Telesto Fiber Optic Modem Manual

Revision History

Filenames are:

G:\Company\Manuals&graphics\Manuals\ReferenceManual\Components\Telesto_modem\FiberOptic\1.0\TelestoFO_Title.lwp

G:\Company\Manuals&graphics\Manuals\ReferenceManual\Components\Telesto_modem\FiberOptic\1.0\TelestoFO_Rev1.0.lwp

Rev	Date	Author	Description
1.0	November 7, 2001	J. Hills	Initial release.

Approval: _____

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1 Introduction

The Telesto Repeater with Fiber Optic Modem (Telesto FO) is a splice enclosure and electro-optical converter for use in Nanometrics Callisto networks, where data will be transmitted between the remote and central sites over fiber optic cable.

Please read carefully the appropriate sections of this manual before storing, installing, operating, or servicing the Telesto FO. If you need technical support, please submit your request by e-mail or fax. Please include a full explanation of the problem and supporting data, to help us direct your request to the most knowledgeable person for reply.

E-mail: support@nanometrics.ca
FAX: To: Support
(613) 592-5929
Telephone: Please ask for Support, at (613) 592-6776

Nanometrics Inc.
250 Herzberg Road
Kanata, Ontario, Canada
K2K 2A1

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2 Organization of this manual

This manual includes both reference and procedural information. Reference information is contained mainly in Chapter 4, "Technical description", and in the appendixes. Procedural information is contained mainly in Chapter 5, "User guide", and Chapter 6, "Servicing".

Please read carefully the sections "Handling and storage precautions", "Preparing to install Telesto FO", and "Preparing to service Telesto FO", before installing, using, or servicing the Telesto FO.

The information in this manual is divided into these chapters:

Chapter	Contents
1. Introduction	Introduction, and support contact information
2. Organization of this manual	An overview of the manual contents
3. Unpacking and post-delivery inspection	Important information on inspecting the shipment and handling the equipment
4. Technical description	An overview of Telesto FO features and specifications
5. User guide	Procedures for installing and maintaining Telesto FO
6. Servicing	Information and procedures for troubleshooting and repairing Telesto FO
Appendix A	Connector pinouts
Appendix B	Specifications
Appendix C	Outline and installation drawing

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3 Unpacking and post-delivery inspection

This chapter provides information on how to check the completeness of the shipment and the condition of the shipped items, instructions on what to do if there are any problems with the shipment, and lists some precautions for handling and storage of Telesto FO. The information in this manual is supplemental and should be used in conjunction with system warranty information.

Unpacking the shipment

Inspect the shipment packaging to ensure the equipment has not been exposed to excessive moisture. Open the shipment and check the contents against the Equipment verification sheet, to ensure that the correct number of Telesto FO units, power cables, data cables, and a toolkit have been included.

There is no as-shipped sheet for the Telesto FO. In addition to the items listed on the Equipment verification sheet, each unit is shipped with these items contained inside the Telesto FO enclosure:

- Fiber optic splice kit
- Cable entry bushings
- Six pigtails with ST-compatible connectors

Inspect each item in the shipment to ensure that none of the items have been damaged in transit. If there are any problems with the shipment, please contact Nanometrics Support.

Handling and storage precautions

Telesto FO should not be stored or operated in an environment with a temperature below -10 degrees Celsius or above 45 degrees Celsius. When disassembling the unit, use anti-static protection for the RS-232 interface PCB if it is to be disconnected from the modem/PCB tray assembly. Please refer to Appendix B for detailed specifications.

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4 Technical description

This chapter provides a brief overview of the Telesto FO, including its function in a terrestrial data network, and the function of the two main modules.

Operational description

The Telesto with fiber optic modem (Telesto FO) is the interface for data transmission in Nanometrics terrestrial networks (Callisto networks) where communication between the remote and central sites is over fiber optic cable. Telesto FO can be used to multiplex seismic data from up to eight remote Europa digitisers.

The internal FO modem provides an RS-232 connection for data communications with the remote site equipment, and a fiber optic connection between the remote and central sites. The RS-232 interface PCB provides protected connections for power and serial data between the remote site equipment and the FO modem. Telesto FO is also the splice and cable enclosure, to provide mechanical protection for the connections.

Nanometrics Callisto networks use terrestrial telemetry methods—RF, private wire, or fiber optic—to transfer data between remote and central sites. The basic functional blocks are the same for all Callisto networks, but the components within these functional blocks can be configured to meet various data collection requirements. Callisto network functional blocks include a digitiser for the seismic data, GPS clock for time-stamping the data, and data communications between the remote and central sites.

Telesto FO can provide up to eight asynchronous data channels for communications between the remote and central sites. The digitised seismic data are received from the Europa digitiser over an RS-232 physical layer, in a serial data stream using the Nanometrics NMXP transmission protocol. The FO modem converts the data stream to a format for optical transmission. System design should accommodate an optical power budget of 15 dB.

Hardware description

The Telesto FO contains two main modules: An RS-232 interface board, and a fiber optic modem. Other internal components include two flex circuits, connecting the RS-232 interface PCB to the external data and power cable connectors; external connectors for the power and data cables; six fiber optic pigtails with multimode fiber (62.5/125 µm) and factory-installed ST-compatible connectors; a splice tray to protect the fusion splices; and ST-compatible adapters in a mounting bracket to store the spare connectors.

RS-232 interface PCB

The RS-232 interface PCB provides an RS-232 connection for the seismic and control data transmitted between the Europa digitiser and the FO modem, and supplies 12 VDC to the FO modem. The interface PCB connections provide protection on both the power and signal paths to the FO modem.

Fiber optic modem

The FO modem receives digitised seismic data and instrument data from one or more Europa digitisers for transmission to the central site, and receives network control information, for example data re-requests, for transmission to the Europas. The FO modem provides eight channels for asynchronous communications. Communication with the Europa is via an RS-232 connection. Communication with the central site is via a fiber optic cable, and assumes an optical power budget (link budget) of 15 dB. Detailed specifications for the FO modem are listed in Appendix B.

5 User guide

This chapter contains procedural information for installing, operating and maintaining Telesto FO. Please read carefully the sections on handling and storage precautions, and pre-installation requirements, before installing Telesto FO. Please refer to Chapter 6, "Servicing", for information on troubleshooting and servicing Telesto FO units that have already been installed.

Preparing to install Telesto FO

Handling and storage precautions

Telesto FO should not be stored or operated in an environment with a temperature below -10 degrees Celsius or above 45 degrees Celsius. Use anti-static protection for the RS-232 interface PCB if it is to be disconnected from the modem/PCB tray assembly. Please refer to Appendix B for detailed specifications.

Pre-installation requirements

Before Telesto FO can be connected for operation, fibers from the external cable must be spliced to pigtails for connection to the internal FO modem. The splicing and testing will need to be done at the remote site, and will require disassembly of the Telesto FO.

Equipment and materials that are included with Telesto FO:

- Fiber optic splice kit
- Cable entry bushings
- Six pigtails with ST-compatible connectors
- Adapter bracket for the unused cable connectors
- Grounding screw
- Toolkit with the appropriate drivers for assembling and disassembling Telesto FO

Recommended additional equipment and materials:

- Fiber optic cable fusion-splicing equipment
- Test equipment for loss measurements in the installed cables

Installing Telesto FO

Please ensure that you have read the previous section, "Preparing to install Telesto FO", before performing any of the procedures described in this section.

Installing Telesto FO entails three main procedures:

- Removing the splice kit
- Splicing the pigtails to the cable
- Connecting the Telesto FO

Removing the splice kit

1. Remove the Telesto FO enclosure top (a driver for the 16 cap screws is included in the toolkit).
2. Remove the screw from both the power and signal flex circuit connectors, and disconnect the flex circuits from the RS-232 interface PCB.
3. Remove the modem/PCB tray assembly (a driver for the 6 screws is included in the toolkit).
4. Remove the splice kit. Do not remove the splice tray base.

Splicing the pigtails to the cable

1. Select a cable entry bushing of the appropriate size for the fiber optic cable.
2. Detach the female part of the pressure gland. Slide the detached part of the pressure gland onto the cable, and then slide the bushing onto the cable. Ensure the orientation of both the bushing and the cable hanger is correct relative to the cable end.
3. Remove the cable armour to expose approximately 1.5 metres of fiber with buffer tube. Retain about 6 cm of the central strength member beyond the end of the cable armour.
4. Prepare the central strength member for attachment to the threaded stud in the enclosure base, as shown in Figure 1: Bend the central strength member to a 90^{o} angle where it exits the cable armour, and form a loop at the end for attachment to the threaded stud.

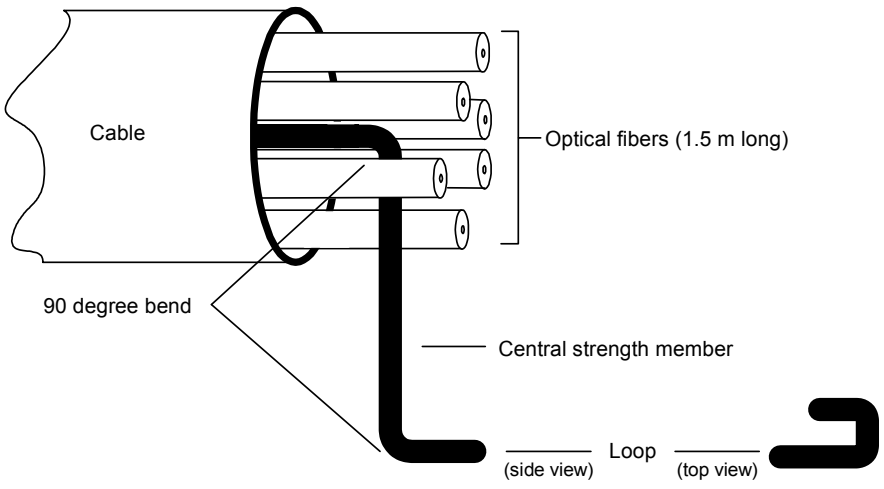

Figure 1: Central strength member prepared for attachment to threaded stud

5. Feed the central strength member end and the fibers through the fixed part of the pressure gland into the Telesto FO enclosure.
6. Secure the central strength member to the threaded stud in the base of the enclosure below the pressure gland (Figure 2), using the two lock washers and nut: Place one lock washer between the enclosure base and the strength member end loop, and the second lock washer between the end loop and the nut.

Figure 2: Location of threaded stud for securing the central strength member

7. Reassemble the pressure gland.
8. Prepare the ends of the pigtails, fibers, and the cable end as required by the cable type, for fusion splicing.
9. Fusion-splice the fibers to the pigtails and install the splice protectors.
10. Install the service loops and splices in the splice tray. Allow enough slack for the pigtails to pass above the tray assembly and connect to either the FO modem or the adapter bracket while complying with the minimum recommended bend radius.
11. Gently secure the fibers and pigtails to the splice tray with cable ties at the splice tray exits. Do not over tighten the cable ties.

Connecting the Telesto FO

1. Reinstall the modem/PCB tray assembly, and secure it with the 6 washers and screws.
2. Plug the power and data connector flex circuits into the appropriate connectors on the RS-232 interface PCB, and secure each plug with a screw.
3. Perform loss measurements on the installed cable, using OTDR test equipment.
4. Connect the power cable lug to the enclosure with the grounding screw.

5. Connect the power supply and an active Europa to the Telesto FO (power and data connector pinouts are shown in Appendix A).
6. Connect the transmit and receive pigtails to the appropriate plugs on the FO modem. Check for data flow, which is indicated by the FO modem Active LED being lit.
7. Connect the spare pigtails to the connectors in the adapter bracket for storage.
8. Reinstall the enclosure top, and secure it with the 16 cap screws.

Operating and maintaining Telesto FO

Once the Telesto FO is properly connected, it requires no scheduled maintenance. Please refer to the FO modem manual for any maintenance information for the internal FO modem.

6 Servicing

If you are planning to service a Telesto FO unit, please first check the warranty information for your system. Please read the section "Preparing to service Telesto FO" before attempting to service a unit.

Servicing Telesto FO will consist of either replacing a basic module or replacing the entire unit. Basic modules include the RS-232 interface PCB, the FO modem, and the power and data flex circuit assemblies with connectors. Repairing the fiber optic cable connections or splices will require disassembly of the Telesto FO.

Preparing to service Telesto FO

Handling and repair environment precautions

- Please refer to the specifications in Appendix B for storage and operation ratings for Telesto FO
- Use anti-static protection for the RS-232 interface PCB if the PCB is to be disconnected and removed from the modem/PCB assembly tray
- Follow cable manufacturers' recommendations for repairing fiber optic splices
- Do not attempt to desolder the flex circuit connections

Equipment and materials

- Toolkit for disassembling and reassembling Telesto FO
- Replacement parts—please contact Nanometrics support for information on replacement parts
- If required, fiber optic cable splicing equipment and materials plus OTDR test equipment

Servicing Telesto FO

To service Telesto FO, troubleshoot the problem to the Telesto FO module level (PCB, assembly, FO modem) or to the optical fiber connection level within the Telesto FO enclosure, and then replace the module or repair the optical fiber connection as required.

Replacing the modules

Replacing a module or repairing a splice will require disassembly of Telesto FO. This section describes complete disassembly and reassembly procedures. Module names are in boldface type, to indicate at what point in the disassembly procedure the module can be replaced.

To disassemble Telesto FO

1. Disconnect the external power and data cables.

2. Remove the Telesto FO enclosure top (a driver for the 16 cap screws is included in the toolkit).
3. Remove the screw from both the power and signal flex circuit connectors, and disconnect the flex circuits from the RS-232 interface PCB.
    a. At this point, the data and power connectors can be removed, to replace the data or power **flex circuit assemblies**.
4. Disconnect the pigtails from the FO modem Tx and Rx plugs, and from the four connectors on the adapter bracket.
5. Remove the **modem/PCB tray assembly** (a driver for the 6 screws is included in the toolkit).
    a. At this point, the **FO modem** is accessible.
    b. Once the FO modem has been removed, the **RS-232 PCB** is accessible.
6. Access the splice tray if the **fiber optic splices** or **pigtails** need to be repaired. Repairs to fibers and testing of the installed fiber should be done in accordance with cable manufacturer's instructions.

To reassemble Telesto FO

1. Reinstall the optical fiber and splices, if required.
2. Reinstall the RS-232 interface PCB and FO modem in the modem/PCB tray assembly, if required.
3. Reinstall the modem/PCB tray assembly, and secure it with the 6 washers and screws.
4. Reinstall the power and data connector ends of the flex circuit assemblies, if required.
5. Plug the power and data connector flex circuits into the appropriate connectors on the RS-232 interface PCB, and secure each plug with a screw.
6. Connect the power cable lug to the enclosure with the grounding screw.
7. Connect the power supply and an active Europa to the Telesto FO (power and data connector pinouts are shown in Appendix A).
8. Connect the transmit and receive pigtails to the appropriate plugs on the FO modem. Check for data flow, which is indicated by the FO modem Active LED being lit.
9. Connect the spare pigtails to the connectors in the adapter bracket for storage.
10. Reinstall the enclosure top, and secure it with the 16 cap screws.

Appendix A: Connector pinouts

Power

Pin	Signal name
A	BAT+
B	EARTH
C	BAT-

Data

Pin	Signal name
S, F	GND
H	Chassis
U	Tx1
J	Rx1
N	Rx2
R	Tx2
G	Rx3
C	Tx3
T	Rx4
K	Tx4
V	Rx5
D	Tx5
P	Rx6
E	Tx6
A	Rx7
B	Tx7
M	Rx8
L	Tx8

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Appendix B: Specifications

Remote site fiber optic termination and modem enclosure

Description

This is a waterproof enclosure that contains the termination for a 6 strand fiber optic cable and has space for one fiber optic modem. It also provides an isolated power supply for the fiber optic modem. The fiber optic modem can be quickly and easily removed and replaced.

Included Parts

Fiber Optic Enclosure

Mounting bolts

Specifications

Optical

Insertion loss	1.5 dB maximum per fiber (one fusion splice, one ST connector)

Interface

Six Strand Fiber Cable Input	Waterproof pressure gland
Allowable Cable Diameter	6.1mm to 15.9mm
Data/Power I/O	19 pin MIL circular connector
Input Voltage	11-17 VDC
Power	Approx. 3.0 W with 1 modem

Environmental

Environment	Meets protected outdoor specification, see document 13065
Environmental Protection	IP67
Housing	Rugged waterproof aluminum enclosure
Size	Approximately 193 mm w x 362 mm l x 86 mm h

Fiber optic modem

Description

This is a 1300 nm multimode wide temperature fiber optic modem.

Included Parts

Fiber optic modem

Modem manual

Specifications

Fiber Optic Interface

Transmitter	ELED, typical launch power –19 dBm
Receiver	PIN Diode, typical sensitivity –36 dBm
Link Budget	15.0 dB typical with 62.5/125um cable
Type	multiplexing
Bit Error Rate	1x10-9 or better
Wavelength	1300 nm
Max. Transmission Distance	9.0 km*

*Assumptions:

a. Multimode cable at 1300 nm has losses of 1.0 db/km
b. 1.5db losses at the near and far ends (3db total)
c. 4.0 db cable break splices/aging

Electrical Interface

Power	3.0 W max.
Input Voltage	12 VDC
Data	RS-232
Protocol	Asynchronous
	8 channels at 38.4 kb/s

Connectors

Optical Rx	ST connector
Optical Tx	ST connector
Comms	DB-25F
Power	1 pin connector

Environmental

Temperature	-10 to 45
Housing	aluminum box
Size	22 mm x 44 mm 102 mm

Notes

1. The power supply voltage must meet the 12 VDC supply requirements specification 13067
2. The modem can be mounted in the remote site enclosure or in the central site rack

Appendix C: Outline and installation drawing