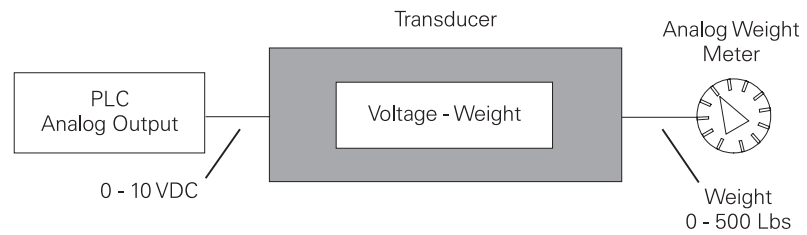


Analog Outputs

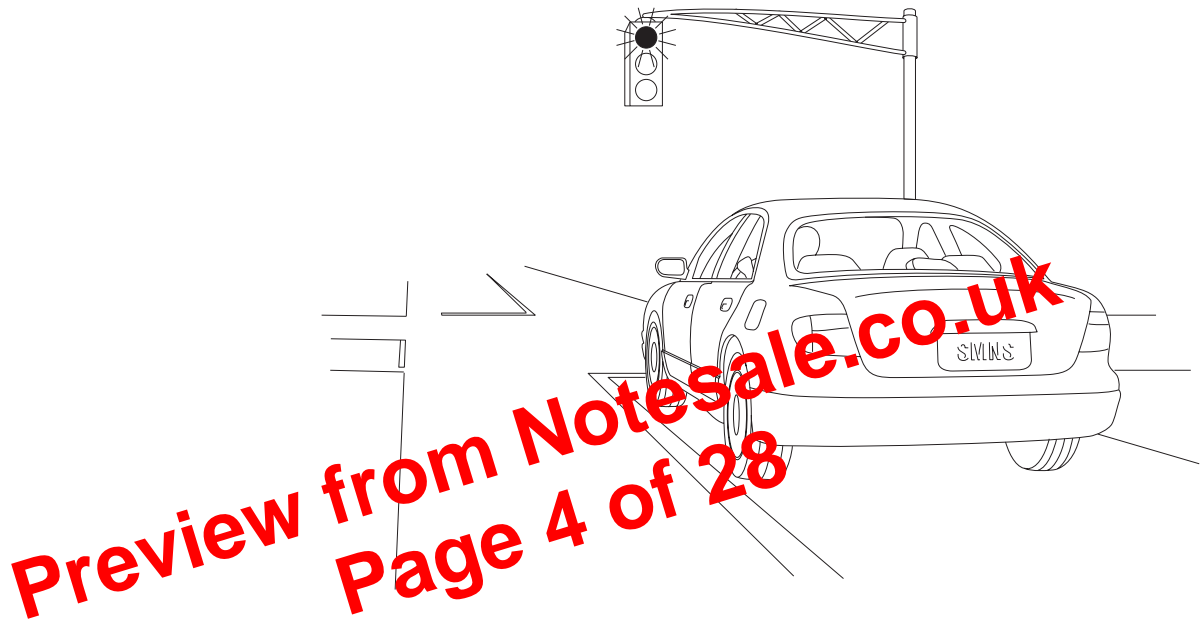
Analog outputs are used in applications requiring control capability of field devices which respond to continuous voltage or current levels. Analog outputs may be used as a variable reference for control valves, chart recorders, electric motor drives, analog meters, and pressure transducers. Like analog inputs, analog outputs are generally connected to a controlling device through a transducer. The transducer takes the voltage signal and, depending on the requirement, amplifies, reduces, or changes it into another signal which controls the device. In the following example a 0 - 10 VDC signal controls a 0 - 500 Lbs. scale analog meter.



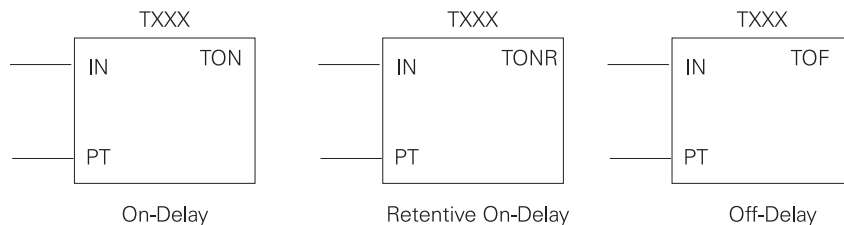
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Timers

Timers are devices that count increments of time. Traffic lights are one example where timers are used. In this example timers are used to control the length of time between signal changes.



Timers are represented by boxes in ladder logic. When a timer receives an enable, the timer starts to time. The timer compares its current time with the preset time. The output of the timer is a logic 0 as long as the current time is less than the preset time. When the current time is greater than the preset time the timer output is a logic 1. S7-200 uses three types of timers: On-Delay (TON), Retentive On-Delay (TONR), and Off-Delay (TOF).



Review 5

1. Analog signals are converted into a _____ format by the PLC.
2. Three types of timers available in the S7-200 are On-Delay, _____ On-Delay, and _____-Delay.
3. The maximum time available on a 100 millisecond time base timer is _____ seconds.
4. A count of 25 on a 10 millisecond time base timer represents a time of _____ milliseconds.
5. There are _____ timers in the S7-200.

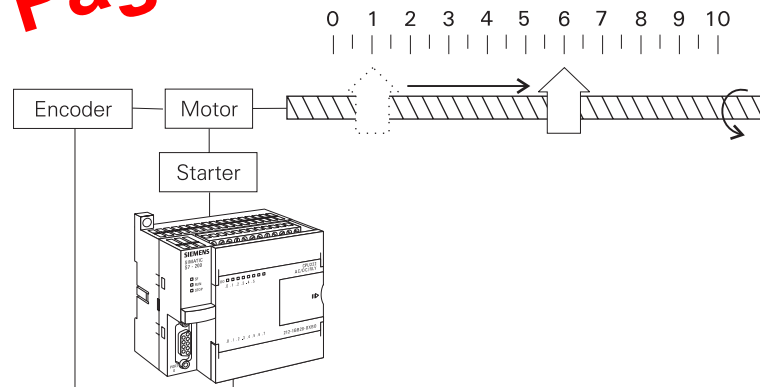
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Definition Boxes and High-Speed Counters

The high-speed counter definition boxes are used to assign a mode to the counter. High-speed counters can be defined by the definition box to operate in any of the twelve available modes. It should be noted that not all counters can operate in all of the available modes. Refer to the *S7-Programmable Controller System Manual* for definitions available for each counter. Each counter has dedicated inputs for clocks, direction control, reset, and start where these functions are supported. The maximum clock input frequency is 20 kHz. For the two-phase counters, both clocks may be run at 20 kHz. In quadrature mode, 1x or 4x counting rates can be selected. At 1x rate the maximum counting frequency is 20 kHz. At 4x rate the maximum counting frequency is 80 kHz.

Positioning

Positioning is one example of an application that can use high-speed counters. In the following illustration a motor is connected through a starter to a PLC output. The motor shaft is connected to an encoder and a positioning actuator. The encoder emits a series of pulses as the motor turns. In this example the program will move an object from position 1 to position 6. Assume the encoder generates 600 pulses per revolution, and it takes 1000 motor revolutions to move the object from one position to another. To move the object from position 1 to position 6 (5 positions) would take 5000 motor revolutions. The counter would count up 30,000 counts (5000 revolutions x 600 pulses per revolution) and stop the motor.



Interrupts

Interrupts are another example of an instruction that must be executed before the PLC has completed the scan cycle. Interrupts in the S7-200 are prioritized in the following order:

1. Communications
2. I/O Interrupts
3. Time-Based Interrupts