



## Glossary of Technical Terms for Process Weighing

### Communication Glossary

**ACK**

A control character sent to acknowledge that a transmission block has been received.

**ACTIVE/PASSIVE**

In current loop applications, a device capable of supplying the current for the loop (active) and a device that must draw its current from connected equipment (passive).

**ADDRESS**

A unique designation for the location of data or the identity of an intelligent device allowing each device on a single communication line to respond to its own message.

**APPLICATION LAYER**

The highest layer of the seven layer OSI model structure; contains all user or application programs.

**ARPANET**

A packet switching network operated by the U.S. government ASCII American Standard Code for Information Interchange. A seven bit plus parity code established by ANSI to achieve compatibility between data services. A set of numbers from zero through 127 assigned to letters, numbers, punctuation marks, and special characters.

**ASYNCHRONOUS**

Transmission in which time intervals between transmitted characters may be of unequal length. Transmission is controlled by start and stop bits at the beginning and end of each character.

**BASEBAND MODEM**

A line driver or short haul modem

**BAUD**

Unit of signaling speed. The speed in baud is the number of discrete conditions or events per second. If each event represents only one bit condition, baud rate equals bits-per-second.

**BAUDOT**

Data transmission code in which five bits represent one character.

**BCC**

Block Check Character. The result of a transmission verification algorithm accumulated over a transmission block. It is normally added to the end e.g. CRC, LBC.

**BEL**

A control character that is used when there is a need to call for attention.

**BELL 212**

An AT&T standard modem providing full duplex, asynchronous or synchronous, 1200 bps data transmission for use on the public telephone network.

**BINARY**

A base 2 logic representation used in digital computers and digital controls. Only two numerals, 0, and 1, are required.

**BCD**

Binary Coded Decimal. A notation in which the individual decimal digits are each represented by a group of binary digits. In the 8, 4, 2, 1 BCD notation, each decimal digit is represented by a four-place binary number, valued in sequence as 8, 4, 2, 1.

**BIT**

Abbreviation for Binary digit. The smallest unit of information in a binary system, a one or zero condition.

**BLOCK MODE**

A facility, available only on some terminals, whereby data on a screen can be edited locally and transmitted as a block when the user has finished, rather than character by character.

**BPS**

Bits per Second. The number of binary digits of information transmitted in one second. Unit of data transmission.

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**BREAK**

A special signal used to interrupt a program.

**BRIDGES**

Connect two or more individual Local Area Networks (LAN) often called subnetworks. Any station on any of the sub-networks can share files and data with any other. A bridge can distinguish between local data and remote data, so data traveling from one station to another in the same sub-network doesn't have to cross the bridge. Bridges are protocol independent and can transfer data between sub-networks.

**BROADBAND**

A communication channel with a band with greater than a voice grade channel and potentially capable of greater transmission rates.

**BSC**

Bisynchronous Transmission. An IBM byte or character oriented communication protocol that has become an industry standard. It uses a defined set of control characters for synchronized transmission of binary coded data between stations in a data communication system.

**BUFFER**

A storage device used to compensate for a difference in rate of flow of data when transmitting data from one device to another. A temporary storage device used to compensate for a difference in the rate and data flow between two devices (typically a computer and a printer).

**BUS**

A data path shared by many devices.

**BYTE**

A binary string functioning as a unit usually shorter than a computer "word". Eight-bit bytes are most common. Also called a "character".

**CACHE**

A small, fast storage buffer integrated in the central processing unit of computers.

**CAN**

A character indicating that the data preceding it is in error and should be ignored.

**CARRIER DETECT**

An RS-232 modem signal that indicates to an attached terminal that the modem is receiving a signal from a remote modem.

**CHARACTER**

A letter, numeral, punctuation, control figure, or any other symbol contained in a message.

**COAXIAL CABLE**

A cable consisting of a central wire surrounded by another wire in the form of a cylinder.

**CPU**

Central Processing Unit. The section of a computer system in which the varied functions of storing and distributing input data, decoding, arithmetic and logic operation, and timing and control signal generation are performed.

**CLOCK**

Shorthand term for the source of timing signals used in synchronous transmission. More generally, the source of timing signals sequencing electronic events.

**CLUSTER**

A collection of terminals or other devices in a single location.

**CONCENTRATOR**

A device used to divide a data channel into two or more channels of lower average speed, dynamically allocating channel space according to demand in order to maximize throughput.

**CR**

Carriage Return. An ASCII control character that moves the cursor or print mechanism to the left margin.

**CRC**

Cyclic Redundancy Check. An error detection scheme in which the block check character is the remainder after dividing all the serialized bits in a transmission block by a predetermined binary number.

**CROSSTALK**

The unwanted transmission of a signal on a channel that interferes with another adjacent channel.

**CTS**

Clear to Send. An RS-232 modem interface control signal which indicates that the attached DTE may begin transmitting.

**CURRENT LOOP**

A method of interconnecting terminals and transmitting signals whereby a binary 1 (mark) is represented by current



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on the line and a binary 0 (space) is represented by the absence of current.

### **DATA BITS**

The bits forming part of a single group of bits that represent data, as opposed to start, parity, and stop bits.

### **DEVICE CONTROL**

A category of control characters primarily intended for turning on or off a subordinate device (DC1, DC2, DC3 etc.)

### **DCE**

Data Communications Equipment. Devices that provide the functions required to establish, maintain, and terminate a data transmission connection e.g. a modem, converter, etc.

### **DELAY**

Period of inactivity.

### **DEMOLUATION**

The process of retrieving digital data from a modulated analog signal.

### **DIBIT**

A group of two bits. The four possible states for a dibit code are 00, 01, 10, 11.

### **DOWNLOADING**

The process of sending configuration parameters, operating software or related data from a central source to remote stations.

### **DSR**

Data Set Ready. An RS-232 modem interface control signal which indicates that the terminal is ready for transmission.

### **DTE**

Data Terminal Equipment. Devices acting as a data source, data sink, or both (terminals, computers, printers, and other devices that are the source or final destination of data).

### **DTR**

Data Terminal Ready. An RS-232 modem interface control signal which indicates to the modem that the terminals are ready for transmission.

### **EBCDIC**

Extended Binary Coded Decimal Interchange Code. An

eight bit character code used primarily in IBM equipment. The code allows for 256 different bit patterns.

### **ECOPLEX**

A method of checking data transmission accuracy by returning characters to the sending station for verification of data integrity.

### **EIA**

Electronic Industries Association. A standards organization in the USA specializing in the electrical and functional characteristics of interface equipment.

### **EIA-485**

The recommended standard of the Electronic Industry Association that specifies the electrical characteristics of generators and receivers for use in balanced digital multipoint systems.

### **EMULATION**

The imitation of a computer system performed by a combination of hardware and software that allows programs to run between incompatible systems.

### **ENQ**

Enquiry. A transmission control character used as a request for a response from a remote station.

### **EOT**

End of Transmission. A transmission control character used to indicate the conclusion of the transmission of one or more texts.

### **EPROM**

Erasable Programmable Read-Only-Memory. Nonvolatile semi-conductor memory that is erasable via ultra violet light and re-programmable.

### **ESC**

Escape. A control character which is used to provide additional control functions. It alters the meaning of a limited number of continuously following bit combinations.

### **ETB**

End of Transmission Block. A transmission control character used to indicate the end of a transmission block of data.

### **ETX**

End of Text. A transmission control character that terminates a text.

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### **EVEN PARITY**

A dumb terminal data verification method in which each character must have an even number of “on” bits. Adding a bit after the data bits to make the total number of binary ones in the data bits and the parity bit an even number.

### **FDDI**

Fiber Distributed Data Interface. An American National Standards Institute standard for fiber optic links with data rates up to 100 Mbps.

### **FE**

Format Effectors. Category of control characters mainly intended for the control of the layout and positioning of information on printing and/or display devices. (Ex., BS, CR, HT, VT.)

### **FLOW CONTROL**

The procedure for regulating the flow of data between two devices; prevents the loss of data once a device buffer has reached its capacity.

### **FDM**

Frequency Division Multiplexer. A device that divides the available transmission frequency range into narrower banks, each of which is used for a separate channel.

### **FSK**

Frequency Shift Keying. A frequency modulation technique in which one frequency represents a mark and a second frequency represents a space.

### **FULL DUPLEX**

Simultaneous two-way independent transmission in both directions (4 wire).

### **GATEWAYS**

Combination of hardware and software connecting two dissimilar LAN's or operating environments. A gateway serves as the interpreter for computers that communicate in different protocols.

### **GS**

Group Separator. A control character used to separate and qualify data logically; normally delimits data item called a group.

### **GUI**

Graphical User Interface. An operating system or environment that displays options on the screen as icons or picture symbols. Users enter commands by pointing at icons with a cursor controlled by hardware device called a “mouse”, and then clicking a button on the mouse.

### **HALF DUPLEX**

Used to describe a communications system capable of transmitting data alternately, but not simultaneously, in two directions (2 wire).

### **HANDSHAKING**

An exchange of predetermined signals between two devices establishing connection. Usually part of a communication protocol.

### **HDLC**

High Level Data Link Control. An international standard communication protocol defined by ISO. A synchronous protocol.

### **HEADER**

The control information added to the beginning of a message. It is usually a transmission block or a packet.

### **HEXADECIMAL**

The hexadecimal number system uses a base of 16 where the first ten digits are 0 - 9 and the last six digits are represented by the letters A - F.

### **INTELLIGENT**

Intelligent Workstation. Sometimes referred to as an intelligent (smart) terminal; a terminal (DTE) that can be programmed; any terminal that can provide the user with independent processing power and applications support personal computers.

### **INTERFACE**

A shared connection or boundary between two devices or systems. The point at which two devices or systems are linked. Common interface standards include EIA Standard RS-232C.

### **ISDN**

Integrated Services Digital Network. A system being developed that integrates voice, data, and other communications over common channels.

### **ISO**

International Standards Organization.

### **KERMIT**

A protocol designed for micro to mainframe file transfers.

### **KSR**

Keyboard send/receive. A combination tele-printer transmitter and receiver.



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**LDM**

Limited Distance Modem. A signal converter which conditions and boosts a digital signal so that it may be transmitted further than a standard RS-232 signal.

**LINE DRIVER**

A signal converter that conditions a digital signal to ensure reliable transmission over an extended distance.

**LAN**

Local Area Network. A data communications system confined to a limited geographic area.

**LRC**

Longitudinal Redundancy Check. An alternative check to the CRC.

**MARK**

In telecommunications, the presence of a signal. A mark impulse is equivalent to the binary 1, represented by a negative voltage in direct connection; the absence of a MARK is a SPACE which is equivalent to the binary 0.

**MODEM**

Modulator-Demodulator. A device used to convert serial digital data from a transmitting terminal to a signal suitable for transmission over a telephone channel or to re-convert the transmitted signal to serial digital data for acceptance by a receiving terminal.

**MODEM ELIMINATOR**

A device used to connect a local terminal and a computer port in lieu of the pair of modems that they would ordinarily connect to; allows DTE to DTE data and control signal connections otherwise not easily achieved by standard cables or connects.

**MODULATION**

The process, or result of the process, whereby some characteristic of one wave is varied in accordance with some characteristic of another wave.

**MULTIDROP LINE**

A single communications circuit that interconnects many stations, each of which contains terminal devices.

**MULTIPOINT**

A system where several devices are sharing a single communication line.

**MULTIPLEXER**

A device used for division of a transmission facility into

two or more subchannels, either by splitting the frequency band into narrower bands (frequency division) or by allotting a common channel to many different transmitting devices one at a time (time division).

**NAK**

Negative Acknowledgement. A control character used to indicate that the previous transmission block was in error and the receiver is ready to accept re-transmission.

**NETWORK**

A system connecting a number of communications devices.

**NODE**

A point of interconnection to a network.

**NULL MODEM**

A set of circuits that enable two DTE (or DCE) devices to be connected by swapping leads.

**NOISE**

An unwanted component of a signal or variable which obscures the information content.

**OPTOCOUPLER**

An isolation device consisting of a light source and a light detector.

**OSI**

Open System Interconnection. A logical structure for network operation established within the International Standards Organization (ISO); a seven layer network architecture used for the definition of network protocol standards to enable any two OSI compliant devices to carry on a meaningful exchange of information; the layers are Physical, Data Link, Network, Transport, Session, Presentation, Application.

**OVERHEAD BIT**

A bit other than a data bit, e.g., check bit, parity bit.

**PACKET**

A group of data elements transmitted together that generally forms a part of a larger transmission made up of a number of packets. A packet is made up of additional information such as packet number and error detecting codes.

**PAD**

Packet Assembler/Disassembler. An interface between a terminal or computer and a packet switching network.

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**PAM**

Phase Amplitude Modulation. Used by some modems to translate bits into a combination of phase shifts and frequency changes.

**PARITY**

An equalization process wherein the number of binary 1's in the digital word being transmitted is automatically maintained at an even or odd count.

**PARITY BIT**

A bit sent after the data bits used for error detection. It is computed from the data bits by both the transmitting and receiving devices, and the result is then compared.

**PARITY ERROR**

The condition that arises when the parity bit does not bear the correct relationship to the data bits.

**PASSIVE**

A term used to indicate the device, receiver or transmitter, in a serial 20 mA loop which DOES NOT supply current.

**PHASE MODULATION**

Used by some modems to translate bits into different phases of a carrier signal.

**PIC**

Programmable Interrupt Controller. A chip used to enable and prioritize hardware interrupts and pass them on to the CPU.

**POLLING**

The conditions resulting from a CPU repeatedly examining a number of devices in turn to see whether anything has happened as opposed to interrupt-driven communications where the devices themselves notify the CPU when something happens.

**PROM**

Programmable Read Only Memory. Nonvolatile memory chip that allows a program to reside permanently in a piece of hardware.

**PROTOCOL**

The rules governing the exchange of information between devices on a data link.

**PSK**

Phase Shift Keying. Used by some modems to encode data as different phase angles.

**RAM**

Random Access Memory. Semiconductor read-write volatile memory. Data stored is lost if power is turned off. Generally understood to mean any memory with both read and write capability and in which the locations can be accessed in any (random) sequence.

**RI**

Ring Indicator. Used by some modems to indicate that it is receiving a call and would be ringing if it were a telephone.

**RISC**

Reduced Instruction Set Computing. Internal computing architecture where processor instructions are pared down so that most can be performed in a single processor cycle, theoretically improving computing efficiency.

**ROM**

Read Only Memory. Nonvolatile semiconductor memory manufactured with predefined data content permanently stored.

**RS**

Record Separator. A control character used to separate and qualify data logically.

**RS-232**

A standard defining the electrical functional and mechanical interface for half/full duplex communications between computers, modems, and peripheral equipment (does not specify format). Transmission distance is limited to 50 feet at 20,000 bits/second (bps). It utilizes unbalanced signaling and is usually used with a 25 pin D shaped connector (DB 25) to interconnect DTE (computers, controllers etc.) and DTE equipment (modems, converters etc.).

**RS-422**

A standard that defines the electrical characteristics of a balanced voltage digital interface with no accompanying physical connector. It is commonly used in point-to-point communications conducted with a dual-state driver. Transmissions can run long distances at high speeds.

**RS-423**

A standard that defines the electrical characteristics of an unbalanced voltage digital interface circuit.

**RS-449**

A standard that defines the functional and mechanical interfaces for Data Terminal Equipment (DTE) and Data



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Communication Equipment (DCE) that employ serial binary data interchange. It is usually used with synchronous transmission. It utilizes balanced signaling and DB37 or DB9 connectors. It is incompatible (mechanical and electrical specifications) with RS-232.

### **RS-485**

A standard that resembles RS-232 except that tri-state rather than dual-state drivers are utilized. It may be used in multipoint applications where one central computer controls many different devices.

### **RS-530**

A standard that defines the mechanical and electrical interfaces between DTE and DCE equipment that transmit serial binary data, whether synchronous or asynchronous. It provides a mean for taking advantage of higher data rates with the same mechanical connector (DB25) used for RS-232. RS-530 and RS-232 are not compatible. Data transmission rate range from 20 Kbps to 2 Mbps.

### **RTS**

Request to Send. An RS-232 modem interface signal sent from the DTE to the modem on pin 4 which indicates that the DTE has data to transmit.

### **RXD**

Received Data. The circuit carrying data from DCE to DTE.

### **SERIAL 20-mA CURRENT LOOP**

A data transfer technique in which the bits representing the data are transmitted in sequence, one after another, over a closed loop by varying the current (mark and space).

### **SERIAL TRANSMISSION**

The most common transmission mode where data bits are sent sequential on a single channel.

### **SHORT HAUL MODEM**

A signal converter which conditions a digital signal to ensure reliable transmission over DC continuous private line metallic circuits without interfering with adjacent pairs in the same telephone cable.

### **SDLC**

Synchronous Data Link Control. An IBM standard protocol.

### **SOH**

Start of Header. A transmission control character used as the first character of a heading of an information message.

### **SPACE**

Absence of signal. In telegraph communication, a space represents the open condition or no current flowing. A space impulse is equivalent to a binary 0.

### **START BIT**

In asynchronous transmission, the first bit in each character, normally a space which prepares the receiving equipment for the reception and registration of the character.

### **STOP BIT**

In asynchronous transmission, the last bit, used to indicate the end of a character; normally a mark condition, which serves to return the line to its idle or rest state.

### **SSR**

Solid State Relay. A semiconductor switch, usually a Triac, SCR (silicon controlled rectifier), or a power transistor. SSRs used in BLH I/O circuits include optocouplers for transient protection.

### **STX**

Start of Text. A transmission control character that precedes a text and is used to terminate a heading.

### **SYN**

Synchronous Idle. A transmission control character used by synchronous transmission system in the absence of any other character (idle condition), to provide a signal.

### **SYNCHRONOUS TRANSMISSION**

In synchronous data transmission, special characters synchronize the transmitting and receiving elements of the link, eliminating the overhead of start and stop bits found in asynchronous communication. Synchronous protocols fall into two categories; CHARACTER or byte-oriented protocols that specify definite character length, and bit-oriented protocols that do not specify character length. Bisynchronous (BSC) is a common character oriented protocol. Synchronous Data Link Control (SDLC) is typical bit oriented protocol.

### **TC**

Transmission Control. Category of control characters intended to control or facilitate transmission of information over communication networks. Samples of TC characters are: ACK, DLE, ENQ, EOT, ETB, ETX, NAK, SOH, STX, and SYN.

### **TIMEOUT**

A period after which, if no response is received, an error is considered to have occurred.

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**TRUNK**

A single circuit between two points, both of which are switching centers or individual distribution points. A trunk usually handles many channels simultaneously.

**TTD**

Temporary Text Delay. The TTD control sequence (STX ENQ) transmitted by a sending station when it wants to retain the line but is not ready to transmit.

**TURNAROUND TIME**

The actual time required to reverse the direction of transmission from sender to receiver or vice versa when using a half-duplex circuit. Time is required for line propagation effects, modem timing, and computer reaction.

**UART**

Universal Asynchronous Receiver/Transmitter. A chip with serial/parallel conversion, parallel/serial conversion, and other facilities designed for use in asynchronous serial communications.

**UNBALANCED LINE**

A transmission line in which the magnitudes of the voltage on the two conductors are not equal with respect to ground.

**UNIX**

An operating system originally designed by AT&T for communicating multiuser 32 bit minicomputers.

**USART**

Universal Synchronous/Asynchronous Receiver/Transmitter. It is similar to a UART but has synchronous capability also.

**VOICE FREQUENCY**

Frequency in part of the audio range essential for the transmission of quality speech.

**VRC**

Vertical Redundancy Check. An error-detection scheme in which the parity bit of each character is set to "1" or "0" so that the total number of "1" bits in the character is odd or even.

**WIDEBAND**

A communication channel that has a greater band width than voice grade lines.

**XMODEM**

A protocol designed for transfers between micro computers.

**X-ON/X-OFF**

Transmitter On/Transmitter Off. Control characters used for flow control, instructing a terminal to start transmission (X-ON) and end transmission (X-OFF).

**X-25**

A protocol used by the packet switching network.

**X.PC**

An asynchronous version of X.25.

**YMODEM**

An enhanced version of XMODEM.

**WATS**

Wide Area Telephone Service. Unlimited use of a telephone circuit for specified periods for an agreed charge.

**WORD LENGTH**

The number of data bits sent at one time during asynchronous communications.

### Instrumentation Glossary

**A/D**

Analog to Digital. Refers to converting levels of a continuously varying voltage to discrete binary numbered values.

**ANSI**

American National Standards Institute. The principal standards development body in the USA.

**AXIAL LOAD**

A load along or parallel to and concentric with the primary axis.

**ACCURACY**

Conformity of an indicated value to an accepted standard value or true value.

**ACCURACY, REF.**

A number or quantity which defines the limit that errors will not exceed (Reference when the device is used under reference operating conditions. Reference Accuracy) accuracy includes the combined conformity, hysteresis, and repeatability errors.





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### **AMBIENT CONDITIONS**

Conditions (temperature, humidity, pressure, etc.) of the medium surrounding the device.

### **CALIBRATION**

The comparison of outputs against standard inputs.

### **DAMPING**

The progressive reduction or suppression of the oscillation of a system.

Note: When the time response to an abrupt stimulus is as fast as possible without overshoot the response is said to be “critically damped”, “under damped” when overshoot occurs; “over damped” when response is slower than critical.

### **DRIFT**

A random change in output-input relationship over a period of time.

### **EMI**

Electromagnetic Interference. Electrical disturbances which propagate into electronic and electrical circuits and cause deviations from the normally expected performance. The frequency range of the disturbance covers the entire electromagnetic spectrum.

### **ERROR**

The algebraic difference between the indication and the true value of the measured signal. It is the quantity which algebraically subtracted from the indication gives the true value.

### **EXPERT SYSTEM**

A computer program emulating the performance of an expert by providing advice, making decisions, or offering appropriate selections. An expert system usually consists of a knowledge base of specific rules, facts, and heuristics (rules of thumb) and an inference procedures for using the knowledge base to solve a problem.

Man-machine interactive systems with specialized problem solving expertise. The two main elements of an expert system are its knowledge base, which contains the domain knowledge for the problem area being addressed, and the inference engine, which contains the general problem solving knowledge.

### **FIRMWARE**

A computer program or software stored in PROM or ROM permanently or semipermanently in EPROM.

### **FREQUENCY RESPONSE**

The range of frequencies over which the output will follow the sinusoidally varying input within specified limits.

### **HYSTERESIS**

The maximum difference for the same input between the upscale and downscale output values during a full range transverse in each direction.

### **LATCH-IN RELAY**

A relay that maintains its contacts in the last position assumed, without coil power.

### **LINEARITY**

The closeness to which a curve approximates a straight line.

Note 1: It is usually measured as a nonlinearity and expressed as linearity; a maximum deviation between an average curve and a straight line. The average curve is determined after making two or more full range traverses in each direction. The value of linearity is referred to the output unless otherwise stated.

Note 2: As a performance specification linearity should be expressed as independent, terminal-based or zero-based linearity. When expressed simply as linearity, it is assumed to be independent linearity.

### **INDEPENDENT LINEARITY**

The maximum deviation of the actual characteristics (average of upscale and downscale readings) from a straight line so positioned as to minimize the maximum deviation.

### **TERMINAL BASED LINEARITY**

The maximum deviation of the actual characteristic (average of upscale and downscale readings) from a straight line coinciding with the actual characteristic at the upper and lower range values.

### **ZERO BASED LINEARITY**

The maximum deviation of the actual characteristic (average of upscale and downscale readings) from a straight line so positioned as to coincide with the actual characteristic at the lower range value, and to minimize the maximum deviation.

### **NATURAL FREQUENCY**

The frequency of free oscillations.

### **MNEMONIC CODE**

Instruction for the computer written in a form that is easy for the programmer to remember.



## Glossary of Technical Terms for Process Weighing

### **NONVOLATILE MEMORY**

A type of computer memory offering preservation of data storage during power loss or shutdown.

### **OPERATING CONDITIONS**

Conditions (ambient temperature, pressure, vibration etc.) to which a device is subjected, but not including the variables measured by the device.

### **NORMAL OPERATING CONDITIONS**

The range of operating conditions within which a device is designed to operate and under which operating influences are usually stated.

### **REFERENCE OPERATING CONDITIONS**

The range of operating conditions of a device within which operating influences are negligible.

### **OPERATIVE LIMITS**

The range of operating conditions to which a device may be subjected without permanent impairment of operating characteristics.

### **OVERRANGE**

Any excess value of the input signal above its upper range value or below its lower range value.

### **POWER CONSUMPTION**

The maximum wattage used by a device within its operating range during steady state signal condition.

### **PROGRAM**

A complete sequence of computer instructions necessary to perform a specific action.

### **RANGE**

The region between the limits within which a quantity is measured, received, or transmitted, expressed by stating the lower and upper range values.

### **LOWER RANGE VALUE**

The lowest quantity that a device is adjusted to measure.

### **UPPER RANGE VALUE**

The highest quantity that a device is adjusted to measure.

### **REFERENCE STANDARD**

A measuring device whose characteristics are precisely known in relation to a primary standard.

### **REPEATABILITY**

The closeness of agreement among a number of consecutive

measurements of the output for the same value of the input under the same operating conditions, approaching from the same direction, for full range traverses.

### **REPRODUCIBILITY**

The closeness of agreement among repeated measurements of the outputs for the same value of input made under the same operating conditions over a period of time, approaching from both directions.

### **RESOLUTION**

The smallest change in input which produces a detectable change in the output signal. The degree to which equal values of a quantity can be discriminated by the device.

### **SENSITIVITY**

The ratio of a change in output magnitude to the change of input which causes it after steady state has been reached.

### **SETPOINT**

In a feedback control loop, the point which determines the desired value of the quantity being controlled.

### **SIGNAL/NOISE RATIO**

Ratio of signal amplitude to noise amplitude. Sinusoidal signals amplitude may be peak or rms. Non-sinusoidal signals are peak values.

### **SHOCK**

The momentary application of an acceleration force to a device. It is usually expressed in units of gravity.

### **SOFTWARE**

A computer program or set of programs held in some kind of storage medium and loaded into read write memory (RAM) for execution.

### **SPAN**

The algebraic difference between the upper and lower range values. The algebraic difference of the transducers zero and full scale values.

### **STABILITY**

The property of a system which does not undergo any change without the application of an external influence.

### **TOLERANCE**

A magnitude defining the limit of allowable error or departure from the true value.

### **TRACEABILITY**

The step-by-step transfer process by which the calibration can be related to primary standards.



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### TRANSDUCER

An element or device which receives information in the form of one physical quantity and converts it to information in the form of the same or other physical quantity.

### TRANSMITTER

A transducer which responds to a measured variable by means of a sensing element and converts it to a standardized transmission signal which is a function of the measurement.

### TRANSIENT

A pulse, damped oscillation, or other temporary phenomenon occurring in a system prior to reaching a steady state condition.

### VOLATILE MEMORY

Refers to a read/write memory whose content is lost when operating power is removed.

### WARM-UP

The time required after energizing a device before its rated performance characteristics apply.

### Load Cell Glossary

### COMBINED ERROR

[Non-Linearity and Hysteresis]. The maximum deviation from a straight line drawn between the original no-load and rated load outputs expressed as a percentage of the rated output and measured on both increasing and decreasing loads.

### CREEP

[Load Cell] The change in load cell output occurring with time while under load and with all environmental conditions and other variables remaining constant. It is usually measured with rated load applied and expressed as a percent of rated output over a specific period of time.

### DEAD LOAD

A non-varying or static load (weight).

### DEFLECTION

[Load Cell] The displacement along the primary axis of the load cell between no-load and rated load

### DRIBBLE

A setpoint function used to control the slow feed of material.

### EXCITATION VOLTAGE

The voltage applied to the input terminals of an electrical bridge circuit.

### GROSS WEIGHT

The weight of a quantity of material including the container, wrapping, etc. which contain the material. The weight of a vehicle or container when it is loaded with goods.

### GROSS WEIGHT-IN

A weighing mode in which the setpoint references the total weight of the vessel contents while controlling the delivery of material to the vessel.

### GROSS WEIGHT-OUT

A weighing mode in which the setpoint references the total weight of the vessel contents while controlling the removal of material from the vessel.

### HEEL

An amount of material remaining in the vessel after the “dump” or empty cycle is completed.

### HEEL LIMIT

An internally programmable weight setting which establishes the maximum allowable weight.

### IN-FLIGHT

Material which continues to enter a weigh vessel after valve closure.

### LIVE LOAD

A moving load or a load of variable force acting upon a structure in addition to its own weight.

### LOAD

The weight or force applied to the load cell.

### SAFE MAXIMUM LOAD

The maximum load in percent of rated capacity which can be applied without producing a permanent shift in performance characteristics beyond those specified.

### ULTIMATE MAXIMUM LOAD

The maximum load in percent of rated capacity which can be applied without producing a structural failure.

### LOAD CELL

A device which produces an output signal proportional to the applied weight or force.



## Glossary of Technical Terms for Process Weighing

### NET BATCH-OUT

A weighing mode in which the assigned setpoint is used to control the withdrawal of specific quantity of material from the vessel.

### NET WEIGHT

The weight of a quantity of material exclusive of its container, wrapping, etc.

### NET WEIGH-IN

A weighing mode in which the setpoint used to control a process material entering the weigh vessel starts its reference at a zero weight level whether or not there is weight already in the vessel.

### NON-LINEARITY

Terminal based. The maximum deviation of the calibration curve from a straight line drawn between the no-load and rated load outputs expressed as a percentage of the rated output and measured on increasing load only.

### PRIMARY AXIS

The axis along which the load cell is designed to be loaded; normally its geometric center line.

### RATED CAPACITY

The maximum axial load the load cell is designed to measure within its specifications.

### RATED OUTPUT

The algebraic difference between the outputs at no load and rated load.

### SHUNT CALIBRATION

Electrical simulation of load cell output by insertion of known shunt resistors between appropriate points within the circuitry.

### SIDE LOAD

Any load acting 90 degrees to the primary axis at the point of axial load applications.

### TARE

The weight of an empty container, or the allowance or deduction from gross weight. The action of adjusting out the known weight of the container from total indicated weight so that the indicator reads net weight directly.

### TEMPERATURE EFFECT ON RATED OUTPUT

The change in rated output due to a change in ambient temperature. It is usually expressed as the percentage

change in rated output per 100 degree F change in ambient temperature.

### TEMPERATURE EFFECT ON ZERO BALANCE

The change in zero balance due to a change in ambient temperature. It is usually expressed as the change in zero balance in percent of rated output per 100 degree F change in ambient temperature.

### COMPENSATED RANGE

The range of temperature over which the load cell is compensated to maintain rated output and zero balance within specific limits.

### SAFE RANGE

The extremes of temperature within which the load cell will operate without permanent adverse change to any of its performance characteristics.

### ZERO BALANCE

Load Cell. The output signal of a load cell with rated excitation and with no load applied. It is usually expressed in percent of rated output.

### ZERO FLOAT

The zero shift caused by one complete cycle of successive rated tensile and compressive loadings.

### ZERO RETURN

The difference in zero balance measured immediately before rated load application of specified duration and measured after removal of the load and when the output has stabilized.

### ZERO SHIFT

A change in zero balance.

### ZERO STABILITY

The degree to which a device maintains its zero balance with all environmental conditions and other variable remaining constant.

## Interface Concepts

### PROTOCOL

Communication between computers is accomplished by encoding data as a series of ones and zeros. As with any encoded message, both the sender and the receiver must understand the coding method. In computer communications this form of encoding is known as a communications protocol.



## Glossary of Technical Terms for Process Weighing

### **BINARY DATA ENCODING**

Computer data streams are nothing more than a sequence of electrical high and low voltage (or current) levels representing two distinct states (1's and 0's). A single eight-bit sequence of ones and zeros can produce any number from 0 - 255 ( $2^8$ ). Computer engineers assigned these 256 binary values to a corresponding character set. The character set includes all of the letters and numbers, punctuation, and a variety of control characters. As a result, every time a computer receives a binary 01000010 (decimal 66, hex 42), it interprets it as the character B. Similarly every time a computer receives a binary 00110001 (decimal 49, hex 31) it interprets it as the number 1.

There are more than one of these code sets, but the most common is ASCII, (American Standard Code for Information Interchange. EBCDIC (Extended Binary Coded Decimal Interchange Code) has been used widely in IBM applications. Baudot and transcode are leftovers from ticker tape and Telex applications.

Accustomed to reading numbers in base 10 or decimal notation (0, 1, 2, 3, 4, 5, 6, 7, 8, 9), most people find base 2 or binary notation (0 or 1) of an eight bit string (required to generate 256 unique characters) difficult to read. So we usually look at the numeric representation of a character (letters, numerical values, punctuation marks, etc.) in base 16 or hexadecimal notation (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F). Refer to the ASCII table to view character equivalents in binary, decimal, octal notation.

### **BIT PROTOCOL (Bit Synchronous)**

Bit Protocol were developed before the availability of high quality telephone lines and UART (Universal Asynchronous Receiver Transmitter) devices. UARTs automatically format data in a predefined, universally accepted packet which includes start and stop bits. Without the benefit of UARTs, protocol designers were forced to implement serial communications using discrete hardware components and custom serial bit streams. Bit oriented protocols simply arrange the series of ones and zeros (bits) in a continuous stream. The data is organized in a defined pattern with the various types of data grouped together. Since these serial bit stream formats were custom designed by each manufacturer, many different formats evolved and currently exist.

The major disadvantages of bit protocols are that a non-standard serial port is required, and their complexity makes them more difficult to understand and interpret.

### **BYTE PROTOCOLS**

The development of UARTs has resulted in use of byte

oriented protocols rather than bit synchronous. A byte of data is a group of bits with a specific meaning e.g. unit address, integer data, etc. As a result, generally more bits are transmitted for each piece of data when compared to a bit synchronous protocol. When used in combination with higher data rates supported by modern telephone lines, they provide acceptable throughput. The main advantage is that the byte protocols are simple and therefore easier to understand and maintain. The only disadvantage is that they are less efficient than bit synchronous protocols, and are best suited to data transmission rates of 1200 bauds and higher. As UARTs are now the most common serial interface, byte protocols are the de-facto standard, and the goal of the system designer is to maintain the throughput of bit synchronous protocols using byte format.

### **SERIAL ASYNCHRONOUS DATA TRANSMISSION**

In serial communication information is transferred one data bit at a time between two computing devices. The flow of this data can follow one of three transmission modes; simplex, half duplex, or full duplex.

1. Simplex allows data flow in only one direction.
2. Half duplex allows data flow in both directions (but not simultaneously)
3. Full duplex allows data flow in both directions simultaneously.

### **DATA FRAME**

Within the asynchronous data stream, each character of data is transmitted in a binary bit frame. Each frame begins with a start bit. A low level voltage signals the beginning of the start bit and the receiving device then begins looking for 1's and 0's. The following five to eight data bits (the number depends of the code used) define the binary character.

For error detection, an optional parity bit can identify whether the total of 1's and 0's was odd or even. Parity bits are used to trap transmission errors. When the transmitting devices frames a character, it counts the number of 1's and 0's within the frame and then attaches a parity bit to make the total count odd or even. If the receiving device detects a discrepancy, it can flag the data and request a re-transmission.

A stop bit signals the end of the character. Stops bits may be one or two where two is required for slower transmission speeds.



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### ASYNCHRONOUS LINK CONTROL

Each end of the link has to conform to certain operating parameters in order for flow to occur without loss of data.

The first parameter is the rate of transmission. Serial data transmission is measured in bit per second (bps). Typical rates are 110, 300, 600, 1200, 2400, 4800 and 9600. In order for two computing devices to interact, both must be operating (transmitting or receiving data) at the same baud rate, or there must be an intermediate memory device (buffer) that accommodates the difference in speed.

In addition to transmit and receive buffers, most serial links use a flow control system to handle data transmission. A common serial flow control is X-ON/X-OFF. When a receive buffer reaches its memory capacity, the receiving device sends an ASCII DC3 (X-OFF) signal to the transmitting device telling it to stop sending data. When the receive buffer has sufficiently unloaded, it transmits an ASCII DC1 (X-ON) signal back to the transmitting device telling it to continue transmission.

Other flow controls commonly used in asynchronous communications are lead control and the ENQ/ACK protocol. A lead control protocol controls data flow by alternately raising and lowering the voltage on a lead of the RS232 interface. DTR (pin 20) and CTS (pin 5) are often used. When a pin's voltage is high, data flow is enabled; when it drops low, data flow is disabled.

ENQ/ACK is a block oriented protocol (protocol that sends a fixed amount of characters every time it transmits). Typically, the transmitting device sends an ENQ character and waits for an ACK character from the receiving device before beginning transmission. Once the ACK character is received, the entire block is transmitted. When the block transmission is complete, the transmitting device once again begins polling the receiving device with ENQ characters.

### SYNCHRONOUS DATA TRANSMISSION

In Synchronous Data Transmission, special characters synchronize the transmitting and receiving elements of the link without the overhead associated with start and stop bits in asynchronous communication.

Synchronous protocols fall into two major categories:

1. Byte-oriented (character) protocols that specify a definite character length.
2. Bit-oriented protocols that do not specify character boundaries.

Binary Synchronous Communication (Bisynchronous

or BSC) is one of the most common character oriented protocols. Bisynchronous uses a set of special characters to define the structure of the data transmission frame. At the start of each block of data are PAD and SYN characters which signal the start of a frame and allow the receiving station to synchronize with the transmitting station clock.

### BiSync HEX

Characters	Value	Description
SYN	32	Synchronous Idle
PAD	55	Start of frame pad
PAD	FF	End of frame pad
DLE	10	Data line escape
ENQ	2D	Enquiry
SOH	01	Start of heading
STX	02	Start of text
ITB	1F	End of intermediate block
ETB	26	End of transmission block
ETX	03	End of text

Synchronous Data Link Control (SDLC) typifies the second type of synchronous protocol, namely, the bit oriented protocol. Instead of using a control character set as does bisynchronous, SDLC uses a variety of bit patterns to flag the beginning and end of a frame. Other bit patterns are used for the address, control and packet header fields which route the frame through a network to its destination.

### CENTRONICS PARALLEL INTERFACE

The Centronics Parallel Interface is a 36 pin, byte-wide interface that has become a widely accepted standard for computer-to-printer communications. The interface has eight lines which carry their respective binary bits in parallel. The transmission of these data bits is controlled by the computer supplied STROBE pulse. Flow control (handshaking) is achieved by asserting or de-asserting either the ACK or BUSY leads or both. All Centronics Parallel logic levels are TTL (Transistor Transistor Logic).

### RS-232 and RS-449 INTERFACES

RS-232 is an Electronic Industries Association (EIA) standard, applicable to the 25-pin interconnection of Data Terminal Equipment (DTE) and Data Communication Equipment (DCE) devices that use the serial binary data interchange.

RS-449 is an Electronic Industries Association (EIA) standard, applicable to the 37 pin and 9 pin interconnection



## Glossary of Technical Terms for Process Weighing

of Data Terminal Equipment (DTE) and Data Communication Equipment (DCE) devices that use the serial binary data interchange.

Both of these standards have been widely accepted in the field of computer and data communications.

### **IEEE-488 PROGRAMMABLE INTERFACE**

The IEEE-488 standard defines the digital interface for programmable instrumentation. The interface transmits data in a byte-serial, bit-parallel fashion among a group of instruments and system components. The protocol was originally promoted by Hewlett Packard for linking laboratory instrumentation and was frequently referred to as the HP-GIB Bus.

### **MODBUS**

When considering available byte protocols for SCADA (Supervisory Control and Data Acquisitions), MODBUS RTU has been a popular choice because of its wide acceptability and the fact that it is designed for use between master and multi-drop slaves. The protocol overhead of

MODBUS in acquiring data is small, requiring a single poll/response transaction for a block read function. The main disadvantage often cited is the requirement to do multiple register reads from multiple data areas to acquire all the data from a single RTU (Remote Terminal Unit). This is because MODBUS maps different types of I/O in separate data areas. The standard MODBUS read command allows 255 bytes to be recovered in a single read.

### **PERFORMANCE**

The rate of data transmission in a system is important because most systems have many transactions on a single communication line. Time taken to scan the total system is a simple addition of the time taken for each unit. To calculate the total time required to acquire the data from each device, the following must be considered; line turn-around time, data transmission rate, number of transactions per device and the size of each transaction. Since line and turn-around and transmission rate are constant, regardless of the protocol, the relative efficiency of protocols is determined by the number of transactions and size of data packets for each transaction.



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