



# Fiber Optic Cable Installation

## Introduction

Fiber optic cables can be easily damaged if they are improperly handled or installed. It is imperative that certain procedures be followed in the handling of these cables to avoid damage and/or limiting their usefulness. The information contained in this manual should serve as a guide to proper handling, installing, testing, and for troubleshooting problems with fiber optic cables.

<b>For:</b>	<b>See page:</b>
Important User Information	2
Overview	3
Fiber Optic Cable Mechanical Limits	4
Fiber Optic Cable Installation Guidelines	5
Fiber Optic Cable Pulling Techniques	5
Fiber Optic Cable Routing Guidelines	7
Installation Checklist	9
Cleaning Techniques for Fiber Optic Cables	10
Additional Fiber Optic Cable Installation and Handling Instructions	10
Rockwell Automation Support	BackCover

## Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at <http://literature.rockwellautomation.com>) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.





In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc. is prohibited.

Throughout this manual, when necessary we use notes to make you aware of safety considerations.

 <b>WARNING</b>	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
 <b>IMPORTANT</b>	Identifies information that is critical for successful application and understanding of the product.
 <b>ATTENTION</b>	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you: <ul style="list-style-type: none"><li>• identify a hazard</li><li>• avoid a hazard</li><li>• recognize the consequence</li></ul>
 <b>SHOCK HAZARD</b>	Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.
 <b>BURN HAZARD</b>	Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be dangerous temperatures.

## Overview

Optical fibers require special care during installation to ensure reliable operation. Installation guidelines regarding minimum bend radius, tensile loads, twisting, squeezing, or pinching of cable must be followed. Cable connectors should be protected from contamination and scratching at all times. Violation of any of these parameters causes increased attenuation or permanent damage to the cable. The following are a few general comments to consider when installing fiber optic cables.

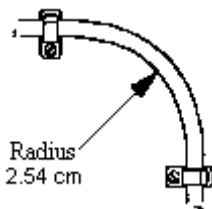
### Do Not Exceed Maximum Cable Lengths

Make sure you check the installation instructions of the module for the appropriate cable lengths to ensure proper operation.

You may experience additional attenuation loss when using bulkhead connectors to join cables even when the total length is less than maximum. Care should be used in maintaining total attenuation budget when joining cables with bulkhead connectors.

### Do Not Exceed Minimum Bend Radius for a Given Cable Type

Exceeding the bend radius of the cable can cause unseen damage to the fibers of the cables that may not manifest itself for a period of time. This can lead to an expensive restringing of cables at a later date. See the following cable specification tables for appropriate bend radii for each catalog number.



**Figure 1 Correct Bend Radius**

## Fiber Optic Cable Mechanical Limits

<b>Catalog Number</b>	<b>Length meters (in.)</b>	<b>Long Term Bend Radius No Load millimeter (in.)</b>	<b>Maximum Tensile Load Newton (lbs.)</b>
2090-SCVGx-0 Glass	50 to 200 (1968 to 7872)	30.0 (1.2)	< 98 (22)
2090-SCVPx-x Plastic	0.1 to 32 (4 to 1260)	40.0 (1.6)	< 245 (55)
2090-SCEPx-x Plastic	0.1 to 32 (4 to 1260)	25.4 (1.0)	< 70 (15)
2090-SCNPx-x Plastic	0.1 to 32 (4 to 1260)	25.4 (1.0)	< 70 (15)

## Fiber Optic Cable Installation Guidelines

General practices to follow when installing fiber optic cables include:

### Avoid Twisting Fiber Optic Cable

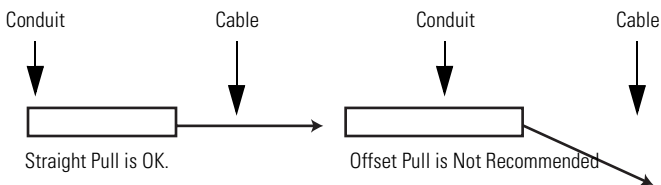
Use proper pulling techniques in laying out your cable. Putting twists in the cable greatly increases your chances of breaking the fibers.

### Use Proper Pulling Techniques for Fiber Optic Cable

Installation methods for both wire cables and optical fiber cables are similar. Just remember these rules:

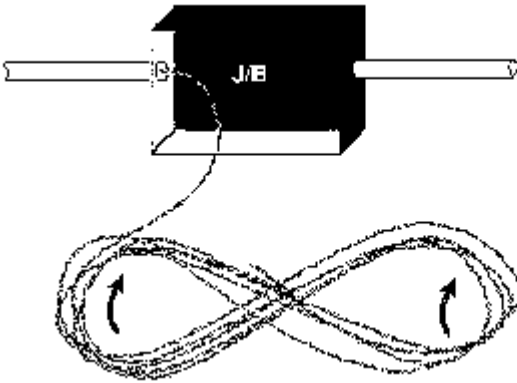
- **Never pull on the connector.** The connector/cable interface is not designed for pulling.
- **Use a pulling grip** designed for pre-connected fiber optic cables. Grips with a fixed pull ring should use a swivel to attach the pull rope.
- **Monitor tension.** Do not exceed the maximum tensile load.
  - On runs from 40m to 100m, use proper lubricants and make sure they are compatible with the cable jacket.
  - On runs over 100m, use proper lubricants and pull from the middle out to both ends.
 If possible, use an automated puller with tension control or at least a breakaway-pulling eye.

- **Always use a straight pull.** Use cable guides to maintain the recommended bend radius. Do not exceed the cable bend radius. Exceeding the bend radius harms the fibers. It may not be immediate, and it may even take a few years but eventually by exceeding the recommended bend radius of the cable you reduce the useful life of the cable.



**Figure 2 Proper Pulling Technique Through Conduit**

- **Do not twist the cable.** Putting a twist in the cable can stress the fibers.
- **Figure 8 for a 40m or longer pull.** If you are installing cable of lengths 40m or longer, use a “figure 8” on the ground to prevent twisting (the figure 8 puts a half twist in on one side of the 8 and takes it out on the other, preventing twists.).



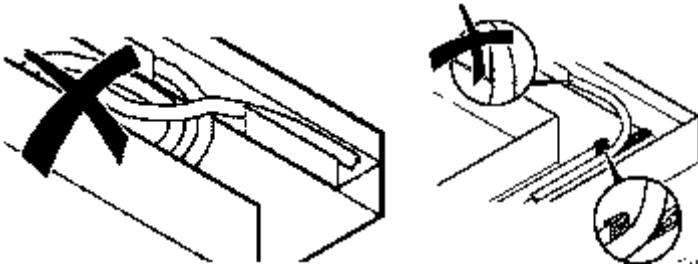
**Figure 3 Prevent Twisting the Cable By Laying Cable in a Figure 8 Pattern**

1. Lay cable on floor in a figure 8 pattern.
  2. Turn Figure 8 cable 360 degrees (upside down) before continuing.
  3. Pull in opposite direction (may require two people).
- **Use a swivel-pulling eye,** to prevent additional twisting of the cable during installation. ■

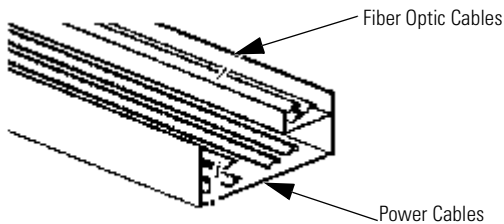
## Properly Route Fiber Optic Cables

Take care when routing through cabinets and right angle raceways.

- **Install cables in raceways without loops.** Avoid placing fiber optic cables in raceways and conduits with copper cables to avoid excessive loading or twisting.

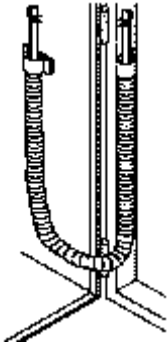


**Figure 4 Using Raceways and Conduits**



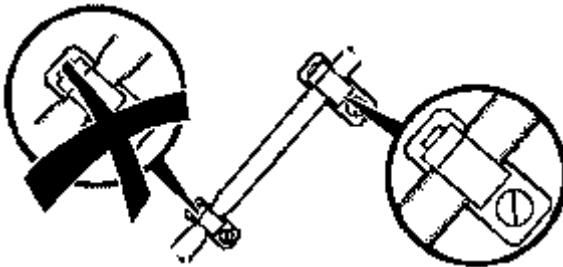
**Figure 5 Using Raceways and Conduits**

- **Protect cables from excessive or frequent bending.** Cables do not have a flex rating. Routing on a cabinet door should be used as a last resort.



**Figure 6 Routing Technique for Cabinet Door**

- **Use proper cable pulling techniques when routing cables.** See the section entitled *Use Proper Pulling Techniques for Fiber Optic Cable* earlier in this manual.
- **Attach cables with plastic clamps having large surface areas.** Avoid pinching or squeezing cable. Cable clamps should be installed manually with gentle pressure.



**Figure 7 Proper Use of Plastic Clamps**



## Installation Checklist

Use the following installation checklist to ensure proper handling.

Installation procedure	Complete	Comments
Maximum cable length not exceeded		
Bending radius not exceeded		
Maximum tensile load not exceeded; proper pulling techniques used		
Cable not squeezed or bent		
Cable installed without loops in raceways		
Cable protected from sharp edges		
Fiber cable installed in separate raceways from copper		
Cable connector cleanliness maintained		
Cable connector finger tight to transceivers		

### ATTENTION



Hand tighten connectors. Do not use tools to tighten connectors as they may cause damage to cables and inhibit signal transmission.

## Cleaning Techniques for Fiber Optic Cables

Proper cleaning of the fiber optic cable ends and transceivers is essential to minimize system attenuation. Dirty fiber optic cables cross contaminate their mating transceivers. Conversely a dirty transceiver contaminates its mating fiber optic cable.

There are a variety of ways to clean fiber optic components.

### Cleaning Fiber Optic Cable Ends

Use a wet wipe to loosen particles on the end of the cable connector using a circular or straight wiping motion while using care to avoid wiping over area of pad that has already been used. Do not use a back and forth scrubbing action. Always use a clean area of the swab for each connector. When in doubt use a fresh wipe. Follow up the wet wipe cleaning with a dry wipe to remove any residue. Use canned air to remove any lint from the cable end.

### Cleaning Fiber Optic Transceivers

Choose an optical grade lint free swab that fits easily into the transceiver barrel. The swab should be gently placed into the barrel of the connector and rotate no more than one turn. Do NOT rotate back-and-forth or round-and-round because debris may be ground into the transceiver. Swabs should only be used ONCE. Use a dry clean swab and insert into barrel and rotate once. Discard swab. Use canned air to blow out the barrel.

## Fiber Optic Cable Installation and Handling Instructions

For more detailed information on the proper care, handling, and installation of these cables see the *Fiber Optic Cable Installation and Handling Instructions* manual, publication number 2090-IN010x-EN-P. This manual can be downloaded free of charge in pdf format from the following website:

**<http://literature.rockwellautomation.com>**

**Notes:**

# Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At <http://support.rockwellautomation.com>, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://support.rockwellautomation.com>.

## Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

Ultra3000 and Kinetix are trademarks of Rockwell Automation.

[www.rockwellautomation.com](http://www.rockwellautomation.com)

### Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 2090-QR001D-EN-P – April 2005

PN 957955-27

Supersedes publication 2090-IN010B-EN-P – September 2004

Copyright © 2004 Rockwell Automation, Inc. All rights reserved. Printed in the U.S.A.