

Application Note AN114

Fiber Optic Cabling System for Fiber Optic Rotational Sensors in Industrial Environments

Objective

This application note provides the engineer with guidance on designing and procuring the fiber optic cabling, fiber optic junction boxes and other interconnect products needed to deploy fiber optic encoders, sensors or any fiber optic system – in a harsh industrial environment.

Background

The Micronor fiber optic sensors are connected using duplex multimode fibers 62.5/125 μ m one fiber is the transmit path and the second fiber is the receive path with light guided back to the interrogator controller such as the MR320 or MR330.

The advantage of these sensors is that they do not have any electronic circuitry embedded and thus can be deployed in rather harsh and challenging environments. Typical communications fiber optic hardware may not always be sufficient because the environment it will be deployed in. It must also be considered that the users and installers are not necessarily familiar or trained to handle fiber optics in the field.

Requirements

The following aspects must be considered when selecting the cabling system:

- LC Duplex, 62.5/125 μ m Multimode Fiber Cable, 0.275NA, Type OM1
- Sensor Adaptor, Duplex
 - Dust and water sealed.
 - Low Inside space requirements.
 - Meets environmental specs for temp, vibration and shock.
- Connector, Duplex
 - Dust and water sealed when mated.
 - Meets environmental specs for temp, vibration and shock.
 - Must have adequate back-shell and strain relieve for use with outdoor cables.
- Storage and Dust caps must be available.
- Be able to clean termini in the field (have cleaning kits available).

- o Typical PC (Physical Contact) optical Performance.
 - < 0.5dB insertion loss
 - 25dB return loss or better

Typical Installations

The typical cabling architecture for a fiber optic sensor deployment using ODVA IP-LC environmental connectors is depicted in *Figure 1*.

All fiber is duplex 62.5/125µm and the cable style varies depending on the environment.

From the controller there is usually a short run to a bulkhead adaptor leading out of the control closet. From here, outdoor rated cable, or cable pulled within conduit leads to the remote sensor area. Often a service connection near the sensor end is part of the installation.

The connector system shall offer all the ingredients to accomplish the cabling. It is also desirable that all the connectors are of the same type and mate with each other.



Figure 1: Typical Cabling Architecture for Harsh Environments

One advantage of standard Duplex LC cabling is the lower cost. *Figure 2* illustrates how non-environmental Duplex LC connections can be utilized and environmentally protected using the MR398-JBPC-CC series of environmental junction boxes.

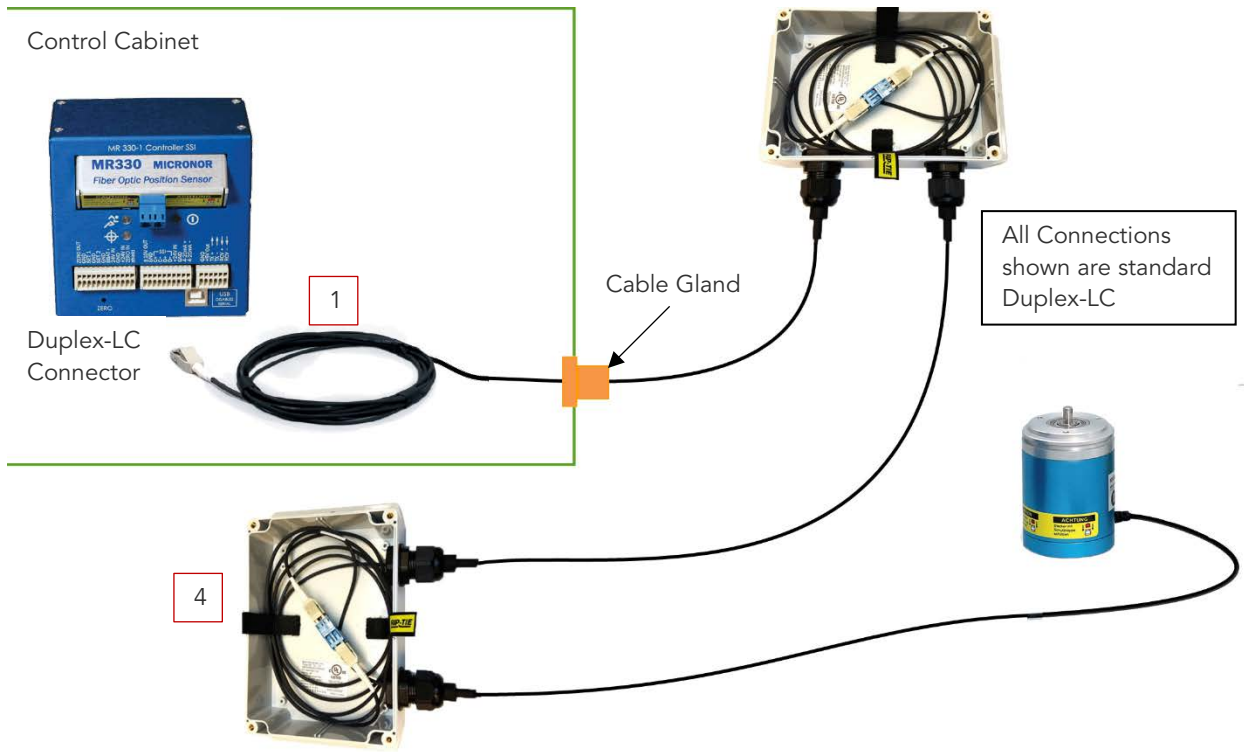


Figure 2: Typical Architecture Using Standard Duplex LC Connections

Parts List

Item	Part No	Description
(All fiber is 62.5/125µm GI multimode fiber)		
<p><i>Duplex LC</i> = Standard Duplex LC, non-environmental</p> <p><i>ODVA IP-LC</i> = Environmentally Sealed Optical Interconnect for Harsh Environments. ODVA-rated as 'Standard Interface' for next generation industrial interconnects.</p> <p>For all cable assemblies <i>XXX</i> = length in meters</p>		
1	MR398-M26-CCXXX	Duplex LC Fiber Optic Cable Assembly, Duplex LC to Duplex LC, Type M26 Light Duty DIB Duplex Cable with 2.9 mm OD PUR outer jacket. This cable is suitable for both indoor and outdoor use where reasonable environmental protection is assured. Typical lengths are 3, 5 and 10 meters.
2	MR320D	ODVA IP-LC Bulkhead Receptacle. This bulkhead adaptor accepts Duplex LC connections on the inside and ODVA IP-LC plug on the outside. Ideal for connections at the control closet to outdoor. It is watertight when mated or closed with dust cap.
3	MR398-H26-DDXXX	ODVA IP-LC Fiber Optic Cable Assembly, Male Plug to Male Plug, Type H26 Heavy Duty Duplex Cable.
4	MR398-JBPC-CC	Fiber Optic Junction Box for providing environmental protection for Duplex LC to Duplex LC connection

Optical Cable Types

M26 – Duplex DIB Cable

Used On Sensors with Standard Duplex LC Pigtaills

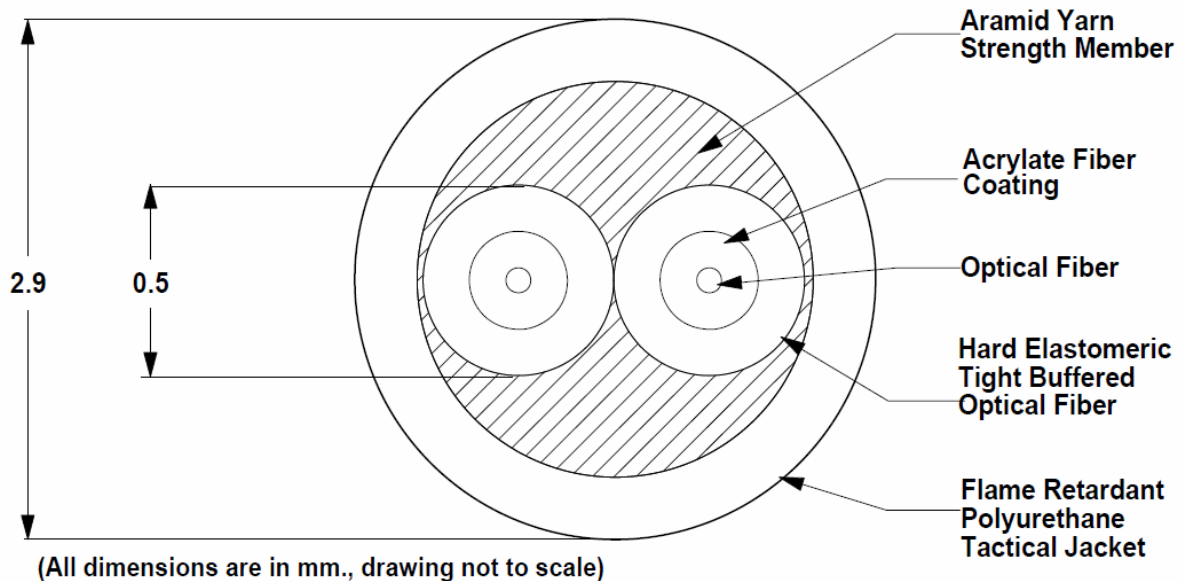


Figure 3: Type H26 Duplex Cable used for Duplex LC Sensor Pigtaills

Table 1: Type M26 Duplex LC Cable Specifications

Parameter	Specification
Fiber Type	Multimode 62.5/125 μ m, Graded Index Fiber, 0.275NA, Type OM1
Attenuation	850 nm = 3.5 db/km 1300 nm = 1.5 db/km
Installation	
Max Tensile Load	500 N (110 lbs.)
Min Bend Radius	5.0 cm (2 in.)
Operating	
Max Tensile Load	300 N (70 lbs.)
Max Bend Radius	3.0 cm (1.2 in.)
Impact Resistance	700 impacts
Crush Resistance	440 N/cm
Temperature	
Operating	-40°C to +71°C
Storage	-55°C to +85°C

H26 – Duplex Breakout Cable

Used with Industrial IP-LC Cabling

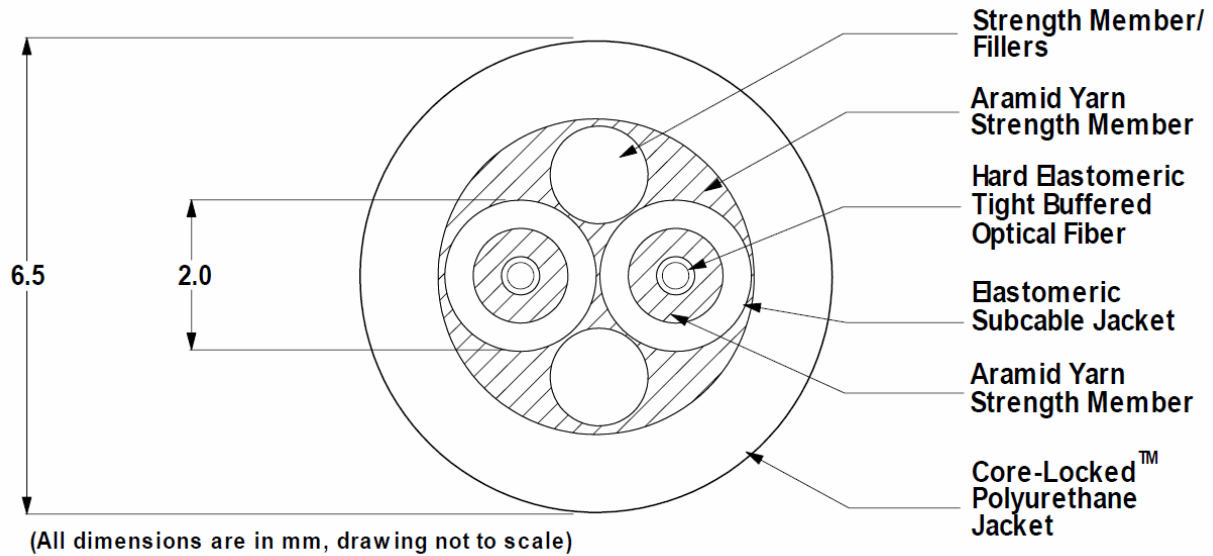


Figure 4: Type H26 Harsh Environment Cable used for Industrial Duplex LC Assemblies

Table 2: Type H26 Industrial Duplex LC Cable Specifications

Parameter	Specification
Fiber Type	Multimode 62.5/125 μ m, Graded Index Fiber, 0.275NA, Type OM1
Attenuation	850 nm = 3.5dB/km 1300 nm = 1.5dB/km
Installation	
Max Tensile Load	2200 N (494 lbs)
Min Bend Radius	10.4 cm (4.0 in)
Operating	
Max Tensile Load	550 N (123 lbs)
Min Bend Radius	5.2 cm (2.0 in)
Impact Resistance	200 impacts
Crush Resistance	440 N/cm
Temperature	
Operating	-55°C to +85°C
Storage	-70°C to +85°C

Connector Types

Duplex LC (Code C)

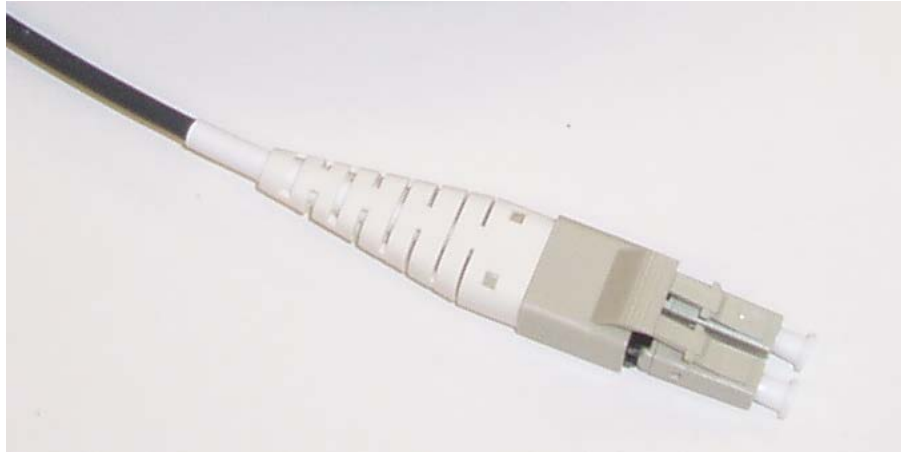


Figure 5: Standard Duplex LC Connector

Table 3: Specifications for Standard Duplex LC Connector

Parameter	Specification
Type	IEC 61754-20
Environmental Rating	Category "C" Controlled Environment Conditions per IEC 61753-1 Ed 2.0 Typically within an office, equipment room, environmental enclosure, telecommunication center or building. Not subjected to condensed water or sand or dust.
Temperature	
Continuous	-40°C to +75°C
Storage	-40°C to +75°C
IP Rating	IP40 (non-environmental)

ODVA IP-LC Harsh Environment Connector (Codes D, E, F)



Figure 6: ODVA IP-LC Connector for Harsh Environments







Table 4: Specifications for ODVA IP-LC Connector

Parameter	Specification
Type	ODVA-selected as recommended "Standard Interface" for industrial interconnects
Environmental Rating	Category "E" Extreme Conditions per IEC 61753-1 Ed 2.0 Typically outdoors, not enclosed. Locations: direct exposed to open air climate subject to industrial sources of harsh chemicals.
Temperature Continuous Storage	-40°C to +85°C -40°C to +85°C
IP Rating	IP66/IP67

Fiber Optic Junction Box – MR398-JB Series

Micronor MR398-JB series fiber optic junction boxes are designed to join two fiber optic cables and environmentally protect the connection. The junction boxes are designed to seal the incoming cables while accommodating varying diameter of fiber cables used in the field. The sealing is accomplished by building up the cable jacket to the desired 12.4mm of the cable glands employed. The through hole of the cable gland is sufficient to sleeve the LC-Duplex or ST connectors through.



Connector #1	Connector #2	Micronor Part Number
 <p>Duplex-LC</p>	 <p>Duplex-LC</p>	MR398-JBPC-CC
 <p>Duplex-LC</p>	 <p>ODVA IP-LC</p>	MR398-JBPC-CD
 <p>ODVA IP-LC</p>	 <p>ODVA IP-LC</p>	MR398-JBPC-DD

Note: For special housing requirements, please contact Micronor sales.

Table 5: MR398 Series Specifications

Specifications		
Size and Weight		
MR398-JBPC-CD and MR398-JBPC-DD	4.53 x 3.54 x 2.17 in. 115.06 x 89.92 x 55.12 mm	0.4 lbs 0.2 kg
MR398-JBPC-CC	6.73 x 4.76 x 2.17 in. 170.94 x 120.90 x 55.12 mm	0.7 lbs 0.35 kg
Housing	Impact-resistant UV Stabilized Polycarbonate, Silicone rubber Gasket Grey Flame retardant	UL508-4x listed UL94-HB Flame Rating
Temperature Range	-40°C to +120°C	Or as limited by fiber optic cable and connector used.
Ingress Protection	IP65 per IEC 529 NEMA 1, 2, 4, 4x, 12 and 13	With connectors attached and properly installed.