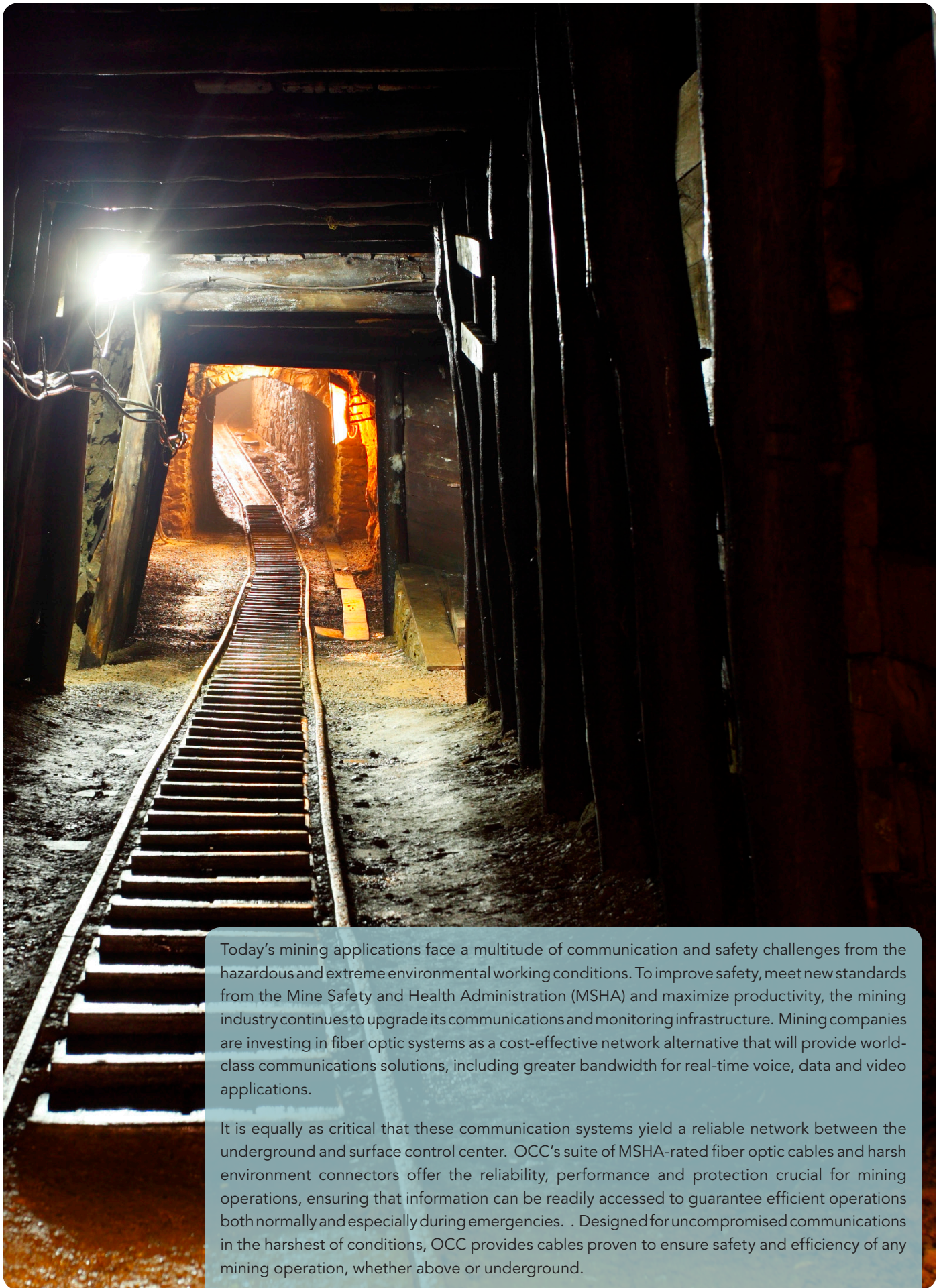




INDUSTRY SOLUTIONS: **MINING**





Today's mining applications face a multitude of communication and safety challenges from the hazardous and extreme environmental working conditions. To improve safety, meet new standards from the Mine Safety and Health Administration (MSHA) and maximize productivity, the mining industry continues to upgrade its communications and monitoring infrastructure. Mining companies are investing in fiber optic systems as a cost-effective network alternative that will provide world-class communications solutions, including greater bandwidth for real-time voice, data and video applications.

It is equally as critical that these communication systems yield a reliable network between the underground and surface control center. OCC's suite of MSHA-rated fiber optic cables and harsh environment connectors offer the reliability, performance and protection crucial for mining operations, ensuring that information can be readily accessed to guarantee efficient operations both normally and especially during emergencies. . Designed for uncompromised communications in the harshest of conditions, OCC provides cables proven to ensure safety and efficiency of any mining operation, whether above or underground.

What makes OCC Mining products superior?

It is easy to recognize that when mining companies invest in quality communications, monitoring and tracking systems, they will continue to improve safety and maximize productivity. The unique demands associated with these systems for real-time high-bandwidth data transmissions, make fiber optic systems ideally suited for mining operations. Optical Cable Corporation's broad range of MSHA-rated fiber optic cables is specifically designed to provide reliable communications in a hazardous and unforgiving environment.

OCC Mining solutions start with tough fiber optic cables. Our MSHA-rated cables are optimized to withstand the rigors of difficult cable pulls, high tensile loading and severe crush occurrences and can repeatedly endure the abuse associated with the extreme demands in surface and sub-surface mining. Where standard fiber optic cables are likely to fail, OCC's MSHA cables are particularly well-suited to survive the harsh environment associated with mining applications. Factors that make OCC's MSHA-rated fiber optic cables ideal for the mining industry include:

- OCC's special **Core-Locked™** jacket is extruded under high pressure directly over the cable's core, resulting in the internal surface of the cable jacket having helical cusped ridges that interlock with the subcables. This helps keep the cable cross-section circular for better crush and impact protection and superior tear resistance during installation.
- **Helical stranding** is a time-tested cable construction design proven to provide flexibility, survival in difficult pulls and excellent mechanical protection for the optical fibers. This design ensures that no one particular element of the cable receives more stress than the other elements—thus equalizing the stress load associated with particularly tough installations.
- Our **water-blocked** fiber optic cables provide the best water protection system available by combining the inherent water tolerant features of tight-buffered and Core Locked™ tight bound cable with super absorbent polymer aramid yarn. This design provides superb water-blocking performance while retaining the termination cost advantages of totally gel-free and powder-free tight-buffered cable.
- OCC's **Ultra-Fox™** and **Ultra-Fox™ Plus** cables feature a unique fiber construction consisting of a primary coating of a UV-cured acrylate material and a tight fitting secondary coating that provides an extraordinary level of protection.

All of these factors make OCC's cables a practical and reliable means of high capacity data transmission in challenging environments without the delicacy normally associated with traditional fiber optic cables.

To compliment our MSHA cables, OCC manufactures a variety

of rugged multi-channel fiber optic and electro-optic connectors. One such family of products is our compact Mini-Hermaphroditic Connector (MHC® II). These connectors are available in both multimode and single-mode versions as well as electro-optic design, and, along with many of OCC's harsh environment connectors, are hermaphroditic. This allows cable assemblies to be daisy-chained together, making it simple to extend the underground fiber optic backbone system without the need for gender-changing adapters. Power or control signals for active equipment may be supplied using hybrid connector options that add electrical and optical signals within the same connector body. These connectors withstand extreme environmental demands and they are specifically designed for reliable data transmission signals.

Applications:

- Environmental Monitoring
- Equipment Control
- HMI/SCADA Applications
- CCTV monitoring
- Voice/Data/Video Communications

To compliment the OCC mining system, OCC offers the Modular Advanced Reel System, or MARS, a lightweight, durable system constructed of a high impact glass reinforced polymer that is easily transported and ideal for applications where cable needs to be deployed and reeled in quickly and stored efficiently. Available with a multitude of storage and deployment accessories, the MARS system allows mining operations to easily replace fiber optic segments with limited down time.





CASE STUDIES

OCC provides a comprehensive solution to mining communications

Today's technology gives miners instant access to critical information related to productivity, life safety and other essential data. In a coal mine in Utah, the challenge was to provide a solution that was intrinsically safe, able to shield from airborne particles such as rock and coal dust, and capable of withstanding extremely harsh conditions.

OCC provided a cable solution utilizing our high impact/high crush resistant fiber cable connected with a fully encapsulated hermaphroditic EZ-Mate industrialized connector, complete with

inter-lockable dust caps. A fixed backbone solution was installed throughout the main infrastructure with a deployable application running out to the Longwall. The fixed solution was attached throughout the mine to the ceiling and the Longwall section run at ground level. The OCC deployable solution used in the Longwall application provides the ability to retract the run in 1000' segments, all while keeping them neatly coiled on a stackable MARST[™] (Modular Advanced Reel System) reel for future deployments. Each MARS reel also has the capability to internally house a fiber cleaning kit, allowing for onsite cleaning prior to re-deployment.

The unique cable designs and configurations from OCC provide long-term reliability, as well as safe and secure transmission of critical data and communications. Since the initial installation of OCC's products & overall communications solution, the mine experienced a ceiling collapse on one segment of the fixed installation. It was reported that the OCC fiber was the only cable in the collapse to have survived. Once again, OCC's unique Core-Locked[™] technology, in combination with other design features, provided the most rugged fiber optic cable in the industry.



CASE STUDIES



OCC products and technology help keep miners safe

The mining industry had been somewhat slow to adopt new technologies for communications within the underground environment, primarily due to concerns over reliability within the mine. The traditional method of communication has been to use a leaky feeder cable, however, this solution has some major drawbacks. First, it is slow and has the potential for EMI from the power cables. Additionally, any cuts or significant damage to the cable renders anything further downstream nonfunctional. In case of a cave in (potential cut cable), anyone on the other side of the break can no longer communicate with the surface. And lastly, in order to communicate on this type of system, there must be line of sight to the cable and even then the range is quite short.

The US government recognized that there was a need to improve safety within the mines and passed the MINER Act, requiring mines to be able to locate everyone within the mine in case of a disaster. This led to the development of several different technologies. One such technology that has been very successful and offers additional benefits to a mine is the wireless network systems. The wireless network system uses standard WIFI technology that has been adapted to the ruggedness of the mining market, and can provide a traditional network for data collection as well as communication. These WIFI points are connected together with a fiber or composite cable which provides power to the electronics. OCC developed several different cables based on our proven military experience that were designed to meet the demands of the underground environment. The primary cables are MSHA rated BX series and CX series cables. The BX cables are used for long runs between hot spots where there is remote power. The CX cables are used to provide remote power to areas where there is no convenient way to get power to the equipment. This also allows the components of the locator systems to be located in areas that are less likely for it to get damaged.

Solving long distance monitoring issues

The mining industry relies on pipelines to transport water which is used to extract minerals from the mined materials. After water is supplied to the mine, it is used to separate the valuable minerals from the ore using gravity and chemicals. This eventually results in wastewater, which then must be transported out to treatment facilities. Pipelines are used to transport fresh water and wastewater to and from the mine location, and it is critical that these pipelines be monitored for faults to prevent economic or environmental loss.

One OCC customer, a major U.S. coal producer, was faced with the problem of having to transport wastewater from multiple mine locations to a single central treatment facility over a twenty-mile pipeline and be able to monitor the system for faults and leaks. OCC worked with the customer to design a fiber optic cable that was durable, flexible, and cable of being direct buried. Fiber optic cable is the ideal medium to use for pipeline monitoring because it can be deployed over long distances with reliable results, and monitoring equipment can detect the slightest changes in light patterns within the fibers when a fault occurs over those distances. Closed circuit video equipment in the field provides real-time coverage of faults when they are detected.

OCC's D-Series Distribution fiber optic cables are extremely small and light-weight, while also providing excellent mechanical and environmental qualities, making them the ideal solution for pipeline monitoring

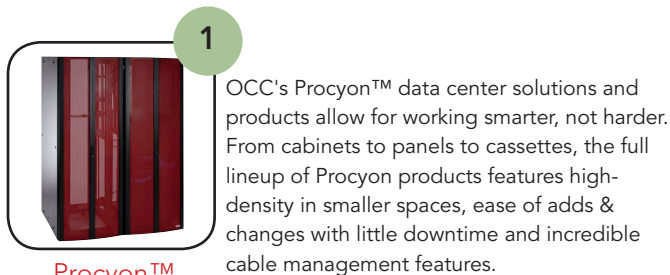


applications, and they can be armored for direct-burial and rodent protection. NEMA 4X enclosures can also be supplied loaded with fiber optic adapter panels, which provides the ideal environmentally protected handoff to monitoring equipment in the field. Finally, OCC's F-Link connector system provides a single connector source for supplying fiber and copper connections to cameras mounted in the field, with F-Link receptacles attached directly to the outdoor enclosures.



Underground mining requires reliable communications, monitoring and tracking systems that guarantee efficient operations. Control rooms that centralize functions of monitoring, recording, and operating equipment rely on fiber optic networks. Installed fiber networks, like OCC's Procyon™ fiber optic solution, are uniquely suited to connect real-time data from environmental and equipment sensors to ensure peak production while maintaining the highest safety standards. Unlike copper-based systems, fiber optic solutions can handle the enormous amounts of data the control room needs to analyze several thousand in and outgoing processing variables that help operators make faster, safer and more effective decisions.

Many production mining equipment components are controlled remotely through fiber optic connection systems like those utilizing OCC's MSHA-rated fiber optic cables and harsh environment connectors. These systems include closed circuit TV and video camera security networks. Cameras positioned along the belt lines, load-outs, silos, bins, and stockpiles relay information back to the control room for operators to visually analyze and aid in effective decision-making. CCTV cameras at mining entrance facilities allow for increased security and miner safety. Reliable communications and tracking systems are also essential to mining safety. In the interest of miner safety, it is vital that operators are able to locate and communicate with mine workers at all times – particularly in the event of emergency situations. With OCC's MSHA-rated fiber optic cables and connectivity components, communication lines deliver reliable, robust and real-time links to all operational facilities and staff in a tough and hazardous environment.



Procyon™ solutions

1 OCC's Procyon™ data center solutions and products allow for working smarter, not harder. From cabinets to panels to cassettes, the full lineup of Procyon products features high-density in smaller spaces, ease of adds & changes with little downtime and incredible cable management features.

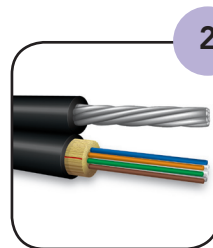
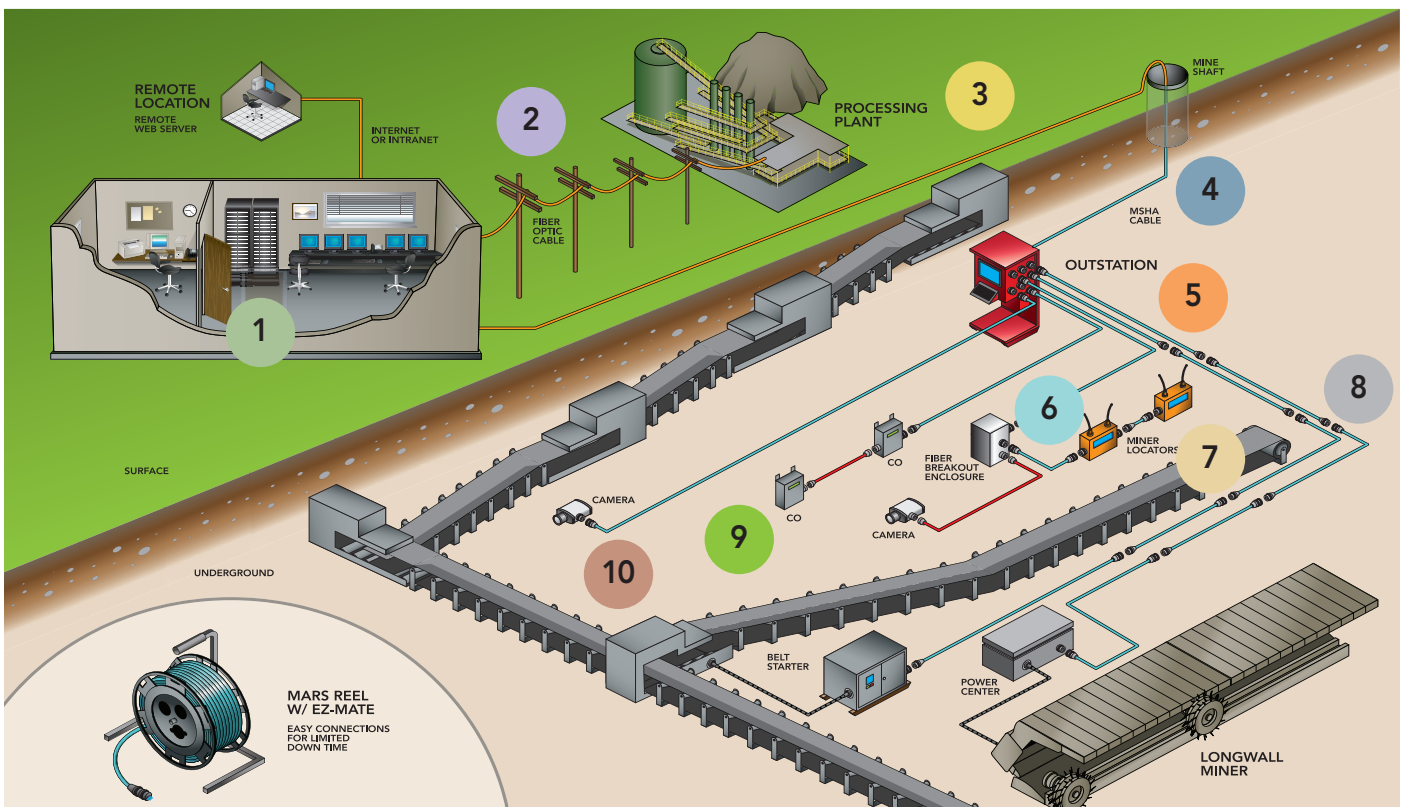


Figure-8 Messenger cables

2 Figure-8 Messenger cables by OCC are ideal for outdoor aerial installations along utility poles for backbone applications without the need for cable lashing or grounding. The lightweight cable has a wide operating temperature range and is designed for excellent UV and weather resistance.



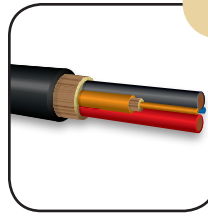
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G-Series CST armored cables

G-Series Subgrouping armored cables are ideal for installations requiring an extremely rugged cable design with maximum mechanical and environmental protection, and is the easiest cable to install when routing to multiple locations.

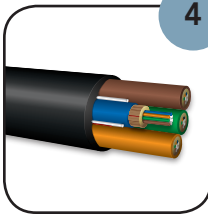
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MSHA-rated composite cables

MSHA-rated composite cables provide the convenience of having both fiber and copper within one cable jacket. Custom designed composite cables are available in a variety of configurations to meet the connector, cable size and electrical performance requirements and can be made in a variety of colors for easy identification.

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MSHA-rated Subgrouping cables

OCC's MSHA-rated Subgrouping cables are designed to allow subcables to be routed to multiple locations. Helically stranded, Core-Locked outer jacket surrounds the subcables for superior crush resistance and survivability. Ideal separation and identification of single-mode and multimode fibers in a single cable.

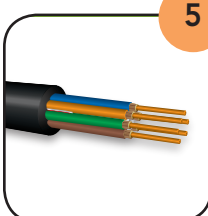
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EZ-MATE connector

The OCC EZ-MATE family of hermaphroditic-style fiber optic connectors provides a comprehensive connectivity solution for deployable or mobilized communications systems. Based on a hermaphroditic design, EZ-MATE connectors allow for quick deployment and gender-independent connectivity, permitting the end user to unreel fiber cable without regard for male or female ends.

5



MSHA-rated Breakout cables

OCC's MSHA-rated Breakout cables feature a rugged cable design with individual subcables for optimum fiber protection. Helically stranded, core-locked and UV/fungus resistant cables offer superior environmental and mechanical protection. Cables are MSHA approved.

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R-JACK™ connector

R-JACK™ connectors provide an efficient solution to ethernet connectivity in harsh environments. R-JACK receptacles feature 100% transversely sealed (IP-68) configurations as a standard product design, preventing dust, water or moisture penetration, with or without dust cap or plug engagement. R-JACK is available in a variety of metals and finishes to fit specific applications.

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F-LINK™ connector

The F-LINK™ Inter-Connect platform was born out of the proven performance of MIL-SPEC cylindrical components, and is a cost-effective solution for commercial, industrial and military applications. F-LINK components were designed to solve a multitude of fiber optic applications, as well as hybrid inter-connect systems (the combination of fiber optic and electrical power). F-LINK is available in a variety of metals and finishes to fit specific applications.

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MHC® II connector

OCC's MHC® II is designed specifically to inter-connect fiber optic channels in a small, yet effective, package. Using a bayonet-style, mechanical coupling interface, the connector is easily mated by a simple twisting motion. The MHC II fiber optic connector features both pin and socket configurations to accommodate a number of fiber types and is available in two, four, six and eight channel versions.



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