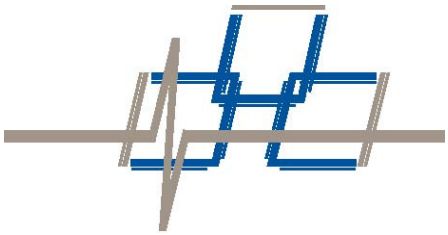
Application Note



Sensor Repair

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Introduction

During the life of our products, it is possible for the optical sensor fiber to become damaged. Through proper site planning, provisions can be made to maintain the reparability of the sensor cable and conduit. Service or maintenance loops should be installed in the sensor cable and conduit at regular intervals as outlined in the product manual for your Alarm Processor Unit (Figure 1). These loops provide extra material that can be moved to the area where the damage occurred and take the place of the broken section which is removed.

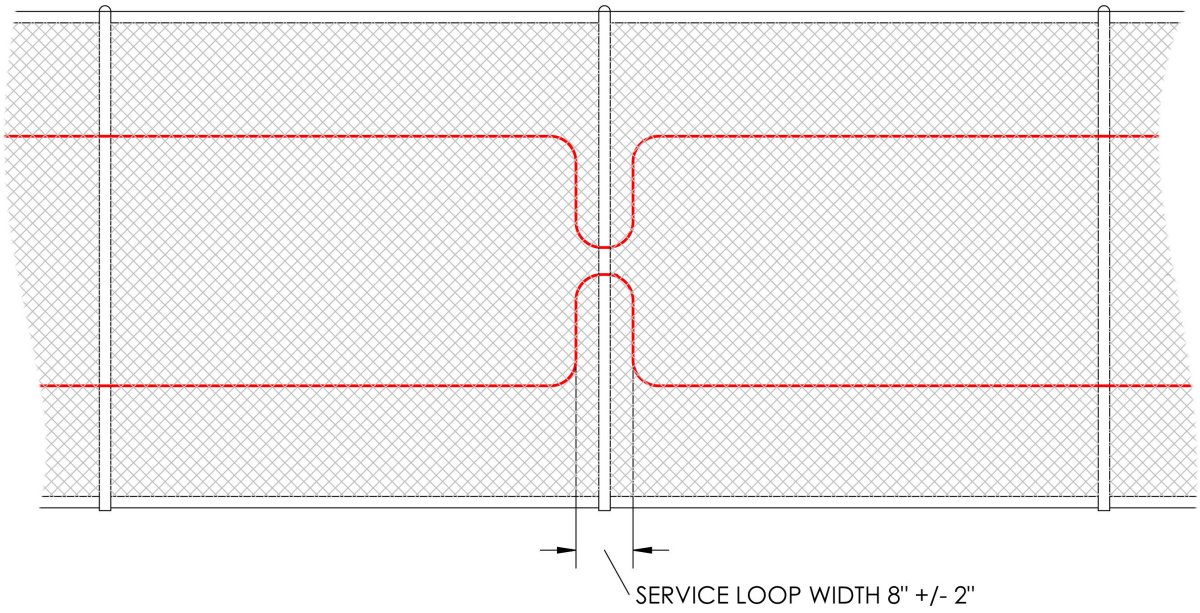

Figure 1

After the slack cable is moved to the repair location (if necessary) and the damaged fiber and conduit has been removed, the repairs can be completed. There are two options for repairing the optical fiber. The ends can be re-connected with arc fusion

splicing, or both ends can be terminated with optical fiber connectors and then mated together using a feed through coupler (Figure 2). Both types of repair are typically acceptable for our 2XX and 3XX processors, however fusion splicing is mandatory in our 5XX systems. Generally connectors will have higher loss than fusion splices. In short systems loss is less of an issue and connectors work just fine. Some systems with lengthy and complicated zones may require the low loss fusion splices in order to stay within their loss budget. Fusion splices are also maintenance free after initial installation whereas connectors may require some attention with regard to cleaning in the future.

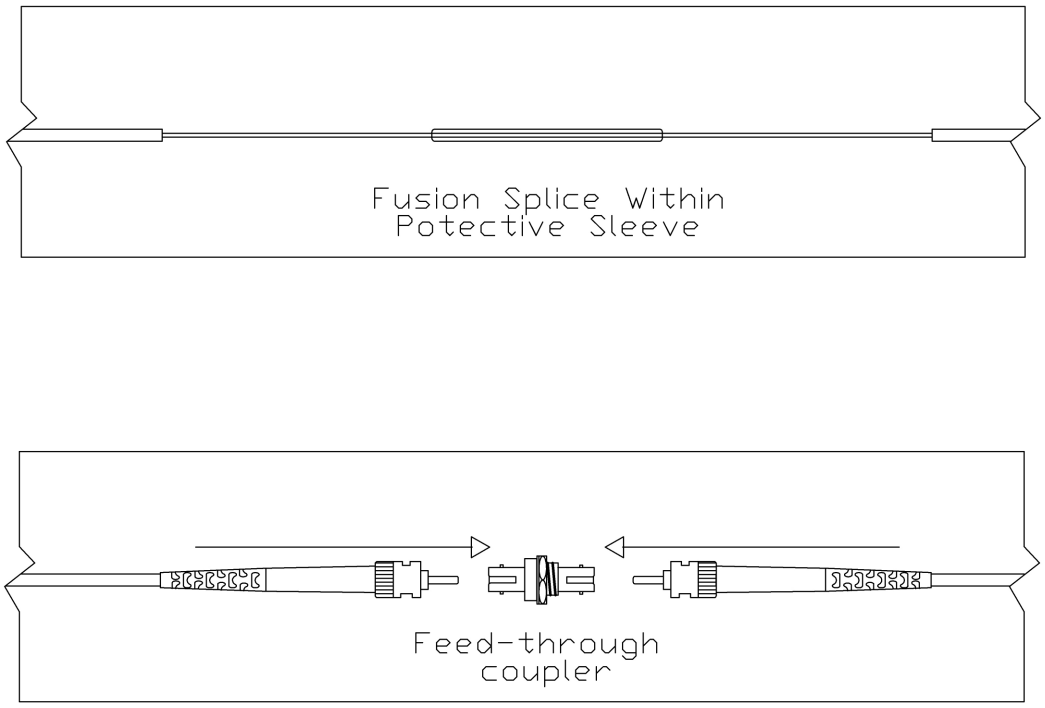

Figure 2

Protection Options

One of the important decisions in this process is choosing how to protect the repair location. After the conduit is cut, and the optical fiber is exposed, it will need to be protected from the elements as well as from potential intruders.

The preferred method of protecting the repaired area is to use the Fiber SenSys Sensor Repair Kit, which consists of optical cable, conduit and conduit couplers. In addition this kit includes two outside plant splice closures (as well as all associated hardware). These can be mounted directly to the fence mesh and have the sensor conduits routed to each end (Figure 3). The optical fiber repair done internally is protected from the elements and can be strain relieved and tensioned appropriately to ensure consistent sensitivity throughout the entire zone. The same can be accomplished using a wall-mount, hinged door, NEMA rated closure, which is beneficial for re-entry (for optical connector cleaning) and can be secured against intrusion with an anti-tamper sensor switch.

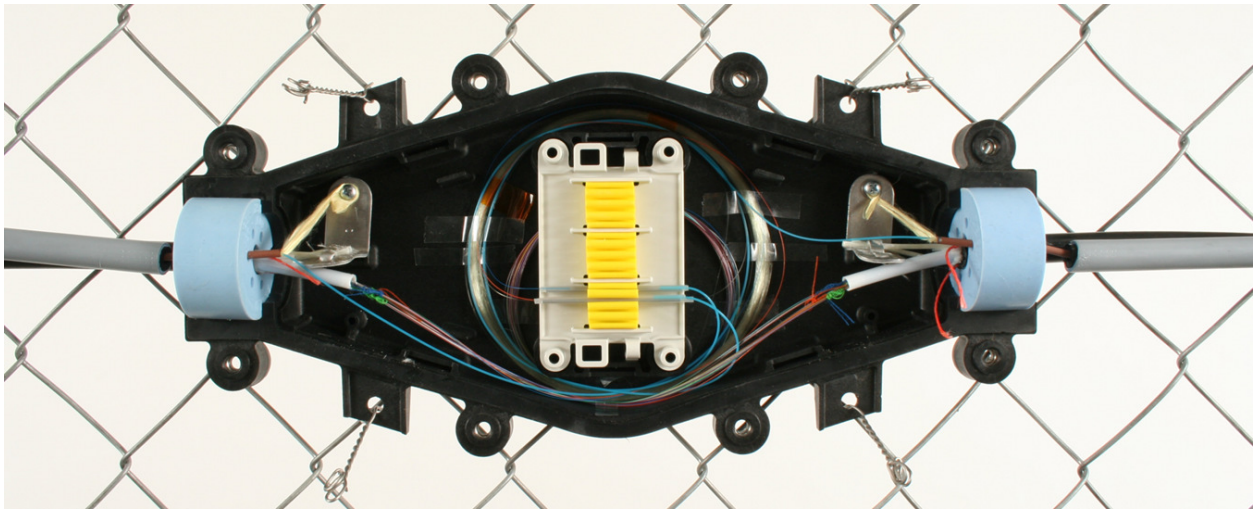

Figure 3

Preparation

In order to facilitate the sensor repair, cable and conduit must be relocated to replace the damaged section which needs to be removed. The first step in this process is to inspect the cable and conduit, if possible measure the amount of damaged product. Typically each storage or maintenance loop will contain 30 to 36 inches (76 to 91 cm) of spare conduit. This measurement will help to determine whether or not there is sufficient conduit available within the zone to make the repair (Figure 4).

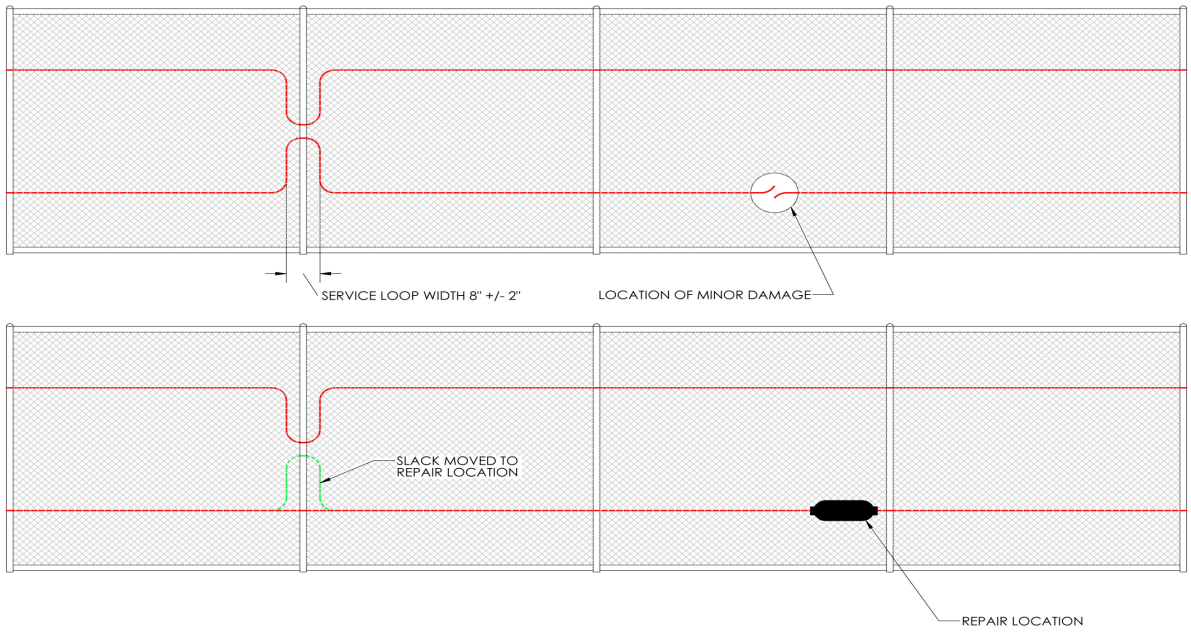

Figure 4

If there is not enough cable and conduit, a repair can still be made by cutting out the damage and adding a new section in its place. This will require splicing or adding connectors at two locations within the zone rather than just one location, and consequently additional system loss. Arc fusion splicing is the recommended method in this situation (Figure 5).

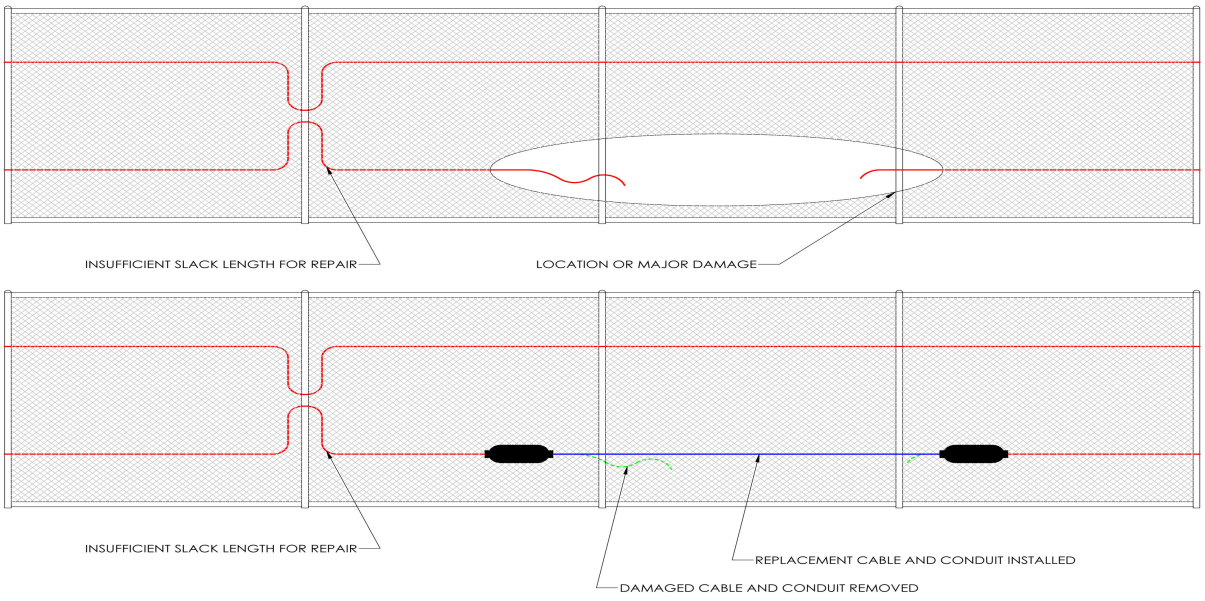

Figure 5

After the type and technique of repair is determined, you will need to prepare all the equipment and supplies necessary. A list of commonly required tools and supplies can be found in Figure 6.

Sensor Repair Supplies and Tools	
Wire Cutters	**Work Gloves**
Wire Ties	**Safety Glasses**
Twist Tool	**Fiber Optic Cutters**
Nut Driver Set	**Fiber Optic Strippers**
10 MM Socket Wrench	**Termination Kit**
Conduit Cutter	**Fusion Splicer**

Figure 6

Moving Slack Cable and Conduit

Once you have determined that the required amount of slack is available in your existing cable plant, and have prepared all your supplies, it is time to begin.

Begin by using a conduit cutter to ring cut the conduit, use caution to not cut the optical fiber cable. Remove any damaged conduit and inspect the optical fiber cable. Next, use snips to carefully cut away any damaged cable. Be sure to leave several inches of fiber in excess of the length of conduit on each side. Use caution while cutting, the optical fiber cable may be under tension due to the initial placing process and can snap back into the conduit and be difficult to retrieve. Ideally you should have 18-24 inches of exposed fiber on each side for use in the splicing or terminating process.

The next step is to remove the wire ties holding the conduit to the fence fabric. Begin at the cut end and work your way along the sensor. Remove all the ties back to and just past the farthest slack loop that is needed. Pull all the needed slack towards the repair location and re-attach the sensor to the fence fabric, working your way back to the repair location. Begin the sensor repair process.

Optical Fiber Sensor Repair

Arc fusion splicing is the preferred method of repairing optical fiber cable. Although the equipment required is costly, the quality of the connection cannot be matched. Optical loss associated with a fusion splice is approximately .05dB per splice. In addition, fusion splices offer minimum back reflection. In the event that an arc fusion splicer is not available, repairs can be made using a termination kit. By installing an optical connector on each end of the broken optical fiber cable, the cable can be reconnected using a feed-through coupler. Cables with connectors joined with a feed-through coupler typically show .3dB loss per connector or .6dB loss per connected pair. In a system with multiple unions, it is clear to see how these loss numbers could add up to a significant amount. For best results, the connector mating surfaces need to be kept very clean and free of dust and debris. Protection of terminated fiber ends should be re-enterable in order to perform routine maintenance cleaning.

After reconnecting the fibers, secure all the loose fiber within the closure against vibration. Verify that all the slack loops inside the closure maintain the minimum bend radius, and are not pulled across any sharp edges. Seal and secure the repair closure, and begin testing per the Users' Manual. After you have verified that the zone loss is within the required specification, the repair is complete.