LFOR PMD Reader

User Guide

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Change Log

Revision	Revision History	Date
-	Initial Release	8/16/2014
A	Added error code 1009	11/5/2018
B	Updated brocade switch procedure with easier zoning configuration	02/04/2019
C	Updated showfiber sample output and added optional parameters Updated cover page to standard template	04/02/2019
D	Added reference to CLI command for NAC firmware version	10/09/2019
E	Updated screen information and error codes. Added fiber examples	06/16/2020
F	Added NAC test_mode and BIT error codes	06/17/2020
G	Added DFARS statement Added more troubleshooting	02/10/2022
H	Added footer	06/21/2022

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Irvin Technologies Inc.
https://itiengineering.com

Product Specifications

Spec	RDR	NAC
Size (approx.)	2RU x 16.7"D	1/2 width x 1RU x 14.2"D
Weight (approx.)	28 lbs (w/o cartridges)	8 lbs
Data Interfaces	None	Gb Ethernet (RJ-45 Copper)
Fiber Interface	Connector on RDR and NAC: D38999/20FB2PA • D38999/20 = shell style is Jam Nut Receptacle • Mates with ITI interconnecting Cables with plug type D38999/26FB2SA or equivalent Link Specification: • Data Rate: Fiber Channel (FC) • Cabling: Single Mode Fiber (1310nm) • Max Fiber Segment Length: 9km • Link Budget: 18 dBm	
Operating Temp	+0 to +49 C	
Grounding	chassis ground stud for MIL-STD-1310H sec. C.6 implementation	
Power	100/240VAC, 50/60 Hz, 2A max Fuse 250V/T3.15A	100/240VAC, 50/60 Hz, 1.5A max Fuse 250V/T2A

CAUTION: Refer to Appendix C for fiber optic power ratings
and cable plant design considerations

PMD Reader System Components

- **Network Access Controller Chassis (NAC)**
- **Power Cords (North American)**
- **Fiber Cable**
- **User Manual**
- **PMD Reader Chassis (RDR)**
- **RDR Rack Rails**
- **NAC Rack Shelf w/Filler Plate**

Power Cords and Outlets

These devices should be installed in close proximity to socket outlets that are easily accessible.

These devices support universal AC input: 100/240VAC @ 50/60Hz. The product is sold in a base configuration with a North American AC power cord with the following characteristics: device side has a 3-prong "PC" power type C13 beveled connector; the wall outlet end has a US type 110-volt outlet connector.

For specific country power cords, contact the manufacturer or purchase the needed power cord directly from an international power cord provider.

Overview

This guide provides instructions and information details on the LFOR PMD Reader system. The term PMD (portable memory device) is used interchangeably with EDTC (enhanced data transfer cartridge). The PMD Reader consists of two hardware components, the Network Access Controller (NAC) and the Reader Chassis.

System Overview
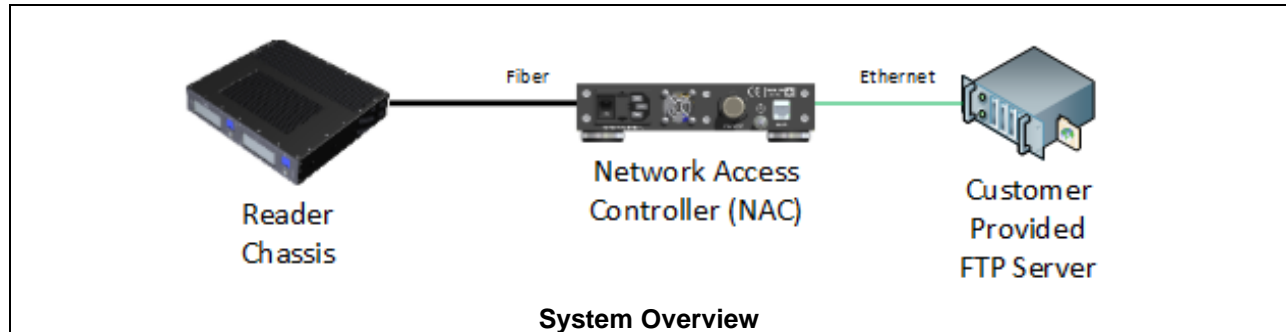
The PMD Reader system downloads data from the PMD using the same file system protocol used by the F-35 Aircraft. The PMD Reader system only implements 'read messages' and as such lacks the software required to write to the PMD. Data must be loaded onto the PMD from an outside source prior to performing a download. The PMD Reader system requires that the EDTC/PMD is running version AS2.0, AS2.2 or newer of the Operational Flight Program (OFP) load.

The NAC is used for configuration and management of the system. Management is provided through a dedicated Ethernet port. It is not possible to manage the device through the data port. The NAC maintains positive control over the Reader chassis, initiating and managing transfer of data from a PMD residing in the Reader chassis to the destination FTP server.

When the Download button is pressed, the Reader chassis signals the NAC that a download is ready and the NAC initiates the data transfer.

The Fiber connection between the NAC and Reader Chassis supports FIPS 104-2 certified encryption to protect the data transfer (*license must be valid for this feature*).

NAC Front Panel
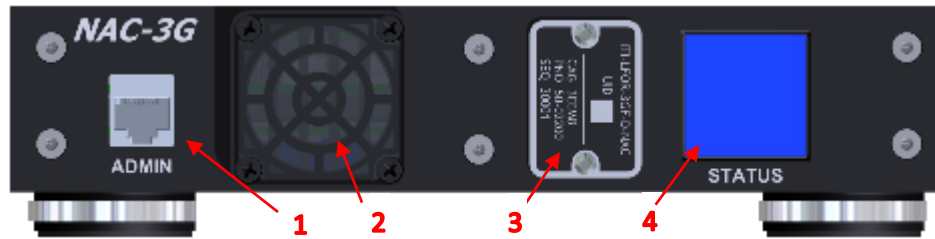
1 Administration Ethernet Port
Port used to configure and maintain the NAC.

2 Intake Fan and Filter
The intake fan uses a filter that can be replaced from the outside. Do not block the intake fan or overheating may occur.
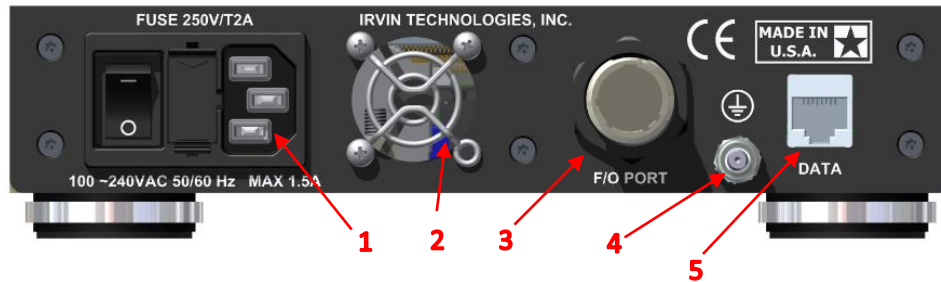
3 ID Tag
Identification tag containing model number and serial number of the device and must not be removed.

⚠️ *If removed the warranty will be voided.*

4 Status Screen
Displays current link state between the NAC and Reader Chassis, internal temperature of NAC, IP address for the administration port, and firmware version.

NAC Rear Panel

1 Power Entry Module with Fuse and Switch

Connect power cable to the connector. When the power switch is in the "|" or on position, the internal power supply is energized and the NAC is ready for use.

2 Exhaust Fan

Do not block the exhaust fan or overheating may occur.

3 Fiber Connector

Port used to connect to the PMD Reader Chassis (*or third-party fiber switch*). When not in use, keep the provided cover on at all times to prevent dirt and dust from getting into the connector.

⚠️ *ATTENTION: It is important that when connecting the provided cable to tighten the fiber connection tight, then back off one click. If the fiber connection is too tight it can cause Db loss of the signal.*
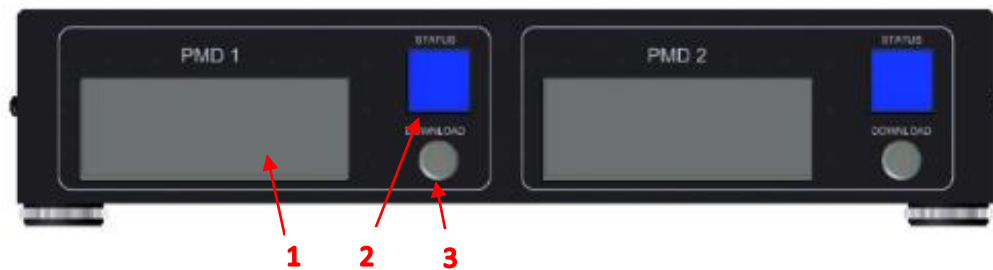
4 Grounding Post

Connect the post to a ground.

5 Data Ethernet port

Connect a computer or network with an accessible FTP server.

Reader Chassis Front Panel

The front of the chassis provides access to two PMD bays (PMD 1 and PMD 2).

1 Receptacle
> The receptacle accepts the PMD.

2 Status Screen
> Status screen displays the current download progress of PMD in the corresponding bay. When no PMD's are inserted the bay 1 status screen will display current fiber optic power status. Error codes will be displayed here as well if issues occur. Refer to *Appendix A* for error code definitions.

3 Download Button
> Press the download button to initiate the download process on the corresponding bay. When the button is pressed the NAC will initiate the download process and read the data from the PMD.

By default, the chassis will revert to idle mode after five minutes if inactivity. To increase the timeout temporarily, press a button to have the chassis powerup. Once the device displays ready, press both download buttons at the same time until the right screen displays the timeout has been increased.

The RDR chassis may initially reboot if the FIPS key has been reset. Once a reboot occurs, the end user will have to press the download button again to start the download.

Reader Chassis Rear Panel
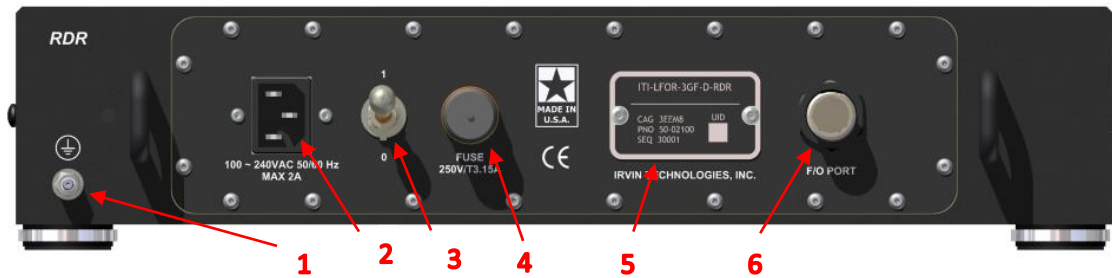
1 Grounding Post

Connect the post to an available ground.

2 Power connector

Connect power cable.

3 Main Power Switch

Controls power to the internal AC-DC power supply. Move to "|" (ON) position to energize the Reader Chassis.

4 Fuse

If needed, use only fuse type designated on the panel.

5 ID Tag

Identification tag containing model number and serial number of the device and must not be removed.

⚠️ *If removed the warranty will be voided.*

6 Fiber Connector

Port used to connect to the NAC (*or third-party fiber switch*). When not in use, keep the provided cover on at all times to prevent dirt and dust from getting into the connector.

⚠️ *ATTENTION: It is important that when connecting the provided cable to tighten the fiber connection tight, then back off one click. If the fiber connection is too tight it can cause Db loss of the signal.*

Connecting the NAC to the Reader Chassis

Single Reader Chassis
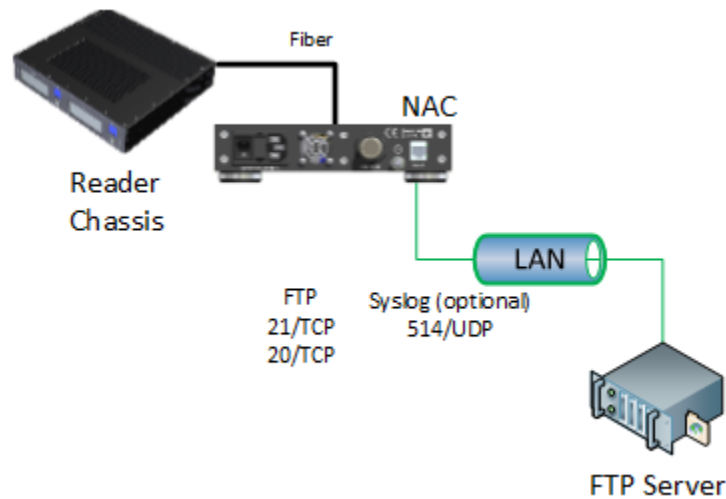
Follow these instructions to connect the devices:

1. Connect the provided Fiber cable to the NAC and the Reader Chassis.

⚠ *ATTENTION: It is important that when connecting the provided cable to tighten the fiber connection tight, then back off one click. If the fiber connection is too tight it can cause Db loss of the signal.*

2. Plug the power cable into the Reader Chassis.
3. Plug the power cable into the NAC.
4. Connect a standard Ethernet cable to the data port in the back of the NAC to an FTP server or network with FTP services available.
5. Power on the NAC and wait 10 seconds for it to completely boot
6. Power on the Reader Chassis. The system is now ready for configuration.

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*CAUTION: Refer to Appendix C for fiber optic power ratings
and cable plant design considerations*

Multiple Reader Chassis through Fiber Switch
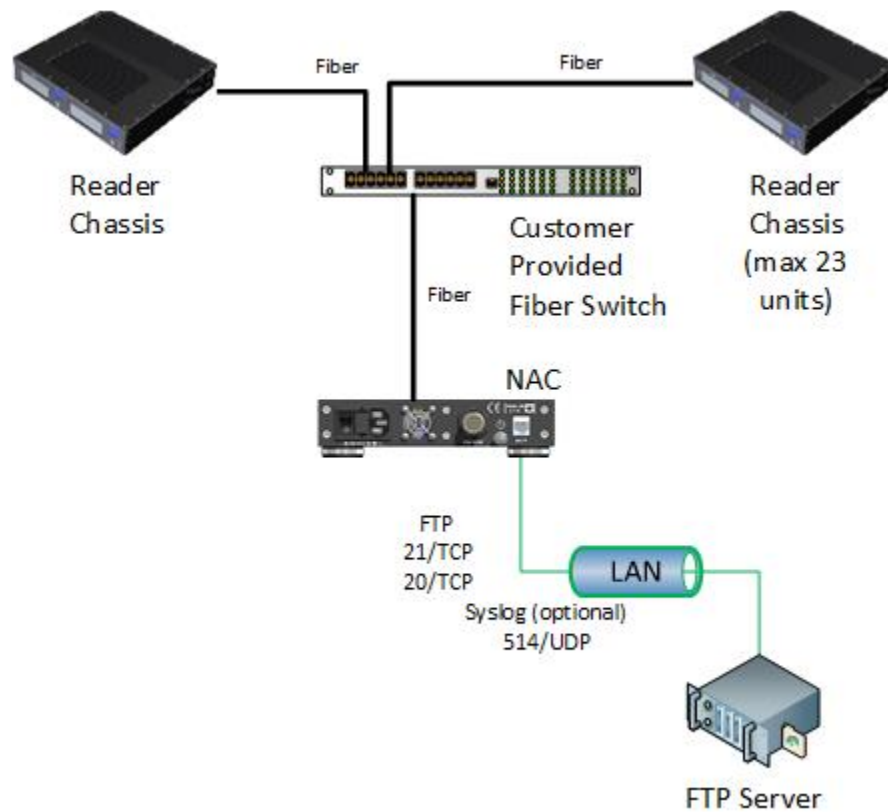
In order to perform this configuration MIL spec to standard LC Fiber connector cables are required. Up to a maximum of 22 Reader Chassis units are supported by a single NAC. For 3rd party fiber switch configuration information refer to *Appendix B*.

CAUTION: Refer to Appendix C for fiber optic power ratings
and cable plant design considerations

Basics

How it works

When a user presses the download button on the Reader Chassis, the chassis signals the NAC to perform a download. The NAC initiates the download process by reading the configured phases in order (from 1 to 4) and retrieving the directory listing from the Reader Chassis. After processing the directory information, the NAC opens an FTP connection to the FTP server. Multiple connections are made to the FTP server in order to perform the download process.
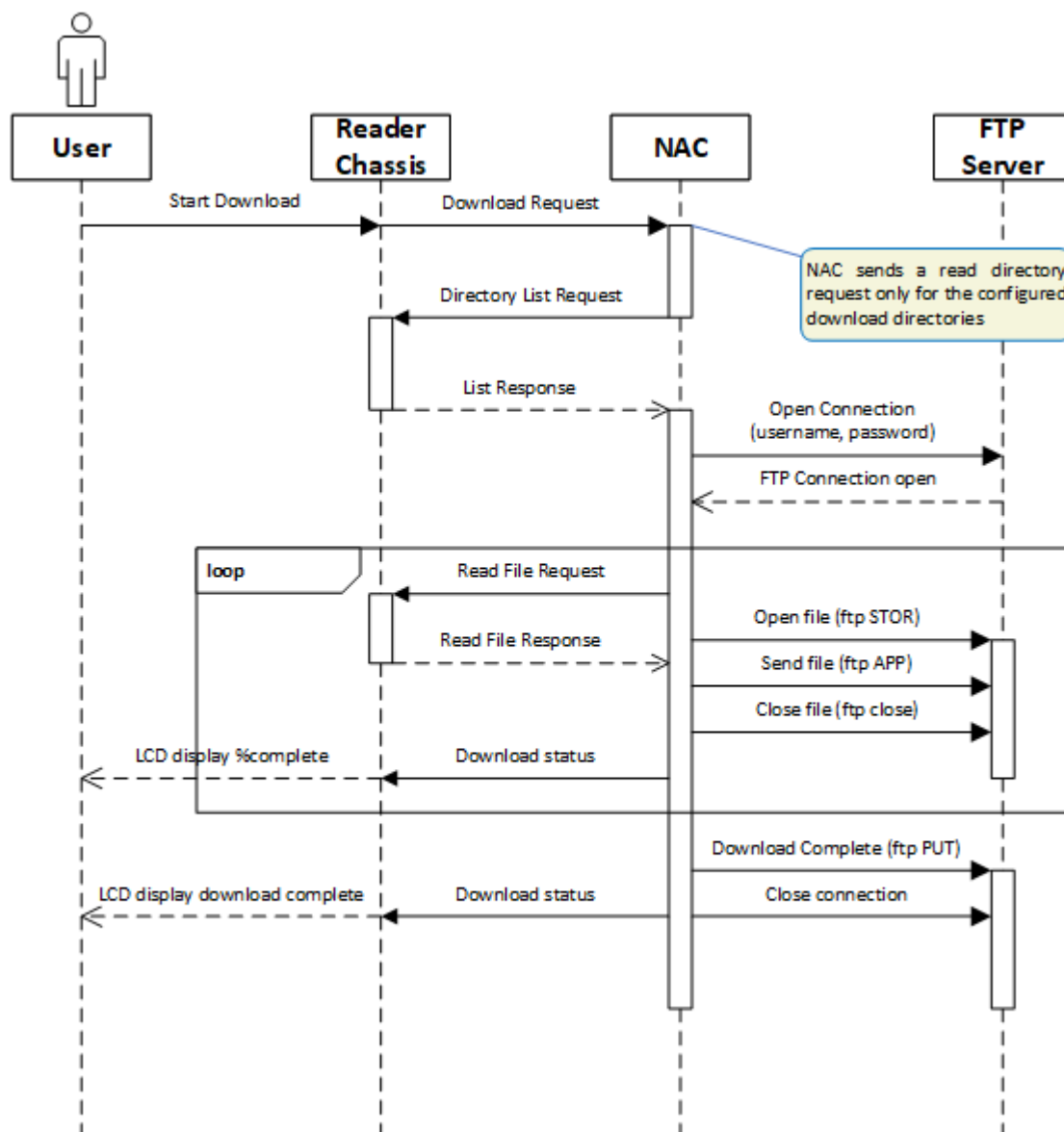
Configuration

The system is configured using a command line interface (CLI) by connecting a client computer via Ethernet cable to the **Admin Port** on the NAC and using telnet. The current IP configuration of the NAC is displayed on the front panel LCD (*factory default 192.168.10.1*). Once the client is configured within the same subnet open a telnet session (*port 23*) to the IP of the NAC.

Use the '*showfiber*' command to display status on the current active Reader Chassis on the fiber network. If the Reader Chassis is idle, they will not be displayed in the status screen. Use the '*print*' command to view all configurations including configured Reader Chassis.

```
CMD> showfiber

Fiber Channel Status:
--------------------

NAC Fiber Channel WWN: 21:00:00:90:9e:84:01:94

Connection Type:  PRIVATE LOOP (point to point)
Connection Speed: 8 Gbps
RX Status:        Passed
RX Power:         -3.2 dBm
TX Status:        Passed
TX Power:         -1.8 dBm

Fiber Channel Nodes Found = 1
Fiber_Channel_WWN        SEQ_ID   MSG_RCV    Fiber_Status RX(dBm) TX(dBm)
20:00:00:90:9e:84:04:c7 30013    247        PASS            -4.0   -1.7

CMD>
```

The *ConnectionType* will display 'private loop' for single NAC-to-Reader Chassis configurations. For multiple Reader Chassis configurations with a fiber switch, 'public loop' will be displayed. The summary will list the Reader Chassis sequence id's configured and the messages received from the chassis. The messages will only increment if the Reader Chassis is powered on (*non-idle state*). The fiber optic status will be updated each time the message count increases and report fiber optic power as well as the overall status.

The World Wide Name (WWN) is the fiber switch address. The last four octets of the WWN are also displayed on the Reader Chassis LCD panel along with the chassis sequence id.

New devices that have had FIPS keys exchanged may take a few seconds to display in the 'showfiber' command.

CLI Reference

NOTE: *Commands are case sensitive.*

Base commands	
cfg	Enter the configuration daemon to configure the NAC. See further CLI References
testFTP	Performs an FTP test by generating and sending data to the FTP server. Testing does not require a PMD. This can only be performed once server configuration has been completed using the configuration daemon
testSyslog	Performs a syslog test by sending multiple test syslog messages to the configured syslog server
lforLogEnable lforLogDisable	Enables/disables verbose logging in the console session.
ifconfig	Displays NAC adapter properties including the MAC address (*HWaddr*)

Configuration Daemon

Use the configuration daemon (*cfg*) to set IP addresses, phase downloads, backups, and configuration restores. Once in the configuration daemon the following CLI commands are available.

NOTE: Enter all commands on a single line. Commands are case-sensitive.

General	
backup	Backups the current configuration to the FTP server
delete	Restore NAC to factory defaults (used to clear nonvolatile configuration data, see CoV)
fw	Display NAC Firmware version (*firmware 3.4.20191009 or later*).
help	Prints list of commands
print	Prints the current configuration
save	Saves any changes that were made to the configuration
reboot	Reboots the NAC
recover	Loads a configuration file from the FTP server
test_mode <0:1>	Places the NAC into test mode, forcing all FTP downloads to a "TEST" directory on the FTP server. (*firmware 3.4.20191009 or later*). Note: This setting is not preserved between power cycles
quit	Exits the configuration daemon

Chassis	
+reader *<seq id>*	Adds a reader chassis to the NAC configuration (max 23 supported)
-reader *<seq* id>	Removes a reader chassis
showfiber [-l]	Displays the fiber channel information on configured chassis. Use the optional parameter -l (*lowercase L*) to print the fiber channel information continuously until the enter key has been pressed.

FIPS (*Reader Chassis must be powered on)*	
create_fips_key	Creates a new key for encryption between the NAC and Reader Chassis

fips_status	Gets the current FIPS status of the link between the NAC and Reader Chassis. The Reader Chassis must be booted with 'LFOR Ready' state displayed on the screen
add_all_rdrs	Sets FIPS keys on all the online readers. The reader must already be in the +reader list. (*firmware 3.4.20191009 or later*).

Network	
eth1 *<ipaddress> <subnet mask> <gateway>*	Sets the IP address of the Admin port
eth0 *<ipaddress> <subnet mask> <gateway>*	Sets the IP address of the Data port
ftp *<ipaddress> <username> <password>*	Sets the FTP server address and credentials for the FTP server *Note:* FTP server must always use port 21
syslog *<ipaddress> <port>*	Sets the IP address and port of the syslog server

| Phase	
create_phase *<id>*	Creates a phase used when performing downloads (max 4 phases supported)
delete_phase *<id>*	Deletes a phase
add_phase_path *<id> <path>*	Adds a directory path to the specified phase (max 4 paths supported)
delete_phase_path *<id> <path>*	Removes a directory path from the specified phase

PMD Download Process

Follow these instructions to download from a PMD:
1. Flip down the handle on the PMD and insert with the top facing upwards.
2. Close the handle on the PMD. If the handle does not close, the PMD is not in all the way.
3. Once the handle is closed press the **Download** button for the corresponding bay. Do not hold the button down.
4. Status will be displayed on the screen as the download progresses (*see examples below)*.
5. Once complete, then button LED will turn off. If the button is lit the download is still processing.
6. It is now safe to remove the PMD.
7. The data (*specified by the phase configuration*) will reside in the destined FTP server.

When the Reader chassis is powered on and not downloading, the left screen will display fiber status. The fiber must be healthy otherwise downloads may fail intermittently which can make troubleshooting difficult.
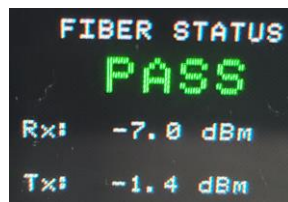
Good Fiber Example
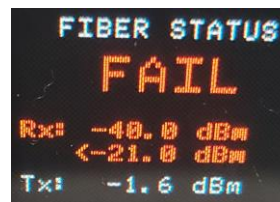
Bad Fiber Example

Reader Booting

Download

Security

Architecture

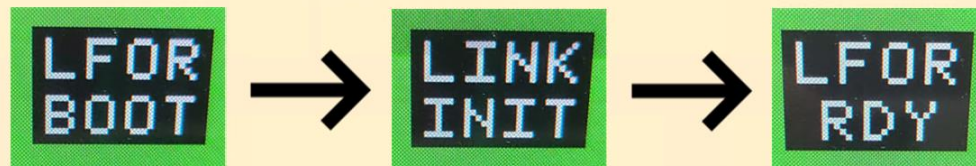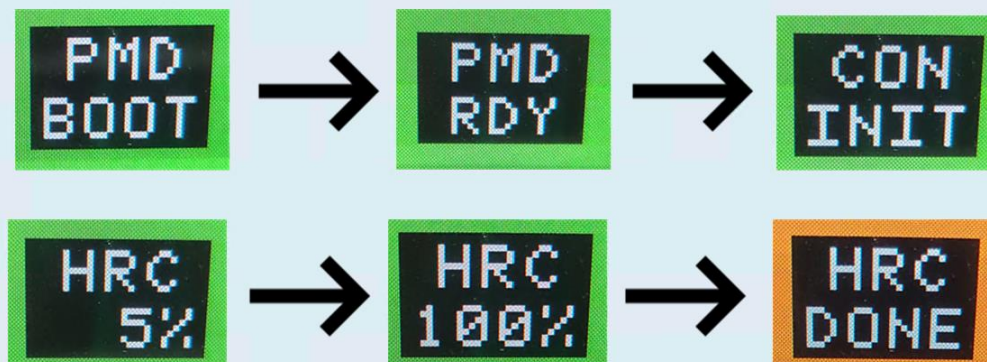During operation the NAC maintains positive control of the interface and is responsible for initiating all PMD read operations. The Reader Chassis proxies all read messages from the NAC to the PMD and from the PMD to the NAC. A user must press the download button to initiate the download which then signals the NAC to start processing. The Reader Chassis itself cannot initiate any downloads and does not store any PMD data in non-volatile memory.

The NAC monitors the Reader Chassis Fiber Channel port for download requests, validates the source request and initiates the PHM data download using the F35 messaging protocol. The NAC only accepts download requests from a configured Reader Chassis. Additionally, a registration process occurs during this configuration that uses an encrypted token to establish valid connections. All messages received by the NAC are validated using an encrypted token. The NAC only implements file read messages and lacks any ability to write to the PMD. The following F35 messages are used by the NAC:

F35 Message	Source	Destination	Function
File System Status	PMD	Controller	Provides PMD status
Action Request	NAC	PMD	Commands PMD to operate in Fiber Channel mode
Read Directory Request	NAC	PMD	Request a list of files and directories for a given path
Read Directory Response	PMD	NAC	Provide a list of files and directories in a given path
Atomic Read File Request	NAC	PMD	Initiate a file read request
Read File Status Response	PMD	NAC	Status message of read request
Read File Extra-Small Response	PMD	NAC	File data message sent when less than 1164 bytes are transferred
Read File Small Response	PMD	NAC	File data message sent when less than 8 KB is transferred
Read File Medium Response	PMD	NAC	File data message sent when less than 64 KB is transferred
Read File Large Response	PMD	NAC	File data message sent when more than 256 KB is transferred
Query Object	NAC	PMD	Request file size
Query Object Response	PMD	NAC	Provide file size

The NAC creates a file download list by sending directory and object queries to the PMD. The NAC does not know the PMD file system structure and must be configured with fully qualified PMD file system paths for download. Once configured, the NAC only reads the configured directory paths.

Audit Functions

The NAC transmits audit events using the RFC 5424 syslog protocol over UDP to the administratively configured syslog server and port. The syslog server is responsible for time stamping the audit events and processing the events into a security audit log.

The following table lists the available audit events:

Audit types	Description
Invalid telnet request	A telnet session was attempted on the data Ethernet port. The log message includes the source IP address.
Telnet session was established	A telnet session was established on the admin Ethernet port. The log message includes the source IP address.
Invalid fiber channel source detected	The NAC received a fiber channel message from an unregistered fiber channel source. The message is rejected and a security event is created recording the fiber channel source address (ID).
Invalid fiber channel message detected	The NAC received an invalid fiber channel message from an authorized fiber channel device. The message is rejected and a security event is created recording the fiber channel source address (ID).
NAC Restarted	The NAC startup process generates an audit event to record the startup of the NAC.
Valid PMD download request received	The NAC received a PMD download request from an authorized Reader Chassis. The security event includes the serial number of the initiating Reader Chassis.
PMD Download Completed	The NAC records the completion of a PMD download event. The security event includes the serial number of the initiating Reader Chassis.

An additional error log file (error_log.txt) is generated in the event a download fails. The log file will reside on the FTP server in the download location. Details of the error will reside in the log file.

FIPS

The PMD Reader is FIPS 140-2 Level 1 compliant. The LFOR FIPS encryption uses a third party FIPS 140-2 module, the Mocana Cryptographic Suite B Module. The software is integrated into the LFOR system to provide secure, high speed AES-256 encryption between the NAC and Reader chassis. It is not possible to change the encryption algorithm. FIPS configuration of the PMD Reader system, to include 140-2 integrity checks, is provided using the "fips_status" command documented in *CLI* reference.

Data Integrity

The PMD Reader employs multiple techniques to provide data integrity throughout the download process. Files stored on the PMD are read into the Reader Chassis using data blocks. The data blocks are formatted into messages for transmission across fiber channel. The formatting process adds tokens to the beginning and end of the file data block. The message is then fully encrypted using the certified encryption engine and transmitted to the NAC chassis over the fiber channel interface. The NAC decrypts the message and performs multiple data integrity checks to assure the message is valid. The tokens at the beginning and end of the data block are used to confirm data block integrity. After completing the message validation, the file data block is transmitted to the FTP server using the File Transmission Protocol over TCP/IP sockets. The FTP protocol combined with TCP/IP messaging provides data integrity for the final leg of PMD data download.

Exportability

The LFOR uses a combination of hardware and software to perform high speed AES-256 encryption. Export of encryption technology is controlled by the United States government. The LFOR contains two export-controlled components with the following export licenses:

FIPS 140 engine (software)

https://www.mocana.com/eula

Encryption engine (hardware)

http://cache.freescale.com/files/32bit/doc/support_info/P2020FAMPECI.pdf?fpsp=1&WT_TYPE=Supporting%20Information&WT_VENDOR=FREESCALE&WT_FILE_FORMAT=pdf&WT_ASSET=Documentation&Parent_nodeId=1213039446079730835499&Parent_pageType=product

The LFOR system does not have an export license. Any customer who transports the LFOR out of the United States must do so by following proper export process.

Notes

Appendix A – Error Codes

Error Codes

Code	Error description
1001	PMD removed during download.
1002	PMD download path errors, check download path configuration. Remove/reinsert PMD and try again.
1003	PMD download read errors, check system log for more information. Remove/reinsert PMD and try again.
1004	LFOR Reader Chassis communication issue. Reset Reader Chassis. If issues continue rekey Reader Chassis and check FIPS status.
1005	FTP communication error. Check network cables and FTP configuration. See syslog for more details.
1006	Typical cause is the PMD is empty. The NAC is configured with a path to download that does not exist on the PMD (e.g. P4\PHM does not exist). Inspect the PMD using a GEMR or GEMR-HS and verify that there is data on it. A secondary cause, less likely, is the PMD is not booting. Power cycle the Reader chassis and remove/reinsert PMD and try again. If issue still occurs verify OFP load version AS2.0, AS2.2 or newer and open a service ticket for further investigation.
1007	NAC communication error. Check network cables and and power. Power cycle NAC. Use '*showfiber*' to check fiber connectivity.
1008	LFOR failed built in test. Contact vendor.
1009	A corrupted file or directory was detected on the PMD. Check the "error_log.txt" in the FTP server's download directory for more information.
BIT ERROR	LFOR Reader Chassis failed built in test on power up. Power cycle Reader Chassis and try again. Most BIT failures are caused by bad power and are recoverable. Contact vendor if BIT failure repeats/reoccurs.
BIT 3	RDR SFP is above or below its operational temperature limits.
BIT 4	RDR receive fiberoptic power is above SFP limits. Overdriving the SFP can cause permanent damage to the system. It is recommended to swap out high power SFPs with lower power variants or add inline attenuation.

Appendix B – Fiber Switches

3rd Party Fiber Switches

Fiber channel zoning is required to use multiple Reader Chassis. The proper zoning configuration for connecting a NAC to multiple Reader Chassis through a fiber channel switch requires the creation of unique zones, each consisting of the NAC and one Reader Chassis. This appendix illustrates the steps used to setup a zoning scheme for a NAC and multiple Reader chassis connected to a Brocade 300 or G610 fiber channel switch. This is for reference purposes as different fiber switches may be used.

This procedure was captured using FabricOS v7.4.2c

(**NOTE:** *Screen shots may vary depending on the version of the Brocade software*)

1. Log into the switch GUI. This requires Java 7 or higher. If the switch is running a lower version of firmware it must be upgraded as older firmware versions are not compatible with newer Java versions.
   To access the switch user Internet Explorer and navigate to the device's web page. The IP address varies but may be defaults of 192.168.0.1 or 192.168.10.1. If the browser complains about Java then execute it from a command prompt as follows:
   javaws "http://<*ip address*>/switchExplorer_installed.html"
       (*specify IP address as appropriate*)
2. The plugin should execute and prompt with a login.
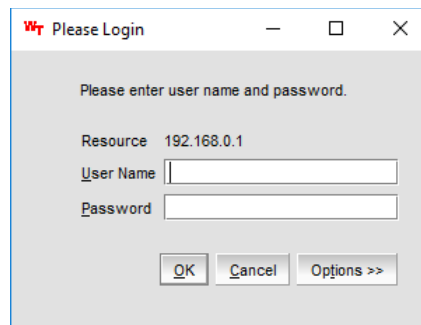
3. Specify credentials. Defaults are admin/password.
4. The primary ports screen will be displayed. At this time, it is recommended to rename the ports accordingly and label the NAC and the other RDR ports (s*imply right click and rename*).
5. For the Brocade 300 switches, all ports must be configured as L-Port:
   a. Right click the port->Properties.
   b. Click Next.
   c. Only have the L-Port option checked, click Next.
   d. Click Finish.
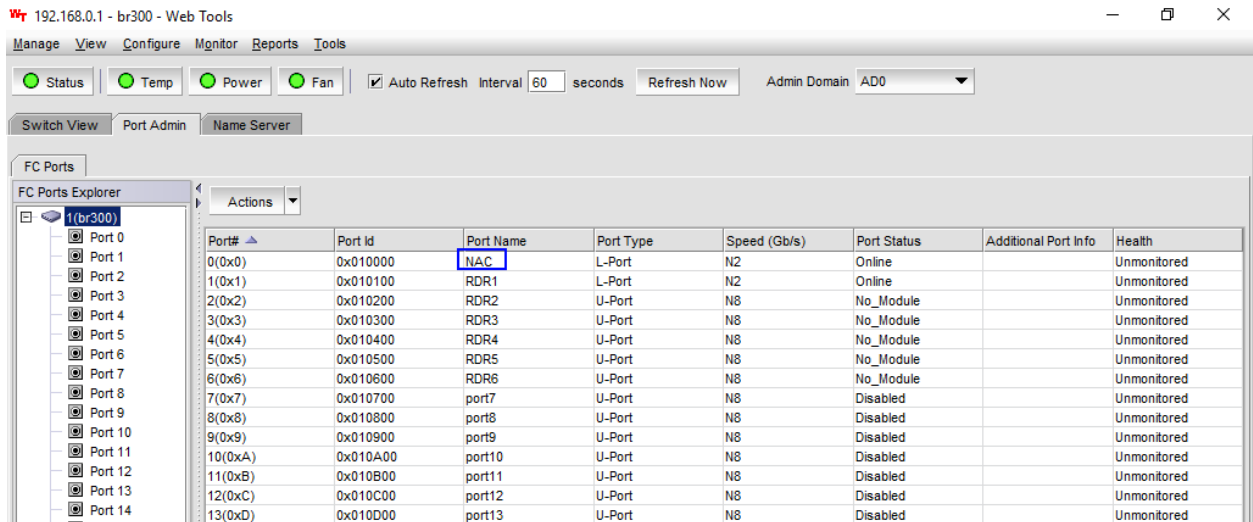
6. Disable other unused ports (*right click set disable*).
7. Click **Configure->Zone Admin**.
8. Once the zone screen loads click the **Zone** tab.
9. On this screen, add a zone for each RDR port that is configured. Each zone contains the NAC port and a single RDR port (*IMPORTANT, only one RDR port*).

   a. Click **New Zone**
   b. For the zone name the easiest nomenclature is '**zone_0_1**', '**zone_0_2**', and so on. Assuming that port 0 is the NAC. This is just for reference purposes but is much easier to read with a port naming convention.
   c. Click **OK**.
   d. The new zone is added and automatically selected.
   e. Expand the ports and select the NAC port, click the right arrow to add it.
   f. Select a RDR port and click the right arrow to add it.
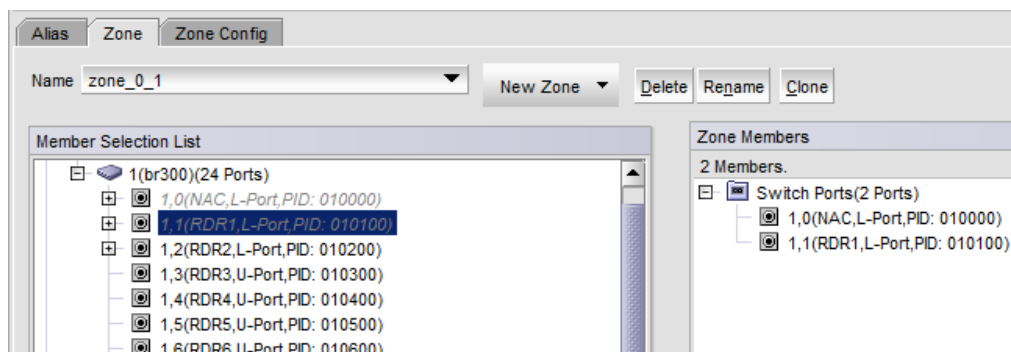
   g. Notice on the right side it contains the NAC port and one RDR only.
   h. Repeat steps A-F for each additional RDR port to create zones for each.
   i. Once the zones are created click **Save Config**, Yes to the prompt.
   j. Wait for the save to complete (*noted on the bottom left of the window*).
10. Next click the **Zone Config** tab.

11. Here a zone configuration will be created and the new zones added to that configuration. This is how the switch determines what is applied at boot up.
    a. Click **New Zone Config**.
    b. Specify a name for the config, in this example '**RDR_zones**' is used.
    c. The new zone config is automatically selected, expand the zone list and add all of the created zones.
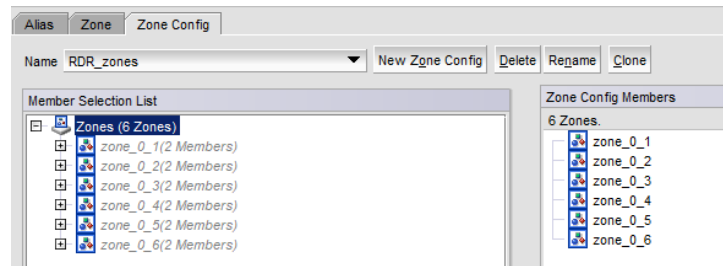
    d. Once the zones are created click **Save Config**, Yes to the prompt.
    e. Wait for the save to complete (*noted on the bottom left of the window*).
12. Click **Enable Config**, select the new config, click **OK** and **Yes** to the prompt.
13. Configuration complete.
14. The NAC/Readers will need to be rebooted to pick up the topology change.
15. To verify that the fiber switch configuration is working properly, log into the NAC console and run the *showfiber* command (see *CLI Reference*) to view the status of the Reader Chassis.

Brocade Diagnostics

This section talks about how to help diagnose fiber connectivity power issues. Fiber is sensitive on how the cable is installed. If the cable is bent, dirty, or fractured, these will all inhibit the signal and create connectivity problems. Dirt is relatively large compared to the size of the core of a single mode fiber. Much of the dirt is hard enough to scratch the fiber if sandwiched between two spring-loaded ferrules. Uncleaned or improperly cleaned connectors can transfer their dirt and contamination to another when mated as well.

source thefoa.org

The end photo is after cleaning the connector; however, ultimately the connector has been damaged as shown in the last image. The final specs are actual indentions on the fiber itself and would require further repair and/or possible re-termination.
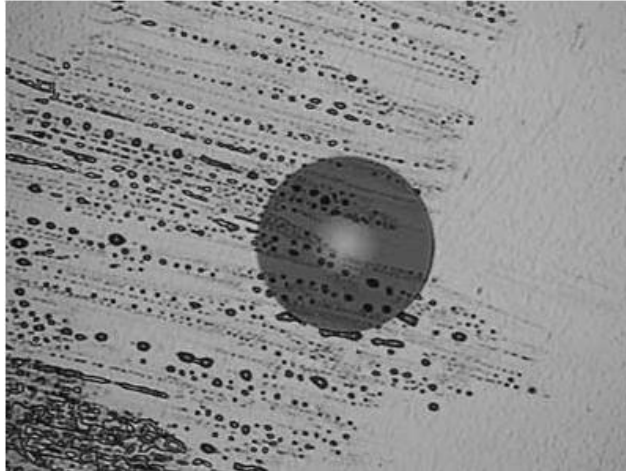
*Example of a fingerprint smudge. *source thefoa.org*

ITI can provide a cleaning instruction upon request.

Power readings between the switch and NAC/Reader can help diagnose fiber problems.

1. Log into the switch via telnet.
2. **At the prompt run: sfpshow <port id> -f**
3. The output will resemble:

```
=============
Port  2:
=============
Identifier:  3    SFP
Connector:   7    LC
Transceiver: 1501001202000000 1,2,4_Gbps SM lw Long_dist
Encoding:    1    8B10B
Baud Rate:   42   (units 100 megabaud)
Length 9u:   4    (units km)
Length 9u:   40   (units 100 meters)
Length 50u (OM2):  0    (units 10 meters)
Length 50u (OM3):  0    (units 10 meters)
Length 62.5u:0    (units 10 meters)
Length Cu:   0    (units 1 meter)
Vendor Name: BROCADE
Vendor OUI:  00:05:1e
Vendor PN:   57-1000014-01
Vendor Rev:  A
Wavelength:  1310 (units nm)
Options:     003a Loss_of_Sig,Tx_Fault,Tx_Disable
BR Max:      0
BR Min:      0
Serial No:   VCF1112100007MB
Date Code:   110516
DD Type:     0x68
Enh Options: 0xf8
Status/Ctrl: 0x92
Alarm flags[0,1] = 0x5, 0x40
Warn Flags[0,1] = 0x5, 0x40
                                  Alarm              Warn
                             low       high      low       high
Temperature: 40    Centigrade   -15       75       -10       70
Current:     40.474  mAmps      1.000    100.000   3.000    90.000
```

```
Voltage:      3267.7  mVolts           2900.0     3700.0     3000.0     3600.0
RX Power:      -6.9   dBm (201.9uW)  4.0      uW  1584.9 uW  6.3     uW  1000.0 uW
TX Power:      -5.4    dBm (1599.5 uW)  631.0  uW  5011.9 uW  1000.0 uW  3162.3 uW

State transitions: 3
Last poll time: 04-27-2020 UTC Mon 00:02:25
```

4. The important readings are the RX/TX power. In the above example RX power indicates the power coming from the Reader (*if this is the NAC port then it's coming from the NAC*). Depending on how the fiber is installed, some Db loss (0-6) is acceptable.
5. The Reader fiber power is displayed on the left screen when the unit is powered on.
6. The NAC fiber power is displayed in the NAC telnet session under the show fiber command.

So how to troubleshoot?

The answer is to look at the RX/TX readings on both sides.

Example 1:

RX: -6.8
TX: -1.9

Port 6
RX: -7.2
TX: -5.2

Fiber

Reader
Chassis
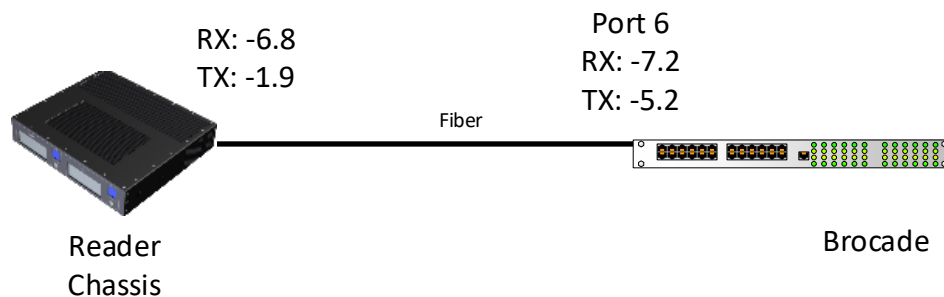
Brocade

This is a healthy example but could still indicate a problem. The Reader is transmitting -1.9 and the Brocade is receiving it at -7.2. That means there's a 5.3 Db loss. Conversely the other line has a 1.6 loss (*brocade TX 5.2 – Reader RX 6.8*). This could indicate a dirty connector. If the fiber is run through patch panels, the dirt could be in any of the termination points and should be analyzed. It is expected that both directions should drop in similar Db loss.

Example 2:

RX: -16.9
TX: -1.2

Port 3
RX: -14.6
TX: -5.1

Fiber

Reader
Chassis

Brocade
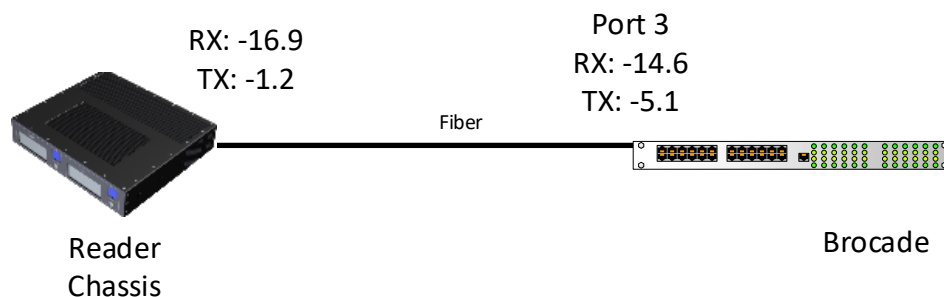
This is an example that indicates the fiber line has a real problem. Readings on both sides indicate a high Db loss which usually indicates the fiber is possibly broken, has bad termination, is very dirty, possible high angle bends. Troubleshooting would be required to determine the exact issue.

Appendix C – Fiber Optic Power Considerations

CAUTION: Optical power outside of specified ranges may result in link failure.
Measure to be sure!!!

General Considerations:
- Keep dust covers on <u>all</u> connectors until ready to connect the fiber cable.
- Interconnect dust caps at NAC and RDR when cable is connected to prevent contamination.
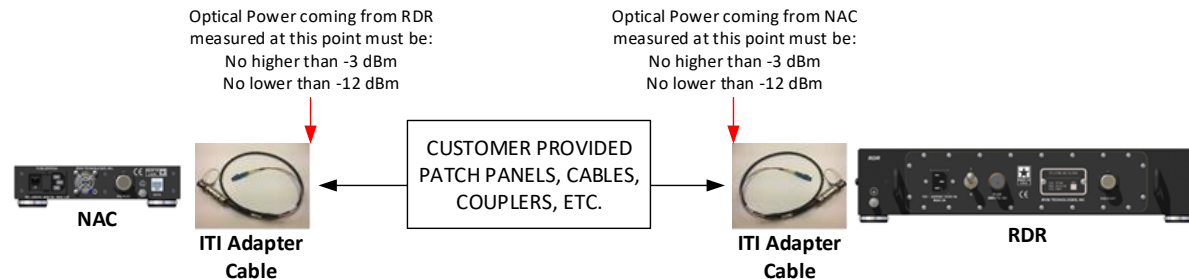

Point to Point Configuration using Direct Interconnect Cable – NAC to one RDR
- No special considerations are necessary.

NAC

RDR

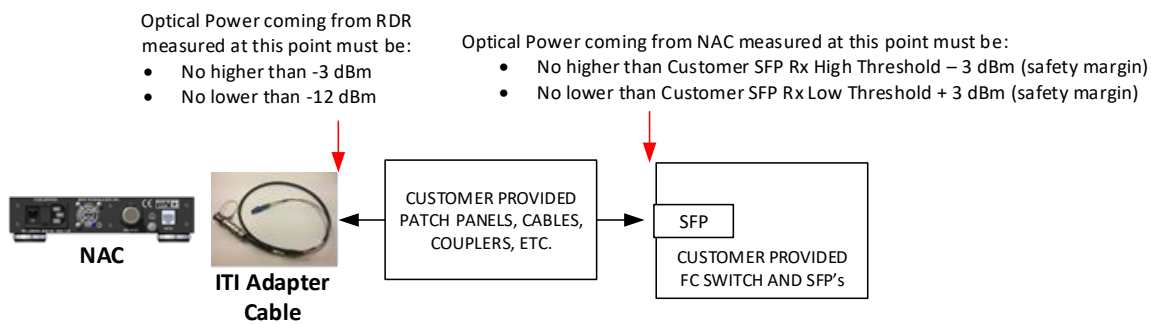**ITI 3m Direct Interconnect Cable**

Point to Point Configuration using MIL to LC adapter cables – NAC to one RDR
- <u>Measure</u> optical power to be sure it is within required sensitivity levels indicated below.
- If optical power is too high, add 5 dB LC attenuator to LC end of the cable

Optical Power coming from RDR measured at this point must be:
No higher than -3 dBm
No lower than -12 dBm

Optical Power coming from NAC measured at this point must be:
No higher than -3 dBm
No lower than -12 dBm

NAC

ITI Adapter Cable

CUSTOMER PROVIDED PATCH PANELS, CABLES, COUPLERS, ETC.

ITI Adapter Cable

RDR

Switched Configuration– NAC to multiple RDR's
- <u>Measure</u> optical power to be sure it is within required sensitivity levels indicated below.
- If optical power is too high, add 5 dB LC attenuator to LC end of the cable

Optical Power coming from RDR measured at this point must be:
- No higher than -3 dBm
- No lower than -12 dBm

Optical Power coming from NAC measured at this point must be:
- No higher than Customer SFP Rx High Threshold – 3 dBm (safety margin)
- No lower than Customer SFP Rx Low Threshold + 3 dBm (safety margin)

NAC

ITI Adapter Cable

CUSTOMER PROVIDED PATCH PANELS, CABLES, COUPLERS, ETC.

SFP

CUSTOMER PROVIDED FC SWITCH AND SFP's

Appendix D – Troubleshooting

This section provides troubleshooting tips for issues that may occur with the device. The lists are ordered from high to low probability.

Reader Chassis displays LINK DOWN

Typical cause: Fiber connection is not healthy.

1. If the NAC and Reader is connected via point-2-point (*p2p*) with no switch in the middle:
    a. Verify that the fiber is connected properly. Some locations are considered p2p but the fiber runs through multiple patch panels which can cause connection failures due to bad or dirty fiber.
    b. If the connection is directly connected via the ITI provided cable, verify that the cable is secured in the back of both the NAC and Reader chassis.

2. If the NAC and Reader is connected via a switch, make sure that the switch is configured:
    a. Log into the switch and check the ports for the NAC and Reader. The port status should be listed as 'Online' (*screen shot depicted in Appendix B*). If it is not showing as online the likely culprits are invalid SFPs on the switch or dirty/broken fiber. Refer to Appendix B for SFP types.
    b. If the switch shows status as online for each device, make sure the zoning configuration is correct. Refer to Appendix B for zoning information.

3. Verify that the NAC is powered on.

Reader Chassis displays PMD RDY after pressing download button

Typical cause: FTP server is not healthy.

1. Telnet to the NAC and run 'testFTP' to determine the health of the FTP server. Errors will be reported to the console.

NAC reboots unexpectedly after adding a new RDR

Typical cause: Configuration not saved before reboot.

1. Telnet to the NAC and run 'lforConfigClearKnownRdrs' to clear previous WWN names from the configuration. Then re-verify the RDR serial numbers on the **cfg** daemon using 'print'.