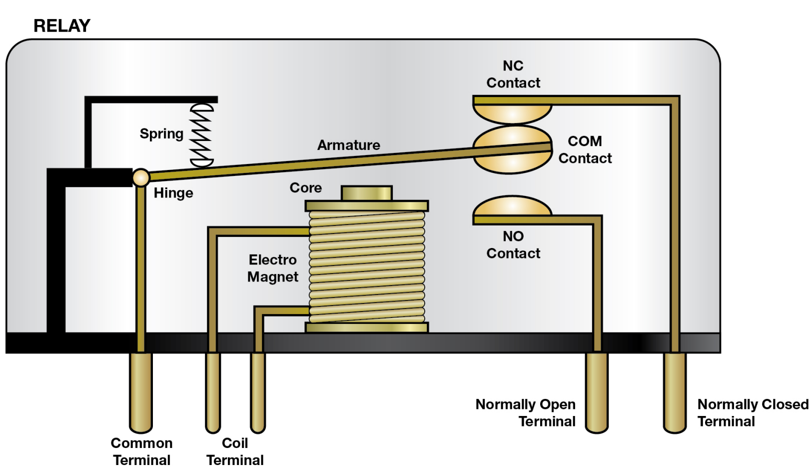
Timers are a critical component for industrial automation applications as well as laboratory, machine tool, and semiconductor manufacturing. They are a core part of every modern Control & Automation system. Understanding your application and the types of operations you need to do will go a long way in helping you to choose the right device.

What is an Electronic Timer and how does it operate?

Electronic Timers consist of an Electromagnetic relay which switches on and off the devices to be controlled and its integrated electronic circuitry and controls which gives the timer its timing capabilities.

An electromagnetic relay is used to safely turn on or off a high current device while using a much smaller and safer current. It works on the basis of an electromagnet and consists of a coil of wire wrapped around a solenoid, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts. When electricity is applied, an electromagnetic coil causes an armature to move—opening or closing the contacts—therefore controlling the flow of electricity from the high current source connected to the load side of the relay. In this way, relays act as bridges that activate larger currents using smaller ones. If the contacts were closed when the relay was de-energized, then it opens the contacts and breaks the connection and vice versa if the contacts were open. When the current to the coil is switched off, the armature is returned by a force, approximately half as strong as the magnetic force, to its relaxing position which is achieved by its spring.

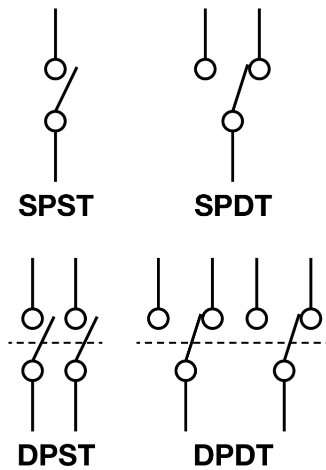


The Electronic Timers incorporates integrated circuitry between an input signal and the small voltage used to control the armature motion. This additional circuitry allows relays to actuate the outputs in different time-delayed combinations. They are designed to delay armature motion on both, coil energization and de-energization. Timers provide a wide range of selectable timing functions so that users can customize and operate their applications with safety and accuracy.

Features and Choices when selecting an Electronic Timer

In general, when deciding on a timer, it's important that you are assured that the devices have a proven design, is marked and certified by UL, IEC, etc. so that you can be used anywhere in the world. Such certifications should be clearly marked on the housing for easy reference. Also Timers should be easy to wire, troubleshoot, and operate. Other criteria in selecting a timer are:

Output Configurations



A Timing Relay switches one or more poles. Normally open (NO) contacts connect the circuit when the relay is activated, the circuit is disconnected when the relay is inactive. Normally closed (NC) contacts disconnect the circuit when the relay is activated, the circuit is connected when the relay is inactive. All contact forms consist of NO and NC combinations.

Common Output configurations:

SPST (Single-Pole Single-Throw): Single contact NO (Form A) or NC (Form B);

SPDT (Single-Pole Double-Throw): Single set of Form C transfer contacts (Changeover C/O). One common terminal connects to either of two others (NO/ NC), never connecting to both at the same time;

DPST (Double-Pole Single-Throw): Equivalent to a pair of SPST contacts actuated by a single coil. Can be NO or NC or one of each;

DPDT (Double-Pole Double-Throw): Equivalent to two SPDT contacts by a single coil.

Mounting/ Dimensions

Mounting is a primary concern for most applications because it is selected long before your timing needs are worked out. Mounting may also be critical depending on who will be operation the timer and where visible readings need to be available for easy viewing. Standard mounting comes in two types: DIN rail mounting and Panel Mount versions. Most Timing devices are very compact and standard devices are 17.5mm or 22.5mm wide.

Supply Voltage

It's important to know what coil voltage inputs your timers can handle and to be sure that multiple voltages are possible to reduce replacement stock requirements. Timers are available in either AC or DC voltages. Recommended is a timer which comprises a universal spectrum and handle all voltages 12V – 240V AV and DC.

Timing Range/ Accuracy

Timing range is another critical criteria when selecting a timer. Available are Timers with specific timing ranges within a few seconds, minutes or hours. Make sure the device you picked fulfills all timing and accuracy requirements of your application. Recommended is selecting a timer with large timing ranges. Some Timers include timing ranges 0.1s up to 999h in one device.

Display options

Most Timers have manual dials on their front to select Timing Range, Timing Functions and set timing parameters. On others configuration is done thru an LCD display which shows current elapsed and remaining runtime information. This feature is recommended for longer timing cycles to have an indicator on the status of the timing process.

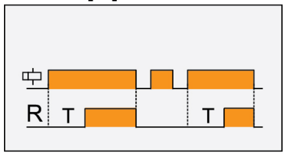
Timing Functions

The most important feature to select in an application is the correct timing function(s) to make its processes accurate and efficient. Mostly used are simple timing functions such as ON Delay, OFF Delay or cyclic ON/ OFF functions. Many other functions are available. Some require a trigger signal others initiate with leading or trailing edge impulses. Economic timers have just 1 function built in, whereas Multi Timers come with several built in functions, e.g. 8 or 18 functions. Advanced Timer have the option for users to program their own timing function for specific applications.

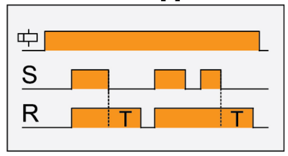
So called TIME SWITCHES have a real time clock built in and machines can be turned ON and OFF at specific days/ times.

Timing functions are explained in timing diagrams which come with the manual of new Electronic Timers. Details for examples of most commonly used functions are below with their timing diagrams and explanations:

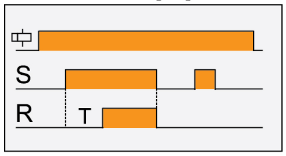
ON DELAY [00]



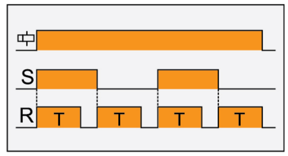
SIGNAL OFF DELAY [9]



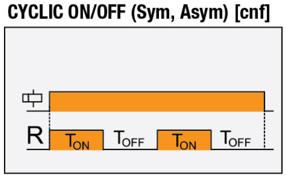
SIGNAL ON DELAY [stn]



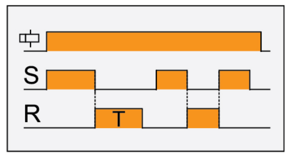
SIGNAL ON/OFF [d]



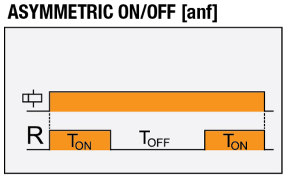
CYCLIC ON/OFF (Sym, Asym) [cnf]



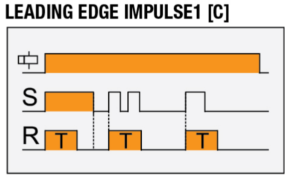
TRAILING EDGE IMPULSE1 [E]



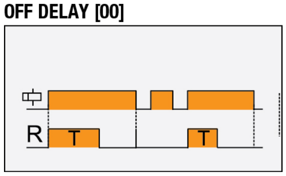
ASYMMETRIC ON/OFF [anf]



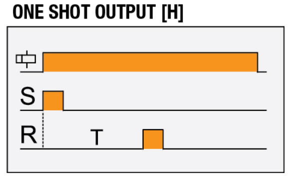
LEADING EDGE IMPULSE1 [C]



OFF DELAY [00]



ONE SHOT OUTPUT [H]



<u>TIMING DIAGRAM FOR EACH FUNCTION</u>

ON DELAY

Timing starts once the input supply voltage is present. The output energizes at the end of timing period T which is set by the user.

SIGNAL ON DELAY

Permanent input supply voltage is required. Timing T starts when signal input B1 is closed. The output energizes at the end of timing period T which is set by user.

CYCLIC ON/ OFF

Timing starts once input supply voltage is present. The output energizes/ de-energizes for the set ON and OFF time. ON/ OFF time are the same. The relay keeps changing its state until input supply voltage is removed.

ASSYMETRIC ON/ OFF

Timing starts once input supply voltage is present. The output energizes/ de-energizes for the set ON and OFF time. ON/ OFF time are different. The relay keeps changing its state until input supply voltage is removed.

OFF DELAY

Output is energized once input supply voltage is present and timing starts. The output de-energizes at the end of timing period T which is set by the user.

SIGNAL OFF DELAY

Permanent input supply voltage is required. Output energizes and timing T starts when signal input B1 is closed. The output de-energizes at the end of timing period T which is set by user.

SIGNAL OFF/ ON

Permanent input supply voltage is required. When signal input B1 is closed or opened for preset time T, the output changes its state after time duration T. T is set by user.

TRAILING EDGE IMPULSE

Permanent input supply voltage is required. When signal input B1 is opened the output energizes until preset timing T is over regardless of any further actions of signal input B1. In another version of TRAILING EDGE IMPULSE function the output resets if signal input B1 closes during timing period T.

LEADING EDGE IMPULSE

Permanent input supply voltage is required. When signal input B1 is closed the output energizes until preset timing T is over regardless of any further actions of signal input B1. In another version of LEADING EDGE IMPULSE function the output resets if signal input B1 opens during timing period T.

ONE SHOT OUTPUT

Permanent input supply voltage is required. Timing T starts when signal input B1 is closed. The output energizes for approx. 1s at the end of timing period T which is set by user.

INTERVAL

Permanent input supply voltage is required. Output energizes and timing T starts when impulse signal input B1 is closed. The output de-energizes at the end of timing period T which is set by user.

Application Examples

Timing Function: CYCLIC (ASSYMETRIC) ON/ OFF

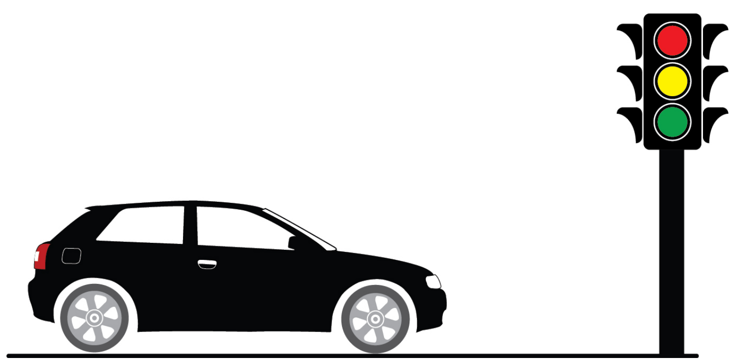
Application: Machine/ Heating Cycles

Various processes require material to be heated or stirred regularly. With a cyclic ON/ OFF function this can be achieved and every OFF time follows an preset ON time. ON/ OFF times can be different or the same. Time switches can solve this also if ON/ OFF times happen at specific times.

Timing Function: ON DELAY

Application: Traffic Light

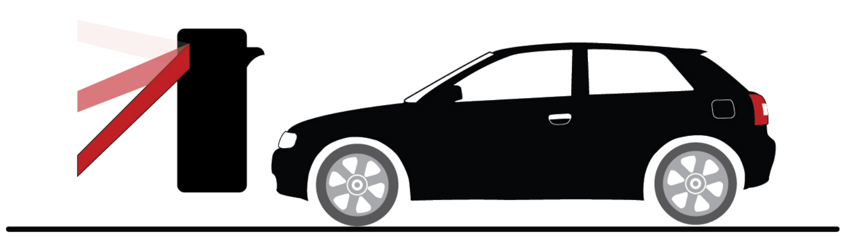
A car pulls up at a traffic light and thru a sensor it triggers a timer. After a set period of time the traffic light changes its state on one side from green to red and from red to green in the other direction.



Timing Function: SIGNAL OFF DELAY

Application: Parking Gate

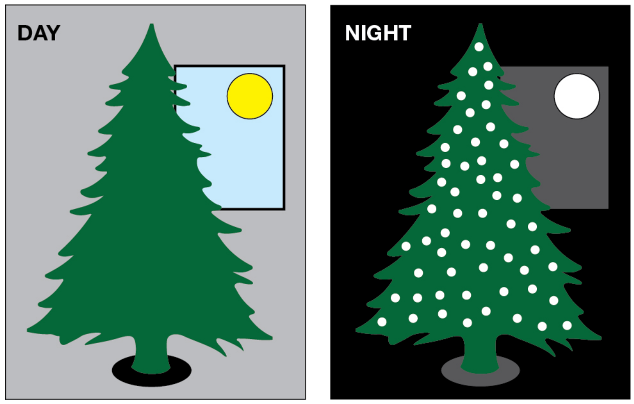
After payment of parking fees the gate to leave the parking garage opens. Once the Car is through the open gate a sensor in the floor triggers the timing period set in the timing relay. After a few seconds the gate is closed for the next upcoming car.



Timing Function: TIME SWITCH

Application: Christmas Lights

The time switch works based on an internal real time clock. Therefore ON and OFF times can be set at specific days/ times. A battery guarantees operation also during power failures. A simple example is Christmas lights during the holiday season which operate only at night and turn off at a specific time.



Multiple Timers in 1 Application

Many of todays applications include complex processes and require multiple timers to work together. Here it is more effective to use Smart Relays or even PLCs rather than many electromechanical or electronical devices in one control box. Timers and other devices here are implanted in their software. The logic is usually designed as if it were relays, using special computer languages such as ladder logic. In Smart Relays, timers are usually simulated by the software built into the controller. This allows for many more options than just using single timers.