Technical terms used in data cable technology

ACR (Attenuation to Crosstalk Ratio)

The distance between the wanted signal and the interfering signal (ACR) is an important factor for the transmission quality.
To ensure a faultless transmission, the interfering signal caused by the crosstalk attenuation must be smaller by a certain factor.
This corresponds to the difference between the near end crosstalk attenuation (NEXT) and the attenuation of the link.
ACR [dB] = NEXT [dB] - a [dB]; (a = Attenuation)

ACR-F

A calculation that normalizes the results of a FEXT measurement, because it takes attenuation into account. It is derived by subtracting the attenuation of the interfering pair from the far end crosstalk (FEXT) that it has caused in the interfered pair.

Alien Crosstalk

Alien crosstalk (AXT) is electromagnetic noise that can occur in a cable that runs alongside one or more other signal-carrying cables. The term "alien" arises from the fact that this form of crosstalk occurs between different cables in a group or bundle, rather than between individual wires or circuits within a single cable.

Attenuation (signal attenuation, conductor attenuation)

The attenuation depends on the conductor resistance R' and the mutual capacitance C'.
The attenuation rises roughly to 50 MHz with the root of the frequency and increases linearly with the length.

Conductor Resistance (resistance per unit length R')

The resistance per unit length R' includes the losses in the metallic conductors.
The conductor dimensions, the conductor material and the temperature determine the DC resistance Ro.
Due to the skin effect the conductor resistance increases with frequency.
It behaves linearly with cable length.

Coupling Attenuation

This is the sum of the unsymmetrical attenuation of cable pairs and the shielding effectiveness/attenuation.

Technical terms used in data cable technology

Decibel [dB]

Decibel indicates the relation between the voltage of received signal (U_2) and transmitted signal (U_1). The result is a factor [dB].
The relation is defined:
U_2/U_1 [dB] = 20 $\log_{10}$ (U_2/U_1)

U_2/U_1 [dB]	Received signal [%]	U_2/U_1 [dB]	Received signal [%]
0.0	100 .0	4.0	63
0.1	98.8	20.0	10
0.2	97.7	40.0	1
0.9	90.1	60.0	0.1
1.0	89.3	80.0	0.01
2.0	79.4	100.0	0.001

De-embedded

The de-embedded testing method for connecting hardware and components provides combinations with all defined quality classes for the RJ45 connectors. The integrated parts are real category 6 which provides the possibility to create open "mix & match" cabling systems without compatibilitiy or test restrictions for the used patchcords, test adapters or active networking devices.

Dielectrical Constant (DK)

The Dielectrical constant is a material constant of the dielectric. The relative permittivity says how much bigger the capacity of the condenser becomes if instead of air the insulant is used as a dielectric. If the dielectrical constant is multiplied by the DK of the empty room, then the result is the DK of the dielectric.

Distributed Inductance L'

The distributed inductance consists of several parts. The outer inductance is determined by line geometry and the magnetic material qualities. It is frequency-independent. Since mainly non-ferromagnetic metals are used as conductor, it is also independent of the current intensity.
The inner inductance can be explained by the current flow and the magnetic fields connected with that in the conductor.
Due to the current superseding, L' disappears at high frequencies. For shielded, symmetrical cables the frequency dependent cover inductance as well as the inductance produced by proximity effect must be taken into account.

Distributed Leakage G'

It describes the insulation losses, the dielectric losses as well as the Corona losses between the wires.
Instead of the often strongly frequency dependent parameter G's the factor Q (Q=theta) indicates the loss factor.
The value of the loss factor depends on the insulant, the insulation design, the frequency and the temperature.
Q should be as small as possible and generally constant.

Technical terms used in data cable technology

DMD

DMD measurement (Differential Mode Delay). With DMD, a single laser light pulse excites a few modes equally within a multimode fibre (MMF) cable. These modes, or light pathways, then follow two or more different paths. These paths may be of different lengths and have different transmission delays as the light travels through the cable. With DMD, a distinct pulse propagating down the cable no longer remains a distinct pulse or, in extreme cases, can become two independent pulses. Strings of pulses tend to interfere with each other, making it difficult to recover data in a reliable fashion.

Lasers function at the baud rates and longer distances required for Gigabit Ethernet: The IEEE 802.3z Gigabit Ethernet Task Force has identified the DMD condition that occurs in certain circumstances with particular combinations of lasers and MMF cable. The resulting characteristics create an additional element of "jitter" that limits the reach of Gigabit Ethernet over MMF cable

Earth Unbalance

The measurement of the difference in the electrical performance of the individual wires of a pair to earth and to the screen. It corresponds to the difference between the capacitance of wire A to the screen and the capacitance of wire B to the screen. It influences the transmission characteristics of the cable.

EMC (Electro Magnetic Compatibility)

The ability for an electrical device to not influence other devices with its electromagnetic field and also to work satisfactorily within the electromagnetic fields of other devices.

FRNC, FR/LS0H or FRNC/LS0H

FR	= flame retardant
NC	= non corrosive - means no corrosive effect in the event of fire
LS	= low smoke - means low smoke emission in the event of fire
0H, ØH or ZH	= no halogen, zero halogen

Halogen free coating material

A halogen is a salt creator. Chlorine, bromine, fluorine and astat are listet in the periodic table of elements.
Cabel with a PVC (polyvinyl chloride) sheath are flame retardant (see > PVC).
Halogen-free sheath materials don't contain any halogens!
Therefore no corrosive gases are emitted from the cable in the event of a fire, the smoke emission is reduced to a minimum and fire propagation is avoided.

Technical terms used in data cable technology

Impedance Z_0 (wave impedance, characteristic wave impedance)

The impedance of a coduit represents the ratio of the voltage wave progressing in a direction to the current wave. Common values are 100, 120 and 150 ohm. For higher frequencies the impedance is the root over the ratio between the distributed inductance L' and the mutual capacitance C'. It is important that the impedance of the cable corresponds with the input/output impedance of the attached end device.

minEMBc

The minEMBc bandwidth (Minimum Calculated Effective Modal Bandwidth) is the newest, most flexible and most accurate method to determine the minimum laser bandwidth (high data rate capability of a fibre). Its results are more comprehensive than those of DMD mask measurement methods.
Both the minEMBc and the DMD measurement techniques were developed as part of the IEEE 802.3ae standard.
The minEMBc method is described in TIA/EIA 455-220A and IEC 60793-1-49 Ed. 2.0. Today, it is the only scaleable measurement technique recognised by international standards
Just as over-filled launch (OFL) bandwidth testing has demonstrated conformance for legacy applications and specifications, laser bandwidth test data provided by Datwyler MMF suppliers can be used to certify the requirements demanded by bandwidth hungry applications used today and in the future.

Mutual Capacitance (Distributed capacitance C')

This is the function of the line geometry (line ÷ line ÷ screen) and the dielectric constant (DK) of the insulation.
As long as the DK of the insulation is constant with frequency, the distributed capacitance is almost frequency-independent.
The mutual capacitance increases linearly with the cable length.

Network Theory

Every homogeneous line is defined by four parameters which refer to a unit length and are generally frequency-dependant. These are the resistance per unit length R' (conductor resistance) in ohm, the distributed inductance L' in Henry, the distributed capacitance C' (mutual capacitance) in Farad and the distributed leakage G' in Siemens.

NEXT, FEXT crosstalk attenuation

An interfering signal is induced by the field produced by a transmitted signal in one twisted pair on to a neighbouring twisted pair. The crosstalk is length-independent and becomes bigger with an increasing frequency.
The difference between the desired signal and the induced signal on the neighbouring twisted pair is described as crosstalk attenuation and is indicated in dB. We distinguish between NEXT = Near End Cross Talk and FEXT = Far End Cross Talk.

NVP (Nominal Phase Velocity of Propagation)

Corresponds to the reciprocal value of the speed of transmission a sinusoidal wave relative to the speed of light.
It is indicated in %c (c = speed of light). The NVP is primarily determined by the relative dielectricity constant of the wire coating. NVP is an approximate average value for the cable.

Technical terms used in data cable technology

OFL (Overfilled Launch Bandwidth)

Overfilled launch bandwidth (OFL BW) is a familiar metric that is now understood to correlate only with LED-based multimode applications (typical: up to 100 Mbit/s).
It is important to understand that OFL BW is never suitable for predicting laser performance.

PE

Polyethylene (PE) is a halogen-free synthetic material that burns easily.
By adding additives, PE can be made flame retardant and get low smoke characteristics.

PiMF

Pair in metal foil - description for a STP cable. Each pair is shielded with a metal foil of its own.

PoE / PoE Plus

Power over Ethernet is the transmission of DC voltage - maximum 15 W (PoE) or 30 W (PoE Plus) - over twisted pair data cables and data networks. The transmission of DC voltage takes place parallel to the transmission of Ethernet protocols in one and the same cable by using the spare wires.

PSACR-F

PSACR-F is the Power Sum Attenuation to Crosstalk Ratio. As with all crosstalk measurements (including ACR) there is also a Power Sum ELFEXT (PSELFEXT). These are calculated values expected for multi-pair simultaneous full duplex transmissions

PVC

Polyvinylchloride (PVC) is a synthetic material containing halogen (unlike Polyethylene). Halogens (salt creators) are chlorine, bromine, fluorine, iodine and astat.
By using additives like chlorine and fluorine PVC can be made flame-retardant and more resistant against outer influences.
PVC jacketed cables are flame-retardant. Synthetic materials containing halogen, form highly-poisonous gases in case of fire. When mixed with water these gases form harmful corrosive acids.

Technical terms used in data cable technology

Return Loss (RL)

The transmission performance of a data cable differs along the length of the cable. The reasons are tolerances caused by different dielectric constants for the insulation and unavoidable production differences along the cable's length.
Although they are so small this discontinuity in the cable construction causes reflections of voltage waves and current waves.
Results of these reflections are:

Reflection coefficient	=	Relation between transmitted (regular) and received (reflected) voltage wave or current wave at the discontinuity points
Reflow factor	=	Sum of all reflections having an effect on the beginning of the line (transmitted wave). This factor indicates the usefulness of a line
Return Loss (RL)	=	Logarithm of the reciprocal value of the reflow factor

A high Return Loss can only be reached by the highest production precision and by extremely little production tolerances (high homogeneity) and therefore is a quality characteristic.

RML (Restricted Mode Launch Bandwidth, RML BW)

RML Bandwidth test procedure is standardized in both TIA/EIA 455-204 (FPTP 204) and IEC 60793-1-41.
RML BW restricts an overfilled launch through a 23.5 micron patchcord, which in turn measures the bandwidth capability of a fiber's low and intermediate mode groups.
The resulting bandwidth measurement predicts laser performance for intermediate bandwidth systems (up to 850 MHz.km) in the same way – and with the same level of accuracy – as OFL BW predicts LED performance in legacy-bandwidth systems.

Skin Effect

The higher the signal frequency, the closer the current flows to the outside of the cable.
At high frequencies the current flows through the very outer molecules of the wire.

Transfer Impedance (Coupling resistance)

The Transfer Impedance is a main parameter for the quality of the screen and is frequency dependant.
The relation is between the voltage drop along the screen on the disturbed lengthways side (outer) to the interfering current on the other side (inside) of the screen.
The coupling resistance is determined by the construction of the screen, the skin effect and the capacitive coupling.