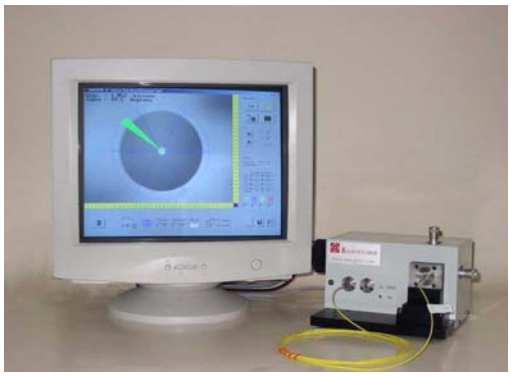
Application Notes - Fibre Optic Cable Assembly Tuning

Fibre Optic Connectors incorporate an alignment key that is normally referenced in the vertical axis. This is to allow 'tuning' optimisation to minimise the insertion loss resulting from offsets in eccentricity between the fibre core and the ferrule outer diameter. In the case of the FC connector the key is traditionally on the outside front body, where it can be removed, rotated and then replaced. Traditional SC connectors (multi-part) incorporate a 4-slot ferrule that can be positioned within the housing relevant to the plastic moulded key on the outer body.



The extensive use of one-piece connectors with fixed keys became popular as the concentricity of fibre and ceramic alignment ferrules improved over the years. The key has also been used as the reference for any angle polish (APC) termination.

As the volume of optical components in any link has increased in recent years so has the need to obtain lower and lower insertion loss. As a result 'tuning' is once again popular.

A number of manufacturers now have 'tunable' one-piece or 'universal' connectors that can be tuned to up to six positions of accuracy.

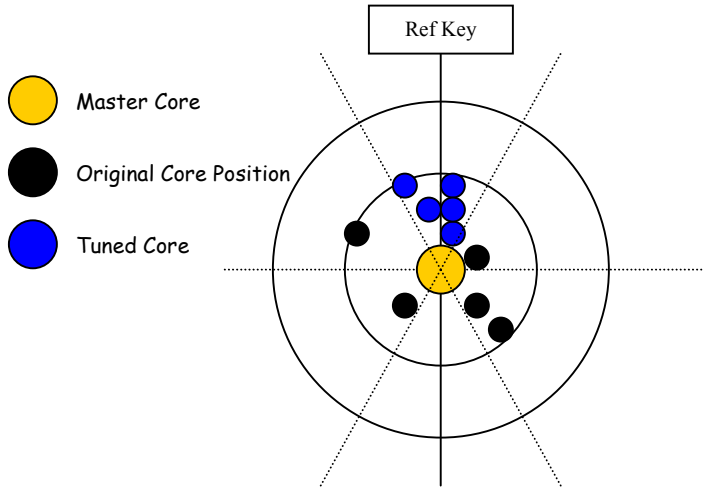
The Koncentrik measurement system allows users to measure the concentricity of a given assembly and to determine the direction of the offset (index). This allows the manufacture of low insertion loss 'tuned' assemblies in addition to offset leads (Adjustment Cords) and true centre test leads (Master Cords) with selection of the appropriate ferrules.

Tuning

The simplified image in Figure 1 shows a ferrule divided into 6 sectors. The core positions of a number of fibre optic terminations (black) are misaligned in relation to the true centre – master cord core (yellow).

This is as a result of three combined eccentricity errors:

- Fibre core concentricity,
- Ferrule Bore Concentricity,
- Match between fibre outside diameter and the ferrule inside diameter.



When tested against a master cord (yellow) each termination would register a different insertion loss, in part as a result of the core offset from the centre.

When the terminations are randomly mated in the field the distance between fibre cores could be even greater. A termination measuring 0.45dB against the master cord could potentially give a much greater insertion loss (>9bB) when connected to a lead with a similar offset in the opposite axis.

During the 'tuning' process the operator rotates the ferrule or the key of the connector to place the core (blue) in the designated vertical vector. Little or no difference will be measured when tested against the master cord but when randomly mated against another tuned lead the insertion loss is effectively half (1/2).

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Koncentrik Measurement System

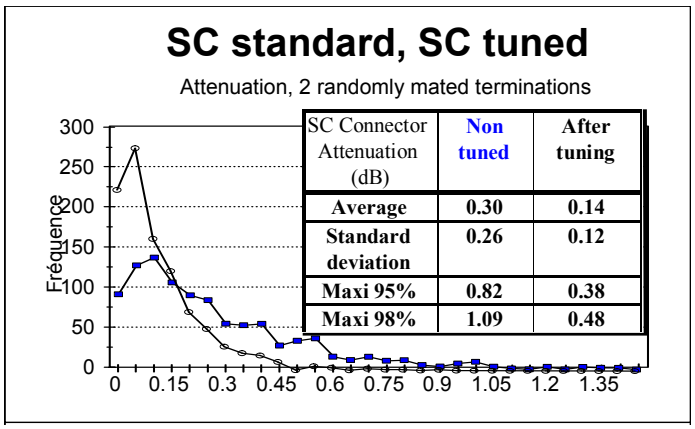
Optimizing Optical Fibre Performance

Optimising Performance

Figure 2 shows the effect this has on standard singlemode randomly mated SC terminations. This can be improved further with selected ferrules, selected fibre and ensuring good fit between the two.

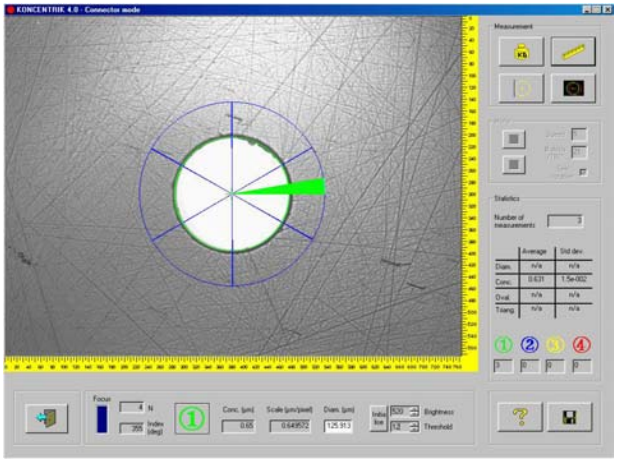
Whatever the level of selection, the tuning process will always reduce the random mated performance further, the insertion loss experienced has been halved.

Master cords should be tuned and have an eccentricity of <0.3µm. With the Koncentrik Measurement system customers can now manufacture their own test leads and be confident that they remain within specification. The Koncentrik System supports measuring patch cords with very low eccentricity by allowing the operator to determine the precision – increasing the number of measurements and the number of rotations.



Key Features

- Incorporated in Koncentrik Measurement System.
- Single Modular Unit for measurement of 2.5mm and 1.25mm PC connectors.
- Semi - automated measurement of fibre core concentricity and index of eccentricity.
- High magnification + Front and backlight options for clear user visual inspection.
- Operator adjustable features include : selection of number & direction of rotations, number of vectors, statistical analysis, measurement speed and accuracy.
- User adjustable quality level for high-speed measurement
- Measurement Report compiled in Excel.
- High precision angle indexing measurement even at low eccentricities.



Key Performance Criteria

Parameter	Accuracy
Concentricity Measurement	±0.15 µm
Fibre Core position angle*	Up to 1° (operator dependant)
* accuracy for eccentricities above 0.2µm	

The above information is provided as a guide to the Koncentrik Measurement System and as such may be subject to change as the system is developed and upgraded. Please contact Data-Pixel for further information:

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