

מושגים במיכשור ובקרה

A

Absolute Zero: Temperature at which thermal energy is at a minimum as 0 Kelvin, calculated to be -273.15°C or -459.6°F .

Accuracy: Closeness of the actual reading to the value of a primary calibration standard usually expressed in percent error at 25°C .

ALOMEGA : An aluminum nickel alloy used in the negative led of a Type K thermocouple.

Ambient Compensation: The design of an instrument such that changes in ambient temperature do not affect the readings of the instrument.

Ambient Temperature: The average or mean temperature of the surrounding air which comes in contact with the equipment and instruments under test.

Ampere (amp): A unit used to define the rate of flow of electricity (current) in a circuit, units are one coulomb (625×10^{18} electrons) per second.

Ammeter: An instrument used to measure current.

ATC: Automatic Temperature Compensation

Auto-Zero: An automatic internal correction for offsets and/or drift at zero voltage input.

Automatic Reset: 1. A feature on a limit controller that automatically resets the controller when the controlled temperature returns to within the limit bandwidth set. 2. The integral function on a PID controller which adjust the proportional bandwidth with respect to the setpoint to compensate for droop in the circuit, i.e. adjust the controlled temperature to the setpoint after the system stabilizes.

Automatic Tuning: An automatic calculation of the optimum PID parameters with a built-in software algorithm to eliminate manual tuning.

AWG: American Wire Gauge

B

BCD, Buffered: Binary coded decimal output drivers, to increase line-drive capability.

BCD, Serial: A digital output format where every decimal digit is represented by binary signals on four lines and up to five decimal digits are present sequentially. The total number of lines is four data lines plus one strobe line per digit.

BCD, Parallel: A digital output format where every decimal digit is represented by binary signals on four lines and all digits are presented in parallel. The total number of lines is 4 times the number of decimal digits.

BCD, Three-State: An implementation of parallel BCD which has 0, 1 and high-impedance output states. The high- impedance state is used when the BCD output is not addressed in multiplexed parallel applications.

BIAS Current: A very low level DC current generated by the measuring device and superimposed on the signal. This current may introduce a measurable offset across a very high source impedance.

Bipolar: The ability of a panel meter or signal conditioner to display both positive and negative readings.

Blackbody: A theoretical object that radiates the maximum the maximum amount of energy at a given temperature, and absorb all the energy incident upon it. A blackbody is not necessarily black. (The name blackbody was chosen because the color black is defined as the total absorption of light energy).

Btu: British Thermal Unit. The quantity of thermal energy required to raise one pound of water 1°F at or near its maximum density (391°F).

Buffer: Any substance or combination of substances which, when dissolved in water, produces a solution which resist a change in its hydrogen concentration on addition of an acid or alkali.

C

CMR (Common-Mode Rejection Ratio): The ability of a panel meter to eliminate the effect of AC or DC noise between signal and ground. Normally expressed in dB at dc to 60 Hz, one type of CMR is specified between SIG LO and PWR GND. In differential meters a second type of CMR is specified between SIG LO and ANA GND (METER GND).

CMV (Common-Mode Voltage): The AC or DC voltage which is tolerable between signal and ground. One type of CMV is specified between SIG LO and PWR GND. In differential meters a second type of CMV is specified between SIG HI or LO and ANA GND (METER GND).

Calorie: The quantity of thermal energy required to raise one gram of water 1°C at 15°C .

Celsius (Centigrade): A temperature scale defined by 0°C at the ice point and 100°C at the boiling point of water.

Ceramic Insulation: High- temperature composition of metal oxides used to insulate a pair of thermocouple wires. The most common are Alumina (AlO) Berylia (BeO) and magnesia (MgO). Their application depends upon temperature and type of thermocouple. High-purity Alumina is required for platinum alloy thermocouples. Ceramic insulators are available as single and multihole tubes or as beads.

CHROMEGA: A chromium-nickel alloy which makes up the positive leg of Type K and Type E thermocouples.

Closeness of Control: Total temperature variation from a desired set point of system expressed as "closeness of control" is $\pm 2^{\circ}\text{C}$ or a system bandwidth with 4°C , also referred to as amplitude of deviation.

Color Code: The ANSI established color code for thermocouple wires in the negative lead is always red. Color code for base metal thermocouples is yellow for Type K, black for Type J, purple for Type E and blue for Type T.

Compensating Alloy: Alloys used to connect thermocouples to instrumentation. These alloys are selected to have similar thermal electric properties as the thermocouple alloys (however, only over a very limited temperature range).

Compensated Connector: A connector made thermocouple alloys used to connect thermocouple probes and wires.

Conductance: The measure of the ability of a solution to carry an electric current.

Conformity Error: For thermocouples and RTD's, the difference between the actual reading and the temperature and the temperature shown in published tables for a specific voltage input.

Counts: The number of the intervals counted by the dual-slop AD converter and displayed as the reading of the panel meter, before addition of the decimal point.

Connection Head: An enclosure attached to the end of thermocouple which can be cast iron, aluminum or plastic within which the electrical connections are made.

Constantan: A copper-nickel alloy used as the negative lead in Type E, Type J and Type T thermocouples.

Control Mode: The output form or type of control action used by a temperature controller to control temperature, i.e. on/off, time proportioning, PID.

Control Point: The temperature at which a system is to be maintained.

Current Proportioning: An output form of a temperature controller which provides a current proportional to the amount of control required. It is normally a 420 milliamp current proportioning band.

Current Transformer: (CT): A transformer designed for AC measurement circuits. It provides isolation and a step-down current output.

Cycle Time: The time usually expressed in seconds for a controller to complete one on/off cycle.

D

dB (Decibel): 20 times the log to base 10 of the ratio of two voltages. Every 20 dB's correspond to a voltage ratio of 10:1, every 10 dB's to a voltage ratio of 3.162:1. For instance, a CMR of 120 dB provides voltage noise rejection of 1,000,000:1. An NMR of 70 dB provides voltage noise rejection of 3,162/1.

Deadband (Hysteresis): In a digital controller, there may be one switching point at which the signal increases and another switching point at which the signal decreases. The difference between the two switching points is called hysteresis or deadband.

Degree: An incremental value in the temperature scale, i.e. there are 100 degrees between the ice and the boiling point in water in the Celsius scale and 180°F between the same two points in the Fahrenheit scale.

Deviation: The difference between the value of the controlled variable and the value at which it is being controlled

Differential: For an on/off controller, it refers to the temperature difference between the temperature at which the controller turns heat off and the temperature at which the heat is turned back on. It is expressed in degrees.

Differential input: A signal-input circuit where SIG LO and SIG HI are electrically floating with respect to ANALOG GND (METER GND which is normally tied to DIG GND). This allows the measurement of the voltage difference between two signals tied to the same ground and provides superior common-mode noise rejection.

Digit: A measure of the display span of panel meter. By convention a full digit can assume any value from 0 through 9, a ½ digit will display 1 and overload at 2, a ¾ digit will display digits up to 3 and overload at 4, etc. For example, a meter with a display span of +3999 counts is said to be a 3 ¾ digit meter.

Din (Deutsche Industries Norm): A set of German standards recognized throughout the world. The 1/8 DIN standard for panel meters specifies an outer bezel dimensions of 96 x 48 mm and a panel cutout of 92 x 45 mm.

DIN 43760: The standard that defines the characteristics of a 100 ohm platinum RTD having a resistance vs. temperature curve specified by $R = 0.00385$ ohms per ohms per degree C.

Dissipation Constant: The ratio for thermistor which relates a change in internal power dissipation to a resultant change of body temperature.

Drift: A change of a reading or a setpoint value over long periods due to several factors including change in ambient temperature, time and line voltage.

Droop: A common occurrence in time- proportional controllers. It refers to the difference in temperature between the setpoint and where the system temperature actually stabilizes due to the time-proportioning action of the controller.

Dual Element Sensor: A sensor assembly with two independent sensing elements.

Dualslope A/D Converter: An analog-to-digital converter which integrates the signal for a specific time, then counts time intervals for a reference voltage to bring the integrated signal back to zero. Such converters provide high resolution at low cost, excellent normal-mode noise rejection, and minimal dependence on circuit elements.

Duplex Wire: A pair of wires insulated from each other and with an outer jacket of insulation around the inner insulated pair.

Duty Cycle: The total time to complete one on/off cycle usually refers to on/off cycle time of a temperature controller.

E

Exposed Junction: A form of construction of a thermocouple probe where the hot or measuring junction protrudes beyond the sheath material so as to be fully exposed to the medium being measured. This form of construction usually gives the fastest response time.

F

Fahrenheit: A temperature scale defined by 32° at the ice point and 212° at the boiling point of water at sea level.

Filter (ABC): Adaptive Bandwidth Filter – Automatically adjusts filter time constant to adapt to noise and noise spikes. Automatically reduces filter time constant in successive 2:1 steps to respond to step changes in the input signal.

G

Gain: The amount of amplification used in electrical circuit.

Ground: 1. The electrical neutral line having the same potential as the surrounding earth. 2. The negative side to do power supply. 3. Reference point for an electrical system.

Grounded Junction: A form of construction of a thermocouple probe where the hot or measuring junction is in electrical contact with the sheath material so that the sheath and thermocouple will have the same electrical potential.

H

Hertz (Hz): Units in which frequency is expressed. Synonymous with cycles per second (cps).

Hysteresis: (see Deadband)

Hold: Meter HOLD is an external input which is used to freeze the display. BCD HOLD is an external input used to freeze the BCD output while allowing the A/D process to continue operation.

I

Ice Point: The temperature at which pure water freezes. 0°C , 32°F .

Input Impedance: The resistance of a panel meter as seen from the source in the case of a voltmeter. This resistance has to be taken into account when the source impedance is high; in the case of an ammeter when the source impedance is low.

Insulated Junction: See underground junction.

Insulation Resistance: The resistance value of the cover material of an electrical conductor, expressed in ohms.

Integral: A form of temperature control. See automatic reset, #2.

Interchangeability Error: A measurement error that can occur if two or more probes are used to make the same measurement, It is caused by a slight variation in characteristics of difference probes.

Isothermal: A process or area that is at a constant temperature.

J

Junction: The point in a thermocouple where the two dissimilar metals are joined.

K

Kelvin: Symbol K. The unit of absolute thermodynamic temperature scale based upon the Celsius scale with 100 units between the ice point and the boiling point of a water $0^{\circ}\text{C} = 273.15\text{ K}$ (there is no degree ($^{\circ}$) symbol used with the Kelvin scale).

L

Lag: 1. A time delay between the output of a signal and the response of the instrument to which the signal is set. 2. A time relationship between two waveforms where a fixed reference point of one wave occurs after the same point of the reference wave.

Limits of Error: A tolerance band for the thermal electric response of thermocouple wire expressed in degrees or percentage defined by ANSI specification MC96.1 (1975).

Load: The electrical demand of a process expressed as power (watts), current (amps) or resistance (ohms).

Loop Resistance: The total resistance of a thermocouple circuit caused by the resistance of the thermocouple wire. Usually used in reference to analog pyrometers which have typical loop resistance requirements of 10 ohms.

LSD (Least-Significant Digit): The rightmost active (non dummy) digit of the display.

M

MSD (Most-Significant Digit): The left-most digit of the display.

Manual Reset (Adjustment): The Adjustment of a proportioning controller which shifts the proportioning band in relationship to the setpoint to eliminate droop or offset errors.

Manual Reset (Switch): The switch in a limit controller that manually resets the controller after the limit has been exceeded.

Maximum Operating Temperature: The maximum temperature at which an instrument or sensor can be safely operated.

Measuring Junction: The thermocouple junction referred to as the hot junction that is used to measure an unknown temperature.

Microvolt: One millionth of a volt, 10^{-6} volts.

Mil: One thousandth of an inch (0/001),.

Milliamp: One thousandth of an amp, 10^{-3} amps, symbol mA.

Millimeter: One thousandth of a meter meters, symbol mm.

Millivolt: One thousandth of a volt, 10^{-3} volts symbol mV.

Mineral-insulated Thermocouple: A type of thermocouple cable which has an outer metal sheath and mineral (magnesium oxide) insulation inside separating pair a of thermocouples wires from

down to compact the mineral insulation and is available in diameters from 0.375 to 0.010 inches. It is ideally suited for high-temperature and severe-duty applications.

Multiplex: A technique which allows different input (or output) signals to use the same lines at different times, controlled by an external signal. Multiplexing is used to save on wiring and I/O ports.

N

N/C (No Connection): A connector point for which there is no internal connection.

NEMA 4: A standard from the National Electrical Manufacturers Association which defines enclosures intended for indoor or outdoor use primarily to provide a degree of protection against windblown, dust and rain, splashing water and hose-directed water.

NEMA 7: A standard from the National Electrical Manufacturers which defines explosion-proof enclosures for use in locations classified as Class 1, Groups A,B, C or D, as specified in the National Electrical code.

NEMA 12: A standard from the National Electrical Manufacturers which defines enclosures with protection against dirt, dust, splashes by non-corrosive liquids and salt spray.

NEMA-size Case: An older US case standard for panel meters, which requires a panel cutout of 3.93 x 1.69 inches.

NMR (Normal-Mode Rejection): The ability of a panel meter to filter out noise superimposed on the signal and applied across the SIG HI to SIG LO input terminals. Normally expressed in dB at 50/60 Hz.

Nicrosil / nisil: A nickel chrome/nickel silicone thermal alloy used to measure high temperatures. Inconsistencies in thermoelectric voltages exist in these alloys with respect to wire gage.

Noise: An unwanted electrical interference on the signal wires.

NPT: National Pipe Thread

O

Offset: The difference in engineering units between the setpoint and the actual process temperature. Also referred to as droop.

Othc: Oxygen-free high-conductivity copper. The industrial designation of the pure copper used in Type T thermocouple.

Ohmmeter: An instrument used to measure electrical resistance.

OMEGALLOY: A nickel chrome/nickel silicon thermal alloy used to measure high temperatures. Inconsistencies in thermoelectric voltages exist in these alloys with respect to wire gage.

On/Off Controller: A controller whose action is fully on or fully off.

ORP: Oxidation Reduction Potential

Overshoot: The number of degrees that a process exceeds the setpoint temperature when coming up to the setpoint temperature.

P

PH(S) (Standard pH Scale): The conventional standard pH scale established on the basis that an individual ionic activity coefficient can be calculated from the Debye-Hückel law for primary buffers.

PID: Proportional integral Derivative – A three-mode control action where the controller has time proportioning integral (auto reset), and derivative action.

PPM: Abbreviation for “parts per million”, sometimes used to express temperature coefficient. For instance , 100 ppm is identical to 0.001%

Platinel: A non-standard high temperature platinum thermocouple alloy whose thermoelectric voltage nearly matches a Type K thermocouple (trademark of Englehard industries).

Platinum: A noble metal which in its pure form is the negative wire of Type R and Type S thermocouples.

Platinum 6%Rhodium: The platinum-rhodium alloy used as the negative wire in conjunction with platinum 30% rhodium to form a Type B thermocouple.

Platinum 10% Rhodium: The platinum-rhodium alloy used as the positive wire in conjunction with pure platinum to form Type S thermocouple.

Platinum 13% Rhodium: The platinum-rhodium alloy used as the positive wire in conjunction with pure platinum to form Type R thermocouple.

Platinum 30% Rhodium: The platinum-rhodium alloy used as the positive wire in conjunction with platinum 6% rhodium to form a Type B thermocouple.

Platinum 67: To develop thermal EMF tables for thermocouples the National Bureau of Standards paired each thermocouple alloy against a pure platinum wire (designated Platinum 27 prior to 1973, and currently platinum 67). The internal EMT's of any alloy combination can be determined by summing the “vs. Pt-67” EMF's to the alloys, i.e. the EMF table for a Type K thermocouple is derived from the Chromel vs. Pt-67 and alumel vs. Pt-67 values.

Primary Standard (NBS): The standard reference units and physical constants maintained by the National Bureau of Standards upon which all measurement units in the United States are based.

Probe: A generic term that is used to describe many types of temperature sensors.

Process Meter: A panel meter with sizeable zero and span adjustment capabilities, which can be scaled for readout in engineering units for signals such as 420 mA, 1050 mA and 1-5 V.

Process Variable (PV): The parameter that is controlled or measured. Typical examples are temperature, relative humidity, pressure flow, level etc. The high process variable is the highest value of the process range, expressed in engineering units. The low process variable is the lowest value of the process range.

Proportioning Band: A temperature band expressed in degrees within which a temperature controller's time proportioning function is active.

Proportioning Control Mode: A time-proportioning controller where the amount of time that the relay is energized is dependent upon the system's temperature.

Proportioning Control Plus Derivative Function: A time proportioning controller with a derivative function. The derivative function senses the rate at which a system's temperature is either increasing or decreasing and adjust the cycle time of the controller to minimize overshoot or undershoot.

Proportioning Control Plus Integral: A two-mode controller with time proportioning and integral (auto reset) action. The integral function automatically adjust the temperature at which a system has stabilized back to the setpoint temperature, thereby eliminating droop in the system.

Proportioning Control with integral and Derivative Functions: Three-mode PID controller. A time proportioning controller with integral and derivative function. The integral function automatically adjust the system temperature to the setpoint temperature to eliminate droop due to the time – proportioning function. The derivative function senses the rate of rise or fall of the system temperature and automatically adjust the cycle time of the controller to minimize overshoot or undershoot.

Protection Head: An enclosure usually made out of metal at the end of a probe where connections to the probe are made.

Protection Tube: A metal or ceramic tube closed at one end into which a temperature sensor is inserted. The tube protects the sensor from the medium into which it is inserted.

R

Range: An area between two limits within which a quantity is measured. It is usually expressed by stating the lower limit first and then the upper limit.

Rankine ($^{\circ}\text{R}$): An absolute temperature scale based upon the Fahrenheit scale with 1800 between the ice point and the boiling point of water $459.67^{\circ}\text{R}=0^{\circ}\text{F}$.

Rate Action: The derivative function of a temperature controller.

Rate Time: The time interval over which the system temperature is sampled for the derivative function.

Ratiometric Measurement: A measurement technique where an external signal is used to provide the voltage reference to the dual slope a/d converter. The external signal can be derived from the voltage excitation applied to a bridge circuit or pick-off supply, thereby eliminating errors due to power supply fluctuations.

Reference Junction: the cold junction in a thermocouple circuit which is held at a stable known temperature. The standard reference temperature is 0°C (32°F); however, other temperatures can be used.

Relay (Mechanical): An electromechanical device that completes or interrupts a circuit by physical moving electrical contacts into contact with each other.

Form "A" – A single-pole, single-throw (SPST) relay with normally open (NO) and common contacts. These contacts close when the relay coil is energized. They open when power is removed from the coil.

Form "B" – A single-pole, single-throw (SPST) relay with normally closed (NC) and common contacts. These contacts open when the relay coil is energized. They close when power is removed from the coil.

Form "C" – A single-pole, double-throw relay with normally open (NO), normally closed (NC) and common contacts.

Relay (Solid State): A solid state switching device which completes or interrupts a circuit electrically with no moving parts.

Repeatability: The ability of a probe or instrument to give the same output or reading under repeated identical conditions.

Resistance: The resistance to the flow of electrical current measured in ohms. For a conductor resistance is a function of diameter, resistivity (an intrinsic property of the material) and length.

Resistance Ratio Characteristic: A relationship between a thermistor's resistance and the temperature.

Resolution: The input corresponding to a one-unit change in the least significant digit. (Good resolution is not necessarily equal to good accuracy).

Response Time (Time Constant): The time required by a sensor to reach 63.2% of a step change in temperature under a specified set of conditions. Five time constants are required for the sensor to stabilize at 100% of the step change value.

RTD: Resistance Temperature Detector.

SCR: Silicon Controlled Rectifier.

Seebeck Effect: When open circuit is formed by junction of two dissimilar metals and the junctions are held at different temperatures, a current will flow in the circuit caused by the difference in temperature between the two junctions.

Seebeck EMS: The open circuit voltage caused by the difference in temperature between the hot and cold junctions of a circuit made from two dissimilar metals.

Secondary Standard: A standard of unit measurement derived from a primary standard.

Sensitivity: The minimum change in input signal to which an instrument can respond.

Setpoint: The temperature at which a controller set to control a system.

Setting Time: The time taken for the display to settle within one digit of the final value when a step is applied to the meter input.

Sheath Thermocouple: A thermocouple made out of mineral insulated thermocouple cable which has an outer metal sheath.

Signal Conditioner: A circuit module which offsets attenuates, amplifies linearizes and/or filters the signal for input to the A/D converter. The typical output signal conditioner is +2 Vdc.

Signal-ended Input: A signal-input circuit where SIG LO (or sometimes SIG HI) is tied to METER GND. Ground loops are normally not a problem in AB-powered meters, since METER GND is transformer-isolated from AC GND.

Span: The difference between the upper and lower limits of a range expressed in the same units as the range.

Span Adjustment: The ability to adjust the gain of a process or strain meter so that a specified display span in engineering units corresponds to a specific signal span. For instance, a display span of 200⁰F may correspond to the 16 mA span of a 420 mA transmitter signal.

Spare: A connector point reserved for options, specials or other configurations. The point is identified by an IE#) for location on the electrical schematic.

Specific Heat: The ratio of thermal energy required to raise the temperature of a body f⁰ to the thermal energy required to raise an equal mass of water 1⁰.

SSR: Solid State Relay: (see Relay, Solid state).

Stability: The quality of an instrument or sensor to maintain a consistent output when a constant input is applied.

Super Cooling: The cooling of a liquid below its freezing temperature without the formation of a solid phase.

Super Heating: 1. The heating of a liquid above its boiling temperature without the formation of a gaseous phase. 2. The heating of a gaseous phase considerably above the boiling-point temperature to improve the thermodynamic efficiency of a system.

T

Teflon: A fluorocarbon polymer used for insulation of electrical wires (trademark of DuPont Company).

TEMPCO: Abbreviation for "temperature coefficient"; the error introduced by a change in temperature. Normally expressed in %/⁰C or ppm/⁰C.

Thermal Conductivity: The property of a material to conduct heat in the form of thermal energy.

Thermal EMF: See Seebeck EMF.

Thermal Expansion: An increase in size due to an increase in temperature expressed in units of an increase in length or increase in size per degree, i.e. inches/inch/degree C.

Thermal Gradient: The distribution of a differential temperature through a body or across a surface.

Thermistor: A temperature-sensing element composed of sintered semiconductor material which exhibits a large change in resistance proportional to a small change in temperature. Thermistors usually have negative temperature coefficients.

Thermocouple: The junction of two dissimilar metals which has a voltage output proportional to the difference in temperature between the hot junction and the lead wires (cold junction) (refer to Seebeck EMF).

Standard thermocouple types are:

Thermocouple

Type (ANSI Symbol)	Material
J	iron/Constantan
K	CHROMEGA [†] /ALOMEGA [†]
T	Copper/ Constantan
E	CHROMEGA [†] / Constantan
R	Platinum/Platinum 13%Rhodium
S	Platinum/Platinum 10%Rhodium
B	Platinum 6%Rhodium/ Platinum 30%Rhodium
G*	Tungsten Tungsten 26/Rhenium
C*	Tungsten 5%/Rhenium Tungsten 26% Rhenium
D*	Tungsten 3% Rhenium/ Tungsten 25%

Not ANSI symbols

[†] Registered Trademarks of OMEGA ENGINEERING, INC.

Thermowell: A closed-end tube designed to protect temperature sensors from harsh environments high pressure and flows. They can be installed into a system by pipe thread or welded flange, and are usually made of corrosion-resistance metal or ceramic material depending upon the application.

Transmitter (Two-wire): A device which is used to transmit temperature data from either a thermocouple or RTD via a two-wire current loop. The loop has an external power supply and the transmitter acts as a variable resistor with respect to its input signal.

True RMS: The true root-mean square value of an AC or AC-plus-DC signal often used to determine power of a signal. For a perfect sine wave the RMS value is 1.11072 times the rectified average value which is utilized for low-cost metering. For significantly non-sinusoidal signals, a true RMS converter is required.

TTL-compatible: For digital input circuit, a logic 1 is obtained for inputs of 2.0 to 5.5 V which can source 40 μ A and a logic 0 is obtained for inputs of 0 to 0.8 V which can sink 1.6 mA. For digital output signals, a logic 1 is represented by 2.4 to 5.5 V with a current source capability of at least 400 μ A; and a logic 0 is represented by 0 to 0.8 V with a current sink capability of at least 16mA.

LS-TTL Compatible: For digital input circuit, a logic 1 is obtained of 2.0 to 5.5 V which can source 20 μ A, and a logic 0 is obtained for inputs of 0 to 0.8 V which can sink 400 μ A. For digital output signals, a logic 1 is represented by 2.4 to 5.5 V with a current source capability of at least 400 μ A; and a logic 0 is represented by 0 to 0.8 V with a current sink capability of at least 16mA. "LS" stands for low-power Schottky.

TTL Unit Load: A load with TTL voltage levels, which will draw 40 μ A for a logic 1 and 1.6 mA for a logic 0.

LS-TTL Unit Load: A load with LS-TTL voltage levels, which will draw 200 μ A for a logic 1 and -400 μ A for a logic 0.

U

Undershoot: The difference in temperature between the temperature a process goes to below the setpoint, after the cooling cycle is turned off, and the setpoint temperature.

Underground Junction: A form of construction of a μ probe where the hot or measuring junction is fully enclosed by and insulated from the sheath material.

Union: A form of pipe lining where two extension pipes are joined at a separable coupling.

Z

Zero Adjustment: The ability to adjust the display of a process or stain meter so that zero on the display correspond to a non-zero signal, such as 4mA, 10mA or 1Vdc. The adjustment range is normally expressed in counts.

Zero Offset: 1. The difference expressed in degrees between true zero and an indication given by a measuring instrument. 2. See Zero Suppression.

Zero Power Resistance: The resistance of a thermistor or RTD element with no power being dissipated.

Zero Suppression: The span of an indicator or chart recorder may be offset from zero (zero suppressed) such that neither limit of the span will be zero. (Example: a temperature recorder which records a 100^o span from 400^o to 500^o is said to have 400% zero suppression.