

## Glossary of Terms

### ACCURACY

The quality of closeness to a specified value under stated conditions. Usually expressed as uncertainty - the maximum deviation to be expected between a reading or output and the actual value being measured.

### A/D (ANALOG TO DIGITAL) CONVERTER

A circuit or device that produces a digital output representing the magnitude of an analog input signal.

### AIR DAMPED

A construction utilizing an air vane to achieve movement damping. This vane is usually housed in a closed chamber to increase the damping action.

### ALPHA

Average temperature coefficient of RTD resistance over the interval of 0 to 100°C. Usually  $0.00385\Omega/\Omega/^\circ\text{C}$  for platinum.

### AMBIENT TEMPERATURE

The average temperature of air surrounding the device or equipment.

### ANALOG

A parameter which varies in a continuous, rather than incremental or discrete-step manner.

### ANALOG METER

A scale and pointer meter capable of indicating a continuous range of values.

### ANSI C39.1 STANDARD

American National Standards Institute specification for analog meters.

### ATTENUATOR

A device that reduces the amplitude or power level of a signal without introducing appreciable distortion.

### AUTO-POLARITY

The ability to measure DC values of either polarity without the need to interchange test lead connections.

### AUTO-ZERO

An automatic correction for offsets and drifts at zero input.

### AVERAGE RESPONDING

An AC measurement obtained using a DC instrument with a rectifying input circuit calibrated in terms of the corresponding RMS value. Accurate only for pure sine wave inputs.

### BALANCE

The change in the position of an

analog pointer from zero when the axis of the moving element moves from the vertical position to the horizontal position. The balance is expressed as a percentage of the scale length.

### BANDWIDTH (FREQUENCY RESPONSE)

The frequency span where a constant amplitude input will produce a meter reading within a specified limit (usually 3db). In controllers, the region around the setpoint where control occurs.

### BIAS CURRENT

Current that flows out of an amplifier's input terminals which will produce a voltage drop across the source impedance. In a perfect amplifier this error term would be zero.

### BAUD

Digital transmission speed in bits per second.

### BURDEN

The input impedance of a measuring circuit (expressed in ohms) or the load on the secondary of a transformer (expressed in volt-amps or watts). In potential or current transformers, burden is the maximum load the transformer can support while operating within its accuracy rating.

### CALIBRATE

To determine the indication or output of a device with respect to a standard.

### CELSIUS

Temperature scale where  $0^\circ$  = freezing and  $100^\circ$  = boiling point of water at sea level. Formerly known as Centigrade.

### CMR (COMMON-MODE REJECTION)

The ability of a circuit or meter to reject a signal that appears at both input terminals with respect to ground.

### CMV (COMMON-MODE VOLTAGE)

An AC or DC voltage which appears between the signal lines and circuit ground or earth.

### COLD JUNCTION COMPENSATION

A correction applied to thermocouple measurements to compensate for the temperature of the TC wire connections, so the temperature reading is only the result of the measuring TC junction.

### CONDUCTIVITY, THERMAL

The ability of a substance to transmit heat by conduction.

### CONFORMITY ERROR

The difference between the actual response and the ideal response to a particular stimulus.

### CONNECTOR, THERMOCOUPLE

A special polarized disconnect device whose current-carrying parts are of thermocouple alloy material.

### CONTROLLER

A device capable of receiving a signal from a process and regulating an input to that process in order to maintain a selected operating condition (control point).

### CONTROL MODE

Type of control used in a feedback control system. One mode is proportional control. Two mode is proportional plus integral (reset) or derivative (rate). Three mode is proportional, integral and derivative (PID).

### CONVERSION RATE

The number of analog-to-digital conversions performed per second by a digital instrument.

### COUNT

One event or one increment of the least significant digit.

### CPU

Central Processing Unit in digital computing systems. Often referred to as microcontroller or microprocessor.

### CREST FACTOR

The ratio of the maximum (crest) value of a periodic function (AC voltage or current) to its RMS value.

### DAMPING

The manner in which the pointer of an analog instrument settles at its steady indication after the applied electrical energy is changed. Usually expressed as percent over-shoot.

### D'ARSONVAL MOVEMENT

A meter movement based upon the permanent magnet DC motor principle: a small coil of wire supported on jewel bearings or taut band between the poles of a permanent magnet. The magnetic field of the DC current passing through the coil interacts with the magnet's field, causing rotation of the coil and an attached pointer against the restoring force of coil springs.

### DB (DECIBEL)

The standard unit for measuring relative strength of a signal parameter such as power or voltage.  $\text{dB} = 10 \log (P_{\text{out}}/P_{\text{in}})$ ;  $\text{dB} = 20 \log (V_{\text{out}}/V_{\text{in}})$ . 20dB corresponds to a voltage ratio of 10. A NMR of 70dB provides voltage noise rejection of 3162/1.

### DEADBAND

The region through which an input can be varied without initiating a response.

### DIELECTRIC STRENGTH

The voltage that can be sustained without breakdown.

### DIFFERENTIAL INPUT

An input circuit where signal high and signal low are electrically floating with respect to signal common or signal ground.

### DIGIT

A measure of the display span of a meter. By convention, a full digit can assume any value from 0 through 9, a  $\frac{1}{2}$  digit will display a 0 or 1 and overrange at 2, a  $\frac{3}{4}$  digit will display up to 3 and overrange at 4. A meter with a display span of  $\pm 3999$  counts is a  $\frac{3}{4}$  digit meter.

### DIN

(DEUTSCHE INDUSTRIE NORM) A set of German technical standards. Commonly used to specify panel meter sizes.

### DRIFT

An unwanted change in the reading or setpoint value over time, when inputs are held constant.

### DUAL-SLOPE CONVERSION

An analog to digital conversion technique which can provide high noise rejection.

### DUPLEX, FULL

Concurrent transmission and reception. Contrasts with half-duplex (one direction at a time).

### ELECTROMOTIVE FORCE (emf)

An electrical potential difference which produces or tends to produce an electric current.

### ELEMENT

A circuit in a watt, VAR or PF meter that accepts one voltage and one current input.

### EMI

Electromagnetic interference.

# WESCHLER INSTRUMENTS

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### EXPANDED SCALE

An arrangement that expands a specific portion of an overall range to occupy a larger portion of the full-scale length than it normally would.

### EXPLOSION PROOF

An enclosure capable of withstanding an explosion of a specified gas or vapor which may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosures by sparks, flashes, heat or explosion of the gas vapor within.

### FAIL-SAFE

Assuming a safe operating mode in the event of a failure.

### FORM

A method for specifying relay contact configuration:

Form A	SPST-NO	(single pole, single throw, normally open)
Form B	SPST-NC	(single pole, single throw, normally closed)
Form C	SPDT	(single pole, double throw)
Change-Over	CO	same as SPDT

### FULL SCALE VALUE

The arithmetic sum of the two end-scale values (may not apply to some specialized meters, such as power factor). When zero is not on the scale, the full-scale value is the higher end-scale value. Examples:

Scale	Full Scale Value
0-200V	200V
25-0-175V	200V
250-0-250V	500V
60-160V	160V

### GRADIENT, THERMAL

A continuously changing temperature as a function of distance.

### GROUND

Reference point for an electrical system. Often used to indicate an earth connection or negative side of a DC supply.

### GROUNDING JUNCTION

A thermocouple construction where the junction is attached (grounded) to the sheath as contrasted to an ungrounded or exposed junction type.

### HYSTERESIS

The difference in an output or activation point due to rising vs. falling input signals.

### IMPEDANCE

The total opposition to electrical flow, including both resistive and reactive elements.

### INPUT RESISTANCE (INPUT IMPEDANCE)

DC (or AC) resistance measured across the input terminals with signal leads disconnected.

### INSULATION RESISTANCE

The resistance measured between two insulated points on a device when a specified DC voltage is applied.

### ITS-90

International Temperature Scale, Revised 1990. The currently accepted thermodynamic temperature scale. Replace the previous standard IPTS-68.

### IRON VANE

A technique for measuring AC or DC current using mutual repulsion of magnetic fields. The rotation is proportional to the strength of the fields, which is proportional to the current flowing in the field coil. Also described as 'moving vane', 'moving iron' or 'repulsion'.

### ISOTHERMAL

A process or area that is a constant temperature.

### JUNCTION

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

### KELVIN (K)

The basic temperature unit of the thermodynamic scale.  $0^{\circ}\text{C} = 273\text{K}$

### KNIFE-EDGE POINTER

Analog meter pointer with end flattened and turned edgewise so that the thinnest dimension or edge is seen by the observer. Often used with mirror-backed scale for increased reading accuracy by elimination of parallax.

### LATCHING (in meter relays)

A condition that requires the manual reset of a tripped relay. The tripped relay cannot be reset (re-energized) until the indicating pointer or display is in a non-alarm position.

### LINE REJECTION

Insensitivity to a power line frequency interference signal. Usually expressed in dB.

### LEAD COMPENSATION

Technique for minimizing or eliminating errors due to signal leads.

### LINEARITY ERROR

A measure of the departure from a straight-line response in the

relationship between two quantities, where the change in one quantity is directly proportional to a change in the other quantity. Usually expressed as a maximum percent.

### LSD (LEAST-SIGNIFICANT DIGIT)

The rightmost active digit of a digital display.

### MEASURING JUNCTION

That junction of a thermocouple subjected to the temperature to be measured.

### MIRROR SCALE

An analog meter scale with a mirror arc that enables alignment of the eye's line of sight perpendicular to the scale when taking a reading. Eliminates parallax, considerably improves reading accuracy.

### MOV (Metal Oxide Varistor)

Component used to protect electronic circuitry from voltage transients.

### MSD (MOST SIGNIFICANT DIGIT)

The leftmost digit of a digital display.

### 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.

### NEMA ENCLOSURE

A rating standard from the National Electrical Manufacturers Association which defines intended use and degree of environmental protection.

### NEMA-SIZE CASE

A US case standard for digital panel meters, which requires a panel cutout of 3.93 x 1.69 inches.

### NMR (NORMAL-MODE REJECTION)

The ability of a meter to filter out noise that appears across the signal inputs in the same manner as the desired signal. Also known as series mode rejection.

### NON-LINEARITY

In an ideal system, the input-out relationship is linear (i.e., straight line). Any departure from straight line is expressed as non-linearity. Two methods are used for measurement. The "best straight line" approach compromises the end points and situates the line to give the most optimistic answer.

### OFFSET

The non-zero output of a device for zero input.

### OFFSET CURRENT

The difference between two bias currents drawn by the inputs of a differential amplifier.

### OHMS PER VOLT

Indication of the total terminal resistance of an analog voltmeter. A 1000-ohms-per-volt meter has a resistance of 150,000 ohms on its 150-volt (full-scale) range, and 300,000 ohms on its 300-volt range. Its basic movement is a 1mA meter.

### ON-OFF CONTROL

Non-proportional control in which the controlled process input is either fully on or fully OFF depending on whether the temperature is above or below the control point dead-band.

### OPTO-ISOLATOR

An isolation device that provides an electrical barrier between related circuits.

### OVERLOAD

The excess load beyond full-scale value that an instrument can withstand without damage or failure. Expressed as a percent of a full-scale value.

### OVERRANGE

A reading that exceeds full scale.

### OVERSHOOT

The amount by which a meter or process exceeds the final value during a transition. Usually expressed as percent of amplitude for a step change.

### PEAK HOLD

An instrument function that permits retaining and displaying the peak value momentarily reached by a signal.

### PHASE ANGLE

The difference in electrical degrees by which current leads voltage in an inductive circuit or lags voltage in a capacitive circuit. Also the phase displacement between primary and secondary currents in a current transformer.

### PIVOT AND JEWEL

Method of suspending the moving coil or moving iron vane in a magnetic field, in analog meters. The movable element is equipped with two metal pivots which engage glass or synthetic-jewel cup bearings.

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### POLYPHASE WATTMETER

A wattmeter with 2 or 3 single-phase wattmeters mounted in the same package.

### POTENTIAL EMF

The relative voltage at a point in a circuit or in space with respect to some reference point.

### POWER FACTOR

The ratio of consumed power to apparent (volt-ampere) power in an AC circuit.

### PPM (PARTS PER MILLION)

A convenient format to express very small numbers, such as temperature coefficients. 100ppm is 0.01%.

### 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 4-20mA, 10-50mA and 1-5V.

### PSIA (PSI Absolute)

A pressure reading using vacuum as the reference.

### PSIG (PSI Gauge)

A pressure reading using ambient air pressure as the reference.

### RANGE

The span of values over which a meter will function without entering overload condition, e.g. 0-150VAC, 0-10A.

### RATIOMETRIC MEASUREMENT

A resistance measurement technique where the unknown resistance is placed in series with a known resistance. The voltage across each is measured to determine the unknown resistance.

### REACTANCE

The opposition presented by capacitance and/or inductance to the passage of alternating current of a given frequency.

### RECTIFIER-TYPE METER

A DC meter equipped with a solid-state rectifier at its input to convert AC energy to DC energy. The instrument provides measurements of the average value of an AC voltage or current, and its scale is usually calibrated in terms of the RMS equivalent. Such calibration is accurate for pure sine-wave signals, but the accuracy decreases for distorted signals.

### REFERENCE JUNCTION

The other junction (usually at ice point) to which the measuring thermocouple junction is compared (see cold junction).

### REPEATABILITY

The ability of an instrument to register the same reading in successive measurements of the same input.

### RESOLUTION

The degree to which nearly equal values of a quantity can be discriminated. In digital meters, the value represented by a one-digit change in the least-significant digit.

### RMS (ROOT MEAN SQUARE)

The square root of the mean of the square of the signal over one full cycle. Effective heating value.

### RTD (RESISTANCE TEMPERATURE DETECTOR)

A metallic sensor where resistance increases in a predictable manner with increasing temperature.

### SECONDARY JUNCTION

An unwanted connection between a pair of thermocouple wires tending to produce a signal representative of the secondary junction temperature rather than the measuring junction temperature.

### SELF HEATING

Internal heating of a transducer as a result of power dissipation.

### SENSITIVITY

The minimum change in input to which a device can respond.

### SETPOINT

The value of a process variable that will initiate an action. The desired control point.

### SETTLING TIME

The time required for the output to settle within a specified band of the final value when a step input change is applied.

### SHIELD

A protective conductive covering that provides a least resistance path to ground for external interference.

### SHUNT

A calibrated low resistance connected in parallel with the input terminals of an ammeter in order to enable measurement of higher currents. It can be internal or external. Typical external shunts are either 50mV or 100mV full scale.

### S.I. (SYSTEM INTERNATIONALE)

The formal name for the metric system.

### SIGNAL CONDITIONER

A circuit or module which offsets, attenuates, amplifies, linearizes and/or filters the signal for transmission or processing by an A/D converter. The typical output span of a signal conditioner is  $\pm 2$ VDC or 4-20mA.

### SINGLE ENDED INPUT

Amplifier with one input referenced to circuit common or ground.

### SNUBBER

A resistance/capacitor or diode/resistor network used to dissipate switching transients. Often used across high current relay contacts.

### SPAN ADJUSTMENT

The ability to adjust the gain of a process or meter so the display span corresponds to a specified signal span.

### SYNCHRONOUS MOTOR

An AC motor whose speed is exactly proportional to the frequency of the applied alternating voltage.

### TAUT BAND

Method of suspending moving coil or moving iron vane in magnetic field. Eliminates pivot and jewel friction problems.

### TEMPERATURE COEFFICIENT (TEMPCO)

The change in a parameter produced by a change in temperature. Normally expressed in %/ $^{\circ}$ C or ppm/ $^{\circ}$ C.

### THERMISTOR

A semiconductor material which exhibits a known electrical resistance vs. temperature.

### THERMOCOUPLE

The junction of two dissimilar metals with a voltage output proportional to temperature.

### THERMOCOUPLE BREAK PROTECTION

A means to indicate when thermocouple has failed in an open circuit condition.

### THERMOCOUPLE LOOP RESISTANCE

The total resistance of the thermocouple and its extension wire.

### THERMOPILE

A number of thermocouples connected in series, arranged so that alternate junctions are the referenced temperature and at the measured temperature to increase the output for a give temperature difference between the measuring and reference junctions.

### THERMOWELL

The housing into which an RTD or thermocouple is inserted. Allows easy removal and/or replacement.

### TIME CONSTANT

The time required for a sensor to respond to 63% of its total change resulting from a step input. Five time constants are required to attain 99% of the total change.

### TRI-STATE OUTPUT

A logic output which has 0, 1 and high impedance output states. For parallel connected outputs, the high-impedance state is used when the output is not active.

### TRUE RMS (TRMS)

The true root-mean-square value of an AC or AC-plus-DC signal. Often used to determine power of a signal.

### TWO-WIRE TRANSMITTER

A signal conditioner in which the signal output and power input share two wires, thus minimizing wiring.

### UNIPOLAR

In electronic meters, a capability for measuring voltage or current of only one polarity, [i.e., the (+) or (-)].

### VAR (VOLT-AMPERES REACTIVE)

The unit of reactive power, as contrasted to real power (watts).

### VOLT

The unit of electromotive force. One volt applied to a resistance of one ohm produces a current of one ampere.

### WATT (W)

Unit of real (effective) electrical power.  $W = VA \times PF$  in a sinusoidal circuit.

### ZERO ADJUSTMENT

The ability to adjust a signal conditioner or meter so that zero output or zero display corresponds to a specific input signal, such as 0V or 4mA.