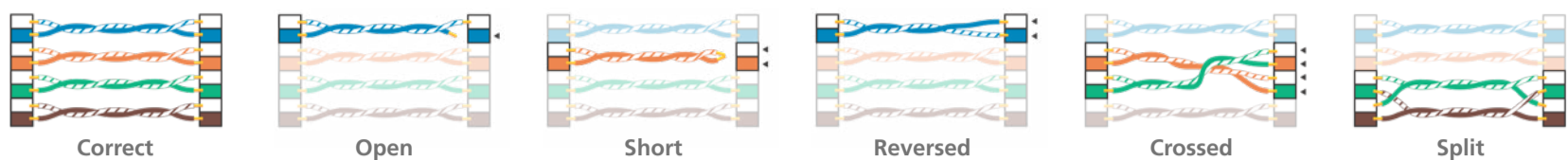
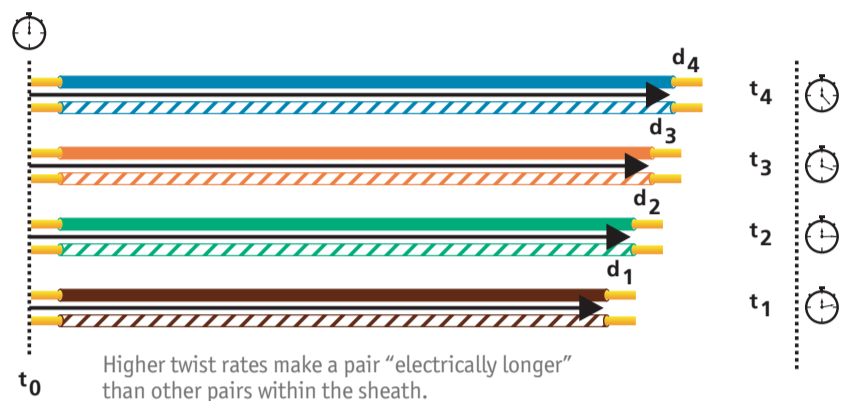


Wiremap

Pair 1 Pair 3
Pair 2 Pair 4



Delay/Skew



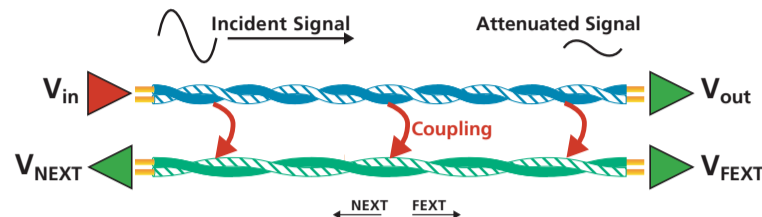
Propagation Delay: $t_4 - t_0$

Delay Skew: $t_4 - t_1$

Skew = Maximum difference in propagation delay between the fastest pair to the slowest pair.

Delay/Skew Failure: Excess length, poor cable design.

Insertion Loss, NEXT, FEXT, ACR, ACRF



$$\text{Insertion Loss: } \left[\frac{V_{in}}{V_{out}} \right]$$

Failure: Excess length, high frequency or temperature, excess return loss, wire gauge too thin, poor cable design.

$$\text{NEXT: } \left[\frac{V_{in}}{V_{NEXT}} \right]$$

Failure: Poor twisting, common mode conversion, CP¹ too close to TO², poor cable or connector design, reflected FEXT.

$$\text{FEXT: } \left[\frac{V_{in}}{V_{FEXT}} \right]$$

Failure: Poor twisting, common mode conversion, poor cable or connector design.

$$\text{ACR} = \text{NEXT} - \text{IL}$$

Attenuation to Crosstalk Ratio

Failure: Excessive NEXT or Insertion Loss.

$$\text{ACRF} = \text{FEXT} - \text{IL}$$

Attenuation to Crosstalk Ratio Far-End

Failure: Excessive Insertion Loss or FEXT.

¹CP = Consolidation Point
²TO = Telecommunications Outlet

Resistance Unbalance

LOOP	PAIR UBL	P2P UBL
1,2	0.01	0.15
3,6	0.01	0.15
4,5	0.00	0.15
7,8	0.01	0.15

Resistance Unbalance within a pair is a measurement of the difference in resistance between the two conductors in a balanced wire pair.

$$\text{Resistance Unbalance}_{\text{within a pair}} = \left[\frac{|R_{C1} - R_{C2}|}{R_{C1} + R_{C2}} \right] 100\%$$

R_{C1} is the DC resistance of conductor 1.

R_{C2} is the DC resistance of conductor 2.

Where conductor 1 and conductor 2 are the two conductors of the same pair.

LOOP	PAIR UBL	P2P UBL
1,2-3,6	0.01	0.20
1,2-4,5	0.01	0.20
1,2-7,8	0.00	0.20
3,6-4,5	0.00	0.20
3,6-7,8	0.00	0.20
4,5-7,8	0.00	0.20

Resistance Unbalance between pairs is a measurement of the difference in parallel resistances between two balanced wire pairs

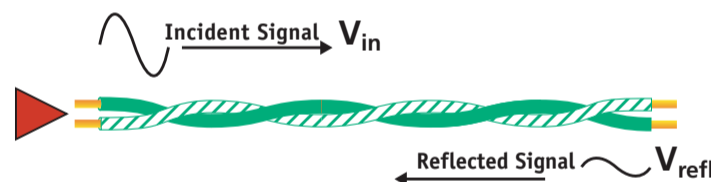
$$\text{Resistance Unbalance}_{\text{between pairs}} = \left[\frac{|R_{P1} - R_{P2}|}{R_{P1} + R_{P2}} \right] 100\%$$

R_{P1} is the DC parallel resistance of the conductors of a pair.

R_{P2} is the DC parallel resistance of the conductors of another pair.

Failure: Contact Resistance Issue or poor cable design. Testing is not required for field certification, but is essential to understand if a link will support higher levels of PoE.

Return Loss



$$\text{Return Loss: } \left[\frac{V_{in}}{V_{refl}} \right]$$

Failure: Mismatched impedance of cable-connector, jack-plug, or cable-cable; untwisting at connector; closely placed connections; asymmetric twisting; high resistance contact; poor cable or connector design.

Loop Resistance



LOOP	PAIR UBL	P2P UBL
1,2	1.4	
3,6	1.3	
4,5	1.4	
7,8	1.1	
LIMIT		20.6

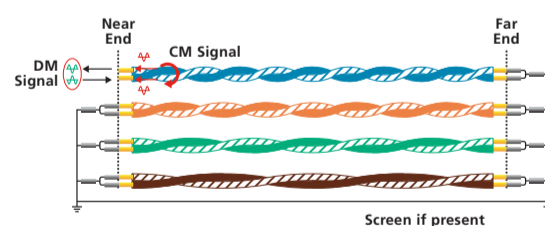
DC Loop Resistance

Measurement, in ohms, of the total DC resistance of the wires of a pair taken together.

Failure: Contact Resistance Issue or poor cable design.

Transverse Conversion Loss

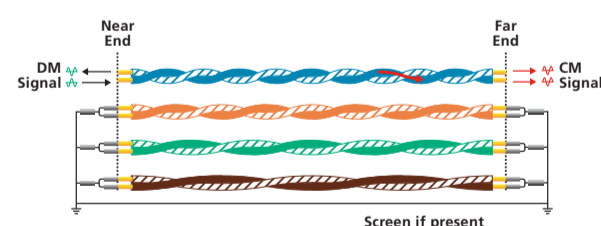
TCL



Transverse Conversion Loss

A ratio, expressed in dB, of the measured common mode voltage on a pair relative to the differential mode voltage on the same pair applied at the same end. TCL indicates if a pair is well balanced and with that has good immunity to external noise.

TCTL



Transverse Conversion Transfer Loss

A ratio, expressed in dB, of the measured common mode voltage on a pair relative to the differential mode voltage applied at the opposite end of the same pair, or on either end of another pair.

ELTCTL

$$\text{ELTCTL} = \text{TCTL} - \text{IL}_{dm}$$

Equal Level Transverse Conversion Transfer Loss

A calculation, expressed in dB, of the difference between measured TCTL and the differential mode Insertion Loss of the disturbed pair.

Failure (also for TCL): poor cable design of production.