Appendix K

Fiber-Optic Remote I/O Network Installation Guidelines

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K1.0 INTRODUCTION

This appendix provides an overview of fiber-optic networks, a description of the hardware components that comprise the AutoMax fiber-optic Remote I/O network, and guidelines for installing the components and fiber-optic cable. Refer to sections 3.5 and 3.6 in this manual for module installation and replacement procedures.

K1.1 Fiber-Optic Remote I/O Network Overview

An AutoMax Remote I/O network can be built using coaxial cable or fiber-optic cable. Fiber-optic cable is recommended when the following factors are required by the application:

- High noise immunity - Fiber-optic cable is not affected by electromagnetic interference and can be installed with other signal or power wiring.
- Isolation - Ground loops and spurious signals are prevented since there is no electrical connection between the two ends of the fiber-optic transmission system.
- Safety - Fiber-optic cable can be used in chemical plants, as well as in oil and gas refineries, since glass is unaffected by most chemicals or solvents. Breaking a fiber will not create a spark leading to a potential explosion. In addition, since there is no electrical current flowing, exposure to water will not cause a short circuit in the fiber-optic cable.
- Distance - Fiber normally has much lower attenuation that copper. Therefore, longer links can be constructed with fiber-optic cable than with copper (coaxial) cable.

Unlike the coaxial cable network, which allows multiple drops to be connected to a main trunkline, a fiber-optic link provides point-to-point communication only. Therefore, a different network configuration and different hardware components are required to enable communication between drops. A “star topology” network configuration is used for the fiber-optic Remote I/O network, as shown in figure K1.1.

The type of cable or the network configuration used has no effect on the operation of the Remote I/O network protocols, application software, or the operation of the Remote I/O module, the Shark Interface module, the Remote I/O Head, or the Remote Drive Interface Head.

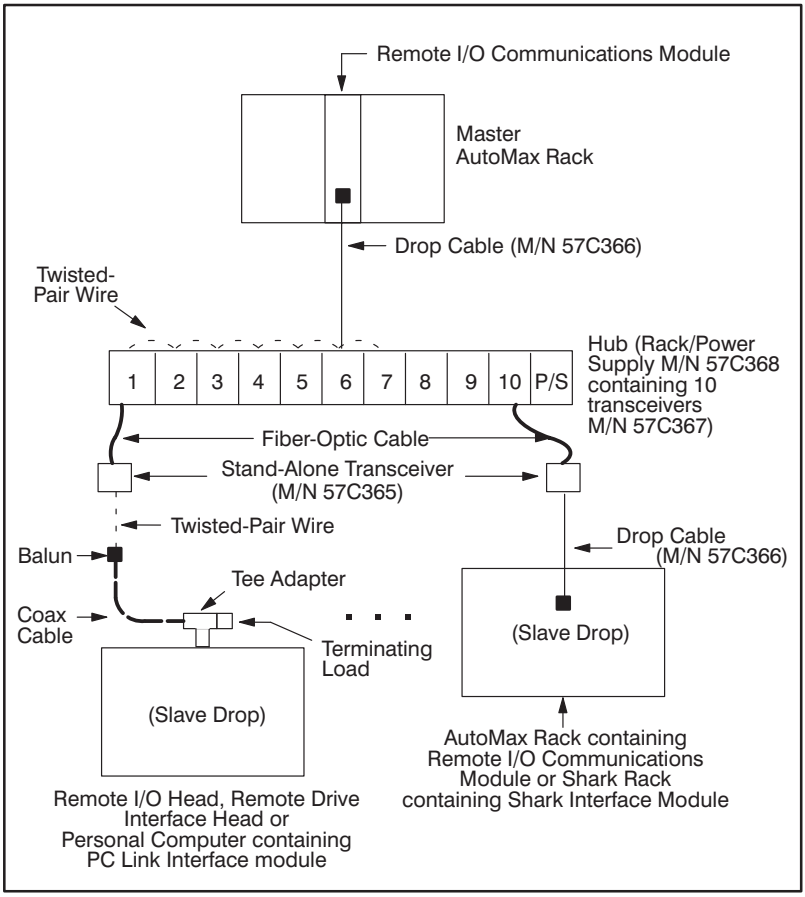

Figure K1.1 - Fiber-Optic Remote I/O Network

As shown in the above figure, a Stand-Alone Transceiver is required at each slave drop on the network. A Stand-Alone Transceiver is required at the master rack only when this rack and the hub cannot be located together in the same cabinet. The transceiver performs the optical conversion of electrical data signals from the Network module to the network and the electrical conversion of optical data signals from the network to the Network module.

Each drop is connected by a fiber-optic link to another transceiver mounted in a rack. Up to 10 transceivers can be mounted in the transceiver rack, also called a “hub”. All communication between drops takes place in the transceiver rack. The optical signals received by any transceiver in the rack are converted into electrical signals and propagated to all other transceivers in the rack via twisted-pair wire connections. Each transceiver then converts the electrical signals to optical signals and retransmits them to its corresponding drop.

K1.2 Fiber-Optic Remote I/O Network System Components

The AutoMax fiber-optic Remote I/O network system consists of the following components:

- Drop Cable (M/N 57C366) - used only with the Remote I/O Communications module or the Shark Interface module.
- BNC Tee Adapter (M/N 45C70), BNC Terminating Load (M/N 45C71), and Balun - used only with the Remote I/O Head, the Remote Drive Interface Head, or a personal computer contianing a PC Link module.
- Stand-Alone Fiber-Optic Transceiver (M/N 57C365)
- Fiber-Optic Rack with Power Supply (M/N 57C368)
- Rack-Mounted Fiber-Optic Transceiver (M/N 57C367)
- Fiber-Optic Cable

Each of these components is shown in figure K1.1 and described in the sections that follow.

K1.2.1 Drop Cable

The drop cable (M/N 57C366) is used to connect the Remote I/O Communications module or the Remote I/O Interface module to the transceiver.

A 9-pin D-shell connector is provided at one end of the 3-foot (1-meter) cable for connection to the Network module. Terminations are provided on the other end of the cable for connection to the terminal strip on the transceiver. Refer to figures K2.2 and K2.4 for these connections.

K1.2.2 BNC Tee Adapter and Balun

For the Remote I/O Head, the Remote Drive Interface Head, and the PC Link module, a twisted-pair-to-coax balun is used to convert the cable between the module and the transceiver. The balun is connected to the module via the BNC Tee Adapter (M/N 45C70). Note that a 75 ohm terminating load (M/N 45C71) is required. The balun is connected to the transceiver using twisted-pair wire. See section 3.1.4 for more information on the BNC Tee Adapter.

K1.2.3 Stand-Alone Fiber-Optic Transceiver

The Stand-Alone Fiber-Optic Transceiver (M/N 57C365) is required at each slave network drop for connection to the fiber-optic network. (A Stand-Alone Transceiver is required at the master rack only if the rack cannot be located within 3 feet of the fiber-optic hub.) It performs the bi-directional conversion between electrical and optical signals. Transceiver technical specifications are listed in Appendix A.

The transceiver is designed to be panel-mounted (vertically or horizontally). Mounting holes are provided on flanges that extend from both ends of the enclosure. See figure K1.2.

Receive and transmit ports labeled “R” and “T”, respectively, are provided on one end of the transceiver for connection to the 1

fiber-optic link with the transceiver hub. The transceiver is shipped with dust caps covering the fiber-optic ports. The dust caps should not be removed until the fiber-optic cables are installed, and should be replaced if the cables are disconnected, to prevent dust accumulation and the resulting loss of signal integrity.

WARNING

TURN OFF AND LOCKOUT OR TAG POWER TO BOTH THE MASTER OR SLAVE DROP AND THE CORRESPONDING RACK-MOUNTED OR STAND-ALONE TRANSCEIVER BEFORE VIEWING THE FIBER-OPTIC CABLE OR TRANSMITTER UNDER MAGNIFICATION. VIEWING A POWERED FIBER-OPTIC TRANSMITTER OR CONNECTED CABLE UNDER MAGNIFICATION MAY RESULT IN DAMAGE TO THE EYE. FOR ADDITIONAL INFORMATION, REFER TO ANSI PUBLICATION Z136.1-1981. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

The green LEDs on either side of each connector indicate the status of the receiver and transmitter and will flicker as data is received and transmitted by the transceiver.

The opposite end of the transceiver contains a six-screw terminal block for operating power and signal connections. See section K2.2 for the terminal block designations. The 24VDC required for transceiver operation must be provided externally. Note that terminal 6 (−24V) is internally connected to the transceiver enclosure.

A jumper between terminals 3 and 4 is used to connect a built-in 120 ohm terminating load between terminals 1 and 2. This jumper must be used on all Stand-Alone Transceivers.

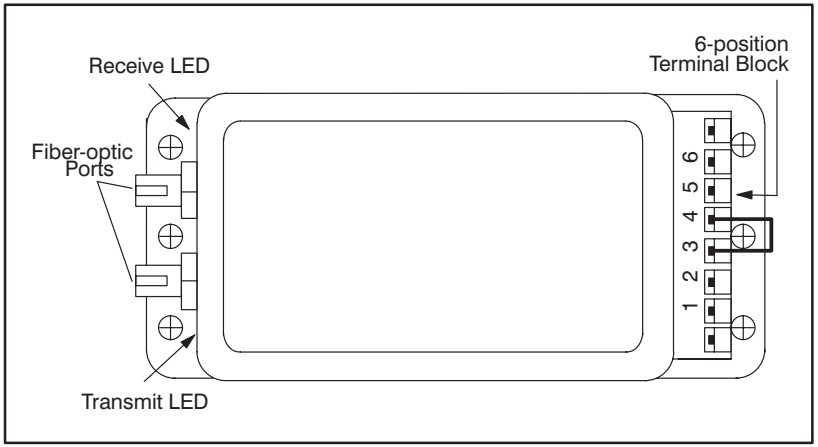

Figure K1.2 - Stand-Alone Transceiver

K1.2.4 Fiber-Optic Rack with Power Supply

The Fiber-Optic Rack and Power Supply (M/N 57C368) provide the mechanical means of mounting and providing power for up to 10 fiber-optic transceivers (M/N 57C367). Technical specifications are listed in Appendix A.

The rack is a 19-inch clear anodized aluminum enclosure with a transparent plastic front panel. The rack contains a 115/230VAC power supply and 10 slots for transceivers. Each transceiver receives operating power through plug connections at the bottom of each slot in the rack. Transceiver-to-transceiver wiring and connection to the fiber-optic link is done through openings in the back of the rack.

The Power Supply consists of a 115/230 to 14V AC transformer connected to a standard IEC-style line cord. On the back of the rack, there is a switch wired to the transformer to allow switching the primary from 115 to 230V AC. The faceplate of the Power Supply contains an ON/OFF rocker switch and a 1.25 amp fuse. A built-in indicator in the ON/OFF switch will illuminate to indicate the presence of power. See Appendix E for the Power Supply schematic.

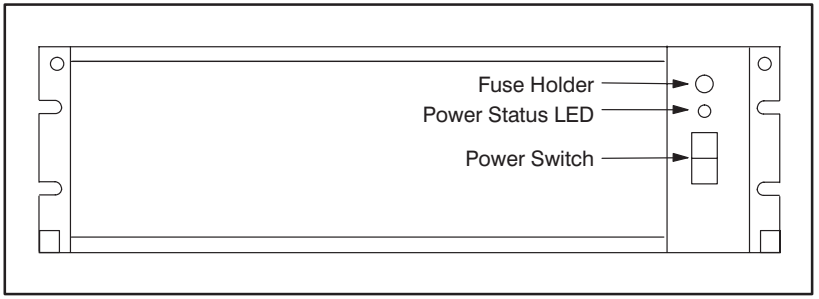

Figure K1.3 - Fiber-Optic Rack and Power Supply

K1.2.5 Rack-Mounted Transceiver

The Rack-Mounted Transceiver (M/N 57C367) is simply the Stand-Alone Transceiver (M/N 57C365) attached to an adapter plate which allows it to be mounted in the Transceiver Rack (M/N 57C368). See figure K1.4.

The adapter faceplate contains one green LED which, when lit, indicates the transceiver is receiving power. Two captive screws on the faceplate secure the transceiver to the rack.

A four-screw terminal block is provided on the back of the adapter for transceiver-to-transceiver data transmission via twisted-pair wire. A 2-pin plug on the back of the adapter provides connection to the rack backplane for input power. The Rack-Mounted Transceiver is shipped with the connections made between the four-screw terminal block and plug on the back of the adapter and the six-screw terminal block on the transceiver. A jumper between terminals 3 and 4 on the six-screw terminal block is used to connect a built-in 120 ohm terminating load between terminals 1 and 2. This jumper must be connected on transceivers at the extreme ends of the rack.

Receive and transmit ports labeled “R” and “T”, respectively, are provided on the back of the transceiver for connection to the fiber-optic link with the Stand-Alone Transceiver. The transceiver is shipped with dust caps covering the fiber-optic ports. The dust caps should not be removed until the fiber-optic cables are installed, and should be replaced if the cables are disconnected, to prevent dust accumulation and the resulting loss of the signal integrity. The green

LEDs on either side each connector indicate the status of the receiver and transmitter and will flicker as data is received and transmitted by the transceiver.

WARNING

TURN OFF AND LOCKOUT OR TAG POWER TO BOTH THE MASTER OR SLAVE DROP AND THE CORRESPONDING RACK-MOUNTED OR STAND-ALONE TRANSCEIVER BEFORE VIEWING THE FIBER-OPTIC CABLE OR TRANSMITTER UNDER MAGNIFICATION. VIEWING A POWERED FIBER-OPTIC TRANSMITTER OR CONNECTED CABLE UNDER MAGNIFICATION MAY RESULT IN DAMAGE TO THE EYE. FOR ADDITIONAL INFORMATION, REFER TO ANSI PUBLICATION Z136.1-1981. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

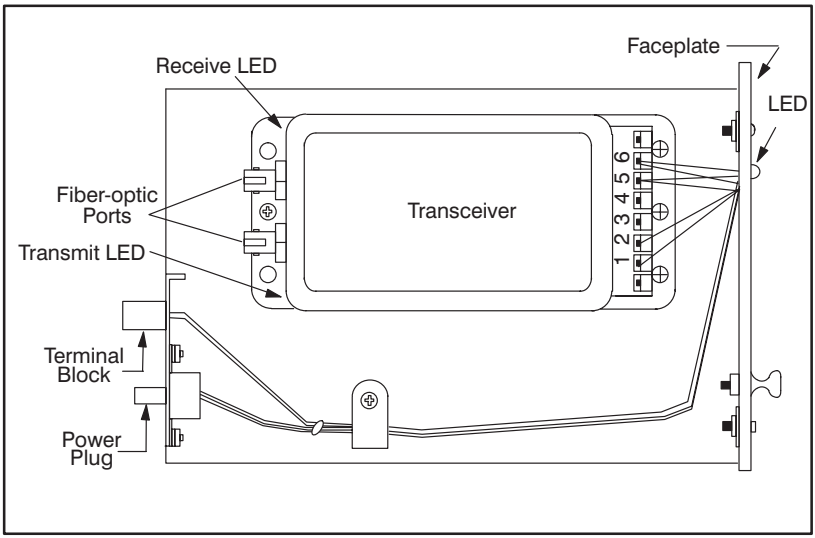

Figure K1.4 - Rack-Mounted Transceiver

K1.2.6 Fiber-Optic Cable

The Remote I/O network requires a 62.5 micron duplex fiber-optic cable. The recommended cable is Belden cable #225362 or equivalent. This cable has a PVC outer jacket and an internal Kevlar strength member. This cable is a breakout type of cable which contains two individually-insulated, tightly-buffered fiber-optic wires (fibers). This cable may be used in areas where the ambient temperature will not exceed 80°C (176°F). Additional cable specifications are provided in Appendix F.

The fiber-optic connectors must be ST®-Compatible Multimode Connectors with ceramic ferrules. Refer to Appendix F for more information.

K2.0 INSTALLATION

This section describes how to install and replace the individual components that make up a fiber-optic link. It also provides network installation and cable handling guidelines. Refer to section 3.6 in the manual for module installation and replacement procedures.

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING WITH ALL APPLICABLE LOCAL, NATIONAL, AND INTERNATIONAL CODES. WIRING PRACTICES, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

TURN OFF AND LOCKOUT OR TAG POWER TO BOTH THE MASTER OR SLAVE DROP AND THE CORRESPONDING RACK-MOUNTED OR STAND-ALONE TRANSCEIVER BEFORE VIEWING THE FIBER-OPTIC CABLE OR TRANSMITTER UNDER MAGNIFICATION. VIEWING A POWERED FIBER-OPTIC TRANSMITTER OR CONNECTED CABLE UNDER MAGNIFICATION MAY RESULT IN DAMAGE TO THE EYE. FOR ADDITIONAL INFORMATION, REFER TO ANSI PUBLICATION Z136.1-1981. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

K2.1 Installation Planning

Use the following procedure to design a fiber-optic network that will achieve maximum signal isolation and cable protection in a specific environment with minimal fiber-optic cable usage.

You will need to select the tools and personnel that are required for fiber-optic cable assembly and installation. Unless you have in-house expertise with fiber-optic cable assemblies and installation, we recommend that you contact an experienced contractor for making up and installing fiber-optic cables.

Step 1. Identify the actual location of the AutoMax drops, Stand-Alone Transceivers, and the Transceiver Rack(s) using an equipment floor plan.

Step 2. Identify the tentative fiber-optic cable routes. Route the cables to allow easy access in the future.

Step 3. Identify the environmental conditions (temperature, humidity, hazardous chemicals) along the route that may damage the cable jacket.

Step 4. Determine how to bypass physical obstructions (walkways, heat sources, furnaces, caustic chemicals) along the route that may damage the cable jacket.

Step 5. Determine the best type of fiber-optic cable installation for each point-to-point link (conduit, raceway, wiring tray).

Step 6. Calculate the total length of the fiber-optic cable for each link.

Step 7. Note that the maximum link length is 2000 meters without splicing.

Step 8. Document the fiber-optic cable system layout. This document should be maintained for the life of the installation.

Step 9. Determine the number of fiber-optic cable components that are needed. Refer to Appendix G for more information on recommended components.

K2.2 Installing the Stand-Alone Transceiver

The Stand-Alone Transceiver may be mounted vertically or horizontally. Horizontal mounting is recommended, however, to provide better access to transceiver LEDs, connectors, and adjustments.

Use the following procedure to install the Stand-Alone Transceiver:

Step 1. Prepare the mounting surface using the mounting dimensions shown in figure K2.1 for the correct placement of the holes.

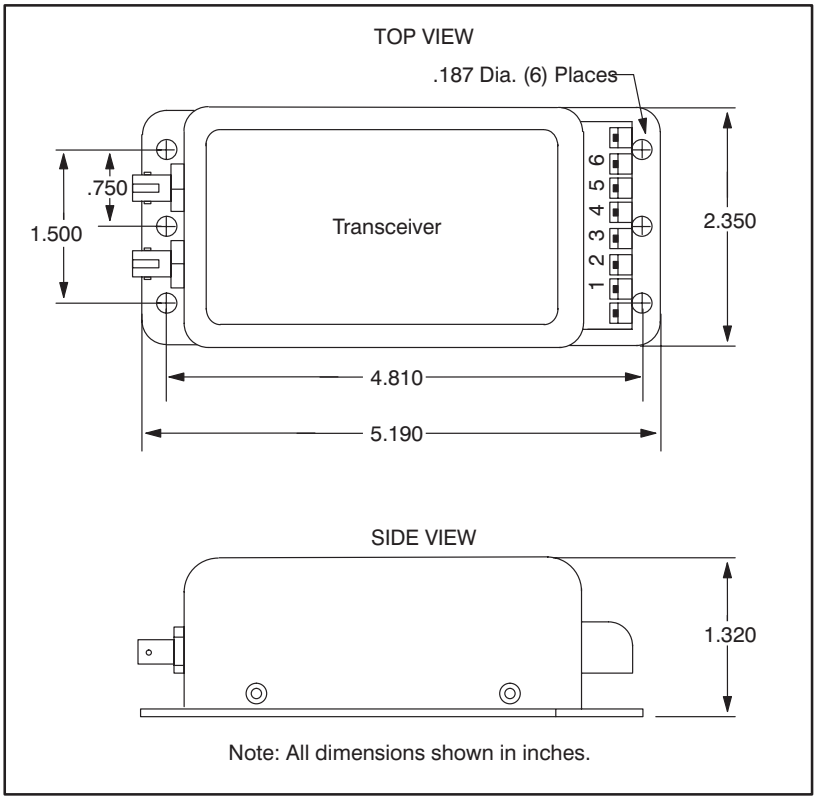

Figure K2.1 - Stand-Alone Transceiver Mounting Dimensions

Step 2. Secure the transceiver to the mounting surface using #8 screws.

Step 3. Verify that the external power supply is turned off. Make the drop cable and input power connections to the transceiver terminal block as shown in figure K2.2.

TRANSCEIVER TERMINAL	CONNECTION
1	DATA - DROP CABLE BROWN WIRE
2	DATA - DROP CABLE BROWN/WHITE WIRE
3	120 OHM LOAD JUMPER*
4	120 OHM LOAD JUMPER*
5	+24VDC
6	GROUND (Connected to transceiver enclosure)

*A jumper between terminals 3 and 4 will connect an internal 120 ohm termination resistor between terminals 1 and 2. This jumper must be used on all Stand-Alone Transceivers.

Figure K2.2 - Stand-Alone Transceiver Terminal Block Connections

Step 4. Connect the transceiver to the fiber-optic network using the guidelines provided in section K2.5.

Step 5. Turn power on to the transceiver.

K2.3 Installing the Rack/Power Supply and Rack-Mounted Transceivers

The user is responsible for providing the means for rack installation in an electrical cabinet. Ensure that all cables are long enough to provide accessibility to the Rack-Mounted Transceivers from the back of the rack to aid in replacement or troubleshooting. Use the following procedure to install the Rack/Power Supply and Rack-Mounted Transceivers.

Step 1. Set the selector switch on the back of the rack to 115 or 230 VAC as required.

Step 2. Install the rack using #8 screws. Allow at least 1” to 2” clearance around the rack for adequate ventilation. Rack mounting dimensions are shown in figure K2.3.

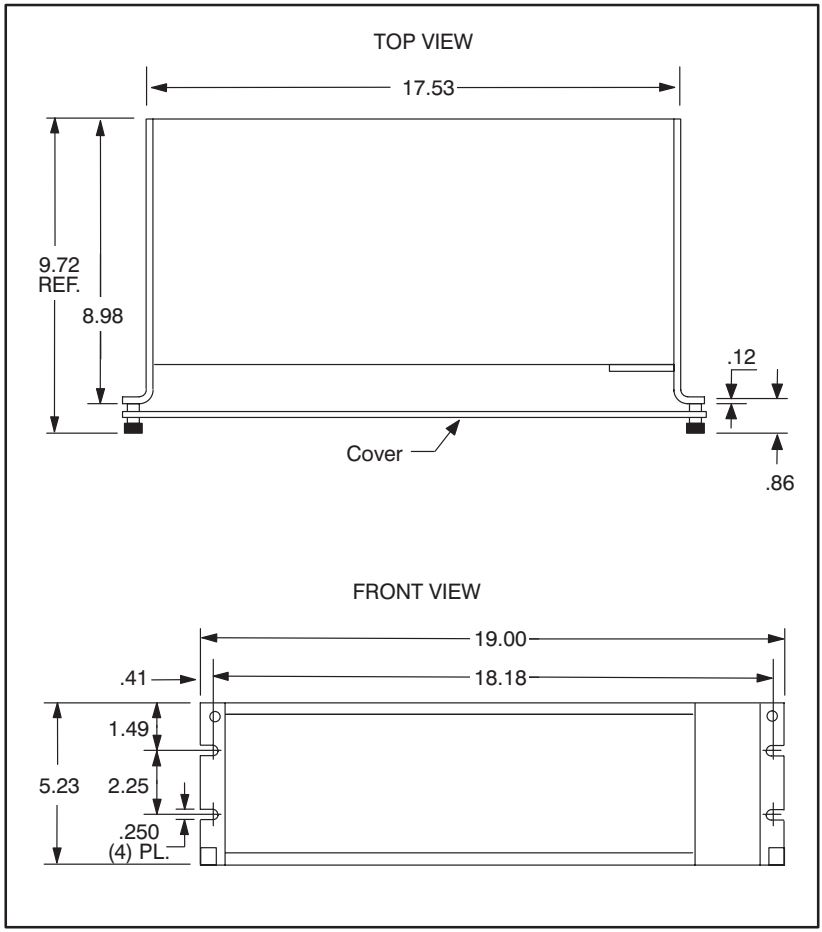

Figure K2.3 - Fiber-Optic Rack Mounting Dimensions

Step 3. Plug each transceiver into any empty slots in the rack. Verify that on the transceivers at the extreme ends of the rack, a jumper has been connected between terminals 3 and 4 on the six-screw terminal block.

Step 4. Use twisted-pair wire (as specified in Appendix G) to make all signal connections between transceivers as shown in figure K2.4. To improve network serviceability, make the signal connections between transceivers on a separate terminal strip as shown in figure K2.5. Use a standard terminal strip for these connections.

ADAPTER TERMINAL	CONNECTION
1	DATA - VIOLET WIRE
2	DATA - BLACK WIRE
3	NO CONNECTION
4	NO CONNECTION

Figure K2.4 - Rack-Mounted Transceiver Terminal Block Connections

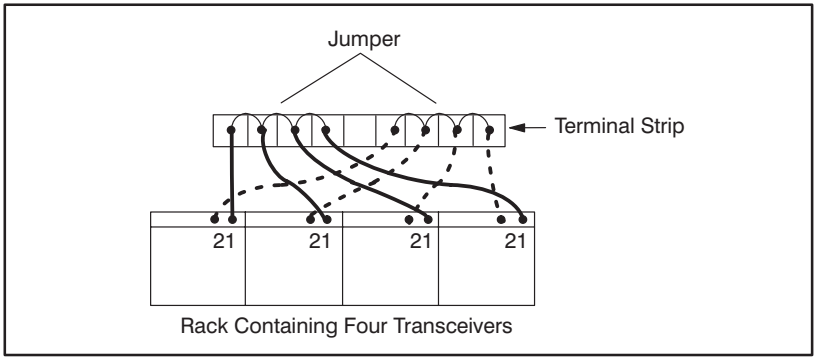

Figure K2.5 - Connecting Rack-Mounted Transceivers to a Terminal Strip

Step 5. Connect each transceiver to the fiber-optic network using the guidelines provided in section K2.5.

Step 6. Verify that the external power supply is turned off. Connect the power cord to a 115 or 230VAC external power supply. Note that the rack frame is grounded directly through the ground pin of the line cord.

Step 7. Use the rocker switch on the front of the Power Supply to turn power ON to the rack. A built-in indicator in the switch will illuminate signifying the presence of power.

Step 8. Secure each transceiver with the captive screws on the faceplate of the module. Attach the transparent plastic front panel.

K2.4 Installing the Fiber-Optic Cable

The fiber-optic cable must be handled by experienced personnel prior to and during installation. Improper handling may result in damage to the cable. Unless you have in-house expertise with fiber-optic cable assemblies and installation, Reliance Electric recommends that you contact an experienced contractor for making up and installing fiber-optic cables. Use the following general guidelines to protect the cable:

- Visually inspect the cable before the installation.

- Route the fiber-optic cable to protect it from abrasion, vibration, moving parts, and personnel traffic. Be sure the cable does not touch abrasive surfaces such as concrete which could wear through and damage the cable's outer jacket.
- Locate the fiber-optic cable away from temperatures greater than 80°C (176°F).
- Protect the fiber-optic cable from: oil, grease, acids, caustics, and other hazardous chemicals that may damage the cables outer jacket.
- Pull the cable in accordance with vendor instructions. Protect the fiber-optic connectors if they are attached.
- Do not exceed the minimum bend radius (3" or 75mm) of the cable.
- Do not exceed the cable's maximum recommended pulling tension.
- Use a cable lubricant to reduce friction when pulling the cable.
- Attach the fiber-optic connectors if the cable was pulled without them. Test the cable using a power meter or optical time domain reflectometer.
- Label the fiber-optic cable, Stand-Alone Transceiver, and its corresponding Rack-Mounted Transceiver with the network ID, the network drop and Remote I/O module slot.

K2.4.1 Attaching the Fiber-Optic Connectors

Typically, short fiber-optic cables are shipped with their connectors attached. You may need to attach connectors if replacement cables are needed, if the fiber-optic link is being altered, or if the cable is very long. Use only ceramic ferrule ST-type connectors. Refer to Appendices F and G for cable and connector specifications. Appendix G also lists the name of the recommended fiber-optic connector kit. This kit contains detailed instructions that describe how to attach the connectors to the fiber-optic cable.

K2.5 Connecting a Fiber-Optic Cable Between a Stand-Alone Transceiver and a Rack-Mounted Transceiver

WARNING

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CAUTION: Do not damage the ends of the fiber-optic cable connectors by touching them or dropping them. Do not use factory-compressed air to clean the fiber-optic ports or connectors because the air may contain impurities that could scratch them. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Use the following procedure to connect a fiber-optic cable between a Stand-Alone Transceiver and a Rack-Mounted Transceiver:

Step 1. Remove the dust caps from the fiber-optic ports on the Stand-Alone and the Rack-Mounted Transceivers. Clean the ports with a lint-free cloth moistened with isopropyl alcohol or a can of compressed air. Save the dust caps. All fiber-optic connectors and ports, when not in use, should be covered with dust caps.

Step 2. Remove the dust caps from the fiber-optic cable's connectors. Use a lint-free cloth moistened with isopropyl alcohol or a can of compressed air to clean the cable's connectors.

Step 3. Attach the cable's connectors to the ports as follows:

- Panel-Mounted Transceiver "T" port: blue fiber-optic wire
- Panel-Mounted Transceiver "R" port: orange fiber-optic wire
- Rack-Mounted Transceiver "T" port: orange fiber-optic wire
- Rack-Mounted Transceiver "R" port: blue fiber-optic wire

Note that the fiber-optic wires are color-coded. Typically, the wires are orange and blue. The wires used in your installation may be of a different color but they should be installed in the same manner as described here. Verify that the transmit connector of one unit is connected to the receive connector of the other unit. Note that both of the fiber-optic wires are the same.

Align the connector's pin with the slot in the transceiver's port. See figure K2.6. Push the connector onto the port. Turn the connector clockwise until it locks onto the port's two pins. Do not bend or kink the wire when you attach it to the port. Bending the wire sharply could break the fiber inside.

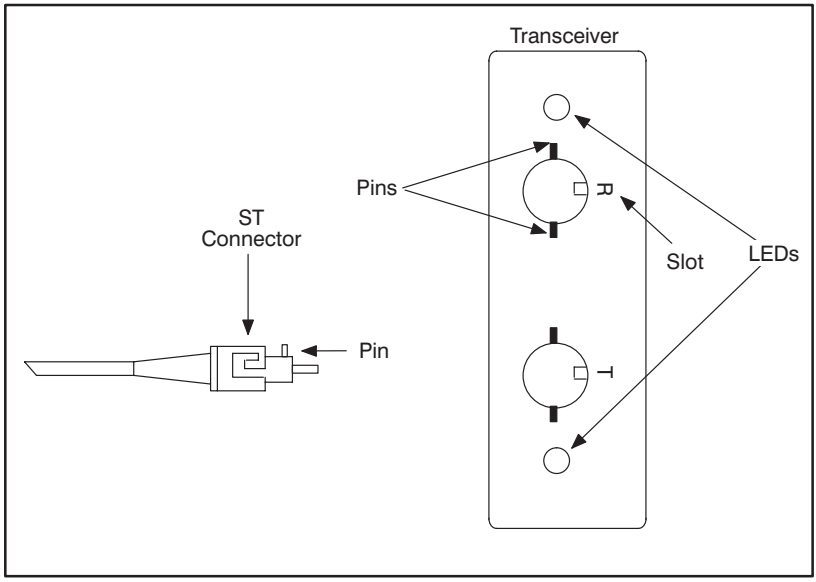

Figure K2.6 - Fiber-Optic Ports and Connectors

K2.6 Replacing the Stand-Alone Transceiver

Use the following procedure to replace a Stand-Alone Transceiver.

Step 1. Remove power from the external power supply that is supplying power to this transceiver.

Step 2. Disconnect the input power cable and the drop cable from the transceiver's six-screw terminal block.

Step 3. Disconnect the fiber-optic cable from the transceiver.

Step 4. Replace the transceiver.

Step 5. Re-connect the input power cable and the drop cable as shown in section K2.2. Connect the jumper between terminals 3 and 4.

Step 6. Re-connect the fiber-optic cable as shown in section K2.5.

Step 7. Turn power on to the external power supply.

K2.7 Replacing the Rack-Mounted Transceiver

Use the following procedure to replace a Rack-Mounted Transceiver.

Step 1. Remove the plastic panel from the front of the Fiber-Optic Rack.

Step 2. Turn the Fiber-Optic Rack's Power Supply off using the rocker switch on the Power Supply's faceplate.

Step 3. Disconnect the fiber-optic cable from the transceiver.

Step 4. Disconnect the twisted-pair cable from the transceiver's four-screw terminal block.

Step 5. Loosen the captive screws on the transceiver's faceplate and remove it from the rack.

Step 6. If the new transceiver is to be located at an extreme end of the rack, connect the jumper between terminals 3 and 4 on the transceiver's six-screw terminal block.

Step 7. Insert the transceiver into the rack and secure it with the captive screws.

Step 8. Connect the twisted-pair cable to the new transceiver as shown in section K2.3.

Step 9. Connect the fiber-optic cable as shown in section K2.5.

Step 10. Turn the Power Supply on. Verify that the LED on the faceplate of the transceiver is on. This indicates that it is receiving power.

Step 11. Re-attach the plastic panel to the front of the rack.

L2.8 Replacing the Fiber-Optic Rack and Power Supply

Use the following procedure to replace the Fiber-Optic Rack and Power Supply. Before beginning this procedure, verify that the fiber-optic cable, the Rack-Mounted Transceiver, and its corresponding Stand-Alone Transceiver are labeled with the network ID number, the network drop number, and the Remote I/O module slot number.

Step 1. Remove the plastic panel from the front of the Fiber-Optic Rack.

Step 2. Turn the Fiber-Optic Rack's Power Supply off using the rocker switch on the Power Supply's faceplate.

Step 3. Remove power from the Power Supply's external 115 or 230VAC source.

Step 4. Disconnect the Power Supply's power cord from the external 115 or 230VAC source.

Step 5. Disconnect the twisted-pair cables and fiber-optic cables from each transceiver in the rack.

Step 6. Remove the rack from the mounting surface.

Step 7. Set the selector switch on the back of the new rack to 115 or 230 VAC as required.

Step 8. Attach the rack to the mounting surface.

Step 9. Insert each transceiver into the new rack and connect the twisted pair cable (refer to section K2.3) and fiber-optic cable (refer to section K2.5).

Step 10. Connect the power cord to the 115 or 230VAC source.

Step 11. Turn power on to the 115 or 230VAC source.

Step 12. Turn the Fiber-Optic Rack's Power Supply on using the rocker switch on the Power Supply's faceplate. The built-in indicator in the switch will illuminate to indicate the presence of power. Verify that the LEDs on all of the Rack-Mounted Transceivers in the rack are on.

Step 13. Re-attach the plastic panel to the front of the Fiber-Optic Rack.

K2.9 Adding a Network Drop

Use the following procedure to add a drop to the fiber-optic network:

Step 1. Identify the route for a new fiber-optic link. Refer to the recommendations provided in section K2.4.

Step 2. Calculate the new link length. Ensure the new total cable length does not exceed the maximum cable length defined in Appendix H. If it exceeds the maximum specified cable length, consult with Reliance Electric before taking any further steps.

Step 3. Install and test the new cable segment following the instructions provided in section K2.4.

Step 4. Install the new Stand-Alone Transceiver following the instructions provided in section K2.2.

Step 5. Stop all communications over the AutoMax network.

Step 6. Install the new Rack-Mounted Transceiver following the instructions provided in section K2.3.

Step 7. Resume network operation.

K2.10 Disconnecting a Network Drop

Use one of the following methods to disconnect a drop from the Remote I/O network. Note that you do not need to stop network operation when you disconnect a drop from the network.

- Disconnect the drop cable or the Tee Adapter from the selected module.
- Disconnect the fiber-optic cable from the Stand-Alone Transceiver.
- Disconnect the fiber-optic cable from the Rack-Mounted Transceiver.

K2.11 Fiber-Optic Cable System Maintenance

The following sections describe recommended maintenance procedures.

K2.11.1 Cable System Documentation Maintenance

Keep the network cable system documentation up-to-date with all changes made to the network configuration during the life of the network.

K2.11.2 Cable System Design Maintenance

When old equipment is relocated or new equipment is installed, new sources of heat, hazardous chemicals, and other changes in the network cable system environment may occur. Evaluate the effect

these changes have on the performance of the network. If necessary, take corrective action such as re-routing certain fiber-optic cables.

K2.11.3 Cable System Inspection

Inspect the fiber-optic cable system periodically. Use the optical time domain reflectometer (OTDR) or power meter for the cable inspection. OTDRs can also be used to perform cable testing during the installation or to locate a possible cable fault during troubleshooting. All tests should be properly documented.

K3.0 DIAGNOSTICS AND TROUBLESHOOTING

This section describes how to troubleshoot the fiber-optic Remote I/O network and its components. Refer to section 6.0 of this manual for troubleshooting procedures for the Remote I/O module, the Remote I/O Head, Remote Drive Interface Head, and the Shark Interface module.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

K3.1 Network Failure

Problem: Error code C appears on any Remote I/O module's LED display. This error code indicates a network failure. Read section 6.3 of this manual and follow step 1-4 before continuing with the procedure described below. The following procedure is used to isolate the cause of a network failure by systematically checking the hardware components that make up a point-to-point fiber-optic link. After each step, determine if the problem has been corrected before continuing to the next step.

Step 1. Verify that the connections are secure between the drop faceplate and the Stand-Alone Transceiver. (Depending upon the application, this will require checking the drop cable or the Tee Adapter and balun connections.) Verify that its connections to the Stand-Alone Transceiver's terminal block are secure and correct as shown in figure K2.2.

Step 2. Check the Stand-Alone Transceiver. Using a voltmeter, verify that the power supply voltage is within normal limits. Verify that the fiber-optic cable connections are secure. Note that the LEDs on the transceiver will flicker to indicate that the transceiver is sending/receiving messages. Verify that the jumper is securely connected between terminals 3 and 4. Replace the transceiver.

Step 3. Check the fiber-optic cable. Verify that the cable has not been damaged due to improper handling (e.g., bending it beyond the minimum bend radius). Test the cable using a fiber-optic power meter or a fiber-optic time domain reflectometer (OTDR). The recommended cable assembly test set is listed in Appendix F. Replace the cable.

Step 4. Remove the plastic panel from the front of the Fiber-Optic Rack, and check the corresponding Rack-Mounted Transceiver.

a.) Using a voltmeter, verify that the power supply voltage is within normal limits. (This step assumes that the Power Supply in the the Fiber-Optic Rack is functional; refer to section K3.2). The power status indicator on the faceplate should be on. If it is off, unscrew the captive screws on the faceplate and remove the transceiver from the rack. Using a voltmeter, verify that the rack is supplying 14 to 18 VAC through the plug in the backplane. Re-insert the transceiver into the rack securely. Replace the transceiver.

b.) Verify that the fiber-optic cables are connected securely to the transceiver. Note that the LEDs on the transceiver will flicker if it is sending/receiving messages.

c.) Verify that the data signal wiring is connected securely to the four-screw terminal block as shown in figure K2.4.

d.) If the transceiver is located at one of the extreme ends of the rack, verify that the jumper is securely connected between terminals 3 and 4 of the transceiver's six-screw terminal block.

K3.2 Power Supply Status Indicator is OFF

Problem: The green status light on the face of the Power Supply is off. This light should be on to indicate the presence of power. If this light is off, use the following procedure to isolate the cause.

Step 1. Verify that the rocker switch on the front of the Power Supply is in the ON position.

Step 2. Verify that the Power Supply is receiving correct input power.

Step 3. Verify that the selector switch is in the appropriate position (115 or 230).

Step 4. Turn off power to the Fiber-Optic Rack. Remove the fuse from the Power Supply and, using an ohmmeter, verify that the fuse is not blown. If the fuse is good, re-insert it and continue with step 5

If the fuse is blown, replace it with the fuse type specified in Appendix A.

Step 5. Turn on power to the rack. If the problem is not corrected, replace the Fiber-Optic Rack and Power Supply.

K3.3 Fiber-Optic Link Adjustment

If a fiber-optic link between any two transceivers is longer than 1000 meters and the values in registers 15-18 increase consistently, you may have to adjust the duty cycle of the the received signal on each end of the link. Use the following procedure:

Step 1. Disconnect all other links from the network.

Step 2. Connect an oscilloscope between terminals 1 and 2 on the transceiver terminal block. The received signal amplitude is approximately 4 volts peak-to-peak.

Step 3. The received signal duty cycle should be 50%. If it is not, then use the potentiometer on the transceiver to adjust it. The potentiometer is located between the two fiber-optic connectors as shown in figure K3.1. Remove the snap-in button to access and adjust the potentiometer.

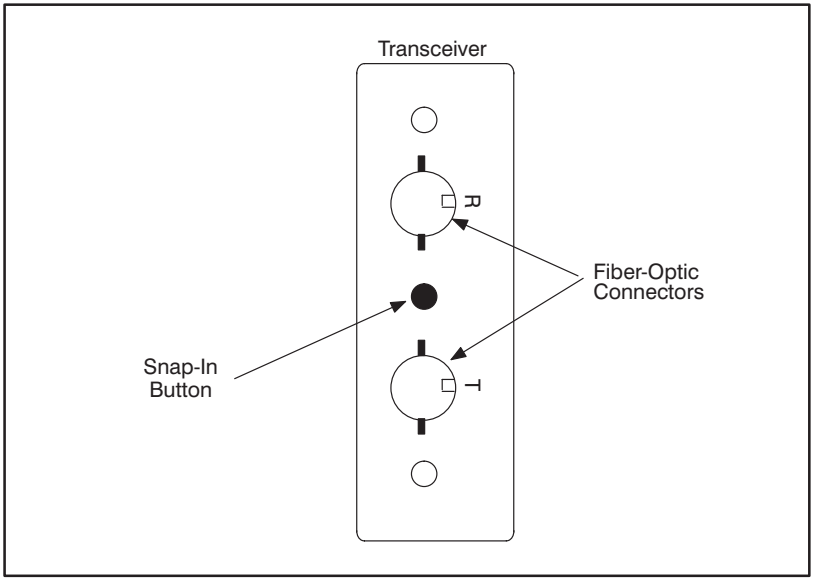

Figure K3.1 - Potentiometer Location