Delta Networking – Agema Family

AG5648 Leaf/ToR Switch
- AG5648
- AG5648V1

Installation Guide

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Regulatory and Safety Information

This product has been tested in accordance to, and complies with the following safety standards and electromagnetic compatibility (EMC) inspection standards.

Emissions	
Applicable standard	• AS/NZS CISPR 22: Class A • ICES-003, Issue Class A • EN 55022: Class A • VCCI Class A • FCC CFR 47 Part 15, Subpart B Class A
Safety	
Applicable standard	• EN 60950-1, Second Edition • UL/CSA 60950-1, Second Edition • IEC 60950-1, Second Edition Including All National
Immunity	
Applicable standard	• EN 300 386, EMC for Network Equipment • EN 55024: • EN 61000-3-2: Harmonic Current Emissions • EN 61000-3-3: Voltage Fluctuations and Flicker • EN 61000-4-2: ESD • EN 61000-4-3: Radiated Immunity • EN 61000-4-4: EFT • EN 61000-4-5: Surge • EN 61000-4-6: Low Frequency Conducted Immunity • EN61000-4-8: Power Frequency magnetic field • EN61000-4-11: Voltage dips and interruptions
RoHS	
Applicable standard	All AG-Series components are EU RoHS compliant

Warning: Fiber Optic Port Safety

CLASS I LASER DEVICE

When using a fiber optic port, never look at the transmit laser while it is powered on. Also, never look directly at the fiber TX port and fiber cable ends when they are powered on.

Table of Contents

Chapter 1: Introduction

1.1 Overview

The AG5648 is next generation leaf/ToR switch for Data Center Networks, as well as Enterprise network deployments. It leverage the 100G technology (4x25G Serdes) to provide 48-port 25G SFP28 and 6-port 100G QSFP28 in a compact 1RU form factor with 2.5 times speed upgrade from current 10Gigabits leaf/ToR switch. The 48 ports 25G are backward compatible to 10G and the 100G uplink offer dual speed – 40G and 100G.

The AG5648 is also SDN capable and supports ONIE installer and OpenFlow for today's open network ecosystem. It also provides comprehensive capability on layer 2 and layer 3 features, including SNMP, Spanning Tree, VLAN, QinQ, Trunk, QoS, RIP, OSPF, IGMP, DVMRP, PIM-DM, PIM-SM, Access Control, etc. This product which aims for Data Center Networks also supports advance features such as MPLS, TRILL, PFC, VEPA, QCN, VxLAN and NVGRE to meet the high-demanding Data Center high performance and virtualization requirement. The AG5648 is excellent choice for next generation hyper scale and medium size datacenters and Core/Aggregation switches in Enterprise network environment.

1.2 Package Content

After unpacking this switch, check the contents to be sure you have received all the components. Then, before beginning the installation, be sure you have all other necessary installation equipment.

- AG5648 series switch: AG5648 or AG5648V1
- 1 x AC power supply for AC version or 1 x DC power supply for DC version
- Rack-mounting kits
- 2 x Velcro strips
- Installation guide

If any item is missing or damaged, contact the vendor immediately, see *"Technical Support"*.
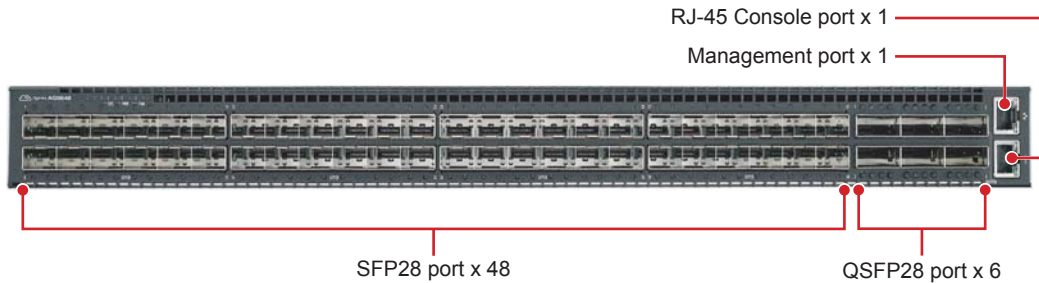
1.3 Features

The following lists the key main features of the AG5648 switch:

- 48 x 25GbE SFP28 ports

- 6 x 100GbE QSFP28 ports

- 1 x OOB Management

- 1 x Console port (RJ-45 type)

- 1 x USB port

- Hot plugging redundant power supply support

- 4 Fan modules

- System / Fan / Power status LED indication

- On board high performance CPU system with large memory

- Internal power supply; Max power 550W (AC version) or 550W (DC version)

- Standard 1U chassis high

- 1.8 Tbps full-duplex switching

- Automatic address learning function to build the packet-forwarding information table. The table contains up to 288K MAC addresses

- Low pin-to-pin latency: Cut-Through & Store and Forward Mode

- 16MB of packet buffer memory

- Support Jumbo Frame up to 12Kbyte
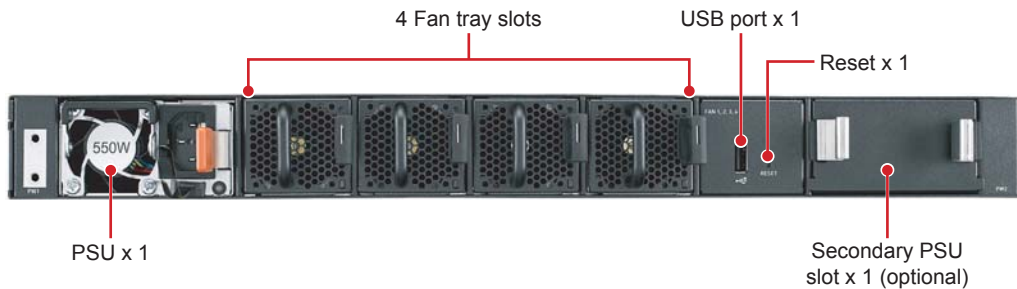
Chapter 2: Appearance and Mechanism

2.1 Product Overview

2.1.1 Front View

RJ-45 Console port x 1

Management port x 1

SFP28 port x 48

QSFP28 port x 6

(Figure 2-1: Front View)

2.1.2 Rear View

4 Fan tray slots

USB port x 1

Reset x 1

550W

PSU x 1

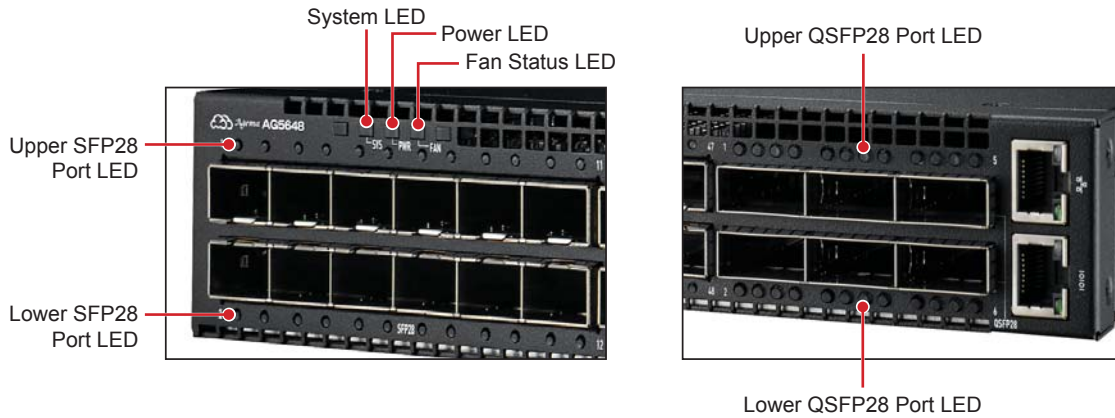Secondary PSU
slot x 1 (optional)

(Figure 2-2: Rear View)

NOTE:
The switch supports up to two PSUs. However, it is shipped with one power supply pre-installed in the rear panel of the switch. You may purchase an additional PSU for redundancy.

2.2 LED Identification

This section provides an overview of the front and rear LEDs.

2.2.1 Front LEDs

(Figure 2-3: Front LED Identification)

LED	Description
System LED	• **Off** – No Power • **Blinking Green** – Booting, or System in Diagnostic mode • **Solid Green** – Normal operation • **Solid Yellow** – Critical Alarm • **Blinking Yellow** – Non-critical alarm
Power LED	• **Solid Green** – Booting • **Off** – Power is disconnected **When NOS is running:** • **Solid Green** – 2 Power Supplies are supplied to the switch and operating normally • **Solid Yellow** – Single power supply is installed and operating • **Blinking Yellow** – 2 Power Supplies are installed, but only single power supply is operating
Fan Status LED	• **Solid Green** – FAN is operating normally • **Solid Amber** – FAN is failed including incompatible airflow direction
25G SFP28 slots	• **Off** – No link • **Solid Green** – A valid link 25G link • **Solid Yellow** – A valid link 10G link • **Blinking Green** – Packet transmission or reception in progress

LED	Description
100G QSFP28 slots	**LED1** • **Off** – No link • **Solid Green** – A valid 100G link • **Solid Amber** – A valid 40G link • **Solid Blue** – A valid 10Gbps link • **Solid Purple** – A 10Gbps link **LED 2 and 4 (working in breakout)** • **Off** – 40/100G operation (assuming LED1 is illuminated) or No link • **Solid Blue** – A valid 25Gbps link • **Solid Purple** – A valid 10Gbps link
Management port	**Link LED** • **Off** – No link is established on the port • **Solid Yellow** – A valid link at 10/100Mbps is established on the port • **Solid Green** – A valid link at 1000Mbps is established on the port **Act LED** • **Off** – No link is established on the port • **Blinking Green** – Activity, transmitting or receiving packet at this port

2.2.2 Rear LEDs

Power Supply LED
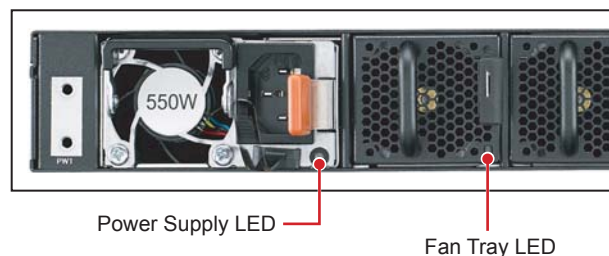
Fan Tray LED

(Figure 2-4: Rear LED Identification)

| LED	Description
Fan Tray LED	• **Solid Green** – Fan operating normally • **Solid Red** – Fan failed
Power Supply LED	• **Off** – No power or power supply failed • **Solid Green** – Power is ok

2.3   System Requirements

Component	Requirement
System requirements	
Switch fabric capacity	Non-blocking full wire speed on all packet sizes
Forwarding architecture	Store and forward or cut-through
Port packet forwarding rate (at 64 Bytes)	14880000 pps (10Gb)
MAC address entries supported	Up to 136K entries
Memory type	16MB buffer memory
OOB port	10/100/1000Mbps, auto sensing, auto negotiation
Host Support	• IPv4: 8K min./72K max. • IPv6: 4K min/36K max.
LPM Route Support	• w/o URPF: IPv4 128K, IPv6/64 85K, IPv6/128 21K • w/ URPF: : IPv4 64K, IPv6/64 21K, IPv6/128 5K
Priority Queues	20 priority queues per port
MAC Address Aging Support	1,000,000 seconds programable (Default 300 seconds)
Spanning Tree Support	• Support IEEE802.1d STP • Support IEEE802.1s MSTP • Support IEEE802.1w RSTP
Host Support	136K shared entries with MAC Table
LPM Routes Support	128K shared entries with MAC Table
Serial Console	• Provide visual feedback of the boot process to the user • Timeout after period of inactivity
Port Trunking	• IEEE802.3ad Link Aggregation Protocol (LACP) • Up to 1024 groups with 256 member per group
Port requirements	
Speed Capability per Port	• 10G/25Gbps (SFP28 port) • 40G/100Gbps (QSFP28 port) • 10G/25G/40G (QSFP28 port, working in breakout)
Full-Duplex Flow Control	Support the IEEE 802.3x PAUSE frame

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2.4   Data Center Deployment

The following figure illustrates the converaged Ethernet data center deployment.
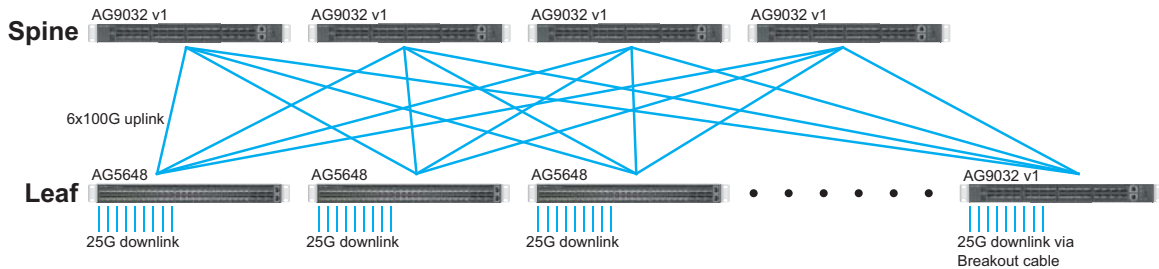
(Figure 2-5: Converaged Ethernet Data Center Deployment)

2.5   Power Supply Modules

The power supply modules are hot-swappable power supply units (PSUs) for the switch. You can install up to two PSUs. The PSUs operate in a load-sharing mode and provides 1+1 redundancy.

(Figure 2-6: Power Supply Unit)

NOTE:
1+1 redundancy is a system where a switch power supply is backed up by another switch power supply in a load-sharing mode. If one power supply fails, the other power supply takes over the full load of the switch.

WARNING:
- The switch includes plug-in power supply and fan tray modules that are installed into its chassis. All modules have a front-to-back airflow direction.
- Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.
- Remove the power cable from the module prior to removing the module itself. Power cable must not be connected prior to insertion in the chassis or equivalent.

2.6 Fan Tray Module

The fan tray module is part of the switch air cooling system that provides cooling for the switch. You must install the fan tray module in the switch that matches the airflow direction of the installed power supply unit.
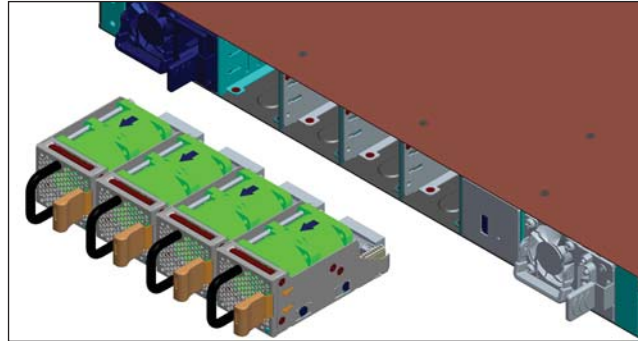
(Figure 2-7: Fan Tray Module)

Chapter 3: Installation

3.1 Mounting

This switch can be mounted in a standard 19-inch equipment rack or on a horizontal surface. Mounting instructions for each type of site follow.

3.1.1 Rack Mounting

Prior rack mounting the switch, pay particular attention to the following factors:

- Mechanical Loading: Do not place any equipment on top of a rack-mounted unit.
- Circuit Overloading: Be sure that the supply circuit to the rack assembly is not overloaded.
- Grounding: Rack-mounted equipment should be properly grounded. Particular attention should be given to supply connections other than direct connections to the mains.

To rack-mount devices:

1. Attach the two brackets to the device using the eight M4 screws provided in the rack mounting kit.

> **NOTE:**
> The switch can also be mounted in a rack using a rack shelf or rack "L" brackets.
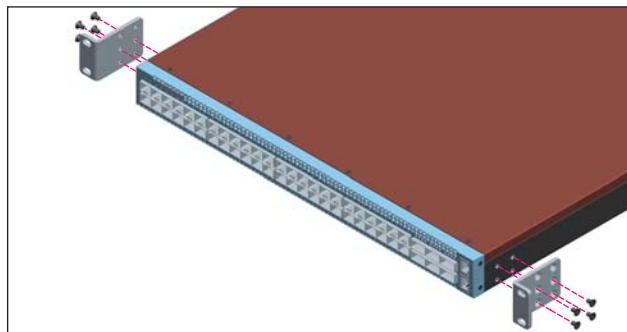
(Figure 3-1: Attaching the Brackets)

2. Mount the device in the rack, using four 12-24 rack-mounting screws.

> **NOTE:**
> Rack screws and clip nuts are not supplied in the rack-mounting kit.

> **CAUTION:**
> Due to the switch's weight, it should be installed by at least two people.

(Figure 3-2: Installing the Switch in a Rack)

3. If installing a single switch only, go to *"Connecting to a Power Source"*.

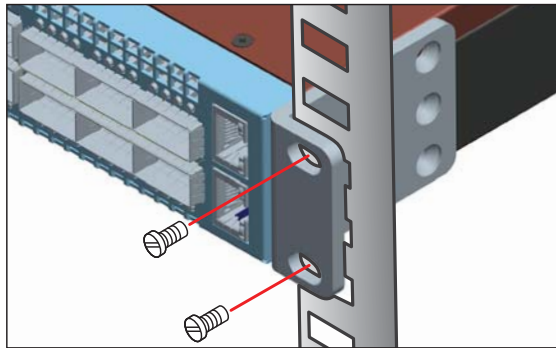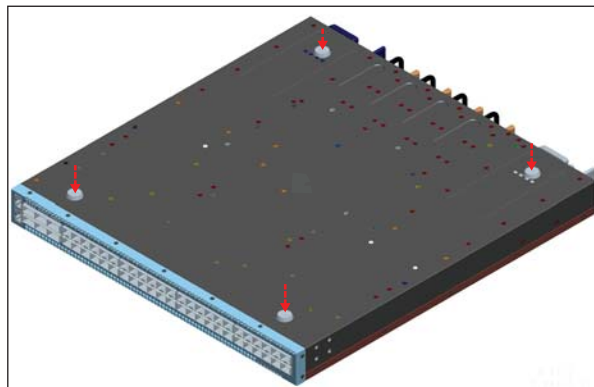4. If installing multiple switches, mount them in the rack, one below the other, in any order.

3.1.2 Horizontal Surface Mounting

The switch includes four pre-installed rubber feet for horizontal surface mounting.

To mount devices on a horizontal surface, follow these steps:

1. Attach the four adhesive feet to the bottom of the first switch.

(Figure 3-3: Attaching the Adhesive Feet)

2. Set the device on a flat horizontal surface near an AC power source, making sure there are at least two inches of space on all sides for proper air flow.

3. If installing a single switch only, go to *"Connecting to a Power Source"*.

4. If installing multiple switches, attach four adhesive feet to each one, then place each device squarely on top of the one below, in any order.

3.2 Installing an Optional Transceiver and Cable

The SFP28 slots support the following optional transceivers and cables:

- 25GBASE-SR
- 25GBASE-LR
- 25GBASE AOC
- 25GBASE DAC

- 10GBASE-SR
- 10GBASE-LR
- 10GBASE AOC
- 10GBASE DAC

The QSFP28 slots support the following optional transceivers and cables:

- 100G Base-SR4
- 100G Base-LR4
- 100G AOC (Active Optical Cable)
- 100G DAC (Direct Attached Cable)
- 100G to 4x25G AOC

- 100G to 4x25G DAC
- 40G Base-SR
- 40G Base-LR4
- 40G AOC (Active Optical Cable)
- 40G DAC (Direct Attached Cable)
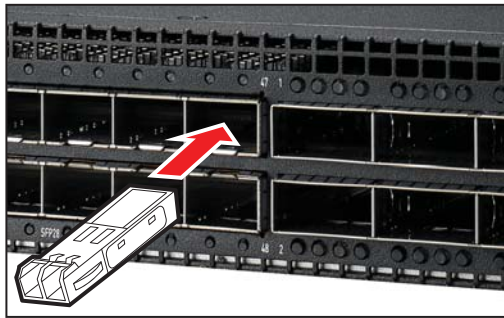
(Figure 3-4: Inserting an SFP28 Transceiver into a Slot)
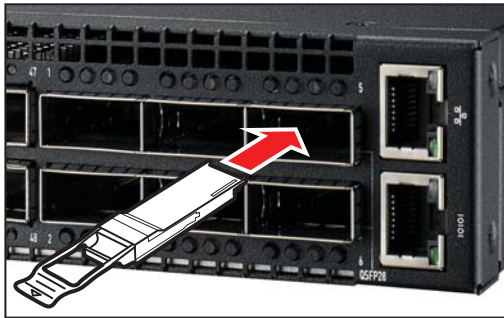
(Figure 3-5: Inserting a QSFP/QSFP28 Transceiver into a Slot)

To install an SFP+, SFP28, QSFP or QSFP28 transceiver, follow these steps:

1. Consider network and cabling requirements to select an appropriate SFP+, SFP28, QSFP or QSFP28 transceiver type.

2. Insert the transceiver with the optical connector facing outward and the slot connector facing down. Note that SFP+, SFP28, QSFP or QSFP28 transceivers are keyed so they can only be installed in one orientation.

AG5648 Leaf/ToR Switch

3. Slide the SFP+, SFP28, QSFP or QSFP28 transceiver into the slot until it clicks into place.

> **NOTE:**
> - SFP+, SFP28, QSFP or QSFP28 transceivers are hot-swappable. The switch does not need to be powered off before installing or removing a transceiver. However, always first disconnect the network cable before removing a transceiver.
> - SFP+, SFP28, QSFP or QSFP28 transceivers are not provided in the switch package.
> - **QSFP28 Ports to SFP28 Ports**: The AG5648 also supports splitting a 100G QSFP28 port into 25G ports via the breakout cables. Do consult your software provider for port mode change and configuration.

3.3   Connecting to the Console Port
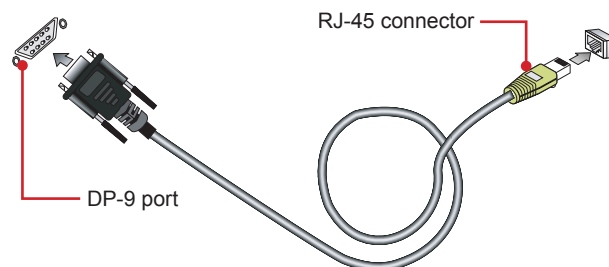
This port is used to connect a console device to the switch through a nullmodem serial cable. The console device can be a PC or workstation running a VT-100 terminal emulator, or a VT- 100 terminal.

> **NOTE:**
> An RJ-45-to-DB-9 cable is not supplied with the switch for connecting to a PC's RS-232 serial DB-9 DTE port.

RJ-45 connector

DP-9 port

(Figure 3-6: Console Port Connection)

3.4　Connecting to a Power Source

3.4.1　Installing an AC Power Supply

To connect a switch to a power source:

1. Insert the power cable plug directly into the AC socket of a PSU located at the back of the switch.

(Figure 3-7: Power Socket)

2. Plug the other end of the cable into a grounded, 3-pin, AC power source.

NOTE:
For International use, you may need to change the AC line cord. You must use a line cord set that has been approved for the socket type in your country.

3. Check the PSU and front-panel LEDs as the device is powered on to be sure that AC power is being received and the Power LED is on. If not, check that the power cable is correctly plugged in.

4. Repeat steps 1 and 2 when a second PSU module is installed.
   Two installed PSU modules operate in a load-sharing mode and provide 1+1 redundancy.

3.4.2　Installing a DC Power Supply

Two types of connection to a power source:

a. DC power cord for DC source connection

1. Insert the power cable plug directly into the DC socket of a PSU located at the back of the switch.

(Figure 3-8: Installing a DC Power Supply and Power Cable)

2. Plug the other end of the cable into DC power source. This product is intended to be supplied by DC power source with rated -40 ~ -72Vdc, 16A minimum, Tma = 40 degree C, and the altitude of operation = 3048 m. The power cable should be 14AWG (16A minimum, 72V minimum).

⚠️ **CAUTION:**
   - Reversing polarity when connecting DC power wires can permanently damage the power supply or the system.
   - Always disconnect the power cable from power source before you service the power supply slots.
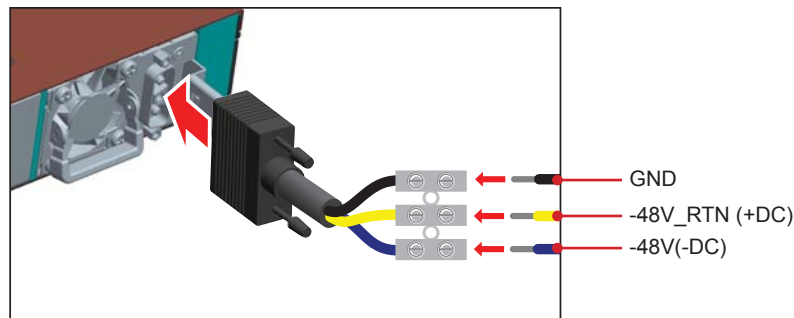
3. Check the PSU and front-panel LEDs as the device is powered on to be sure that DC power is being received and the Power LED is on. If not, check that the power cable is correctly plugged in.

4. Repeat steps 1 and 2 when a second PSU module is installed.
   Two installed PSU modules operate in a load-sharing mode and provide 1+1 redundancy.

b. Adapter connector for DC source connection

1. Attach the connector directly into the DC socket of a PSU located at the back of the switch.

-48V_RTN (+DC)
GND
-48V(-DC)

(Figure 3-9: Assembling a DC Connector and Power Wires)

2. Plug the other end of power wires into DC power source. This product is intended to be supplied by DC power source with rated -40 ~ -72Vdc, 16A minimum, Tma = 40 degree C, and the altitude of operation = 3048 m. The power cable should be 14AWG (16A minimum, 72V minimum).
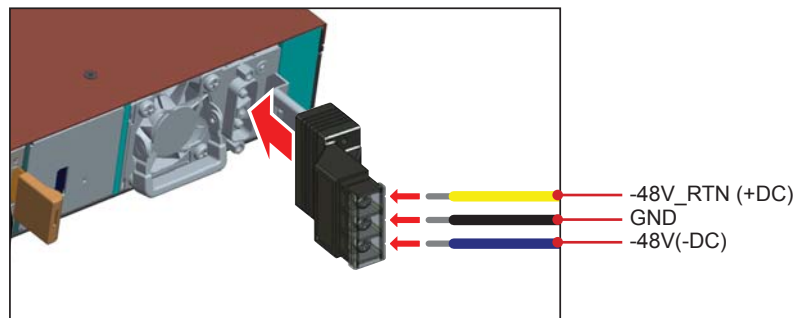
⚠️ **CAUTION:**
   - Reversing polarity when connecting DC power wires can permanently damage the power supply or the system.
   - Always disconnect the power cable from power source before you service the power supply slots.

3. Check the PSU and front-panel LEDs as the device is powered on to be sure that DC power is being received and the Power LED is on. If not, check that the power cable is correctly plugged in.

4. Repeat steps 1 and 2 when a second PSU module is installed.
   Two installed PSU modules operate in a load-sharing mode and provide 1+1 redundancy.

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Chapter 4: Making the Network Connections

The AG5648 switch is designed to provide high-speed, lossless Ethernet connections between server racks through its 25G SFP28 or 100G QSFP28 ports. This chapter describes how to make network connections to the switch.
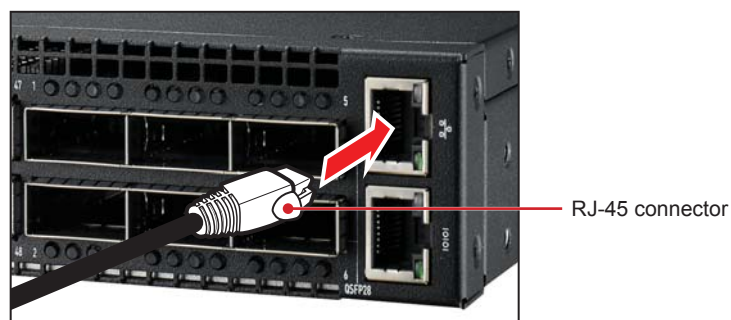
4.1　Twisted-pair Connections

The switch's Management port connection requires an unshielded twisted-pair (UTP) cable with RJ-45 connectors at both ends. Use Category 5, 5e or 6 cable for 1000BASE-T connections, Category 5 or better for 100BASE-TX connections, and Category 3 or better for 10BASE-T connections.

4.1.1　Cabling Guidelines

The RJ-45 port on the switch supports an automatic MDI/MDI-X pinout configuration, so you can use a standard straight-through twisted-pair cable to connect to any other network device (PCs, servers, switches, routers, or hubs).

4.1.2　Connecting to the Management Port

1. Attach one end of a twisted-pair cable segment to the link device's RJ-45 connector.

RJ-45 connector

(Figure 4-1: Making a Connection to the Management Port)

2. Attach the other end to the Management port on the switch.

   Make sure the twisted pair cable does not exceed 100 meters (328 ft) in length.

3. When the connection is made, the Mgmt LED (on the switch) will light green to indicate that the connection is valid.

4.2   Fiber Optic Connections

Optional 25G SFP28 or 100G QSFP28 transceivers can be used for fiber connections from the switch to other network devices in the data center. An SFP28 or QSFP28 transceiver may also be used for long distance connections to devices at another site.

> **(!) WARNING:**
> - When selecting a fiber SFP28 or QSFP28 device, considering safety, please make sure that it can function at a temperature that is not less than the recommended maximum operational temperature of the product. You must also use an approved Laser Class 1 SFP28 or QSFP28 transceiver.

The following figure illustrates the SFP28 or QSFP28 port fiber connection.
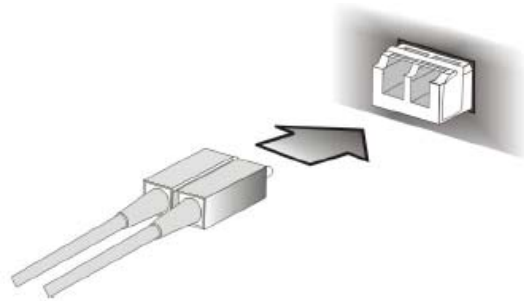
(Figure 4-2: Making SFP28 Port Fiber Connection)
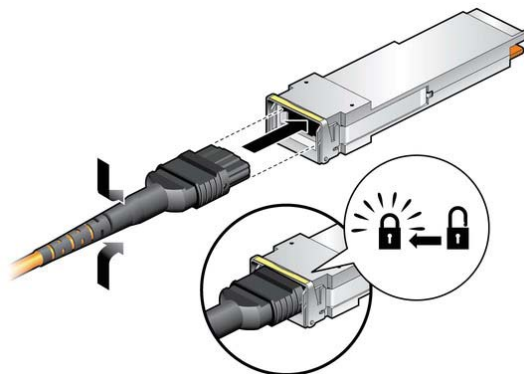
(Figure 4-3: Making QSFP28 Port Fiber Connection)

4.3   Ethernet Cabling

To ensure proper operation when installing the switch into a network, make sure that the current cables are suitable for 10BASE-T, 100BASE-TX or 1000BASE-T operation. Check the following criteria against the current installation of your network:

- Cable type: Unshielded twisted pair (UTP) or shielded twisted pair (STP) cables with RJ-45 connectors; Category 3 or better for 10BASE-T, Category 5 or better for 100BASE-TX, and Category 5, 5e or 6 for 1000BASE-T.
- Protection from radio frequency interference emissions
- Electrical surge suppression
- Separation of electrical wires (switch related or other) and electromagnetic fields from data based network wiring
- Safe connections with no damaged cables, connectors or shields

Appendix 1 : Technical Specifications

Item	Description	
Key components		
Switch controller	• AG5648: BCM56963 x 1 • AG5648V1: BCM56967 x 1	
PHY	BCM5461S x 1	
CPU	Intel Rangley C2538 2.4Ghz	
Flash ROM	16 MB SPI Flash	
System memory	4GB DDR3 SO-DIMM	
mSATA Device	8GB SSD	
Network Protocol and Standards Compatibility		
Network protocol/ compatibility	• IEEE 802.3ba 100Gb/s Ethernet • IEEE 802.3 10Base-T on console port • IEEE 802.3u 100Base-TX on console port • IEEE 802.3ab 1000BASE-T on console port • IEEE 802.3x Flow-Control • IEEE 802.3z 1000BASE-X • IEEE 802.3ae 10Gb/s Ethernet	
Interface Information		
Interface	• Small Form-factor Pluggable 28 (QSFP28) slot x 48 • Quad Small Form-factor Pluggable 28 (QSFP28) slot x 6 • 10/100/1000Mbps Management port x 1 • RJ45 Console port x 1 • USB port x 1	
Power Supply Unit		
Type	AC-in PSU	DC-in PSU
Max. output power	550W	550W
Input voltage	AC 100 ~ 240V	DC -48 ~ -60V
Output voltage	DC 12V	DC 12V
Physical		
Dimensions (W x D x H)	438.5 x 460 x 43.0 mm (17.26 x 18.11 x 1.69 inches)	
Weight	7.99 kg (17.61 lbs)	
Environmental Specifications		
Operating temperature	0 to 40°C	
Storage temperature	-20 to 70°C	
Operating humidity	10 to 90% RH	
Storage humidity	5 to 95% RH	

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Appendix 2 : Warranty

Limited and Support Warranty

Three Years End-User Guarantee.

The new product you purchased from Delta or Delta authorized resellers ("Resellers") will be free from defects in materials, workmanship, and design affecting normal use, for a period of three (3) years from the original purchase date. This warranty does not include accessories or any free bundled sales items which may have been delivered along with the product. The original purchasing invoice and the serial number on your product are both required when you request for any warranty service.

During the warranty period, products for which proper claims are made will, at Delta's option, be repaired or replaced at Delta's expense. Customers may contact Delta's technical support for warranty services, which may be provided either through Resellers or by Delta directly. Delta owns all parts removed from the repaired products. Delta will use new or reconditioned parts made by various manufacturers to perform repairs and/or to build replacement products. All replaced or repaired products will be warranted for the remainder of the original warranty period or thirty (30) days, whichever is longer.

Unless otherwise having a separate service level agreement (SLA) with Delta, you may only have any in-warranty product returned to Delta for repair or replacement in a normal turnaround time which differs according to geographic areas.

EXCLUSIONS

This Guarantee does not apply to defects resulting from: improper or inadequate installation, use, or maintenance; actions or modifications by unauthorized third parties or the end user; accidental or willful damage; or normal wear and tear.

Technical Support

- For software related technical support and product return policy, please contact your software providers.
- For hardware related technical support, please send your e-mail to AgemaTechSupport@deltaww.com.
- Please note that hardware related issues are limited to the following situations:
  - System Self-Diagnostic Test Failure
  - Product is physically damaged on arrival
  - Missing items in the package (see *"Package Content"*)
  - The product does not power on
  - Fan failure

Return Policy

Any product returned to Delta or Resellers without prior Return Material Authorization (RMA) from Delta will be considered an unauthorized return, and you will not receive any repair or replacement for the product and Delta will not ship the product back to you. The authorization will be provided through the e-mail: AgemaTechSupport@deltaww.com.
For in-warranty defective product return, you shall be responsible for proper packaging and Delta will not take responsibility for any shipping damage due to your improper product packaging.

Disclaimer

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