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FIBER OPTIC CONNECTORS AND MULTIPORT ASSEMBLIES INCLUDING RETENTION FEATURES

Abstract

Fiber optic connectors and connectorized fiber optic cables include connector housings having locking portions defined on the connector housing that allow the connector housing to be selectively coupled to a corresponding push-button securing member of a multiport assembly. Methods for selectively connecting a fiber optic connector to and disconnecting the fiber optic connector from the multiport assemblies allow for connector housings to be forcibly and nondestructively removed from the multiport assembly.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of U.S. patent application Ser. No. 17/958,600 filed on Oct. 3, 2022, which is a continuation of U.S. patent application Ser. No. 17/068,291 filed on Oct. 12, 2020, which is now U.S. Pat. No. 11,460,646 granted on Oct. 4, 2022, which is a continuation of U.S. patent application Ser. No. 16/516,546 filed on Jul. 19, 2019, which is now U.S. Pat. No. 10,802,228 granted on Oct. 13, 2020, and which is a continuation of U.S. patent application Ser. No. 16/018,918 filed on Jun. 26, 2018, which is now U.S. Pat. No. 10,379,298 granted on Aug. 13, 2019, which claims the benefit of U.S. Provisional Patent Application 62/526,011, filed on Jun. 28, 2017, U.S. Provisional Patent Application 62/526,018 filed on Jun. 28, 2017, and U.S. Provisional Patent Application 62/526,195 filed on Jun. 28, 2017, the contents each of which are hereby incorporated by reference in their entirety.

BACKGROUND
Field
[0002] The present disclosure relates generally to assemblies for interconnecting or otherwise terminating optical fibers and fiber optic cables in a manner suitable for mating with corresponding optical receptacles.
Technical Background
[0003] Optical fibers are used in an increasing number and variety of applications, such as a wide variety of telecommunications and data transmission applications. As a result, fiber optic networks include an ever increasing number of terminated optical fibers and fiber optic cables that can be conveniently and reliable mated with corresponding optical receptacles in the network. These terminated optical fibers and fiber optic cables are available in a variety of connectorized formats including, for example, hardened OptiTap® and OptiTip® connectors, field-installable UniCam® connectors, preconnectorized single or multi-fiber cable assemblies with SC, FC, or LC connectors, etc, all of which are available from Corning Incorporated, with similar products available from other manufacturers, as is well documented in the patent literature.

[0004] The optical receptacles with which the aforementioned terminated fibers and cables are coupled are commonly provided at optical network units (ONUs), network interface devices (NIDs), and other types of network devices or enclosures, and often require hardware that is sufficiently robust to be employed in a variety of environments under a variety of installation conditions. These conditions may be attributable to the environment in which the connectors are employed, or the habits of the technicians handling the hardware. Consequently, there is a continuing drive to enhance the robustness of these connectorized assemblies, while preserving quick, reliable, and trouble-free optical connection to the network.

BRIEF SUMMARY

[0005] Fiber optic connectors, connectorized cable assemblies, multiport assemblies, and methods for connecting fiber optic connectors to, and disconnecting fiber optic connectors from multiport assemblies are disclosed herein.

[0006] In one embodiment, a fiber optic connector includes a ferrule including an optical fiber bore and a connector housing, where the connector housing includes a ferrule retaining portion positioned at a front portion of the connector housing, the ferrule retaining portion structurally configured to engage and retain the ferrule, a longitudinal axis extending from the front portion of the connector housing, through the ferrule retaining portion to a rear portion of the connector housing positioned opposite the front portion, a nominal housing portion defined on an outer surface of the connector housing, and a locking portion defined on the outer surface of the connector housing and interrupting the nominal housing portion, where the locking portion includes a port engagement face that extends inward from the nominal housing portion of the connector housing toward the longitudinal axis and that is oriented transverse to the longitudinal axis, and the locking portion further includes a locking portion recess positioned rearward of the port engagement face and inward of the nominal housing portion of the connector housing, and the locking portion recess is oriented transverse to the port engagement face and includes a planar surface extending across at least a portion of the outer surface of the connector housing.

[0007] In another embodiment, a connectorized fiber optic cable includes a ferrule including an optical fiber bore and a connector housing including a ferrule retaining portion positioned at a front portion of the connector housing, the ferrule retaining portion engaged with the ferrule, a longitudinal axis extending from the front portion of the connector housing, through the ferrule retaining portion and the optical fiber bore of the ferrule to a rear portion of the connector housing positioned opposite the front portion, a nominal housing portion defined on an outer surface of the connector housing, and a locking portion defined on the outer surface of the connector housing and interrupting the nominal housing portion, where the locking portion includes a port engagement face that extends inward from the nominal housing portion of the connector housing toward the longitudinal axis and that is oriented transverse to the longitudinal axis, and the locking portion further includes a locking portion recess positioned rearward of the port engagement face and inward of the nominal housing portion of the connector housing, and the locking portion recess is oriented transverse to the port engagement face and includes a planar surface extending across at least a portion of the outer surface of the connector housing, and a fiber optic cable including an optical fiber extending along the longitudinal axis of the connector housing to the optical fiber bore of the ferrule.

[0008] In yet another embodiment, a multiport assembly includes a shell defining a cavity positioned within the shell, a plurality of optical adapters positioned within the cavity of the shell, the plurality of optical adapters structurally configured to receive, align, and optically couple dissimilar optical connectors, a plurality of optical connector ports including respective connection port passageways permitting external optical connectors to access the plurality of optical adapters positioned within the cavity of the shell, the connection port passageways including respective connector insertion paths, and a plurality of push-button securing members associated with respective ones of the connection port passageways, each push-button securing member of the plurality of push-button securing members including a bore extending through the push-button securing member, the bore defining an inner perimeter, a connector engagement face positioned on the bore and oriented transverse to a corresponding connector insertion path, the connector engagement face including an inner end and an outer end positioned outward of the inner end, and a ramp positioned on the bore, the ramp extending between the inner perimeter of the bore and the inner end of the connector engagement face.

[0009] In yet another embodiment, a fiber optic junction includes a multiport assembly includes a shell defining a cavity positioned within the shell, an optical adapter positioned within the cavity of the shell, the optical adapter structurally configured to receive, align, and optically couple dissimilar optical connectors, an optical connection port defined by the shell and in communication with the cavity, the optical connection port includes a connection port passageway extending into the cavity and defining a connector insertion path, and a push-button securing member that intersects the connection port passageway, the push-button securing member including a bore extending through the push-button securing member and defining an inner perimeter, and a connector engagement face extending inward from the inner perimeter of the bore, and a fiber optic connector positioned at least partially within the connector insertion path of the multiport assembly, the fiber optic connector including a connector housing including a ferrule retaining portion positioned at a front portion of the connector housing, the ferrule retaining portion structurally configured to engage and retain a ferrule, a longitudinal axis extending from the front portion of the connector housing, through the ferrule retaining portion to a rear portion of the connector housing positioned opposite the front portion, a nominal housing portion defined on an outer surface of the connector housing, and a locking portion defined on the outer surface of the connector housing and interrupting the nominal housing portion, where the locking portion includes a port engagement face that extends inward from the nominal housing portion of the connector housing toward the longitudinal axis and that is oriented transverse to the longitudinal axis, and the locking portion further includes a locking portion recess positioned rearward of the port engagement face and inward of the nominal housing portion of the connector housing, and the locking portion recess is oriented transverse to the port engagement face and includes a planar surface extending across at least a portion of the outer surface of the connector housing, and where the port engagement face is selectively engaged with the connector engagement face of the multiport assembly.

[0010] In yet another embodiment, a method for selectively connecting a fiber optic connector to a multiport assembly includes inserting a connector housing of a fiber optic connector into a connector port of a multiport assembly, the connector housing including a longitudinal axis extending through the connector housing, engaging a ramp of a push-button securing member of the multiport assembly with the connector housing, moving the push-button securing member away from a connector insertion path defined by the multiport assembly, moving at least a portion of the connector housing through a bore of the push-button securing member of the multiport assembly, moving at least a portion of the push-button securing member into a locking portion recess of the connector housing, and engaging a connector engagement face of the push-button securing member that is oriented transverse to the connector insertion path of the multiport assembly, with a port engagement face of the connector housing that is oriented transverse to the longitudinal axis of the connector housing to selectively couple the connector housing to the multiport assembly.

[0011] In yet another embodiment, a fiber optic connector includes a ferrule and a connector housing, where the ferrule includes an optical fiber bore and the connector housing includes a ferrule retaining portion structurally configured to engage and retain the ferrule at a front portion of the connector housing, a longitudinal axis extending from a leading edge plane of the front portion of the connector housing, through the ferrule retaining portion, to a rear portion of the connector housing, a nominal housing portion defined on an outer surface of the connector housing, a rotationally discrete keying portion defined on the outer surface of the connector housing, and a rotationally discrete locking portion defined on the outer surface of the connector housing, where the nominal housing portion is interrupted by the rotationally discrete keying portion and the rotationally discrete locking portion, the connector housing has an unobstructed line of sight from the rotationally discrete keying portion to the leading edge plane of the connector housing along an advancing direction of the fiber optic connector, the rotationally discrete keying portion includes at least one rotationally discrete contact surface that is structurally configured to inhibit rotation of the connector housing about the longitudinal axis when engaged with a complementary keying portion of an optical connector port, the rotationally discrete locking portion includes a rearwardly facing port engagement face and a locking portion recess that is positioned rearward of the port engagement face, the locking portion recess is obstructed from the leading edge plane of the connector housing along the advancing direction of the fiber optic connector by the port engagement face, and the port engagement face of the locking portion is structurally configured to inhibit axial movement of the connector housing along a retracting direction of the fiber optic connector when engaged with a complementary securing member of an optical connector port.

[0012] In yet another embodiment, a multiport assembly includes a shell defining a cavity positioned within the shell, a plurality of optical adapters positioned within the cavity of the shell, the optical adapters structurally configured to receive, align, and optically couple dissimilar optical connectors, a plurality of optical connector ports including respective connection port passageways permitting external optical connectors to access the plurality of optical adapters positioned within the cavity of the shell, the connection port passageways including corresponding connector insertion paths, a plurality of rotationally discrete keying portions associated with respective ones of the connection port passageways, where each keying portion includes at least one rotationally discrete contact surface in unobstructed line of sight with an open end of a respective connection port passageway and the at least one rotationally discrete contact surface is structurally configured to inhibit rotation of a connector housing residing in the respective connection port passageway, and a plurality of push-button securing members associated with respective ones of the connection port passageways, where each push-button securing member is biased in an engaged position, in which a rotationally discrete locking portion of the push-button securing member is positioned within the corresponding connector insertion path, and is selectively positionable into and out of a disengaged position, in which the rotationally discrete locking portion of the push-button securing member is positioned outside the corresponding connector insertion path, the rotationally discrete locking portion of each push-button securing member includes a ramp oriented to progressively constrict the corresponding connector insertion path along an advancing direction of a fiber optic connector in the respective connection port passageway and an locking portion recess obstructed from the open end of the respective connection port passageway by a connector engagement face of the rotationally discrete locking portion of the push-button securing member, and the connector engagement face of the rotationally discrete locking portion is structurally configured to inhibit axial movement of a fiber optic connector in the connection port passageway along a retracting direction of a fiber optic connector in the respective connection port passageway.

[0013] In yet another embodiment, a method for connecting a fiber optic connector to a multiport assembly includes providing a fiber optic connector including a ferrule and a connector housing, where the ferrule includes an optical fiber bore and the connector housing includes a ferrule retaining portion structurally configured to engage and retain the ferrule at a front portion of the connector housing, a longitudinal axis extending from a leading edge plane of the front portion of the connector housing, through the ferrule retaining portion to a rear portion of the connector housing, a nominal housing portion defined on an outer surface of the connector housing, a rotationally discrete keying portion defined on the outer surface of the connector housing, and a rotationally discrete locking portion defined on the outer surface of the connector housing, where the nominal housing portion is interrupted by the rotationally discrete keying portion and the locking portion, the rotationally discrete keying portion includes an unobstructed line of sight with the leading edge plane of the connector housing along an advancing direction of the fiber optic connector, the rotationally discrete keying portion including at least one rotationally discrete contact surface structurally configured to inhibit rotation of the connector housing about the longitudinal axis when engaged with a complementary keying portion of an optical connector port, the locking portion includes a rearwardly facing port engagement face and a locking portion recess that is positioned rearward of the port engagement face, the locking portion recess is obstructed from the leading edge plane of the connector housing along the advancing direction of the fiber optic connector by the port engagement face, and the port engagement face of the locking portion is structurally configured to inhibit axial movement of the connector housing along a retracting direction of the fiber optic connector when engaged with a complementary locking portion of an optical connector port, advancing the fiber optic connector along the advancing direction into an optical connector port of a multiport assembly including a plurality of optical adapters, the optical adapters structurally configured to receive, align, and optically couple the fiber optic connector with a dissimilar optical connector within the multiport assembly, aligning the rotationally discrete keying portion of the connector housing with a complementary rotationally discrete keying portion associated with the optical connector port to permit the rotationally discrete locking portion of the connector housing to engage a rotationally discrete locking portion of a push-button securing member associated with the optical connector port, and engaging the rotationally discrete locking portion of the connector housing with the rotationally discrete locking portion of the push-button securing member associated with the optical connector port.

[0014] In yet another embodiment, a connectorized fiber optic cable assembly includes a ferrule, a connector housing, a cable adapter, a fiber optic cable, and a type SC conversion housing, where the connector housing includes a ferrule retaining portion, an adapter seating portion, a longitudinal axis extending transversely from a leading edge plane of the front portion of the connector housing, through the ferrule retaining portion and the adapter seating portion of the connector housing, to a rear portion of the connector housing, a rotationally discrete keying portion defined on the outer surface of the connector housing, a rotationally discrete locking portion defined on the outer surface of the connector housing, and a nominal housing portion defined on an outer surface of the connector housing and interrupted by the keying portion and the locking portion of the connector housing, the ferrule comprises a 2.5 millimeter nominal ferrule diameter, is retained by the ferrule retaining portion of the connector housing, and comprises an optical fiber bore, the keying portion of the connector housing comprises at least one rotationally discrete contact surface that is structurally configured to inhibit rotation of the connector housing about the longitudinal axis when engaged with a complementary keying portion of an optical connector port, the locking portion of the connector housing includes a rearwardly facing port engagement face and a locking portion recess that is positioned rearward of the port engagement face, the locking portion recess of the locking portion is obstructed from the leading edge plane of the connector housing along the advancing direction of the fiber optic connector by the port engagement face, the port engagement face of the locking portion is structurally configured to inhibit axial movement of the connector housing along a retracting direction of the fiber optic connector when engaged with a complementary locking portion of an optical connector port, the cable adapter comprises an optical cable passageway, an optical fiber passageway, a housing insert portion seated in the adapter seating portion of the connector housing to align the optical cable passageway and the optical fiber passageway with the longitudinal axis of the connector housing, and an adapter abutment limiting an extent to which the cable adapter extends into the adapter seating portion of the connector housing, the fiber optic cable extends along the optical cable passageway of the cable adapter and comprises an optical fiber extending along optical fiber passageway of the cable adapter and the optical fiber bore of the ferrule, and the connector housing comprises a line of sight from the keying portion to the leading edge plane of the connector housing that is obstructed only by the type SC conversion housing along an advancing direction of the fiber optic connector.

[0015] In yet another embodiment, a connectorized fiber optic cable assembly includes a ferrule, a connector housing, a cable adapter, a fiber optic cable, and a hardened conversion housing, where the connector housing includes a ferrule retaining portion, an adapter seating portion, a longitudinal axis extending transversely from a leading edge plane of the front portion of the connector housing, through the ferrule retaining portion and the adapter scating portion of the connector housing, to a rear portion of the connector housing, a rotationally discrete keying portion defined on the outer surface of the connector housing, a rotationally discrete locking portion defined on the outer surface of the connector housing, and a nominal housing portion defined on an outer surface of the connector housing and interrupted by the keying portion and the locking portion of the connector housing, the ferrule includes a 2.5 millimeter nominal ferrule diameter, is retained by the ferrule retaining portion of the connector housing, and includes an optical fiber bore, the keying portion of the connector housing includes at least one rotationally discrete contact surface that is structurally configured to inhibit rotation of the connector housing about the longitudinal axis when engaged with a complementary keying portion of an optical connector port, the locking portion of the connector housing includes a rearwardly facing port engagement face and a locking portion recess that is positioned rearward of the port engagement face, the locking portion recess of the locking portion is obstructed from the leading edge plane of the connector housing along the advancing direction of the fiber optic connector by the port engagement face, the port engagement face of the locking portion is structurally configured to inhibit axial movement of the connector housing along a retracting direction of the fiber optic connector when engaged with a complementary locking portion of an optical connector port, the cable adapter including an optical cable passageway, an optical fiber passageway, a housing insert portion seated in the adapter seating portion of the connector housing to align the optical cable passageway and the optical fiber passageway with the longitudinal axis of the connector housing, and an adapter abutment limiting an extent to which the cable adapter extends into the adapter seating portion of the connector housing, the fiber optic cable extends along the optical cable passageway of the cable adapter and includes an optical fiber extending along optical fiber passageway of the cable adapter and the optical fiber bore of the ferrule, the hardened conversion housing including a pair of opposing fingers including opposing interior faces that extend parallel to, and are arranged symmetrically about, the longitudinal axis of the connector housing, a finger spacing between the opposing interior faces of the opposing fingers is between 10.80 millimeters and 10.85 millimeters, a finger depth along a direction parallel to the longitudinal axis of the connector housing is between 8.45 millimeters and 8.55 millimeters, a finger width along a direction perpendicular to the finger depth and the longitudinal axis of the connector housing is less than 10 millimeters, outer faces of the opposing fingers lie along a common outside diameter of between 15.75 millimeters and 15.85 millimeters, an outer face of one of the opposing fingers is truncated in a plane parallel to the opposing interior faces to define a truncated span of between about 14.75 millimeters and about 14.95 millimeters, extending from the outer face of the truncated opposing finger to the outer face of the opposite finger, and the connector housing includes a line of sight from the keying portion to the leading edge plane of the connector housing that is obstructed only by the hardened conversion housing along an advancing direction of the fiber optic connector.

[0016] In yet another embodiment, a connectorized fiber optic cable assembly includes a ferrule, a connector housing, a cable adapter, a fiber optic cable, and a type SC conversion housing, where the connector housing includes a ferrule retaining portion positioned at a front portion of the connector housing, an adapter seating portion, a longitudinal axis extending transversely from a leading edge plane of the front portion of the connector housing, through the ferrule retaining portion and the adapter seating portion of the connector housing, to a rear portion of the connector housing, a nominal housing portion defined on an outer surface of the connector housing, and a locking portion defined on the outer surface of the connector housing and interrupting the nominal housing portion of the connector housing, the locking portion of the connector housing includes a port engagement face that extends inward from the nominal housing portion of the connector housing toward the longitudinal axis and is oriented transverse to the longitudinal axis, the locking portion of the connector housing further includes a locking portion recess positioned rearward of the port engagement face of the locking portion and inward of the nominal housing portion of the connector housing, the locking portion recess is oriented transverse to the port engagement face of the locking portion and includes a planar surface extending across at least a portion of the outer surface of the connector housing, the ferrule includes a 2.5 millimeter nominal ferrule diameter, is retained by the ferrule retaining portion of the connector housing, and includes an optical fiber bore, the cable adapter includes an optical cable passageway, an optical fiber passageway, a housing insert portion seated in the adapter seating portion of the connector housing to align the optical cable passageway and the optical fiber passageway with the longitudinal axis of the connector housing, and an adapter abutment limiting an extent to which the cable adapter extends into the adapter seating portion of the connector housing, the fiber optic cable extends along the optical cable passageway of the cable adapter and includes an optical fiber extending along optical fiber passageway of the cable adapter and the optical fiber bore of the ferrule, the type SC conversion housing surrounds the ferrule retaining portion of the connector housing and a portion of the connector housing rearward of the ferrule retaining portion of the connector housing, and the type SC conversion housing is positioned forward of the locking portion of the connector housing along the longitudinal axis of the connector housing such that the type SC conversion housing would present potential interfere with engagement of the locking portion of the connector housing with a securing member of an optical port.

[0017] In yet another embodiment, a connectorized fiber optic cable assembly includes a ferrule, a connector housing, a cable adapter, a fiber optic cable, and a hardened conversion housing, where the connector housing includes a ferrule retaining portion positioned at a front portion of the connector housing, an adapter seating portion, a longitudinal axis extending transversely from a leading edge plane of the front portion of the connector housing, through the ferrule retaining portion and the adapter seating portion of the connector housing, to a rear portion of the connector housing, a nominal housing portion defined on an outer surface of the connector housing, and a locking portion defined on the outer surface of the connector housing and interrupting the nominal housing portion of the connector housing, the locking portion of the connector housing includes a port engagement face that extends inward from the nominal housing portion of the connector housing toward the longitudinal axis and is oriented transverse to the longitudinal axis, the locking portion of the connector housing further includes a locking portion recess positioned rearward of the port engagement face of the locking portion and inward of the nominal housing portion of the connector housing, the locking portion recess is oriented transverse to the port engagement face of the locking portion and includes a planar surface extending across at least a portion of the outer surface of the connector housing, the ferrule includes a 2.5 millimeter nominal ferrule diameter, is retained by the ferrule retaining portion of the connector housing, and includes an optical fiber bore, the cable adapter includes an optical cable passageway, an optical fiber passageway, a housing insert portion seated in the adapter seating portion of the connector housing to align the optical cable passageway and the optical fiber passageway with the longitudinal axis of the connector housing, and an adapter abutment limiting an extent to which the cable adapter extends into the adapter seating portion of the connector housing, the fiber optic cable extends along the optical cable passageway of the cable adapter and includes an optical fiber extending along optical fiber passageway of the cable adapter and the optical fiber bore of the ferrule, the hardened conversion housing includes a pair of opposing fingers includes opposing interior faces that extend parallel to, and are arranged symmetrically about, the longitudinal axis of the connector housing, a finger spacing between the opposing interior faces of the opposing fingers is between 10.80 millimeters and 10.85 millimeters, a finger depth along a direction parallel to the longitudinal axis of the connector housing is between 8.45 millimeters and 8.55 millimeters, a finger width along a direction perpendicular to the finger depth and the longitudinal axis of the connector housing is less than 10 millimeters, outer faces of the opposing fingers lie along a common outside diameter of between 15.75 millimeters and 15.85 millimeters, an outer face of one of the opposing fingers is truncated in a plane parallel to the opposing interior faces to define a truncated span e of between about 14.75 millimeters and about 14.95 millimeters, extending from the outer face of the truncated opposing finger to the outer face of the opposite finger, and the hardened conversion housing surrounds the ferrule retaining portion of the connector housing and the locking portion of the connector housing to interfere with engagement of the locking portion of the connector housing with a securing member of an optical port.

[0018] In yet another embodiment, a multiport assembly includes a shell defining a cavity positioned within the shell, a plurality of optical adapters positioned within the cavity of the shell, the optical adapters structurally configured to receive, align, and optically couple dissimilar optical connectors, a plurality of optical connection ports including respective connection port passageways permitting external optical connectors to access the plurality of optical adapters positioned within the cavity of the shell, the connection port passageways including respective connector insertion paths, and a plurality of push-button securing members associated with respective ones of the connection port passageways, where each push-button securing member is biased in an engaged position, in which a locking portion of the push-button securing member is positioned within a corresponding connector insertion path, and is selectively positionable into and out of a disengaged position, in which the locking portion of the push-button securing member is positioned outside the corresponding connector insertion path, and the locking portion of each push-button securing member is configured to permit forcible nondestructive disengagement of an external optical connector from the locking portion of the push-button securing member upon application of a force on the external optical connector in a direction along an axis extending along the corresponding connector insertion path.

[0019] In yet another embodiment, a multiport assembly includes a shell defining a cavity positioned within the shell, a plurality of optical adapters positioned within the cavity of the shell, the optical adapters structurally configured to receive, align, and optically couple dissimilar optical connectors, a plurality of optical connection ports including respective connection port passageways permitting external optical connectors to access the plurality of optical adapters positioned within the cavity of the shell, the connection port passageways including respective connector insertion paths, and a plurality of push-button securing members associated with respective ones of the connection port passageways, where each push-button securing member includes a locking portion, where the push-button securing member is repositionable between a disengaged position, in which the locking portion is positioned outside a corresponding connector insertion path, and an engaged position, in which the locking portion is positioned within the corresponding connector insertion path.

[0020] In yet another embodiment, a method for selectively connecting a fiber optic connector to a multiport assembly includes inserting a connector housing of a fiber optic connector into a connector port of a multiport assembly, engaging a push-button securing member of the multiport assembly with the connector housing, moving the push-button securing member away from a connector insertion path defined by the multiport assembly, moving the connector housing through the push-button securing member of the multiport assembly, and engaging a locking portion of the push-button securing member with the connector housing to selectively couple the connector housing to the multiport assembly.

[0021] In yet another embodiment, a method for selectively disconnecting a fiber optic connector from a multiport assembly includes disengaging a locking portion of a push-button securing member of a multiport assembly from a connector housing of a fiber optic connector, moving the push-button securing member away from a connector insertion path defined by the multiport assembly, and moving the connector housing through the push-button securing member of the multiport assembly.

[0022] Although the concepts of the present disclosure are described herein with reference to a set of drawings that show a particular type of fiber optic cable, and connector components of particular size and shape, it is contemplated that the concepts may be employed in any optical fiber connectorization scheme including, for example, and without limitation, hardened OptiTap® and OptiTip® connectors, field-installable UniCam® connectors, single or multi-fiber cable assemblies with SC, FC, LC, or multi-fiber connectors, etc.

Description

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0023] The following detailed description of specific embodiments of the present disclosure can be best understood when read in conjunction with the following drawings, where like structure is indicated with like reference numerals and in which:

[0024] FIG. **1** schematically depicts a perspective view of a fiber optic connector including a connector housing, according to one or more embodiments shown and described herein;

[0025] FIG. **2** schematically depicts a lower perspective view of the fiber optic connector of FIG. **1** including a locking portion, according to one or more embodiments shown and described herein;

[0026] FIG. **3**A schematically depicts a cross-section of the fiber optic connector of FIG. **1**, according to one or more embodiments shown and described herein;

[0027] FIG. **3**B schematically depicts another cross-section of a port engagement face of the fiber optic connector of FIG. **1**, according to one or more embodiments shown and described herein;

[0028] FIG. **4** schematically depicts a top perspective view of the connector housing of the fiber optic connector of FIG. **1**, according to one or more embodiments shown and described herein;

[0029] FIG. **5** schematically depicts a perspective cross-section of the connector housing of the fiber optic connector of FIG. **1**, according to one or more embodiments shown and described herein;

[0030] FIG. **6** schematically depicts another cross-section of the fiber optic connector of FIG. **1**, according to one or more embodiments shown and described herein;

[0031] FIG. **7** schematically depicts the fiber optic connector of FIG. **1** with a conversion housing installed to the connecter housing, according to one or more embodiments shown and described herein;

[0032] FIG. **8** schematically depicts an exploded view of the fiber optic connector of FIG. **1** including another conversion housing, according to one or more embodiments shown and described herein;

[0033] FIG. **9** schematically depicts a cross-section of the conversion housing of FIG. **8** and a retaining member, according to one or more embodiments shown and described herein;

[0034] FIG. **10** schematically depicts a rear perspective view of the retaining member of FIG. **9**, according to one or more embodiments shown and described herein;

[0035] FIG. **11** schematically depicts a front perspective view of the retaining member of FIG. **9**, according to one or more embodiments shown and described herein;

[0036] FIG. **12** schematically depicts a perspective view of another connector housing, according to one or more embodiments shown and described herein;

[0037] FIG. **13** schematically depicts a cross-section of the connector housing for FIG. **12** along section **13-13** of FIG. **12**, according to one or more embodiments shown and described herein;

[0038] FIG. **14** schematically depicts a perspective view of another connector housing, according to one or more embodiments shown and described herein;

[0039] FIG. **15** schematically depicts a perspective view of another connector housing, according to one or more embodiments shown and described herein;

[0040] FIG. **16**A schematically depicts a multiport assembly, according to one or more

embodiments shown and described herein;
[0041] FIG. **16**B schematically depicts a cross-section of the multiport assembly of FIG. **16**A, according to one or more embodiments shown and described herein;
[0042] FIG. **17** schematically depicts cross-section of an optical connector port of the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0043] FIG. **18** schematically depicts a fiber optic connector inserted into the optical connector port of FIG. **17**, according to one or more embodiments shown and described herein;
[0044] FIG. **19** schematically depicts a front perspective view of a push-button securing member of the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0045] FIG. **20** schematically depicts a rear perspective view of a push-button securing member of the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0046] FIG. **21** schematically depicts a side perspective view of a push-button securing member of the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0047] FIG. **22** schematically depicts a fiber optic connector approaching the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0048] FIG. **23** schematically depicts the fiber optic connector inserted within an optical connection port of the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0049] FIG. **24** schematically depicts the fiber optic connector further inserted within the optical connection port of the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0050] FIG. **25** schematically depicts a side cross-section view of the fiber optic connector inserted within the optical connection port of the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0051] FIG. **26** schematically depicts the fiber optic connector engaging a push-button securing member of the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0052] FIG. **27** schematically depicts the fiber optic connector fully inserted to the optical connection port of the multiport assembly of FIG. **16**, according to one or more embodiments shown and described herein;
[0053] FIG. **28** schematically depicts a front view of another push-button securing member according to one or more embodiments shown and described herein;
[0054] FIG. **29** schematically depicts a top view of a push-button of the push-button securing member of FIG. **28**, according to one or more embodiments shown and described herein;
[0055] FIG. **30** schematically depicts another top view of the push-button of the push-button securing member of FIG. **28** with an o-ring seated to the push-button, according to one or more embodiments shown and described herein;
[0056] FIG. **31** schematically depicts a bottom view of the push-button of FIG. **29**, according to one or more embodiments shown and described herein;
[0057] FIG. **32** schematically depicts a blank for making the push-button securing member of FIG. **28**, according to one or more embodiments shown and described herein;
[0058] FIG. **33** schematically depicts the push-button securing member of FIG. **28** in isolation, according to one or more embodiments shown and described herein;
[0059] FIG. **34** schematically depicts another multiport assembly including a push-button securing member, according to one or more embodiments shown and described herein;
[0060] FIG. **35** schematically depicts a cross section of the multiport assembly and push-button securing member of FIG. **34**, according to one or more embodiments shown and described herein;

and

[0061] FIG. **36** schematically depicts the push-button securing member of FIG. **34** in isolation, according to one or more embodiments shown and described herein.

DETAILED DESCRIPTION

[0062] Embodiments described herein generally relate to various devices for forming an optical connection between optical fibers. More particularly, embodiments described herein include fiber optic connectors including connector housings having a locking portion that selectively engages a push-button securing member of a multiport assembly to selectively couple the fiber optic connector to the multiport assembly. The locking portion of the connector housing and/or the push-button securing member of the multiport assembly may be configured to allow forcible, non-destructive disengagement of the connector housing from the multiport assembly upon the application of a predetermined force to the connector housing. In this way, damage to the multiport assembly and/or the fiber optic connector resulting from unexpected or unintended forces applied to the connector housing may be minimized.

[0063] In embodiments, the push-button securing members may generally intersect a connection port passageway of the multiport assembly, which may reduce the need for securing features positioned on the perimeter of the connection port passageway. By reducing the need for securing features positioned on the perimeter of the connection port passageway, adjacent connection port passageways on the multiport assembly may be positioned closer to one another such that a greater number of connection port passageways to be included in a multiport assembly without increasing the overall size of the multiport assembly. Furthermore, the push-button securing members may be configured to automatically engage a connector housing upon the full insertion of the connector housing to the connection port passageway, such that a user may selectively couple the connector housing to the multiport assembly with one hand, thereby simplifying the connection of the connector housing to the multiport assembly. The connector housings may further include a keying portion that selectively engages a corresponding keying portion of the multiport assembly to ensure and maintain the rotational orientation of the fiber optic connector with the multiport assembly. These and other embodiments of fiber optic connectors and multiport assemblies are disclosed in greater detail herein with reference to the appended figures.

[0064] As used herein, the term “advancing direction” refers to a direction that is parallel to a longitudinal axis of the connector housing and in which the connector housing may be inserted into a corresponding port. Conversely, reference herein to the “retracting direction” refers to the opposite direction, i.e., a direction that is parallel to the longitudinal axis of the connector housing and in which the connector housing may be retracted from a corresponding port. In the appended figures, the advancing direction is depicted as “AD” and the retracting direction is depicted as “RD.”

[0065] Referring initially to FIG. **1**, a perspective view of a fiber optic connector **100** is schematically depicted. The fiber optic connector **100** generally includes a connector housing **110**, including a ferrule retaining portion **112** at a front portion **111** of the connector housing **110**. The connector housing **110** further includes a rear portion **113** positioned opposite the front portion **111** in an axial direction. The ferrule retaining portion **112** of the connector housing **110** is generally configured to hold and retain a ferrule **102** that is positioned at least partially within the ferrule retaining portion **112**.

[0066] In embodiments, the fiber optic connector **100** is coupled to a fiber optic cable **10** at the rear portion **113** of the fiber optic connector **100**. The fiber optic cable **10** generally includes an optical fiber **12** extending through the fiber optic cable **10**. The optical fiber **12** may generally extend through the connector housing **110** and the ferrule **102** along a longitudinal axis **114** of the connector housing **110**. For fiber optic cables **10** including a single optical fiber **12**, the optical fiber **12** may be coaxial with the longitudinal axis **114**. For multifiber cables, this alignment will be orthogonally offset for one, more than one, or all of the optical fibers of the cable.

[0067] In embodiments, the connector housing **110** generally includes an outer surface **118** that extends around a perimeter of the connector housing **110**, and the outer surface **118** may include one or more cross-sectional shapes. For example, in the embodiment depicted in FIG. **1**, the front portion **111** of the connector housing **110** includes a rectangular cross-section including planar sides, while the rear portion **113** of the connector housing **110** includes a curved outer surface **118**.

[0068] Referring to FIG. **2**, a lower perspective view of the connector housing **110** is schematically depicted. The connector housing **110** includes a nominal housing portion **120** defined on the outer surface **118** of the connector housing **110**. The nominal housing portion **120** extends about and axially along the outer surface **118** of the connector housing **110** but may be interrupted by a variety of distinctive surface features defined on the outer surface **118** of the connector housing **110**. The nominal housing portion **120** is referenced herein as being “nominal” to help distinguish it from the various distinctive surface features that are defined on the connector housing **110**. Without these distinctive surface features, the nominal housing portion **120** would form a relatively uniform and continuous surface of the connector housing **110**, and would extend far enough along a length of the connector housing **110** to provide a convenient surface for a user to handle the connector housing **110** without the use of a specialized connector handling tool or other supplemental hardware. Reference herein to a surface feature, e.g., a keying portion or a locking portion, that is “defined on” the outer surface **118** of the connector housing **110** contemplates that the surface feature may be a subtractive surface feature, like a cut-out, or an additive surface feature, like a projection.

[0069] In the embodiment depicted in FIG. **2**, the connector housing **110** includes a locking portion **130** defined on the outer surface **118** at the rear portion **113** of the connector housing **110**. The locking portion **130** is positioned on a curved surface of the outer surface **118** in the embodiment depicted in FIG. **2**, and generally includes a port engagement face **132** that extends inward from the nominal housing portion **120** toward the longitudinal axis **114** of the connector housing **110**. In one embodiment, the port engagement face **132** may generally define an edge-to-edge cross sectional cut-out of the connector housing **110**, in which the port engagement face **132** extends across the outer surface **118** in a direction transverse to the longitudinal axis **114**. In other embodiments, the port engagement face **132** may generally define a pocket cut-out of the connector housing **110**, in which the port engagement face **132** extends radially inward from the outer surface **118** toward the longitudinal axis **114**, and is bounded in a circumferential direction by the nominal housing portion **120**.

[0070] The locking portion **130** further includes a locking portion recess **134** positioned rearward of the port engagement face **132** and inward of the nominal housing portion **120**. The locking portion recess **134** includes a generally planar surface **136** that is oriented transverse to the port engagement face **132** and that extends at least partially across the outer surface **118** of the connector housing **110**. The locking portion recess **134** may also include a ramp portion **138** positioned rearward of the planar surface **136** and that extends outward from the planar surface **136** to the nominal housing portion **120** moving along the locking portion recess **134** in the retracting direction.

[0071] In embodiments, the port engagement face **132** extends inward from the nominal housing portion **120** of the connector housing **110** by a distance that corresponds to features of a push-button securing member **230** (FIG. **17**) such that the connector housing **110** may be selectively coupled to and removed from the push-button securing member **230** (FIG. **17**). In one embodiment, the port engagement face **132** extends inward from the nominal housing portion **120** by a distance of at least about 0.75 millimeters.

[0072] Referring collectively to FIGS. **2** and **3**A, the port engagement face **132** generally defines a planar surface that is oriented transverse to the longitudinal axis **114**. The port engagement face **132** includes and extends between an inner end **131** and an outer end **133** that is positioned outward of the inner end **131**. The outer end **133** may include a rounded or chamfered edge, which may assist in preventing breakage of the outer end **133** when the connector housing **110** is forcibly removed from a connection port, as described in greater detail herein.

[0073] In some embodiments, the outer end **133** is positioned closer to the front portion **111** of the connector housing **110** in an axial direction than the inner end **131**, such that the port engagement face **132** is both rearward and outward facing. In these embodiments, the port engagement face **132** generally defines a plane that intersects the longitudinal axis **114** at an angle that is less than 30 degrees evaluated from perpendicular.

[0074] For example, as best shown in FIG. **5**, the port engagement face **132** is a formed as a rearward-facing cut-out that lies in a plane that intersects the longitudinal axis **114** at an acute angle α.sub.1, and the ramp portion **138** is formed as a forward-facing cut-out that lies in a plane that intersects the longitudinal axis **114** at an angle α.sub.2 that is greater than α.sub.1. In embodiments, α.sub.2 is generally between 110 degrees and 180 degrees and may generally be selected to correspond to a feature of a push-button securing member **230** (FIG. **17**), as described in greater detail herein. As noted above, in embodiments, the angle α.sub.1 is generally within 30 degrees of perpendicular (i.e., the port engagement face **132** lies in a plane that intersects the longitudinal axis at an angle between 60 degrees and 90 degrees) such that the port engagement face **132** is outward and rearward facing. By orienting the port engagement face **132** in a rearward and outward facing orientation, the port engagement face **132** may be selectively disengaged from a push-button securing member **230** (FIG. **17**) upon the application of a force above a predetermined threshold, as described in greater detail herein. In other embodiments, the port engagement face **132** is oriented such that the port engagement face **132** that extends in a plane that is orthogonal to the longitudinal axis **114**.

[0075] Referring to FIG. **3**B, in some embodiments, the port engagement face **132** may include a locking face **135** that extends in a plane that is orthogonal to the longitudinal axis **114** (FIG. **3**A), and a release face **137** positioned outward from the locking face **135**. In the embodiment depicted in FIG. **3**B, the release face **137** extends in a plane that intersects the locking face **135** at an angle φ.sub.1. In embodiments, the angle φ.sub.1 is between about 0 degrees and 30 degrees, inclusive of the endpoints, such that the release face **137** is outward and rearward facing. By including both a locking face **135** that extends in a plane that is orthogonal to the longitudinal axis **114** and a release face **137** that is outward and rearward facing, the port engagement face **132** of the connector housing **110** may be rigidly connected to a push-button securing member **230** (FIG. **17**) engaged with the locking face **135**. However, the port engagement face **132** of the connector housing may be releasably engaged with a push-button securing member **230** (FIG. **17**) engaged with the release face **137** upon the application of a force above a predetermined threshold, as described in greater detail herein.

[0076] Referring again to FIGS. **2** and **3**A, in embodiments, the front portion **111** has a perimeter extending around the outer surface **118** of the front portion **111** that is less than a perimeter extending around the outer surface **118** of the rear portion **113** of the connector housing **110**. The connector housing further includes a transition region **116** positioned between the front portion **111** and the rear portion **113**, where the perimeter of the connector housing **110** extending around the outer surface **118** increases moving along the transition region **116** from the front portion **111** to the rear portion **113** in an axial direction.

[0077] In embodiments, the connector housing **110** includes a thread **122** extending around the outer surface **118** at the transition region **116**. The thread **122** generally includes crests **126** that are separated from one another by a pitch **124**. The thread **122** may be utilized to selectively couple one or more conversion housings to the connector housing **110**, as described in greater detail herein. While the thread **122** is depicted as being positioned on the transition region **116**, it should be understood that the thread **122** may be alternatively or additionally positioned on the outer surface **118** of the front portion **111** and/or the rear portion **113** of the connector housing **110**.

[0078] In embodiments, the pitch **124** between the crests **126** of the thread **122** is less than a length

140 of the locking portion recess **134** evaluated in an axial direction. Because the pitch **124** of the thread **122** is less than the length **140** of the locking portion recess **134**, the locking portion recess **134** may selectively interact with a push-button securing member **230** (FIG. **17**) while the pitch **124** prevents the thread **122** from interacting the push-button securing member **230** (FIG. **17**), as described in greater detail herein.

[0079] Referring particularly to FIG. **3**A, the ferrule **102** is positioned within and engaged with the ferrule retaining portion **112** of the connector housing **110**. The ferrule **102** defines an optical fiber bore **104** that is configured to retain the optical fiber **12**. The optical fiber bore **104** is generally aligned with the longitudinal axis **114** of the connector housing **110** such that the longitudinal axis **114** is coaxial with the optical fiber bore **104**.

[0080] Referring collectively to FIGS. **4** and **5**, a perspective view of the connector housing **110** and a cross-section of the fiber optic connector **100** are schematically depicted. The connector housing **110** includes a keying portion **150** defined on the outer surface **118** of the connector housing **110**, the keying portion **150** including pair of opposing contact surfaces **152**. The opposing contact surfaces **152** are structurally configured to inhibit rotation of the connector housing **110** about the longitudinal axis **114** when engaged with a complementary keying portion of an optical connection port **220** (FIG. **17**). In the embodiment depicted in FIGS. **4** and **5**, the keying portion **150** is positioned at the rear portion **113** of the connector housing **110**, and interrupts the nominal housing portion **120**. In embodiments, the keying portion **150** of the connector housing **110** extends closer to the front portion **111** of the connector housing **110** than does the locking portion **130** of the connector housing **110**, such that the keying portion **150** may contact features of an optical connection port **220** (FIG. **17**) prior to the locking portion **130**, as described in greater detail herein. In the embodiment depicted in FIG. **5**, the keying portion **150** of the connector housing **110** extends at least partially into the transition region **116** of the connector housing **110**. In some embodiments, the keying portion **150** may only extend forward into the transition region **116**, such that the keying portion **150** terminates prior to the front portion **111** of the connector housing **110** moving forward along the outer surface **118**. The keying portion **150** may generally extend in an axial direction a distance that is longer than the transition region **116** and/or the front portion **111** in the axial direction.

[0081] Referring to FIGS. **5** and **6**, in embodiments, the keying portion **150** and/or the locking portion **130** (and portions thereof) may be rotationally discrete on the outer surface **118** of the connector housing **110**. As used herein, the term “rotationally” discrete represents a limited width-wise extent along the outer surface **118** of the connector housing **110**, as the connector housing **110** is rotated about its longitudinal axis **114**. For example, the keying portion **150** may be relatively long and have a relatively narrow width, which width can be described with reference to the rotational arc θ.sub.1 circumscribed by the width of the keying portion **150** relative to the longitudinal axis **114** of the connector housing **110**. In the illustrated embodiments, the arc θ.sub.1 is about 50 degrees, and it is contemplated that the arc θ.sub.1 may, in many embodiments, be between about 30 degrees and about 70 degrees. Similarly, in the illustrated embodiments, the locking portion **130** is wider than the keying portion **150**, i.e., about 90 degrees, and it is contemplated that the arc θ.sub.2 circumscribed by the width of the locking portion **130** may be between about 120 degrees and about 60 degrees. In some embodiments, the locking portion **130** is wider than the keying portion **150** such that the rotational arc θ.sub.1 is less than about 30% of the rotational arc θ.sub.2. In one embodiment, the rotational arc θ.sub.2 is less than 90 degrees. In the embodiment depicted in FIGS. **5** and **6** the rotational arcs θ.sub.1, θ.sub.2 are mutually exclusive such that the keying portion **150** and the locking portion **130** are defined on different surface portions of the outer surface of the connector housing. In one embodiment, the rotational arc θ.sub.2 circumscribed by the width of the locking portion **130** relative to the longitudinal axis **114** of the connector housing **110** is greater than about 90 degrees, and the rotational arc θ.sub.1 circumscribed by the width of the keying portion **150** relative to the longitudinal axis **114** of the housing is less than a rotational arc θ.sub.2. In another embodiment, the rotational arc θ.sub.2 circumscribed by the width of the locking portion **130** relative to the longitudinal axis **114** of the connector housing **110** is less than about 120 degrees, and the rotational arc θ.sub.1 is greater than about 60 degrees, but does not exceed about 70 degrees. In one embodiment, the sum of the rotational arcs θ.sub.1, θ.sub.2 are limited such that (θ.sub.1+θ.sub.2)<180°.

[0082] The keying portion **150** generally has an unobstructed line of sight to a leading edge plane **115** that is defined by the front portion **111** of the connector housing **110** and that is orthogonal to the longitudinal axis **114**. The keying portion **150** of the connector housing **110** helps to ensure proper rotational orientation of the fiber optic connector **100** when it is engaged with an optical connection port **220** (FIG. **17**) having a complementary keying portion. The locking portion **130** can also be configured to help ensure that the connector housing **110** cannot be inadvertently locked into an optical connection port **220** (FIG. **17**) in a rotationally misaligned state. It is contemplated that it may be insufficient to rely on the locking portion **130** alone for proper rotational alignment of the connector housing because, in some instances, there will not be close contact between the respective surfaces of the locking portion recess **134** and a push-button securing member **230** (FIG. **17**) of an optical connection port **220** (FIG. **17**). In fact, in some embodiments a gap will be intentionally provided between these surfaces to isolate a spring-loaded movement of the push-button securing member **230** (FIG. **17**) of the optical connection port **220** (FIG. **17**) from the connector housing **110**, as described in greater detail herein. It is also noteworthy that the locking portion **130** does not enjoy an unobstructed line of sight with the leading edge plane **115** of the connector housing **110**, as is the case with the keying portion **150**. The unobstructed line of sight of the keying portion **150** can be used to help ensure proper rotational orientation of the connector housing **110** as the connector housing **110** is initially advanced into a complementary optical connection port **220** (FIG. **17**), and before the obstructions of the locking portion **130** begin to interface and interfere with various portions of the optical connection port **220** (FIG. **17**). Accordingly, although in embodiments the keying portion **150** and the locking portion **130** are both rotationally discrete and could conceivably be used on their own to help ensure proper rotational alignment, the present inventors have recognized that it may be best to rely on the keying portion **150** for rotational alignment, and the locking portion **130** for engagement, because the keying portion **150** enjoys an unobstructed line of sight that is not subject to inadvertent interference with the optical connection port **220** (FIG. **17**), and the locking portion **130** is often designed to avoid close contact with the hardware of the optical connection port **220** (FIG. **17**).

[0083] In the embodiment depicted in FIGS. **5** and **6**, the keying portion **150** comprises the pair of rotationally discrete contact surfaces **152** that interrupt the nominal housing portion **120** as a negative cut-out. The discrete contact surfaces **152** generally include planar surfaces that are accessible without obstruction from the leading edge plane **115** of the connector housing **110**. The contact surfaces **152** generally line in planes that intersect a plane defined by the port engagement face **132**. In one embodiment, the contact surfaces **152** lie in planes that are orthogonal to the port engagement face **132**. For example, in the embodiment depicted in FIGS. **4** and **5**, the contact surfaces **152** lie in planes that are generally parallel with the longitudinal axis **114**, such that the contact surfaces **152** are may restrict rotation of the connector housing **110** about the longitudinal axis **114**. The port engagement face **132** generally lies in a plane that intersects the longitudinal axis **114** of the connector housing **110**, such that the port engagement face **132** may restrict axial movement of the connector housing **110** along the longitudinal axis **114**, such as when engaged with a corresponding surface within an optical connection port **220** (FIG. **17**).

[0084] Referring to FIG. **7**, a type SC conversion housing **180** is selectively coupled to the front portion **111** of the connector housing **110**. In the embodiment depicted in FIG. **7**, the type SC conversion housing **180** generally increases perimeter evaluated around the front portion **111** of the connector housing **110**, to provide the connector housing **110** a footprint suitable for use in an SC type connection. Type SC conversion housings are characterized by a connector footprint as set forth in IEC 61754-4, published by the International Electrical Commission, which defines the standard interface dimensions for the type SC family of fiber optic connectors and may be updated periodically. As is noted in the aforementioned standard, the parent connector for the type SC connector family is a single position plug connector which is characterized by a 2.5 millimeter nominal ferrule diameter. It includes a push-pull coupling mechanism which is spring loaded relative to the ferrule in the direction of the optical axis. The plug has a single male key which may be used to orient and limit the relative position between the connector and the component to which it is mated. The optical alignment mechanism of the connector is of a resilient sleeve style. IEC 61754-4 defines the standard interface dimensions of active device receptacles for the type SC connectors. The receptacles are used to retain the connector plug and mechanically maintain the optical datum target of the plugs at a defined position within the receptacle housings. The SC connector standard encompasses simplex plug connector interfaces, simplex adaptor connector interfaces, duplex plug connector interfaces, and duplex adaptor connector interfaces.

[0085] The connector housing **110** comprises a line of sight from the keying portion **150** (FIG. **6**) to the leading edge plane **115** (FIG. **5**) of the connector housing **110** that is obstructed only by the type SC conversion housing **180** along the advancing direction of the fiber optic connector **100**. The type SC conversion housing **180** surrounds the ferrule retaining portion **112** (FIG. **4**) of the connector housing **110** and a portion of the connector housing **110** rearward of the ferrule retaining portion **112** of the connector housing **110**. The type SC conversion housing **180** is positioned forward of the locking portion **130** (FIG. **5**) of the connector housing **110** along the longitudinal axis **114** of the connector housing **110** such that the type SC conversion housing **180** would present potential interference with engagement of the locking portion **130** (FIG. **5**) of the connector housing **110** with a securing member of an optical port.

[0086] Referring to FIGS. **8**, **9**, **10**, and **11**, a hardened conversion housing **182** is schematically depicted. In embodiments, the hardened conversion housing **182** includes internal threads that engage the thread **122** of the connector housing **110**. The hardened conversion housing **182** may be retained in place by a retention member **185** that may be selectively coupled to the front portion **111** of the connector housing **110**. The retention member **185** may be configured to mechanically interfere with and prevent rotation of the hardened conversion housing **182** with respect to the connector housing **110**, thereby retaining the hardened conversion housing **182** on the thread **122** of the connector housing **110**. In embodiments, the hardened conversion housing **182** includes opposing fingers **183** that comprise interior faces **187** that extend parallel to and are arranged symmetrically about the longitudinal axis **114** of the connector housing **110**. In embodiments, the opposing interior faces **187** of the opposing fingers **183** are spaced apart from one another by a distance **189**, which is selected to be between about 10.80 millimeters and about 10.85 millimeters, inclusive of the endpoints. Each of the fingers **183** have a depth **186** evaluated along a direction parallel to the longitudinal axis **114** of the connector housing **110** that is between about 8.45 millimeters and about 8.55 millimeters, inclusive of the endpoints. Each of the fingers **183** further include a width **188** evaluated along a direction perpendicular to the finger depth **186** and the longitudinal axis **114** of the connector housing **110** that is less than about 10 millimeters. Outer faces of the opposing fingers **183** lie along a common outside diameter **190** of between about 15.75 millimeters and about 15.85 millimeters, inclusive of the endpoints. The outer face of one of the opposing fingers **183** is truncated in a plane parallel to the opposing interior faces **187** to define a truncated span **192** extending from the outer face of the truncated opposing finger **183** to the outer face of the opposite finger **183**, the span **192** being between about 14.75 millimeters and about 14.95 millimeters, inclusive of the endpoints.

[0087] In embodiments, the connector housing **110** comprises a line of sight from the keying portion **150** (FIG. **6**) to the leading edge plane **115** (FIG. **5**) of the connector housing **110** that is obstructed only by the hardened conversion housing **182** along the advancing direction of the fiber optic connector **100**. The hardened conversion housing **182** surrounds the ferrule retaining portion **112** (FIG. **4**) of the connector housing **110** and a portion of the locking portion **130** (FIG. **5**) of the connector housing **110** such that the hardened conversion housing **182** would interfere with engagement of the locking portion **130** of the connector housing **110** with a securing member of an optical port.

[0088] Referring to FIGS. **12** and **13**, a perspective view and a cross-section of another embodiment of a connector housing **110** are schematically depicted, respectively. In the embodiment depicted in FIG. **13**, the outer surface **118** of the rear portion **113** of the connector housing **110** includes planar surfaces, as compared to the curved surface depicted in FIG. **1** and described above. The planar surfaces may correspond to planar surfaces within a port assembly configured to receive the connector housing. In the embodiment depicted in FIG. **13**, the outer surface **118** of the rear portion **113** of the connector housing **110** forms a hexagonal shape, however, it should be understood that the connector housing **110** may include any suitable number of planar surfaces. In the embodiment shown in FIGS. **12** and **13**, the connector housing **110** includes the locking portion **130**, but the keying portion **150** (FIG. **6**) may optionally be omitted. Because the connector housing **110** includes planar surfaces which may correspond to complementary planar surfaces in a port assembly, rotational mis-alignment between the connector housing **110** and the port assembly may be limited. For example, the connector housing **110** may only be insertable to the port assembly in a number of rotational positions that corresponds the number of planar surfaces of the connector housing **110**.

[0089] Referring to FIG. **14**, a perspective view of another connector housing **110** is schematically depicted. In the embodiment depicted in FIG. **14**, the thread **122** is positioned on the front portion **111** of the connector housing **110**, forward of the transition region **116**. As described above, the thread **122** may be utilized to selectively couple a conversion housing to the connector housing, and the thread **122** may be positioned on the front portion **111**, the transition region **116**, and/or the rear portion **113** of the connector housing **110**.

[0090] Referring to FIG. **15**, a perspective view of another connector housing **110** is schematically depicted. In the embodiment depicted in FIG. **15**, the contact surfaces **152** of the keying portion **150** extend outward as a positive surface projection from the connector housing **110**, as compared to the recessed contact surfaces **152** described above. The contact surfaces **152** may be configured to engage with recessed contact surfaces of a port assembly to align the connector housing **110**. Additionally, in the embodiment depicted in FIG. **15**, the locking portion **130** is formed as a curved, concave surface recessed from the nominal housing portion **120**, as compared to the locking portions **130** described above having the port engagement face **132** (FIG. **5**). The concave surface of the locking portion **130** may be configured to engage with a push-button securing member **230** (FIG. **28**) including opposing arms **274** (FIG. **28**), as described in greater detail herein.

[0091] The fiber optic connectors **100** described above may be utilized to optically couple the optical fibers **12** (FIG. **3**A) to other optical fibers. For example the fiber optic connectors **100** may be selectively coupled to an optical connector port to optically couple the optical fiber **12** (FIG. **3**A) to another optical fiber positioned within the optical connector port. To facilitate the connection of multiple fiber optic connectors **100**, “multiport” assemblies described herein may include multiple optical connector ports. The structure and configuration of example multiport assemblies and the interaction of the connector housing **110** of the fiber optic connectors **100** are described below.

[0092] Referring collectively to FIGS. **16**A and **16**B, a perspective view of a multiport assembly **200** and a section view of the multiport assembly **200** along section **16**B-**16**B are schematically depicted, respectively. The multiport assembly **200** generally includes a plurality of optical connection ports **220** that are configured to receive fiber optic connectors **100** (FIG. **1**). In the embodiment depicted in FIG. **16**A, the multiport assembly **200** includes five optical connection ports **220**, however, it should be understood that multiport assemblies **200** according to the present disclosure may include any suitable number of optical connection ports **220**. The multiport assembly **200** includes an upward-facing top surface **207** and an outward-facing front end **206**. In embodiments, the multiport assembly **200** generally includes scallops **205** associated and aligned with each of the optical connection ports **220** and extending between the outward-facing front end **206** and the top surface **207**. The scallops **205** generally include a cut-out extending into the outward-facing front end **206** and the top surface **207** of the multiport assembly **200** and may provide a tactile indication of the positioning of the optical connection ports **220** and a push-button securing member **230** associated with the optical connection port **220**. For example, a user may insert a fiber optic connector **100** (FIG. **1**) into the optical connection port **220**, and/or may depress a push-button securing member **230** to remove a fiber optic connector **100** (FIG. **1**) from the multiport assembly **200**. In some settings, the multiport assembly **220** may be difficult to reach and/or the user may not have a direct line of sight to the optical connection port **220** and/or the push-button securing member **230**, and the scallop **205** may provide tactile feedback to the user to locate the optical connection port **220** and/or the push-button securing member **230**.

[0093] Referring collectively to FIGS. **17** and **18**, a cross-section of one of the plurality of optical connection ports **220** without and with a fiber optic connector **100** positioned within the optical connection port **220** are schematically depicted, respectively. In embodiments the optical connection ports **220** are generally positioned at a front end **206** of the multiport assembly **200** and extend toward a rear end **208** of the multiport assembly **200** positioned opposite the front end **206**. The multiport assembly **200** includes a shell **202** that defines a cavity **204** positioned within the shell **202**. In the embodiment depicted in FIGS. **17** and **18**, the shell **202** includes an upper member **201** that is coupled to a lower member **203** to form the shell **202**. In other embodiments, the shell **202** may have a unitary construction, or may include multiple members coupled to one another to define the cavity **204**.

[0094] In embodiments, the multiport assembly **200** includes a plurality of optical adapters **210** positioned in the cavity **204** that correspond to each of the optical connection ports **220**. Each of the optical adapters **210** are structurally configured to receive, align, and optically couple dissimilar optical connectors. For example, the optical adapters **210** are configured to receive the fiber optic connector **100** on one side, and optically couple the fiber optic connector **100** to another fiber optic connector including a different shape.

[0095] Each of the optical connection ports **220** include a connection port passageway **222** that includes an open end positioned opposite the cavity **204** and that permits an external optical connector **100** to access a corresponding optical adapter **210** positioned within the cavity **204** of the shell **202**. Each of the connection port passageways **222** define a connector insertion path **224** extending inward along the connection port passageway **222** to the optical adapter **210**. The connector insertion path **224** generally defines the path a fiber optic connector **100** follows upon being inserted to the connection port passageway **222**.

[0096] The multiport assembly **200** includes a plurality of push-button securing members **230**, each of which intersect a corresponding connector insertion path **224**. The push-button securing members **230** are movable in a direction that is transverse to the connection port passageway **222**, as described in further detail herein.

[0097] Referring collectively to FIGS. **19**, **20**, and **21**, a rear perspective view, a front perspective view, and a side view of a push-button securing member **230** are schematically depicted, respectively. The push-button securing members **230** generally include a main body **242** and a retention portion **240** extending outward from the main body **242**. The retention portion **240** may be configured to contact the shell **202** (FIG. **18**) of the multiport assembly **200** (FIG. **18**) and retain the push-button securing members **230** within the shell **202** of the multiport assembly **200**. Each push-button securing member **230** generally defines a bore **232** extending through the push-button securing member **230**, each bore **232** defining an inner perimeter **231**. While the bore **232** depicted in FIGS. **19-21** is depicted as including a circular shape, it should be understood that the bore **232** may include any suitable shape for receiving a fiber optic connector **100** (FIG. **1**). For example, in some embodiments, the bore **232** may include planar surfaces configured to interface with planar surfaces of a connector housing **110** (FIG. **13**).

[0098] Each push-button securing member **230** includes a locking portion **233** including a connector engagement face **234** positioned on the bore **232**. When installed to the multiport assembly **200** (FIG. **17**), in some embodiments, the connector engagement face **234** is generally oriented transverse to the corresponding connector insertion path **224** (FIG. **17**), and defines a locking portion recess **239** that is generally obstructed from the open end of the connector insertion path **224** (FIG. **17**) by the connector engagement face **234**. The connector engagement face **234** extends between an inner end **237** an outer end **235** positioned outward from the inner end **237**, as evaluated from a center of the bore **232**. In embodiments, the outer end **235** may include a rounded or chamfered edge, which may assist in preventing breakage of the outer end **235** when a connector housing **110** (FIG. **18**) is forcibly removed from the connection port passageway **222** (FIG. **18**), as described in greater detail herein.

[0099] In some embodiments, the outer end **235** is positioned on the inner perimeter **231** of the bore **232** such that the connector engagement face **234** extends inward from the inner perimeter **231**. In other embodiments, the connector engagement face **234** may extend outward from the inner perimeter **231** of the bore **232**. The push-button securing member **230** further includes a ramp **236** that extends between the inner perimeter **231** of the bore **232** to the inner end **237** of the connector engagement face **234**, such that the ramp **236** is upward and forward facing when the push-button securing member **230** is positioned within the multiport assembly **200** (FIG. **17**). The ramp **236** generally includes an ascending portion **238***a* that extends inward from the inner perimeter **231** of the bore **232** and a plateau portion **238***b* that extends between the ascending portion **238***a* and the inner end **237** of the connector engagement face **234**. The ascending portion **238***a* of the ramp **236** is oriented to progressively constrict the corresponding connector insertion path **224** (FIG. **17**).

[0100] Referring again to FIGS. **17** and **18**, the plateau portion **238***b* of each of the push-button securing members **230** is generally aligned with the connector insertion path **224**. In embodiments, the ramp **236** of each of the push-button securing members **230** is positioned forward of the connector engagement face **234** of the push-button securing members **230**. In other words, the ramps **236** of each of the push-button securing members **230** are positioned closer to the front end **206** of the multiport assembly **200** than the connector engagement face **234** of the push-button securing member **230**. In this way, the ramp **236** may contact a fiber optic connector **100** being inserted along the connector insertion path **224** prior to the connector engagement face **234**, as described in greater detail herein.

[0101] In some embodiments, the connector engagement face **234** of each of the push-button securing members **230** defines a plane that is orthogonal to the connector insertion path **224**. In other embodiments, the connector engagement face **234** of each of the push-button securing members **230** are oriented such that the inner end **237** (FIG. **20**) of the connector engagement face **234** is positioned closer to the front end **206** of the multiport assembly **200** than the outer end **235** (FIG. **20**) of the connector engagement face **234**. In these embodiments, the connector engagement face **234** of each of the plurality of push-button securing members **230** defines a plane that intersects the corresponding connector insertion path **224** at an angle that is less than 30 degrees from perpendicular, such that the connector engagement face **234** faces rearward and upward. By orienting the connector engagement face **234** of each of the push-button securing members **230** rearward and upward, a fiber optic connector **100** may be removed from the multiport assembly **200** upon an application of force to the fiber optic connector **100** in a direction along the connector insertion path **224**, as described in greater detail herein.

[0102] In embodiments, a resilient member **250** is engaged with each of the push-button securing members **230**. The resilient members **250** may bias the push-button securing members **230**, and may generally include a spring, such as and without limitation a compression spring, a tension spring, a torsion spring, or the like. In embodiments, the resilient members **250** include a spring constant of between about 10 newtons per millimeter and about 50 newtons per millimeter, inclusive of the endpoints. In another embodiment, the resilient members **250** include a spring constant of between about 12 newtons per millimeter and about 16 newtons per millimeter, inclusive of the endpoints. Increasing the spring constant may increase a force required to move the push-button securing members **230** between an engaged position and a disengaged position, as described in greater detail herein. The resilient members **250** may include a free length of between about 3 millimeters and about 20 millimeters, inclusive of the endpoints. In one embodiment, the resilient members **250** have a free length of between about 5 millimeters and about 8 millimeters, inclusive of the endpoints.

[0103] The push-button securing members **230** are repositionable between an engaged position, in which the locking portion **233** of each of the push-button securing members **230** is positioned within and intersects the corresponding connector insertion path **224**, and a disengaged position, in which the locking portion **233** is spaced apart from the corresponding connector insertion path **224**. More particularly, the push-button securing members **230** are repositionable between an engaged position, in which the connector engagement face **234** of each of the push-button securing members **230** is positioned within and intersects the corresponding connector insertion path **224**, and a disengaged position, in which the connector engagement face **234** is spaced apart from the corresponding connector insertion path **224**.

[0104] In embodiments, the resilient members **250** bias the push-button securing members **230** into the engaged position, such that a force must be applied to resilient members **250** to reposition the push-button securing members **230** into the disengaged position.

[0105] For example and referring to FIG. **22**, a fiber optic connector **100** is depicted approaching an optical connection port **220**. As shown in FIG. **22**, the front portion **111** of the connector housing **110** is initially inserted within the connector insertion path **224** of the connection port passageway **222**.

[0106] Referring to FIG. **23**, as the fiber optic connector **100** is further inserted along the connector insertion path **224**, the front portion **111** of the connector housing **110** may pass through the bore **232** of the push-button securing member **230**. As described above, in some embodiments the perimeter of the front portion **111** of the connector housing **110** may be less than a perimeter of the rear portion **113** of the connector housing **110**, and in some configurations, the front portion **111** of the connector housing may be sized to pass through the bore **232** of the push-button securing member **230** without contacting the ramp **236** of the push-button securing member **230**.

[0107] Referring collectively to FIGS. **24** and **25**, the optical connector port **220** includes a rotationally discrete keying portion **260** extending inward into the connector insertion path **224**. The rotationally discrete keying portion **260** comprises includes rotationally discrete contact surfaces, more particularly a forward-facing surface **262** that is oriented to face the open end of the connection port passageway **222**, and one or more lateral-facing surfaces **264** that are configured to engage the contact surfaces **152** of the keying portion **150** of the connector housing **110**. Through engagement with the contact surfaces **152** of the keying portion **150** of the connector housing **110**, the lateral-facing surfaces **264** are structurally configured to inhibit rotation of the connector housing **110** when inserted into the connection port passageway **222**. Each of the rotationally discrete contact surfaces of the keying portion **260** of the multiport assembly **200** have an unobstructed line of sight with an open end of the connection port passageway **222**.

[0108] As shown in FIGS. **24** and **25**, in some instances, the fiber optic connector **100** may be inserted to the connection port passageway **222** with the keying portion **150** of the connector housing **110** mis-aligned with the corresponding keying portion **260** of the connection port passageway **222**. In the embodiment depicted in FIGS. **24** and **25**, the keying portion **150** of the connector housing **110** includes a recessed portion of the connector housing and the keying portion **260** of the connection port passageway **222** extends inward into the connector insertion path **224**. As such the keying portion **260** may mechanically interfere with portions of the connector housing

110 other than the keying portion **150** of the connector housing **110**, preventing further insertion of the connector housing **110**, as shown in FIGS. **24** and **25**. Instead, the connector housing **110** must be rotated to align the keying portion **150** of the connector housing **110** with the keying portion **260** of the connection port passageway **222** to allow further insertion of the connector housing **110** into the connection port passageway **222**. In some configurations rotational alignment of the keying portion **150** of the connector housing **110** with the keying portion **260** of the connection port passageway **222** may assist in maintaining a suitable optical connection between the optical fiber **12** (FIG. **3**A) with an optical fiber positioned in the optical adapter **210**. For example and without being bound by theory, in some configurations, signal loss between the optical fiber **12** (FIG. **3**A) and an optical fiber positioned in the optical adapter **210** may depend on the rotational position of the optical fiber **12** (FIG. **3**A) with respect to the optical fiber positioned in the optical adapter **210**. As such, the optical fiber **12** (FIG. **3**A) may be positioned within the connector housing **110** such that the optical fiber **12** is rotationally aligned with the optical fiber positioned in the optical adapter **210** when the keying portion **150** is aligned with the keying portion **260** of the connection port passageway **222**.

[0109] As described above, in some embodiments, the keying portion **150** of the connector housing **110** includes a positive surface projection (see e.g., FIG. **14**), as compared to the recessed keying portion **150** depicted in FIG. **25**. In these embodiments, the keying portion **260** of the connection port passageway **222** may include a complementary recessed keying portion **260** that similarly restricts insertion of the connector housing **110** unless the keying portion **150** of the connector housing **110** is rotationally aligned with the keying portion **260** of the connection port passageway **222**.

[0110] Referring to FIG. **26**, with the keying portion **150** of the connector housing **110** aligned with the keying portion **260** of the connection port passageway **222**, the connector housing of the fiber optic connector **100** may be further inserted into the connection port passageway **222**. As the connector housing **110** of the fiber optic connector **100** is further inserted, the connector housing **110** contacts the ramp **236** of the push-button securing member **230**. As described above, the ramp **236** is oriented to be upward and forward facing. As such, as the connector housing **110** is further inserted into the, axial force exerted on the ramp **236** as the connector housing **110** is inserted may be resolved into downward force applied to the push-button securing member **230**. The downward force applied to the push-button securing member **230** moves the push-button securing member **230** downward in a vertical direction that is transverse to the connector insertion path **224**, and the locking portion **233** including the connector engagement face **234** of the push-button securing member **230** may be moved out of the connector insertion path **224**, thereby moving the push-button securing member **230** into the disengaged position. As described above, in embodiments, the resilient member **250** is engaged with the push-button securing member **230** and biases the push-button securing member **230** into the engaged position. Accordingly, in these embodiments, the biasing force of the resilient member **250** must be overcome to move the push-button securing member **230** into the disengaged position.

[0111] Referring to FIG. **27**, when the fiber optic connector **100** is fully inserted to the connection port passageway **222**, the front portion **111** of the connector housing **110** may be engaged with the optical adapter **210**. Additionally, the push-button securing member **230** may be re-positioned back into the engaged position. More particularly, the port engagement face **132** (FIG. **26**) of the connector housing **110** may be engaged with the connector engagement face **234** of the push-button securing member **230**, and the ramp **236** (FIG. **26**) of the push-button securing member **230** may be positioned within the locking portion recess **134** (FIG. **26**) of the connector housing **110**. Engagement between the connector engagement face **234** (FIG. **17**) of the push-button securing member **230** (FIG. **17**) with the port engagement face **132** (FIG. **17**) of the connector housing **110** inhibits axial movement of the connector housing along the retracting direction of the fiber optic connector **100** with respect to the multiport assembly **200**, selectively coupling the connector housing **110** to the multiport assembly **200**. Further, the retention portion **240** of the push-button securing member **230** may strike and contact the shell **202** as the push-button securing member **230** is repositioned to the engaged position, which may produce an audible sound. A user inserting the connector housing **110** may utilize the auditory sound of the retention portion **240** hitting the shell **202** as confirmation that the connector housing **110** is fully inserted and is selectively coupled to the multiport assembly **200**.

[0112] As best illustrated in the cross-section shown in FIG. **18**, a gap may be positioned between the locking portion recess **134** of the connector housing and the ramp **236** of the push-button securing member **230**, such that only the port engagement face **132** of the connector housing **110** contacts the push-button securing member **230**. In this way, minimal vertical forces may be transmitted from the push-button securing member **230** to the connector housing **110**, which may assist in maintaining alignment of the connector housing **110** with the optical adapter **210**.

[0113] While in FIGS. **22-27**, a single optical connector port **220** is shown in cross-section as described above, it should be understood that the other optical connector ports **220** of the multiport assembly **200** may be substantially the same. With the fiber optic connector **100** inserted into the optical connector port **220** and selectively coupled to the push-button securing member **230**, the optical fiber **12** (FIG. **1**) of the fiber optic connector **100** may be optically coupled to another optical fiber positioned within the optical adapter **210**, forming a fiber optic junction **300**. By moving from the engaged position to the disengaged position with the insertion of a fiber optic connector **100**, and then back to the engaged position upon the full insertion of the fiber optic connector **100**, a user may selectively couple the fiber optic connector **100** to the multiport assembly **200** with one hand. In this way, the multiport assembly **200** and the connector housing **110** of the present disclosure may provide a significant benefit over conventional port assemblies which may require the use of two hands to manipulate a bayonet connection, a locking nut connection, or the like.

[0114] Furthermore and referring to FIG. **27**, the use of push-button securing members **230** that are selectively positioned within a connector insertion path **224** may allow a distance between adjacent optical connection ports **220** to be reduced as compared to conventional port assemblies. For example, some conventional port assemblies utilize bayonet connections and/or locking nut connections, each of which require connection components positioned radially outward of a connector insertion path. By contrast, the push-button securing members **230** of the present disclosure generally intersect the connector insertion paths **224**, minimizing the need for connection components positioned outward of the connector insertion paths **224**. As such, the distance between adjacent optical connection ports **220** may be reduced, allowing an increase in an overall density of optical connection ports **220** on the multiport assembly **200**. For example, in the embodiment depicted in FIG. **27**, adjacent optical connection ports **220** may be spaced apart by a distance **280** evaluated between central axes **282** extending along the connector insertion paths **224** of the optical connection ports **220**. In embodiments, the distance **280** may be less than about 13 millimeters. Furthermore, while the embodiment depicted in FIG. **21** shows optical connection ports **220** extending across the multiport assembly **200** in a lateral direction, it should be understood that it is contemplated that multiport assemblies **200** according to the present disclosure maybe positioned in any suitable orientation with respect to one another, and may be positioned on top of one another in the vertical direction.

[0115] Referring again to FIG. **17**, to remove the fiber optic connector **100** from the multiport assembly, the push-button securing member **230** is moved from the engaged position back into a disengaged position by moving the push-button securing member **230** downward in a direction that is transverse to the central axis **282** extending along the connector insertion path **224** (e.g., in the vertical direction as depicted). For example, the push-button securing members **230** may be moved to the disengaged position by depressing a top surface **228** of the push-button securing member **230** to overcome the biasing force of the resilient member **250**. In one embodiment, the push-button securing member may be repositioned into the disengaged position under a force exceeding a predetermined threshold between 5 newtons and 50 newtons applied to the push-button securing member **230** in a direction that is transverse to the axis extending along the corresponding connector insertion path **224**. In another embodiment, the push-button securing member **230** may be repositioned into the disengaged position under a force exceeding a predetermined threshold between 20 newtons and 25 newtons applied to the push-button securing member **230** in a direction that is transverse to the axis extending along the corresponding connector insertion path **224**.

[0116] In embodiments, each push-button securing member **230** is configured to permit forcible nondestructive disengagement of an external optical connector **100** from the locking portion **233** of the push-button securing member **230** upon application of a force on the external optical connector **100** in a direction along the central axis **282** extending along the corresponding connector insertion path **224**. For example, in embodiments, the push-button securing members **230** are configured to be repositioned into the disengaged position upon the application of a force on the optical connector **100**, transmitted to the push-button securing member **230** through the engagement between the connector engagement face **234** of the push-button securing member **230** and the port engagement face **132** of the connector housing **110**. As described above, one or both of the connector engagement face **234** of the push-button securing member **230** and the port engagement face **132** of the connector housing **110** may be oriented at an angle with respect to the vertical direction as depicted (i.e., the port engagement face **132** of the connector housing at an angle from perpendicular with the longitudinal axis **114**, and the connector engagement face **234** at an angle from perpendicular with respect to the connector insertion path **224**). As such, a force applied to the connector housing **110** in an axial direction (i.e., along the connector insertion path **224**) may be resolved into a vertical force applied to the push-button securing member **230** by the connector engagement face **234** of the push-button securing member **230** and/or the port engagement face **132** of the connector housing **110**. The vertical force may reposition the push-button securing member **230** into the disengaged position.

[0117] Furthermore, as described above, the outer end **133** (FIG. **3**) of the port engagement face **132** of the connector housing **110** and/or the outer end **235** (FIG. **20**) of the connector engagement face **234** of the push-button securing member **230** include chamfered or rounded edges. The chamfered and/or rounded edges of the outer end **133** (FIG. **3**) of the port engagement face **132** of the connector housing **110** and/or the outer end **235** (FIG. **20**) of the connector engagement face **234** of the push-button securing member **230** may reduce point forces on the connector housing **110** and/or the push-button securing member **230** as the push-button securing member **230** is repositioned into the disengaged position. By reducing point forces on the connector housing **110** and/or the push-button securing member **230**, breakage of the connector housing **110** and/or the push-button securing member **230** may be reduced.

[0118] In one embodiment, the plurality of push-button securing members **230** are each moved to the disengaged position upon the application upon the application of the force on the external optical connector **100** exceeding a predetermined threshold of between 20 newtons and 500 newtons, inclusive of the endpoints. In some embodiments, the plurality of push-button securing members **230** are each moved to the disengaged position upon the application of the force on the external optical connector **100** exceeding a predetermined threshold of 20 newtons and 25 newtons. As such, a fiber optic connector may be removed from the multiport assembly **200** upon the application of a predetermined force. This selective disengagement may assist in reducing damage to the multiport assembly **200** and/or the fiber optic connector **100**, for example in instances when unanticipated or undesired forces are applied to the fiber optic connector **100**.

[0119] The force required to reposition the plurality of push-button securing members **230** into the disengaged position is related to the relative orientation of the port engagement face **132** of the connector housing **110** and the connector engagement face **234** of the push-button securing member **230** and can be tailored as desired. For example, as described above, the port engagement face **132** is generally oriented to lie in a plane that intersects the longitudinal axis **114** at an angle that is 30 degrees or less from perpendicular, and is oriented to be rearward and outward facing. Increasing the angle from perpendicular of the port engagement face **132** with respect to the longitudinal axis **114** (e.g., orienting the port engagement face **132** to be more downward facing) may reduce the force required to remove the fiber optic connector **100**, as more of the axial force on the connector housing **110** may be resolved into the vertical direction. Conversely, as the angle of the port engagement face **132** with respect to the longitudinal axis **114** approaches perpendicular, the force required to remove the fiber optic connector **100** will increase, as less of the axial force on the connector housing **110** is resolved into the vertical direction.

[0120] Similarly, as described above, the connector engagement face **234** of each of the push-button securing members **230** defines a plane that intersects the corresponding connector insertion path **224** at an angle that is less than 30 degrees from perpendicular, such that the connector engagement faces **234** face rearward and upward. Increasing the angle from perpendicular of the connector engagement face **234** with respect to the connector insertion path **224** (e.g., orienting connector engagement face **234** to be more upward facing) may reduce the force required to remove the fiber optic connector **100**, as more of the axial force on the connector housing **110** may be resolved into the vertical direction. Conversely, as the angle of the connector engagement face **234** with respect to the connector insertion path **224** approaches perpendicular, the force required to remove the fiber optic connector **100** will increase, as less of the axial force on the connector housing **110** is resolved into the vertical direction. In this way the orientation of the port engagement face **132** of the connector housing **110** and the connector engagement face **234** of the push-button securing members **230** may be tailored to achieve a desired force required to remove the connector housing **110** from the multiport assembly **200**.

[0121] In some embodiments as described above, the port engagement face **132** may include a locking face **135** (FIG. **3**B) and a release face **137** (FIG. **3**B). In these embodiments, the locking face **135** (FIG. **3**B) may be configured to engage a connector engagement face **234** of a push-button securing member **230** that is oriented orthogonal to the connector insertion path **224**, thereby securing the connector housing **110** such that the connector housing **110** cannot be forcibly removed from the multiport assembly **200**. In particular, as neither the connector engagement face **234** of the push-button securing member **230** or the locking face **135** of the port engagement face **132** resolve axial force applied to the connector housing into a vertical direction (i.e., as both the locking face **135** (FIG. **3**B) and the connector engagement face **234** of the push-button securing member **230** are oriented in the vertical direction), the connector housing **110** may not be removed by axial force applied to the connector housing **110**. In other configurations, the release face **137** (FIG. **3**B) may be configured to engage a connector engagement face **234** of a push-button securing member **230**, such that axial force applied to the connector housing **110** may resolve into a vertical force, and the connector housing may be forcibly removed from the multiport assembly as described above. Accordingly, connector housings **110** including the port engagement face **132** with both the locking face **135** (FIG. **3**B) and the release face **137** (FIG. **3**B) may selectively be removable from multiport assemblies **200** including push-button securing members **230** that engage the release face **137** (FIG. **3**B), while may be fixedly attached to multiport assemblies **200** including push-button securing members **200** that engage the locking face **135** (FIG. **3**B).

[0122] Referring now to FIG. **28**, another embodiment of a push-button securing member **230** is schematically depicted. In the embodiment depicted in FIG. **28**, the push-button securing member **230** includes a push-button **270** and a securing member **272** including a pair of opposing arms **274** that are selectively deformable between the engaged position and the disengaged position, in and out of the connector insertion path **224**, respectively. In the embodiment depicted in FIG. **28**, the pair of opposing arms **274** are elastically deformable in an outward direction from the connector insertion path **224** upon the depression of the push-button **270**. In some configurations, the opposing arms **274** are configured to engage a concave locking portion **130** (FIG. **15**) of a connector housing **110**.

[0123] Referring collectively to FIGS. **29-31**, top perspective views and a bottom perspective view of the push-button **270** are schematically depicted respectively. In some embodiments, such as the embodiments depicted in FIGS. **29-31**, the push-button **270** includes a planar top surface **271** and optionally includes an o-ring **269** that is seated on the push-button **270**. Referring particularly to FIG. **31**, in embodiments the push-button **270** includes a wedge **273** positioned on a bottom surface that is configured to engage and reposition the opposing arms **274** (FIG. **28**) into the disengaged position.

[0124] Referring to FIGS. **32** and **33**, a perspective view of a blank that may be used to form the securing member **272** and a perspective view of a formed securing member **272** are depicted, respectively. The securing member **272** includes the opposing arms **274** that are configured to engage and retain a connector housing **110** (FIG. **27**). The securing member **272** further includes tabs **276** that are positioned on and extend outward from the opposing arms **274**. Each of the tabs **276** include a flange **277** oriented transverse to the connector insertion path **224** (FIG. **28**). The flanges **277** may be configured to engage the connector housing **110** (FIG. **27**) and move the opposing arms **274** outward as the connector housing **110** (FIG. **27**) is inserted along the connector insertion path **224**. The securing member **272** further includes push-button flanges **278** positioned at a top end of the securing member **272**. The push-button flanges **278** are oriented to face upward and are configured to engage the push-button **270**, such that when the push-button **270** is depressed, the opposing arms **274** move outward to the disengaged position. In embodiments, the securing member **272** may be selected such that the opposing arms **274** may selectively deform outward the application of the force on the external optical connector **100** exceeding a predetermined threshold between 20 newtons and 25 newtons.

[0125] Referring to FIGS. **34-36**, another embodiment of the push-button securing member **230** is schematically depicted. Like the embodiment described above with respect to FIGS. **28-33**, the push-button securing member **230** includes a securing member **272** with selectively deformable arms **274**, each having tabs **276** with flanges **277** that are oriented transverse to the connector insertion path **224**. However, in this embodiment, the push-button flanges **278** are oriented to face outward and in the same direction as the flanges **277** on the opposing arms **274**. This allows for the push-button **270** to be positioned in-line with the connector insertion path **224**, as depicted in FIG. **35**.

[0126] Accordingly, it should now be understood that embodiments described herein include fiber optic connectors including connector housings having a locking portion that selectively engages a push-button securing member of a multiport assembly to selectively couple the fiber optic connector to the multiport assembly. The locking portion of the connector housing and/or the push-button securing member of the multiport assembly may be configured to allow forcible, non-destructive disengagement of the connector housing from the multiport assembly upon the application of a predetermined force to the connector housing. In this way, damage to the multiport assembly and/or the fiber optic connector resulting from unexpected or unintended forces applied to the connector housing may be minimized.

[0127] In embodiments, the push-button securing members may generally intersect a connection port passageway of the multiport assembly, which may reduce the need for securing features positioned on the perimeter of the connection port passageway. By reducing the need for securing features positioned on the perimeter of the connection port passageway, adjacent connection port passageways on the multiport assembly may be positioned closer to one another such that a greater number of connection port passageways to be included in a multiport assembly without increasing the overall size of the multiport assembly. Furthermore, the push-button securing members may be configured to automatically engage a connector housing upon the full insertion of the connector housing to the connection port passageway, such that a user may selectively couple the connector housing to the multiport assembly with one hand, thereby simplifying the connection of the connector housing to the multiport assembly. The connector housings may further include a keying portion that selectively engages a corresponding keying portion of the multiport assembly to ensure and maintain the rotational orientation of the fiber optic connector with the multiport assembly.

[0128] It is noted that recitations herein of a component of the present disclosure being “structurally configured” in a particular way, to embody a particular property, or to function in a particular manner, are structural recitations, as opposed to recitations of intended use. More specifically, the references herein to the manner in which a component is “structurally configured” denotes an existing physical condition of the component and, as such, is to be taken as a definite recitation of the structural characteristics of the component.

[0129] It is noted that terms like “preferably,” “commonly,” and “typically,” when utilized herein, are not utilized to limit the scope of the claimed invention or to imply that certain features are critical, essential, or even important to the structure or function of the claimed invention. Rather, these terms are merely intended to identify particular aspects of an embodiment of the present disclosure or to emphasize alternative or additional features that may or may not be utilized in a particular embodiment of the present disclosure.

[0130] For the purposes of describing and defining the present invention it is noted that the terms “substantially” and “about” are utilized herein to represent the inherent degree of uncertainty that may be attributed to any quantitative comparison, value, measurement, or other representation. The terms “substantially” and “about” are also utilized herein to represent the degree by which a quantitative representation may vary from a stated reference without resulting in a change in the basic function of the subject matter at issue.

[0131] Having described the subject matter of the present disclosure in detail and by reference to specific embodiments thereof, it is noted that the various details disclosed herein should not be taken to imply that these details relate to elements that are essential components of the various embodiments described herein, even in cases where a particular element is illustrated in each of the drawings that accompany the present description. Further, it will be apparent that modifications and variations are possible without departing from the scope of the present disclosure, including, but not limited to, embodiments defined in the appended claims. More specifically, although some aspects of the present disclosure are identified herein as preferred or particularly advantageous, it is contemplated that the present disclosure is not necessarily limited to these aspects.

[0132] It is noted that one or more of the following claims utilize the term “wherein” as a transitional phrase. For the purposes of defining the present invention, it is noted that this term is introduced in the claims as an open-ended transitional phrase that is used to introduce a recitation of a series of characteristics of the structure and should be interpreted in like manner as the more commonly used open-ended preamble term “comprising.”

Claims

1. A multiport assembly comprising: a shell defining a cavity; a plurality of optical adapters positioned within the cavity of the shell; a plurality of optical connector ports each comprising respective connection port passageways permitting external optical connectors to access the plurality of optical adapters positioned within the cavity of the shell; and a plurality of push-button securing members associated with respective ones of the connection port passageways, each push-button securing member of the plurality of push-button securing members comprising a retention portion configured to contact the shell and retain the plurality of push-button securing members within the shell of the multiport assembly, and wherein each of the push-button securing members is repositionable between an engaged position, that intersects a portion of a corresponding connector insertion path and a disengaged position, so that the push-button securing member is positioned outside the corresponding connector insertion path.

2. The multiport assembly of claim 1, wherein each of the plurality of push-button securing members define a connector engagement face that is less than 30 degrees from a direction perpendicular from a respective connector insertion direction.

3. The multiport assembly of claim 1, further comprising a plurality of resilient members each associated with a respective one of the plurality of push-button securing members for biasing one of the plurality of push-button securing members.

4. The multiport assembly of claim 1, wherein a bore extends through each respective one of the plurality of push-button securing members, and the bore defining an inner perimeter with a connector engagement face positioned on the bore and oriented transverse with the connector engagement face comprising an inner end and an outer end positioned outward of the inner end; and a ramp positioned on the bore, the ramp extending between the inner perimeter of the bore and the inner end of the connector engagement face

5. The multiport assembly of claim 4, wherein: the plurality of optical connector ports are positioned at a front end of the multiport assembly and the multiport assembly comprises a rear end positioned opposite the front end; and the ramp of each of the push-button securing members is positioned forward of the connector engagement face of each of the push-button securing members.

6. The multiport assembly of claim 4, wherein: the ramp of each of the push-button securing members comprises: an ascending portion that extends inward from the inner perimeter of the bore; and a plateau portion that is positioned rearward of the ascending portion.

7. The multiport assembly of claim 6, wherein the plateau portion is aligned with the corresponding connector insertion path.

8. The multiport assembly of claim 2, wherein each of the push-button securing members is repositionable between the engaged position so that the connector engagement face of the push-button securing member intersects the corresponding connector insertion path and the disengaged position has the connector engagement face of the respective push-button securing member is spaced apart from the corresponding connector insertion path.

9. The multiport assembly of claim 2, wherein the plurality of optical connector ports are positioned at a front end of the multiport assembly and the multiport assembly comprises a rear end positioned opposite the front end, and wherein the outer end of the connector engagement face of each of the plurality of push-button securing members is positioned closer to the rear end of the multiport assembly than the front end.

10. The multiport assembly of claim 1, wherein each of the push-button securing members comprises a connector engagement face defined by a plane that intersects the corresponding connector insertion path at an angle that is less than 30 degrees from perpendicular.

11. A multiport assembly comprising: a shell defining a cavity; a plurality of optical adapters positioned within the cavity of the shell; a plurality of optical connector ports each comprising respective connection port passageways permitting external optical connectors to access the plurality of optical adapters positioned within the cavity of the shell; a plurality of push-button securing members associated with respective ones of the connection port passageways, each push-button securing member of the plurality of push-button securing members comprising a retention portion configured to contact the shell and retain the plurality of push-button securing members within the shell of the multiport assembly, and wherein each of the push-button securing members is repositionable between an engaged position, that intersects a portion of a corresponding connector insertion path and a disengaged position, so that the push-button securing member is positioned outside the corresponding connector insertion path; and a plurality of resilient members each resilient member associated with a respective push-button securing member and each resilient member comprising a spring constant between about 10 newtons per millimeter and about 50 newtons per millimeter.

12. The multiport assembly of claim 11, wherein each of the plurality of push-button securing members define a connector engagement face that is less than 30 degrees from a direction perpendicular from a respective connector insertion direction.

13. The multiport assembly of claim 11, further comprising a plurality of resilient members each being associated with a respective one of the plurality of push-button securing members.
14. The multiport assembly of claim 11, wherein a bore extends through each respective one of the plurality of push-button securing members, and the bore defining an inner perimeter with a connector engagement face positioned on the bore and oriented transverse with the connector engagement face comprising an inner end and an outer end positioned outward of the inner end; and a ramp positioned on the bore, the ramp extending between the inner perimeter of the bore and the inner end of the connector engagement face
15. The multiport assembly of claim 14, wherein: the plurality of optical connector ports are positioned at a front end of the multiport assembly and the multiport assembly comprises a rear end positioned opposite the front end; and the ramp of each of the push-button securing members is positioned forward of the connector engagement face of each of the push-button securing members.
16. The multiport assembly of claim 14, wherein: the ramp of each of the push-button securing members comprises: an ascending portion that extends inward from the inner perimeter of the bore; and a plateau portion that is positioned rearward of the ascending portion.
17. The multiport assembly of claim 16, wherein the plateau portion is aligned with the corresponding connector insertion path.
18. The multiport assembly of claim 12, wherein each of the plurality of push-button securing members is repositionable between the engaged position so that the connector engagement face of the push-button securing member intersects the corresponding connector insertion path and the disengaged position has the connector engagement face of the respective push-button securing member is spaced apart from the corresponding connector insertion path.
19. The multiport assembly of claim 12, wherein the plurality of optical connector ports are positioned at a front end of the multiport assembly and the multiport assembly comprises a rear end positioned opposite the front end, and wherein the outer end of the connector engagement face of each of the plurality of push-button securing members is positioned closer to the rear end of the multiport assembly than the front end.
20. The multiport assembly of claim 11, wherein each of the push-button securing members comprises a connector engagement face defined by a plane that intersects the corresponding connector insertion path at an angle that is less than 30 degrees from perpendicular.
21. The multiport assembly of claim 11, wherein a bore extends through each respective one of the plurality of push-button securing members, and the bore defining an inner perimeter with a connector engagement face positioned on the bore and oriented transverse with the connector engagement face comprising an inner end and an outer end positioned outward of the inner end; and a ramp positioned on the bore, the ramp extending between the inner perimeter of the bore and the inner end of the connector engagement face.
22. A method for selectively disconnecting a fiber optic connector from a multiport assembly, the method comprising: depressing a push-button securing member of a multiport assembly, moving the push-button securing member away from a connector insertion path defined by the multiport assembly; disengaging a connector engagement face of a locking portion of the push-button securing member from a connector housing of a fiber optic connector, wherein the connector engagement face comprises an inner end and an outer end positioned outward of the inner end and the locking portion comprises a ramp that extends between an inner perimeter of a bore of the push-button securing member and the inner end of the connector engagement face with a plurality of resilient members each being associated with a respective push-button securing member and comprising a spring constant between about 10 newtons per millimeter and about 50 newtons per millimeter for biasing to an engaged position; and moving the connector housing through the push-button securing member of the multiport assembly.
23. The fiber optic connector of claim 22, wherein a front portion of the connector housing

comprises a rectangular cross-section comprising planar sides, and the rear portion of the connector housing comprises a curved outer surface.