

DV6016RPS Repeater Shelf

Equipment Manual

060660-001 Rev C



**Equipment Manual
for
DV6016RPS Repeater Shelf**



DV6016RPS Repeater Shelf

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About this Manual

Who Should Use This Manual?

This manual is written to provide a system engineer/technician with information to install and operate the Repeater Shelf. It is designed to lead the user through the whole series of operations that he/she may need to perform.

What Should I Do First?

It is very important that you read Section 1 first. Familiarize yourself with the safety precautions and the terms used throughout this manual. Also, make sure that you received all the equipment you ordered and that it is in good physical condition.

How Is This Manual Organized?

Section 1 gives an overview of safety precautions and the inspection process and lists other documentation related to the Repeater Shelf. Section 2 gives a detailed physical and functional description of the equipment. Section 3 contains Task-Oriented-Practice (TOP) procedures for the installation and operation of the Repeater Shelf.

Revision History

REVISION	DATE	REASON FOR CHANGE
Original	7/95	Initial Release
A	12/95	Incorporates the shelf controller, dual optical switch modules and information bulletin #DV-07(DV6000 Grounding)
B	2/99	Incorporates new system design lines, less stringent ventilation requirements and new modes (firmware versions 7, 10, and 11).
C	3/02	Trademark Updates

Related Publications

Listed below are the titles and part numbers of manuals related to this one. Copies of these publications can be ordered by contacting Sales Representative.

Title/Description	Part Number
DV6000 Installation and Operation Manual	PN 060681-001

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SECTION

1

Read This First

1.1 Important Rules for Safety



NOTE: Please read this section carefully before beginning installation or operation.

*Table 1.1.
Admonishments used
in this documentation*

A black and white icon of a hand with the index finger pointing to the right.	NOTE	Designed to draw the user's attention to a particular part of a procedure or explanation which is considered to be of higher importance or worthy of extra attention.
A yellow triangular warning sign with a black exclamation mark in the center.	CAUTION	Designed to direct the user's attention to a specific task which, if not performed carefully, can cause serious damage to equipment.
A red octagonal stop sign with the word "STOP" in white capital letters in the center.	WARNING	Designed to direct the user's attention to a procedure or task which, if not performed carefully, can cause physical injury to the user.

1.2 Safety Precautions

The DV6000 system conforms to the requirements of a Class I laser product as defined in the US Department of Health and Human Services, Bureau of Radiological Health Regulation 21 CFR Subchapter J.

While Class I radiation levels are not exceeded when equipment components are handled per instructions, enough invisible infrared energy is emitted from the end of an active fiber to damage the retina of the eye. To avoid potentially dangerous laser radiation, follow the operating and servicing procedures set forth in this manual in the sequences specified. DANGER labels on the equipment alert users to the potential for exposure to hazardous amounts of invisible radiation.



WARNING: DO NOT look into a transmitter's optical bulkhead receptacle or an active fiber end emanating from a transmitter. DO NOT look at an optical fiber that is connected to an operating transmitter but not connected to a receiver. There may be no visible indication of light, but invisible radiation can seriously damage the retina of the eye. Immediately place a cap or hood over any radiating bulkhead receptacle or connector to avoid potentially dangerous radiation exposure. In addition to helping prevent injury, capping connectors also keeps dirt particles from entering them. C-COR.net also strongly recommends that you turn optical transmitters off before performing fusion splicing.



CAUTION: DV6000 equipment is electrostatic discharge sensitive. To prevent electrostatic discharge damage, wear a grounded wrist strap when you touch DV6000 equipment. Always place units on an approved, grounded, antistatic surface. Use antistatic packaging when transporting equipment.

CUSTOMER COMPLIANCE NOTICE



CAUTION: Changes or modifications to this unit not expressly approved by C-COR.net could void the user's authority to operate the equipment.

FCC COMPLIANCE NOTICE



NOTE: This equipment has been tested and found to comply with the limits for a Class A 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 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 the interference at his own expense.

PRODUCT SAFETY NOTICE



NOTE: This equipment has been tested and found to comply with United States Product Safety Standard UL-1950.

Other product compliance standards may apply.

1.3 Inspection of Equipment and Customer Return Policy

C-COR.net thoroughly inspects all equipment before shipment. Equipment is then carefully packed in secure containers, encased in packing material, to ensure that it leaves the plant in factory fresh condition. The carrier bears responsibility for its safe delivery.

Immediately upon receiving the shipping container, check it for dents, water damage, or other visible signs of improper handling during shipment. Do not remove the equipment from the shipping container and the protective plastic bag until you are ready to use it.

If You Find Visible Damage...

If you notice that the shipping container shows signs of improper handling, note that fact on the freight bill and have the carrier's representative sign it. Then contact the carrier to file a damage report. Also, contact C-COR.net to let us know that the equipment you received was damaged by the carrier. For contact information, see "*Contacting C-COR.net Technical Service*" in this Front Matter.

If You Find Hidden Damage...

Occasionally, the contents of a shipping container are damaged even though the container does not appear to be damaged. The most likely cause is rough handling during transit. If you find this to be the case, contact C-COR.net. For contact information, see "*Contacting C-COR.net Technical Service*" in this Front Matter.

If Parts of Your Order are Missing...

After you have inspected for damage, verify that you've received everything you ordered. The best way to do this is to compare the packing slip to the original purchase order. If you find a discrepancy, contact C-COR.net. For contact information, see "*Contacting C-COR.net Technical Service*" in this Front Matter.

If You Must Return Equipment...

If you find it necessary to return equipment to us, you must first obtain a Returned Merchandise Authorization (RMA). To request an RMA, contact C-COR.net. For contact information, see "*Contacting C-COR.net Technical Service*" in this Front Matter.

Always retain the original shipping container, packing material, and protective foam, and use them for repacking should it become necessary to return the equipment.

SECTION**2**

Introduction to the DV6016RPS Repeater Shelf

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2.1 General Description

The DV6016RPS Repeater Shelf (RPS) is an equipment shelf that mounts in a standard 19- or 23-inch EIA or WECO equipment rack. It provides two slots for power supplies, one dedicated slot for the Repeater Shelf controller and six slots for optical receivers, optical transmitters, and /or optical switches, in various combinations (maximum 6 modules total).

For 1-in, 1-out repeater service, an RPS is equipped with one or two power supplies and up to three receiver/transmitter pairs. Each optical receiver sends its electrical data-signal output through a short coaxial patch cable to the data input connector of the adjacent optical transmitter. An alternative 1-in, 2-out repeater configuration uses either one or two receivers, each feeding two transmitters.

An RPS may also be used to add redundant fiber path capability to one or more nearby DV6016ES equipment shelves. In this “optical shelf” service, the RPS is equipped with one or two power supplies and up to six optical transmitters. The transmitters receive their data inputs (through coaxial patch cables up to 60 inches long) from the electrical data-signal outputs of DV6016MX multiplexer or DV6016DAP drop/add/pass modules in the DV6016ES shelves.

The addition of a Repeater Shelf Control Module enables remote status monitoring for repeater applications and management/control of Dual Optical Switch modules for backup protective switching. With a Controller, the RPS becomes an integral component in DV6000 protective redundant ring or folding ring system configurations.

2.2 Physical Description

The RPS (**Figure 2-1**) is a single-shelf chassis 10.5 in. (26.67 cm) high (six rack units), 11 in. (27.94 cm) deep (same depth as the DV6016ES equipment shelf), and 17.5 in. (44.45 cm) wide. Its mounting flanges extend the full front width to 19-in. (48.26 cm), and have mounting holes for installation in a standard 19-inch equipment rack with either EIA or WECO spacing. Extender brackets allow installation in a 23-inch rack.

A ground jack is mounted on the ventilation panel beneath the power supply slots to accommodate a wrist-strap banana plug.

The inside of the shelf’s rear panel is equipped with two 19-socket female connectors for plug-in connection of one or two power supplies, and with a backplane board containing seven 40-pin male connectors. Six of the backplane connectors are for plug-in connection of optical modules, either receivers, transmitters or switches. The seventh is for the Repeater Shelf Controller card.

The shelf’s rear panel contains a spring-loaded tie point for connection to the office ground, and two 3-pin male connectors for plug-in connection of a 110- or 220-VAC power line to each installed power supply. Two 2-position terminal blocks permit power-supply connections to an office’s 48-VDC battery plant instead, where applicable.

Additional rear-panel connectors are three RJ-11 connectors for RS-485 network monitoring and control wiring and two 2-position terminal blocks for access to normally open major- and minor-alarm relay contacts.

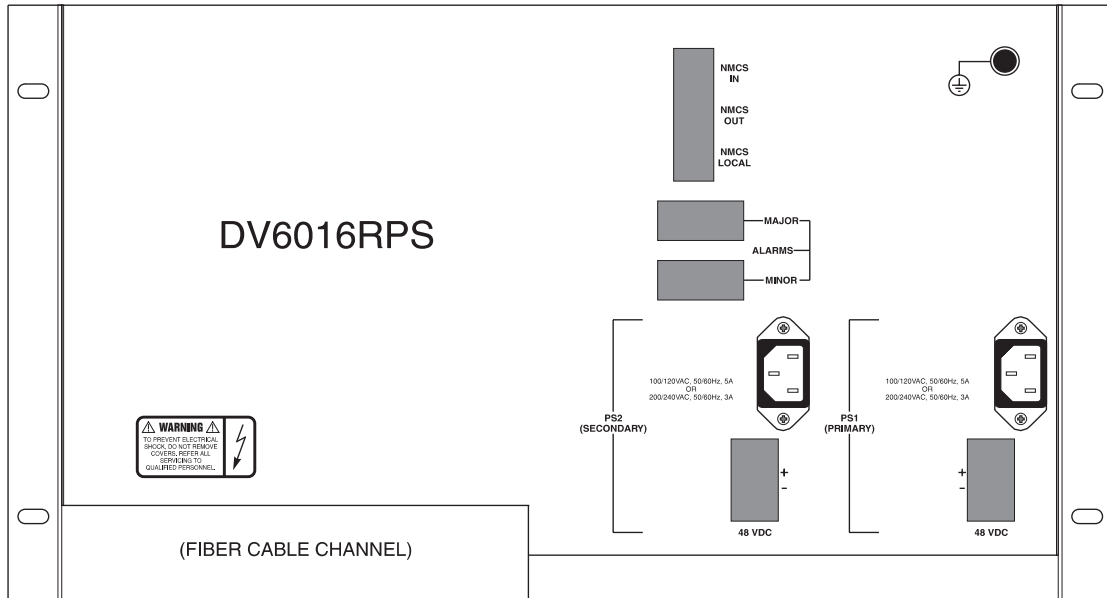


Figure 2-1. Front View of Repeater Shelf

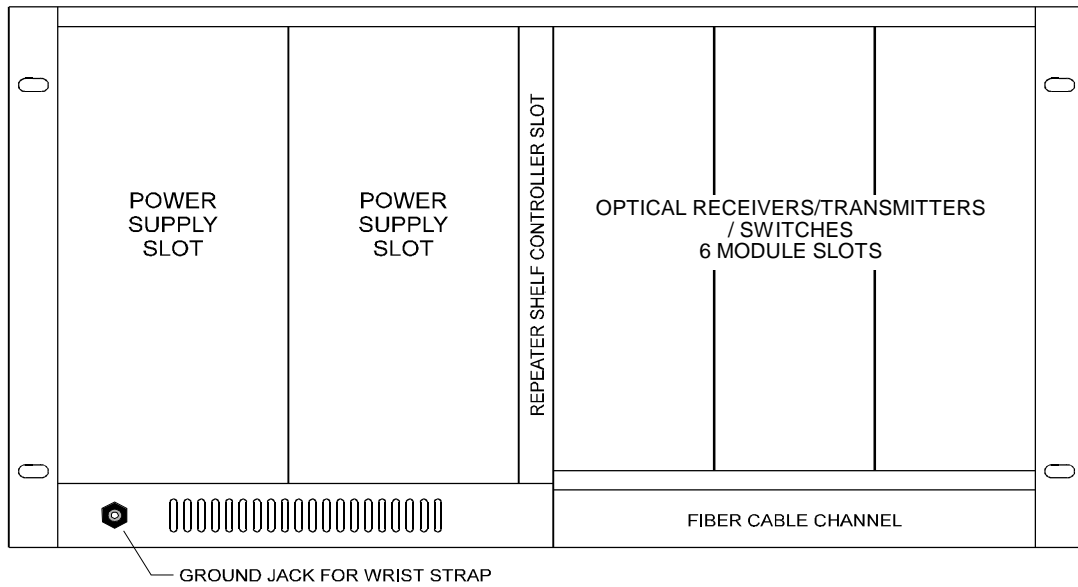


Figure 2-2. Rear View of Repeater Shelf

2.3 Plug-in Modules

2.3.1 Power Supplies

Any of the following power supply modules may be installed in the RPS:

- DV6011PSA, DV60ACPSB For 110-VAC input
- DV6022PSA, DV60ACPSB For 220-VAC input
- DV6048PSA, DC6048PSB For 48-VDC input

Any of these modules can supply the ± 5 and ± 12 VDC power required by all other modules installed in the shelf. Installing two power supplies provides full power redundancy (automatic backup if either supply fails). **Figure 2-3** shows the front-panel arrangements of the power supplies. **Table 2-1** describes their test point, display, and control functions.

Table 2-1. Front Panel Controls, Indicators, and Connections for Power Supplies

TYPE	NAME OF INDICATOR, CONTROL, OR CONNECTION	FUNCTION
Test point	+12 V	Test point for the nominal +12 VDC secondary power rail. This supply is normally set high at +12.8 VDC $\pm 3\%$ to overcome backplane voltage drops (including steering diodes on modules).
Test point	-12 V	Test point for the nominal -12 VDC secondary power rail. This supply is normally set high at -12.8 VDC $\pm 3\%$ to overcome backplane voltage drops (including steering diodes on modules).
Test point	+5 V	Test point for the nominal +5 VDC primary power rail. This supply is normally set high at +5.35 VDC $\pm 3\%$ to overcome backplane voltage drops (including steering diodes on modules).
Test point	-5 V	Test point for the nominal -5 VDC primary power rail. This supply is normally set high at -5.45 VDC $\pm 3\%$ to overcome backplane voltage drops (including steering diodes on modules).
Test point	GND	Ground reference point when measuring voltages at the ± 5 or ± 12 VDC test points.
LED (red)	FAIL	The FAIL LED illuminates if the power supply's secondary output voltages depart more than 20%, or its primary output voltages vary more than 10%, from the factory-set values listed above. Switching a supply off also lights its FAIL LED if a second supply installed in the shelf is providing backup power. Under normal operating conditions, this LED remains off.
LED (green)	DC-OK	The DC-OK LED remains illuminated as long as the power supply's secondary output voltages are within $\pm 20\%$, and its primary voltages are within $\pm 10\%$, of the factory-set values listed above.

FOR 110- OR 220-VAC DV6011PSA, DV6022PSA & DV60ACPSB POWER SUPPLIES ONLY:		
Switch	0, 1	On/off switch for the power supply (and for the shelf if only one supply is installed). 0 position: supply off. 1 position: supply on.
Fuseholder	FUSE	Replaceable fuse that provides protection in case of an overload condition: DV6011PSA:T 6.3A, 250V;DV6022PSA:T 3.15A, 250V; DV60ACPSB:T 8A, 250V
FOR 48-VDC DV6048PSA & DV6048PSB POWER SUPPLIES ONLY:		
Switch/	0, 1	10-Ampere protective circuit breaker that doubles as the Circuit on/off switch for the power supply (and for the shelf if Breaker only one supply is installed). 0 position: supply off. 1 position: supply on. An overload trips the breaker to the 0, or off, position. When the overload condition has been corrected, the breaker must be manually returned to the 1, or on, position.
Test points	+, - 48 V	Test points for measuring the actual input voltage (36-72 VDC) available at the power supply from the nominal 48-volt battery plant.

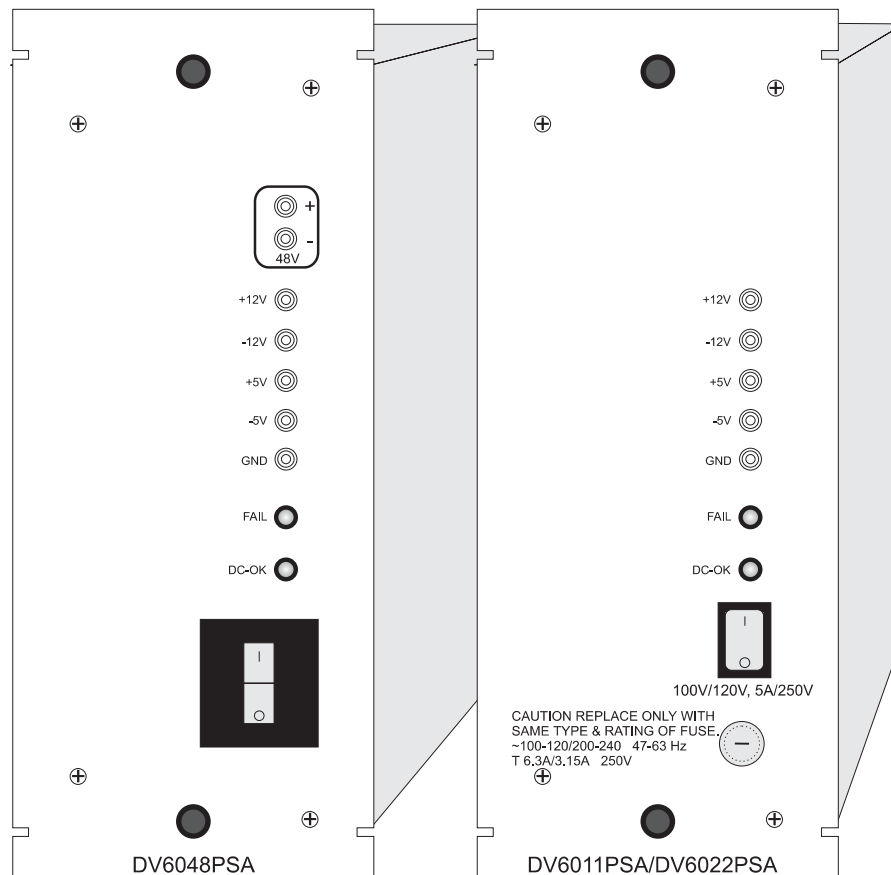


Figure 2-3. Power Supply Front Panels

2.3.2 Repeater Shelf Controller

The Repeater Shelf Controller module occupies the slot immediately adjacent to the power supplies. **Figure 2-4** shows the front-panel arrangement of the DV6016RPC Repeater Shelf Controller. **Table 2-2** describes Controller front-panel display, test point, and signal connection functions. **Table 2-3** describes alarm states and conditions reported by the Controller module.

The DV6016RPC Repeater Shelf Controller provides status and control functions for all modules installed in the DV6016RPS Repeater Shelf.

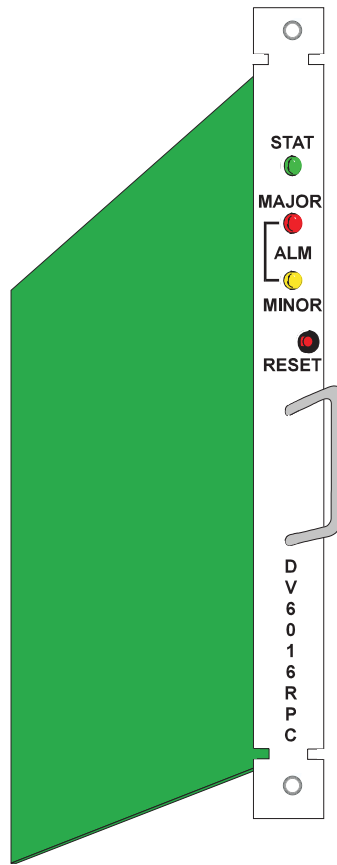


Figure 2-4. Repeater Shelf Controller Front Panel

The Repeater Shelf Controller is also capable of monitoring “subtended” DV6016ES Equipment Shelves. Subtended shelves are shelves co-located with the Repeater Shelf that are controlled by the Repeater Shelf Controller module through the RS485 interface. The Controller can monitor received signal status from Demultiplexor (DV-6016-DX2) and Drop/Add/Pass “DAP” (DV-6016-DAP2 or DV-6016-DAP-UG firmware upgrade) modules mounted in DV6016ES Equipment Shelves, and uses this information to determine when an optical switch position needs to be changed.

Commands from network management and control software intended for subtending shelves are passed along by the Repeater Shelf Controller directly to the appropriate shelf. Refer to the *SMART-NETT User’s Manual, DV6000 and Optiworx Products*, PN 060919-001, for information on using DV6000 SMART-NETT software to manage the Repeater Shelf Controller and subtending shelves. Responses from the subtending shelves to the Network Manager are also passed by the Controller.

Table 2-2. Front Panel Indicators and Controls for Repeater Shelf Controller DV6016RPC

TYPE	NAME OF INDICATOR OR CONTROL	FUNCTION
LED	STAT	Indicates the operating condition of the Repeater Shelf Controller. GREEN indicates no detected failures. RED indicates an internal failure of the controller. Upon receipt of an OSS command for the DV6016RPS this LED will go OFF, and will light again upon successful execution of the command.
LED	MAJOR ALM	Indicates the receipt of a Major Alarm from any one of the monitored components. GREEN indicates no alarms in the DV6016RPS. RED indicates a major alarm.
LED	MINOR ALM	Indicates the receipt of a Minor Alarm from any one of the monitored components. GREEN indicates no alarms in the DV6016RPS. YELLOW indicates a minor alarm.
Push-Button (recessed)	RESET	Depressing this push-button forces a Repeater Shelf Controller processor REBOOT.

All inputs and outputs for the DV6016RPC are connected at the rear panel, and travel through the edge connector on the module. The monitoring and control functions of the Repeater Shelf Controller are accessible via RJ11 connectors on the rear panel of the shelf. The Controller communicates with modules installed in the shelf through the backplane buses of the Repeater Shelf.

Table 2-3. Alarm Conditions Reported by the Repeater Shelf Controller DV6016RPC

MONITORED EQUIPMENT	ALARM	CONDITION
Power Supply DV6011PSA, DV6022PSA, and DV6048PSA	Major	One power supply installed; any output voltage over/under or Two power supplies installed, any output voltage over/under on both supplies.
Power Supply DV6011PSA, DV6022PSA, and DV6048PSA	Minor	Two power supplies installed; any output voltage over/under on either supply.
Optical Transmitters DV6301TXD and DV6501TXD	Major	Transmitter Laser bias is out of range or Transmitter TEC Current Out Of Range or Transmitter Bias out of Limit
Optical Transmitters DV6301TXD and DV6501TXD	Minor	Loss of Data or Transmitter Laser bias out of range or Transmitter TEC Current Out Of Range
Optical Receiver DV6302RCQ	Major	Receiver Loss of optical input power
Optical Receiver DV6302RCQ	Minor	Receiver Loss of Data or Receiver low optical input power
Dual Optical Switch DV6120DS	Major	Switch failure (no switch action detected in response to switch command)

2.3.3 Optical Receiver

Figure 2-5 shows the front-panel arrangement of the DV6302RCQ optical receiver module used in the RPS for repeater applications. **Table 2-4** describes receiver front-panel display, test point, and signal connection functions. (There is also an SM DEFEAT/NORMAL switch accessible only from the side of a receiver module. This switch has no effect on a receiver in an RPS running without a controller card installed.)

Optical connection to the receiver is through a front-mounted super FC/PC bulkhead adapter. The bulkhead is at a 45° angle to the module's vertical front panel to keep the optical pigtail from extending beyond the front of the mainframe after installation.

Optical automatic gain control (AGC) keeps the receiver's electrical output at a constant level regardless of received optical power, as long as the latter remains between 1 μ W (–30 dBm) and 150 μ W (–8 dBm).

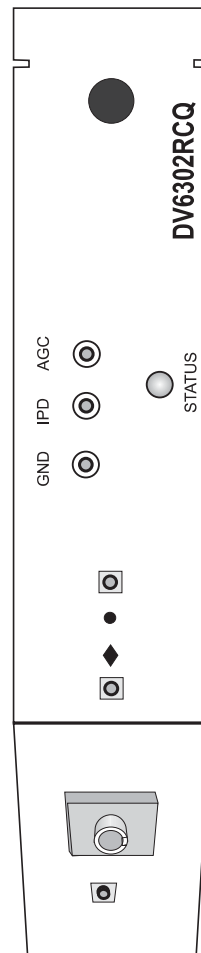


Figure 2-5. Optical Receiver Module

Table 2-4. Front Panel Indicators, Test Points, and Signal Connections for Optical Receiver DV6302RCQ

TYPE	NAME OF INDICATOR, CONTROL, OR CONNECTION	FUNCTION
LED	STATUS	Indicates condition of optical signal being received. GREEN indicates that the detected power level is normal, between 1 μ W (–30 dBm) and 150 μ W (–8 dBm). RED indicates that the detected power level is <1 μ W (–30 dBm). AMBER indicates that the received optical power level is >100 μ W (–10 dBm), that there is no data modulation, or that the bit rate is outside the lock limit (from a far-end MUX or DAP failure).
DVM	AGC	Test point for measuring automatic gain control voltage. Reading test point here should be between +1 and +2 volts.
DVM	IPD	Test point for measuring InGaAs APD (avalanche test point photodiode) current, with a scale factor of 50 mV/ μ W. At a reading of about 2.5 V (50 μ W), the APD bias loop goes into a current limiting mode to protect the device, and IPD voltage no longer reflects the optical power being received. If received power is >100 μ W (–10 dBm), a test point low-reflection optical attenuator should be installed in the span cable to reduce the level to between 30 μ W and 50 μ W. An IPD reading of <0.040 +/- .002V switches the STATUS LED to RED.
DVM	GND	Ground reference point when measuring AGC or IPD test-point test point voltages.
SMB - Male	•	Clock signal synchronized with the optically received (Clock) signal. Companion to the ♦ (A Data) signal.
SMB - Male	♦	Retimed 2.38 Gbps main data signal as derived from the (A Data) received optical signal. Data sense is the same as at the far-end transmitter. The falling edge of the companion clock signal (above) is in the middle of a data bit.
FC Bulkhead	Optical	FC bulkhead adapter compatible with a super FC/PC Input connector terminating the incoming fiberoptic cable.
SMB - Male	B Data	Complement (inverse) of the ♦ (A Data) signal.

2.3.4 Optical Transmitters

Either of the following two optical transmitter modules may be installed in the RPS:

- DV6301TXD For 1310 nm wavelength transmission
- DV6501TXD For 1550 nm wavelength transmission

Figure 2-6 shows the front-panel arrangement of the transmitter modules. **Table 2-5** describes their front-panel display, test point, and signal connection functions. (There is also an SM DEFEAT/NORMAL switch accessible only from the side of a transmitter module. This switch has no effect on a transmitter in an RPS running without a controller card installed.)

Optical connection to a transmitter is through a front-mounted super FC/PC bulkhead adapter. The bulkhead is at a 45° angle to the module's vertical front panel to keep the optical pigtail from extending beyond the front of the mainframe after installation and is protected by a metal cage.

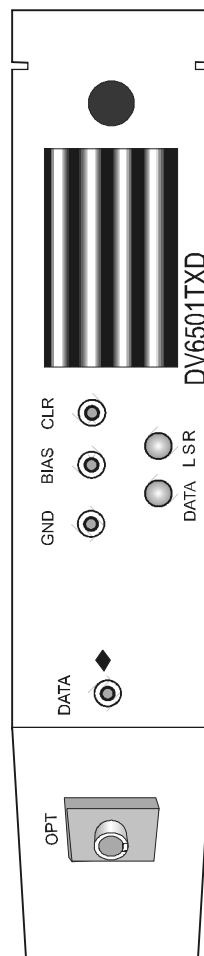


Figure 2-6. Optical Transmitter Module

Table 2-5. Front Panel Indicators, Test Points, and Signal Connections for Optical Transmitters DV6301TXD and DV6501TXD

TYPE	NAME OF INDICATOR, CONTROL, OR CONNECTION	FUNCTION
LED	LSR	Indicates status of laser and thermoelectric laser cooling control. GREEN indicates that both are operating normally. RED indicates that laser current has increased by 20 mA and the laser either failed or is near failure. AMBER indicates excessive thermoelectric cooler current (>860 mA) and that the module's thermal environment should be evaluated.
LED	DATA	Indicates condition of electrical data input signal being received. GREEN indicates that random data is present. AMBER indicates lack of the expected density of data transitions at the module's input. This is a coarse indication only. It can occur even with data present if the input's bit rate is off frequency; that condition would be detected at the downstream receiver.
DVM	CLR	Test point for measuring thermoelectric cooler current, with test point a scale factor of 1 mV/mA. Measurements typically range between 50 and 800 mV. The higher the positive voltage, the more the laser is being cooled.
DVM test point	BIAS	Test point for measuring normalized laser DC bias current. When the transmitter is initially set up under steady-state conditions, this is set to 1.00 V. The scale factor for evaluating changes in laser bias caused by aging is 50 mV/mA. Readings typically show a slow (and acceptable) wander of ± 100 mV related to thermal environment and data activity, but readings approaching 2.5 V mean the laser is nearing the end of its useful life.
DVM test point	GND	Ground reference point when measuring CLR or BIAS test-point voltages.
SMB Female	◆ (Data)	Connector for the electrical data input signal.
FC Bulkhead	Optical Output	FC bulkhead adapter compatible with a super FC/PC connector terminating the outgoing fiberoptic cable.
APC Bulkhead	Optical Output	APC Bulkhead adapter compatible with an APC connector terminating the outgoing fiberoptic cable.
SC Bulkhead	Optical Output	SC Bulkhead adapter compatible with an SC connector terminating the outgoing fiberoptic cable.

2.3.5 Dual Optical Switch

The DV6120DS Dual 1x2 Optical Switch provides two independent, controllable single mode optical switches, designated S1 and S2, with full status monitoring and remote control. **Figure 2-7** shows the front-panel arrangement of the Dual Optical Switch modules. **Table 2-6** describes their front-panel display and signal connection functions.

The Dual Optical Switch module may occupy any of the six general/optical slots to the right of the Repeater Shelf Controller module. Each switch in the module is capable of receiving two inputs, an X input and a Y input. These inputs can be either 1310 or 1550nm single mode optical signals.

The Dual Optical Switch can be operated via the front panel or by means of a signal received from the Repeater Shelf Controller Module. These controls provide independent positioning of two single pole, double throw, single mode optical switches.

Two modes of operation are possible with the Switch module: (1) Automatic Protective Switching Enabled, and (2) Automatic Protective Switching Disabled. Mode status and switch position can be determined from front panel indicators and via Network Management elements.

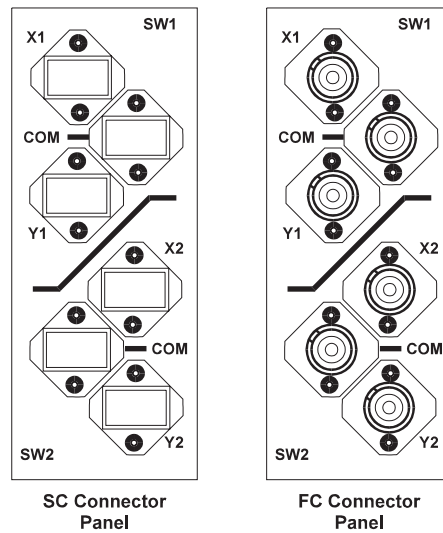
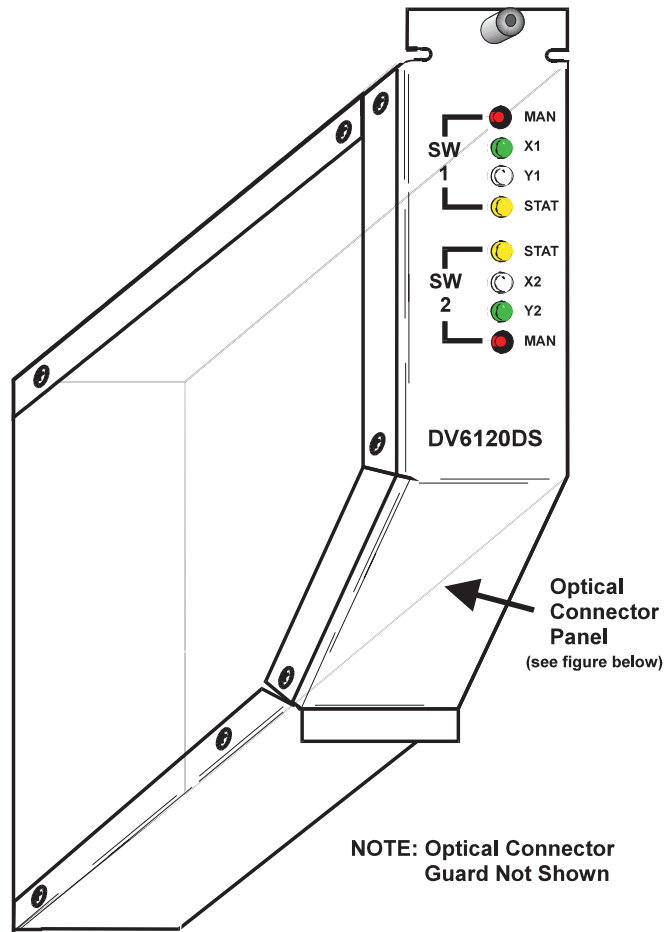


Figure 2-7. Dual Optical Switch Module

Table 2-6. Front Panel Indicators, Controls and Signal Connections for Dual Optical Switch module DV6120DS

TYPE	NAME OF INDICATOR, CONTROL, OR CONNECTION	FUNCTION
Push-button (recessed)	MAN (Manual Switch, 1 per switch, 2 per module)	With Automatic Switching Enabled this switch will cause the corresponding optical switch to toggle. The Repeater Shelf Controller may then, toggle the switch again, depending on signal conditions. With Automatic Switching Disabled (Due to Network Configuration or absence of the Controller module), pushing this switch will toggle the corresponding optical switch unconditionally.
LED	X1	This indicator will light GREEN when switch 1 is in the X position.
LED	Y1	This indicator will light GREEN when switch 1 is in the Y position.
LED	STAT (Automatic Protective Switching Status one per switch, two per module)	This indicator will light GREEN when Automatic Protective Switching is Enabled and the Repeater Shelf Controller is present. It will light YELLOW when Manual Switching is selected due to absence of the Controller module or Automatic Protective Switching being Disabled with the Controller present. It will light RED when no switching action is detected following an RPC command.
LED	X2	This indicator will light GREEN when switch 2 is in the X position.
LED	Y2	This indicator will light GREEN when switch 2 is in the Y position.
Bulkhead Connector	X (1 per switch, 2 per module)	This connector provides the X lead input to the optical switch, available to support Ultra FCPC or Ultra SCPC connectors.
Bulkhead Connector	Common (1 per switch, 2 per module)	This connector provides the common lead output from the optical switch, available to support Ultra FCPC or Ultra SCPC connectors.
Bulkhead Connector	Y (1 per switch, 2 per module)	This connector provides the Y lead input to the optical switch, available to support Ultra FCPC or Ultra SCPC connectors.

2.4 Functional Description

2.4.1 Repeater Shelf Facilities

The RPS (repeater shelf) chassis provides a versatile home for certain subsets of DV6000-system plug-in modules. Mechanically, the shelf serves the modules' physical support (mounting), access, and ventilation needs. Electrically, it provides a prefabricated network of power, system communication, and local alarm circuit pathways that can interconnect numerous possible combinations of current and future modules. Without a controller card installed, system communication and alarm circuit pathways built into the RPS remain inactive.

Adding a controller card activates three serial digital busses that support full DV6000 system communications through unique 3-bit identification of any anticipated module in any possible slot position. These serial busses are referred to as I²C busses. Each of the busses provide a path for control and status monitoring between the Repeater Shelf Controller and dedicated slot positions. Slot positions are also paired for repeater functions and for automatic protection in the following manner: slot 1(primary) with slot 2 (secondary), slot 3 (primary) with slot 4 (secondary), slot 5(primary) with slot 6 (secondary).

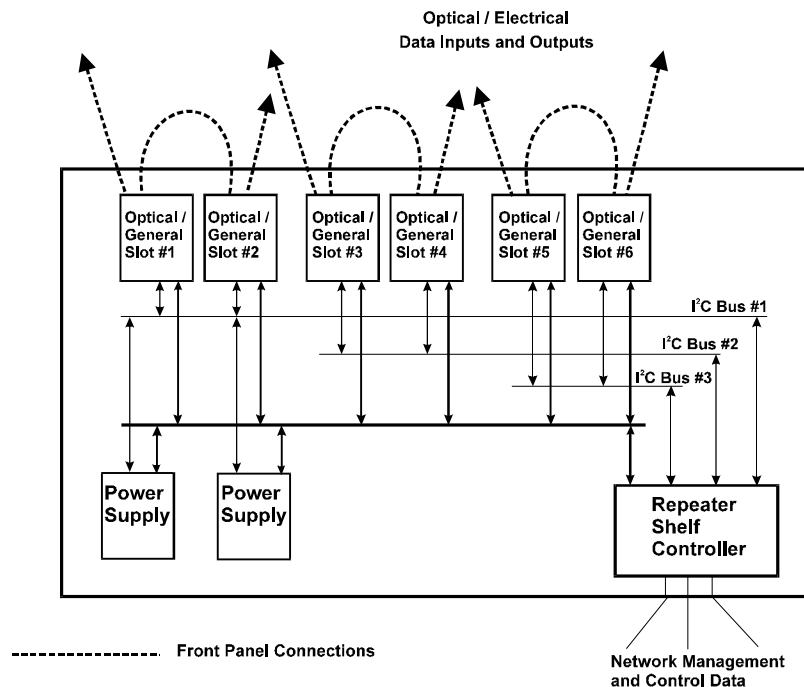


Figure 2-8. Block Diagram: Repeater Shelf Bus Architecture

Figure 2-8 is a basic block diagram of the internal bus architecture of the DV6016RPS Repeater Shelf with the Controller installed. The Controller connects through its edge connector to the bus and three I²C interfaces. Alarm conditions in any module(s) are reported to the controller card, which sets major or minor alarm circuits for the shelf as a whole. Network Management is connected to the Controller through two RJ11 connectors with RS485 interface, that are connected in a daisy chain with any other DV6000-related equipment at the site. A third RJ11 connector connects a subtending shelf, or daisy-chained subtending shelves, to the RPS.

Network Management can be used to configure the Repeater Shelf to operate in any of several specific operating modes. Automatic switching of a module in the RPS can be made dependent on the state of modules in a subtending DV6000 shelf, automatic switching can be enabled or disabled, switching time can be adjusted by assigning a time delay, and the actual operating mode, designating switching conditions, can be assigned.

For DV6000 SMART-NETT Users -

Specific operating modes can be assigned in DV6000 SMART-NETT in the Repeater Shelf's OSM Configuration window. Automatic switching of a module in the RPS can be made dependent on the state of modules in a subtending DV6000 shelf by the entry of the DV6000 shelf DAP's Serial Number in the Repeater Shelf's OSM Configuration window. In the same window, automatic switching can be enabled or disabled, and switching time can be adjusted by assigning a time delay. And the actual operating mode can be designated.

For example, for the shelf to operate in "B Path Disable" mode (used in Redundant Ring and Folding Ring networks), a transmitter in one slot in the shelf must be paired to the subtending shelf DAP by the entry of the DAP S/N. Time delays must be set to "0", automatic switching protection must be enabled, and the "Subtending" field of the OSM Configuration window must be set to "FN".

DV6000 SMART-NETT designates four different modes - five choices for the Subtending field: none, HW, FN, DV, and RSR. These mode tags do *not* correspond directly to the applications described in this section. They can be quickly described as follows:

none: There is no subtending shelf connected to the Repeater Shelf, so switching is dependent on nothing outside that RPS.

HW: This operating mode is called Receiver Alarm/Transmitter Disable. It is used with paired optical receivers and transmitters in the Repeater Shelf. Receivers are placed in the primary slot of each pair (slot 1 of 1 & 2, 3 of 3 & 4, 5 of 5 & 6), and transmitters in the secondary slot. The transmitter will be enabled or disabled according to the data alarm status of its paired receiver. Time delays can be set for polling and re-enabling. See paragraph 2.4.4.

FN: This is "B Path Disable" mode. Operating in this mode, the Repeater Shelf Controller will monitor the state of a designated DAP. When the DAP switches to its "B" path, or if DAP/RPC communication fails, the Controller will disable the module installed in the slot paired with the DAP.

DV: This operating mode manages optical switches for protective switching with subtending DV6000 equipment shelves. With protective switching enabled, optical switches will toggle between different inputs in response to alarms reported by DAPs or DEMUXes paired to the switch module. See paragraph 2.4.7.

RSR: This operating mode manages optical switches for protective switching with subtending Single Channel Remote Receiver units. With protective switching enabled, optical switches will toggle between different inputs in response to alarms reported by Remote Receivers paired to the switch module. See paragraph 2.4.7.

Refer to the “DV6000 SMART-NETT Model #DV9903 User’s Manual”, PN 060834-001 for more information about using SMART-NETT to configure the RPS. These operating modes allow the Repeater Shelf to be used in some of the applications discussed in this section (Section 2.4).

2.4.2 Power Supply Considerations

A single power supply module (installed in either power supply slot) can meet all shelf needs. Adding a second supply reduces loading of the first, but more importantly, each then provides automatic backup for the other in case of a supply failure.

HOT INSERTION/REMOVAL OF MODULES



NOTE: Inserting or removing any module while the RPS is in service (with either one or two power supplies in use) may induce transient, short duration bit errors in other modules in the shelf. Any such errors will not affect long-term system operation.

2.4.3 Repeater Service

The 30 dB drop in optical signal strength allowable in a single DV6000 system fiber optic link occurs over about 75 km (45 miles) for 1310-nm transmission, or about 90 km (55 miles) for 1550-nm transmission. The optical signal can then be restored to its original launch power level of 0 dBm by converting it to an electrical data signal in a DV6302RCQ optical receiver and immediately feeding that signal into a DV6301TXD or DV6501TXD optical module for retransmission as a refreshed optical signal. See the “Recommended Design Guidelines” with the Specifications at the end of this Section.

2.4.4 RPS Provisioned for 1-In, 1-Out Repeater Service

Figure 2-9 is a functional block diagram showing how modules interrelate in an RPS provisioned for straight-through repeater service.

In this configuration, one RPS can provide repeater service for one, two, or three fiber optic circuits. Each incoming fiber optic cable goes to the optical input connector of a DV6302RCQ receiver. The receiver’s electrical data output signal goes through a short coaxial patch cable to the data input connector of an adjacent DV6301TXD or DV6501TXD optical transmitter, and the transmitter feeds the outgoing fiberoptic cable.

For this purpose, the receiver and transmitter modules must be placed in adjacent, paired slots. A receiver would reside in slot #1, and it would connect by patch cable to a transmitter in slot #2. Another receiver/transmitter pair would reside in slots #3 and #4, and another in #5 and #6.

This application does not require a controller card. However, with no controller card, no software control or shelf alarming is possible; the only alarm reporting would be at the LEDs on the module front panels. A controller card in the shelf would allow remote control of the shelf and modules, and remote and local shelf alarming. If set to operate in **Receiver Alarm/Transmitter Disable mode**, it also allows the transmitter of a receiver/transmitter pair to be disabled when the receiver goes into an alarm state.

(DV6000 SMART-NETT Users: In order to operate in Receiver Alarm/Transmitter Disable mode, each Optical Switch must be set to “HW” in the “Subtending” field of the OSM Configuration window. Refer to the “DV6000 SMART-NETT Model #DV9903 User’s Manual”, PN 060834-001 for more information about using SMART-NETT to configure the RPS.)

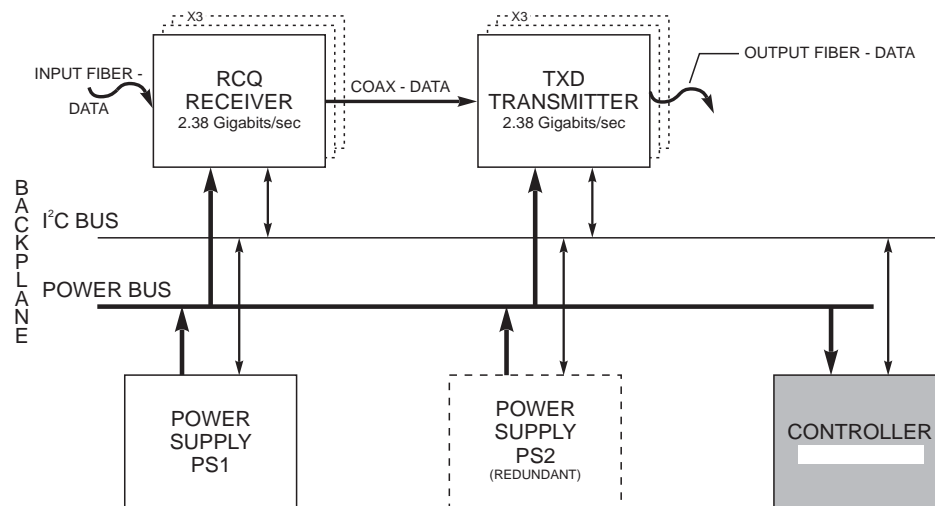


Figure 2-9. Block Diagram: 1-In, 1-Out Repeater Service



NOTE: The I²C Bus depicted in Figure 2-9 is actually all three busses drawn as one bus for simplification.

2.4.5 RPS Provisioned for 1-In, 2-Out Repeater Service

The diagram of **Figure 2-10** shows a variation of repeater service in which the optical signal coming in on one cable can be retransmitted over two outgoing cables. This configuration uses both of the data-signal outputs available from a DV6302RCQ receiver. The noninverted main data signal supplies one transmitter. The inverted signal available at the SMB connector behind the FC optical connector on the receiver’s angled bulkhead supplies the second transmitter.

To keep the patch cables carrying the electrical data signals as short as possible, in this application the receiver module should be installed in the shelf between the two transmitter modules it feeds. One RPS can provide this kind of 1-in, 2-out repeater service for one or two incoming circuits.

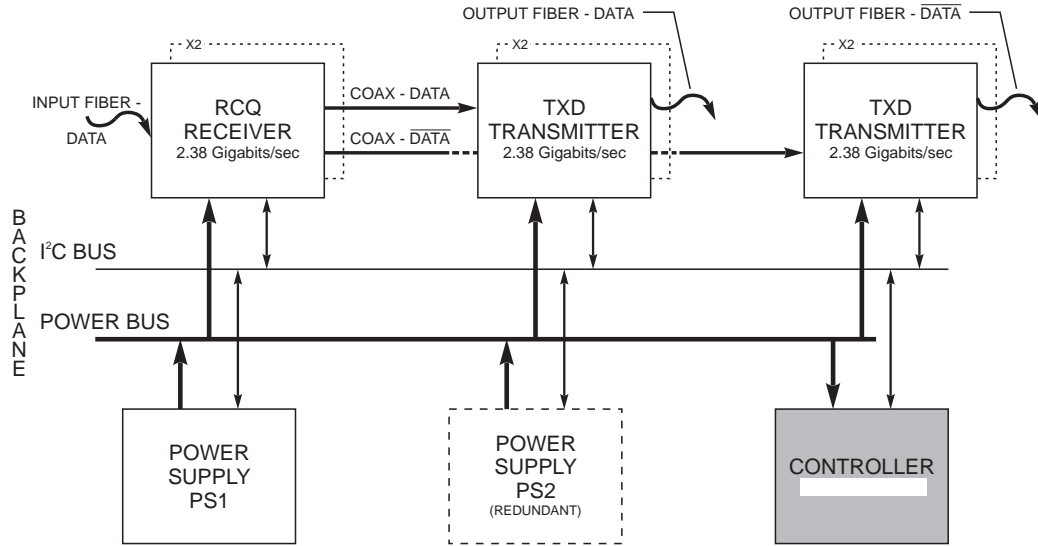


Figure 2-10. Block Diagram: 1-In, 2-Out Repeater Service

NOTE: The I²C Bus depicted in **Figure 2-10** is actually all three busses drawn as one bus for simplification.

2.4.6 RPS Provisioned as Optical Shelf

Figure 2-11 shows module interrelationships in an RPS configured as an optical shelf holding transmitters only. Here the effect of the RPS is to augment the shelf capacity of nearby DV6016ES equipment shelves. Each of up to six transmitters in the RPS receives its electrical data input signal through a coaxial patch cable (up to 60 inches long) from a multiplexer or drop/add/pass module in a DV6016ES shelf above or below the RPS or in an adjacent equipment rack.

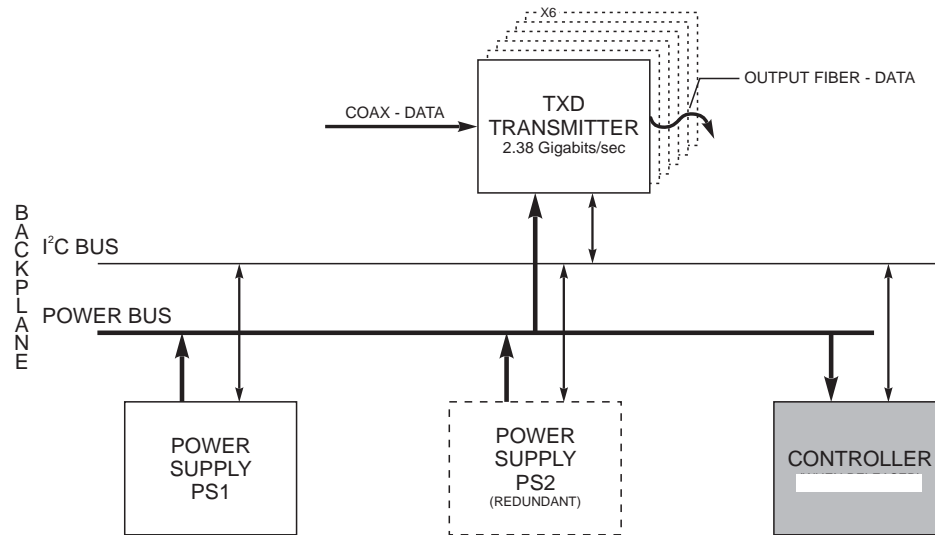


Figure 2-11. Block Diagram: Optical Shelf Service

NOTE: The I²C Bus depicted in **Figure 2-12** is actually all three busses drawn as one bus for simplification.

2.4.7 RPS with Optical Switches - DV6000 or Single Channel

Figure 2-12 shows module interrelationships in an RPS configured as an optical switch shelf holding Dual Optical Switches only. The optical switches allow automatic or manual selection of redundant alternate optical paths in the event of a failure in the on-line path. Operating in Optical Switch Mode, the Repeater Shelf Controller will handle up to 12 subtended DV6000 shelves, or 12 Single Channel remote receivers. If enabled, the Repeater Shelf Controller will switch the optical paths automatically when a DAP, DEMUX, or Single Channel remote receiver experiences a problem. An operator can also use the Manual Push-button on the appropriate switch front panel to switch paths.

(DV6000 SMART-NETT Users: In order to operate in Optical Switch mode with subtending DV6000 shelves, each slot in the shelf occupied by an Optical Switch must be set to "DV" in the "Subtending" field of the OSM Configuration window. To operate in Optical Switch mode with subtending DV6312 Remote Single Channel Receivers, each slot in the shelf occupied by an Optical Switch must be set to "RSR" in the "Subtending" field of the OSM Configuration window. Refer to the "DV6000 SMART-NETT Model #DV9903 User's Manual", PN 060834-001 for more information about using SMART-NETT to configure the RPS.)

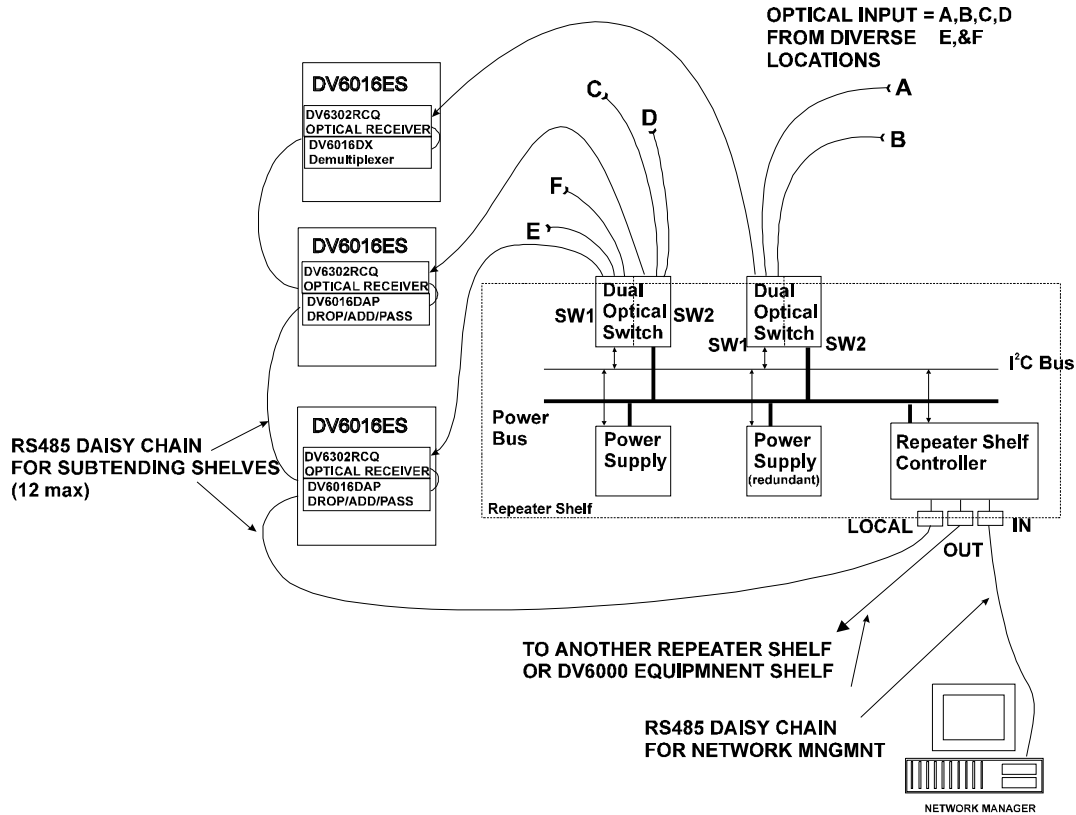


Figure 2-12. Block Diagram: Optical Switch Service

2.4.8.1 Automatic Protective Switching Enabled

If Automatic Protective Switching (APS) is Enabled (local DAP/DEMUX Received Signal Monitored), the Optical input to the DAP or DEMUX must come from a DV6302RCQ Optical Receiver card, which may be installed in the same DV6016RPS Repeater Shelf or in a subtended Shelf. With a subtended Single Channel remote receiver, the Controller monitors the remote receiver directly.

A Subtended Shelf is one which is located with a DV6016RPS Repeater Shelf, with automatic protective switching provided by the Repeater Shelf Controller. In this configuration the Network Management interface for the Subtended Shelf / Shelves is connected to the RJ11 jack on the Repeater Shelf labeled "Local". This connection must be made for the Controller to perform Automatic Protective Switching. Each Switch installed in the Repeater Shelf can support one subtended Shelf. This means that a maximum of 12 shelves can be subtended by one Repeater Shelf (with 6 switch modules, 2 switches per module)

With Automatic Protective Switching Enabled, the Controller will cause the appropriate switch to toggle under the following conditions:

1. Loss of optical signal (IPD alarm at the receiver)
2. Loss of frame
3. Excessive BER in the incoming signal.

Upon detection of a failure (this may take up to 3 seconds in a fully populated system), the switch will, after a user-selectable delay of n seconds, change to the STANDBY leg of the switch. If after switching occurs, a failed condition still exists, then the switch will revert to the PRIMARY position, after a user-selectable delay of at least $2n$ seconds. If a failed condition still exists, and after a delay of at least $3n$ seconds, the switch will revert to the STANDBY position. If a failed condition still exists at this time, then the switch will revert to the Primary position and remain there.

Timer settings are contained in the Repeater Shelf Controller configuration file. Separate timer settings as well as control information is entered for each Slot in which a Dual Optical Switch is installed.

2.4.8.2 Automatic Protective Switching Disabled

In this configuration the only switch control available is local push-button control or remote Network Management command. There is no requirement for subtending shelves in this configuration. The Repeater Shelf Controller will store the status of Automatic Protective Switching Enabled/Disabled for each switch in non-volatile memory, and no alarm scanning will be performed for the particular switch/switches that have Automatic Protective Switching Disabled.

2.4.9 Redundant Rings and Folding Rings - B Path Disable

These ring configurations are designed to provide redundant signal protection in the case of a fiber break between sites in a DV6000 ring. The folding ring is necessary when adds and drops are occurring at all of the sites. In this type of configuration, dual sets of DV6000 shelves are installed at each site. The pairs of DV6000 shelves are augmented by a Repeater Shelf with a Controller, which must be set up to operate in "B Path Disable Mode". (This mode is identified in DV6000 SMART-NETT as "FN" mode.) See **Figure 2-13** for an example of the hardware setup.

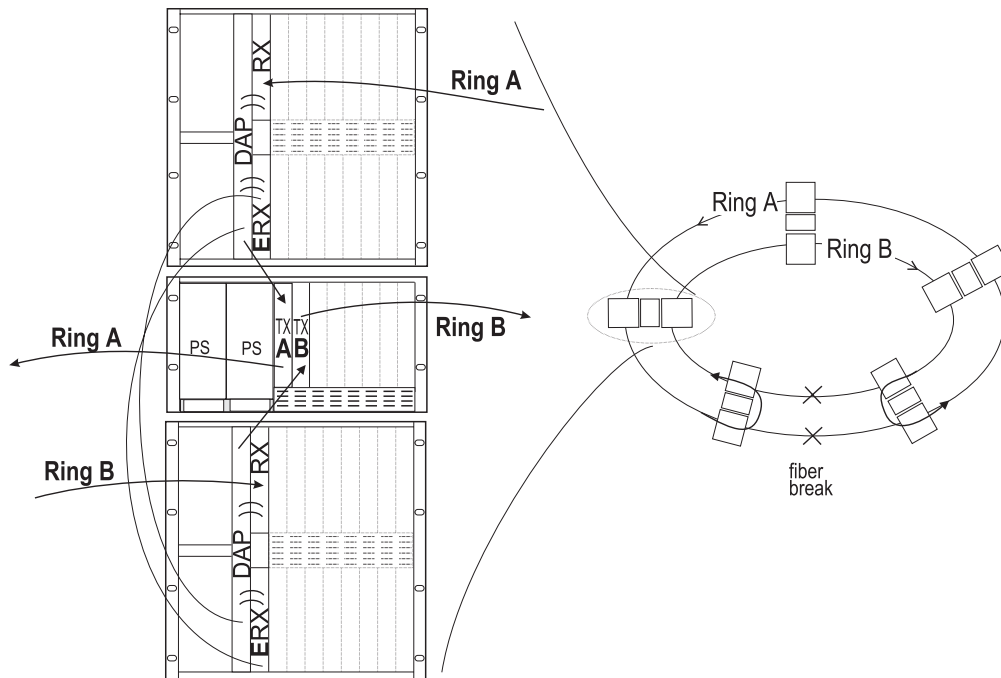


Figure 2-13. Folding Ring Site

The DV6000 shelves are partially controlled by the Repeater Shelf Controller. They are referred to as “subtended” or “subtending” shelves.

At a folding ring site, each DV6000 shelf feeds the other shelf’s backup receiver. In each shelf, the optical signal is accepted at the optical receiver (RX), and demultiplexed in the DAP. Channels are dropped to local decoders and added from local encoders, and the signals are multiplexed in the DAP. The primary multiplexed output (A) from the DAP is passed to the outgoing optical transmitter, and the inverted output signal (B) is passed to the electrical receiver (ERX) in the other DV6000 shelf.

If the fiber in the primary ring (A) is broken, the alarm on the primary receiver will cause the DAP to switch from its primary receiver’s input to its backup receiver, the electrical receiver. Each electrical receiver is using the signal from the other ring, which is travelling in the opposite direction, and so not affected at that site by a break in the fiber.

If the RPS Controller is operating in “B Path Disable” mode, it will detect the DAP’s switch to the backup path, and disable the transmitter in the RPS which has been paired to the DAP. When the DAP switches from the backup path to the primary path, the Controller will enable the transmitter. (**DV6000 SMART-NETT Users:** The enabling/disabling of a TX is paired to DAP switching by entering the DAP’s Serial Number in the OSM configuration window for that slot. In order to operate in “B Path Disable” mode, a slot in the shelf must be set to “FN” in the “Subtending” field of the OSM Configuration window. Refer to the “DV6000 SMART-NETT Model #DV9903 User’s Manual”, PN 060834-001 for more information about using SMART-NETT to configure the RPS.)

In the folding ring configuration, the transmitter for the backup ring (TXB) would be paired to the DAP, and would be disabled if the DAP switched to the B path. This causes the receiver downstream on the backup ring to alarm, and its DAP to switch to its backup receiver. This ensures that folding takes place on both sides of the fiber break, as shown in **Figure 2-13**. In a simpler redundant ring configuration, the primary transmitter would be paired to the DAP, and would be disabled when the DAP switched. This would shift the redundant ring system from its primary ring to its backup ring.

2.5 Repeater Shelf Specifications

DV6016RPS REPEATER SHELF-COMPATABLE MODULES SPECIFICATIONS			
Specification	Transmitter	Receiver	Dual Optical Switch
Optical Input	N/A	-10 to -30 dBm	N/A
Optical Output	0 dBm	N/A	N/A
Optical Reflectance	N/A	N/A	Intrinsic Reflectance - better than 40 dB
Optical Loss	N/A	N/A	<1 dB to Common to Active Port, including connectors
Isolation	N/A	N/A	>40 dB, Port X to Port Y
Switching Speed	N/A	N/A	< 100 msec
System Specifications			
Transmission Speed	2.38 Gbps		
Optical Wavelengths	1310 nm and 1550 nm		
Receiver Type	InGAsP APD		
Transmitter Type	DFB Laser		

Recommended Design Guidelines

- Up to 15 repeaters can be used for links between MUX/DMUX/DAP/RAM sites.
- With 1550 nm transmitters, rated for 2 dB dispersion penalty at 1800 ps/nm dispersion over standard single-mode fiber (18 ps/nm/km), the maximum span between DAP or RAM sites is 600 km, with five intermediate repeaters located at 100 km intervals along the link.
- Transmitters located in the RPS shelf, and any transmitters that may accept B data, should be transmitters marked with double diamonds to indicate the presence of an input equalization circuit. Transmitters without input equalization should only be used in slots contiguous to the MUX/DMUX/DAP card in the DV6000 shelf, and just above or below the associated RAM card in the DV6128 SAS shelf.

Addendum

Certain DV6016RPS repeater shelves were factory modified to operate on 48 VDC only. Their 110/220-VAC input connectors were removed. The resulting openings in the rear panels of the shelves were closed with blank covers.

The serial numbers of the affected DV6016RPS shelves are:

9538447	9538452	9538458	9538465	9538471
9538448	9538453	9538459	9538466	9538472
9538449	9538454	9538461	9538467	
9538450	9538456	9538462	9538469	
9538451	9538457	9538464	9538470	

The only power supply module usable in these shelves is 48-VDC module DV6048PS, DV6048PSA, or DV6048PSB.

All other Repeater Shelves will operate with the following supplies:

DV6048PSA
DV6011PSA
DV6022PSA
DV6048PSB
DV60ACPSB

SECTION

3

Installation of the DV6016RPS Repeater Shelf - Task Oriented Practice (TOP) Procedures

3.1	Introduction	3-2
3.2	Using a TOP Document	3-3
	Installation Task List	3-4
	TOP Procedures	3-5

3.1 Introduction

This section presents the procedures for installation of the DV6016RPS Repeater Shelf (RPS), provisioning of the shelf with the DV6000 system modules it is meant to house, and initial turn-up and test of the installed RPS and modules.



WARNING: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*



WARNING: *To avoid exposure to invisible laser radiation, do not look into the ends of any optical fiber or bulkhead connector. Use an optical power meter to identify active fibers. Do not assume that laser power is turned off or that a fiber is disconnected at its far end.*



WARNING: *Infrared radiation is invisible and can seriously damage the retina of the eye. To avoid potentially dangerous radiation exposure, immediately place a protective cap or hood over any radiating bulkhead receptacle or optical fiber connector. This practice also keeps dirt particles from entering the connector.*



CAUTION: *DV6000 equipment is electrostatic discharge sensitive. To prevent electrostatic discharge damage, wear a grounded wrist strap when you touch DV6000 equipment. Always place units on an approved, grounded, antistatic surface. Use antistatic packaging when transporting equipment.*



CAUTION: *This equipment generates, uses, and can radiate radio frequency energy. If it is not installed and used in accordance with the instruction manual, it may cause interference to radio communications. It has been tested and found to comply with limits for a Class A digital device pursuant to Subpart B of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference from equipment operated in a commercial environment. Operation of this equipment in a residential area may cause interference to TV and radio reception, in which case the user, at his own expense, must take whatever measures may be required to correct the interference.*

This equipment does not exceed the Class A limits for radio emission for digital apparatus set out in the radio interference regulations of the Canadian Department of Communications. Operation in a residential area may cause unacceptable interference to TV and radio reception, requiring the owner or operator to take whatever steps are necessary to correct the interference.

3.2 Using a TOP Document

The procedures in this section are written in the Task Oriented Practice (TOP) format. TOP procedures are step-by-step instructions for completing indicated tasks. To find instructions for installing the DV6016RPS Repeater Shelf, proceed as follows:

1. Find the task to be performed in the Task Index List (IXL-001).
2. Locate the procedure for the task. Each procedure in this manual is one of the following three types:
 - a) Non Trouble Clearing Procedure (NTP) - Director level procedure listing normal work items to be performed.
 - b) Detail Level Procedure (DLP) - Detailed step-by-step instructions.
3. Perform all the items in the NTP (director level procedure) in the order listed unless you are sent to another NTP. When you finish an NTP, you have completed the task. For more detailed information, you may be referred from the NTP to Detail Level Procedures (DLP-xxx). Detail Level Procedures may also direct you to other Detail Level Procedures.



Note: When you complete a Detail Level Procedure, return to the procedure that sent you to the just-completed DLP.



Note: If one NTP (director level procedure) sends you to another, in most cases you need not return to the first NTP after finishing the second.

IXL-001
Page 1 of 1

Installation Task Index List

Find Your Job in the List Below	Then Go To:	Pg:
INSTALL REPEATER SHELF AND ASSOCIATED RACK EQUIPMENT	NTP-002	3-5
Inspect Installation Site	DLP-500	3-8
Unpack Equipment and Inspect For Damage	DLP-501	3-10
Mount Repeater Shelf in Rack	DLP-502	3-11
Install Fans	DLP-503	3-13
Install Heat Baffles	DLP-504	3-16
INSTALL PLUG-IN MODULES IN REPEATER SHELF	NTP-003	3-6
Connect Office Ground	DLP-505	3-19
Install Power Supplies in Shelf	DLP-506	3-20
Clean and Mate Fiberoptic Connectors and Adapters (SC and FC) ...	DLP-507	3-23
Install Transmitters and Receivers in Shelf	DLP-508	3-25
Install Repeater Shelf Controller in Shelf	DLP-513	3-38
Install Dual Optical Switch in Shelf	DLP-514	3-40
INITIAL TURN-UP AND TEST	NTP-004	3-7
Check Output Voltages of Power Supplies	DLP-509	3-30
Confirm Power Presence for Transmitters and Receivers	DLP-510	3-32
Check Transmitter Bias and Cooler Voltages	DLP-511	3-33
Check and Adjust Receiver Optical Input Power; Check Receiver AGC and IPD Voltages	DLP-512	3-35

Install DV6016RPS Repeater Shelf (RPS)

Summary: This procedure describes how to install a DV6016RPS Repeater Shelf in an equipment rack.

Do Items Below in the Order Listed	For Details Go To:	Pg:
1. Obtain a box cutter and common hand tools for installation.		
2. Examine the system and site plans to become familiar with the RPS location and the associated equipment.	DLP-500	3-8
3. Unpack the RPS and associated hardware and inspect each item for damage.	DLP-501	3-10
4. Mount the RPS in the assigned position in a 23-inch rack using two extender brackets and eight 12-24 by 1/2-inch binding-head machine screws, with external tooth star lock washers. Alternatively, mount the shelf directly in a 19-inch rack or a 23-inch rack equipped with auxiliary rails for mounting 19-inch equipment.	DLP-502	3-11
5. Install fans if necessary. Cooling fans are required to be used if the DV6016RPS is installed beneath other equipment, or if it is the highest unit in the rack.	DLP-503	3-13
6. Install heat baffles if necessary. Heat baffles are required to be used if the DV6016RPS is installed directly above or below other DV6000 equipment. Heat baffles are used in conjunction with the cooling fans to direct air flow.	DLP-504	3-16

Stop! You have completed this procedure.

NTP-003
Page 1 of 1

Install Plug-in Modules in Repeater Shelf

Summary: This procedure describes insertion of power supply, transmitter, and receiver modules into equipment slots of a DV6016RPS Repeater Shelf; ground and power connections to the shelf; fiberoptic cable connections to transmitter and receiver modules; and data signal interconnections between modules.

Do Items Below in the Order Listed	For Details Go To:	Pg:
1. Connect the repeater shelf to the office ground in accordance with local practice and national electrical codes. A spring-loaded grounding post is provided at the rear of the repeater shelf.	DLP-505	3-19
2. Install power supplies in the repeater shelf. Power supplies that operate on a source voltage of 48 VDC, 110 VAC, or 220 VAC may be used. Two power supplies may be used in a single shelf for protective redundancy.	DLP-506	3-20
3. Clean and mate fiberoptic connectors and adapters.	DLP-507	3-23
4. Install transmitters and receivers in the repeater shelf.	DLP-508	3-25
5. Install Repeater Shelf Controller in the repeater shelf.	DLP-513	3-38
6. Install Dual Optical Switch in the repeater shelf.	DLP-514	3-40

Stop! You have completed this procedure.

Initial Turn-up and Test

Summary: Turn-up and test procedures for a DV6016RPS Repeater Shelf consist of the following items:

Do Items Below in the Order Listed	For Details Go To:	Pg:
1. Check output voltages of power supplies.	DLP-509	3-30
2. Confirm power presence for transmitters and receivers.	DLP-510	3-32
3. Check transmitter bias and cooler voltages.	DLP-511	3-33
4. Check and adjust receiver optical input power; check receiver AGC and IPD voltages.	DLP-512	3-35

Stop! You have completed this procedure.

DLP-500
Page 1 of 2

Inspect Installation Site

Summary: This procedure is a pre-installation review of system and site plans to ensure that you are familiar with the DV6000 system, the office where the equipment is to be installed, the equipment it interfaces with, and the bay(s) in which equipment is to be installed.

1. Obtain and familiarize yourself with the site plans, which should include a full description of each DV6000-system shelf to be installed. The site plan is vital for installing a DV6016RPS repeater shelf because both DV6016ES equipment shelves and DV6016RPS repeater shelves can be configured in many different ways to serve diverse purposes. The site plan must specify the modules to be installed in each DV6000-system shelf. Without this information, installation cannot proceed.
2. If the repeater shelf is to be used strictly for repeater service with signal connections only between receivers and transmitters in the same shelf, there are no restrictions on shelf location. However, if the plan calls for signal connections between a MUX or DAP module in a DV6016ES equipment shelf (ES) and a transmitter in a repeater shelf (RPS), be sure the planned RPS location allows signal connections to be made with coaxial cables no more than 36 inches long. This generally means that a source MUX/DAP module must be in an ES that is located:
 - Immediately above or below the RPS in the same rack;
 - Directly to the left of the RPS in an immediately adjoining rack; or
 - Directly or diagonally to the right of the RPS in an immediately adjoining rack.
3. Be sure that rack layout provides adequate ventilation for each DV6000-system shelf to be installed. Repeater shelves require no active cooling if there is adequate space allowed for convection cooling. However, other equipment in the rack must be ventilated as required (DV6000 shelves require the installation of fans and baffles) so that heated air from other units does not enter the RPS.
 - Unless the RPS is to be the bottommost unit installed in a rack, a heat baffle should be installed directly beneath the RPS to deflect heated air rising from equipment beneath it and to admit cooling air;
 - If there is equipment directly above the RPS, or if it is at the very top of the rack, a fan must be installed immediately above the RPS to draw cooling air through the shelf; and
 - Unless the fan above an RPS is to be the topmost unit installed in a rack, a heat baffle should be installed immediately above the fan to deflect air heated by passage through the RPS.

Figure 500-1 illustrates these requirements.

4. Be sure the appropriate equipment racks have been installed and are properly connected to office ground. A DV6016RPS shelf fits a 19" rack directly. It may be installed without modification into a 23" rack equipped with vertical adapter rails, or extender brackets may be added to the shelf itself.

5. Check that the required wiring for AC or DC source power has been installed.
6. If additional preparatory work is required, notify the appropriate organization.

Stop! You have completed this procedure.

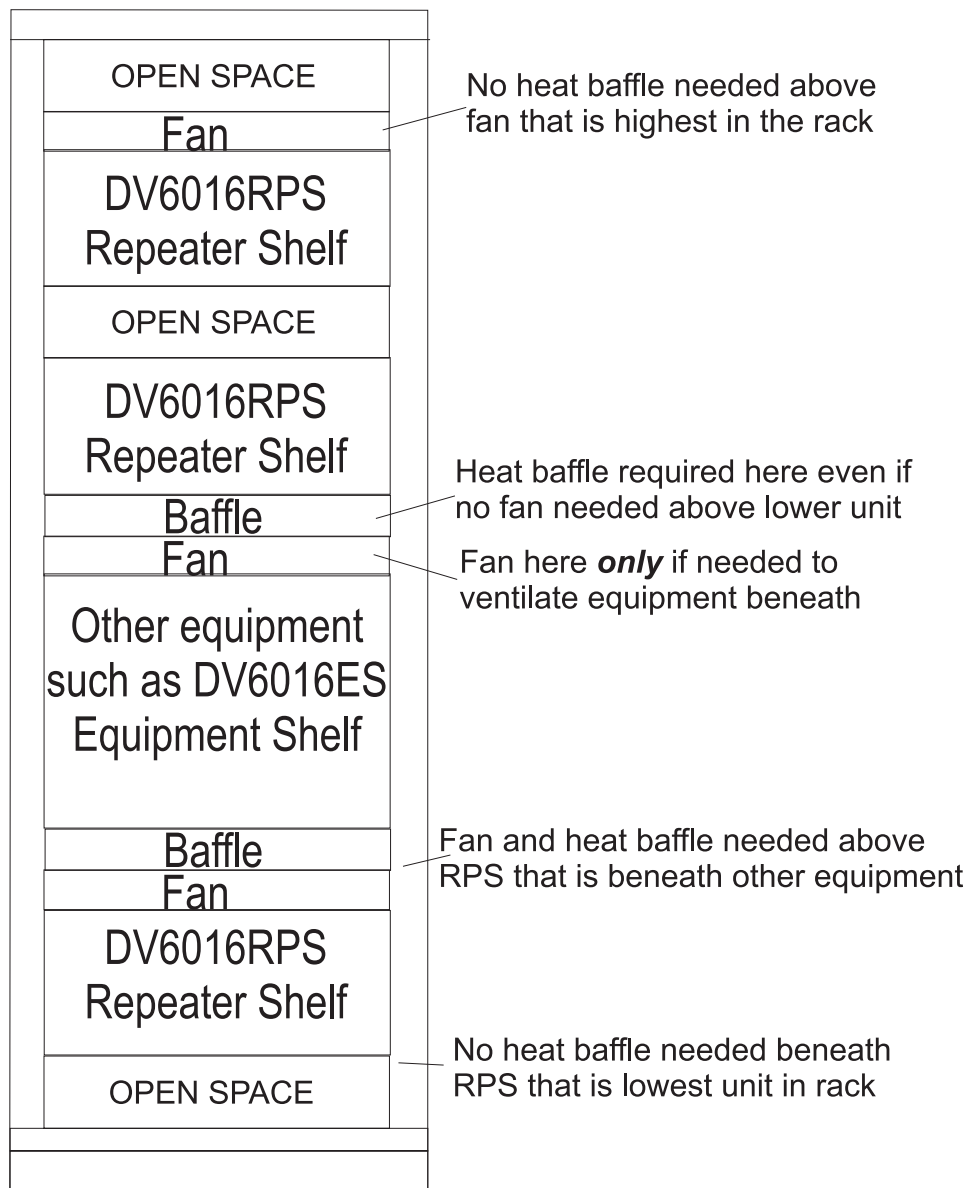


Figure 500-1. Ventilation Requirements for Repeater Shelves

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Unpack Equipment and Inspect for Damage

Summary: The installer will inspect and open the shipping boxes, verify that all parts have been received, and verify that no shipping damage has occurred.

1. Obtain the following tools and equipment to unpack the equipment:
 - ESD wrist strap
 - ESD anti-static mat
 - Box cutter



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling units follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit place it on an approved, electrically grounded, anti-static mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.
3. Examine the outside of the shipping carton for tears, dents, punctures, etc., that would indicate possible shipping damage. Note any container damage.
4. Open the shipping cartons and carefully unpack the equipment. Do not discard the packing materials at this time.
5. Check each component against the packing list to make sure that the correct catalog numbers and quantities were received. Note any discrepancies.
6. Carefully inspect each item for damage. Check for detached, broken, or bent parts, damaged connectors, bent connector pins, and other physical damage to the unit chassis or its circuit board. Do not install any product that is significantly damaged.
7. If there is any damage to the equipment, see “*Contacting C-COR.net Technical Support*” in the Front Matter of this manual for further guidance and information on contacting C-COR.net.
8. If the product is undamaged and all components are accounted for, discard packing material if desired. You may still want to save some original shipping cartons and packing materials for reuse should it become necessary to return any equipment.

Stop! You have completed this procedure.

Mount Repeater Shelf in Equipment Rack

Summary: The repeater shelf can be rack-mounted in two ways:

- Directly in a 19-inch rack (or a 23-inch rack equipped with auxiliary rails for mounting 19-inch equipment); or
- In a 23-inch rack by attaching extender brackets between the shelf and rack.

Both front and rear access to the rack are required for installation.



Warning: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:

- ESD wrist strap
- Two 19-to-23-inch extender brackets EB10P (for installation in a 23-inch rack without auxiliary rails only)
- Binding-head machine screws, four 1/2 inch by 12-24 or 10-32 (as rack or rack rails require), four external tooth star lock washers, plus four 1/2 inch by 12-24 with external tooth star lock washers, if extender brackets are used
- Flat-blade or Phillips screwdriver to match mounting screws



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling units follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit place it on an approved, electrically grounded, anti-static mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.
3. Is the repeater shelf being installed in a 23-inch rack without auxiliary rails?
 - If YES, go to step 4.
 - If NO, go to step 5.
4. Attach a 19-to-23-inch extender bracket EB10P (Figure 502-1) to each side of the front panel using two 12-24 by 1/2-inch binding-head machine screws with external tooth star lock washers.
5. Position the unit in its assigned location in the rack. (When filling a rack with stacked units, start at the bottom of the rack and work up to avoid possible tolerance build-up impact on unit spacing.)
6. Align the four mounting holes in the front panel (or extender brackets) with the applicable holes in the rack and insert four 1/2-inch by 12-24 or 10-32 mounting screws with external tooth star lock washers(as applicable).
7. Tighten the four mounting screws securely.

Stop! You have completed this procedure.

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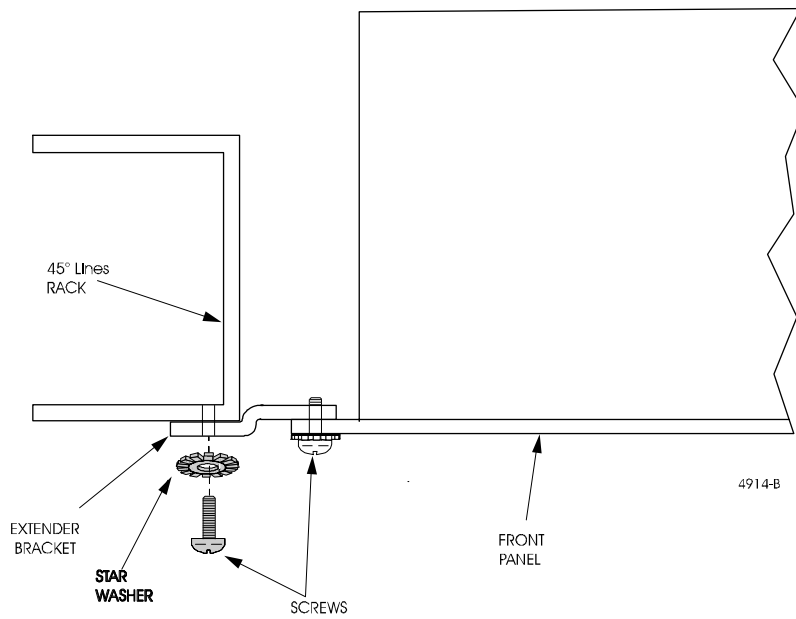


Figure 502-1. Installing 19-to-23-Inch Rack Extender Brackets

Install Fans

Summary: This procedure describes how to mount cooling fans (**Figure 503-1**) required in a repeater shelf installation. (See the discussion of ventilation in DLP-500.)

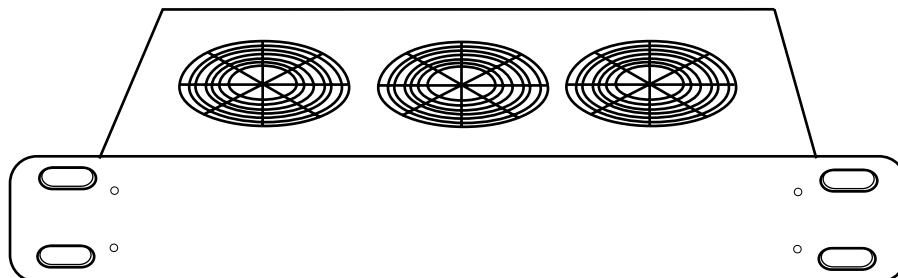


Warning: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - Rack-mount cooling-fan shelf, as shown in Figure 503-1, such as DV6911FAN (for 110-VAC operation), DV6922FAN (for 220-VAC operation), or DV6948FAN (for 48-VDC operation)
 - Two 19-to-23-inch extender brackets EB17P (for installation in a 23-inch rack without auxiliary rails only)
 - Binding-head machine screws, four 1/2 inch by 12-24 or 10-32 (as rack or rack rails require), four external tooth star lock washers, plus four 1/2 inch by 12-24 with external tooth star lock washers if extender brackets are used
 - Ground wire, 16 AWG, stranded wire
 - Flat-blade or Phillips screwdriver to match mounting screws
2. Is the fan shelf being installed in a 23-inch equipment rack without auxiliary rails?
 - If YES, go to step 3.
 - If NO, go to step 4.
3. Attach a 19-to-23-inch extender bracket EB17P (**Figure 503-2**) to each side of the front panel using two 12-24 by 1/2-inch binding-head machine screws with external tooth star lock washers.
4. Position the unit in its assigned location in the rack (**Figure 503-3**), oriented to blow upward. (When filling a rack with stacked units, start at the bottom of the rack and work up to avoid possible tolerance build-up impact on unit spacing.)
5. Align the four mounting holes in the front panel (or extender brackets) with the applicable holes in the rack and insert four 1/2-inch by 12-24 or 10-32 mounting screws with external tooth star lock washers (as applicable).
6. Tighten the four mounting screws securely.
7. Connect the fan shelf's grounded power cord to an appropriate, grounded power source and apply power.

Stop! You have completed this procedure.

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4880-A

Figure 503-1. Rack-mount Fan Shelf

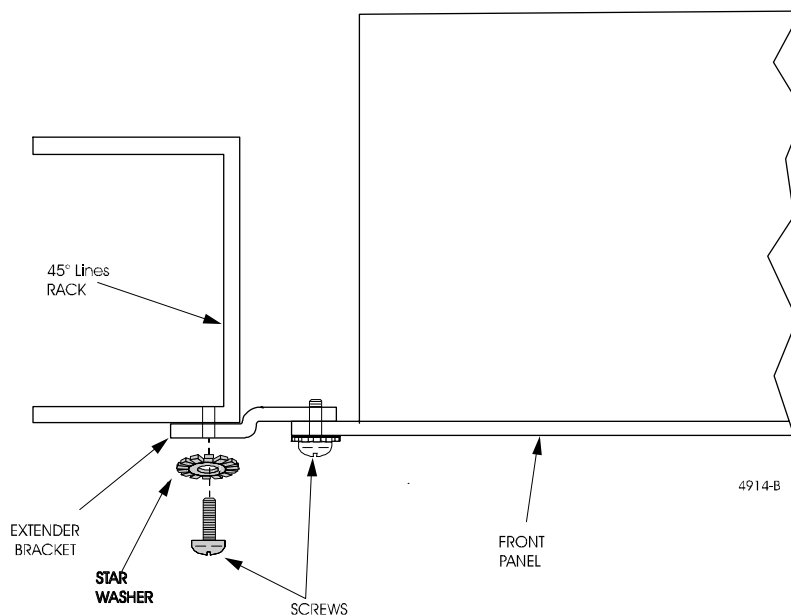


Figure 503-2. Installing 19-to-23-Inch Rack Extender Brackets

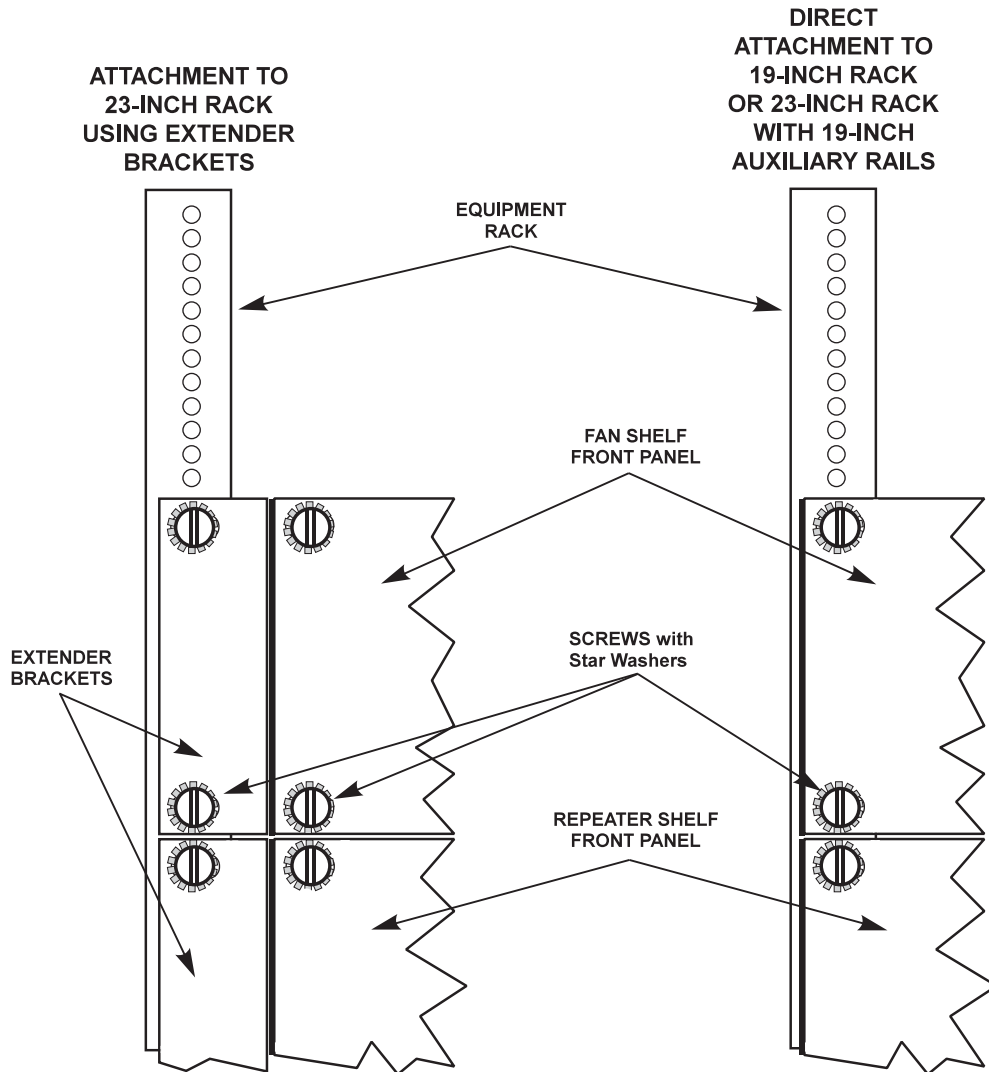


Figure 503-3. Positioning Fan Shelf and Securing to Rack

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Install Heat Baffles

Summary: This procedure describes how to mount the heat baffles required in a repeater shelf installation. (See the discussion of ventilation in DLP-500.)



Warning: *To prevent electrical shock, never install hardware adjacent to electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - Rack-mount heat baffle, such as DV6916HB
 - Two 19-to-23-inch extender brackets EB17P (for installation in a 23-inch rack without auxiliary rails only)
 - Binding-head machine screws, four 1/2 inch by 12-24 or 10-32 (as rack or rack rails require), four external tooth star lock washers, plus four 1/2 inch by 12-24 with external tooth star lock washers if extender brackets are used
 - Flat-blade or Phillips screwdriver to match mounting screws
 - Ground wire, 16 AWG, stranded wire
2. Is the heat baffle being installed in a 23-inch equipment rack without auxiliary rails?
 - If YES, go to step 3.
 - If NO, go to step 4.
3. Attach a 19-to-23-inch extender bracket EB17P (**Figure 504-1**) to each side of the front panel using 12-24 by 1/2-inch binding-head machine screws with external tooth star lock washers.
4. Orient the unit so that its sloping baffle plate will direct airflow as required (**Figure 504-2**) and position the unit in its assigned location in the rack (**Figure 504-3**).
5. Align the mounting holes in the front panel (or extender brackets) with the applicable holes in the rack and insert 1/2-inch by 12-24 or 10-32 mounting screws (as applicable) with external tooth star lock washers.
6. Tighten the mounting screws securely.
7. Connect the heat baffle unit to ground using a 16 Ga. stranded wire attached to a ground lug (A lug on a mounting screw). Attach the other end to the frame, do not exceed 2 feet maximum length.

Stop! You have completed this procedure.

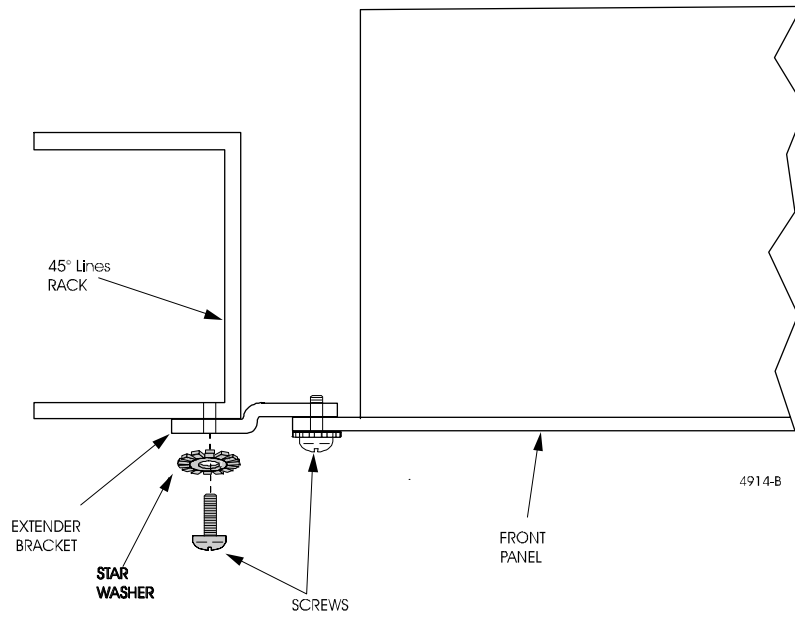


Figure 504-1. Installing 19-to-23-Inch Rack Extender Brackets

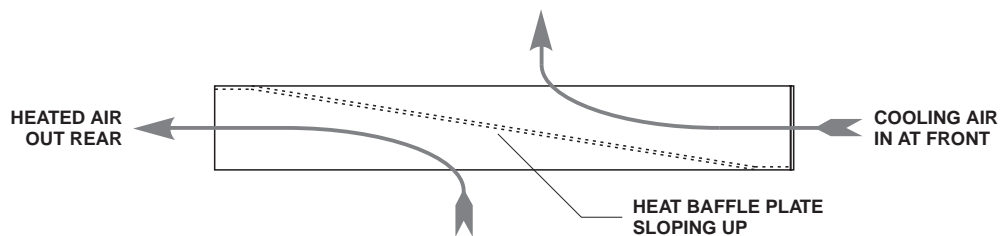


Figure 504-2. Orienting Baffle Plate for Required Airflow

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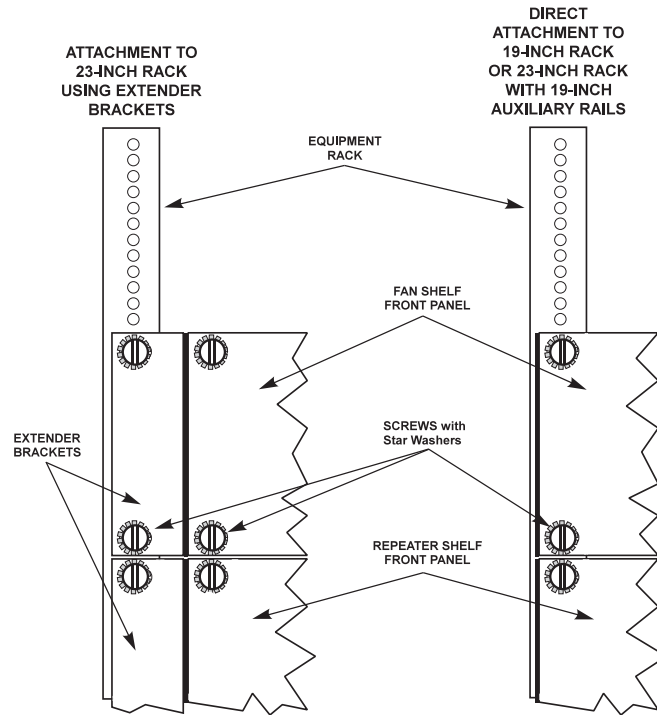


Figure 504-3. Positioning Heat Baffle and Securing to Rack

Connect Repeater Shelf to Office Ground

Summary: This procedure establishes a ground connection between the DV6016RPS repeater shelf and the office ground. This connection must be made in accordance with all local and national electrical codes.



Warning: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*



Caution: *This procedure assumes the equipment rack is connected to office ground.*

1. Obtain the following:
 - ESD wrist strap
 - Ground wire, 16 AWG, stranded wire



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling units follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit place it on an approved, electrically grounded, anti-static mat.*

2. Place the ESD wrist strap on your wrist and snap its grounding wire to the wrist band. Plug the ground plug into a grounded ESD jack.
3. At the upper right-hand rear of the repeater shelf, depress the spring-loaded ground post and insert the stripped ground wire into the hole in the post. Release the ground post to engage the ground wire.
4. Connect the other end to the frame. Do not exceed 2 feet maximum length. Be sure this connection is made using methods and hardware that meet all applicable local and national electrical codes.
5. Dress and secure the ground wire so that it cannot come into contact with any other electrical terminations.

Stop! You have completed this procedure.

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Install Power Supplies in Repeater Shelf

Summary: This procedure describes how to install one or two plug-in power supply modules in a rack-mounted repeater shelf. Only one power supply is required to operate all other modules in a shelf, but installing a second supply provides protective redundancy. When two supplies are used, they operate independently and could be connected to different input power sources. Although a repeater shelf's power supply slots are designated "PS1 (Primary)" and "PS2 (Secondary)," they are functionally identical. If only one supply is to be used, it may be installed in either slot.



Warning: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - ESD wrist strap
 - One or two power supply module(s), DV6011PSA if to operate on 110 VAC, DV6022PSA if to operate on 220 VAC, DV6048PSA if to operate on 48 VDC
 - One 3-wire AC power cable for each AC power supply to be installed
 - Flat-blade or Phillips screwdriver to match DC-input terminal screws (if installing a DV6048PSA power supply)



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling units follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit place it on an approved, electrically grounded, anti-static mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.
3. Check that the power supply to be installed is turned off (power switch or circuit breaker in "0" position).
4. On the power supply to be installed, check the clamp position indicators behind the top and bottom clamp knobs to be sure the clamp fingers behind the front panel will not interfere with module insertion. The top indicator should be at 9 o'clock, the bottom one at 3 o'clock. If necessary, rotate the indicators (and thus the fingers) to those positions.
5. Slide the power supply into an empty power supply slot in the repeater shelf. The connector at the rear of the power supply will mate with the shelf's connector when the module is fully inserted into the slot (module front panel against top and bottom shelf rails).
6. Turn the power supply's top and bottom clamp knobs clockwise until the clamp position indicators move to 12 and 6 o'clock, respectively, and resistance to knob rotation indicates that the clamp fingers have been pulled against the edges of the slots behind the shelf rails.

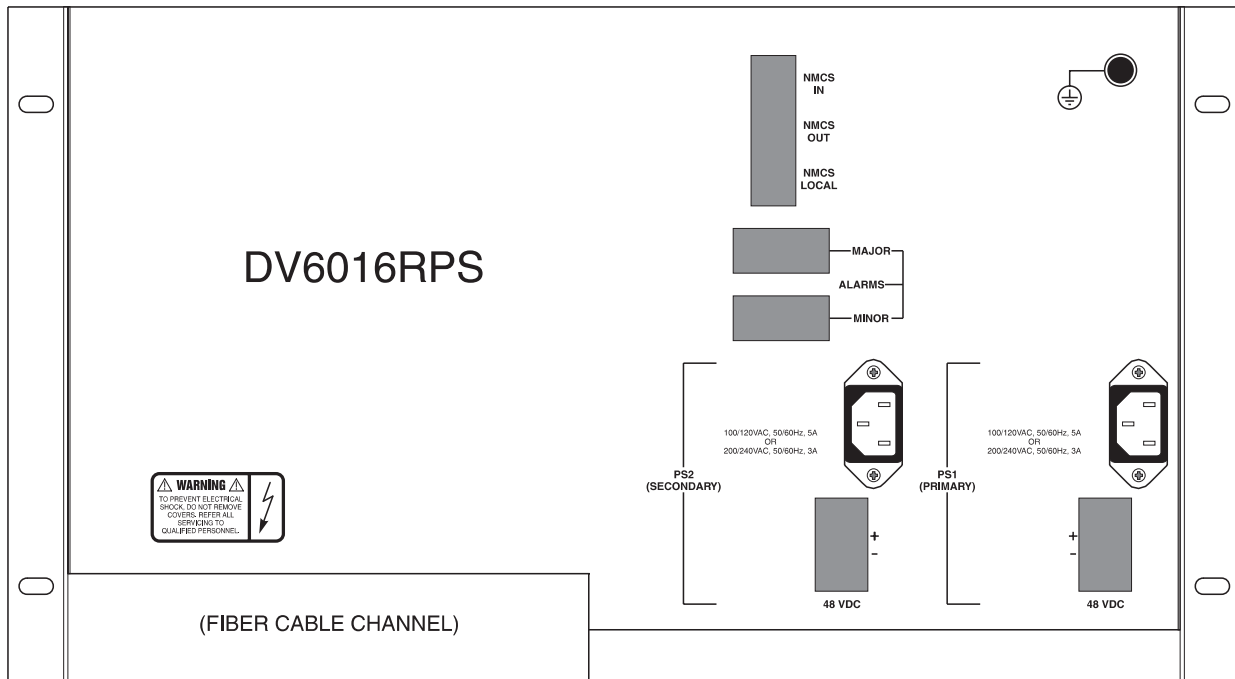
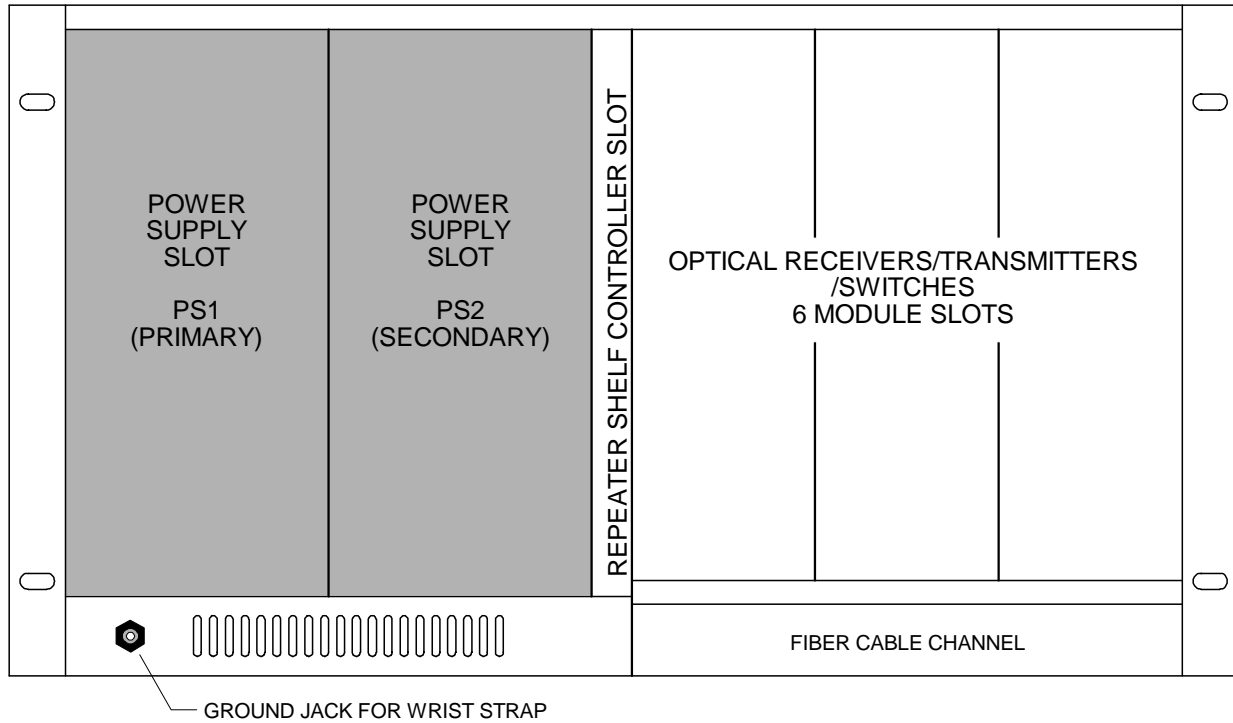


NOTE: It is advisable to provide a separate power feed for the second supply to protect operation in the event the feed to the first supply fails.

7. Repeat steps 3 through 6 for the second power supply if applicable.
8. Is an inserted power supply to operate on either 110 or 220 VAC?
 - If YES, go to step 9.
 - If NO, go to step 11.
9. Connect the female end of a 110 or 220 VAC source power cable to the AC power connector for the repeater shelf slot occupied by a DV6011PSA or DV6022PSA power supply. Swing the captive cord retainer aside, mate the connectors, and snap the retainer over the plug to secure it in place. Repeat this step with a cable for the second power supply if applicable.
10. Connect the power cable to the AC power source, but do not switch the power supply on. Repeat this step for the second AC power cable if applicable.
11. Is an inserted power supply to operate on 48 VDC?
 - If YES, go to step 12.
 - If NO, go to **Stop! You have completed this procedure.**
12. Be sure the appropriate fuse is removed to isolate the 48-VDC wiring provided to the repeater shelf location. Repeat this step for the second 48-VDC circuit if two are to be used.
13. Remove the protective plate covering the 48-VDC input terminals for the repeater shelf slot occupied by a DV6048PSA power supply. To do this, squeeze together the two pairs of plastic prongs retaining the plate and lift the plate off the prongs. Repeat for the second 48-VDC input terminal block if applicable.
14. Loosen the 48-VDC input terminal screws, connect the 48-VDC power wires in their correct polarity (as marked on the repeater shelf chassis), and tighten the terminal screws. (Wiring provided for the 48-VDC supply must be 16 AWG or larger.) Repeat for the second 48-VDC input terminal block if applicable.
15. Replace the protective plate over the 48-VDC input terminals by positioning it over one pair of prongs at a time and pressing it in until the prongs snap into place. Repeat for the second 48-VDC input terminal block if applicable.
16. Install the appropriate fuse to make 48-VDC power available to the repeater shelf, but do not switch the power supply on. Repeat for the second 48-VDC power supply if applicable.

Stop! You have completed this procedure.

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Cleaning and Mating Instructions for Fiberoptic Connectors and Adapters (SC and FC)

Summary: The performance of an optical fiber system is largely dependent on the fiber connector cleaning procedures followed prior to installation. Clean all connectors and adapters before making any connections.

1. Required cleaning materials. See **Figure 507-1**.
 - Lint free laboratory wipes
 - Isopropyl alcohol
 - Cotton-tipped swabs
 - Special “Lint Free” pipe cleaners
 - Clean, dry, oil free compressed air



Figure 507-1. Cleaning Materials

2. To clean connectors, moisten a lint-free wipe with alcohol and wipe completely around the connector ferrule twice. Wipe several times across the tip.
3. Use a dry lint-free wipe to wipe completely around the connector ferrule twice. Also wipe several times across the tip.
4. Blow across the end of the ferrule with clean dry compressed air.
5. Visually inspect the connector tip for cleanliness. If the tip does not appear to be thoroughly cleaned, repeat steps 2, 3, and 4.
6. To clean SC and FC adapters, use a pipe cleaner moistened with alcohol. Insert the pipe cleaner into the adapter and rotate. Blow dry with clean dry compressed air. See **Figure 507-2**.

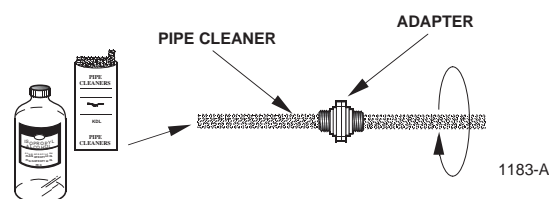


Figure 507-2. Cleaning SC and FC Adapters

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7. Clean attenuators with clean dry compressed air only. Do not use a moistened wipe or pipe cleaner. See **Figure 507-3**.

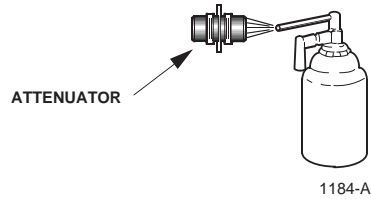


Figure 507-3. Cleaning SC and FC Attenuators

8. Mate SC and FC connectors by inserting the connector into the adapter and aligning the connector key with the adapter key slot.
9. For FC connectors, push the connector into the adapter and screw the threaded cap clockwise onto the adapter to complete the connection.
10. Connect an SC connector by aligning the key with the adapter key slot. Push the connector into the adapter.

Stop! You have completed this procedure.

Install Transmitters and Receivers into Repeater Shelf

Summary: This procedure describes how to install optical receiver/transmitter pairs or individual optical transmitters in a DV6016RPS repeater shelf (**Figures 508-1 to 508-3**). Receiver/transmitter pairs are installed for repeater service. Individual transmitters are installed to add fiber paths beyond the module capacity of DV6016ES equipment shelves adjacent to the repeater shelf.



Warning: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - ESD wrist strap
 - Protective caps or hoods as needed to cover every fiberoptic connector and bulkhead optical receptacle to be dealt with at the repeater shelf location
 - Short coaxial patch cables as needed to interconnect receivers and transmitters to be installed in the repeater shelf
 - Coaxial patch cables up to 60 inches long as needed to interconnect transmitters to be installed in the DV6016RPS repeater shelf and signal-source MUX or DAP modules in adjacent DV6016ES equipment shelves
 - 50-Ohm push-on terminators for all receiver connectors not to be used for receiver-to-transmitter interconnections
2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling units follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit place it on an approved, electrically grounded, anti-static mat.*

3. Be sure each power supply installed in the repeater shelf is turned off (power switch or circuit breaker at "0" position; no power supply LED lit).
4. Observing the handling precautions presented in the **WARNINGS** below, identify each incoming/outgoing optical cable to be attached to a receiver or transmitter in this shelf and route it through the opening at the rear of the shelf into the shelf's fiber cable channel.



Warning: *To avoid exposure to invisible laser radiation, do not look into the ends of any optical fiber or bulkhead connector. Use an optical power meter to identify active fibers. Do not assume laser power is turned off or that the fiber is disconnected at the other end.*

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Warning: *Infrared radiation is invisible and can seriously damage the retina of the eye. To avoid potentially dangerous amounts of radiation exposure, a protective cap or hood MUST be immediately placed over any radiating bulkhead receptacle or optical fiber connector. This practice also keeps dirt particles from entering the connector.*

5. If not already done, clean all fiberoptic connectors and adapters per DLP-507.
6. Perform the complete sequence of steps 7 through 11 in turn for each receiver or transmitter to be installed. Completing installation of one unit before going on to the next provides the best security for each unit while it is being handled and generally makes cable connections easiest.
7. Insert the receiver or transmitter far enough into its assigned slot in the shelf to be mechanically secure, but do not yet plug it into the backplane connector.
8. Connect the appropriate fiberoptic cable to the bulkhead receptacle on the angled portion of the unit's front panel. In the case of a transmitter, that means first routing the cable upward through the slot in the bottom of the optical-connection guard.
9. With the optical connection made, check the clamp position indicator behind the clamp knob at the top of the unit's front panel to be sure the clamp finger behind the panel will not interfere with module insertion. The indicator should be at 9 o'clock. If necessary, rotate the indicator (and thus the finger) to that position.
10. Insert the transmitter or receiver the rest of the way into its slot in the shelf, mating its rear connector with the backplane connector. Be careful not to pinch or exert pressure on the fiberoptic cable during this operation.
11. Turn the unit's clamp knob clockwise until the clamp position indicator moves to 12 o'clock and resistance to knob rotation indicates that the clamp finger has been pulled against the edge of the slot behind the upper shelf rail.
12. When all fiberoptic cable connections have been made and all receiver/transmitter modules have been fully inserted and clamped in place, connect coaxial patch cables and terminating resistors as follows:
 - For each receiver/transmitter pair providing 1-in, 1-out repeater service, connect a minimum-length patch cable between the receiver's ♦ (A data) output connector and the transmitter's ♦ (data) input connector. Place a 50-ohm push-on terminator on the receiver's • (clock) and B data output connectors.
 - For each receiver feeding two transmitters in 1-in, 2-out repeater service, connect a minimum-length patch cable between the receiver's ♦ (A data) output connector and the ♦ (data) input connector of the transmitter that is to repeat the incoming optical signal in noninverted form. Connect a minimum-length patch cable between the receiver's B data output connector and the ♦

(data) input connector of the transmitter that is to repeat the incoming optical signal in inverted form. Place a 50-ohm push-on terminator on the receiver's • (clock) output connector.

- For each transmitter providing additional optical-path capacity for a DV6000-system unit in an adjacent DV6016ES equipment shelf, connect a coaxial patch cable (not to exceed 60 inches in length) between the transmitter's ♦ (data) input connector and the appropriate data output connector of the MUX or DAP unit in the equipment shelf.

Stop! You have completed this procedure.

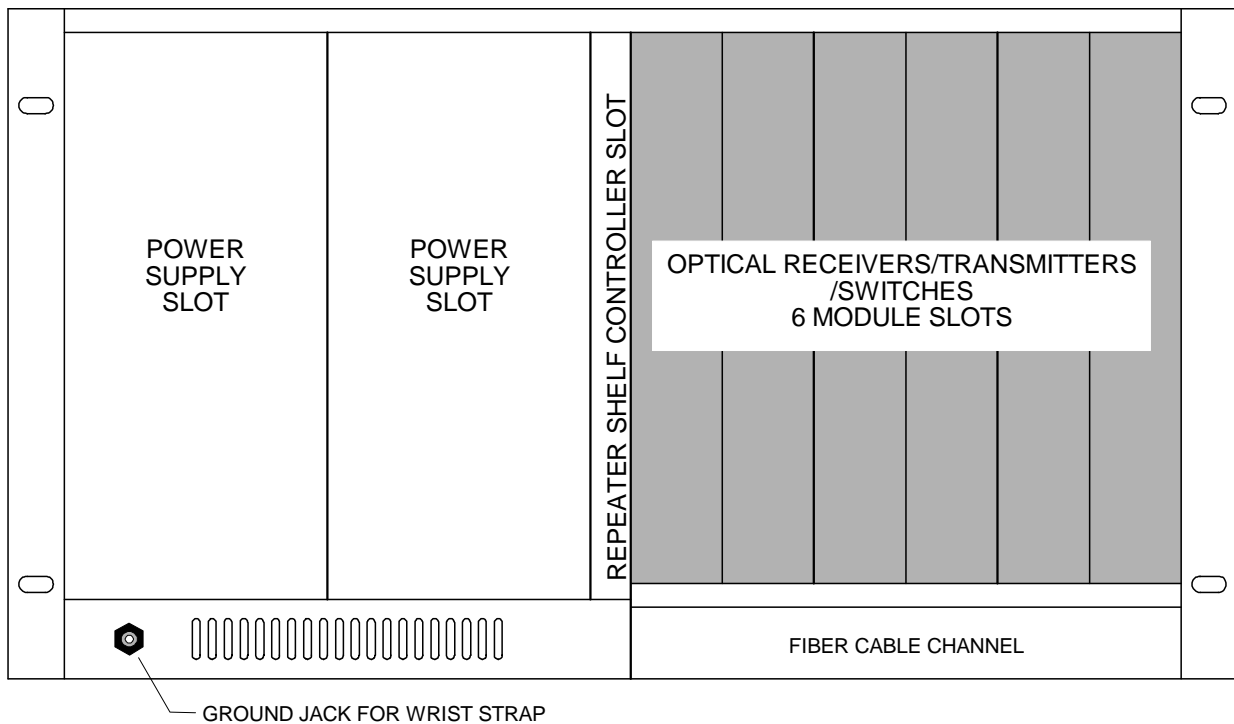


Figure 508-1. Transmitter/Receiver Module Locations in the DV6016RPS Repeater Shelf

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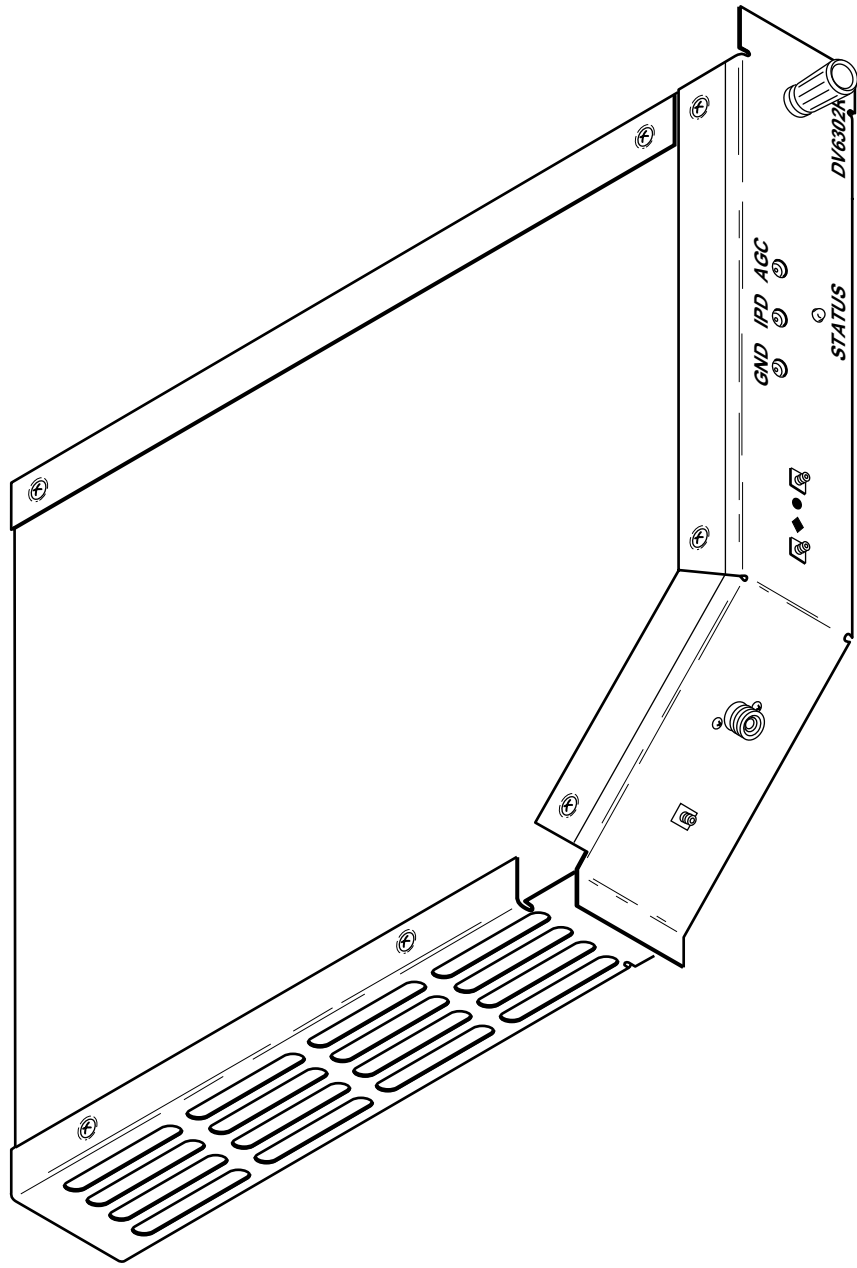


Figure 508-2. DV6000-System Optical Receiver Module

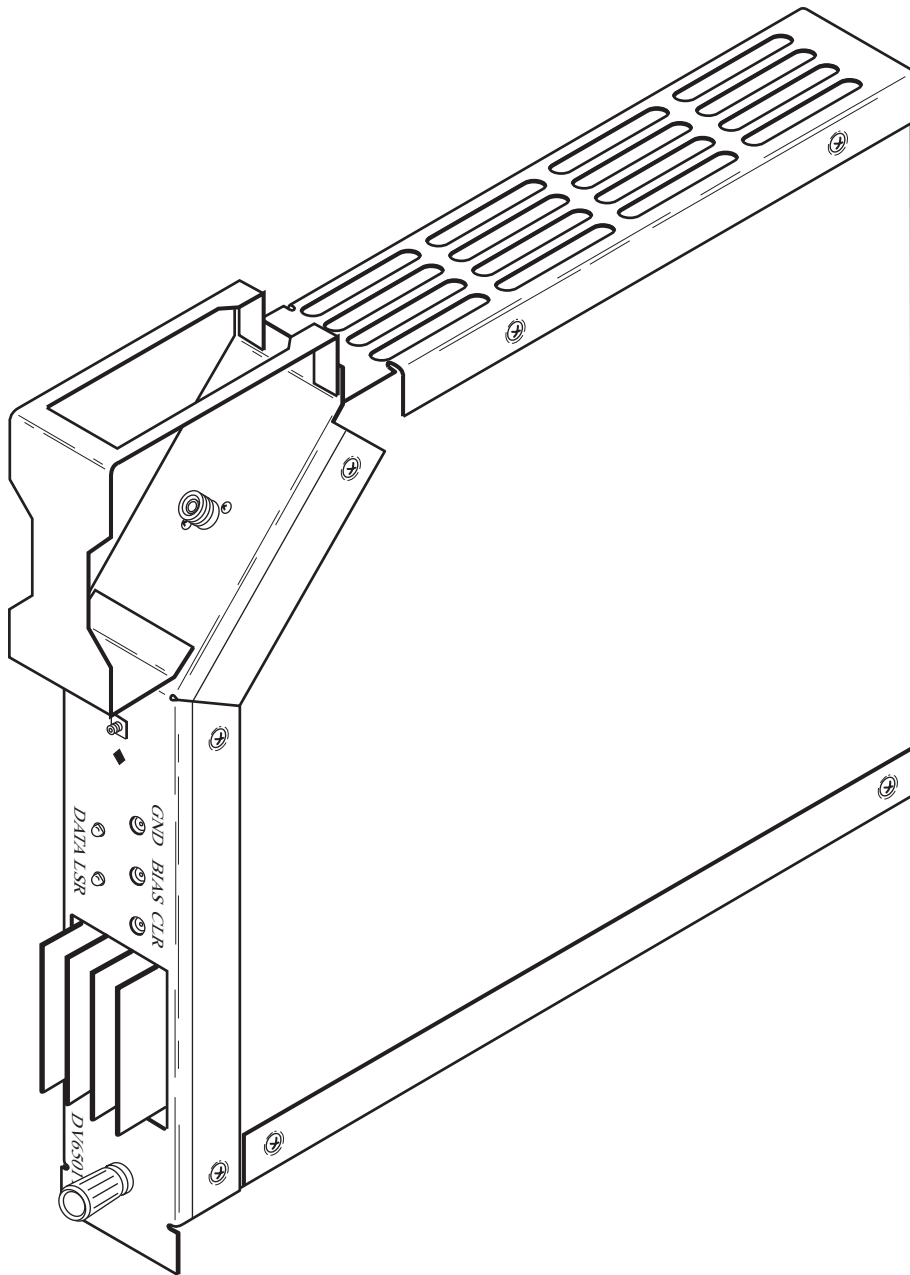


Figure 508-3. DV6000-System Optical Transmitter Module

Check Output Voltages of Power Supplies

Summary: Each power supply produces four nominal output voltages: +5 VDC, –5 VDC, +12 VDC, and –12 VDC. This procedure describes how to determine whether actual power supply output voltages fall within the acceptable limits shown in Table 509-1.



Warning: *To prevent electrical shock, never work on electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - ESD wrist strap
 - Digital voltmeter with test leads
2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling DV6000-system units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded, anti-static mat.*

3. See that at least one optical receiver or transmitter is installed in the repeater shelf.



Note: Do not test power supply voltages without at least one optical receiver or transmitter installed in the DV6016RPS shelf. Without such a load on the power supply, supply output voltages will not fall within limits shown in **Table 509-1**.

4. Check each transmitter installed in the shelf to be sure its optical output connector either has an outgoing fiberoptic cable properly connected to it or is capped.



Warning: *To avoid exposure to invisible laser radiation, do not look into the ends of any optical fiber or bulkhead connector. Use an optical power meter to identify active fibers. Do not assume laser power is turned off or that the fiber is disconnected at the other end.*



Warning: *Infrared radiation is invisible and can seriously damage the retina of the eye. To avoid potentially dangerous amounts of radiation exposure, a protective cap or hood **MUST** be immediately placed over any radiating bulkhead receptacle or optical fiber connector. This practice also keeps dirt particles from entering the connector.*

5. Turn on the power supply to be tested by moving its rocker switch or circuit breaker to the "1" position. (If two power supplies are installed in the shelf, leave the second one off.) The activated supply's green DC-OK LED should light.
6. Plug the voltmeter's negative lead into the power supply ground (GND) test point. Use the positive lead to make contact with each of the output-voltage test points in turn. See **Figure 509-1**. Compare the measured value with the limits (**Table 509-1**).

Table 509-1. DC Output Voltage Limits for DV6000-System Power Supplies

NOMINAL DC VOLTAGE	LOWER LIMIT	UPPER LIMIT
+12 V	+ 12.6 V	+ 13.4 V
- 12 V	- 12.6 V	- 13.4 V
+ 5 V	+ 5.2 V	+ 5.5 V
- 5 V	- 5.3 V	- 5.6 V

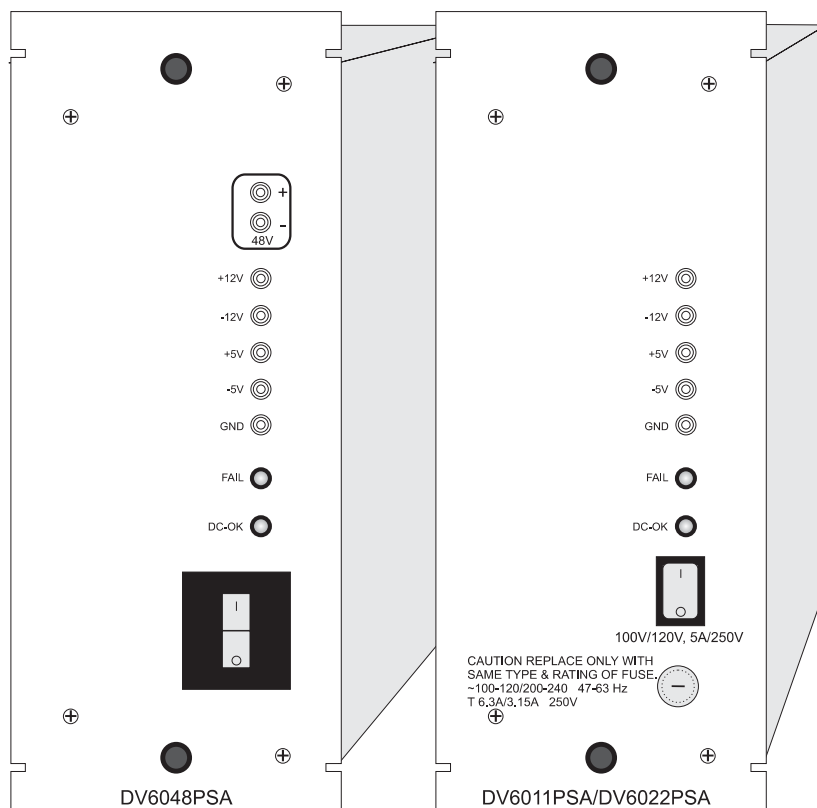


Figure 509-1. DV6000 A Series Power Supplies

7. If the tested output voltages are not within the tolerance limits, replace the power supply and return the faulty unit to C-COR.net.
8. Repeat steps 5 through 7 for the second installed power supply, if applicable.

Stop! You have completed this procedure.

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Confirm Power Presence for Transmitters and Receivers

Summary: This procedure describes how to check that power is reaching each transmitter or receiver installed in the repeater shelf.



Warning: *To prevent electrical shock, never work on electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - ESD wrist strap
2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling DV6000-system units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded, anti-static mat.*

3. Turn on a power supply installed in the repeater shelf.
4. Check the LEDs on the modules installed in the shelf:
 - On each installed receiver module, the LED marked STATUS should be illuminated. The color the LED shows is irrelevant for this test.
 - On each installed transmitter module, the LEDs marked DATA and LSR should be illuminated. The colors the LEDs show are irrelevant to this test.
 - If two power supplies are installed in the repeater shelf but only one is turned on, it is normal for the inactive supply's red FAIL LED to be illuminated.
5. If, for any installed transmitter or receiver, no LED illuminates when a power supply is turned on, turn off the power supply and reseal the module in question to be sure that it is making good electrical contact with the backplane connector. Then turn the power supply on again, and again check the LED(s) of the module in question.
6. If, for any installed transmitter or receiver, no LED illuminates when a power supply is turned on again per step 5, turn off the power supply and remove any modules that do not seem to be receiving power properly. Return suspected faulty modules to C-COR.net.

Stop! You have completed this procedure.

Check Transmitter Bias and Cooler Voltages

Summary: This procedure describes how to test the bias voltage of a transmitter module installed in a repeater shelf.



Warning: *To prevent electrical shock, never work on electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - ESD wrist strap
 - Digital voltmeter with test leads
2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling DV6000-system units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded, anti-static mat.*



Note: *Transmitter bias voltage measurements are meaningful only if performed while the transmitter's laser is being driven by a data signal. This means that the repeater shelf containing the transmitter under test must be fully operational, and that the transmitter's DATA LED must be showing green, indicating that the module is seeing the expected density of data transitions at its input.*

3. Use the digital voltmeter to measure the voltage between the transmitter's BIAS and GND test points. See Figure 511-1.
4. Record the voltage measurement.
5. The bias voltage should be 1.0 ± 0.2 VDC over a temperature range of 0 - 50° C.
6. If measured bias voltage is not within the limits of step 5, replace the transmitter module and return the faulty unit to C-COR.net.

Stop! You have completed this procedure.

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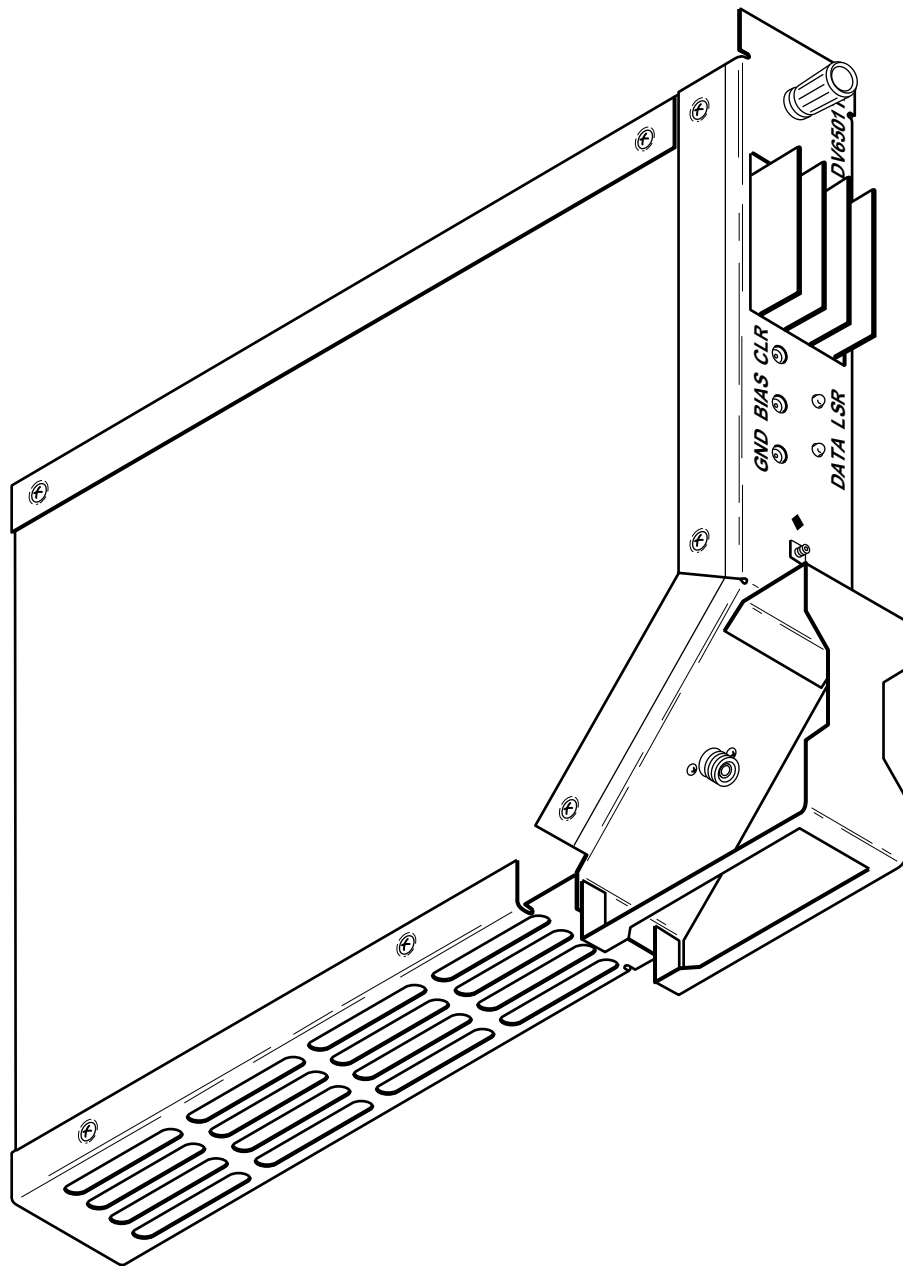


Figure 511-1. DV6000-System Optical Transmitter (DV6301TXD or DV6501TXD)

Check and Adjust Receiver Optical Input Power; Check Receiver AGC and IPD Voltages

Summary: This procedure describes the:

- Measurement of the optical power level present at the optical input receptacle of a receiver module installed in a repeater shelf
- Adjustment of the optical power level if necessary
- Measurement of the receiver automatic gain control (AGC) voltage



Warning: *To prevent electrical shock, never work on electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - ESD wrist strap
 - Optical power meter
 - Digital voltmeter with test leads
2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling DV6000-system units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded, anti-static mat.*

3. Identify the optical input cable serving the receiver in question in the repeater shelf.



Note: This input cable must be live (carrying an optical signal) for the purposes of this test. If the cable is not live, this test will not be valid or useful.



Warning: *To avoid exposure to invisible laser radiation, do not look into the ends of any optical fiber or bulkhead connector. Use an optical power meter to identify active fibers. Do not assume laser power is turned off or that the fiber is disconnected at the other end.*



Warning: *Infrared radiation is invisible and can seriously damage the retina of the eye. To avoid potentially dangerous amounts of radiation exposure, a protective cap or hood MUST be immediately placed over any radiating bulkhead receptacle or optical fiber connector. This practice also keeps dirt particles from entering the connector.*

4. Connect the input optical cable to the optical power meter.

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5. Measure the received optical power and record the measurement. For proper receiver operation, the received signal must have an optical power level between -30 dBm and -10 dBm.
6. If the received optical power is less than -30 dBm, action must be taken to increase the output level at the site where the optical signal originates, or to reduce optical attenuation in the fiber path between sites.
7. If input power is too high, *i.e.*, greater than -10 dBm, insert an in-line optical attenuator, C-COR.net model FASVAFC or equivalent (a single-mode, variable attenuator with FC connectors) in the optical input line before the receiver input.



Warning: *To avoid exposure to invisible laser radiation, do not look into the ends of any optical fiber or bulkhead connector. Use an optical power meter to identify active fibers. Do not assume laser power is turned off or that the fiber is disconnected at the other end.*



Warning: *Infrared radiation is invisible and can seriously damage the retina of the eye. To avoid potentially dangerous amounts of radiation exposure, a protective cap or hood MUST be immediately placed over any radiating bulkhead receptacle or optical fiber connector. This practice also keeps dirt particles from entering the connector.*

8. If remedial steps were required to get the received optical input signal to an acceptable level (between -30 dBm and -10 dBm), repeat the measurement and record the results.
9. Use the digital voltmeter to measure the voltage between the receiver's GND and AGC test points. See **Figure 512-1**. The reading should be between +1 and +2 volts.
10. Plug the digital voltmeter negative and positive leads into the receiver's GND and IPD test points, respectively. The voltage measured here indicates the input optical power at a ratio of 50 mV/ μ W below -13 dBm (50 μ W). For an optical power level greater than -13 dBm, the reading will be 2.5 volts. For normal operation the IPD voltage reading should be between .050 and 2.5 VoltsD.C.

Stop! You have completed this procedure.

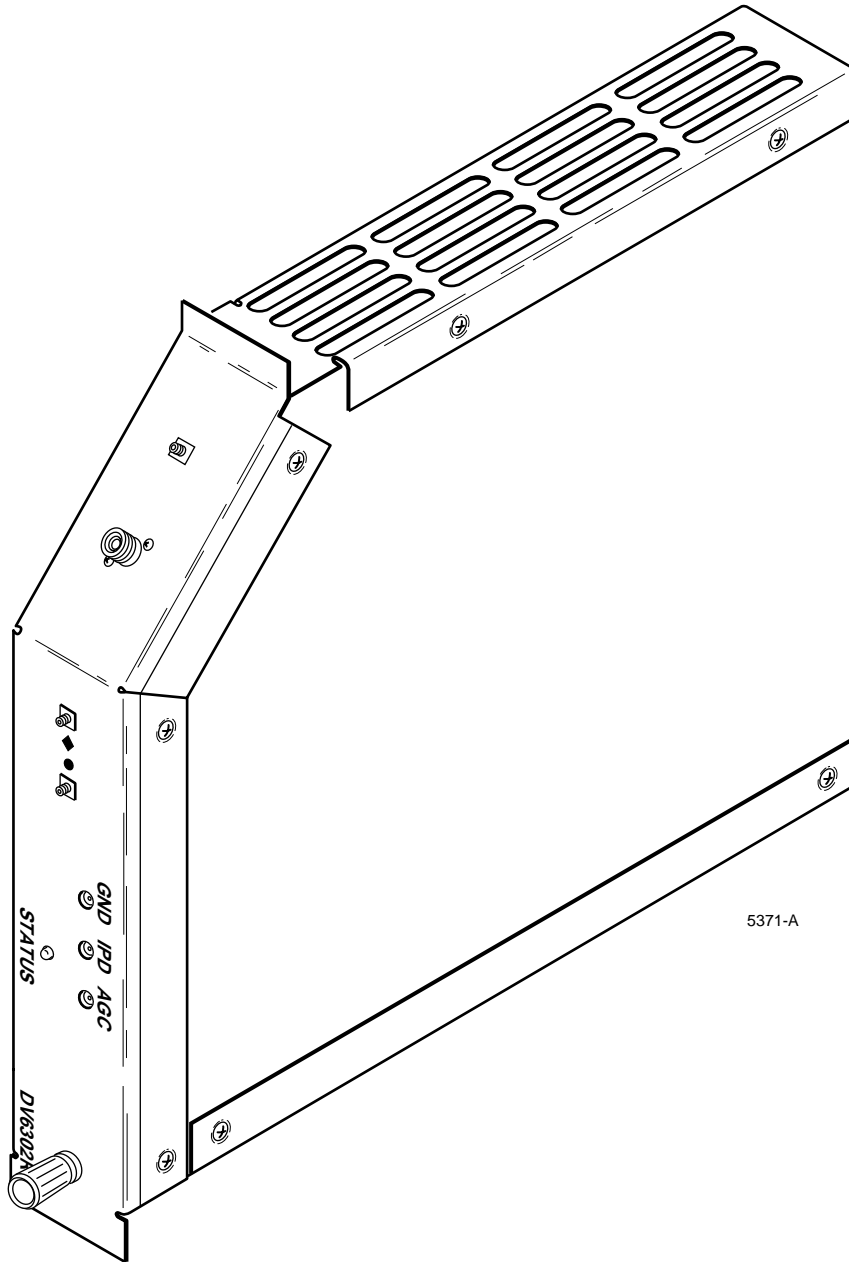


Figure 512-1. DV6000-System Optical Receiver (DV6302RCQ)

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Install Repeater Shelf Controller in Repeater Shelf

Summary: This procedure describes how to install a plug-in Repeater Shelf Controller module in a rack-mounted repeater shelf. Only one Repeater Shelf Controller is required to operate all other modules in a shelf.



Warning: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - ESD wrist strap
 - One Repeater Shelf Controller Module DV6016RPC
 - Two 1/4-inch by 4-40 sems mounting screws (with captive lock washers) and two #4 flat washers.
 - Flat-blade or Phillips screwdriver to match mounting screws



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling DV6000-system units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded, anti-static mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.
3. Align the Repeater Shelf Controller Module edges with the channels in the Repeater Shelf Controller Slot, immediately to the right of the power supplies, and slide the Repeater Shelf Controller into the Shelf. The connector at the rear of the Repeater Shelf Controller will mate with the shelf's connector when the module is fully inserted into the slot (module front panel against top and bottom shelf rails).
4. Align the mounting holes in the front panel with the holes in the rack and insert 1/4-inch by 4-40 sems (with captive lockwasher) mounting screws with additional #4 flat washer.
5. Tighten the mounting screws securely.
6. For each Dual Optical Switch Module installed in this shelf enter the following configuration information into the Repeater Shelf Controller via the Network Manager (in the OSM configuration window for SMART-NETT users):
 - The Serial Number of the DAP or Dmux that will be monitored for the switch.
 - 5 Delay Times
 - Primary Position
 - Protective Switching (Enable/Disable)
 - Switch Configuration Primary or Backup
 - Subtending Mode (none, HW, FN, **DV** - if subtending DV6000 shelf, or **RSR** - if subtending Single Channel Remote Receivers)

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7. If a protective switching scheme is being used (redundant rings, folding rings, etc.), enter the necessary configuration information for the pertinent transmitter or receiver modules into the Repeater Shelf Controller via the Network Manager (in the OSM configuration window for SMART-NETT users):
 - The Serial Number of the DAP or Dmux that will be monitored for the switch
 - Delay Times, if applicable (0 for folding rings)
 - Primary Position
 - Protective Switching (**Enable**/Disable)
 - Subtending Mode (none, **HW**, **FN**, DV, or RSR)

Stop! You have completed this procedure.

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Install Dual Optical Switch in Repeater Shelf

Summary: This procedure describes how to install a plug-in Dual Optical Switch module in a rack-mounted repeater shelf. Any number of Dual Optical Switch modules may be installed in a shelf.



Warning: *To prevent electrical shock, never install electrical equipment in a wet location or during a lightning storm.*

1. Obtain the following tools and equipment:
 - ESD wrist strap
 - Protective caps or hoods as needed to cover every fiberoptic connector and bulkhead optical receptacle to be dealt with at the repeater shelf location
 - Optical patch cables as needed to interconnect switches to be installed in the DV6016RPS repeater shelf and Receiver or Transmitter modules in the Repeater Shelf or adjacent DV6016ES equipment shelves
 - One Dual Optical Switch Module DV6120DS



Caution: *Electronic equipment can be damaged by static electrical discharge. When handling DV6000-system units, always follow Electrostatic Discharge (ESD) protection practices. Wear a grounded wrist strap when you touch a unit. Use anti-static packaging when transporting or storing units. When working on a unit, always place it on an approved, electrically grounded, anti-static mat.*

2. Place the ESD wrist strap on your wrist and snap the ground wire to the wrist strap. Plug the ground plug into a grounded ESD jack.
3. Observing the handling precautions presented in the WARNINGS below, identify each incoming and/or outgoing optical cable to be attached to a Dual Optical Switch in this shelf and route it through the opening at the rear of the shelf into the shelf's fiber cable channel.



Warning: *To avoid exposure to invisible laser radiation, do not look into the ends of any optical fiber or bulkhead connector. Use an optical power meter to identify active fibers. Do not assume laser power is turned off or that the fiber is disconnected at the other end.*



Warning: *Infrared radiation is invisible and can seriously damage the retina of the eye. To avoid potentially dangerous amounts of radiation exposure, a protective cap or hood MUST be immediately placed over any radiating bulkhead receptacle or optical fiber connector. This practice also keeps dirt particles from entering the connector.*

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4. If not already done, clean all fiberoptic connectors and adapters per DLP-507.
5. Perform the complete sequence of steps 7 through 11 in turn for each Dual Optical Switch to be installed. Completing installation of one unit before going on to the next provides the best security for each unit while it is being handled and generally makes cable connections easiest.
6. Insert the Dual Optical Switch far enough into its assigned slot in the shelf to be mechanically secure, but do not yet plug it into the backplane connector.
7. Connect the appropriate fiberoptic cables to the bulkhead receptacles on the angled portion of the unit's front panel.
8. With the optical connections made, check the clamp position indicator behind the clamp knob at the top of the unit's front panel to be sure the clamp finger behind the panel will not interfere with module insertion. The indicator should be at 9 o'clock. If necessary, rotate the indicator (and thus the finger) to that position.
9. Insert the Dual Optical Switch the rest of the way into its slot in the shelf, mating its rear connector with the backplane connector. Be careful not to pinch or exert pressure on the fiberoptic cables during this operation.
10. Turn the unit's clamp knob clockwise until the clamp position indicator moves to 12 o'clock and resistance to knob rotation indicates that the clamp finger has been pulled against the edge of the slot behind the upper shelf rail.
11. When all fiberoptic cable connections have been made and all Dual Optical Switch modules have been fully inserted and clamped in place, connect optical patch cables as specified by network design.
12. For each Dual Optical Switch Module installed in this shelf enter the following configuration information into the Repeater Shelf Controller via the Network Manager:
 - The Serial Number of the DAP, Dmux, or Remote Single Channel Receiver that will be monitored for the switch.
 - 5 Delay Times
 - Primary Position
 - Protective Switching (Enable/Disable)
 - Switch Configuration Primary or Backup
 - Subtending mode (**DV** if with a DV6000 shelf or **RSR** if with a Remote Single Channel Receiver)

Stop! You have completed this procedure.

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