Fiber optic cable jacks and plugs are provided. In one aspect, a cable is made from at least one length of fiber optic line having a first end and a second end. A first plug includes a one-piece mechanical body with a cable interface to engage the fiber optic line first end, and a microlens to transceive light with the cable interface. The first plug is shaped to engage a first jack housing. A second plug includes a one-piece mechanical body with a cable interface to engage the fiber optic line second end, and a microlens to transceive light with the cable interface. The second plug is shaped to engage a second jack housing. The mechanical bodies have inner walls that form an air gap cavity interposed between the microlens convex surface and an engaging jack optical interface.
FIBER OPTIC CABLE INTERFACE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

This invention generally relates to optical cables and, more particularly, to a fiber optical cable with a microlens integrated into the cable housing/body.

[0002] 2. Description of the Related Art

Conventionally, optical fiber connectors are spring-loaded. The fiber endfaces (optical interfaces) of the two connectors are pressed together, resulting in a direct glass to glass or plastic to plastic contact. The avoidance of glass-to-air or plastic-to-air interfaces is critical, as an air interface results in higher connector losses. However, the tight tolerances needed to eliminate an air interface make these connectors relatively expensive to manufacture.

[0005] FIG. 1 is a partial cross-sectional view of a Transmission Optical SubAssembly (TOSA) optical cable plug (prior art). The plug 100 is made from a plastic housing 102 with a bore ferrule 106 to secure an optical fiber 108. The plug 100 also includes a plastic lens 110, manufactured as a subassembly, integrated into the plug. The lens 110 has a curved surface to create a focal plane where the plug mates with a jack 112. The lens permits a low loss air gap to be formed between the plug and a connecting jack. In addition to the expense of manufacturing a 2-part plug, the plug must be made to relatively tight tolerances, so that the lens focal plane aligns with the jack, which also increases the cost of the plug.

[0006] FIG. 2 is a partial cross-sectional view of an 8 Position 8 Contact (8P8C) interface (prior art). The ubiquitous 8P8C connector is a hardwired electrical connector used commercially and residentially to connect computers, printers, and routers. The 8P8C is often referred to as RJ45. Although the housing/body can be made as a one-piece plastic molding, the spring-loaded contacts and the necessity of cable crimping add to the complexity of manufacturing the part. Advantageously however, the spring-loaded contacts permit the part to be made to relatively lax tolerances.

[0007] It would be advantageous if an optical cable jack and plug could be made as a one-piece housing incorporating a microlens.

[0008] It would be advantageous if the above-mentioned optical cable jack and plug could be made to a relaxed set of tolerances.

SUMMARY OF THE INVENTION

Accordingly, a fiber optic cable is provided. The cable is made from a cable section including at least one length of fiber optic line having a first end and a second end. A first plug includes a one-piece mechanical body with a cable interface to engage the fiber optic line first end, and a microlens to transmit light with the cable interface. The first plug is shaped to engage a first jack housing. A second plug includes a one-piece mechanical body with a cable interface to engage the fiber optic line second end, and a microlens to transmit light with the cable interface. The second plug is shaped to engage a second jack housing. In one aspect, the first and second plug mechanical bodies have a form factor of an 8 Position 8 Contact (8P8C) plug mechanical body.

[0010] More explicitly, each microlens includes a convex surface for interfacing with a jack optical interface, and each cable interface is formed in a focal plane of its corresponding microlens. The mechanical bodies have inner walls that form an air gap cavity interposed between the microlens convex surface and an engaging jack optical interface. At least a portion of the mechanical bodies are transparent in the range of light wavelengths between 650 and 1800 nanometers (nm), and the microlenses are formed in the transparent portion of the mechanical bodies.

[0011] Additional details of the above-described optical cable plug, as well as an optical cable jack, and mating optical plug/jack are provided below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a partial cross-sectional view of a Transmission Optical SubAssembly (TOSA) optical cable plug (prior art).

[0013] FIG. 2 is a partial cross-sectional view of an 8 Position 8 Contact (8P8C) interface (prior art).

[0014] FIG. 3 is a partial cross-section view of a fiber optic cable.

[0015] FIG. 4 is a plan view of a variation of the optical cable of FIG. 3.

[0016] FIG. 5 is a partial cross-sectional view of a fiber optic cable plug.

[0017] FIGS. 6A and 6B are partial cross-section views of a fiber optic cable jack.

[0018] FIG. 7 is a plan view depicting a variation of fiber optic cable jack of FIG. 6B.

[0019] FIG. 8 is a partial cross-sectional view of a fiber optic cable interface.

[0020] FIG. 9 is a plan view of a first variation of the fiber optic cable interface of FIG. 8.

[0021] FIG. 10 is a plan view of a second variation of the fiber optic cable interface of FIG. 8.

DETAILED DESCRIPTION

[0022] FIG. 3 is a partial cross-section view of a fiber optic cable. The fiber optic cable 300 comprises a cable section including at least one length of fiber optic line 302 having a first end 304 and a second end 306. A first plug 308 includes a one-piece mechanical body 310 with a cable interface 312 to engage the fiber optic line first end 304, and a microlens 314 to transceive light with the cable interface 312. The first plug 308 is shaped to engage a first jack housing (not shown, see FIG. 6). A second plug 316 also includes a one-piece mechanical body 318 with a cable interface 320 to engage the fiber optic line second end 306, and a microlens 322 to transceive light with the cable interface 320. The second plug is shaped to engage a second jack housing (not shown). For example, the one-piece mechanical bodies 310/318 may be an injection molded plastic material.

[0023] In one aspect, the first and second plug mechanical bodies 310/318 have a form factor of an 8 Position 8 Contact (8P8C) plug mechanical body (see FIG. 8). This is not to say that the optical cable 300 need necessarily be mated to a conventional 8P8C electrical jack, but rather, that the mechanical bodies 310/318 can be interfaced with the next generation optical cable that will be replacing the 8P8C electrical cable. However in one aspect, the mechanical bodies can be interfaced with an 8P8C form factor jack that incorporates the electrical contacts of a conventional 8P8C connector, but also includes at least one optical interface. It should be noted, however, that the fiber optic cable is not limited to any particular jack form factor.
 Typically, each microlens (e.g., microlens 314) has a diameter 324 in the range of about 1-3 millimeters (mm). As shown, each microlens (e.g., microlens 314) includes a convex surface 326 for interfacing with a jack optical interface (not shown). Each cable interface (e.g., cable interface 312) is formed in the focal plane 328 of its corresponding microlens. That is, the fiber ends 304 and 306 are in the focal plane 328. Note: the microlens as shown has a convex surface 326 for interfacing with a jack optical interface and a planar surface 334 adjacent the cable interface. However, the microlens is not limited to any particular shape or combination of surface shapes. A variety of lens designs are known in the art.

The mechanical bodies (e.g., body 310) form an air gap cavity 330 interposed between the microlens convex surface 326 and an engaging jack optical interface (not shown). The air gap cavity 330 has an air gap length 332 in the range of 0.1 to 1 mm.

At least a portion of the mechanical bodies 310/318 are transparent in a range of light wavelengths between 650 and 1800 nanometers (nm), and the microlenses 314/322 are formed in the transparent portion of the mechanical bodies. Note: if the connectors are used to transceive light in wavelengths outside the above-specified range, housing materials can be designed explicitly for this range, or materials can be used to more broadly transmit in the above-specified range, as well wavelengths outside this range.

FIG. 4 is a plan view of a variation of the optical cable of FIG. 3. In this aspect the cable includes a plurality of fiber optic lines 302a through 302n, where n is a variable not limited to any particular value. The first plug 308 has a cable interface 312a ‡ 312n and microlens 314a ‡ 314n associated with each fiber optic line. Likewise, the second plug 316 has a cable interface 320a ‡ 320n and microlens 322a ‡ 322n associated with each fiber optic line.

FIG. 5 is a partial cross-sectional view of a fiber optic cable plug. The fiber optic cable plug is the same as the first plug 308 of FIG. 3. As such, the plug 308 comprises a one-piece mechanical body 310 for engaging a jack housing (not shown, see FIG. 6). The plug mechanical body includes a cable interface 312 to engage a fiber optic line end (not shown, see FIG. 3), and a microlens 314 to transceive light with the cable interface 312. Additional details can be found above in the explanation of FIGS. 3 and 4, and are not repeated here in the interest of brevity.

FIGS. 6A and 6B are partial cross-section views of a fiber optic cable jack. The jack housing 602 comprises a one-piece housing 602 for engaging a plug mechanical body (see FIGS. 3 and 5). The jack housing 602 includes a cable interface 608 to engage a printed circuit board (PCB) (not shown) and an optic element 606. In one aspect, the one-piece housing 602 is an injection molded plastic material.

As shown in FIG. 6A, the optic element is a laser source 606a (e.g., a laser diode). As shown in FIG. 6B, the optic element is a photodiode 606b. Referencing both FIGS. 6A and 6B, the optical element 606 has a first (electrical) interface connected to the contact 608 and a second (optical) interface 610. A microlens 612 is optically connected to the optic element second interface 610. As with the plug of FIGS. 3 and 5, the jack housing 602 may have the form factor of an 8P8C mechanical body (see FIG. 8).

Typically, the microlens 612 has a diameter 614 in the range of about 1-3 mm. The microlens 612 includes a convex surface 616 for interfacing with a plug optical interface (see FIG. 3) and the optic element 608 is formed in a focal plane 618 of the microlens 612. The jack housing 602 has inner walls 620 forming an air gap cavity 330 interposed between the microlens 612 and the engaging plug optical interface (not shown, see FIG. 3). The air gap cavity 330 has an air gap length 332 in a range of 0.1 to 1 mm.

As with the plug of FIG. 3, at least a portion of the housing 602 is transparent in the range of light wavelengths between 650 and 1800 nm, and the microlens 612 is formed in the transparent portion of the housing.

FIG. 7 is a plan view depicting a variation of fiber optic cable jack of FIG. 6. A plurality of contacts 608a through 608n, where n is a variable, engage a PCB (not shown). There is a microlens 612a ‡ 612n associated with each contact 608. Note: the optic elements 606 may be laser sources, photodiodes, or a combination of laser sources and photodiodes.

FIG. 8 is a partial cross-sectional view of a fiber optic cable interface. In this aspect the plug and jacks have a form factor similar to an 8P8C interface. The fiber optic cable 800 comprises a cable section including a first fiber optic line 302 having a first end 304 and a second end 306. A first plug 308 includes a one-piece mechanical body 310 with a cable interface 312 to engage the fiber optic line first end 304, and a microlens 314 to transceive light between the fiber optic cable first end 304 and a first jack optical interface (i.e. microlens 612a) in the first jack housing 602a. A second plug 316 includes a one-piece mechanical 318 body with a cable interface 320 to engage the fiber optic line second end 306, and a microlens 322 to transceive light between the fiber optic cable second end 306 and a second jack optical interface (i.e. microlens 612b) in the second jack housing 602b.

A first jack 602a includes a one-piece housing 602a with a laser source 606a and a microlens optical interface 610 to transmit light from the laser source 606a to the microlens 312 of the first plug 308. The first jack housing 602a is shaped to engage the first plug mechanical body 310. A second jack 602b includes a one-piece housing 602b with a photodiode 606b and a microlens optical interface 610b to transmit light from the microlens 612b of the second plug to the photodiode 606b. The second jack housing 602b is shaped to engage the second plug mechanical body 318. Additional details of the above-described plugs and jacks can be found in the explanations of FIGS. 3-7 above, which are not repeated in the interest of brevity.

As shown, each plug micro lens 314/322 includes a convex surface 326 interfaced to the corresponding jack microlens 612a/612b. As in FIG. 3, each plug cable interface 310/320 is formed in a focal plane of its corresponding microlens 314/322. The first jack microlens 612a has a convex surface 616a interfaced to the convex surface 326 of the first micro lens 314. Likewise, the second jack microlens 612b has a convex surface 616b interfaced to the convex surface 326 of the second micro lens 322. Each optical element (laser source 606a or photodiode 606b) is formed in a focal plane of its corresponding microlens 612.

The first and second jack housings 602a/602b have walls with inner surfaces 620. The air gap cavities 330 are positioned between each plug microlens convex surface 326 and the engaging jack microlens convex surface 616, are surrounded by the jack inner surfaces 620.

FIG. 9 is a plan view of a first variation of the fiber optic cable interface of FIG. 8. Shown is a plurality of fiber optic lines 302a ‡ 302n. The first and second plugs 308/318 have a microlens 314a/322a through 314n/322n and cable
interface 312a/320a through 312n/320n associated with each fiber optic line 302. Likewise, the first and second jacks 600a/600b have a microlens 616 associated with each fiber optic line. Note: the first jack may include an additional laser source associated with each fiber optic line. Alternately as shown, the first jack may be comprised of a combination of laser sources and photodiode optic elements. Likewise, the second jack may include an additional photodiodes associated with each fiber optic line. Alternately as shown, the second jack may be comprised of a combination of laser sources and photodiode optic elements.

[0039] FIG. 10 is a plan view of a second variation of the fiber optic cable interface of FIG. 8. In this aspect, the first and second jacks 600a and 600b are as described above in the explanation of FIG. 8. The difference is that the plugs do not include a microlens. Explicitly, a cable section includes a first fiber optic line 302 having a first end 304 and a second end 306. A first plug 1000 has a cable interface 1002 to engage the fiber optic line first end 304 and to transceive light between the fiber optic cable first end and a first jack optical interface (e.g., the convex surface 616a of the microlens 612a) in the first jack housing 602a. Likewise, a second plug 1004 has a cable interface 1006 to engage the fiber optic line second end 306 and to transceive light between the fiber optic cable second end 306 and a second jack optical interface (e.g., the convex surface 616b of the microlens 612b) in the second jack housing 602b.

[0040] Generally, the microlenses, the jack bodies, and plug housings result in a low cost alternative to conventional optical connectors. The low cost feature comes from the fact that the lens is not built separately from glass, but molded out of the body material in the same step used to build the body. As noted above, the microlens and body/housing can be fabricated in the same process using injection molding.

[0041] Fiber optic cable jacks and plugs have been provided, built from one-piece bodies and housings that incorporate a microlens. Some examples of particular housing designs and dimensions have been given to illustrate the invention. However, the invention is not limited to merely these examples. Fiber optic cables have been shown ending with plugs, but alternately the fiber optic cable interfaces can be made using jacks instead of plugs, or a combination of a plug on one end and jack on the other end. Other variations and embodiments of the invention will occur to those skilled in the art.

We claim:
1. A fiber optic cable comprising:
a cable section including at least one length of fiber optic line having a first end and a second end;
a first plug including a mechanical body with a cable interface to engage the fiber optic line first end, and a micro-lens integrally formed in the mechanical body to transceive light with the cable interface, the first plug being shaped to engage a first jack housing;
a second plug including a mechanical body with a cable interface to engage the fiber optic line second end, and a microlens integrally formed in the mechanical body to transceive light with the cable interface, the second plug being shaped to engage a second jack housing;
wherein at least a portion of the mechanical bodies are transparent in a range of light wavelengths between 650 and 1800 nanometers (nm); and,
wherein the microlenses are formed in the transparent portion of the mechanical bodies.

2. The fiber optic cable of claim 1 wherein the first and second plug mechanical bodies have a form factor of an 8 Position 8 Contact (8P8C) plug mechanical body.
3. The fiber optic cable of claim 1 wherein each microlens has a diameter in a range of about 1-3 millimeters (mm).
4. The fiber optic cable of claim 1 wherein each microlens includes a convex surface for interfacing with a jack optical interface and a planar surface for interfacing with a cable end, and,
wherein each cable end is formed in a focal plane of its corresponding microlens.
5. The fiber optical cable of claim 4 wherein the mechanical bodies form an air gap cavity interposed between the microlens convex surface and an engaging jack optical interface.
6. The fiber optic cable of claim 5 wherein the air gap cavity has an air gap length in a range of 0.1 to 1 mm.
7. (canceled)
8. The fiber optic cable of claim 1 further comprising:
a plurality of fiber optic lines; and,
wherein the first and second plug mechanical bodies each have a cable interface and an integrally formed microlens associated with each fiber optic line.
9. The fiber optic cable of claim 1 wherein the mechanical bodies are an injection molded plastic material.
10. A fiber optic cable plug comprising:
a mechanical body for engaging a jack housing, including:
a cable interface to engage a fiber optic line end;
a microlens integrally formed in the mechanical body to transceive light with the cable interface,
wherein at least a portion of the mechanical body is transparent in a range of light wavelengths between 650 and 1800 nanometers (nm); and,
wherein the microlens is formed in the transparent portion of the mechanical body.
11. The fiber optic cable plug of claim 10 wherein the mechanical body has a form factor of an 8 Position 8 Contact (8P8C) mechanical body.
12. The fiber optic cable plug of claim 10 wherein the microlens has a diameter in a range of about 1-3 millimeters (mm).
13. The fiber optic cable plug of claim 10 wherein the microlens includes a convex surface for interfacing with a jack optical interface and a planar surface for interfacing with the cable interface; and,
wherein the cable interface is formed in a focal plane of the microlens.
14. The fiber optical cable plug of claim 10 wherein the mechanical body forms an air gap cavity interposed between the microlens and an engaging jack optical interface.
15. The fiber optic cable plug of claim 14 wherein the air gap cavity has an air gap length in a range of 0.1 to 1 mm.
16. (canceled)
17. The fiber optic cable plug of claim 10 further comprising:
a plurality of cable interfaces to engage a plurality of fiber optic lines; and,
a microlens integrally formed in the mechanical body and associated with each cable interface.
18. The fiber optic cable plug of claim 10 wherein the mechanical body is an injection molded plastic material.
19. A fiber optic cable interface comprising:
a cable section including a first fiber optic line having a first end and a second end;
a first plug including a mechanical body with a cable interface to engage the fiber optic line first end, and a micro-lens integrally formed in the mechanical body to transceive light between the fiber optic cable first end and a first jack optical interface in a first jack housing;
a second plug including a mechanical body with a cable interface to engage the fiber optic line second end, and a micro-lens integrally formed in the mechanical body to transceive light between the fiber optic cable second end and a second jack optical interface in a second jack housing;
a first jack including a housing with a laser source, and a micro-lens integrally formed in the housing to transmit light from the laser source to the micro-lens of the first plug, the first jack housing being shaped to engage the first plug mechanical body;
a second jack including a housing with a photodiode, and a micro-lens integrally formed in the housing to transmit light from the micro-lens of the second plug to the photodiode, the second jack housing being shaped to engage the second plug mechanical body;
wherein at least a portion of the first and second plug mechanical bodies are transparent in a range of light wavelengths between 650 and 1800 nanometers (nm); wherein the first and second plug micro-lenses are formed in the transparent portion of the plug mechanical bodies; wherein at least a portion of the first and second jack housings are transparent in the range of light wavelengths between 650 and 1800 nm; and, wherein the first and second jack micro-lenses are formed in the transparent portion of the jack housings.

20. The fiber optic cable interface of claim 19 wherein the first and second plug mechanical bodies have a form factor of a 8 Position 8 Contact (8P8C) plug; and,

wherein the first and second jack housings have a form factor of a 8P8C jack.

21. The fiber optic cable interface of claim 19 wherein each micro-lens has a diameter in a range of about 1-3 millimeters (mm).  

22. The fiber optic cable interface of claim 19 wherein each plug micro-lens includes a convex surface interface to the corresponding jack micro-lens and a planar surface interface to a corresponding cable end;

wherein each plug cable interface is formed in a focal plane of its corresponding micro-lens; wherein the first jack micro-lens has a convex surface interface to the convex surface of the first plug micro-lens; wherein the second jack micro-lens has a convex surface interface to the convex surface of the second plug micro-lens; and,

wherein each jack laser source and photodiode is formed in a focal plane of its corresponding micro-lens.

23. The fiber optic cable interface of claim 22 wherein the first and second jack housings have walls with inner surfaces; the fiber optic cable interface further comprising:  

air gap cavities interposed between each plug micro-lens convex surface and the engaging jack micro-lens convex surface, surrounded by the jack wall inner surfaces.

24. The fiber optic cable interface of claim 23 wherein the air gap cavities have an air gap length in a range of 0.1 to 1 mm.

25. (canceled)

26. The fiber optic cable interface of claim 19 further comprising:

a plurality of fiber optic lines; wherein the first and second plug mechanical bodies each have an integrally formed micro-lens, and cable interface associated with each fiber optic line; and, wherein the first and second jack housings each have an integrally formed micro-lens associated with each fiber optic line.

27. The fiber optic cable interface of claim 19 further comprising:  

a second fiber optic line having a first end and a second end; wherein the first plug includes a cable interface to engage the second fiber optic line first end, and a micro-lens integrally formed in the mechanical body to transceive light between the second fiber optic cable first end and a third jack optical interface in the first jack housing; wherein the second plug includes a cable interface to engage the second fiber optic line second end, and a micro-lens integrally formed in the mechanical body to transceive light between the second fiber optic cable second end and a fourth jack optical interface in the second jack housing;

wherein the first jack includes a photodiode, and a micro-lens integrally formed in the housing to transmit light to the photodiode from the micro-lens of the first plug associated with the second fiber optic line; and,

wherein the second jack includes a laser source, and a micro-lens integrally formed in the housing to transmit light from the laser source to the micro-lens of the second plug associated with the second fiber optic line.

28. The fiber optic cable interface of claim 19 wherein the plug mechanical bodies and jack housings are an injection molded plastic material.

29. A fiber optic cable jack comprising:  

a housing for engaging a plug mechanical body, including:  

a contact to engage a printed circuit board (PCB); an optic element selected from a group consisting of a photodiode and a laser, having a first interface connected to the contact and a second interface; and,

a micro-lens integrally formed in the housing and optically connected to the optic element second interface; wherein at least a portion of the housing is transparent in a range of light wavelengths between 650 and 1800 nanometers (nm); and,

wherein the micro-lens is formed in the transparent portion of the housing.

30. The fiber optic cable jack of claim 29 wherein the housing has a form factor of an 8 Position 8 Contact (8P8C) mechanical body.

31. The fiber optic cable jack of claim 29 wherein the micro-lens has a diameter in a range of about 1-3 millimeters (mm).

32. The fiber optic cable jack of claim 29 wherein the micro-lens includes a convex surface for interfacing with a plug optical interface and a planar surface for interfacing with the optic element; and,

wherein the optic element is formed in a focal plane of the micro-lens.

33. The fiber optical cable jack of claim 29 wherein the housing has inner walls forming an air gap cavity interposed between the micro-lens and the engaging plug optical interface.

34. The fiber optic cable jack of claim 33 wherein the air gap cavity has an air gap length in a range of 0.1 to 1 mm.

35. (canceled)
36. The fiber optic cable jack of claim 29 further comprising:
   a plurality of contacts to engage a PCB; and,
   a microlens, integrally formed in the housing, associated with each contact.
37. The fiber optic cable jack of claim 29 wherein the housing is an injection molded plastic material.
38. A fiber optic cable interface comprising:
   a cable section including:
   a first fiber optic line having a first end and a second end;
   a first plug with a cable interface to engage the fiber optic line first end and transceive light between the fiber optic cable first end and a first jack optical interface in a first jack housing;
   a second plug with a cable interface to engage the fiber optic line second end and transceive light between the fiber optic cable second end and a second jack optical interface in a second jack housing;
   a first jack including a housing with an optic element selected from a group consisting of a laser source and a photodiode, and a microlens integrally formed in the housing to transceive light between the selected optic element and the microlens of the first plug, the first jack housing being shaped to engage the first plug mechanical body; and,
   a second jack including a housing with an optic element unselected from the group of optic elements and a microlens integrally formed in the housing to transceive light between the microlens of the second plug to the unselected optic element, the second jack housing being shaped to engage the second plug mechanical body;
   wherein at least a portion of the jack housings are transparent in a range of light wavelengths between 650 and 1800 nanometers (nm); and,
   wherein the microlenses are formed in the transparent portions of the jack housings.
39. A fiber optic cable comprising:
   a cable section including at least one length of fiber optic line having a first end and a second end;
   a first plug including a mechanical body shaped to engage a first jack housing, a cable interface to engage the fiber optic line first end, and a microlens, the microlens having a planar surface to transceive light with the fiber optic line first end, and a convex surface to transceive light with a first jack optical interface;
   a second plug including a mechanical body shaped to engage a second jack housing, a cable interface to engage the fiber optic line second end, and a microlens, the microlens having a planar surface to transceive light with the fiber optic line second end, and a convex surface to transceive light with a second jack optical interface;
   wherein the fiber optic cable first end is formed in a focal plane of the first plug microlens; and,
   wherein the fiber optic cable second end is formed in a focal plane of the second plug microlens.
40. A fiber optic cable plug comprising:
   a mechanical body for engaging a jack housing, including:
   a cable interface to engage a fiber optic line end;
   a microlens to transceive light with the cable interface, the microlens having a planar surface to transceive light with the cable interface, and a convex surface to transceive light with a jack optical interface; and,
   wherein the cable interface is formed in a focal plane of the plug microlens.
41. A fiber optic cable interface comprising:
   a cable section including:
   a first fiber optic line having a first end and a second end;
   a first plug including a mechanical body with a cable interface to engage the fiber optic line first end, and a microlens to transceive light between the fiber optic cable first end and a first jack optical interface in a first jack housing;
   a second plug including a mechanical body with a cable interface to engage the fiber optic line second end, and a microlens to transceive light between the fiber optic cable second end and a second jack optical interface in a second jack housing;
   a first jack including a housing with a laser source and a microlens to transmit light from the laser source to the microlens of the first plug, the first jack housing being shaped to engage the first plug mechanical body;
   a second jack including a housing with a photodiode and a microlens to transmit light from the microlens of the second plug to the photodiode, the second jack housing being shaped to engage the second plug mechanical body;
   wherein each plug microlens includes a convex surface interfaced to the corresponding jack microlens and a planar surface interfaced to a corresponding cable end;
   wherein each plug cable interface is formed in a focal plane of its corresponding microlens;
   wherein the first jack microlens has a convex surface interfaced to the convex surface of the first plug microlens;
   wherein the second jack microlens has a convex surface interfaced to the convex surface of the second plug microlens; and,
   wherein each jack laser source and photodiode is formed in a focal plane of its corresponding microlens.
42. The cable interface of claim 41 wherein each jack microlens has a planar surface for interfacing to its corresponding optic element.
43. A fiber optic cable interface comprising:
   a cable section including:
   a first fiber optic line having a first end and a second end;
   a first plug with a cable interface to engage the fiber optic line first end and transceive light between the fiber optic cable first end and a first jack optical interface in a first jack housing;
   a second plug with a cable interface to engage the fiber optic line second end and transceive light between the fiber optic cable second end and a second jack optical interface in a second jack housing;
   a first jack including a housing with an optic element selected from a group consisting of a laser source and a photodiode, and a microlens to transceive light between the selected optic element and the microlens of the first plug, the first jack housing being shaped to engage the first plug mechanical body; and,
   a second jack including a housing with an optic element unselected from the group of optic elements and a
microlens to transceive light between the microlens of the second plug to the unselected optic element, the second jack housing being shaped to engage the second plug mechanical body;
wherein the first jack microlens has a convex surface interfaced to the first plug and a planar surface for interfacing to the selected optic element;

wherein the second jack microlens has a convex surface interfaced to the second plug and a planar surface for interfacing to the unselected optic element; and,
wherein each jack laser source and photodiode is formed in a focal plane of its corresponding microlens.

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