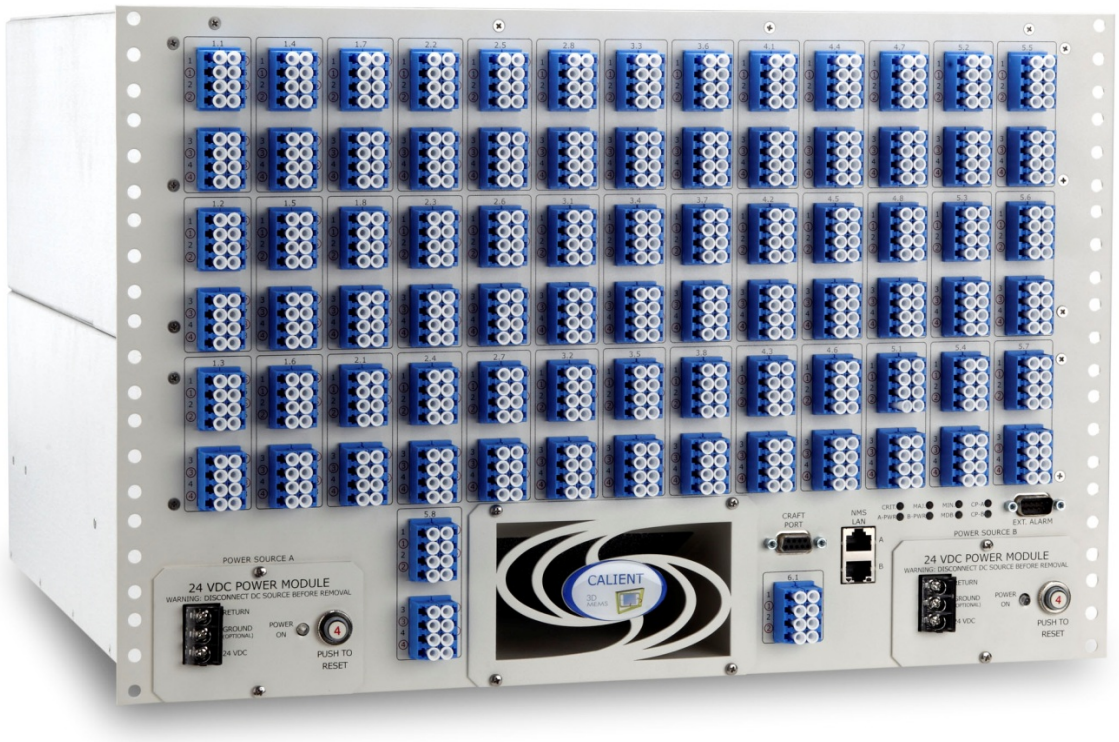
Move the light, not the fiber

S320 Photonic Switch Hardware User Manual



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Service and Support

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4 SAFETY ALERTS AND PROCESSES

This Safety Summary reviews specific safety precautions to observe when installing, operating or working around the S320 Photonic Switch.

When preparing to install the CALIENT S320 Photonic Switch, review the following list to ensure a safe installation:

- If a site survey was performed (recommended), review the completed site survey sheet for accurate site information.
- Review the safety precautions, notes and warnings contained throughout this manual.
- Observe all weight cautions related to handling equipment. Ensure that adequate personnel and resources are available during the installation to lift and transport the CALIENT S320 Photonic Switch.
- Locate power sources and prepare to observe all safety precautions related to connecting and applying electrical power.
- Take all electro-static discharge (ESD) prevention measures when handling the CALIENT S320 Photonic Switch.
- Inspect the site for sources of laser light and take all applicable precautions when near such sources.
- Exercise all applicable cautions when moving and handling hazardous materials such as compressed gas and alcohol.
- Apply the prescribed optical fiber handling and cleaning cautions.

4.1 Laser Safety

4.1.1 General Cautions

The CALIENT S320 Photonic Switch switches coherent (laser) light between input and output optical fiber terminations. The range of the light wavelengths passed through the equipment is outside the visible spectrum. Because the unaided human eye cannot detect the presence of this light, the light can pose a serious health hazard. If the hazard is not mitigated through the use of proper safety equipment and through the observance of safety precautions, blindness can result. This section presents the general safety precautions that must be observed by personnel working on or around CALIENT S320 Photonic Switch to reduce or eliminate the laser radiation hazard.

Danger

Use of controls, adjustments or procedures other than those specified in this manual might result in hazardous radiation exposure.

The CALIENT S320 Photonic Switch can switch the laser energy supplied by any one of the input fiber-optic cables to any one of the output fiber-optic cables. Therefore, all optical connectors of this device must either be attached to a fiber-optic cable that is part of a closed optical system, or capped with the supplied connector covers.

Under no circumstance shall attempts be made to operate this equipment with a fiber-optic connector uncapped or disconnected from a closed optical communication system fiber-optic cable.

All service to this device that requires removal of the housing panel is required to be performed by the manufacturer or its authorized agent(s).

Personnel operating in the near vicinity of any equipment carrying optical traffic may not be aware of possible exposure to light radiating from uncovered connectors of the equipment.

If the connectors are not capped, light might escape from the connectors of the CALIENT S320 Photonic Switch.

- Always keep fiber cables connected to all of the CALIENT S320 Photonic Switch connectors regardless of whether the fiber termination is providing an active cross-connection. If a cable is not connected to a connector, be sure the connector is capped. This prevents accidental exposure to a light source, and it also helps to prevent physical contamination of the connector's fiber-optic surfaces.
- Never look directly into a fiber end or into any optical connector. There is no warning when the connector is connected to a light source.
- Wear the appropriate laser safety glasses when a laser source may be present. When evaluating protection glasses, always consider the laser power, wavelength and the manufacturer class warnings for the laser device.

4.1.2 Laser Sources

The CALIENT S320 Photonic Switch generates Class 1 coherent (laser) light, but it passes higher-powered laser light from external sources. The CALIENT S320 Photonic Switch passes laser radiation through its fiber terminations when traffic-carrying fibers are connected to the switch.

4.1.3 Class 1 Laser

The CALIENT S320 Photonic Switch uses a Class 1 laser internally as a test source. Light from this laser could potentially be available at a fiber termination.

This laser product is certified as a Class 1 laser product to the requirements of the US Federal Product Performance Standard for Laser Products contained in the regulations in 21 CFR 1040 10. Class 1 laser products are not considered hazardous, but lasers more powerful than Class 1 may be connected to the CALIENT S320 Photonic Switch.

Though the CALIENT S320 Photonic Switch has no laser sources higher than Class 1, the total optical power through the equipment - and potentially available at any one of the fiber terminations, split-out cable connectors, patch panel cables, or patch panel coupling sleeves—could aggregate to the level of a Class 4 source.

4.2 Electrostatic Caution

Components that contain integrated circuits can be damaged by static electricity. Static electricity potentials develop through the movement of human bodies, and are released as Electro-Static Discharges (ESD) whenever encountering other objects. Dry air allows greater static charges to accumulate, but because potentials high enough to damage circuits can occur anywhere, precautions against ESD are imperative when working around the CALIENT S320 Photonic Switch.

The ESD symbol shown here appears on packaging and other items as a reminder to take the necessary precautions to prevent electro-static damage to the CALIENT S320 Photonic Switch.

ESD can damage the CALIENT S320 Photonic Switch. To reduce the possibility of ESD damage, most racks provide grounding jacks into which anti-static wrist straps can be plugged. Observe the following precautions whenever you are working with the CALIENT S320 Photonic Switch:

- Always wear a tested and verified grounded wrist strap to prevent ESD and be sure the wrist strap is plugged into a grounding jack.
- Observe warning labels on bags and cartons. Whenever possible, do not remove a module from its antistatic packaging until it is to be installed in the rack.
- Always store and transport any module in antistatic packaging.
- Keep all static-generating materials such as plastic foil wrappers, other plastics, Styrofoam and cardboard containers away from the CALIENT S320 Photonic Switch.
- Maintain ambient humidity within the 20% to 85% limits specified for CALIENT S320 Photonic Switch operation.

4.3 Optical Connections

4.3.1 Keeping Fiber Connectors Clean

Optical fiber connectors require special handling to mitigate contamination from dust and debris that could increase insertion loss. Contamination during connection of the connector surface perpendicular to the light propagation can increase insertion loss and back-reflection. Once a pair of clean connectors is mated, however, it is unlikely that further contamination will occur until the next time the fibers are disconnected.

To minimize the effects of particulate contamination, the surface of the connector end must be cleaned before connection. This cleaning operation is extremely critical, as an improperly prepared optical surface can cause loss of performance.

4.3.2 Optical Fiber Bend Radius

The Minimum Bend Radius (MBR) for optical fiber cables used on the CALIENT S320 Photonic Switch is 1 inch (25 mm). An optical fiber or fiber-optic cable should not be bent below the MBR. Bending a fiber below the MBR can result in damage to the fiber. Improper handling of optical fiber and cables can have detrimental effects on CALIENT S320 Photonic Switch performance. Observe the following precautions for handling fiber and cable:

- Keep optical surfaces clean — only trained personnel should clean optical cables and connectors.
- When optical cables or optical connectors are not connected, make sure the cables and/or connectors are capped. Be sure to use clean caps.
- Handle the fiber cables as little as possible.
- Never eat, drink, or smoke around optical equipment.
- Keep cable runs neat and observe the Minimum Bend Radius when bending fiber-optic cables.

4.4 Cleaning Substance Hazards

4.4.1 Isopropyl Alcohol

When cleaning the optical fiber connectors, it might be necessary to use a solvent. The solvent that is recommended for cleaning optical fiber connectors is isopropyl alcohol, optical purity.

DOT HAZARD CLASS: Flammable Liquid.

When handling isopropyl alcohol, keep container closed and away from heat, sparks, or open flame. Store in an approved flammable materials cabinet when not in use. Dispose of soiled materials in an appropriately marked approved container.

When handling isopropyl alcohol, observe these precautions:

- Keep container closed, away from heat, sparks, and flame.
- Use with adequate ventilation.
- Avoid breathing vapor.
- Wash thoroughly after handling.
- Avoid contact with eyes, skin and clothing.
- If fluid is spilled, clean up and dispose as hazardous waste according to local requirements.

Isopropyl alcohol is harmful if inhaled or ingested, and when it contacts the eyes or skin. Only use in a well-ventilated area. If exposure occurs, immediately call emergency medical services, then your local poison control center. For external exposures (that is, eyes or skin), immediately flush the exposed area with large amounts of clean water for a minimum of 15 minutes.

4.4.2 Leak/Spill Disposal Information

Remove all sources of ignition. Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from vapors. According to local practices, dispose contaminated clean-up materials as hazardous waste in an approved facility.

4.4.3 Decanting Information

When decanting isopropyl alcohol from a distribution container to a supply container, ensure the supply container is appropriately labeled to prevent possible contamination with a foreign substance. When refilling storage and work containers, follow these steps:

- Empty the previous contents into a solvent waste container.
- Partially (5-10%) fill the container to be filled with alcohol.
- Cap the container and shake to clean out the container.
- Pour out this shaken alcohol into the solvent waste container.
- Refill the container to the 80-90% level.
- Close the container lid.
- Immediately close the distribution container lid.

Note

Failing to keep cleaning solution containers closed except when in use can result in solution contamination.

4.4.4 Nitrogen Precautions

When cleaning CALIENT S320 Photonic Switch optical fiber connectors, CALIENT recommends using small, disposable canisters of 99.9% pure nitrogen compressed gas. Attention should be given to the information supplied in the cylinder supplier's Material Safety Data Sheet (MSDS).

Warning

Nitrogen canisters contain high-pressure gas that can cause rapid suffocation. Nitrogen gas acts as a simple asphyxiant by displacing air necessary for life. If asphyxiation symptoms occur —rapid respiration, loss of muscular coordination, fatigue, dizziness or nausea — move immediately to fresh air. Do not puncture or incinerate nitrogen canisters.

4.4.5 Nitrogen Cylinder Precautions

If using an industrial-size compressed gas cylinder:

- Keep it from falling over or rolling around where the valve could be damaged.
- Open the cylinder valve a little at a time. If the valve cannot be opened by hand, return the cylinder to the supplier. Never use force (such as using a wrench) when opening a cylinder valve. Similarly, never use force to close a cylinder valve.
- Never heat a cylinder that contains a liquefied gas to increase the gas flow or to increase the required rate.
- Use only connectors designed specifically for compressed gas cylinders. Never use intermediate connectors.
- Always check the condition of couplings before use.
- Use only materials compatible with the gas.
- Never allow any substance whatsoever (gas or liquid) to get into a cylinder that is in use. If there is a risk of this, mount an anti-return valve. If a foreign substance accidentally gets into a cylinder, notify the supplier.

5 THE CALIENT S320 PHOTONIC SWITCH SYSTEM

5.1 Overview

CALIENT's S320 Photonic Switch is a breakthrough in fiber-optic cross-connect systems. The S320 Photonic Switch provides software-controlled and transparent fiber optic switching functionality, and it will revolutionize the way optical fiber is installed and managed.

The S320 Photonic Switch enables dynamic optical layer optimization in next generation data centers and software defined networks. Datacenter operators and Service Providers can now stay ahead with the runaway pace of fiber deployment and make fiber networks more profitable.

The S320 Photonic Switch has carrier-class reliability making it at home in Datacenters, Metro Software Defined Networks (SDN), FTTx networks, and Government deployments. ItS320 supports a wide range of network applications, from the network core to access, allowing any optical input fiber to be connected at the photonic level to any output fiber, irrespective of the data rate or protocol of the signals carried by the fiber.

5.2 Architecture

The CALIENT S320 Photonic Switch establishes monitors and changes connections between single-mode optical fibers using Micro-Electro-Mechanical Systems (MEMS) optical switching. Connections are made between fibers carrying signals with any wavelength, data rate or protocol. TheS320 Switch architecture is shown in Figure 1.

The core of theS320Switch is the MEMS Switch Module (MSM320). Input fibers are connected to the MSM320, which establishes connections with any of the desired output fibers. Light tapped from the input and output fibers is fed to the Optical Monitoring Module (OMM) to enable monitoring of existing connections, and establishment and optimization of new connections. Light is tapped using fiber tap couplers in the S320-TC Photonic. Mirror drivers control each connection by supplying voltage to each MEMS mirror. Users manage and communicate with the CALIENT S320Switch via the Control Processor (CP). To ensure high availability, the Processors and power supplies are redundant.

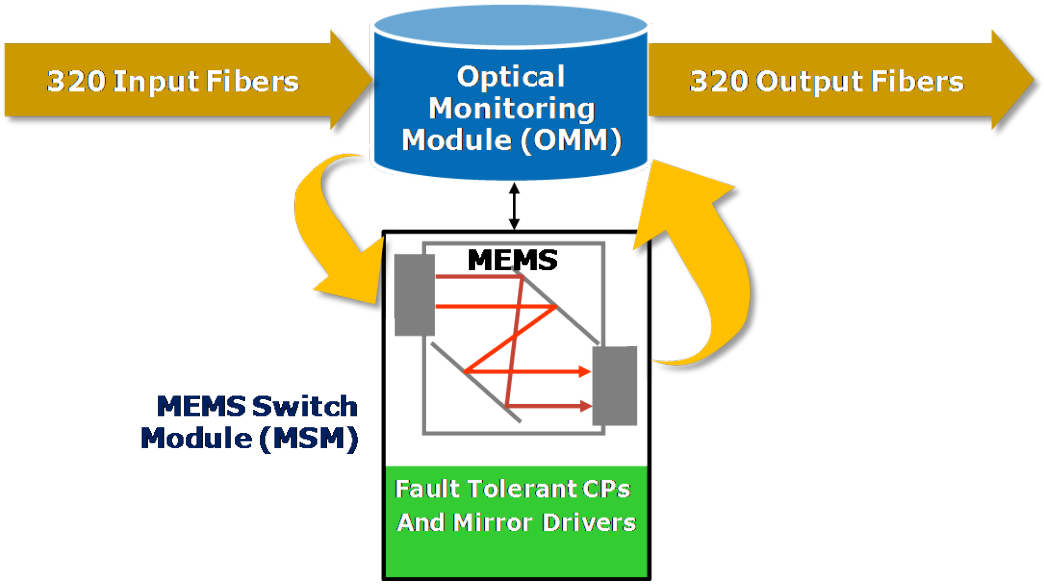

Figure 1: CALIENT S320 Photonic Switch Architecture

The core of the CALIENT S320 Photonic Switch is the MSM320 that establishes the light paths. The light path within the MSM320 architecture is illustrated in Figure 2.

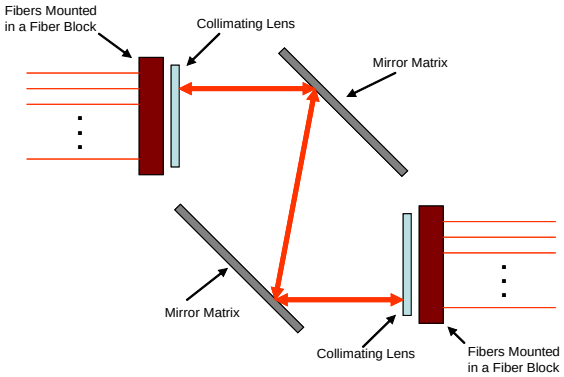

Figure 2: Light path within the MSM320

Light is directed from the input fibers to the output fibers using array of tiny silicon mirrors that are fabricated using the proven MEMS process. An optical signal transmitted through the CALIENT S320 Photonic Switch passes through three sections of the MSM320: the input collimator array, which directs the light from each input fiber to its input mirror; the mirror matrix, an array of MEMS input mirrors and an array of MEMS output mirrors; and the output collimator array, which couples light from each output mirror back into its output fiber. High-quality mirrors and collimators, and precise electrostatic control of the position of each mirror, enable switch times less than 20 ms and optical loss that is typically less than 2.0 dB for the S320-TC Photonic Switch.

The MSM320 module as shown in Figure 3 is the core of the CALIENT S320 Photonic Switch system. The MSM320 module supports up to 320 input fiber terminations and up

to 320 output fiber terminations. It is controlled by the Processors and powered by the mirror driver.

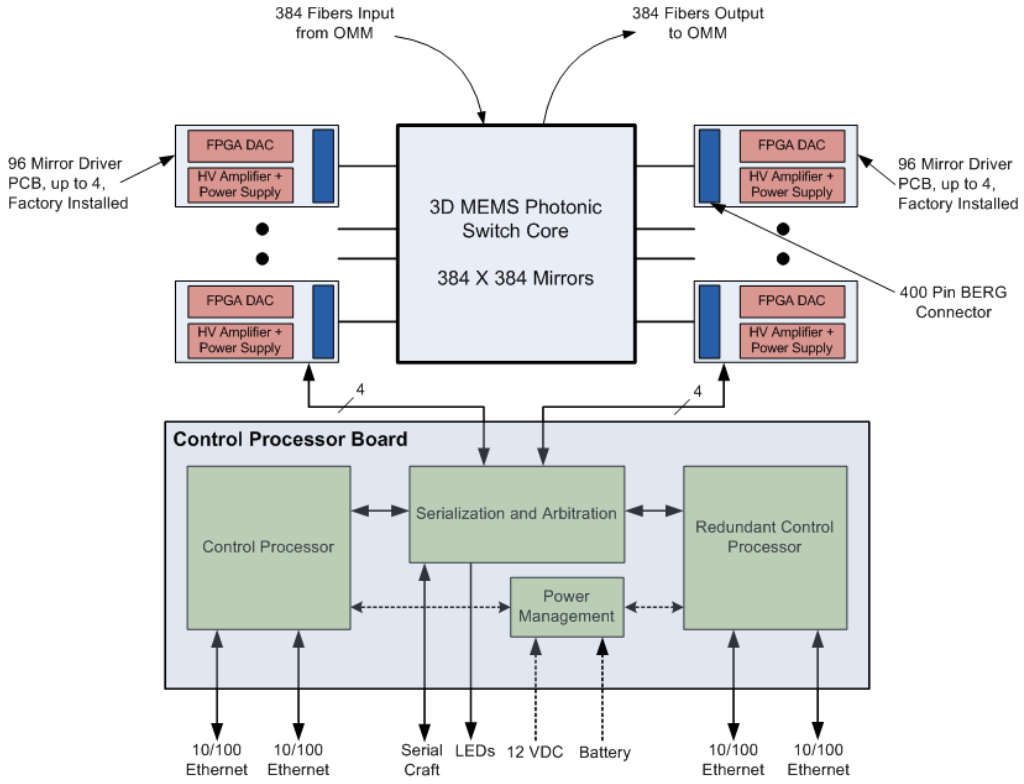

Figure 3: MSM320 block diagram

The switching matrix in the MSM320 module consists of a dedicated MEMS mirror for each input fiber, and a dedicated MEMS mirror for each output fiber. The angular position of each mirror is determined by the voltages applied to the mirror by the mirror drivers. To direct light from an input fiber to an output fiber, voltages are applied to the input fiber's input mirror to point that mirror at the output mirror corresponding to the desired output fiber. The output fiber's output mirror is aligned by applying the required voltages so that the final reflection is directed with minimum insertion loss to the desired output fiber. The MSM320 module sits on vibration isolators for enhanced protection against environmental impacts.

Within the MSM320 module, there are eight (8) mirror drivers with each mirror driver capable of supporting up to 96 MEMS mirrors. These mirror drivers provide the appropriate voltages to each MEMS mirror in the MSM320 module for establishing and maintaining connections. The mirror drivers are controlled by the Processor, which is the "brain" of the S320 Photonic Switch. The Processor establishes and maintains connections, and co-ordinates system management. Because of the vital role of the Processor, the S320 Photonic Switch is configured with redundant Processors. The Processors operate as active and hot standby. Configuration and provisioning changes made on the active Processor are reflected onto the hot standby Processor. If the active Processor fails, the standby Processor takes over. No existing connections are affected by the Processor switchover.

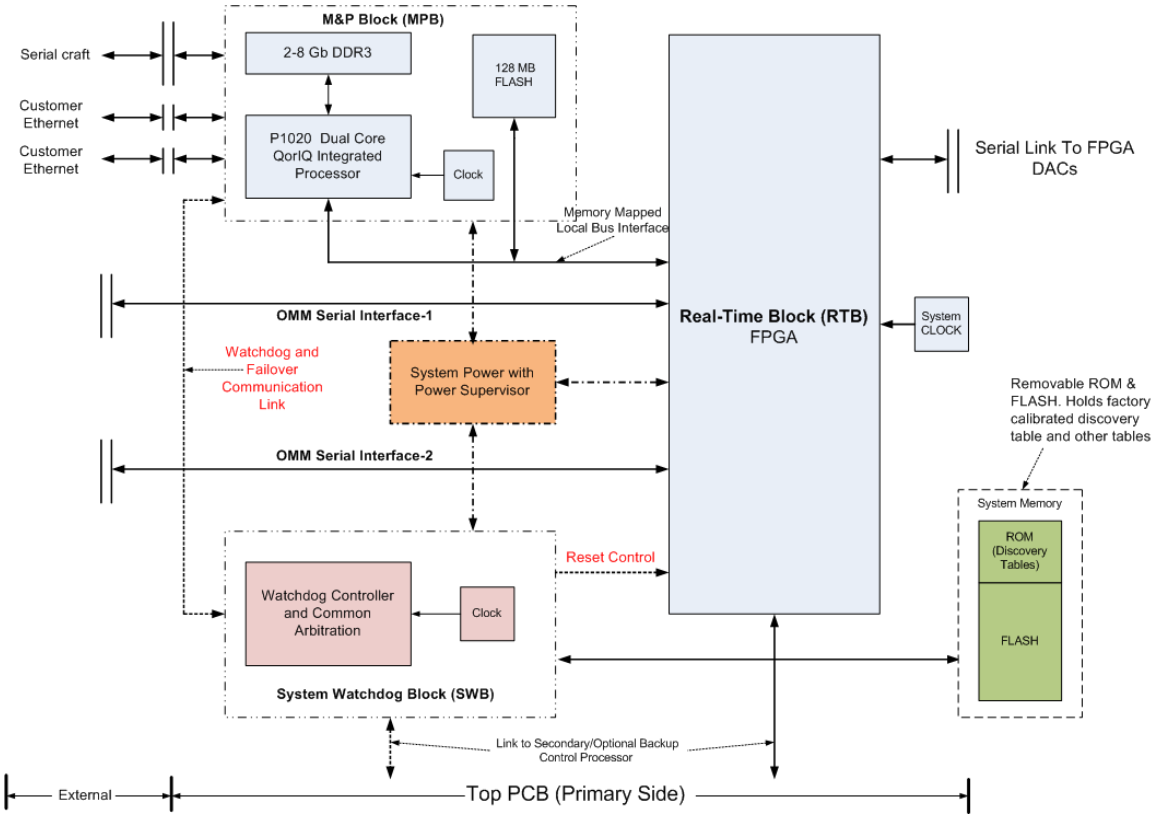

Figure 4: MSM320 architecture

Figure 4 shows the architecture of the MSM320 in more detail. The Processor writes the control parameters to memory mapped locations in the Real Time Block FPGA using the local bus, where the data is transmitted over serial links to associated mirror drivers. There is an independent full duplex LVDS link to each mirror driver, and the integrity of each transmission is ensured through CRC checking. Elaborate power management guarantees proper sequencing at power-on; if the system goes to battery back-up, the two Processors are switched to low power mode to maximize battery resources while the drivers continue to function in normal capacity to maintain mirror positions.

Figure 5 shows the block diagram of the OMM module, which contains the sensors that detect the average optical power on each fiber. The CALIENT S320 Photonic Switch system contains two OMM modules: one for all input fiber terminations and a second for all output fiber terminations. The light propagating towards the MSM320 module on each input fiber and the light propagating away from the MSM320 module on each output fiber are tapped off and sent to the OMM modules. Light is tapped using fiber tap couplers (S320-TC) or using a free-space method (S320-FS).

The sensing provided by the OMM modules enables monitoring of the average optical power at all 320 input and 320 output fiber terminations. The power levels provided by the OMM module are then used by the CALIENT S320 Photonic Switch system to monitor and optimize the mirror alignment of an existing or new connection for minimum optical loss. The power levels measured by the OMM are also available to the user via the S320 Photonic Switch management interface. Please refer to the CALIENT S320

Photonic Switch Software User Manual for a detailed description of the software management interface.

The Real Time Block implemented on an FPGA allows the Processor to receive inputs from both OMM modules. The OMM modules continuously provide feedback on mirror connection qualities to the mirror algorithms. The FPGA communicates with the OMM using serial LVDS links. Each OMM also contains an index channel laser to calibrate the photodetectors properly. For enhanced system reliability, the two OMM modules also share each other's index channel laser.

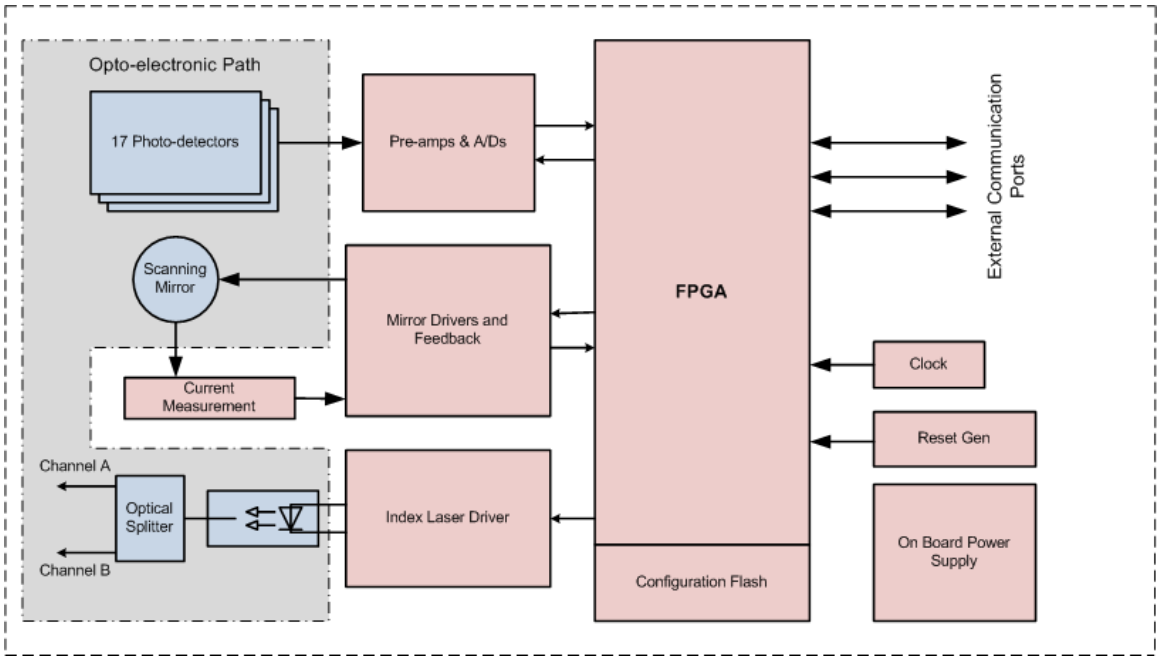

Figure 5: OMM block diagram

5.3 Front and Back Panel

The CALIENT S320 Photonic Switch system, its front and back panels are shown in Figure 6. This section describes the front panel interfaces of the CALIENT S320 Photonic Switch system.

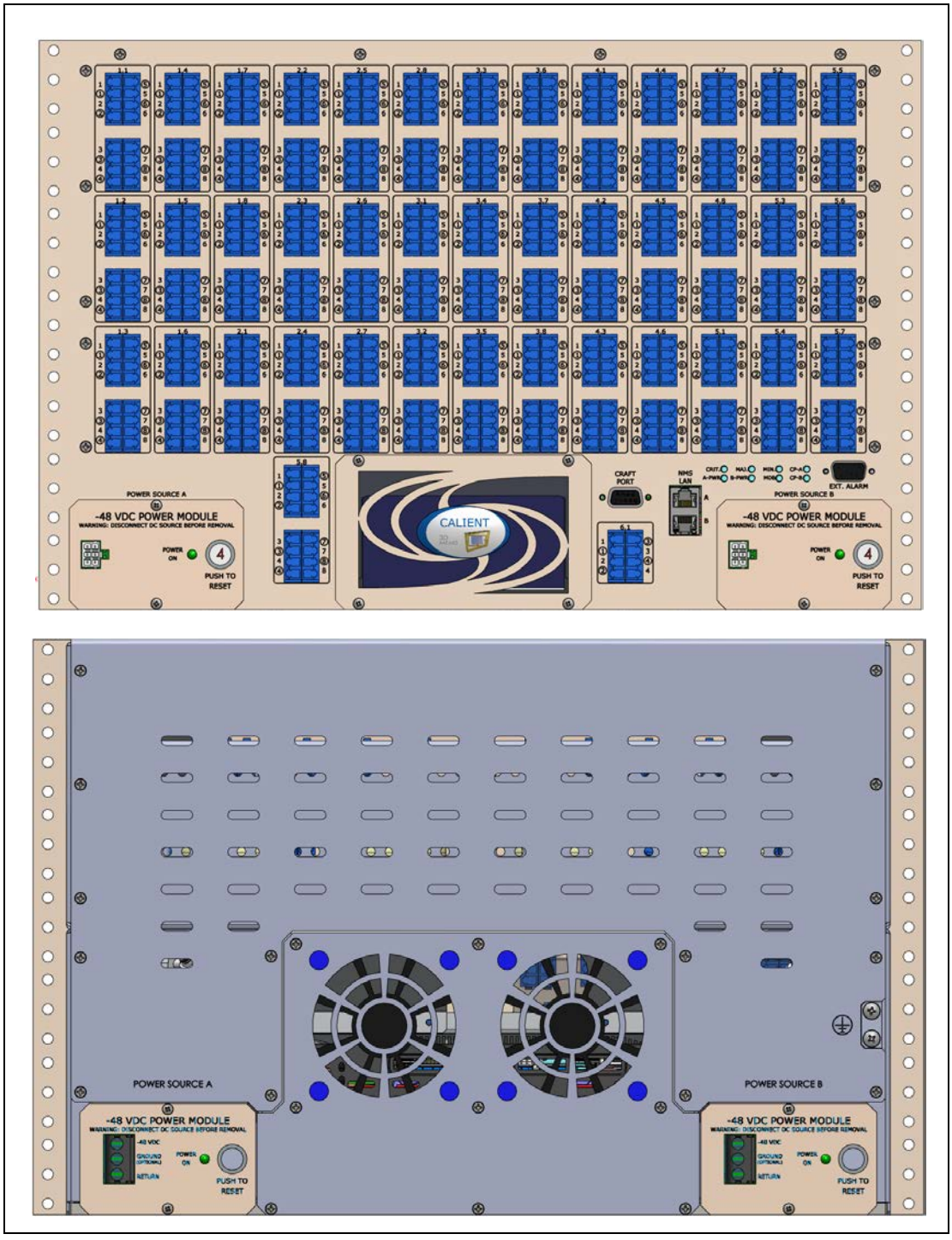

Figure 6: The CALIENT S320 Photonic Switch system with front (top) and back (bottom) panels. As shown: The S320 Photonic Switch model with front -48 VDC power option and rear blanks

5.3.1 Fiber Interface

The Fiber Interface is the optical interface point for the CALIENT S320 Photonic Switch. The user's input and output optical fibers are connected to the Fiber Interface. The Fiber Interface is configured at the factory for the connector type and mode of operation selected by the user. A standard S320 Photonic Switch Fiber Interface, as shown in Figure 6, has an array of 320 input and 320 output LC-UPC bulkhead adaptors. In the standard Fiber Interface, the fibers are numbered using the format s.f.p, where s (segment number) = [1-5], f (fiber group) = [1-8] and p (port number) = [1-8]. Each number s.f.p corresponds to a pair of fibers, input (p number is not circled) and output (p number is circled). So port 1.2.6 is a pair of fibers, input and output, that is the 6th port in the 2nd fiber group of the 1st segment.

5.3.2 Operational Status LEDs

Immediately below the Fiber Interface, the CALIENT S320 Photonic Switch operational status LEDs are located. A total of eight (8) LED indicators provide a visual alert to the user of system-level fault conditions. These LEDs are summarized as follows:

1) Critical (CRIT), Major (MAJ) and Minor (MIN) equipment alarm indicators, where solid red indicates that one or more alarm is present

2) Power Source A (A-PWR), Power Source B (B-PWR) and Latching Battery Power Source (L-PWR) indicators, where solid green indicates that power is applied to each feed

3) Configuration Processor A (CP-A) and Configuration Processor B (CP-B) alarm indicators, where solid green indicates that the CP's are operational while blinking green indicates that there is activity in the switch

Please refer to the CALIENT S320 Photonic Switch Software User Manual for a detailed description of CALIENT S320 Photonic Switch alarm behavior.

5.3.3 External Alarm Interface

Immediately adjacent to the operational status LEDs, the CALIENT S320 Photonic Switch external facility alarm interface connector is provided. Three (3) dry contact-latching relays for critical, major and minor alarms are available for connections to facility or exchange scan equipment by way of this DB-9 connector. This alarm interface is listed in Table 1.

Pin	NetName	Text Name
1	CRITV_NC	Critical Alarm Visual Normally Closed
2	CRITV_RET	Critical Alarm Visual Common
3	CRITV_NO	Critical Alarm Visual Normally Open
4	MAJV_NC	Major Alarm Visual Normally Closed
5	MAJV_RET	Major Alarm Visual Common
6	MAJV_NO	Major Alarm Visual Normally Open
7	MINV_NC	Minor Alarm Visual Normally Closed

8	MINV_RET	Minor Alarm Visual Common
9	MINV_NO	Minor Alarm Visual Normally Open

Table 1: External alarm interface definitions

5.3.4 Management Interface

Immediately adjacent to the operational status LEDs, the CALIENT S320 Photonic Switch management interfaces are provided. These interfaces are:

- Ethernet: Dual Gigabit Ethernet (GbE) ports using RJ45 connectors with status LEDs (labeled NMS LAN A and B). The Ethernet connection is used to control the CALIENT S320 Photonic Switch using TL1 (via a Telnet session) or using the browser based graphical user interface (GUI).

- Craft Serial: One (1) RS-232 port using a DB-9 connector (labeled CRAFT PORT). The craft serial cable connection provides a means of retrieving or setting the CALIENT S320 Photonic Switch IP address and performing TL1 operations.

Please refer to the CALIENT S320 Photonic Switch Software User Manual for a detailed description of CALIENT S320 Photonic Switch software management interface.

5.3.5 Power Source Interface

The CALIENT S320 Photonic Switch system is powered via redundant A and B power source inputs and an external battery latching battery power source input. CALIENT provides various power module options (-48 VDC, and an external AC power supply option). The DC power supply modules are installed either on the front or on the rear facing power supply locations. The power modules are initially installed at the factory while blank patch panels are placed on the unused vacant power supply locations. The power modules are hot-swappable and field-replaceable. All power modules are modular and connect with the same 3-pin connector. The AC power supply option is external to the S320 switch and is used in conjunction with the 48VDC module. The DC output of the AC power supply has a nominal output of -48VDC and only connects to the -48VDC input to the S320 power module .

Table 2 Power supply Input Voltage Tolerances

Power Supply	Min. Input Voltage	Nominal Input Voltage	Max. Input Voltage
48 VDC	43. 2VDC	48VDC	52. 8VDC
External AC Power supply option	90VAC	120VAC	264VAC

Figure 7 shows the S320 model CALIENT S320 Photonic Switch system with the front facing DC power supplies while blank patch panels are shown on the unused power supply locations on the rear. Figure 7 shows the same S320 model with the DC power supplies installed on the rear while the front facing power supply locations are vacant. Figure 8 shows a close up of all the power supply options.

If the A power source fails, the CALIENT S320 Photonic System automatically draws all required power from the alternate B power source without impact to existing cross connects or management connectivity. S320

As described in section 5.3.2, LEDs indicating power source status are also provided on the front panel. Furthermore, “push-to-reset” circuit protection breakers for both power source inputs are provided immediately above the A power source input.

Figure 7 The S320 model CALIENT S320 Photonic Switch system with front (top) blanks and rear (bottom) -48 VDC power module option

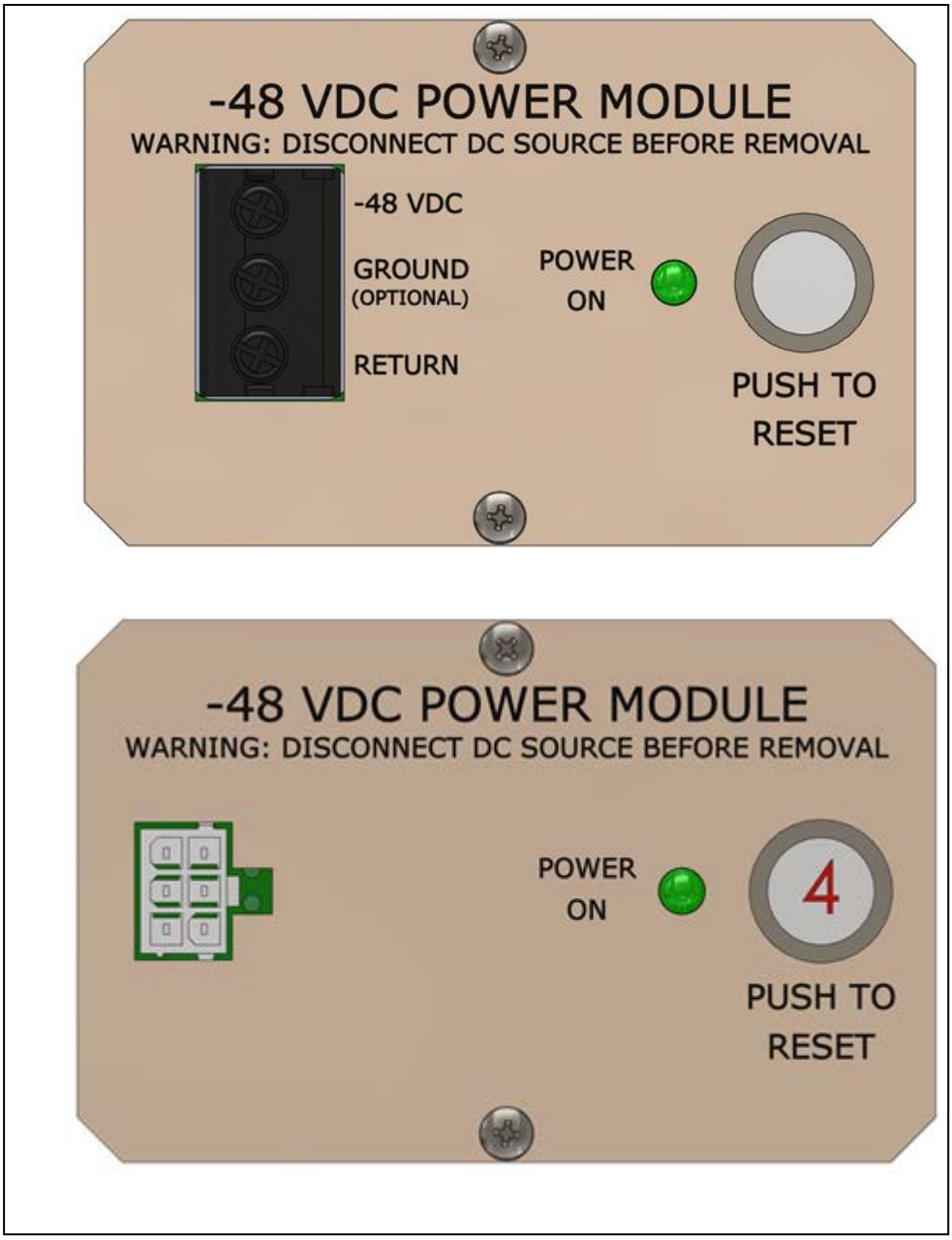

Figure 8: Power module option (top to bottom): terminal strip -48 VDC

6 UNPACKING PROCEDURE

This chapter describes procedures for receiving and unpacking the CALIENT S320 Photonic Switch.

6.1 Receiving

The CALIENT S320 Photonic Switch is shipped in a single container. The shipping container (H = 21", D = 24", and W = 27", weight = 61 lbs) contains the CALIENT S320 Photonic Switch and other elements of the CALIENT S320 Photonic Switch (CD manual and accessory kit). Optional equipment such as optical cables are packaged and shipped separately.

Inspect the exterior of the shipping containers for any obvious signs of damage. Document any damage on the bill of lading and report damage to your shipper and/or insurance carrier. The procedure for replacing damaged CALIENT products is described in section 6.6.

6.2 Unpacking Preparation

Prepare to unpack and inspect the CALIENT S320 Photonic Switch by reviewing the following unpacking suggestions.

6.2.1 Personnel Required

The CALIENT S320 Photonic Switch equipment exceeds the OSHA recommended safe lifting weight for one person. CALIENT recommends that a minimum of two persons lift and move the switch module.

6.2.2 Tools and Equipment Used for Unpacking

These tools are recommended to move and open the CALIENT S320 Photonic Switch shipping containers:

- Utility knife
- Phillips head screw driver #1 and #2

6.3 Unpacking Procedure

Note

When unpacking, remove and retain the shipping lockdown baseplate, materials and containers for future shipments. The CALIENT S320 Photonic Switch can only be shipped using the original baseplate and container; otherwise the warranty will be void.

Electro Static Discharge

The CALIENT S320 Photonic Switch is sensitive to electro-static discharge (ESD). Be sure to wear either a wrist or ankle ESD grounding strap when handling the CALIENT S320 Photonic Switch components.

To inspect and unpack the CALIENT S320 Photonic Switch, perform the following steps:

- Carefully inspect the exterior of each shipping container for any obvious signs of damage that may have occurred during shipping
- Cut the band straps wrapped around the containers

Caution Heavy Lifting

The CALIENT S320 Photonic System weighs approximately 47 lbs. Take proper care when lifting it. When handling the switch module, always keep it right-side-up and level.

- Remove the cables and box with CDs, and set these aside. Carefully lift the chassis out of its carton. Remove its anti-ESD bag and retain the bag for future shipping needs.
- Compare the contents of the shipment against the packing list. If any items are missing, contact CALIENT Service and Support.

6.4 Contents Inventory

The shipping container includes the following general contents:

- **The CALIENT S320 Photonic Switch system hardware:** The CALIENT S320 Photonic Switch chassis
- **Cables:** Craft serial cable (1), and Ethernet cables (2).
- **Documentation:** A CD with copies of the CALIENT S320 including the Release Notes.
- **Miscellaneous:** 12-24 Rack mounting screws (8) and left and right hand chassis mounting brackets.

6.4.1 Unlocking the S320 Switch

The CALIENT S320 Photonic System Switch is unlocked when the system is unpacked from the shipping container.

When unpacking the CALIENT S320 Photonic Switch, remove and retain the shipping baseplate (see Figure 9 below), materials and containers for future shipments. The CALIENT X272 Photonic Switch can only be shipped using the original lockwon baseplate and container.

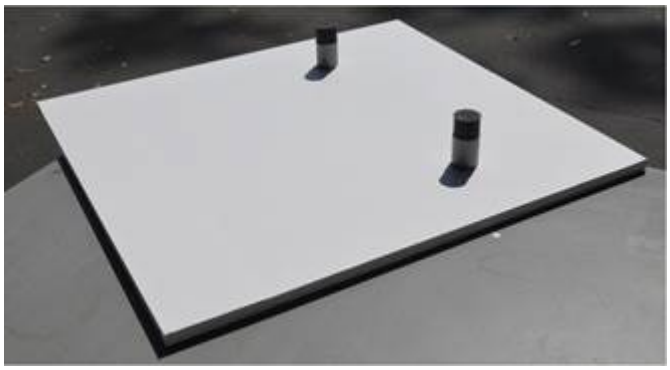

Figure 9 Shipping baseplate

6.5 Shipping and Storage Requirements

Table 3 lists environmental requirements for storing and transporting the CALIENT S320 Photonic Switch.

Storage temperature	Storage humidity
-40° to +70° C (-40° to +158°F)	5% to 95% non-condensing

Table 3: Environmental storage requirements

6.6 Missing or Damaged Contents

If any items are missing or any damage is detected, contact CALIENT Service and Support. Returned contents require a Return Material Authorization (RMA), which is provided by CALIENT Service and Support.

7 HARDWARE INSTALLATION

The CALIENT S320 Photonic Switch installation consists of the following general steps:

1) *Physical installation* of the CALIENT S320 Photonic Switch into a rack
2) Connecting the *configuration interfaces* (serial craft cable and Ethernet cables) of the CALIENT S320 Photonic Switch
3) Connecting the *power interfaces* of the CALIENT S320 Photonic Switch
4) *Booting up* the CALIENT S320 Photonic Switch
5) Installing the *fiber interfaces* of the CALIENT S320 Photonic Switch

Before the CALIENT S320 Photonic Switch is installed, please assemble the following:

- 5 RU of rack space in a 19”or 23” rack (23” requires mounting brackets) to house the CALIENT S320 Photonic Switch
- Power accessible to the CALIENT S320 Photonic Switch
- Input and output optical fiber cables with LC-UPC connectors, accessible at the CALIENT S320 Photonic Switch rack
- Computer resources providing VT-100 terminal emulation and craft serial interface accessible at the CALIENT S320 Photonic Switch rack

7.1 Physical Installation

7.1.1 Safety Requirements

A safe installation takes account of the following precautions:

- Review the safety summary and comply with Caution, Warning, and ESD statements
- This equipment is for installation only in a restricted access location (dedicated equipment room or electrical closet) in accordance with the National Electrical Code
- This equipment shall be provided with a readily-accessible disconnect device in the building installation power supply circuit
- This equipment shall be provided with a branch circuit breaker or fuse, rated maximum 10 A, in the building installation supply circuit
- Elevated operating ambient temperature: if the CALIENT S320 Photonic Switch is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient temperature. Please take note of the CALIENT S320 Photonic Switch has specified maximum operating temperature.
- Reduced air flow: installation of the equipment in a rack must be such that the amount of air flow required for safe operation of the equipment is not compromised
- Mechanical loading: mounting of the equipment in the rack must be such that a hazardous condition does not occur due to uneven mechanical loading

- Circuit overloading: consideration must be given to the rated current requirements of the CALIENT S320 Photonic Switch and other equipment connected to the same current protection and supply wiring circuit, so that the total rating does not overload the supply
- Reliable earthing: reliable earthing of rack-mounted equipment must be maintained. Particular attention must be given to supply connections other than direct connections to the branch circuit (e.g. the use of a power strip).

7.1.2 Required Tools

Tools used to install the CALIENT S320 Photonic Switch are listed below.

Tools
#1 and #2 Phillips screwdrivers
#10 gauge wire stripper, crimp tool and pliers
ESD mats
Wrist grounding straps
Label maker
Anti-ESD examination gloves

Table 4: Tools required for installation

7.1.3 Install the CALIENT S320 Photonic Switch into a Rack

The CALIENT S320 Photonic Switch is a 5-RU unit and mounts to racks uprights by screws through the front panel perimeter holes.

CALIENT recommends that two people install the CALIENT S320 Photonic Switch into a rack, one person to support the unit and a second person to secure the rack screws. CALIENT strongly recommends use of a shelf while mounting the CALIENT S320 Photonic Switch in a rack.

To install the CALIENT S320 Photonic Switch into a rack, first attach a shelf to the rack, one screw-hole below the desired location of the CALIENT S320 Photonic Switch. This shelf will support the CALIENT S320 Photonic Switch while it is bolted to the rack. Lift the CALIENT S320 Photonic Switch onto the shelf, and bolt the CALIENT S320 Photonic Switch to the rack.

Danger

Failure to follow safety rules and instructions in this manual may result in bodily injury.

7.2 Configuration Interface

7.2.1 Connecting the Craft Serial Cable

The craft interface connects to the CALIENT S320 Photonic Switch by way of the craft serial cable (included). The craft serial cable connection provides a means of retrieving (or setting) the CALIENT S320 Photonic Switch IP address and performing TL1 operations. Connect one end of the serial cable to the serial connector on the front of the CALIENT S320 Photonic Switch. Connect the other end of the cable to the serial connector on the host PC.

7.2.2 Connecting Ethernet

The CALIENT S320 Photonic Switch has two Gigabit Ethernet (GbE) RJ-45 jacks, which are labeled “NMS LAN A” and “NMS LAN B” on the front of the CALIENT S320 Photonic Switch. The Ethernet connection is used to control the CALIENT S320 Photonic Switch using TL1 via a Telnet session, or using the browser-based graphical user interface (GUI).

Note:

Use shielded Ethernet cables with the shields grounded at both ends.

7.3 Power Connections

Please refer to Section 5.3.5 for detailed figures of the power module options (-48 VDC, AC) and their connections.

7.4 Booting Up

The switch supports two Ethernet ports (Eth0 and Eth2). The default IP addresses for these ports are:

Eth0: 169.254.100.11
Eth2: Unassigned

Note

CALIENT does not recommend changing the IP address of the Eth1 port at this time.

To access the CALIENT S320 Photonic Switch, please use the default username (there is no password):

- Username: root

After the initial installation, the username and password can be changed at the user's discretion. If the default password is changed, please keep a record of the new password.

Note

If the user-changed password is lost or forgotten, it can only be reset by disrupting existing active connections and traffic. Please contact CALIENT Customer Service if you lose or forget your password.

If the IP address has been changed from the default or is otherwise unknown, it can be retrieved using the serial interface. To retrieve the current IP address, connect a serial cable to the serial port on the CALIENT S320 Photonic Switch. Once connected and logged in, enter *calient-config-network --show* to determine the IP address of the switch.

Alternatively use the TL1 Agent through the console or a PC, using a standard terminal emulation program such as Putty. Please use the terminal emulation settings listed in Table 5. The default TL1 username and password is:

- Username: admin
- Password: pxc***

Item	Value
Data rate	11520 baud
Bits	8
Parity	None
Stop bit	1
Set local echo	Off
Flow control	None
Terminal setting	VT100 or ASCII
Echo	Off
Line wrap	Auto

Table 5 Terminal emulation settings for the S320

At the TL1 prompt, use the ACT-USER command to log in. The following example uses the default username and password:

*agent>act-user::admin:::pxc****

agent>rtrv-ip

Once the IP address is known, the user must configure the client IP network interface to be on the same subnet as the CALIENT S320 Photonic Switch. Then, the user can log into the GUI or telnet to the TL1 agent using the S320's management interface.

The next task in the installation procedure involves applying power to the CALIENT S320 Photonic Switch and booting the CALIENT S320 Photonic Switch software.

7.4.1 Applying Electrical Power

Apply electrical power to the CALIENT S320 Photonic Switch. The system will begin its boot process, which will take 3-4 minutes. The operational status LED indicators on the front panel provide status information as described in below.

Indicator	Color	Indicates
A PWR, B PWR, L PWR	Green	Power is applied
MDB	Green	Operational
CRIT, MAJ, MIN	Red	One or more alarms exists
CP A, CP B	Green	System has passed startup diagnostics and is operating

Table 6: The CALIENT X272 Photonic Switch FSU LED indicators

If power is applied to the Power Source A input but not the Power Source B input (or vice versa), the CALIENT X272 Photonic Switch will boot up and function, but the B PWR LED will not be illuminated and a major alarm will be generated and communicated to the user via the CALIENT X272 Photonic Switch management interfaces.

Table 7: The CALIENT S320 Photonic Switch FSU LED indicators

If power is applied to the Power Source A input but not the Power Source B input (or vice versa), the CALIENT S320 Photonic Switch will boot up and function, but the B PWR LED will not be illuminated and a major alarm will be generated and communicated to the user via the CALIENT S320 Photonic Switch management interfaces.

Please refer to the CALIENT S320 Photonic Switch Alarm Reference Guide for a detailed description of CALIENT S320 Photonic Switch alarm behavior.

Note

The power to the CALIENT S320 Photonic Switch must be removed before connecting or disconnecting the Molex or wires to the Terminal Strip.

7.4.2 Logging In

The default IP address for the WebGUI and TLI, included in the configuration loaded into the CALIENT S320 Photonic Switch before it is shipped, is 192.168.0.2, and the Gateway is 192.168.0.1. It is the last message displayed to the user before the TL1 prompt. To access the CALIENT S320 Photonic Switch using the WebGUI or TL1, please use the following default username and password:

- Username: admin
- Password: pxc***

After the initial installation, the username and password can be changed at the user's discretion. If the default password is changed, please keep a record of the new password.

Note

If the user-changed password is lost or forgotten, it can only be reset by disrupting existing active connections and traffic. Please contact CALIENT Customer Service if you lose or forget your password.

If the IP address has been changed from the default or is otherwise unknown, it can be retrieved using the serial interface. To retrieve the current IP address, connect a serial console to the serial port on the CALIENT S320 Photonic Switch. Once connected, use the login credentials listed below to login. The default login is

- Username: root (no password).

After successfully logging in, execute the command: *calient-config-network –show*

Once the IP address is known, the user must configure the client IP network interface to be on the same subnet as the CALIENT S320 Photonic Switch. Then, the user can log into the GUI or telnet to the TL1 agent using the CALIENT S320 Photonic Switch's management interface.

Please refer to the CALIENT S320 Photonic Switch Software User Manual for a detailed description of CALIENT S320 Photonic Switch software-enabled hardware operation.

7.5 Fiber Connections

The final task in the installation procedure involves connecting fibers to the CALIENT S320 Photonic Switch and establishing cross connects.

Connect fiber cables from equipment and outside plant fibers to the LC-UPC bulkhead adaptors on the CALIENT S320 Photonic Switch Fiber Interface. Adaptors without circles on the port number labels are CALIENT S320 Photonic Switch inputs, and adaptors with circles on the port number labels are CALIENT S320 Photonic Switch outputs. As Figure 1 shows, because of the directionality of the CALIENT S320 Photonic Switch monitoring taps, the CALIENT S320 Photonic Switch operates with light transmitted from the input fiber terminations to fiber terminations. User optical transmitters are connected to the inputs, and user optical receivers are connected to the outputs. Once a connection is established from the input fiber terminations to the output fiber terminations, it should be noted that light can also be simultaneously transmitted from the output fiber terminations to the input fiber terminations.

To ensure the specified CALIENT S320 Photonic Switch optical insertion loss and return loss, clean optical connectors using standard cleaning procedures as described in Section 4 before connecting them to the CALIENT S320 Photonic Switch Fiber Interface.

Please refer to the CALIENT S320 Photonic Switch Software User Manual for a detailed description of how to establish cross connects using the CALIENT S320 Photonic Switch.

APPENDIX A: SYSTEM SPECIFICATIONS

7.6 Regulatory Compliance

7.6.1 Safety Compliance

The CALIENT S320 Photonic Switch equipment has been tested and found to comply with the following standards:

- UL 60950-1:2003
- IEC 60950-1
- 21 CFR 1040.10 and 1040.11 Class 1 laser

7.6.2 Electromagnetic Immunity Compliance

The CALIENT S320 Photonic Switch equipment has been tested and found to comply with the following standards:

- GR-1089-CORE
- ETSI EN 300 386 V1.2.1 (2000-03)
- AS/NZS CISPR22:2004
- VCCI V-3 / 2006.04
- EN 55024: 1998/A1:2001/A2:2003
- EN 55022: 1998/A1:2000/A2:2003
- EN 61000-3-2: 2000
- EN 61000-3-3: 1995/A1: 2001 Class: A
- FCC Part 15, Subpart B
- Industry Canada ICES-003

7.6.3 Environmental Compliance

The CALIENT S320 Photonic Switch has been tested and found to comply with:

- GR-63-CORE (NEBS)

7.7 Reliability, Availability & Serviceability (RAS)

The CALIENT S320 Photonic Switch MTBF is greater than 28.5 years with fully redundant control processors and power supplies. Alarm indicators are also provided.

7.8 Equipment Space Requirements

The CALIENT S320 Photonic Switch is 5 RU high. It is designed for installation in a 19-inch rack. Mounting brackets supplied with the CALIENT S320 Photonic Switch allow it to be mounted in a 23-inch rack or a rack compliant with ETSI standard ETS-300-119-4. Equipment space requirements are listed in Table 6.

Feature	Description
Dimensions	12. 2" H x 17.5" W x 19" D 310 x 445 x 483 mm
Mounting	19" or 23" or ETSI ETS 300 119-4 racks (front or mid-mounting)
Weight	45 lbs, 20.5 kg

Table 8: Physical dimensions of the CALIENT S320 Photonic Switch

7.9 Optical Specifications

All specifications apply across the O- and C-bands, unless otherwise stated.

Fiber type: single-mode fiber

Configuration time: < 25 ms

- The configuration time is the time for the optical power at a port to fall from 90% to 10% of its original value

Polarization-dependent loss (PDL): < 0.3 dB

Polarization-mode dispersion (PMD): < 10 fs

Chromatic dispersion at 1550 nm, end of life (EoL): < 0.25 ps/nm

Static crosstalk: < -65 dB

Path stability: < 0.2 dB

Repeatability: ± 0.25 dB

Dynamic range: +10 dBm to -20 dBm

Switching cycles: $>10^9$

Insertion loss including connectors, end of life (EoL), for the S320-TC Photonic Switch:

- Minimum 1.2 dB
- Typical 2.0 dB
- Maximum 3.0 dB

Return loss, end of life (EoL), when fiber terminations are terminated and the CALIENT S320 Photonic Switch is powered:

- Typical 40 dB
- Minimum 35 dB

7.10 Environmental Considerations

The environmental characteristics of the CALIENT S320 Photonic Switch are listed in Table 7.

Parameter	Value
Operating – Temperature	0 to 50°C (32 to 122°F)
- Humidity	5% to 90%, non-condensing
Non-operating – Temperature	-40 to 70°C (-40 to 158°F)
- Humidity	5% to 95%, non-condensing

Table 9: Environmental characteristics

APPENDIX B: LISTING OF PART NUMBERS AND ACCESSORIES

7.11 Part Numbers

7.11.1 Systems

CT-S320-2S-LU0-48TF-00-00	S320 STD. SHELF, TC-OPT, DR=+5/-20, LC/UPC, -48V FRONT TS
CT-S320-2S-LU0-48TR-00-00	S320 STD. SHELF, TC-OPT, DR=+5/-20, LC/UPC, -48V REAR TS

7.11.2 Software

CT-SW-S-5.X-000-00-00	S320 SOFTWARE REL 5.X,STD SHELF CONFIG,USER CLASS DISA
CT-SW-S-5.X-010-00-00	S320 SOFTWARE REL 5.X,STD SHELF CONFIG,USER CLASS ENA

7.12 Accessories

DC Power Module Variants	Part Number
-48VDC Power Module (Molex)	700491-00
-48VDC Power Module with Terminal Strip	700463-00

Ventilation Components	Part Number
Rear Fan Module	700489-00
Front Filter	280840-00

Note

For custom part numbers, please contact CALIENT Sales or Customer Service.