JDS Uniphase

SmartCoupler (OC)

Technical Practice

April 2000

FiberMultiplier
Document No. 526-501-201 rev 102

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1. Introduction

This practice provides information and installation procedures for the FiberMultiplier SmartCoupler (OC) protected bi-directional system (Pn.500.520.006).

Before proceeding to installation, JDS Uniphase recommends a review of Section 5 "Preparing and Testing Fiber Links for Bi-directional Transmission" for background information on bi-directional transmission. See also the Planning Guideline from JDS Uniphase.

1.1 Document Revisions

Revision 102 – April 2000 – Name Change

Revision 101 – (May 1999)Updated Specifications.

Revision 100 (January 1998) - Initial release.

2. SmartCoupler (OC)

The SmartCoupler (OC) system converts two-fiber optical links into a single fiber bi-directional link. The existing links may be 1310nm or 1550nm. Any transmission rate is supported. SmartCoupler (OC) systems automatically verify acceptable backreflection levels and provide protection against *'silent loopback'* failures.

Accessories :

Part No.	*Description*
519.530.007	FiberShelf
520.209.315	48V/110V Adapter
520.204.320	Wall Mount Brackets
520.213.010	OPM Rail
520.213.020	URB Rail
520.213.012	OPM/URB Brackets - Type A

3. System Overview

SmartCoupler (OC) systems provide the following advantages over passive or unprotected couplers in bi-directional fiber links:

1. Automatic protection against the "silent" failures which can otherwise occur in these links following a connector disconnect, connector degrade, optical transmitter (Tx) failure or cable cut. *These silent failures are caused by reflected optical power from components in the link or from an open fiber. These reflections can easily provide sufficient near end crosstalk that the optical receiver (Rx) in the transmission system will stay "alive" even though the true signal from the far end is lost. The alarms and automatic electronic protection switching capability of the transmission system will not be activated resulting in a long service outage.*

2. Automatic verification on startup that the level of any backreflected optical power will not be sufficient to exceed crosstalk thresholds.

The optical circuit of the SmartCoupler (OC) unit is shown in Figure 1. It consists of a low loss optical circulator for bi-directional access packaged with an optical tap, a power monitor and an optical switch. SmartCoupler (OC) modules are installed at each end of the link and are connected directly to the Transmit/Receive fibers of the transmission equipment.

When the units are powered, optically connected and switched to **ENABLE**, they perform a simple protocol using their optical switches for signaling (auto-verification). This protocol compares the power level of the normal signal from the far end of the link to the locally backreflected power. If this ratio (i.e. crosstalk ratio) is not large enough for safe operation, the units will continue to test and will not accept traffic.

In the event that only one end of the system determines an acceptable crosstalk ratio, it will continue to attempt to Auto-Verify with the other unit.

When both sides verify successfully, the SmartCouplers will allow the optical signal from the local transmission equipment to pass through to the common fiber, enabling traffic, and optical monitoring will begin.

The monitor continually measures the incoming optical power level at the common port and compares with stored reference levels. When a disconnect, connector degrade or Tx failure occurs, the power level seen by the monitor will change. When this change exceeds preset thresholds, the SmartCoupler will block the the local transmitter's optical signal. This action triggers blocking at the far end of the link (if not already triggered by the failure). Both receivers in the transmission system see no optical power, transmission alarms will be activated and, for protected links, transmission equipment will transfer traffic to protection in both directions. The units will restart the test protocol and will re-enable traffic and monitoring only when an acceptable crosstalk ratio is detected.

To support installation and maintenance, SmartCoupler units also provide external dry contact alarms and local controls and displays.

4. Equipment Description

The SmartCoupler (OC) Module is contained in a metal housing which is 1" wide x 6" high x 9.5" deep. The front panel secures the 3 optical bulkheads, the **PASSIVE/ENABLE** switch, the **BLOCK** push-

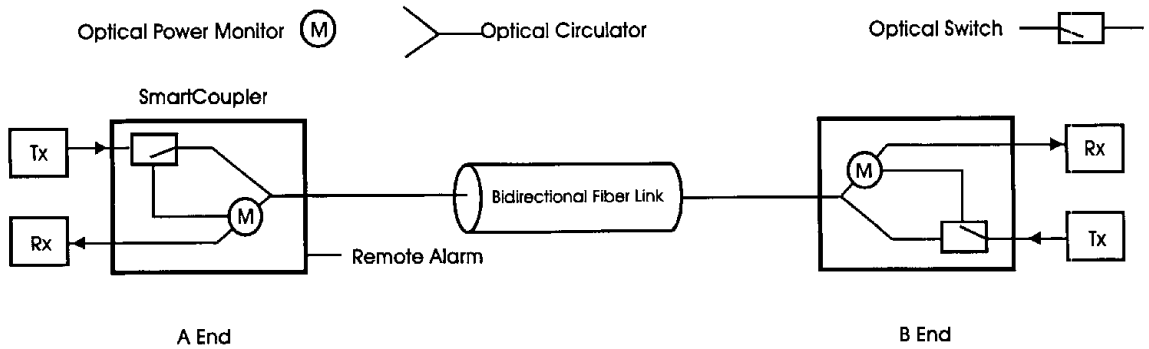


Figure 1 - SmartCoupler (OC) Optical Circuit

button and the LEDs. The alarm and power connectors are on the rear panel. Both views are shown in Figure 2. Specifications are listed in Section 8.

4.1 Optical Connections

There are three optical ports located on the front panel of the SmartCoupler (OC) module. The **COM** port is connected to the bi-directional fiber. The **TX** port is connected to the transmit port of the transmission equipment, and the **RX** port is connected to the receive port of the transmission equipment.

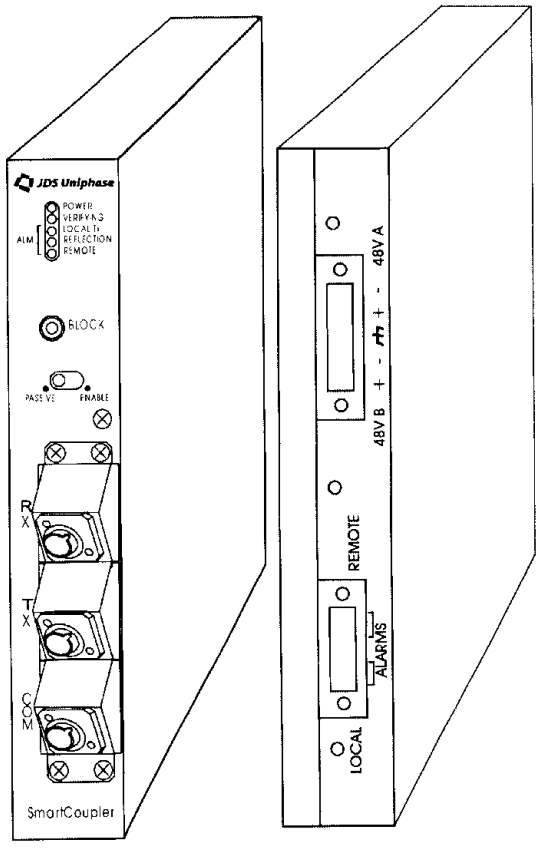


Figure 2 - SmartCoupler (OC) Front/Rear Panels

4.2 Controls

4.2.1 PASSIVE/ENABLE Switch

When the switch is set to **PASSIVE**, the module operates as a passive coupler. In this position, the **BLOCK** push-button is enabled and can be used to manually control the optical switch.

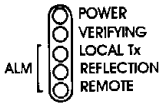
When the switch is set to **ENABLE**, the module will monitor the optical power level on the link, and if necessary, will start auto-verification of the link. In this position the **BLOCK** push-button is disabled.

4.2.2 BLOCK Push-button

The **BLOCK** push-button manually operates the SmartCoupler (OC) optical switch. When the push-button is depressed, the SmartCoupler will **BLOCK** the optical signal coming from the local transmission equipment, preventing it from reaching the common fiber. When the push-button is released, the SmartCoupler will return to passive operation, allowing the optical signal to pass through to the common fiber.

4.3 Displays

The module has five display LEDs.



POWER (Green)

Illuminated as long as there is power supplied to the unit.

VERIFYING (Yellow)

Illuminated while unit is performing auto-verification.

LOCAL Tx (Red)

Illuminated when there is local Tx failure or when the optical level of the local transmission equipment is out of the acceptable range for proper operation of

the bi-directional link (-10 to -35dBm) as measured at the Rx port at the remote end.

REFLECTION (Red)

Illuminated when the auto-verification routine has determined a backreflection level less than 9 dB below the true signal level.

REMOTE (Red)

Illuminated when auto-verification has determined that a fault is at the remote end or in the common fiber. (Note: when SmartCouplers at both ends of the link show REMOTE (Red), the fault is in the common fiber.)

When power to the unit fails, no LEDs will be illuminated.

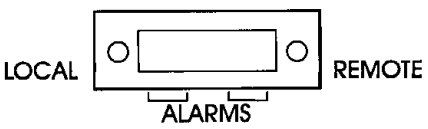
When there is a fault detected, the POWER LED and the appropriate alarm LED will be illuminated. The VERIFYING LED will also remain illuminated as the unit will continue auto-verification until the fault is corrected.

Identification of a fault can require up to 2 minutes. When an alarm is first displayed, the alarm LED will flash approx once per second until the SmartCoupler has confirmed the alarm. This can require up to 2 additional minutes. Once the alarm indication has been confirmed, the alarm LED will stop flashing and remain on until the alarm condition changes.

Note: When the SmartCoupler (OC) is matched with a SmartCoupler PB Optical Card or a previous version of the SmartCoupler module that does not have the enhanced alarm feature, the SmartCoupler auto-verification and LED/alarm indications work as described. The LED/alarm indications of the SmartCoupler PB optical card or previous version of the SmartCoupler will cycle on and off as the auto-verification routine progresses, indicating a fault, but they do not provide fault isolation information.

4.4 Alarm Output

Two Form B (active closed) relay alarms are provided on the rear panel of the unit, labelled LOCAL and REMOTE.



The mating connector is supplied. As soon as a fault is detected, the LOCAL alarms on the SmartCouplers at each end of the link will close. When auto-verification has determined the cause of the failure, the corrresponding alarm, LOCAL or REMOTE will close on each SmartCoupler.

The LOCAL alarm will trigger under any of the following conditions:

1. Unit is in Auto-Verification mode.
2. Local Tx failure or the optical level of the local transmission equipment is out of the acceptable range for proper operation of the bi-directional link (-10 to -35dBm) as measured at the Rx port at the remote end.
3. Local backreflection is too high, usually indicating a mismated or dirty connector.
4. SmartCoupler (OC) is switched to **PASSIVE**.
5. Power Loss (-48V) to the SmartCoupler (OC).

The REMOTE alarm will trigger under any of the following conditions:

1. Remote end fails to auto-verify (problem could be at the far end or in the common fiber).
2. Optical level from the remote end is out of range.
3. Power Loss (-48V) to the SmartCoupler (OC).

When the alarms from both SmartCouplers are analyzed together, they provide the same detailed fault isolation information as the LED display. This detailed alarm input may then be used to identify the location and nature of the fault. See Appendix D for additional details of the failure states.

4.5 Switching Thresholds

The switching threshold levels accurately identify the optical signature of fiber cable breaks, connectors being disconnected and gradual system degradation. At the same time the selected thresholds are tolerant of normal fiber handling. They are:

- Rapid increase: +1.4dB
- Rapid decrease: -6dB
- Slow increase: +6dB
- Slow decrease: -6dB

Changes in excess of these thresholds will result in the SmartCouplers blocking the optical link within 15ms.

4.6 Power and Grounding

The SmartCoupler (OC) is powered by supplying -48VDC to a 5-pin connector located on the rear panel. The mating connector is supplied. If required, an optional -48/110V adapter is also available. The SmartCoupler (OC) has an internal self-resetting fuse. If the SmartCoupler (OC) is connected to a fuse panel, a 250 mA slow acting fuse is recommended.

4.7 Loss of Electrical Power

If all electrical power to the SmartCoupler (OC) is lost, the optical switch will remain in (or revert to) passive coupler operation so no traffic interruption occurs. If power is lost and recovered, the unit will power up preserving the last optical state prior to the loss of power. If the SmartCoupler (OC) was performing Auto-Verification, it will restart the Auto-Verification sequence.

5. Preparing and Testing Fiber Links for Bi-directional Transmission

5.1 Link Loss Budget

The total end to end loss of the fiber link including the approximately 4 dB allowance for the bi-directional components, must not exceed the maximum loss budget specified by the transmission equipment manufacturer.

Note that the maximum optical power at the Receive port when the system is in operation should not exceed -10 dBm. If necessary, for short links, an attenuator should be placed on the transmit port of the transmission equipment at each end of the link.

See Appendix A for the Link Planning Worksheet. This worksheet can be used as a planning tool to evaluate a specific optical link. It provides a method to determine whether or not the link can support bi-directional transmission. A sample link is used as an example to help guide the calculation. If the calculation fails, contact JDS Uniphase Customer Support for suggestions on how to improve the link performance or for low insertion loss options.

5.2 Backreflection

Backreflection from open connectors or cut fiber provides a mechanism for coupling optical signals from an optical transmitter into a local optical receiver. This crosstalk signal, if strong enough, can lead to:

1. degradation in the performance of the transmission system and
2. silent loopback failure following a Tx or fiber failure.

The SmartCoupler (OC) Auto-Verification routine automatically measures backreflection levels and allows operation only when the near-end crosstalk level (resulting from backreflection) is at least 9 dB lower than the level of true signal from the far end Tx.

Backreflection from Rayleigh scattering (within the fiber itself) will become high enough to prevent successful Auto-Verification on links with higher than 19 dB link loss. Therefore, it is recommended that SmartCouplers be used only on links with 19 dB loss or less. For a more detailed discussion of backreflection and Rayleigh scattering, please see JDS Uniphase Doc. #525-300-006, "FiberMultiplier Systems Overview".

Before commissioning a fiber link for bi-directional transmission, sources of high backreflection should be eliminated.

5.2.1 Eliminating Sources of High Backreflection

5.2.1.1 Splices and Connectors

Fusion splices always have extremely low backreflection. While mechanical splices have higher backreflection, they are quite acceptable provided they are in good condition. Degraded mechanical splices can have high backreflection. If mechanical splices are present, the link should be OTDR tested and any high backreflection splices replaced.

Any connectors located near the ends of the link (i.e. in patchpanels) which are not physical contact PC polished, should be PC polished or replaced with PC or APC connectors. Since existing PC polished connectors may have become highly backreflective as a result of contamination or damage during remating, backreflections from these should be tested before turning up the system. If desired, backreflections from mated connectors in patch panels may be tested prior to installation of the bi-directional system using

either a source, powermeter and coupler, or a backreflection tester.

To eliminate Rayleigh scattering from the long fiber on the far side of the connector as well as backreflections from connectors further along the fiber, a high loss "mandrel" bend (see Appendix C) should be made past each connector as it is tested. Contaminated connectors may usually be recovered to acceptable backreflection by cleaning. Connectors tested as "good" should remain mated to avoid new contamination.

6. Installation

6.1 Mounting

Mount SmartCoupler (OC) units following the installation instructions provided with the mounting equipment supplied.

6.2 Electrical Connections

Remove the power connector from the rear of the SmartCoupler (OC). Following the pin-out diagram in Figure 3, connect the ground pin to Frame ground, connect the primary power source to the -48V A/Return A leads. If available, connect the secondary power source to the -48V B/Return B leads. Once the connector is wired, plug it back into the unit.

6.3 Alarm Connections

Alarms are connected from the SmartCoupler (OC) to the alarm inputs of the associated transmission equipment or to office alarm collection devices. Remove the alarm connector from the rear of the SmartCoupler (OC) and wire both the local and remote alarms. Plug the connector back into the unit. If a single alarm output is required, the local and remote alarm outputs should be connected in parallel with jumpers.

6.4 Field Adjustments and Settings

No field adjustments are required for operation of the SmartCoupler (OC) system.

6.5 Installation into the Transmission System

Note that traffic will be briefly interrupted during installation. If necessary, disconnect traffic from the common fiber(s).

6.5.1 Fiber Dressing

To guard against accidental changes in optical power level, it is recommended that all fiber dressing/management on the common fibers be completed prior to installing traffic on the SmartCoupler (OC) links.

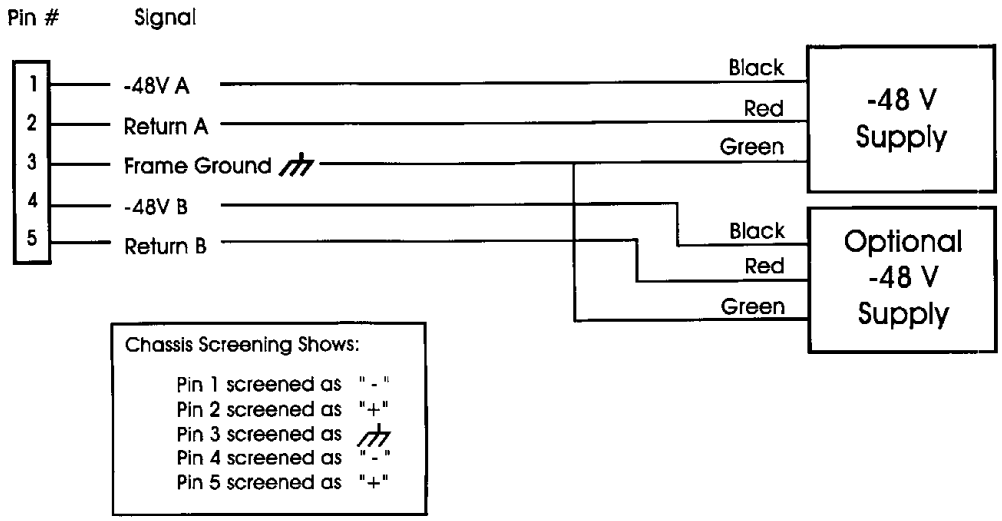


Figure 3 - Power Connector Pin-Out and Optional Adapter Wiring

6.5.2 System Installation

Clean all Connections prior to mating.

Perform the following procedure at both ends of the link:

1. Connect the Tx of your transmission equipment to the Tx port of the SmartCoupler (OC).
2. Connect the common fiber link to the COM port of the SmartCoupler (OC).
3. Connect the Rx of your transmission equipment to the Rx port of the SmartCoupler (OC).
4. Ensure that the SmartCoupler (OC) is switched to **ENABLE**.

Once both SmartCouplers are connected, the system will complete the auto-verification routine within 30 seconds. The VERIFYING LED will turn off and the Alarm Relay contacts will open when both ends have passed successfully.

It is recommended that you measure the Rx signal at both ends of the link to verify sufficient optical power with margin.

(Disconnecting the Rx port will not trigger the SmartCoupler (OC) Auto-Verification routine.)

WARNING: If there is a fault, it will take up to two minutes for the SmartCoupler (OC) to identify and display an alarm. When an alarm is first displayed, the alarm LED will flash approximately once per second until the SmartCoupler (OC) has confirmed the alarm. This can require up to 2 additional minutes. Once the alarm indication has been confirmed, the alarm LED will stop flashing and remain on until the alarm condition changes.

Once the problem is isolated, the VERIFYING LED will remain on, the appropriate alarm LED will illuminate and the appropriate alarm (LOCAL or REMOTE) will close. See Appendix D for details of the failure states.

Auto-verification will continue until all faults are cleared.

A step-by-step troubleshooting procedure is provided in Appendix B if the SmartCouplers fail to verify.

6.5.3 Maintenance

Maintenance on the SmartCoupler (OC) common fiber links should be undertaken when the SmartCoupler is switched to **PASSIVE** (to disable accidental switching) on both SmartCouplers. Note that this does not interrupt traffic as the SmartCouplers will operate as passive couplers set to **PASSIVE**. When switched back to the **ENABLE** position, the unit will resume monitoring.

7. Customer Support

Customer support is available 7 days a week, 24 hours a day and can be contacted at the following:

In North America: 1-800-367-7029

International: +1 613 727-1304

Ext. 8999

Internet e-mail: support@ca.jdsunph.com

Corporate Headquarters:

570 West Hunt Club Road
Nepean, Ontario
Canada, K2G 5W8

Web Page: www.jdsunph.com

8. SmartCoupler (OC) Specifications

Category	Description	
Optics	Monitor Range (at Rx)	-10 to -35 dBm
	Monitor Accuracy	± 0.5 dB
	Switching Thresholds	+1.4 dB short-term - 6.0 dB short-term ± 6.0 dB long-term drift
	Switching Speed	15 ms (Maximum)
	Isolation	< -52 dB (Tx to Rx)
	Insertion Loss	Tx to Common: < 2.5 dB Common to Rx: < 2.0 dB
	Max. Link Loss	19 dB on Comm. Fiber
Display LEDs	Power, Alarms	
Connectors	FC, ST, or SC	
Controls	Laser Test push-button	
Fiber	Input singlemode; Output singlemode.	
Power	1 W Max., -48 VDC nominal (-40 to -60 VDC)	
Alarms	LED Display and Two Form B Relay Output Alarms	
Dimensions	1" wide by 6" high by 9.5" deep (including bulkheads)	
Mounting	Shelf, dual or single configurations, wall mount	
Environmental	0 to +50 °C, 95% R.H., non-condensing (operating range)	
Approvals and Standard Compliance	EMC and Immunity (ESD): • FCC part 15, Class B • This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations. Safety: • CSA - C22.2 • UL 1950	

Note: Specifications are subject to change without prior notice.

NOTE: This equipment is tested and found 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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient or relocate the receiving antenna.
- increase the separation between the equipment and receiver.
- connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- consult the dealer or an experienced radio/TV technician for help

Warning: Changes or modifications not expressly approved by JDS Uniphase could void the user's authority to operate this equipment.

Appendix A - Link Planning Worksheet

Transmission Link Specification

Line	Description	Actual Value	*Example Value*
A.	Measured Link Loss (must be <9dB)*	_____ dB	*10 dB*
B.	Tx Output (minimum)	_____ dBm	*-5 dBm*
C.	Guaranteed Rx Input Sensitivity	_____ dBm	*-30 dBm*
D.	SmartCoupler (OC) Insertion Loss (maximum).	*4.5* dB	

Bi-directional Calculations

This test determines whether the link power budget will be adequate for bi-directional transmission.

Line E = ( ) - ( ) - (4.5) = _____dBm (minimum expected receiver level)
(Line B) (Line A) (Line D)

There is sufficient link budget to use SmartCoupler (OC) when the following statements are true:

1) Line E is within monitor range (-10dBm and -35dBm)

2) Line E > Line C

(otherwise contact JDS Uniphase for assistance)

Example: *(-5) - (10) - (4.5) = -19.5 dBm*

1) Expected receiver level (-19.5 dBm) is between -10 dBm and -35 dBm
LINE E is between -10 dBm and -35 dBm

2) Expected receiver level (-19.5 dBm) > Rx Input Input Sensitivity (-30 dBm)
LINE E > LINE C **√ All OK**

**** Restriction due to Rayleigh scattering: see paragraph 5.2***

Appendix B - Step-by-Step Troubleshooting Procedure

Instructions: Normally no optical attenuation pads should be installed - please verify.
One technician, with an optical power meter to complete measurements, is required at each site.

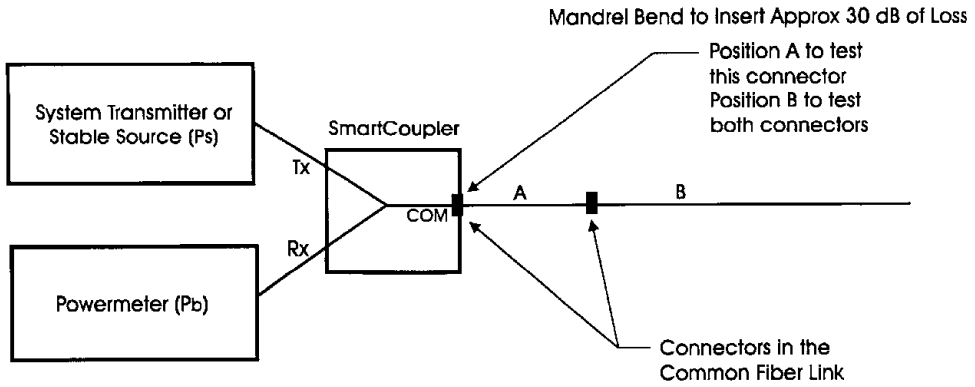
Step	A End	B End
1	Ensure SmartCouplers are installed according to instructions in Section 6	
2	Switch SmartCoupler to **PASSIVE**.	
3	Connect Powermeter to the Rx port of SmartCoupler	
4	Press and hold the BLOCK push-button.	
5	The reading on the Powermeter is the true Rx power. **a** = _____ dBm	The reading on the Powermeter is the reflected Rx power. **b** = _____ dBm
6	Verify **a** is as expected given the estimated link loss plus 4.5 dB insertion loss of the SmartCouplers, and the Transmission equipment Tx level (line e of Appendix A). If **a** is lower than expected, locate and eliminate source of attenuation.	
7	Release the BLOCK push-button.	
8		Press and hold the BLOCK push-button.
9	The reading on the Powermeter is the reflected Rx power. **b** = _____ dBm	The reading on the Powermeter is the true Rx power. **a** = _____ dBm
10		Verify **a** is as expected given the estimated link loss plus 4.5 dB insertion loss of the SmartCouplers, and the Transmission equipment Tx level (line e of Appendix A). If **a** is lower than expected, locate and eliminate source of attenuation.
11		Release the BLOCK push-button.
12	Calculate the crosstalk ratio: **a - b** = _____ dBm	Calculate the crosstalk ratio: **a - b** = _____ dBm

A crosstalk ratio of < 9 dB will cause the SmartCoupler auto-verification to fail. Use the Mandrel Bend test (Appendix C) to isolate the source of the backreflection. Start the Mandrel Bend test at the end where this ratio is smallest.

13	Reconnect the Rx of your transmission equipment to the Rx port of the SmartCoupler.
14	Switch the SmartCouplers to **ENABLE**.

Once both SmartCouplers are connected and switched ON the system will complete the auto-verification routine within 30 seconds. If successful, the POWER LED will be the only LED remaining on and the Alarm Relay contact will open. If unsuccessful, the auto-verifying routine will take up to an additional 90 seconds to diagnose the fault. Once this is complete, the VERIFYING LED will remain on, the appropriate alarm LED will illuminate, and the corresponding Alarm Relay contact will close. See Appendix D for additional details of the failure states.

Appendix C - Mandrel Bend Test for Local Backreflection Measurement



Notes: 30 dB loss at 1310nm = approx 5 snug turns around a 1/4" mandrel.
Ps = Power Launched by Source
Pb = Backreflection Signal

Figure 4 - Mandrel Bend Test

Mandrel Bend Test

This test measures local connector backreflections. The high loss of the Mandrel Bend eliminates backscattered or backreflected optical power which would otherwise be returned from fiber or components past the connector under test. The maximum allowed backreflection from connectors is (receive power - 16dB) for the first connector, and (receive power - 13dB) for all the connectors thereafter. This will be easily achieved with clean PC polished connectors.

Note: Since the backreflection even of high quality optical connectors can change when the connector is disconnected and remated, "good" connectors should remain mated after testing.

	Power **a** refers to the True Rx power as measured in Appendix B
a	Referring to Figure 4, insert Mandrel Bend at location A.
b	The reading on the powermeter (reflected Rx) should be less than (**a - 16dB**). If not, disconnect and clean connector thoroughly, remate, and retest.
c	Remove Mandrel Bend from location A. Referring to Figure 4, insert Mandrel Bend at location B.
d	The reading on the powermeter (reflected Rx from both connectors) should be less than (**a - 13dB**). If not, disconnect and clean connector thoroughly, remate, and retest.
e	Remove Mandrel Bend and insert after next connector.
f	The reading on the powermeter (reflected Rx from all connectors up to the Mandrel Bend) should be less than (**a - 13dB**). If not, disconnect and clean connector thoroughly, remate, and retest.
g	Repeat steps *e* and *f* all the way to the second SmartCoupler or until you have found all sources of backreflection as necessary.
h	After the fault is corrected, repeat the Troubleshooting Procedure of Appendix B to verify your link.

Appendix D - Alarms and Trouble Indications

IMPORTANT: Wait for two minutes after any corrective action to allow the SmartCoupler to retest the link. If an alarm is still displayed, wait until the alarm LED stops flashing before taking any more corrective action.

When the alarms from both SmartCouplers are analyzed together, they provide detailed information about the location and nature of the fault. This information can be integrated into existing operations and support systems. The failure states and their meaning are described in the following table:

A End			B End			Fault
LEDs	**Alarms**		**Alarms**		**LEDs**	
✹ Power O Verifying O Local Tx O Reflection O Remote					✹ Power O Verifying O Local Tx O Reflection O Remote	**Working normally**
✹ Power ✹ Verifying O Local Tx O Reflection O Remote	LOCAL		LOCAL		✹ Power ✹ Verifying O Local Tx O Reflection O Remote	• **Auto-verification is in progress**, no fault exists or has been determined yet. (Will clear within 30 seconds if no fault exists.)
✹ Power ✹ Verifying ✹ Local Tx O Reflection O Remote	LOCAL			REMOTE	✹ Power ✹ Verifying O Local Tx O Reflection ✹ Remote	• **Tx at A has failed**. • Tx at A is higher or lower than the acceptable range (-10 to • -35dBm) as measured at the Rx port at B.
✹ Power ✹ Verifying O Local Tx O Reflection ✹ Remote		REMOTE	LOCAL		✹ Power ✹ Verifying ✹ Local Tx O Reflection O Remote	• **Tx at B has failed**. • Tx at B is higher or lower than the acceptable range (-10 to • -35dBm) as measured at the Rx port at A.
✹ Power ✹ Verifying O Local Tx O Reflection ✹ Remote		REMOTE		REMOTE	✹ Power ✹ Verifying O Local Tx O Reflection ✹ Remote	• **Fault is in the common fiber**.
✹ Power ✹ Verifying O Local Tx ✹ Reflection O Remote	LOCAL		LOCAL		✹ Power ✹ Verifying O Local Tx ✹ Reflection O Remote	• **High backreflection** (likely from an open connector or splice) is affecting both ends.

A End			B End			Fault
LEDs	Alarms		Alarms		LEDs	
✹ Power ✹ Verifying ○ Local Tx ✹ Reflection ○ Remote	LOCAL				✹ Power ✹ Verifying ○ Local Tx ○ Reflection ✹ Remote	• **High backreflection at A.**
✹ Power ✹ Verifying ○ Local Tx ○ Reflection ✹ Remote			LOCAL		✹ Power ✹ Verifying ○ Local Tx ✹ Reflection ○ Remote	• **High backreflection at B.**
✹ Power ○ Verifying ○ Local Tx ○ Reflection ○ Remote	LOCAL				✹ Power ○ Verifying ○ Local Tx ○ Reflection ○ Remote	• **SmartCoupler at A is set to PASSIVE** (SmartCoupler at A is operating but as a passive device (no monitoring)).
✹ Power ○ Verifying ○ Local Tx ○ Reflection ○ Remote			LOCAL		✹ Power ○ Verifying ○ Local Tx ○ Reflection ○ Remote	• **SmartCoupler at B is set to PASSIVE**(SmartCoupler at B is operating but as a passive device).
○ Power ○ Verifying ○ Local Tx ○ Reflection ○ Remote	LOCAL	REMOTE			✹ Power ○ Verifying ○ Local Tx ○ Reflection ○ Remote	• **Lost power to SmartCoupler at A** (unit is operating but as a passive device). B is unaffected.
✹ Power ○ Verifying ○ Local Tx ○ Reflection ○ Remote			LOCAL	REMOTE	○ Power ○ Verifying ○ Local Tx ○ Reflection ○ Remote	• **Lost power to SmartCoupler at B** (unit is operating but as a passive device). A is unaffected.