TereScope 1

Fast Ethernet Photonic Air Link

Installation Guide

Standards Compliance

This equipment is designed to comply with UL 1950; CSA 22.2 No 950; FCC Part 15 Class B; CE-89/336/EEC, 73/23/EEC, IP-66.

FCC Notice

WARNING: This equipment has been designed to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct for the interference at his own expense.

The user is cautioned that changes and modifications made to the equipment without approval of the manufacturer could void the user's authority to operate this equipment.

It is suggested that the user use only shielded and grounded cables when appropriate to ensure compliance with FCC Rules.

CE Mark

The CE mark symbolizes compliance with the EMC directive of the European Community. Such marking is indicative that the specified equipment meets or exceeds the following technical standards:

- EN 55022 – Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment
- EN 50081-1 – Electromagnetic compatibility of Radio Interference Characteristics of Information Technology Equipment – Generic Emission standard Part 1: Residential commercial and light industry environment
- EN 50082-1 – Electromagnetic compatibility – Generic immunity standard Part 1: Residential, commercial and light industry environment
- EN61000-4-2 (previously IEC 1000-4-2) – Electromagnetic compatibility for industrial-process measurement and control equipment – Part 4, Section 2: Electrostatic discharge requirements
- EN61000-4-3 (previously IEC 1000-4-3) – Electromagnetic compatibility for industrial-process measurement and control equipment – Part 4, Section 3: Radiated electromagnetic field requirements
- EN61000-4-4 (previously IEC 1000-4-4) – Electromagnetic compatibility for industrial-process measurement and control equipment – Part 4, Section 4: Electrical fast transient/burst requirements
- EN61000-4-5 – Electromagnetic compatibility for industrial-process measurement and control equipment – Part 4, Section 5: Surge Immunity requirements
- EN61000-4-6 – Electromagnetic compatibility for industrial-process measurement and control equipment – Part 4, Section 6: Immunity to conducted disturbances induced by radio frequency fields
- EN61000-4-8 – Electromagnetic compatibility for industrial-process measurement and control equipment – Part 4, Section 8: Power frequency magnetic field immunity requirements
- EN61000-4-11 – Electromagnetic compatibility for industrial-process measurement and control equipment – Part 4, Section 11: Voltage dips short interruptions and voltage variations immunity requirements
- EN61000-3-2 – Harmonic standard
- EN61000-3-3 – Voltage Fluctuation and Flicker standard
- CISPR 22 – Radiated and Line-conducted Class B
- EN 60950 – ITE Safety

A 'Declaration of Conformity', in accordance with the above standards, has been made and is on file at *MRV* ®.

MRV® Laser Safety Certification

The TereScope 1 is designed, built, and tested to be eyesafe, even if the output beams are viewed directly, provided that no magnifying optics are used.

This product is Class 1 according to the American National Standard for Safe Use of Lasers ANSI Z136.1-1993 provided that there is no reasonable probability of accidental viewing with optics in the direct path of the beam where the TereScope 1 is installed.

This product is Class 1M according to the International Standard of the International Electrotechnical Commision IEC 60825-1, Amendment 2, January 2001 entitled “Safety of laser products.” The following explanatory label is applicable to these products:

LASER RADIATION
DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS
(BINOCULARS OR TELESCOPES)
CLASS 1M LASER PRODUCT

This product complies with United States FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50 as published in June, 2001, which allows for the use of the IEC 60825-1 classification standard. Under this standard, these products are Class 1M.

A ‘Declaration of Conformity’, in accordance with the above standards, has been made and is on file at *MRV*.

Disclaimer

MRV® reserves the right to make changes to any technical specifications in order to improve reliability, function or design.

MRV reserves the right to modify the equipment at any time and in any way it sees fit in order to improve it.

MRV provides this document without any warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability or fitness for a particular purpose.

The user is advised to exercise due discretion in the use of the contents of this document since the user bears sole responsibility.

Trademarks

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Contact Information

For customer support, you can:

- Contact your local MRV representative
- E-mail us at InternationalSupport@mrv.com
- Visit our MRV Web site at http://www.mrv.com

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About this Guide

Purpose

This guide is intended for the user who wishes to install the TereScope 1 Photonic Air Link.

Audience

Qualifications

Users of this guide are expected to have working knowledge of:

- Fiberoptic Cabling
- LAN equipment (OSI Layer 2)

Training

Installers are required to do a training course on *MRV* TereScopes that includes:

- FSO links (site survey, installation equipment, alignment, etc.)
- Indoors and outdoors installation
- On-the-job-training
- Proficiency tests

Experience

Installers are required to have experience in LAN and FSO equipment installation.

Authorization

When all the requirements specified above (namely, Qualifications, Training, and Experience) have been met, the installer is required to receive authorization from *MRV* certifying eligibility to install the TereScope 1.

Latest Revision

The latest revision of the installation guide can be found at:

ftp.international.mrv.com/support/tech_data

Related Documents

- Release Notes for TereScope 1 – produced if required. (This document contains information not found in the Installation Guide and/or overriding information.)
- TereScope Installation Guide (Publication No. 46366)
- TereScope 1 Photonic Air Link User Manual (Publication No. 46508)
- OptiSwitch User Manual (Publication No. 46215)
- MegaVision NMS User Manual (Publication No. 46654)

Acronyms

CATV	Cable Antenna TeleVision
CLI	Command Line Interpreter
FSO	Free-Space Optics
GPS	Global Positioning System
MTBF	Mean Time Between Failures
NA	Numerical Aperture
OSI	Open Systems Interconnection
PVC	PolyVinyl Chloride
RSSI	Receiver Signal Strength Indication
STP	Shielded Twisted-Pair
TELNET	(dial-up) TELephone NETwork (connection protocol)
UTP	Unshielded Twisted-Pair

Safety Requirements

⚠	**Caution!** To reduce risk of electrical shock and fire and to maintain proper operation, ensure that the safety requirements stated hereunder are met!

When Installing

- Ensure, by visual inspection, that no part of the TereScope 1 is damaged.
- Avoid prolonged eye contact with the laser beam.
- Ensure that the system is installed in accordance with ANSI Z136.1 control measures (engineering, administrative, and procedural controls).
- Ensure that the system is installed in accordance with applicable building and installation codes.
- Install the TereScope 1 in a restricted location since it is a Class 1M FSOCS transmitter and receiver. A restricted location is a location where access to the transmission equipment and exposed beam is restricted and not accessible to the general public or casual passerby. Examples of restricted locations are: sides of buildings at sufficient heights, restricted rooftops, and telephone poles. This definition of a restricted location is in accordance with the proposed IEC 60825-I Part 12 requirements.
- Avoid using controls, adjustments, or procedures other than those specified herein as they may result in hazardous radiation exposure.

During Operation

Avoid prolonged eye contact with the laser beam.

Chapter 1

Overview

Front View

Figure 1 and *Figure 2* describe the TereScope 1 transceiver layout pertaining to installation.

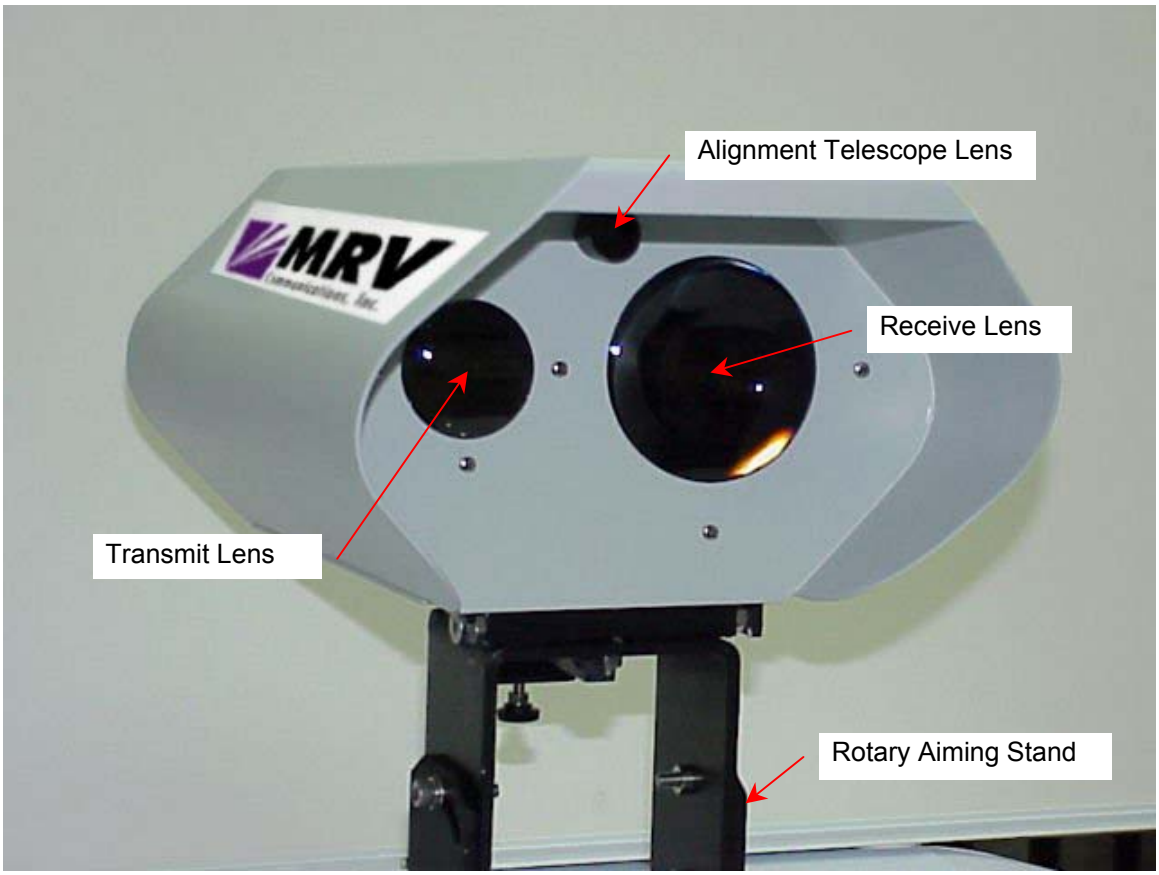


Figure 1: Front View of TereScope 1 Transceiver

Rear View

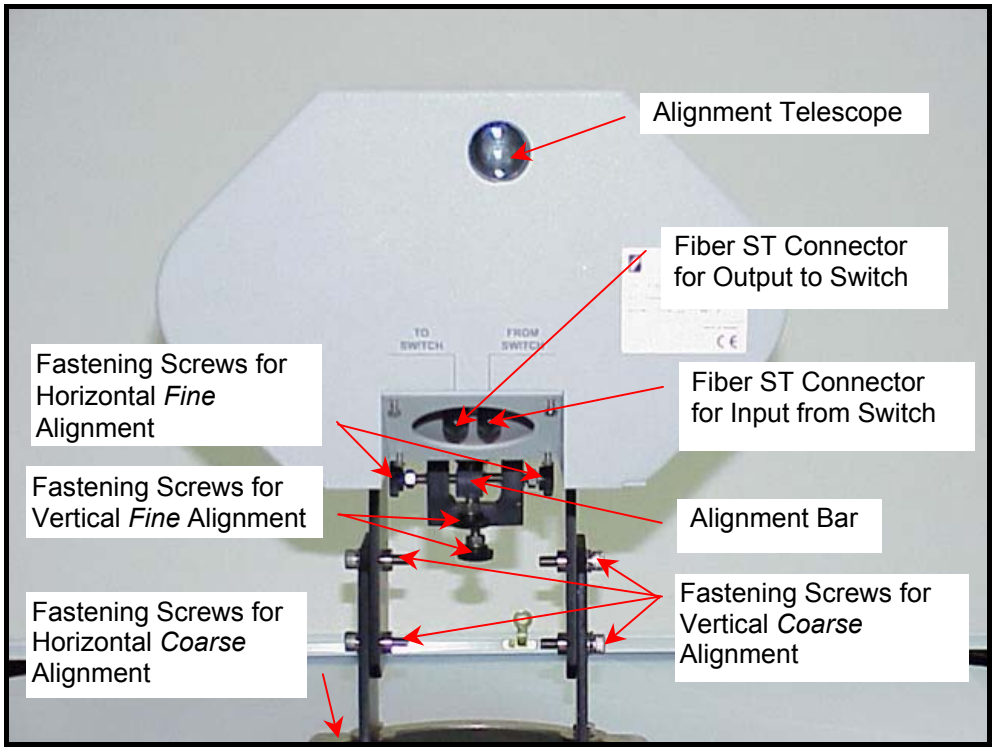


Figure 2: Rear View of TereScope 1 Transceiver

Chapter 2

Preparation

Pre-Installation

Ensure that the requirements in the chapter “Pre-Installation” in the *TereScope 1 Photonic Air Link User Manual (Publication No. 46508)* have been met.

Tools

Mounting Tools

Table 1: Tools for Mounting

Part Number	Description	Qty
	Concrete Drill	1
	3/8-inch concrete drill bit	1
	Hammer (200 g to 500 g)	1
	Ratchet	1
	Ratchet extension	1
	Ratchet bit	1
	Concrete bolts (not shown!)	6

TereScope 1 Tools

Table 2: Tools for TereScope 1

Part Number	Description	Qty
	Philips screwdriver	1
	Cutter	1
	Exactor knife	1
	8 mm open-end wrench	1
	10 mm open-end wrench	1
	13 mm open-end wrench	1
	5 mm Allen hex wrench	1

Alignment Tools

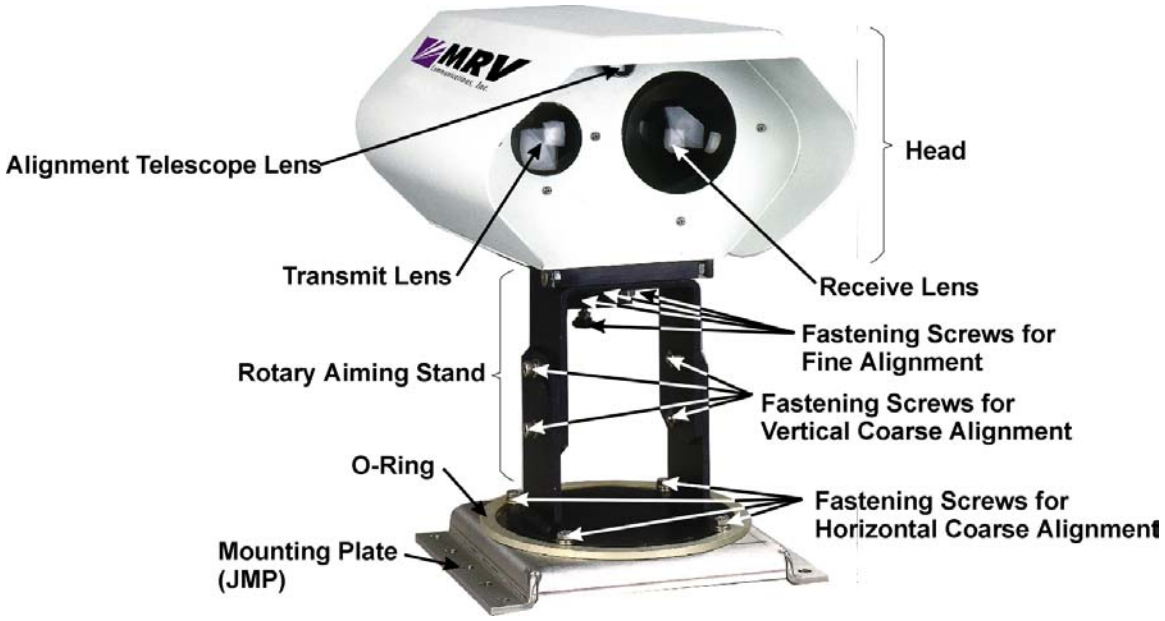
Table 3: Tools for Alignment

Part Number	Description	Qty
	MultiMode Power Meter (850 nm wavelength)	1 (or 2 for faster alignment with 2 technicians)
	Patch Fiberoptic Cable: 400/430 μm with ST connector for TereScope Model A 600/630 μm with ST connector for TereScope Model C	1 (or 2 for faster alignment with 2 technicians)

Equipment

TereScope 1 Transceivers

Table 4: TereScope 1 Transceiver and Parts



Part Number	Description	Qty
Model A: TS1/A/DST Model C: TS1/C/DST	TereScope 1 transceiver (Head, Rotary aiming stand, Alignment screws, and O-ring)	2 per link
JMP	Mounting Plate (JMP)	1 per TereScope 1 transceiver
	8 mm Bolts	Four per Mounting Plate

Mounting Accessories

Any one of the following mounting accessories may be required for mounting the TereScope 1 transceiver.

Table 5: Mounting Accessories for the TereScope 1 Transceiver

1) Parapet/Ledge Mount (using JMP only)

2) Wall Mount (using JMP and JMB)

3) Floor Pedestal Mount
(using JMP and M015C)

4) Wall Pedestal Mount
(using JMP and M054C)

5) Extended Wall Mount
(using JMP and M062C)

Part Number	Description	Qty
JMP	Parapet/Ledge Mount	1 per TereScope 1 transceiver
JMB	Wall Mount	2 per TereScope 1 transceiver (Option)
10 00 M015C	Floor Pedestal Mount	1 per TereScope 1 transceiver (Option)
10 00 M054C	Wall Pedestal Mount	1 per TereScope 1 transceiver (Option)
10 00 M062C	Extended Wall Mount	1 per TereScope 1 transceiver (Option)

Fiberoptic Cables

Table 6: Fiberoptic Cables for the TereScope 1

TereScope 1 Model ***A*** Fiberoptic Cable with ***black sleeve***. (TereScope 1 Model ***C*** Fiberoptic Cable has an **orange** sleeve.)

TereScope 1 Model ***A*** Fiberoptic Cable – Close-up view of the protective unshrunk portion of the black sleeve. The **Yellow** cap is not supplied.

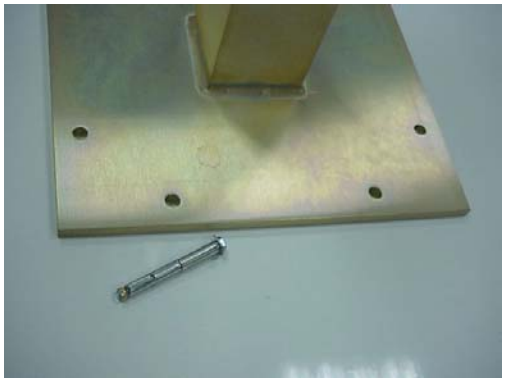
Part Number	Description	Qty
FO-25/PAL/A	**Model A** Cable *Color* Black *Length (max)* = 50 m (164 ft) *Attenuation* = 10 dB/km *Bend Radius (min. permitted)* = 210 mm (8.25 in) Transmit Fiber *Sheath Color* = **Yellow** *Core/Cladding Diameter* = 100/140 µm *Fiber Bend Radius (min. permitted)* = 60 mm (2^1/2 in) Receive Fiber *Sheath Color* = **Blue** *Core/Cladding Diameter* = 400/430 µm *Fiber Bend Radius (min. permitted)* = 60 mm (2^1/2 in)	2 per link
FO-25/PAL/B	**Model C** Cable *Color* **Orange** *Length (max)* = 50 m (164 ft) *Attenuation* = 10 dB/km *Bend Radius (min. permitted)* = 210 mm (8.25 in) Transmit Fiber *Sheath Color* = **Yellow** *Core/Cladding Diameter* = 100/140 µm *Fiber Bend Radius (min. permitted)* = 120 mm (5 in) Receive Fiber *Sheath Color* = **Blue** *Core/Cladding Diameter* = 600/630 µm *Fiber Bend Radius (min. permitted)* = 120 mm (5 in)	2 per link

Chapter 3

Procedure

Following a step-by-step procedure for installing the TereScope 1.

Step 1: Installing a Mounting Accessory



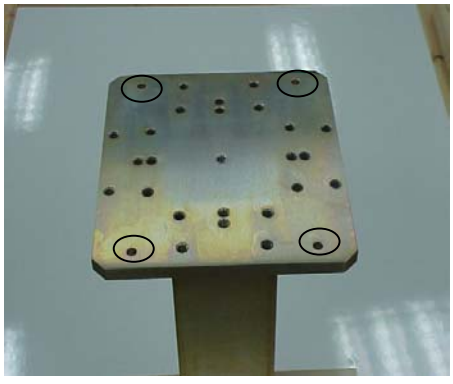
Pre-drilled Holes in the Mounting Accessory.

Inserting Concrete Bolts.

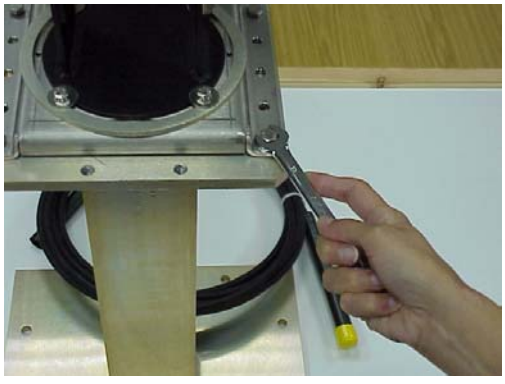
Using the mounting tools (shown in *Table 1*):

1. Drill at least 6 suitable holes through the concrete base (i.e., parapet/ledge, wall, floor, etc., whichever is applicable) on which the mounting accessory is to be installed.
2. Fasten the mounting accessory rigidly to the concrete base using at least six concrete bolts.
3. Repeat Substeps *1* and *2* for each mounting accessory.

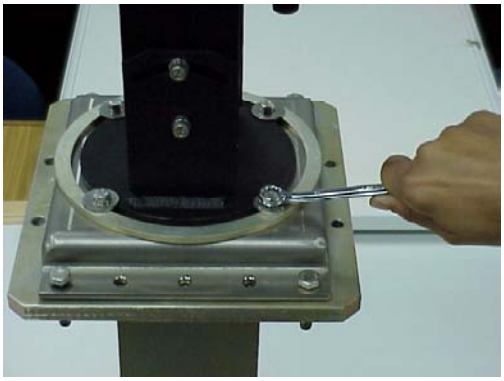
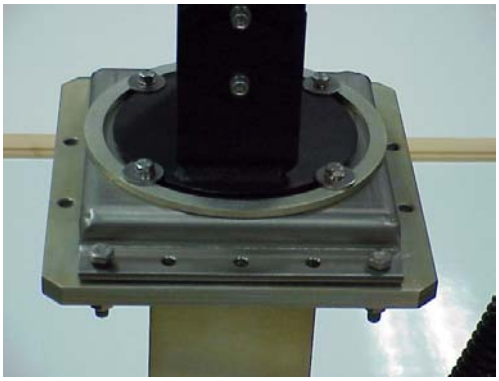
Step 2: Attaching a TereScope 1 Transceiver to a Mounting Accessory



Mounting Accessory with Holes (encircled) for attaching the Mounting Plate (JMP).



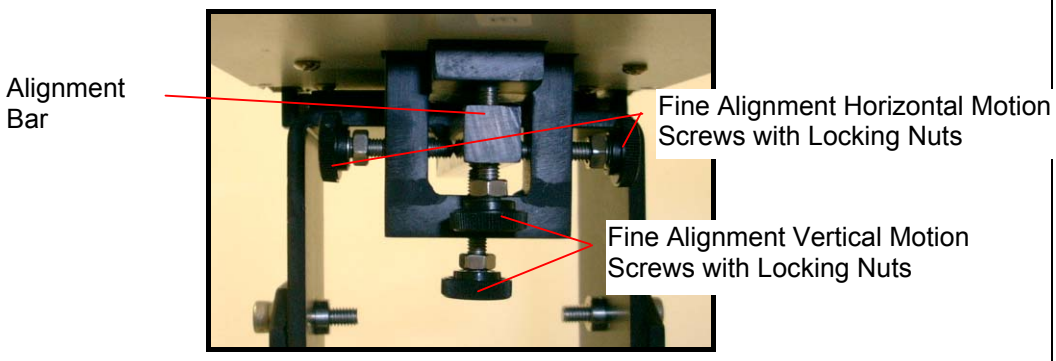
Fastening the Mounting Plate to the Mounting Accessory with the four 8 mm supplied bolts using a 13 mm open wrench (shown in Table

	2).
	
Fastening the O-Ring and Rotary Aiming Stand to the Mounting Plate.	TereScope 1 transceiver fastened to the Mounting Accessory.

1. Place the Mounting Plate (JMP) on the Mounting Accessory so that its *four* corner holes fully overlap those of the Mounting Accessory.
2. Using a 13 mm open-end wrench (shown in *Table 2*) fasten the Mounting Plate *tightly* to the Mounting Accessory with the supplied *four* 8 mm bolts.
3. Place the aluminum O-Ring (shown in *Table 4*) on top the Mounting Plate.
4. Place the Rotary Aiming Stand (shown in *Table 4*) inside the O-Ring and on the Mounting Plate, and loosely fasten them with the four supplied 10mm bolts and washers. Do not tighten the bolts yet because the TereScope 1 transceiver has to be rotated, as instructed in the next step (*Step 3: Coarse Alignment*).
5. Repeat Substeps *1* to *4* for the other TereScope 1 transceiver.

Step 3: Coarse Alignment

1. Make sure that the *four* horizontal coarse alignment fastening bolts and *four* vertical coarse alignment fastening Allen screws (shown in *Table 4*) are slightly loosened.
2. To enable maximum flexibility during the fine alignment stage, rotate the fine alignment screws until the alignment bar (shown below) is centered.

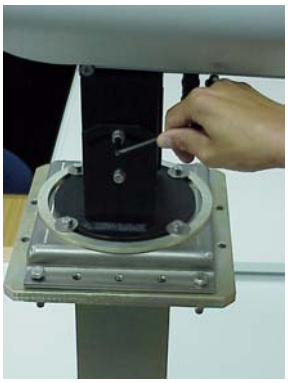


3. While looking (see note below) through the telescope, rotate and tilt the TereScope 1 transceiver to bring the telescope crosshairs on the telescope lens of the opposite TereScope 1 transceiver. (This assures that the coarse alignment is correct.)

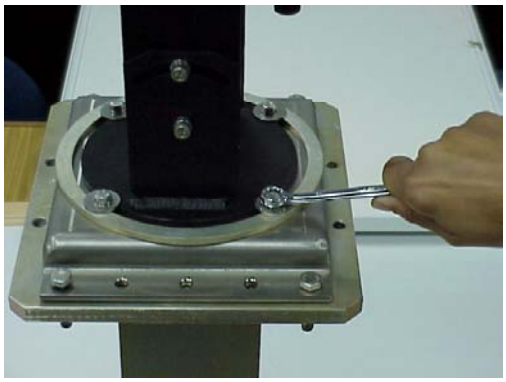
Note

The laser used in the Opto-electronic modules is Class 1M and sighting it through the telescope from 10 m (33 ft) is not harmful. Even so, exposure time should be minimized.

4. Using a 5 mm Allen hex wrench, tighten the four vertical coarse alignment screws.
5. Using a 10 mm open-end wrench (shown in *Table 2*), tighten the four horizontal coarse alignment bolts.
6. Repeat Substeps *1* to *5* for the other TereScope 1 transceiver.



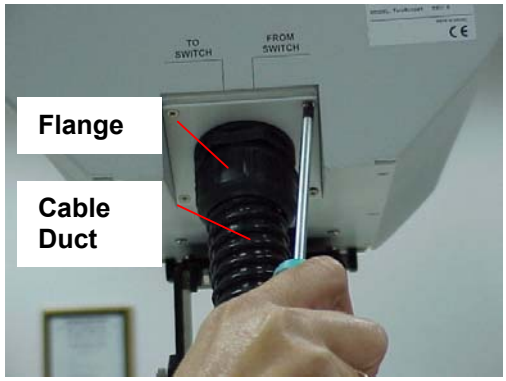
Tightening the four Allen screws after coarse vertical alignment.



Tightening the four 10 mm bolts after coarse horizontal alignment.

Step 4: Disconnecting the Flange and Attached Duct

Disconnecting the flange and cable duct



Disconnecting the flange and cable duct – close-up view

Using a Philips screwdriver (shown in *Table 2*), loosen the *four* screws in order to disconnect the flange and attached cable duct.

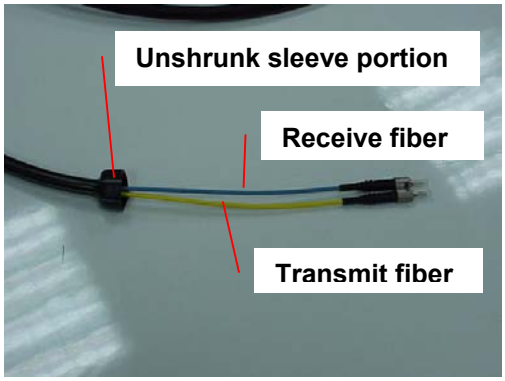
Step 5: Laying the Fiberoptic Cable

Cutting off the plastic bands of the fiberoptic cable.

1. Cut off the plastic bands before installing the cable on the roof and building.
2. It is strongly recommended to run the fiberoptic cable on roofs and in buildings in cable canals (made of PVC) and not to pull them through ducts because of the risk of applying too much damaging frictional stress.
3. For each bend of the cable at a corner, use a short piece of flexible plastic tubular duct (the same type supplied with the TereScope 1 and shown in *Step 4: Disconnecting the Flange and Attached Duct*). The duct serves a double purpose. It ensures that no damaging stress will be applied to the cable, and that the cable will be accessible for troubleshooting if needed.
4. Make sure that one end of the fiberoptic cable reaches the TereScope 1 transceiver and the other end reaches the switch or media converter to which it is to be connected.

Step 6: Exposing the Fiberoptic Cable Connectors

Cutting off the unshrunk sleeve.



Exposed cable fibers and connectors.

Each end of each cable is fitted with two ST type optical connectors and protected with a heat shrink sleeve. After the fiberoptic cable has been laid. While ensuring that no damage can be caused to the fibers of the cable, ***very carefully*** cut off the unshrunk part of the heat shrink sleeve with scissors or an exactor knife to expose the cable fibers and connectors.

Step 7: Slipping the Cable through the Duct and Flange

Slipping the fiberoptic cable through the duct and flange.

1. After cutting off the unshrunk piece of the sleeve on the fiberoptic cable end, hold the cable in one hand and the duct in the other.
2. Pointing the duct and cable down, gently slip the cable through the duct until the connectors and fibers appear through the flange. The cable will stop slipping when the unshrunk sleeve portion (shown in *Step 6: Exposing the Fiberoptic Cable Connectors*) reaches the flange.

Step 8: Fine Alignment

1. At one TereScope 1 transceiver (Site A), do one of the following:
   a. Connect one end of the yellow-sheathed transmit fiber to the **TX** port of an OptiSwitch EM2003-2PAL module or MC102/P media converter. Connect the other end of the fiber to the TereScope 1 transceiver's **FROM SWITCH** connector.
   b. Connect a temporary light source with a 100/140 μm patch cable to the TereScope 1 transceiver's **FROM SWITCH** connector.

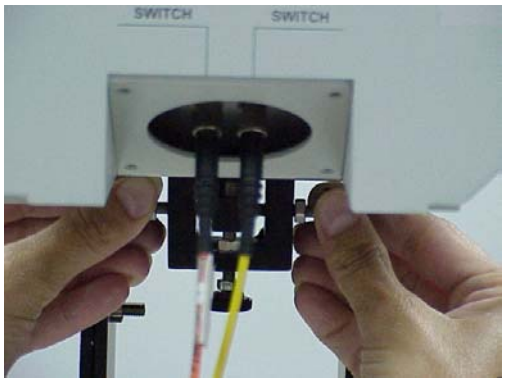
	**Note** When using the light source option, it is necessary to know its power output level so that the receive power at the other end of the link can be calculated. The laser transmit output power of the EM2003-2PAL module (in the OptiSwitch) and of the MC102/P media converter is +4 dBm for Model A and +7 dBm for Model C. Using *Table 7*, make sure that the attenuation of the link (extends between the fartherest ends of the two TereScope 1 fiberoptic cables) is smaller than the difference between the output power at one end and the receiver sensitivity at the other end.

Connecting one end of the Transmit fiber to the **TX** port.

Connecting the other end of the Transmit fiber to the **FROM SWITCH** port on the TereScope 1 transceiver.

2. At the other TereScope 1 transceiver (Site B), use the fiberoptic patch cable (described in *Table 3*) to interconnect the optical power meter and the TereScope 1 transceiver **TO SWITCH** connector.

3. Make sure that the power meter is set for 850 nm wavelength and gives the power readings in dBm.
4. At Site A, turn the horizontal motion screws until the installer at Site B reports maximum received power.



(This assures that the beam spot is positioned symmetrically in the left-right direction about the TereScope1 receiver located behind the telescope lens, as shown in *Figure 3*.)
Tighten the nuts lightly – do *not* tighten!

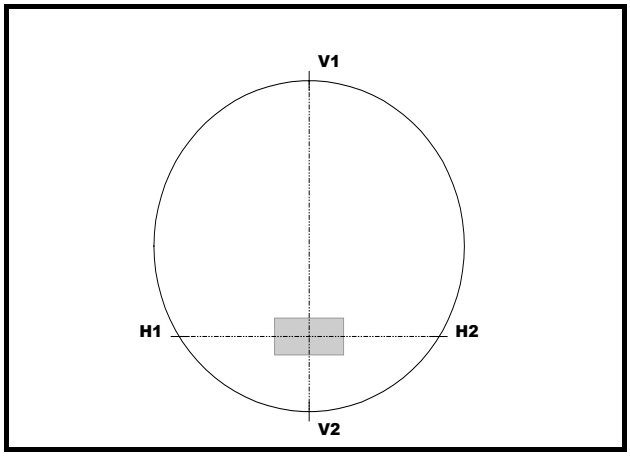
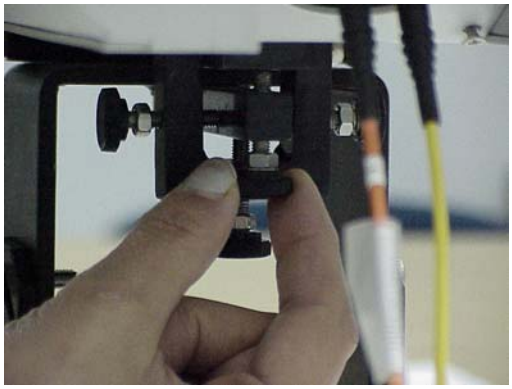


Figure 3: Beam (circle) *on* Receiver (rectangle) after Horizontal Alignment

5. At Site A, turn the vertical motion screws until the installer at Site B reports maximum received power.



(This assures that the beam spot is now positioned at the center of the TereScope1 receiver located behind the telescope lens, as shown in *Figure 4*.)

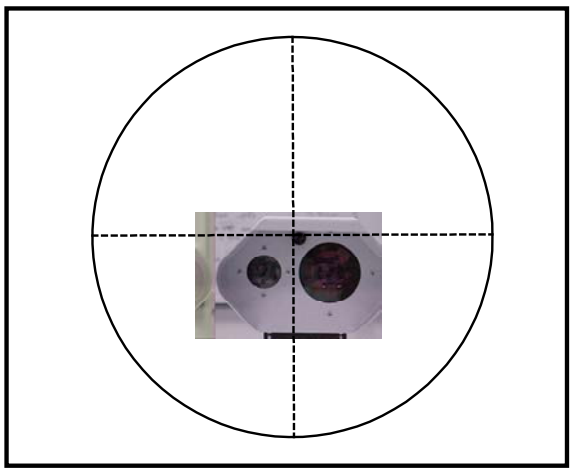


Figure 4: Final Beam *Position* after Horizontal and Vertical Alignment

The received power should be *about* the same as the expected power given in *Table 7*, which shows expected power for various distances. Record the maximum received power in dBm.

	Note This power reading is the sum of both signal and background light. On a sunny day or for long air links, the background light may add significantly to the true signal power. The problem is resolved in Substeps *8* and *9*.

	Note If the power meter has a 62.5/125 µm fiber ferule, the optical readings on the receive side will be less than expected. This is due to loss of light. Light is lost because the core/cladding diameters of the fiberoptic cables, which are 400/430 µm or 600/630 µm, are different from the ferule's. In such case, look for the relative max optical power at the receiver on both side.

Table 7: Air Link Distance vs Minimum Required Received Signal Power

Air Link Distance (m)	Received Power for Model A		Received Power for Model C	
	μW	***dBm***	***μW***	***dBm***
10	270	-5.7		
50	*32*	*-15*	*330*	*-4.8*
100	*8*	*-21*	*84*	*-10.8*
150	*3.6*	*-24.5*	*37*	*-14.3*
200	*2*	*-27*	*21*	*-16.8*
240	*1.4*	*-28.5*	*15*	*-18.4*
300			*9.3*	*-20.3*
350			*6.8*	*-21.7*
400			*5.2*	*-22.8*
470			*3.8*	*-24.2*

6. Repeat the horizontal and then the vertical alignment to ensure maximum reading.

7. Without moving the fine alignment screws, tighten their nuts to lock the position.

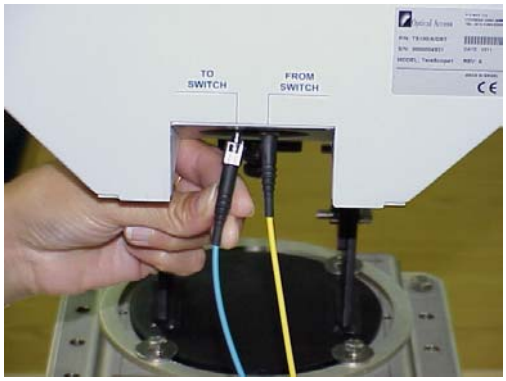
8. Disconnect or turn off the light source, then measure and record the background light power in dBm.

9. Subtract the background reading from the recorded maximum received power in Substep *5* to get the signal power. This signal power should be *close* to the expected power given in .

10. Repeat Substeps *1* to *9* for the opposite direction to complete the Fine Alignment.

Step 9: Connecting up the TereScope 1 Link

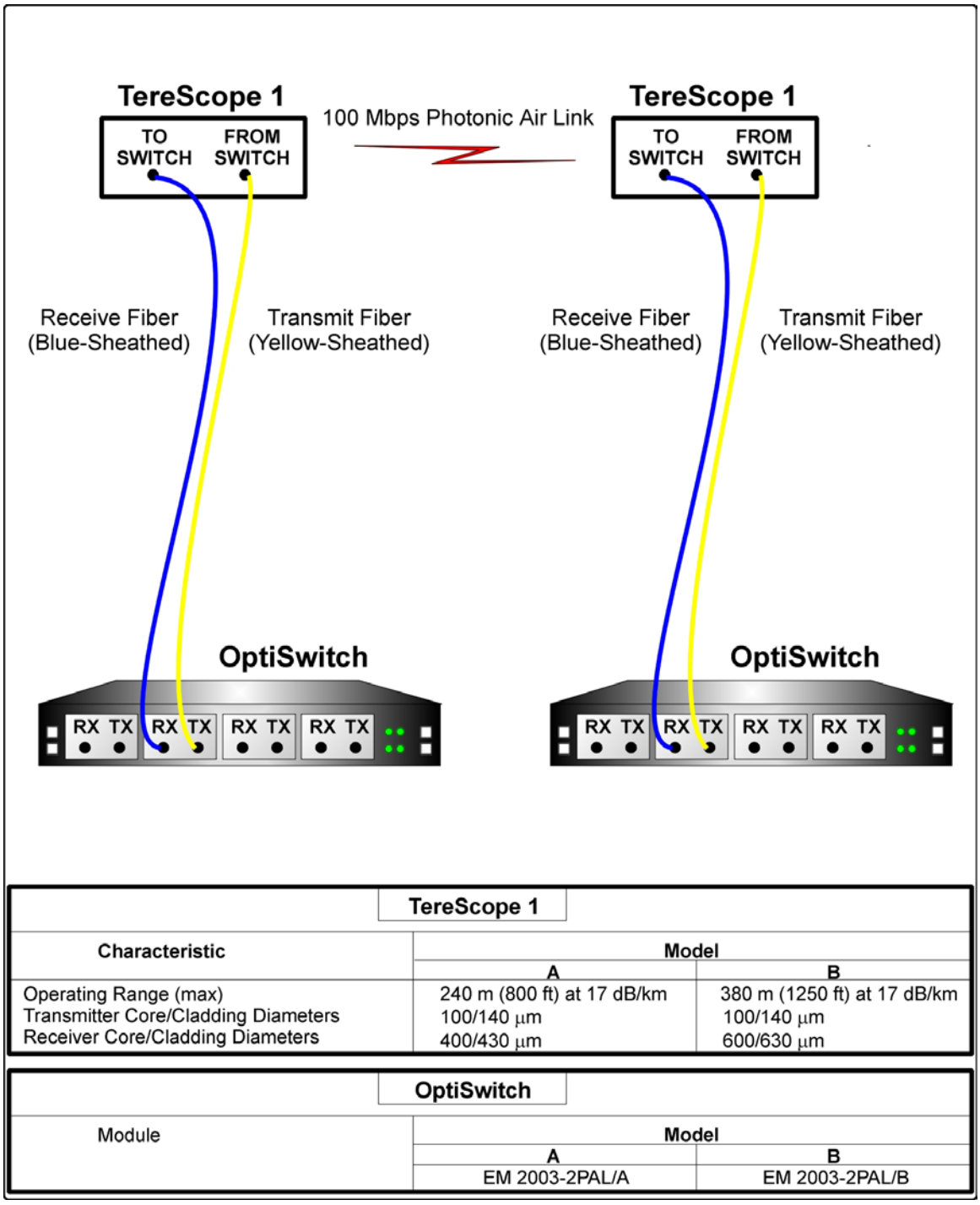
1. Disconnect the Power Meter and Temporary Light Source together with their patch cables from the two TereScope 1 transceivers.



2. Make sure that the transmit cable (yellow) is connected to the TereScope 1 transceiver **FROM SWITCH** connector.
3. Make sure that the receive cable (blue) is connected to the TereScope 1 transceiver **TO SWITCH** connector.
4. Refasten the flange and duct to the TereScope 1 transceiver with the four screws.

5. Make sure that the transmit cable (yellow) is connected to the MC102/P media converter or the EM2003-2PAL module (in the OptiSwitch) **TX** connector.
6. Make sure that the receive cable (blue) is connected to the MC102/P media converter or the EM2003-2PAL module (in the OptiSwitch) **RX** connector.

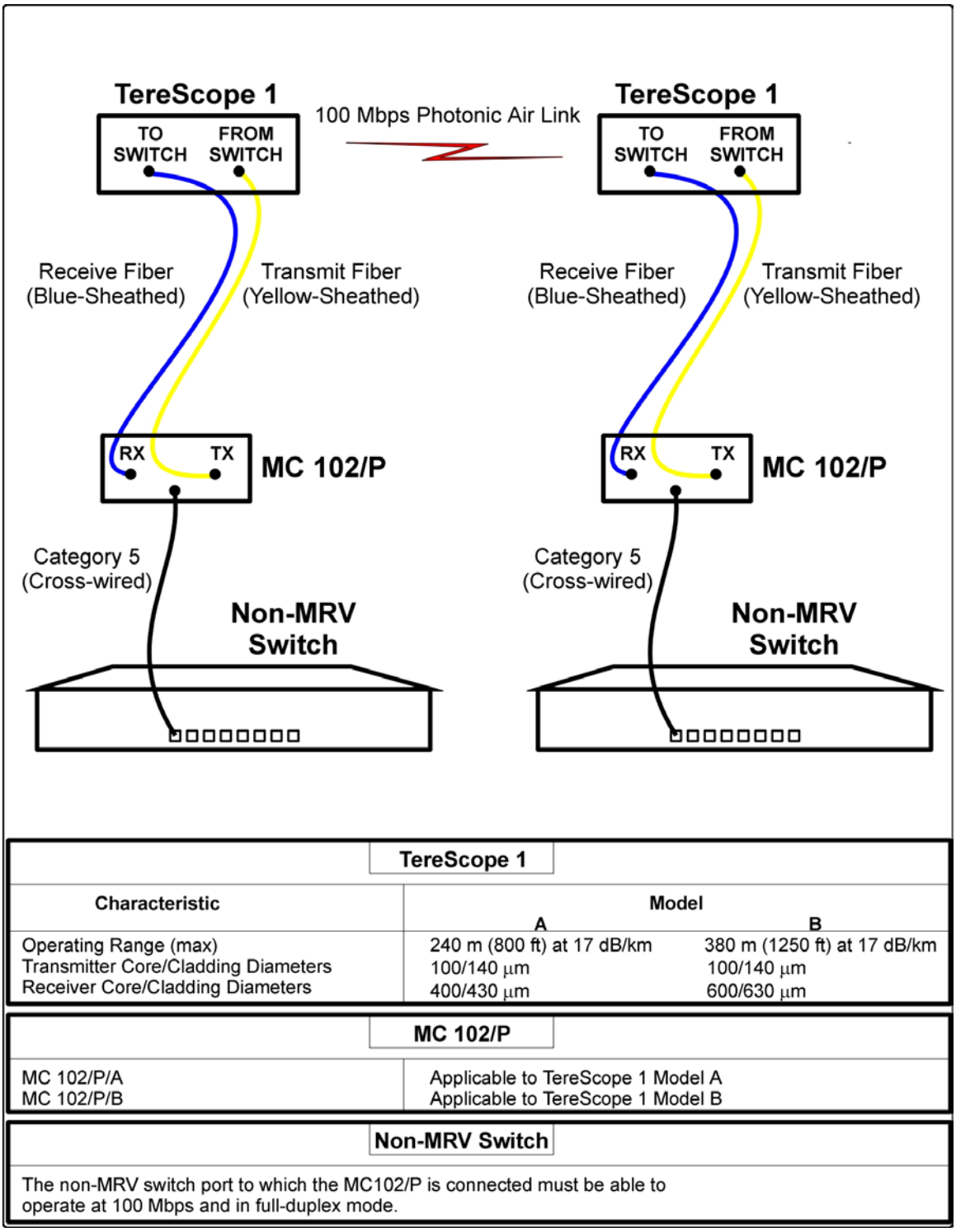
At this stage, the link is fully installed and schematically should look like *Figure 5* or *Figure 6*.



TereScope 1		
Characteristic	**Model**	
	A	**B**
Operating Range (max)	240 m (800 ft) at 17 dB/km	380 m (1250 ft) at 17 dB/km
Transmitter Core/Cladding Diameters	100/140 µm	100/140 µm
Receiver Core/Cladding Diameters	400/430 µm	600/630 µm

OptiSwitch		
Module	**Model**	
	A	**B**
	EM 2003-2PAL/A	EM 2003-2PAL/B

Figure 5: Interconnection of TereScope 1s and OptiSwitches



TereScope 1		
Characteristic	**Model**	
	A	**B**
Operating Range (max)	240 m (800 ft) at 17 dB/km	380 m (1250 ft) at 17 dB/km
Transmitter Core/Cladding Diameters	100/140 μm	100/140 μm
Receiver Core/Cladding Diameters	400/430 μm	600/630 μm

MC 102/P	
MC 102/P/A	Applicable to TereScope 1 Model A
MC 102/P/B	Applicable to TereScope 1 Model B

Non-MRV Switch
The non-MRV switch port to which the MC102/P is connected must be able to operate at 100 Mbps and in full-duplex mode.

Figure 6: Interconnection of TereScope 1s, Media Converters, & Non-MRV Switches

Step 10: Performing Link Connectivity Test

Perform the PING test with a PC connected to the switch in order to check if the link connectivity is OK.

On passing the ping test, the link is ready for operation.

Appendix A

Troubleshooting

General

Since the TereScope 1 transceiver is a passive device, it is *not* affected by EMI, RFI, power cuts, etc. Only violent physical disturbances or faulty optical power input from the connecting switch or media converter may cause the link to malfunction.

This means that if there is a problem, it is most likely in the peripheral equipment to which the link is connected, i.e., in the switch or media converter and outwards.

Troubleshooting a link connected to a switch requires working knowledge of the switch. This appendix describes the troubleshooting procedure for the link connected to MRV's MC102/P media converter.

Procedure

Follow the steps in the order given until the problem is resolved. If the problem persists, consult your *MRV* representative.

Table 8: Troubleshooting the TereScope 1 Link Connected to MC102/Ps

No.	Problem	Probable Cause	Corrective Action
1	All LEDs are OFF	Power failure.	1. Check that the power cord. 2. Check the power at the wall outlet.
2	Link LED **P1 L** of *local* MC102/P is OFF.	Connections at the RJ45 connectors of the *local* MC102/P are faulty.	1. Ensure that the RJ45 connector of the *local* MC102/P is connected. 2. Ensure that the RJ45 connector of the *remote* MC102/P is connected. 3. Ensure that the Category 5 cables at both MC102/Ps are correctly wired (straight or cross-wired, as appropriate).
3	Link LED **P2 L** of *local* MC102/P is OFF.	*Remote* MC102/P is not transmitting or TereScope 1 transceivers are not aligned.	1. Ensure that the fiber connected to the **Rx** connector of the local MC102/P is neither disconnected nor broken. 2. Ensure that the fiber connected to the **Tx** connector of the *remote* MC102/P is neither disconnected nor broken. 3. With the aid of an optical power meter (850 nm wavelength), check all cable ends for the correct optical power levels. If the power levels are not correct, ensure that the TereScope 1

No.	Problem	Probable Cause	Corrective Action
			transceivers are properly aligned.
4	Activity LED **P1 A** or **P2 A** of the *local* MC102/P is OFF.	Network host is not communicating.	Test connectivity across the link (using, for e.g., the PING utility) to determine whether the LEDs are functioning properly.
5	Line Integrity Signal LED **LIN** of *local* MC102/P is ON.	Light from *remote* MC102/P is not being received.	1. Ensure that the fiber connected to the **Tx** connector of the *remote* MC102/P is: a. Not disconnected b. Not broken c. Has light in it. 2. Ensure that the fiber connected to the **Rx** connector of the *local* MC102/P is: a. Not disconnected b. Not broken c. Has light emerging from it.
6	Line Integrity Signal LED **LIN** of *local* MC102/P and *remote* MC102/P is ON.	Link laser beam obstructed.	1. Ensure that the light at the **Tx** connector of the *local* MC102/P and *remote* MC102/P are ON. 2. Ensure that both fibers of the fiberoptic cable are connected to the **Rx** connector of the *local* MC102/P and *remote* MC102/P. 3. Ensure that no physical obstacle (object or heavy fog) is blocking the laser beam between the two TereScope 1 transceivers.
7	Link traffic throughput too low.	The configuration of one or more devices is not correct.	1. Ensure that all network devices connected to the link are set to either 100 Mbps full-duplex or auto-negotiation mode. 2. At both MC102/Ps, ensure that both toggles of the DIP switch are set to the **100FULL** (full-duplex) or **AUTO** (auto-negotiation) position. 3. Remove the two non-MRV switches and two media converters. Connect the two ends of the TereScope 1 link to two OptiSwitches, at EM2003-2PAL module ports. Connect two PCs to the OptiSwitches, at EM2003-4TP (or EM2003-8TP) module ports. Set the port speed to 100 full duplex and transfer a file noting whether the transfer time is reasonable.

Link Diagnostics Form

MRV Communications, Inc.				**TereScope 1®** **Link Diagnostics Form**			
City				Date	__/___/ **03**		
Company Name				PAL	A		B
General Information		**Data**		***Host Network Equipment***			
Link Distance				***Network Device***	***Model & Type***		
Link Elevation angle		_____°		Switch			
Link east – west orientation		E_____ ° W_____ °		Router			
Cables Information	√	***Cable Length***		E1 Equipment			
PAL/A cable				10/100BaseT HUB			
PAL/B cable				BER Tester			
Pictures				Other			
Supply current status pictures of the link for both units.				***Customer Switch / Router Setup***			
Software Type				Port Configuration			
Ethernet				Physical link existence			
Warehouse Storage							
Media Converter Setting				***OptiSwitch Setup***			
Dipswitch Status		***Dipswitch Status***		***LED's Status***		***LED's Status***	
Side A	**ON OFF**	**Side B**	**ON OFF**	**Side A**	**ON OFF**	**Side B**	**ON OFF**
Optical level	[dBm]	Optical level	[dBm]	Optical level	[dBm]	Optical level	[dBm]
Dipswitch 100Full		Dipswitch 100Full		L1		L1	
Dipswitch Auto		Dipswitch Auto		A1		A1	
LED's Status	**ON OFF**	***LED's Status***	**ON OFF**	L2		L2	
P1 L		P1 L		A2		A2	
P1 A		P1 A		Port Config'		Port Config'	
P2 L		P2 L		get-pal-port-optical-power		get-pal-port-optical-power	
P2 A		P2 A					
LIN		LIN					
CAT 5	Cross	CAT 5	Cross				
CAT 5	Direct	CAT 5	Direct				
PC NIC setup		PC NIC setup					

Problem description:_____

Please add the following:

1. End-to-end drawing of the link network, including all network accessories.
2. Switch/Router port setup configuration of each link end.
3. BER test configuration (if used).