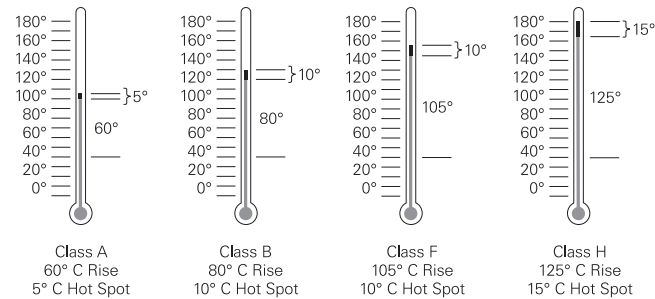


## Insulation Class

Standards established by the *National Electrical Manufacturers Association (NEMA)* to meet *motor* temperature requirements found in different operating environments. The combination of an *ambient temperature* of 40°C and allowed temperature rise equals the maximum winding temperature of a *motor*. A margin is also allowed to provide for a point at the center of the *motor's* windings where the temperature is higher.



## Insulator

A material with a high *resistance* to the flow of electrons. Plastic, rubber, glass, and mica are examples of materials that are good insulators.

## International Electrotechnical Commission (IEC)

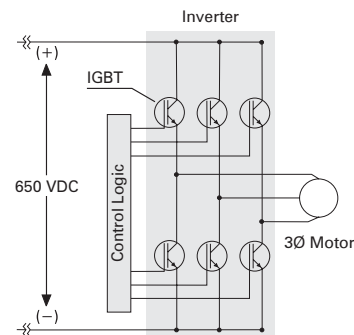
An organization based in Geneva, Switzerland, with over 50 member nations. IEC writes standards for electrical and electronic equipment and practices.

## Interrupting Rating

The maximum level of fault *current* that a *circuit breaker* or *fuse* can interrupt. The interrupting rating is also called the ampere interrupting capacity (AIC).

## Inverter

A device that converts *direct current* to *alternating current*. Inverter is also used as a synonym for an AC drive even though the AC drive usually includes other circuits.



## ISO

A federation of standards organizations from over 100 countries that develops voluntary standards for business, science, and technology. The official name is Organization Internationale de Normalisation. The name ISO is from the Greek word "isos" which means equal.

## Isolation Transformer

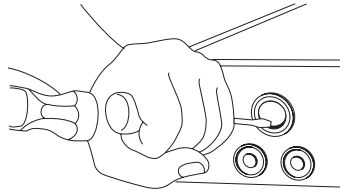
A transformer used to limit the transfer of electrical noise from one circuit to another.

## Joule

The basic unit of electrical energy. 1 Joule is equal to 1 watt-second or the amount of energy transferred in one second when the power is one watt.

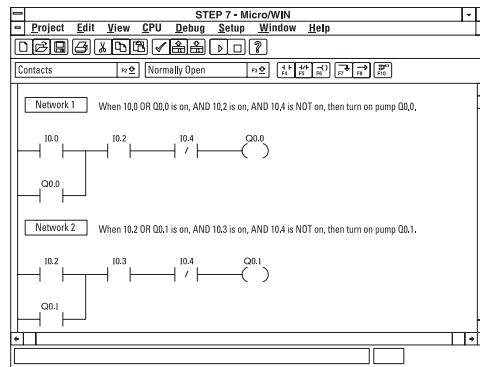
## Knockout

A place in an enclosure where a piece of the enclosure can be removed to allow for cabling.



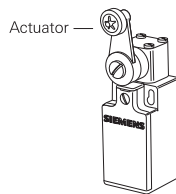
## Ladder Logic

A method of programming a programmable logic controller that uses symbols that evolved from the diagrams used with control relays.



## Limit Switch

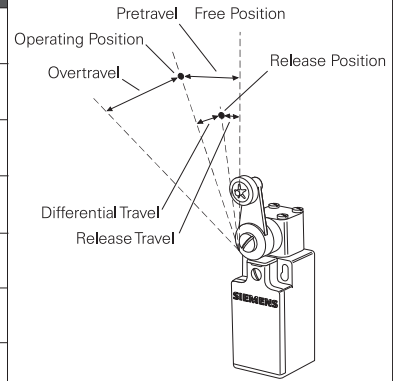
A type of sensing switch that opens or closes its contacts when its actuator is moved by an object.



## Limit Switch Positions

The following terms identify the operating positions of a *limit switch*.

Position	Definition
<b>Free Position</b>	Position of actuator when no external force is applied.
<b>Pretravel</b>	Distance or angle traveled moving the actuator from the free position to the operating position.
<b>Operating Position</b>	Contacts in the limit switch change from their normal state (NO or NC) to their operated state.
<b>Overtravel</b>	Distance the actuator can travel safely beyond the operating position.
<b>Differential Travel</b>	Distance traveled between the operating position and the release position.
<b>Release Position</b>	Contacts change from their operated state to their normal state.
<b>Release Travel</b>	Distance traveled from the release position to the free position.

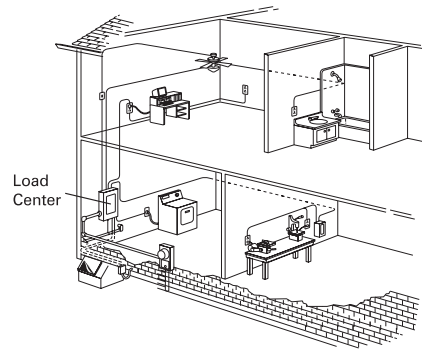


## Load-Break Switch

A switch designed to safely interrupt load *current*.

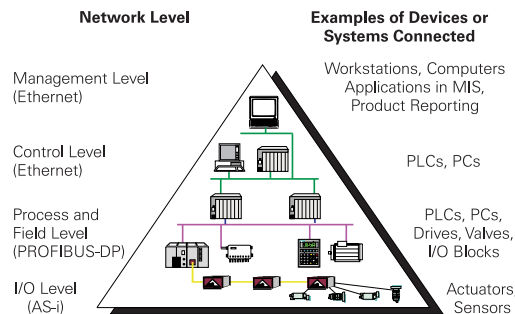
## Load Center

An industry term used to identify a lighting and appliance *panelboard* when it is used in certain (usually residential) applications.



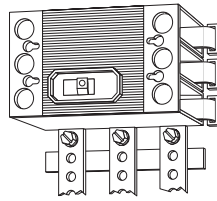
## Local Area Network (LAN)

A communication system that interconnects intelligent devices within a limited area, but may also connect other networks for larger-scale communication.



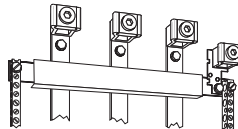
## Main Breaker

The circuit breaker in a load center, panelboard, switchboard, or switchgear that is connected to the source of supply.



## Main Lug Only

A designation given to a load center or panelboard to indicate that it does not include a main breaker.



## MCM

Thousands of circular mils. A method for designating the cross-sectional area of a conductor, especially conductors larger than AWG 4/0 (four aught). One mill is equal to 1/1000 of an inch. Circular mil area is the diameter (in mils) of a circular conductor squared. 1 MCM is 1000 circular mils (also shown as 1kcmil).

## Metric Unit Prefix

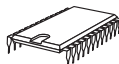
A prefix added to a unit of measure to increase or decrease the size of that unit of measure. For example, the metric unit prefix kilo can be added to meter to form a unit of length (kilometer) equal to 1000 meters. Metric unit prefixes are associated with powers of ten.

**Metric Prefix Examples**

Value	Prefix	Symbol
1,000,000,000 = $10^9$	giga	G
1,000,000 = $10^6$	mega	M
1,000 = $10^3$	kilo	k
0.001 = $10^{-3}$	milli	m
0.000001 = $10^{-6}$	micro	$\mu$
0.000000001 = $10^{-9}$	nano	n

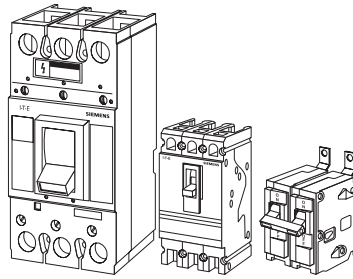
## Microprocessor

The integrated circuit or chip that contains the central processor unit.



## Molded Case Circuit Breaker

A *circuit breaker* enclosed in an insulated housing. The housing is normally made of molded plastic.

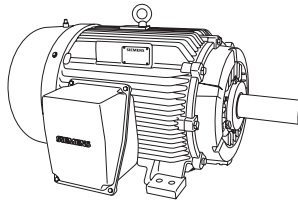


## Molded Case Switch

A switch enclosed in an insulated housing similar to that of a *molded case circuit breaker*.

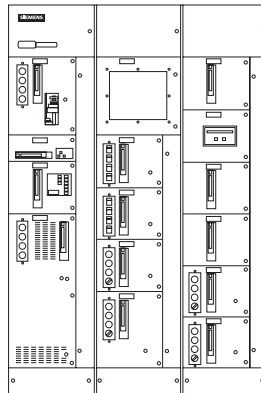
## Motor

A device used to transform electrical energy into mechanical energy.



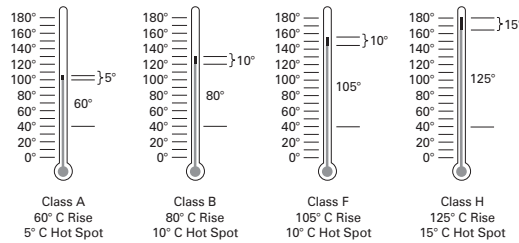
## Motor Control Center

A metal *enclosure* containing multiple *motor* control circuits. Typically, individual control circuits are mounted in removable containers often referred to as pans or buckets.



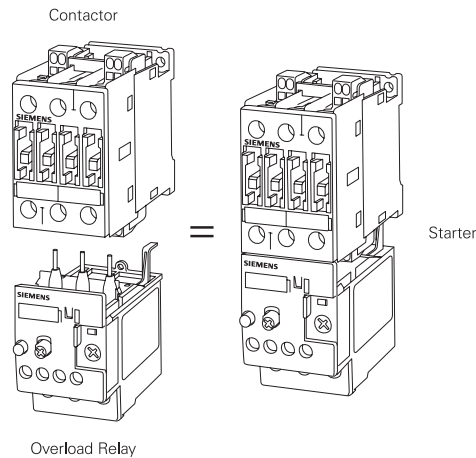
## Motor Insulation Class

A letter designation based upon standards established by the National Electrical Manufacturers Association that corresponds to a motor's allowable temperature rise and maximum allowable operating temperature (based on 40°C ambient temperature).



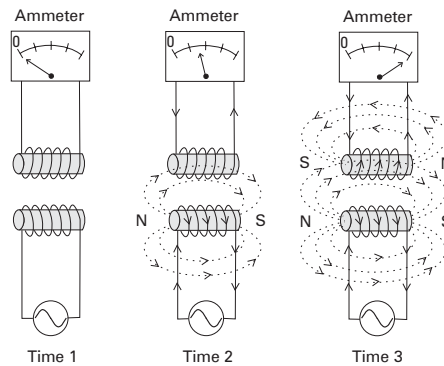
## Motor Starter

Often refers to a contactor and an overload relay assembled together to remotely control the operation of a motor while providing overload protection. This definition applies to a full voltage starter.



## Mutual Induction

A process that involves varying lines of magnetic flux from one conductor that induce a voltage into a second adjacent conductor. This is the basic operating principle of a transformer.



**National Electrical Manufacturers Association (NEMA)**

An organization of manufacturers of electrical equipment that, among other things, develops standards for electrical equipment.



**National Electrical Code® (NEC®)**

A document revised every three years based upon inputs to and recommendations of the National Electrical Code Committee of the *National Fire Protection Association*. The intent of the *NEC®* is to describe safe electrical practices. Although the *NEC®* is an advisory document, its use is often incorporated into laws and regulatory practices.

**National Fire Protection Association (NFPA)**

A private, nonprofit organization with international membership. The NFPA has been the sponsor of the *National Electrical Code® (NEC®)* since 1911.

**NEMA Enclosure Type**

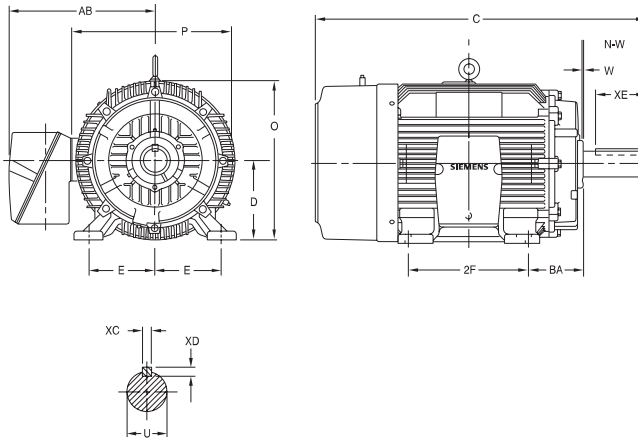
A designation given to an *enclosure* based on standards published by the *National Electrical Manufacturers Association*. The NEMA type provides an indication of degree of protection provided by the enclosure.

**NEMA Enclosure Type Examples**

NEMA Type	Description
1	Intended for indoor use. Provides protection against a limited amount of falling dirt.
3R	Intended for outdoor use. Provides protection against rain, sleet, and damage from external ice formation.
4	Intended for indoor or outdoor use. Provides protection against windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation.
4X	Intended for indoor and outdoor use. Provides protection against corrosion, windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation.
12	Intended for indoor use. Provides protection against circulating dust, falling dirt, and dripping noncorrosive liquids.

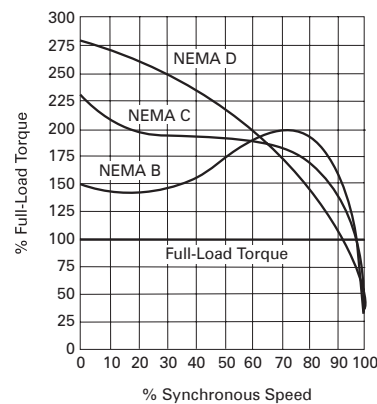
## NEMA Frame Size

A designation that identifies motor dimensions based upon standards provided by the National Electrical Manufacturers Association. Motors too large to correspond to NEMA frame sizes are referred to as above NEMA motors.



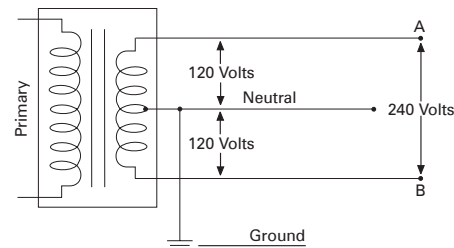
## NEMA Motor Design

A letter designation based upon standards established by the National Electrical Manufacturers Association that corresponds to a motor's speed and *torque* characteristics.



## Neutral

A reference connection in a power distribution system.



## Ohm

The basic unit of resistance, reactance and impedance. The symbol for the ohm is " $\Omega$ ," the Greek letter omega.



## Ohmmeter

A meter designed to measure resistance.

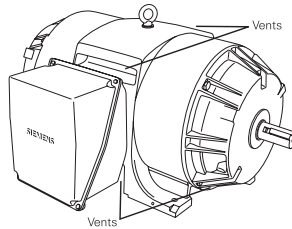
## Ohm's Law

A law that states that the current in a circuit is directly proportional to the voltage and inversely proportional to the resistance.

$$I = \frac{E}{R}$$

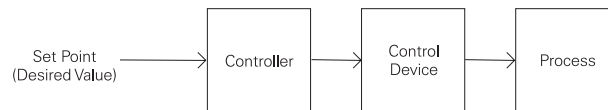
## Open Drip Proof (ODP)

A motor enclosure type that permits air flow through the motor, but is designed to prevent liquids or solids falling from above at angles up to 15 degrees from the vertical from entering the motor.



## Open-Loop Control

A control technique that does not use a feedback signal.



## Overcurrent

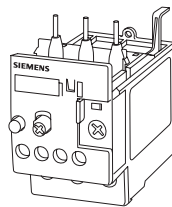
A current in excess of the rated current for a device or conductor. An overcurrent can result from an overload, short circuit, or ground fault.

## Overload

Can refer to an operating condition in excess of a full-load rating or a current high enough to cause damage if it is present long enough. An overload does not refer to a short circuit or ground fault.

## Overload Relay

A device used to protect a motor from damage resulting from an overcurrent.

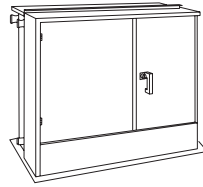


## Overload Relay Class

Defines the length of time an overcurrent condition can exist before an overload relay trips. For example, a class 10 overload relay will allow 600% of full load amperes for up to 10 seconds.

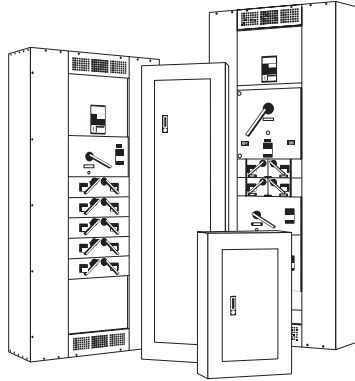
## Pad-Mounted Transformer

An enclosed transformer mounted outside on a concrete pad.



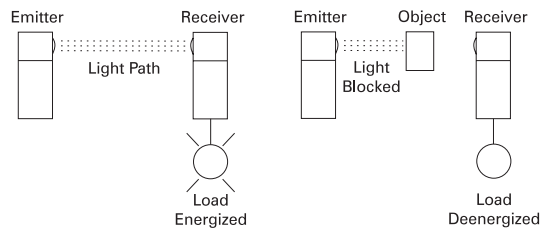
## Panelboard

A front-accessible panel containing overcurrent protection devices for use in controlling lighting, heating, or power circuits.



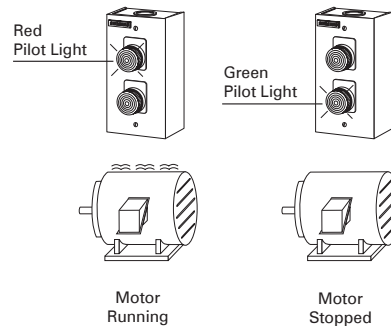
## Photoelectric Sensor

A type of sensing switch that uses light to detect the presence of an object without coming into physical contact with the object.



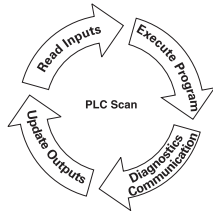
## Pilot Light

A small light used to indicate a specific condition in a circuit.



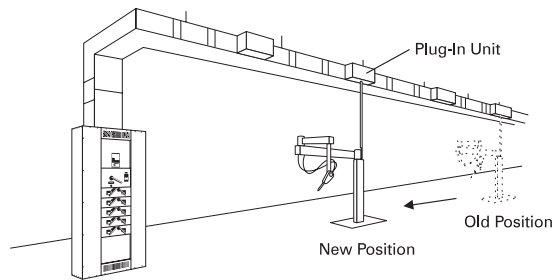
## PLC Scan

A complete execution cycle of a programmable logic controller. The PLC scan involves taking in new inputs, executing the user program, performing diagnostic and communication functions, and generating new outputs. The PLC scan is repetitively executed.



## Plug-in Busway

Busway that incorporates plug-in units to allow loads to be distributed over the length of the run.



## Potentiometer

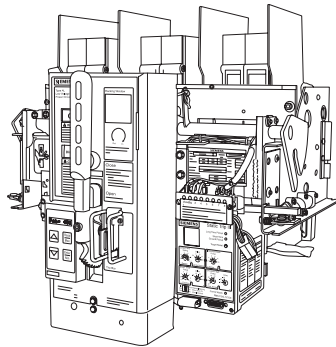
A type of variable resistor. Often referred to as a pot.

## Power

The rate at which work is done or energy is transformed. In an electric circuit, power is measured in watts or sometimes in horsepower. The term power is also often used loosely to refer to electrical energy.

## Power Circuit Breaker

A circuit breaker, characterized by large frame sizes and high short time ratings, which is used in switchgear or switchboards, and whose open construction allows for easy inspection, maintenance, and replacement of current carrying and operating parts. Available for low and medium voltage systems.

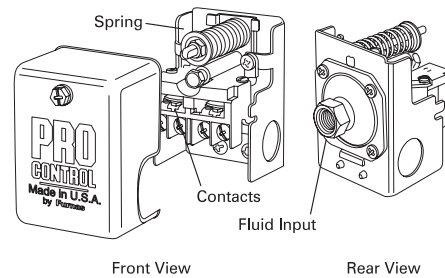


## Power Factor

The ratio of *true power* to *apparent power* in a circuit. Power factor is also equal to the cosine of the phase angle.

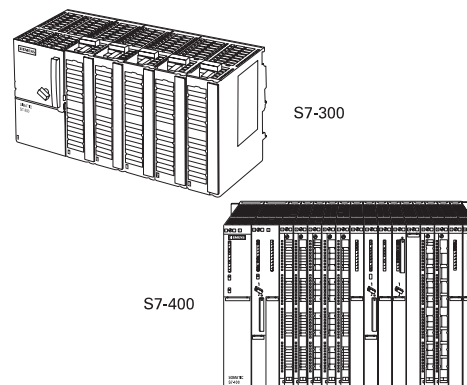
## Pressure Switch

A control device that opens or closes its contacts in response to a change in the pressure of a liquid or gas.



## Programmable Logic Controller (PLC)

A type of industrial computer used to control machines and processes. The PLC accepts inputs from switches and sensors and uses these inputs together with other data and program logic to control output devices.

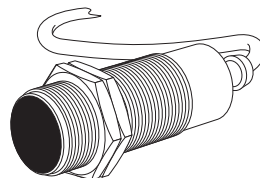


## Proportional-Integral-Derivative (PID) Control

A *closed-loop control* technique that seeks to minimize error by reacting to three values. One that is proportional to the error, one that is representative of the error over time, and one that is representative of the rate of change of the error.

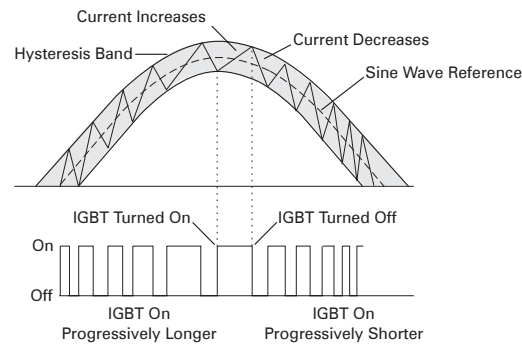
## Proximity Sensor

A type of *sensing switch* that detects the presence or absence of an object without physical contact.



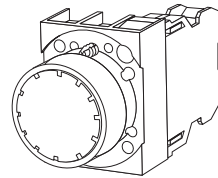
## Pulse Width Modulation (PWM)

As applied to *variable frequency drives*, this is a technique for controlling the voltage applied to an AC motor by varying the pulse width while also controlling the frequency of the pulses.



## Pushbutton

A control device used to manually open and close a set of contacts.

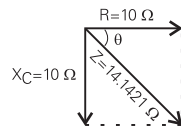


## Random Access Memory (RAM)

Usually refers to a type of *semiconductor* memory often used for temporary storage because it requires the continual application of power to retain information. For some systems, battery backup is used to prevent data or program loss in the event of a power outage.

## Reactance

The opposition to *alternating current* resulting from circuit *inductance* and *capacitance*. The symbol for reactance is "X." The unit for reactance is the ohm.



## Reactive Power

Power associated with *inductance* or *capacitance*. The unit for reactive power is the var.

## Read Only Memory (ROM)

Usually refers to a type of *semiconductor* memory often used for permanent storage of data or programs that do not change.