MachineDesign

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SELECTING THE RIGHT TIMER FOR YOUR APPLICATION

Introduction

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 and 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.

Shown are a sampling of Altech's wide variety of Electronic Timers and Switches designed and manufactured for a broad number of industries.

What is an Electronic Timer and How Does it Operate?

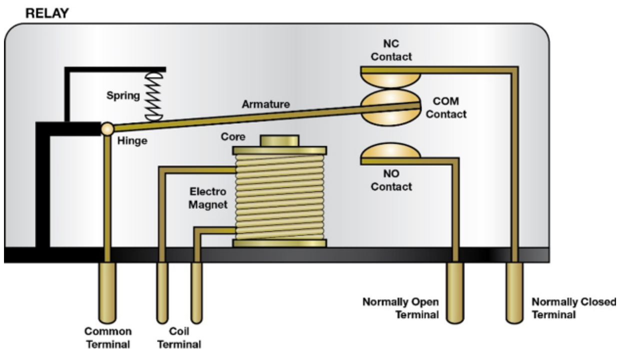


Figure 1

Note the coil terminal that operates the electromagnet, which operates from a low voltage, and the NO and NC terminals that are used to switch the high voltage lines.

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 provides the timer with timing capabilities.

An electromagnetic relay safely turns 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 that 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 (see Figure 1). 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 de-energized. 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.

Electronic Timers incorporate 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.

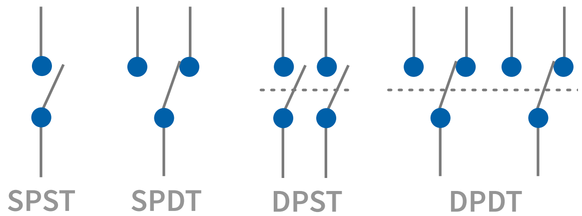


Figure 2

This illustration shows the four types of connections output configurations found in Electronic Timers.

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, and are marked and certified (UL, IEC, etc.), so that they can be used anywhere in the world. 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 include:

Output Configurations

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

Common Output configurations (see Figure 2):

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 and 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 operating 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.

Figure 3

The two different types of methods used to select timing range, timing function, and set timing parameters, as shown here, are manual dials (left) and LCD displays (right).

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 that comprises a universal spectrum and handles all voltages 12V – 240V AC and DC.

Timing Range and Accuracy

Timing srange is another critical criteria to pay attention to when selecting a timer. Available are Timers with specific timing ranges within a few seconds, minutes or hours. Make sure the devices you choose fulfill all the timing and accuracy requirements of your application. We recommend selecting a timer with large timing ranges. Some Timers include timing ranges 0.1s up to 999h in one device.

Display Option

Most Timers have manual dials on their front to select Timing Range, Timing Functions, and set timing parameters. On other Timers, configuration is done through an LCD display, which shows current elapsed and remaining runtime information (see Figure 3). 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. Most often simple timing functions are used, such as ON Delay, OFF Delay or cyclic ON/ OFF functions—with many other functions available. For example, some functions require a trigger signal, while others initiate with leading or trailing edge impulses. Economic timers have just one function built in, whereas Multi Timers come with several built in functions, such as 8 or 18 functions. Advanced Timers have the option for users to program their own timing functions into the device for specific applications.

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

Timing functions are explained in timing diagrams (see Figure 4), 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:

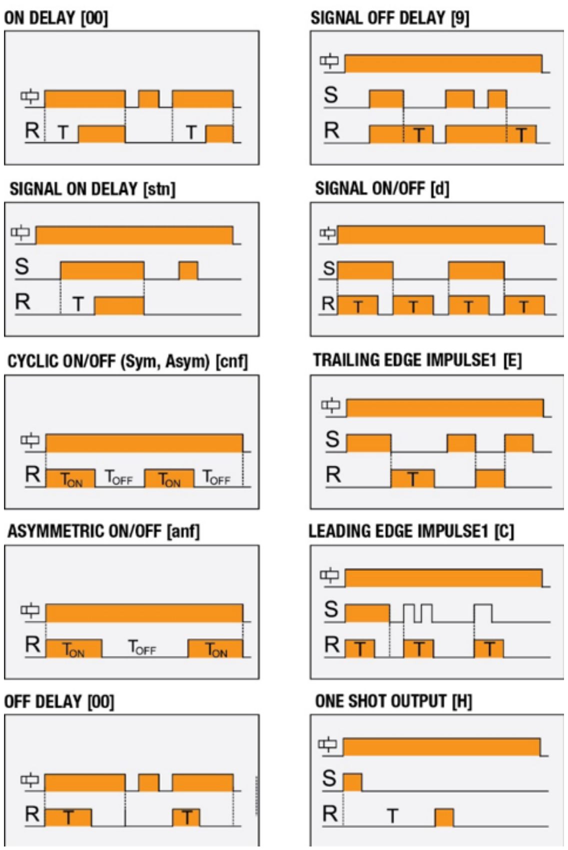


Figure 4

Illustrated here are some common timing diagrams that are being used in a variety of applications today.

Timing Diagram for Each Function

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

For this function, 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 an input supply voltage is present. The output energizes/de-energizes for the set ON and OFF time. ON/OFF times are the same. The relay keeps changing its state until the input supply voltage is removed.

Assymetric On/Off

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

Off Delay

Output is energized once an 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

A 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 the user.

Signal On/Off

A 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 the user.

Trailing Edge Impulse

A 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 Ipulse

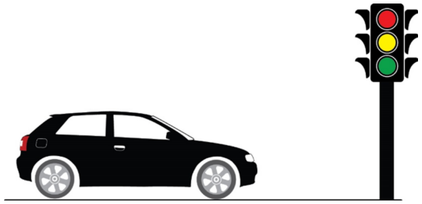
A permanent input supply voltage is required. When signal input B1 is closed the output energizes until preset timing T is over regardless of any further actions of signal input B1. In another version of LEADING EDGE IMPULSE function the output resets if signal input B1 opens during timing period T.

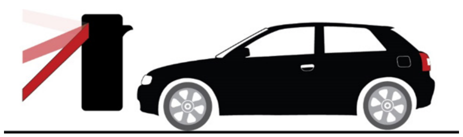
One Shot Input

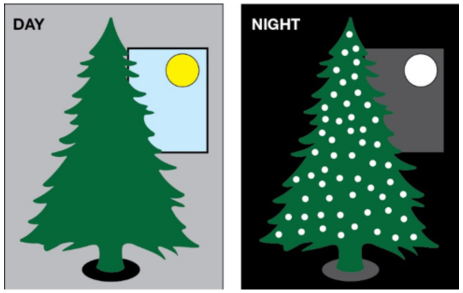
A permanent input supply voltage is required. Timing T starts when signal input B1 is closed. The output energizes for approximately 1s at the end of timing period T, which is set by the user.

Interval

A 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 the user.







Application Examples

Application: Machine/Heating Cycles

Timing Function: CYCLIC (ASSYMETRIC) ON/ OFF

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 a preset ON time. ON/OFF times can be different or the same. Also time switches can solve this if ON/OFF times happen at specific times.

Application: Traffic Light

Timing Function: ON DELAY

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

Application: Parking Gate

Timing Function: SIGNAL OFF DELAY

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.

Application: Christmas Lights

Timing Function: TIME SWITCH

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 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 One Application

Many of today's applications include complex processes and require multiple timers to work together. In this case, it is more effective to use Smart Relays or even PLCs rather than many electromechanical or electronic devices in one control box. When this is the case, timers and other devices are implanted in software. The logic is usually designed as if it was connected to 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.