

Common Terms Used in the
Switching and Electronics Industry

AFV/Audio-Follow-Video - A control mode in a routing switcher (switching array) in which the audio inputs associated with a video input are automatically selected when the video source is selected. That is, audio and video are always switched together. See Breakaway. Audio may be either single channel or multi-channel (stereo).

ASCII - American Standard Code for Information Interchange. A 7-bit binary code representing the English alphabet, decimal numbers and common punctuation marks. Also includes "control characters" such as Carriage Return or End of Text. An 8-bit superset of the standard ASCII codes is often used today to include foreign characters and other symbols. These supersets are often called Extended ASCII Character Sets.

Active Video - The portion of a video signal that contains the visible picture information.

BNC - A type of coaxial connector used in situations requiring shielded cable for signal connections and/or controlled impedance applications.

BPS - The amount of binary data sent in bits per second. Not to be confused with baud rate. Modern data and fax modems, for example, transmit at 14,400 bits per second using a baud rate of 2,400 baud. This is accomplished by complex encoding methods. Also used as a general term to define any rate that digital data flows (see Mbps).

Balanced Input - A differential input circuit pair with equal impedance to ground on each side. See Differential Input. The advantages as opposed to single-ended transmission are noise rejection over long distances of cabling.

Balanced Output - A differential output circuit pair with equal source impedance on each side. See Differential Output.

Bandwidth - The measure of a circuit's ability to pass a full amplitude signal over a range of signal frequencies. Normally measured between the point or points where the signal amplitude falls to -3dB below the passband frequency.

Baseband - An unmodulated signal or band of signals. The video signal seen on a waveform monitor is a baseband video signal.

Baud Rate - The signaling or symbol rate of a digital transmission path or device. A symbol can represent more than one bit of information, depending on the encoding or modulation scheme used to create the symbol. Often used interchangeably with bits per second (BPS), although incorrectly. See BPS.

Blanking/Blanking Interval - The period of time when a television monitor is "blanked" while the electron beam retraces from right to left or bottom to top. In a baseband video signal, the intervals between active video lines and between the last active line in a field and the first active line in the next. Ideally, a video switcher would sense when a blanking period occurs and would switch the video signal during this time. This prevents any visually unpleasant video effects on a monitor. This requires the video switcher to actively monitor each of the user's video sources.

Blocking - A term with multiple and conflicting industry usage. 1) May be used to express the inability to connect a single input of a switching array to multiple outputs simultaneously without any input loading or mismatches. If multiple outputs are connected to a given input, proportional input loading will occur. 2) In multi-stage switching arrays (tri-stage or 3-stage), it refers to the possibility that the user may not be able to route an input to an output at all times (blocking due to unavailable middle stages). See Non-Blocking. It is possible that even if blocking occurs, the switching array may be able to be reinitialized in a logical order to avoid the blocking connection conditions.

Breakaway - A routing control mode wherein an audio source can be selected independently of the video source and vice versa. See AFV/Audio-Follow-Video.

Break-Before-Make - Disconnecting the present circuit before connecting a new circuit. Also known as Break/Make.

Byte - A grouping of 8 binary bits is called a byte.

Carry Current - See Cold Switching.

Channel Crosstalk - Coupling of a signal from one channel to another or any other output by conduction or radiation. Crosstalk is expressed in decibels (dB) at a specified load impedance and over a specific frequency range or ranges.

See Crosstalk Isolation.

Coaxial Cable - A cable that has one conductor (shield) completely surrounding the other (center conductor), the two being coaxial and separated by an insulator. Standard industry types have a braided shield, or a semi-rigid copper or stainless steel shield material. Braided shield coaxial cable offers more physical flexibility but less shielding.

Cold Switching - Closing the relay contacts before applying voltage and current, plus removing voltage and current before opening the contacts. (Contacts do not make or break current.) Also see Dry Circuit Switching. Larger currents may be carried through the contacts without damage to the contact area since contacts will not "arc" when closed or opened.

Common Mode Rejection - The ability of a differential input circuit to reject a signal common to both inputs, normally "hum" developed by 50 or 60 Hz power line (mains) voltages.

Common Mode Rejection Ratio (CMRR) - A measure in decibels of the effectiveness of a circuit in rejecting a common mode voltage.

Common Mode Voltage - The voltage common to both sides of a differential circuit pair. The differential voltage across the circuit pair is the desired signal, whereas the common voltage signal is the unwanted signal which may have been coupled into the transmission pair.

Component Video - A three-channel video signal wherein the luminance, hue and color saturation information are carried as R, G and B (Red, Green and Blue) signals or as one of several variations of color difference signals.

Composite Video - A single video signal carrying combined luminance, chrominance and raster synchronizing information.

Contact Bounce - The intermittent and usually undesired opening of mechanical relay contacts during closure, or closing of contacts during opening. Contact bounce period depends upon the type of relay and varies from .5mS for small reed relays to 10-20mS for larger solenoid types. Solid-state or mercury wetted contacts (Hg) do not have a contact bounce characteristic.

Contact Life - The maximum number of expected closures before failure. Life is dependent on the switched voltage, current, and power. Failure is usually when the contact resistance exceeds an end of life value. Typical failure mode is non-closure of the contact as opposed to a contact sticking closed.

Contact Potential - A voltage produced between contact terminals due to the temperature gradient across the relay contacts, and the reed-to-terminal junctions of dissimilar metals. (The temperature gradient is typically caused by the power dissipated by the energized coil.) Also known as contact offset voltage, thermal EMF, and thermal offset. This is a major consideration when measuring voltages in the microvolt range. There are special low thermal relay contacts available to address this need. Special contacts are not required if the relay is closed for a short period of time where the coil has no time to vary the temperature of the contact or connecting materials (welds or leads).

Contact Rating - The voltage, current, and power capacities of relay contacts under specified environmental conditions. See Carry Current and Switched Current.

Contact Resistance - The resistance in ohms or milliohms across closed contacts. Also see Path Resistance.

Crosspoint Switch - A switch which, when closed, connects the signal on an input bus to one or more output buses. Also referred to as a matrix switch or switching array.

Crosstalk/Crosstalk Isolation - Unwanted interference in an output resulting from other input and output signals, measured in dB below the nominal signal level, and is expressed in decibels (dB) at a specified load impedance and over a specific frequency range or ranges. Also referred to as All Hostile or Hostile Crosstalk. See Channel Isolation.

Current Surge Limiting - The circuitry necessary to protect relay contacts from excessive and possibly damaging current caused by capacitive loads.

Daisy Chaining - The serial control connection of two or more mainframes in a master/slave(s) configuration. Also, some switching modules or cards can be daisy-chained to yield more inputs. This term is also used in reference to control panels daisy chaining (looping) from control panel to control panel to the final destination, the switching system.

Decibels (dB) - The logarithmic ratio between two signal levels. In video and audio, it is normally defined as: $dB=20 \log_{10}(V2/V1)$

Destination - The equipment connected to the output of a routing switcher, crosspoint switch or switching array. Used when defining the size of a switching array, the user must specify how many sources and destination there are in the system. See Source.

Differential Gain - Unwanted variations in a video signal's chrominance sub-carrier's amplitude that result from changes in the signal's DC level, usually specified between 10% and 90% of full scale. Expressed in a percentage, or a fraction of a percentage.

Differential Input - An input circuit that actively responds to the difference between two terminals rather than the difference between one terminal and ground. Often associated with balanced input circuitry, but also may be used with an unbalanced source.

Differential Phase - Unwanted variations in a subcarrier's phase as a result of changes in the chrominance signal's DC level, usually specified between 10% and 90% of full scale. Expressed in degrees, or fractions or a degree.

Differential Output - An output circuit where the output voltage appears between two active output terminals rather than between one terminal and ground. Normally associated with balanced circuitry. See Differential Input.

Dry Circuit Switching - Switching below specified levels of voltage and current to minimize any physical and electrical changes in the contact junction. Also see Cold Switching.

Dry Reed Relay - A glass enclosed, hermetically sealed, magnetically actuated contact. No mercury or other wetting material is used. Typical atmosphere inside the glass enclosure is nitrogen.

DUT - Abbreviation for Device Under Test. See UUT.

ECL Logic - Abbreviation for Emitter Coupled Logic, a very high speed digital technology.

Electromechanical Effects - A relay that uses an electromagnet to move an armature thereby actuating current.

EMI - Abbreviation for Electromagnetic Interference. A term that defines unwanted electromagnetic radiation from a device which could interfere with desired signals in test or communication equipment. RFI (Radio Frequency Interference) and EMI are often used interchangeably.

Equalization - Selective amplification (signal restoration) applied to a signal in order to compensate for high frequency attenuation and other distortions encountered in long lengths of cable.

F-Type Connector - A threaded medium performance coaxial signal connector typically used in consumer applications (TV's and VCR's). This connector is typically usable as high as 1GHz. It is inexpensive since the pin of the connector is actually the center conductor of the coaxial cable.

Failsafe - In terms of relay technology, when power is lost, the relay contacts fall back to a default position.

Floating - The condition where a common mode voltage exists, or may exist between earth ground and the instrument or circuit of interest. Low side of circuit is not at earth potential.

Full Fanout - See Non-Blocking

Hostile Crosstalk - See Crosstalk.

Hostile Input - An unselected input carrying a signal which causes unwanted interference and coupling in a desired output. See Crosstalk.

Input Bus - A circuit path on the input side of a switching array which connects to the inputs of one or more crosspoint switches. Each input connector leads to an input bus.

Insertion Loss - The attenuation of signals due to routing them through a switching module or system. Specified as a decibel value (dB) over a frequency range. Loss could be due to the resistive, inductive or capacitive features of the signal path, or a combination of all of these.

Insulation Resistance - The ohmic resistance of insulation. It degrades quickly as humidity increases. Lower insulation resistance provides a path for leakage current to ground. This is very critical when making measurements on semiconductor components where picoamp measurements are being made.

K-Type Connector - A small type of threaded coaxial signal connector typically used in higher frequency applications. This connector is typically usable as high as 40GHz. It may be mated by an SMA connector with much lower performance.

Latching - In relay or switching technology, this refers to the ability to keep the contact status in place even if power is removed from the equipment.

Leakage Current - Error current that can degrade sensitive measurements. Even high resistance paths between low current conductors and nearby voltage sources can generate significant leakage currents. Leakage in insulating material, micro-contamination on insulating surfaces, and moisture (humidity) can have catastrophic effects on picoamp and sub-picoamp (femtoamp) measurements.

Looping Input - An input which passes a video signal in and out of a device without terminating the cable or affecting the signal quality. Looping inputs use two connectors normally wired together with no active components between them. If the looping feature is not used, a 75 ohm terminator should be placed on the second connector, or a provision for switching in a 75 ohm termination internally.

Low Thermal - See Contact Potential

Mbps - Megabits per second (millions of bits per second). A measure of digital data transmission rate.

Mainframe - A unit which accepts modules and/or cards. Typically in Universal Switching's equipment, the Mainframe unit provides control and power to the modules installed.

Master / Master Mainframe - A mainframe that has control of other mainframes (slaves) in a serial chain. A master/slave combination has one bus address and appears as one mainframe with increased capacity.

Matrix - An arrangement of signal circuits in which input buses are represented by parallel vertical lines and output buses as overlapping horizontal lines (or visa versa), forming a grid-like array. Crosspoint switches at each crossing point connect inputs to outputs. Also referred to as a switching array, or crosspoint switch.

Mercury Wetted Relay - A reed relay in which the contacts are wetted by a film of mercury (Hg). Usually has a required operating position to avoid liquid mercury from shorting the contacts; other types are position insensitive. This type of relay is usually higher power and longer life, but at a higher dollar cost. Another benefit of this type of contact is the repeatability of contact resistance and virtually no contact bounce.

MTBF - An abbreviation of Mean Time Between Failure, a theoretical period of time between failures in equipment based on stresses in environment, temperature, levels of quality and other parameters.

MTR - An abbreviation for Mean Time To Repair, a theoretical period of time need to repair a piece of equipment given certain circumstances.

Multiplexer - Being able to connect a single sources to any multiple destinations (one at a time), or the opposite. Also referred to as a Scanner.

N-Type Connector - A larger threaded coaxial connector with high power handling and good high frequency characteristics. Typically usable to 12.5GHz, but some manufacturers offer connectors usable to 18GHz.

Non-Blocking - A term with multiple and conflicting industry usage. 1) May be used to express the ability to connect a single input of a switching array to multiple outputs simultaneously without any input loading or mismatches. This usually results in a constant signal loss because of the use of power dividers (signal splitters) to configure the non-blocking switching array. Non-

Noise - Any unwanted electronic signal, or an unwanted audible sound (from fans or cooling devices).

Nyquist Frequency - If an analog signal is sampled at a rate more than twice that of its highest frequency component, it can be properly reconstructed when reconverted back to the analog domain. The required sampling rate is called the Nyquist frequency. Conversely, the analog bandwidth required to accurately transmit a properly reconstructed sampled image is one half the image sample (pixel clock) rate. See Wideband.

Output Bus - An output circuit path leading from the output(s) of one or more crosspoint switches arranged in a crosspoint switching array. Typically, only one crosspoint switch at a time can feed a signal to an output bus. Each output connector is fed from an output bus.

Path Resistance - The resistance of a complete signal path, including the switching element's contact resistance, any PC board circuit resistance and connector terminal resistance and or cabling. Also see Contact Resistance.

Piezoelectric Currents - The current caused by mechanical stress to the insulating materials or connectors. To minimize this problem in low current or voltage measurements, the stress must be removed from the insulators, and materials with a low piezoelectric effect must be used.

Propagation Delay - The specified amount of time for a signal to pass through a previously closed signal path. The delay must be considered, for example, when the signal is used to synchronize other signals, or is being used in a Clock / Data configuration. This is due to both the electrical length of the signal path, and any active components in the signal path.

RGB - A three-component video signal in which all the colors in a scene or image are conveyed as three primary colors (Red, Green and Blue) on three separate channels. Some times, the Green signal also carries the Sync information as well. Many high resolution video monitors have RGB inputs.

RS-232 - An asynchronous serial data interchange standard. RS-232 links between equipment are normally limited to 50 feet (16 meters). Also referred to as RS-232C (most popular revision).

RS-422 - A more robust serial digital data interchange standard utilizing individual differential signal pairs for data transmission in each direction. Depending on data transmission rates, RS-422 can be used at distances to 4,000 feet (1,275 meters). Also referred to as RS-422A (the most popular revision).

RS-485 - A very robust serial data interchange standard. An RS-485 communications channel is a party-line (multi-drop) digital signal and, like RS-422, is balanced. It is very immune to interference, making it more reliable in demanding environments. It is usable at distances of 4,000 feet and beyond.

Redundant Power Supply - A second power supply circuit sometimes specified for systems used in critical applications. Redundancy is useful where unexpected power failures can cause a major system to fail, often at great expense. Redundant power supplies could be fed from different AC power (mains) circuits for maximum system reliability. Power supplies are usually "diode or'ed" and should be hot swappable.

Relay - An electrically controlled mechanical device that opens and closes electrical contacts when a voltage (or current) is applied to a coil. A relay provides isolation of control signals from switched signals.

Return Loss - A measure of the undesirable signal reflections from an imperfectly-terminated transmission line. Expressed in dB. Also see VSWR.

SMA - A small type of threaded coaxial signal connector typically used in higher frequency applications. This connector is typically usable to 26GHz.

Self-Terminating - A switching configuration which automatically terminates a signal path when it is not connected to any other signal path. It is usually most important to terminate unused inputs to a unit to assist in reducing noise and improve crosstalk isolation.

Settle Time - The time required for establishing relay connections and stabilizing user circuits. For relay contacts, this includes contact bounce.

Shielding - A metal enclosure or gasket for a circuit, or a metal shield surrounding wire conductors (coaxial or triaxial cable) to lessen interference, interaction, or current leakage. The shield is usually grounded.

Single-Ended Input - A circuit that responds to the voltage on one input terminal and ground. See Differential Input.

Single-Ended Output - A circuit whose output is developed between one output terminal and ground. See Differential Output.

Slave - A mainframe that is serially connected to a controlling mainframe (master). The slave is controlled from a master. See Master / Master Mainframe.

SMB / SMC - Types of small coaxial signal connectors typically used in high frequency applications. SMC threads to the mating connector while the SMB "snaps" to the mating connector.

Solid State Relay - A relay that switches electric circuits by use of semiconductor elements without moving parts or conventional contacts.

Source - The equipment providing a signal to the input of a routing switcher, crosspoint switch, or switching array. See Destination.

Switched Current - The maximum current level that can be reliably handled while opening and closing contacts. Also see Carry Current.

Sync - A abbreviation for synchronizing, as in synchronizing pulses. The timing pulses in a video signal which identify lines, fields and frames.

Sync-On-Green - An RGB signal format in which the sync information for all three channels is included on the green channel.

Syntax - The language "spoken" by devices communicating with each other.

Terminated/Termination/Terminator - An impedance used to terminate a transmission line. For example; cables used for video distribution should be terminated with a 75 ohm resistor (terminator) at the last connector on the receiving end if it is not already terminated internally.

Thermal EMF - See Contact Potential

TNC - A threaded type of BNC coaxial connector.

Triaxial Cable - A cable with three conductors: one conductor surrounded by an inner shield and an isolated outer shield. Generally, the inner shield is connected to a guard potential and the outer shield to signal LOW or ground.

Trigger - An external stimulus that initiates one or more instrument functions. Trigger stimuli include : a front panel button (TAKE), an external input voltage pulse.

TTL Logic - Abbreviation for Transistor-Transistor Logic, a very typical medium speed digital technology.

Twinaxial Cable - A cable with three conductors: one twisted pair of conductors surrounded by an outer shield.

UUT - An abbreviation for Unit Under test. Also see DUT (device Under Test).

Voltage Clamping - The circuitry necessary to protect relay or solid-state switching elements from excessive voltage. A possible source of this excessive voltage could be caused by switching current into inductive loads.

VSWR - Abbreviation for Voltage Standing Wave Ratio. The loss due to the mismatch introduced into the signal by the load or source signal path characteristics. Expressed as a ratio of the highest voltage to the lowest voltage found in the signal. Also expressed as Return Loss in dB. The Return Loss expression is the more modern term.

VXI - A newer electrical and mechanical standard (based on the VME standard, with Extensions for Instrumentation) mainly utilized in the ATE industry to assist different vendor's equipment to work together in a common control and packaging environment.

Wideband - 1) an adjective describing the characteristics of a communications circuit or channel that can carry a large quantity of information at a high rate. 2) In video applications, a circuit or system with sufficient bandwidth to convey very high resolution information in an image (video) signal. For reconstructed video images from a computer, the required bandwidth is half the pixel clock rate. See Nyquist Frequency