

OPTICAL FIBRE MANAGEMENT SYSTEM

This invention relates to an optical fibre management system, and in particular to a fibre management system for use in telecommunications exchange equipment racks.

- 5 Known telecommunications racks incorporate optical shelves and optical trays in order to achieve fibre management. Whilst known techniques have generally proved adequate, some problems have emerged, including: -
- 10 (i) Difficulties in maintaining an adequate fibre bend radius when turning in horizontal or vertical planes;
- (ii) Restrictions to the capabilities of existing practices when employed to terminate new technologies (e.g. blown fibre and ribbon cables);
- 15 (iii) Ensuring access to unterminated fibres without disturbing working systems;
- (iv) Effective cable management within racks due to the increasing numbers of coaxial and fibre links which need to be terminated onto equipment shelves; and
- 20 (v) The need to reduce the cost of procurement, installation and maintenance of network equipment.

The aim of the invention is to provide an improved form of fibre management system.

- The present invention provides a fibre management system comprising a support plate and at least one fibre management module as hereinafter defined, the support plate
- 25 being formed with a regular grid of apertures, and the or each fibre management module being provided with at least two pegs each of which is shaped and sized to fit within any one of the apertures, wherein each peg is attached to
- 30 the respective fibre management module in such a manner as to permit relative movement therebetween, whereby the or each fibre management module is detachably fixable to the support plate in any one of a number of positions.

- Throughout this specification, the term fibre
- 35 management module should be taken to mean a module that can be used for optical fibre handling functions such as guiding, anchoring and splicing.

In a preferred embodiment, the grid is a square grid, preferably having a centre-to-centre pitch of 10mm. Conveniently, the or each peg is tapered towards its free end.

5 Preferably, each peg is slidably mounted in a respective slot formed in the respective fibre management module, each fibre management module slot being of re-entrant (for example T-shaped) cross-section.

10 Conveniently, at least one of the fibre management modules is provided with a curved fibre-receiving groove, the or each curved groove having a radius of curvature of at least 35mm. Also, at least one of the fibre management modules may be provided with means for anchoring an optical fibre thereto, at least one of the fibre management modules
15 may be provided with means for anchoring a fibre splice, and at least one of the fibre management modules may be constituted by a blown fibre microduct.

The invention will now be described in greater detail, by way of example, with reference to the accompanying
20 drawings, in which: -

Figure 1 is a schematic front elevation of a telecommunications exchange equipment rack;
Figure 2 is a perspective view of a fibre management tray of the equipment of Figure 1;
25 Figure 3 is an exploded perspective view of a section of a fibre management tray and a fibre management module for connection thereto, both of which are constructed in accordance with the invention;
Figure 4 is a plan view of a second form of fibre
30 management module constructed in accordance with the invention;
Figure 5 is an end elevation of the module of Figure 4;
Figure 6 shows a locating peg for use with the module
35 of Figures 4 and 5;

Figure 7 is a perspective view of a third form of fibre management module constructed in accordance with the invention; and

5 Figures 8-11 are perspective views of further fibre management modules constructed in accordance with the invention.

Referring to the drawings, Figure 1 shows a telecommunications exchange equipment rack R including optical line terminating equipment 1 for optical cables
10 which enter the rack via a blown fibre microduct 2. Individual microducts 3 (one of which is shown in Figure 1) leave the blown fibre microduct 2 at a breakout manifold 4 provided within a vertical cable duct 5. The rack R is provided with an optical shelf 6 constituted by four
15 vertically spaced fibre management trays 7, and with a sub-rack cable termination area 8 provided with a single fibre management tray 9. Each individual microduct 3 is terminated on a respective one of the fibre management trays 7. The fibre (or fibres) within each microduct 3
20 is/are spliced to a respective ruggedised optical cable 10 (only one of which is shown in Figure 1) by a respective splice 11 associated with the corresponding fibre management tray 7. The optical cables 10 are fed to the sub-rack cable termination area 8 via a vertical cable
25 duct 12. Fibre management modules (not shown in Figure 1) can be attached, in a manner described below, to each of the fibre management trays 7 and 9.

Figure 2 is a schematic representation of one of the fibre management trays 7 together with a number of fibre
30 management modules. Thus, Figure 2 shows the ^{individual} ~~blown fibre~~ microduct 3, a splice module 13 (including the splice 11 and a plurality fibre anchorage modules 14), a number of horizontal fibre guides 15, and a number of vertical fibre
35 guides 16. All these modules are detachably fixed to the base 17 of the tray 7, the base being formed with a plurality of apertures 17a which facilitate circulation of air within the rack R, and hence cooling of the components.

As shown in Figure 2, the horizontal fibre guides 15 guide the ruggedised cable 10 around the tray 7, and a pair of back-to-back vertical fibre guides 16 define an exit point for the ruggedised cable. Alternatively, the exit point could be defined by a single vertical guide.

Figure 3 is a schematic representation showing a section of the base plate 17 of another form of fibre management tray 7, and another type of horizontal fibre guide 21, and illustrates the method of interconnecting fibre management modules and fibre management trays. The base plate 17 is formed with a grid of 3.5mm diameter circular apertures 19 having a centre-to centre pitch of 10mm square. The fibre guide 21 is of two-part construction, having base portion 21a and a complementary, snap-engaging lid 21b. Both parts 21a and 21b of the guide 21 are curved through 90°, and the base portion 21a is formed with a groove 22 for receiving optical fibre (such as the ruggedised cable 10). The groove 22 is curved with a radius of curvature of 35mm, that is to say the minimum bend radius for unruggedised fibre. The guide 21 is also suitable for ruggedised fibres. The base portion 21a is provided with a pair of tapered location pegs 23. Each of the pegs 23 is sized to be a friction fit within each of the apertures 19 of the base plate 17. The pegs 23 are spaced so as to lie on two of the points of a notional 10mm square grid, so that the guide 21 can be fixed to the base plate 17, by inserting its pegs 23 into a respective pair of apertures 19, in any one of a large number of different positions.

Figures 4 and 5 show yet another form of horizontal fibre guide 31. This guide 31 is generally cuboidal, and has a curved groove 32 formed in one of its major surfaces. A pair of orthogonal T-shaped slots 33 are formed on the other major surface of the guide 31. The curved groove 32 has a radius of curvature of 35mm, and curves through 90°. A respective peg 34 (see Figure 6) is associated with each

of the slots 33, each peg having a tapered shank 34a and a head portion 34b which is sized to be a sliding friction fit within each of the T-shaped slots. The pegs 34 can, therefore, be positioned anywhere along the slots 32, thereby enhancing the versatility of positioning of the guide 31 on its base plate 17 (not shown in Figures 4 to 6).

Figure 7 shows a vertical fibre guide 41 having a main body portion 41a and a lid portion 41b which is a sliding fit on the main body portion. The main body portion 41a is formed with an open-mouthed covered groove 42; the groove having a radius of curvature of 35mm, curving through 90°, and being covered by the lid 41b. The two straight edge portions of the guide 41 are provided with pegs (not shown but similar to the pegs 23 of the guide 21). Alternatively, these edge portions are formed with T-shaped slots (similar to the slots 33) and pegs (similar to the pegs 34) are associated therewith. In either case, it will be apparent that the guide 41 can be detachably fixed, in a wide variety of different positions, to a base plate such as the base plate 17.

Figure 8 shows a single fibre anchorage module 51 having a base portion 51a and a lid portion 51b snap-engageable therewith. The two portions 51a and 51b are formed with semi-cylindrical grooves 52 for receiving (as a tight-fit) a ruggedised fibre such as an optical cable 10. As with the guide 41, the bottom surface of the base portion 51a is provided with pegs 23 or with slots 33 for receiving pegs 34 (none of which is shown), so that the module 51 can be detachably fixed to a base-plate (not shown - but similar to base plate 17) in any one of the large number of positions.

Figure 9 shows a multi-fibre anchorage module (constituted by four modules 51) associated with a fibre ribbon anchorage module 61, all of the modules being detachably fixed to a base plate 17 by means of pegs (not

shown - but either pegs 23 or pegs 34). A respective ruggedised fibre is anchored in each of the modules 51, the protective ruggedised coating of each of the fibres being removed "downstream" of the associated module 51 to expose the bare fibre 10a thereof. The four bare fibres 10a are provided with a secondary coating to form a ribbonised fibre 10b. The anchorage module 61 is similar to each of the anchorage modules 51 in that it has snap-engaging base and lid portions 61a and 61b. In order to anchor the ribbonised fibre 10b, the lid portion 61b of the module 61 is formed with a cut-out 62 which is sized to grip the ribbonised fibre firmly against the base portion 61a when the two portions are snap-engaged.

Figure 10 shows a splice holder 71 for a multi-fibre splice, the holder being formed with a groove 72 for receiving (as a snap-fit) the splice protector 73 of the splice (not shown) connecting two ribbonised fibre units 74a and 74b. The base of the holder 71 is provided with pegs 23 or with slots 33 for receiving pegs 34 (none of which are shown), so that the holder can be detachably fixed to a base plate 17 in any one of a large number of positions.

Figure 11 shows a splice holder 81 for four single-fibre splices, the holder being formed with four grooves 82, each of which is adapted to receive (as a snap-fit) the splice protector 83 (only one of which is shown) of the splice (not shown) connecting a respective pair of optical fibres 84a and 84b. The base of the holder 81 is provided with pegs 23 or slots 33 for pegs 34 (none of which are shown in Figure 11) for detachably connecting the holder to a base plate 17.

It will be apparent that other fibre management modules (such as the ~~blown fibre~~ ^{individual} microduct 3) could be provided with connection means (such as pegs 23 or 34) for detachable connection to a base plate 17. Thus, the invention provides a fibre management system in which fibre

management modules can be detachably fixed to base plates in many different positions, thereby constituting a very versatile system. Moreover, by appropriate sizing and positioning of the pegs 23 and 34, the fibre management modules described above can be used with the base plates of the optical shelves of existing telecommunications exchange equipment racks. The system described above can, therefore, be adopted for current equipment practices. The modular concept is expected to be adaptable to any other type of fibre management module that may be developed in the future, so that the system should be capable of incorporating new fibre management situations as these evolve.

The modules utilised also ensure a minimum bend radius of 35mm for unruggedised fibre, and so ensure that there are no difficulties in maintaining an adequate fibre bend radius when turning optical fibres in both horizontal and vertical planes. The modules also enable effective management of optical fibres and cables within racks, and so facilitate the siting of the increasing number of fibre links which need to be terminated on equipment shelves. Moreover, because of its modular nature, the cost of procurement, installation and maintenance of network equipment can be reduced.

The system has many other applications, including the management and termination of fibre distributed directly to sub-racks (such as the sub-rack cable termination area 8 of Figure 1); the termination of blown fibre cable pre-terminated with connectorised tails; the termination of secondary-coated cable; termination using blown fibre tubing; termination using multi-fibre splicing techniques; the housing of passive optical components (such as passive splitters, WDMs or optical attenuators); and fibre management within full-depth (600mm) racks or on optical backplanes.

The system described above could be modified in a number of ways. For example, the base plate grid pattern could have a centre-to-centre pitch other than 10mm square. Also the base plates could be provided with runners which
5 enable them to be withdrawn from the equipment whilst maintaining the capability of adequate fibre management.



CLAIMS

1. A fibre management system comprising a support plate and at least one fibre management module as hereinbefore defined, the support plate being formed with a regular grid of apertures, and the or each fibre management module being provided with at least two pegs each of which is shaped and sized to fit within any one of the apertures, wherein each peg is attached to the respective fibre management module in such a manner as to permit relative movement therebetween, whereby the or each fibre management module is detachably fixable to the support plate in any one of a number of positions.
2. A system as claimed in claim 1, wherein the grid is a square grid.
3. A system as claimed in claim 2, wherein the grid has a centre-to-centre pitch of 10mm.
4. A system as claimed in any one of claims 1 to 3, wherein each peg is tapered towards its free end.
5. A system as claimed in any one of claims 1 to 4, wherein each peg is slidably mounted in a respective slot formed in the respective fibre management module.
6. A system as claimed in claim 5, wherein each fibre management module slot is of re-entrant cross-section.
7. A system as claimed in claim 6, wherein each slot is of T-shaped cross-section.
8. A system as claimed in any one of claims 1 to 7, wherein at least one of the fibre management modules is provided with a curved fibre-receiving groove.



9. A system as claimed in claim 8, wherein the or each curved groove has a radius of curvature of at least 35mm.

10. A system as claimed in any one of claims 1 to 7,
5 wherein at least one of the fibre management modules is provided with means for anchoring an optical fibre thereto.

11. A system as claimed in any one of claims 1 to 7,
wherein at least one of the fibre management modules is provided with means for anchoring a fibre splice.

12. A system as claimed in any one of claims 1 to 7,
10 wherein at least one of the fibre management modules is constituted by a blown fibre microduct.

13. A fibre management system substantially as herein before described with reference to, and as illustrated by, Figures 3 to 11 of the accompanying drawings.
