Calix Appendices

RFI Response References

COS Systems RFI Response

Calix Organization Chart

Equipment Data Sheets

E9-2 Intelligent Access Edge

E9-2 Aggregation Services Manager (ASM3001)

E7-2 Intelligent Modular System

E7-2 XG1601 Line Card

GigaSpire BLAST u4xg

GigaPoint GP1100X

GigaPoint GP1101X

GigaPoint GP4201X

GigaSpire BLAST u6xw

GigaSpire BLAST u6.1

GigaSpire BLAST u6.2

GigaSpire BLAST u4hm

Installation Guides

E9-2 Installation Guide

E7-2 Installation Guide

Software Solution Briefs

Subscriber Management Connector (SMx) Solution Brief

Advanced Routing Module (ARm) Solution Brief

Services

E9-2 Layer 3 Deployment Service Description Document

Network Design and Turn Up Service Description Document

Network Management Turn up or Upgrade Service Description Document

Calix Support Policy: Premier Support

Calix Education Services Solution Brief

Executive Summary

To whom it may concern,

COS is the global leader in automated open access software with over 200 Service Providers and 1 million+ subscribers connected through our platform across 10 countries. COS' software was established in 2008 making it a first of its kind software for open access automation. The platform has allowed multiple service providers, and types of services to be chosen over a user marketplace in Europe nearly a decade before US communities, and has been automating and enabling wholesale services for fiber to the home network operators since its inception. On COS' most mature networks 150 service providers of various types of services promote their offerings to end users on our customer full service marketplace.

COS is rooted in municipal fiber to the home and the vast majority of COS customers are government owned operators or electricity utility companies building and operating FTTH infrastructure through open access in both Europe and the US. Our first US network deployed with COS Business Engine is a utility owned and operated network that has been utilizing our system since early 2016. KPUDbroadband

COS' value is that we focus on the core software to enable a true automated and scalable open access network. Our platform is integrated with the hardware solution of your choosing and can support all kinds of environments, independent of architecture, including PON or Ethernet Point-to-point implementations. COS is an elite partner with Calix - and our integration brings together two top brands merging hardware and software to bring a successful open access network to the City of Superior. COS' software is built to provide network operators automation and a state of the art user experience without limits to architecture or hardware choices. We integrate with Calix HW/SW (via SMX for provisioning of services, monitoring, etc. COS provides the full order to billing functionality with rating and invoicing details/specification and then integrates with ERP for the wholesale invoicing and cash management in the ERP system.

COS truly believes in best of breed strategy and provides a world leading software solution to automate open access Networks. A wide range of integration capabilities with hardware/software vendors as well as partners to operate these networks. This creates stability in the business and maximizes our customers' flexibility to grow fast and scale

over time. We provide you flexibility and choice not just for ISP’s but for operators and architecture.

Regards,
Mikael Philipsson
CEO

1. Diagram of Proposed Solution

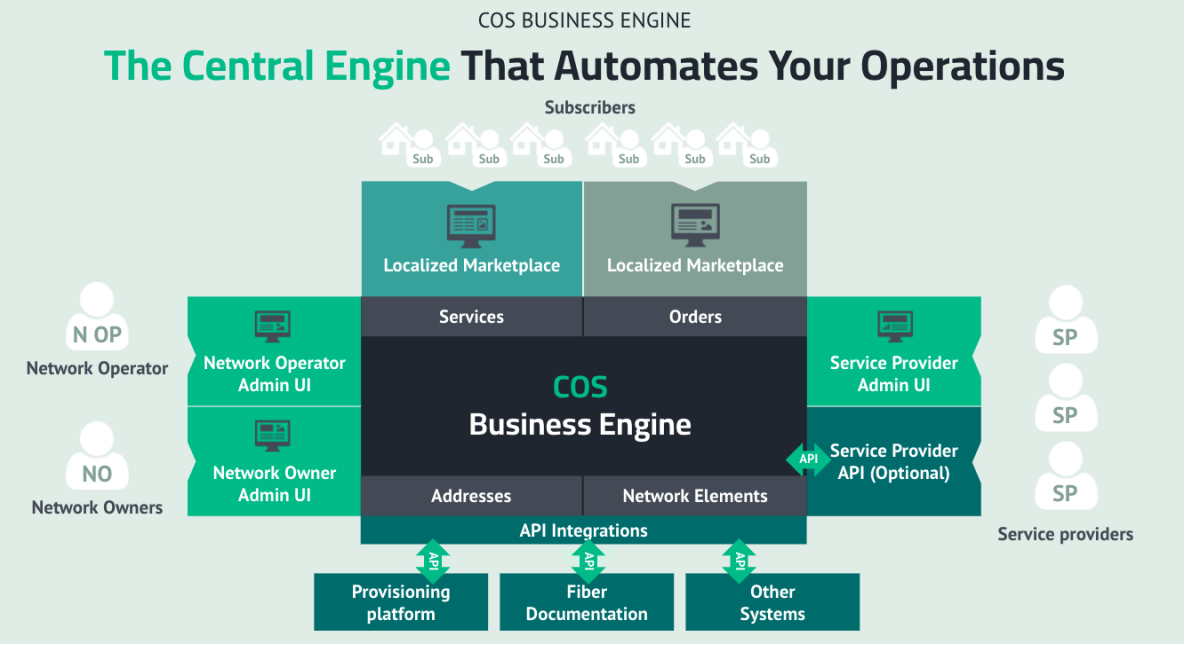
An End-to-End Software for FTTH Operators with Native Open Access Support

COS automates the complete commercial and technical process in FTTH rollouts to "zero touch" so customers can buy broadband online and start surfing seconds later.

We enable FTTH operators to maximize utilization of the infrastructure to all available service providers. The open access software orchestrates the network and all involved parties (end-customers, service providers, network operators) and service providers can manage their offerings and operate their customers.

This is key to improving ROI in fiber rollouts - increasing revenues and lowering the cost results in being able to provide affordable fiber to the home to everyone, even in challenging areas.

Figure 1. Overview of COS Business Engine in an automated open access Network



The entire COS platform is web-based and hosted on the Azure platform. It allows access for all different users in the open access ecosystem with tailored access to information and functionality based on their user profile. Via several integration methods other systems can

be connected. The customer/subscriber facing web interface is built to be quick and easy to customize.

Based in Sweden with operations in the US, COS Business Engine has a team of Swedish developers that have supported the development of the platform since its inception in 2008. We have SLA's for support and a process for tickets and custom development. Our staff has been dedicated to improving the efficiency and operations of the open access business model for almost two decades. Although the model seems innovative and new in the US - Sweden, much of Europe and South Africa have adopted it as the leading model for broadband and FTTH networks. In fact, through the model Sweden has reached 97% FTTH coverage, even though the population density is approximately half of what it is in the USA, and has lower broadband costs, more competition and average network take rates that exceed 70%. When discussing open access the most true model quoted is most often the "Swedish Model".

Detailed Bill of Materials

PRICING

TABLE 1. ONE-TIME ONBOARDING PROJECT FEE	Qty	Fee per Unit	Total Fee
COS Business Engine one-time fee for project management, setup, configuration and training, including automated provisioning.	1	$88,000 - $30,000 discount	$58,000
Payment terms: Net 30 days		Subtotal	$58,000
		ONE-TIME FEE	**$58,000**

TABLE 2. MONTHLY FIXED RECURRING SUBSCRIPTION FEE	Qty	Fee per Unit	Total Fee
COS Business Engine Maintenance and Support Base Fee (covers cloud hosting, software maintenance, upgrades and usage support)	1	$2,750 - $850 discount	$1,900
COS Demand Aggregation and Survey Module Base Fee within Douglas County		$500	$500
Payment terms: Net 30 days. Invoiced at the beginning of the applicable month.		Subtotal	$2,400
		TOTAL FEE	**$2,400**

TABLE 3. MONTHLY VARIABLE RECURRING SUBSCRIPTION FEE (BASED ON ASL)	Qty	Fee per Unit	Total Fee per ASL
ASL Fee, Active Service Locations		$2.20 - $0.75 discount	$1.45
Payment terms: Net 30 days. Invoiced in arrears based on the highest number of Active Service Locations (ASLs) during the previous month. ASL = a service location where a service is actively provisioned			

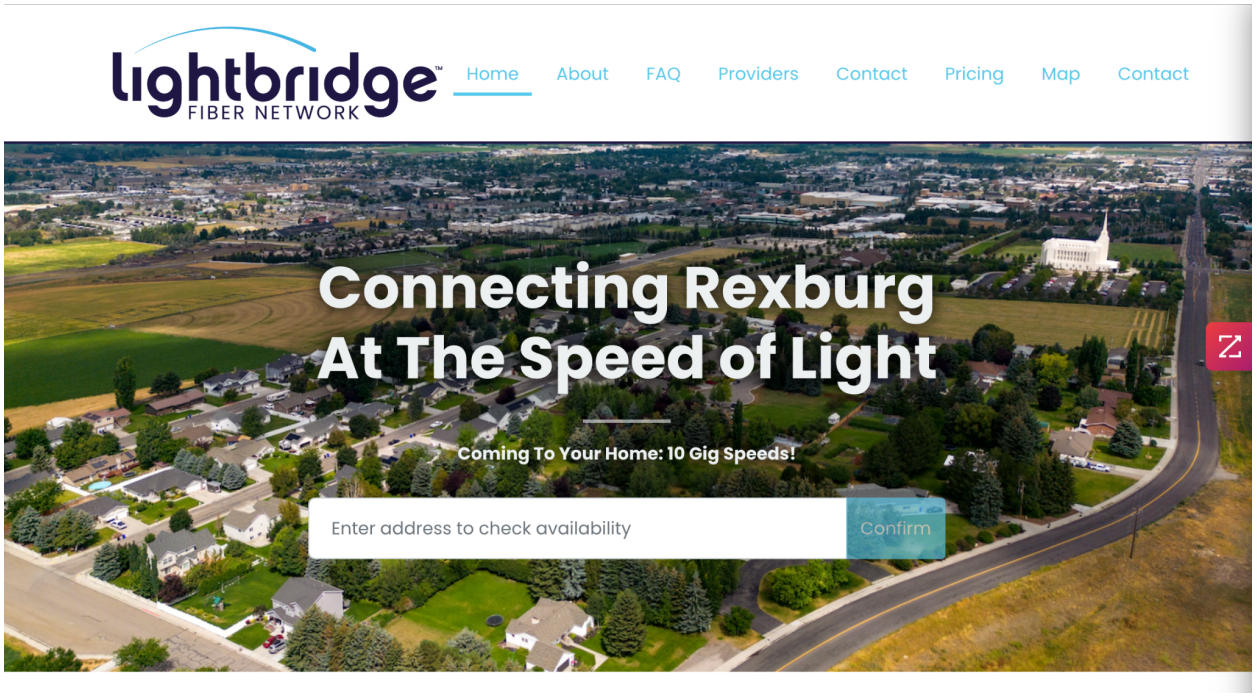
TABLE 4. PROFESSIONAL SERVICES & SUPPORT FEES	Fee per Unit
Premium support and professional services. Advanced Product support or consultancy work. Min. 1h per support ticket/work item.	$215 /h
Standard support. Email support. Response within 24 hours on business days (response requires less than 15 minutes to prepare).	Included
Payment terms: Net 30 days. Invoiced in arrears	

Description of the Proposed Solution

The COS Business Engine software is based on an end-to-end system starting with survey and demand aggregation to customer signup, installs and operations. Before the network is built, geographical areas and smaller "community zones" are the typical means to show the future subscribers what services will be available on the network at their location, while already installed service locations will be tied to "groups" that share the same offering and could also have a unique Marketplace with local market customization features. Every Service Location that is installed will have an ONT documented, including its connections higher up in the network. Customers will choose a service from the marketplace, and through COS's integration to Calix SMX, that service will be activated automatically.

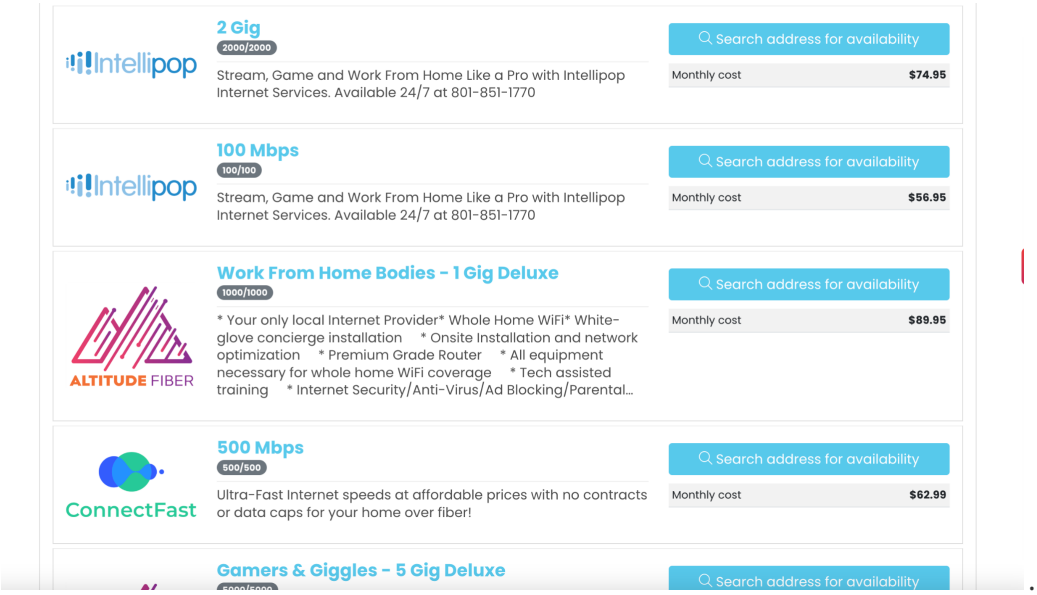
Demand Aggregation

Demand Aggregation has been at the core of COS's US products since 2012 with the launch of COS Service Zones. With our demand Aggregation platform you can determine address availability, take a survey, and even pre sign up and submit a deposit. Customize your webpage to your community allowing citizens the local network feeling.



Self Service Marketplace

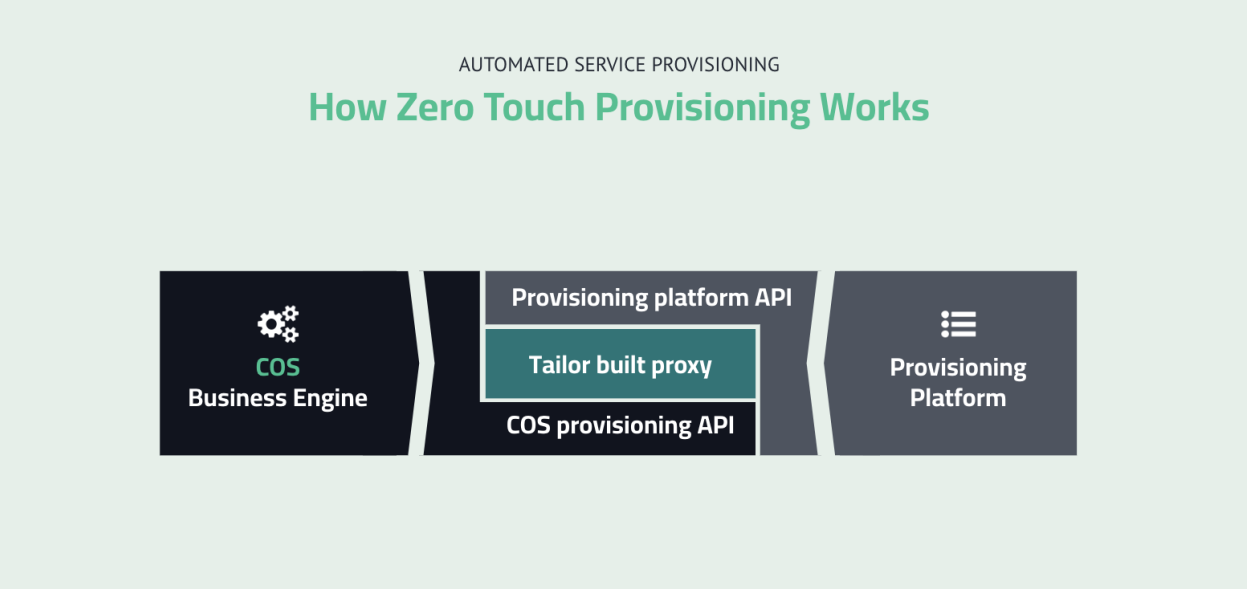
COS Business Engine is purpose built for open access and allows the subscriber to not only choose one provider at a time, but can actually buy services from multiple providers at the same time, eg. Internet from one ISP and IP Phone (VOIP) from another. And these services are automatically activated on the network regardless of which ONT/CPE brand you choose - our API integrations can support any brand.



In the marketplace service providers can market additional services (such as television, telephone, medical smart home, VOD etc) to the broadband service as they wish and can configure this in their own portal without involvement of the operator.

Zero Touch Provisioning

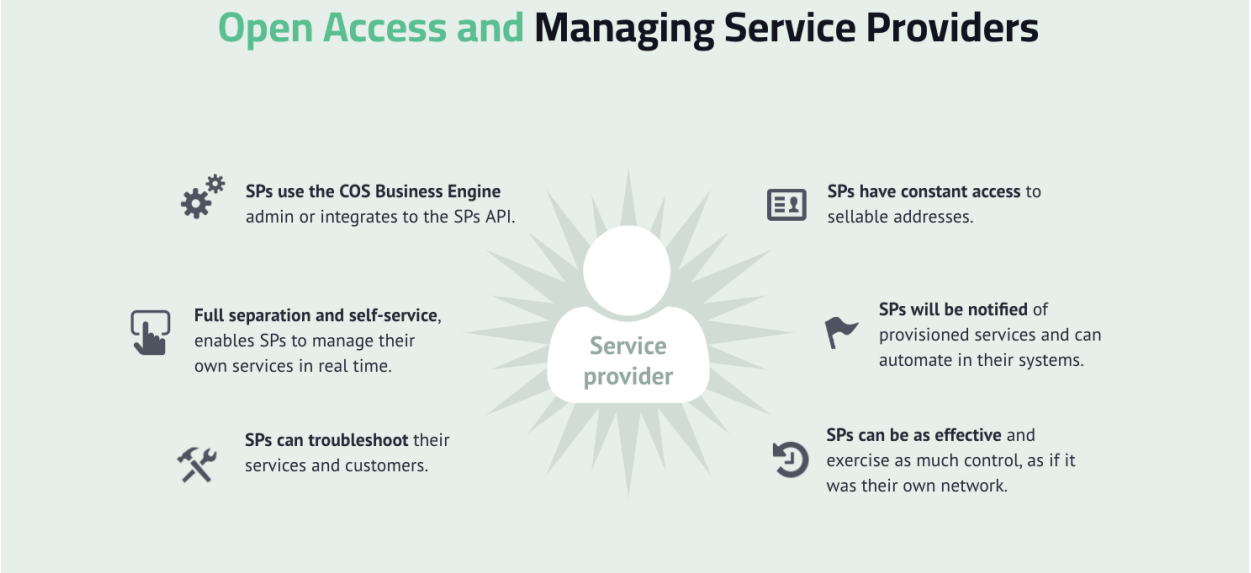
The COS software is integrated with the network equipment management system to perform the activation/deactivation of the service, and much more.



The subscriber will be able to go to the Marketplace and search for their address. This will show them available services for their address. As they make their selection and complete the signup steps, COS Business Engine will send provisioning instructions to the electronic vendor's NMS (Network Management System) platform. Within 1 minute the service will be provisioned. Most often they do, but service orders must not be placed on the Marketplace. If the Service Provider is in contact with the customer, they can place the order directly in the COS Business Engine which will trigger automated service provisioning. There is also an API for Service Providers if they would like to be able to do this on their own website or from their own CRM/BSS system.

Service Provider Management

The Service Providers will have access to manage their service offerings and pricing and also to troubleshoot customers experiencing problems, and resolving tickets, as well as establishing trouble tickets with the Operator.



Business Engine is a seamless system for open access operators and ISPs and provides Access for Service providers to diagnostic data for troubleshooting.. As a provider is selling services to a customer, they will be able to access diagnostic data for how their service is performing at the customer location. This data is extracted from the NMS platform through the API integration. The Service Provider will be able to troubleshoot their customers almost as if it was their own network, but only for their subscribers thanks to the COS Business Engine service provider separation.

Data Integrity

Business Engine has over 2000 data validations built in to ensure long term data quality. Some validations are done on input or import, while some are done continuously to detect discrepancies and highlighted in the Provisioning dashboard for administrators to take action. This way revenue leakage is eliminated.

Software Ecosystem

No one likes to swivel chairs between systems, which is not only inefficient, but also the main reason for poor data quality. That's why the COS platform offers multiple options for integrations, data transfer and validations. COS believes in data quality and control in order to manage an efficient profit generating network. We have developed Business Engine as a Central Dashboard for your software ecosystem. We integrate with a variety of tools including fiber network planning and documentation, construction management and hardware partners to make our customers networks as unique as each customer.

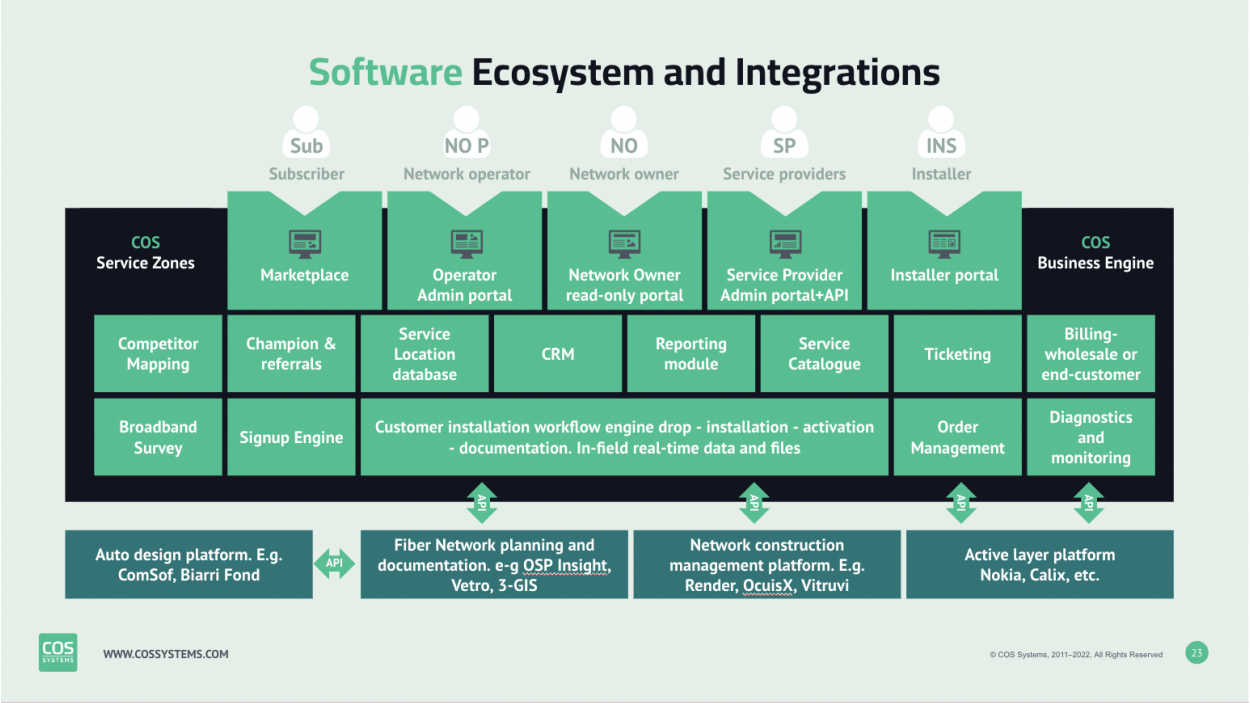


Figure 9: COS software ecosystem

Network Architecture and Hardware Flexibility

Successful network deployments typically revolve around well-established network protocols, selecting vendors based on individual requirements aligned with those protocols. This ensures modularity, growth capability, and easy maintenance. Currently, other all in one open access hardware/software solutions appear as a proprietary "black box" system, which might make future diversification challenging without a total overhaul. COS believes that software and network hardware should be independent allowing customers to make a best in class decision on each.

We support flexibility in network architecture and vendors, supporting both Active Ethernet and PON networks. We believe that it is a customer by customer decision to choose architecture and supplier. Many networks over time will evolve and support multiple vendors. Our partnerships with network vendors include an elite partnership with Calix making a truly best in class solution for open access.

References and Contact Information

A. Corporate Information

COS Systems is located at 42 Broadway, Suite 12-206 New York, NY, 1000. The contact for the City of Superior is COS CEO Mikael Philipsson Mikael.Philipsson@cossystems.com, 800-562-1730.

B. Company History and Formation

COS Systems was incorporated in Umea Sweden in 2008 and has been in operations as a software company serving FTTH operators and open access operators since its inception. Since 2013, COS Systems Inc has been an American wholly owned subsidiary of the company group COS Systems AB, which is based in Sweden. The operations in the USA are run through COS Systems Inc.

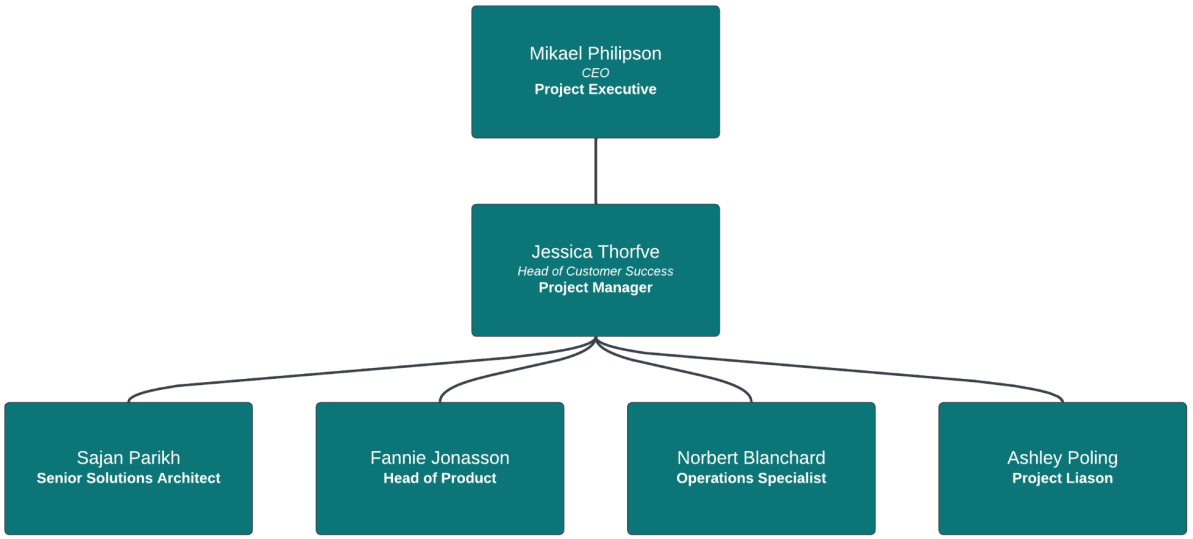
COS Systems is privately owned by COS Systems AB. COS Systems AB is in turn owned by Private Equity fund Pivot Partners AB.

C. Number of Employees

COS Systems employs 30 employees.

D. Organizational Chart

COS systems implementation team has the largest combined experience implementing and supporting open access projects of any company in North America. Led by our CEO Mikael Philipsson who ran IP Only - a Nordic Open Access operator that brought FTTH to over 1 million passings. Our team will support the onboarding of the City of Superior's Business Engine instance and all integrations and best practices for a best in class automated open access network.



Implementation Team:

Mikael Phillipsson - CEO/ Project Executive

Mikael has over 20 years of experience in building and operating fiber infrastructures and 18 years with IP-Only, a nordic fiber wholesale and large enterprise operator where he held roles as CEO (7 years), CTO, Sales Director, Product & strategic sales. He led the restructuring from a pure B2B Fiber infrastructure operator to enter the residential FTTH market with an open access business model. 1,5 million addressed households and 1m HP built in close partnerships with 100+ municipalities. 25+ acquisitions and 2 public take-outs (DGC and Availio). Revenue growth from 47m Euro, 145 FTE in 2013 to 200m Euro and ~700 FTE in 2018.

After leaving IP-Only, several projects as Industrial advisor to EQT in the fiber/Internet Security sector and since 2020 engaged in COS Systems, first in the board and since february 2021 as CEO.

Jessica Thorfve - Customer Success Director

Jessica started her career in 2011 working at T3 (telecom 3 Sverige AB), a nationwide Service Provider operating in over 160 open access fiber networks throughout Sweden. She has always worked closely with the open access Network Operators and has deep insights from a Service Provider perspective on the operational procedures in FTTH networks. Since she started at COS, she has been working as a Customer Success Manager onboarding customers on the COS platforms and being responsible for project management in implementation projects of COS Business Engine across North America.

Sajan Parikh - Senior Solutions Architect

Sajan possesses over a decade of distinguished experience in the telecommunications sector, having served in roles ranging from engineer to executive and consultant. He has notably impacted over 700 global networks, infusing each project with a distinctive perspective that harmonizes operations, technology, and leadership. Key achievements include spearheading the launch of both wireless and wireline Internet Service Providers (ISPs), overseeing large-scale mergers and acquisitions from both business and technical standpoints, and devising network designs and migration strategies for Fortune 100 enterprises. Additionally, Sajan is adept as a software engineer and network architect, having meticulously constructed and integrated technology ecosystems to ensure alignment across diverse business units, including sales, support, network design, operations, field teams, management, and executive leadership.

Norbert Blanchard - Operations Specialist

Norbert was born and raised in France, and has been living in the US for 22 years and is a current resident of San Francisco, California. Norbert has worldwide experience in the telecom and IT industries, working for global equipment suppliers and operators in large corporations and start-ups in consulting, sales and operations, and has managed relationships with government representatives, enterprises, and strategic partners. Norbert shares the COS passion for open access and has worked as an Operations Director for Covage, one of the largest open access networks in the world, with operations in France and Spain.

Ashley Poling - Senior Sales Executive - Project Liaison

Ashley has been working in the Fiber To The Home industry for nearly a decade. Prior to coming to COS she led projects with municipalities, electric utilities and cooperatives across the US from feasibility through network launch and marketing with the turnkey firm Magellan Advisors. She joined the COS team in 2022 to support the rapid expansion in North America and ensure fiber operators have the best tools to enable accessible FTTH to everyone, everywhere.

Implementation Experience:

The following examples are implementations the COS team has completed in North America that highlight our overall ability to produce automated open access networks for our customers.

Pictou County, Ontario Canada

Pictou County has worked with provincial funding to deploy an open access network to its residents who struggle with low speed or total lack of access. The County's network is open access and currently has three internet service providers. The County chose in 2022 to implement COS Business Engine to power the County's project. It's a GPON network and the electronics are provided by COS Partner Ciena/Tibit. Customer facing Marketplace: marketplace.munpict.ca

Kitsap Public Utilities - Poulsbo, Washington

Kitsap PUD is a public utility in the USA that was COS's first open access customer in North America. The cooperation started in 2016 with the implementation of COS Service Zones to aggregate demand for FTTH in Kitsap County, with some 100 000+ households. Later COS Business Engine was selected as the operations platform for the open access network, where five providers are competing for the growing number of customers. It's an Active Ethernet network and the electronics are from Allied Telesis.

https://ftth.socious.com/blog/kitsap-pud-signs-agreement-to-manage-open-access-network-with-cos-business-engine

City of Rexburg, Idaho

The City of Rexburg, Idaho has established the need for digital infrastructure and began investing in a backbone for municipal services and to propel fiber to the home in an open access business model. In 2023 the City created an agreement with Silver Star Communications to invest in and run the public private partnership network called LightBridge. The City's network utilizes COS Business Engine as the software to allow automated open access and multiple service providers (currently three). It's a multi-gig PON network and the electronics are provided by Calix. COS is a global elite partner and the preferred open Access partner of Calix. Customer facing Marketplace: lightbridge.com. Silver Star is also building open Access FTTH in Jackson, WY, operating it with the same instance of COS Business Engine. See, silverlight-fiber.com

Red Deer County, Alberta, Canada

Red Deer County in rural Alberta, Canada has joined forces with neighboring municipalities and the electric cooperative to create a municipally controlled corporation called Rural Connect Ltd. to deliver broadband Internet services to thousands of rural residents under-served by existing private sector service providers. Rural Connect will build an open access network operated by COS' partner Valo Networks. Valo will bring its experience running Open Networks to the consortium and utilize COS Business Engine to promote an automated open access network with a marketplace for multiple providers. The provider of GPON hardware is Fiberhome.

Southern Ute Tribe - Ignacio, Colorado

The Southern Ute Indian Tribe will deploy an open access Fiber to the Home network to connect almost 3000 residents in its territory. The partnership with operator Bonfire Fiber will utilize COS' Business Engine to manage and operate the open access network, allowing ISPs to sell services over the network. The provider of GPON electronics is Nokia, with whom COS has a global partnership with a multitude of implementations in North America and Europe. The COS Business Engine Marketplace is not open to the public yet as construction is still underway, but the demand aggregation platform is open for survey takers and pre-signups: bonfirefiber.servicezones.net.

References and Clients

Kitsap PUD - Kitsap, WA

Contact: Angela Bennik

Address: 1431 NW Finn Hill Rd, Poulsbo, WA 98370

Phone: 360-271-3425

Date Work Performed: 2016 - Current

Description of Work:

Kitsap PUD is a public utility in the USA that was COS's first open access customer in North America. The cooperation started in 2015 with the implementation of COS Service Zones to aggregate demand for FTTH in Kitsap County, with some 100 000+ households. The year after COS Business Engine was selected as the operations platform for the open access network, where five providers are competing for the growing number of customers. See kpud.broadbandportal.net

Silver Star Communications - Freedom, WY

Contact: Brock Walters

Address: 3700 E 41st Ave, Denver, CO 80216

email: bwalters@silverstar.net

Date Work Performed: June 2023 - Current

Description of Work:

Silver Star Networks is a 100+ year old telecommunications company that began delivering phone services in 1912 in the area of Star Valley Wyoming, They began building Fiber in the 1990's and have expanded to include over 1800 miles of fiber delivering services to businesses and residents. In 2023 Silver Star began deploying Fiber to the Home in two communities utilizing an open access model. They have chosen COS Systems Business Engine to power their open access business in both Jackson, Wyoming and in partnership with the City of Rexburg, Idaho. See lightbridgefiber.com and silverlight-fiber.com (these are actually just two separately branded Marketplace operated by one COS Business Engine instance)

WideOpen Networks - Blacksburg VA

Contact: Dr. Andrew Cohill

Address: 2000 Kraft Dr SW #2150, Blacksburg, VA 24060

Phone: 540-552-2150

Date Work Performed: 2019 - Current

Description of Work:

Dr Andrew Cohill, who is the founder of WideOpen Networks, was the director of Blacksburg Electronic Village, a very early internet community built around the University of Virginia Tech. After working with a large number of communities across the USA to plan, design, build and operate fiber networks, COS Service Zones and COS Business Engine were selected as the key platforms as they set out to build an open access Network in Blacksburg and surrounding counties in 2019. See wideopen.servicezones.net and wideopenblacksburg.broadbandportal.net

Bonfire Fiber - Denver, CO

Contact: Justin Roller

Address: 3700 E 41st Ave, Denver, CO 80216

email: Justin.Roller@bonfireig.com

Date Work Performed: 2022 - Current

Description of Work:

Bonfire Fiber is an open access Fiber network owner and operator in the Mountain Region of the US working closely with municipalities to meet the needs of bridging the digital divide. Bonfire chose the COS platforms Service Zones and Business Engine in 2022. The team has worked alongside our customer success team to implement and launch the products in their first market operating an open network for the Southern Ute Tribe. See bonfirefiber.servicezones.net

Below is a partial list of clients that COS Systems delivers similar services to Connect Superior 's goals. COS has also served 100+ current and past customers on our demand aggregation product, Service Zones over the past 10 years including municipalities and municipal utilities.

Client	Contact	Number	Address	Email
Fujitsu Network Communications	Anthony Bednarczyk	214-784-8333	2801 Telecom Parkway, Richardson, Texas 75082	Anthony.Bednarczyk@fujitsu.com
NoaNet	Clair Ward	816-519-2370	11707 E Sprague Ave. Suite 201 Spokane Valley, WA 99206	claire.ward@noanet.net
Valo Networks	Phil Roberts	403-830-9235	09 8 Ave SW #200, Calgary, AB T2P 1B8, Canada	phil.roberts@valonetworks.com
IBI/Arcadis	Keith Ponton	780-982-0192	537 South Broadway Suite 500 Los Angeles CA 90013 United States	keith.ponton@ibigroup.com
Municipality of Pictou County, ON, Canada	Derek Eisan	902-485-4311	46 Municipal Drive, Pictou Nova Scotia,	derek.eisan@ruralmopc.net

			Canada	
Rock Networks, Canada	Joe Hickey	613-853-7858	89 Cutler Ave. Unit 104 Dartmouth, Nova Scotia, Canada, B3B 0J5	joe.hickey@rocknetworks.com
Regio Help, Austria	Willem Brinkert	+43 650-94-55-362	Gewerbegebiet Nord 9, Munderfing, 5222, Austria	willem.brinkert@regiohelp.eu
Telia Company, Europe	Chris Chemnitz Head of Activation Common | CPS IT Production	+46 73 064 50 89	Stjärntorget 1, 169 79 Solna, Sweden	Chris.chemnitz@teliacompany.com
FiberNet, Finland	Janne Ahola, Managing Director	+35 850-37-76-505	Vanha Kaarelantie 33A, FI-01610, Vantaa, Finland	janne.ahola@fibernet.fi
VX Fiber, Europe, Africa	Jens Sörensen Chief Deployment Officer	+46 708431070	Ostra Radhusgatan 6, 903 26 Umea, Sweden	jens.sorensen@vx.se
BostNet, Sweden	Jessica Hakansson	+46 70-540-7570	Ostra Kyrkogatan 2, 901 06 Umea, Sweden	jessica.hakansson@bostaden.umea.se
Ume.net, Sweden	Lena Solstam	+46 70-209-4407	Storgatan 34, 901 05 Umea, Sweden	lena.solstam@umeaenergi.se
Skellefteå Kraft, Sweden	Anders Pettersson	+46 910-740-693	Kanalgatan 71, 931 34 Skelleftea, Sweden	anders.v.pettersson@skekraft.se

Solution Specifications - Software:

Support for syslog, SNMP, trap and performance management in OSS software

COS supports ingesting events from various sources and acting upon them. For example, COS can ingest SNMP Traps from NMS systems when a new ONT is first seen, triggering an action to create and add that ONT into COS's inventory for later provisioning to a customer.

Another example would be ingesting a message from an NMS that involves an alarm or fault.

The exact nature of COS's involvement in these types of monitoring protocols varies depending on the organization and other vendors selected.

Our suggestion would be to properly align your monitoring needs to the different organizational units, their personnel, first-party EMS systems, and the protocols they support. This is a typical process during onboarding and cannot be answered until other dependencies are carefully agreed upon.

Layer 2 segmentation technology provide separate VLANs/VPNs for each ISP and its customers on the open-access network

COS Business Engine maintains and manages the business and commercial offerings across different geographic areas, service location types, different ISPs, and complex pricing and technical items that come from any and all permutations of a particular customer choosing a particular service from a particular ISP.

COS takes this information and automatically provisions to a variety of vendors and creates Layer 2 separation and handoff between not only the ISP, but potentially service type, or package through the use of 802.1Q VLANs, S-Tags, and C-Tags.

COS can be configured to support different business models, the most common being the VLAN on the data port of the ONT being the tag assigned to the ISP, the S-Tag corresponding to hardware or PON attributes, and the C tag being unique to each customer in that region or area.

This is one of many potential ways COS Business Engine can create different types of Layer 2 separation not just between the ISPs, but also other potential items.

24x7x365 next-business day hardware and software maintenance on critical components

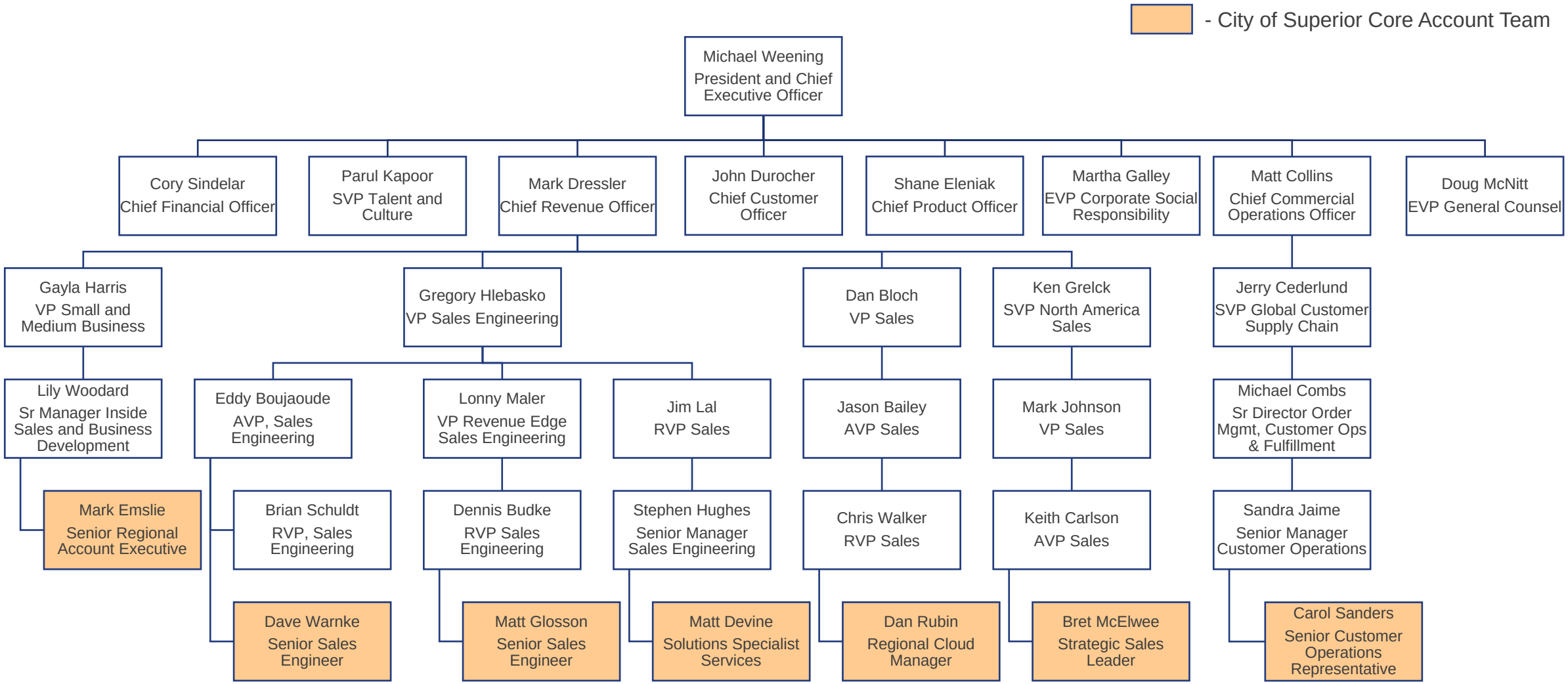
COS provides a tier based SLA based on the critical nature of a potential error. For critical errors the SLA supports a four hour reaction time.

Provisioning for all subscriber services, including residential single-family, multifamily,commercial and community anchor

COS Business Engine supports the provisioning of all subscriber types and alternative services beyond just Internet.


Calix

Calix Organization Chart and City of Superior Account Team



INTELLIGENT ACCESSEDGE

Data Sheet

AXOS e9 2®

Intelligent EDGE System

Calix

The revolutionary Calix E9-2 Intelligent EDGE System is designed to deliver unconstrained scale and bandwidth enabling service providers to converge mobile, business and residential services networks. This convergence as well as the E9-2's ability to redefine the access EDGE of the network by collapsing functions into a single system, enables service providers to realize dramatic reductions in total cost of operations and ownership. The Calix E9-2, built on the AXOS platform—Access eXtensible Operating System, allows service providers to deploy rapidly and meet the demands of the always on world.

Functional Description

The Calix E9-2 Intelligent EDGE System consists of one or more E9-2 shelves. The E9-2 is an unconstrained, disaggregated system that utilizes the latest in data center high bandwidth interconnect technology to enable it to scale to very high density, non-blocking capacity. The E9-2 is aggregated into a single system when utilizing the System Aggregation and Control cards (CLX3001). The architecture of the E9-2 enables line cards to support nonblocking uplink capacity and as new technologies are incorporated the system easily integrates new uplink options.

REDEFINED ACCESS EDGE

The E9-2 collapses the functions of the traditional OLT, the aggregation switch and the EDGE router with subscriber management into a single system reducing the rack space and power used in the data center / central office and more importantly reducing the number of systems required to be provisioned and managed.

CARRIER GRADE SYSTEM

The E9-2 Intelligent EDGE System enables full carrier grade redundancy for network and equipment connections. In addition, it provides redundancy on the access network utilizing NG-PON2 wavelength mobility and Type B protection for GPON.

INTEGRATED CABLE AND FIBER MANAGEMENT

The E9-2 system supports cable and fiber management, which ensures operators can easily install and remove additional cards without having to remove cables or fibers from any other card in operation. Additionally, there is an optional air filter / fiber cover that snaps to the front of the chassis.

LINE CARD SUPPORT

The E9-2 shelf has 2 universal line card slots. Access line cards can be mixed and matched within the system and additional shelves can be aggregated to increase subscriber density.

CONVERGED SERVICES NETWORKS

The E9-2 enables convergence of residential, business and mobile services into a unified access network. E9-2 delivers scalable residential IPTV, high-speed internet (HSI), voice and business services. In addition, the E9-2 supports high value business class services allowing operators to use a common access network to deliver higher revenue generating opportunities.

INDUSTRY STANDARDS COMPLIANCE

The E9-2 meets all applicable industry compliance standards, including NEBS Level 3, UL, FCC and CE mark.

SPECIFICATIONS

Minimum software release

- Calix E9-2 AXOS Release 3.1 for NG1601 and CLX3001

Slots per shelf

- 2 Universal card slots
- 4 Fan module slots

Virtual backplane

- Enabled by the System Aggregation and Control cards CLX3001 (see appropriate datasheet)

Management interfaces

- 2 Ethernet 10/100/1000 (RJ-45 connectors on back of E9-2)
- 2 RS-232 (RJ-11 connectors on back of E9-2)
- 1 Ethernet 10/100/1000 (RJ-4 connector on the front of each line card)

Dimensions (W x H x D)

- Width: 17.44” (44.3 cm)
- Height: 3.44” (8.7 cm)
- Depth: 17.94” (45.5 cm)
- Rack height is 2 RU

Weight

- 16 lb (7.2 kg) E9-2 shelf
- 19.4 lb (8.8 kg) shelf with four fan modules

Power dissipation

- Maximum power 600 watts per shelf

Power feeds

- Integrated power management on Calix E9-2 line cards
- Redundant -48 VDC battery feeds (A and B)
- Input Range: -42.5VDC to -56VDC

Operating environment

- Temperature: 23º to +131º F (-5º to +55º C)
- Humidity: 5 to 95% (non-condensing)
- Operating altitude: 10,000 ft (3,049 m)

Storage environment

- Temperature: 23º to +131º F (-40º C to +85 º C)
- Humidity: 5 to 95% (non-condensing)

Alarm I/O interfaces (per shelf)

- Wire wrap pin access on E9-2 back
- User definable alarm inputs: 3, outputs: 1

Air filter

- Field Replaceable from front of chassis (no tools required)

Compliance

- UL-60950, Standard for Safety, Issue 1, April 1, 2003
- NEBS Level 3 compliance (GR-63-CORE, GR-1089-CORE, GR-3028)
- FCC Part 15 Class A
- CE mark (on chassis and entire system)

Synchronization

- Synchronization is enabled by the E9-2 line cards as required with internal and/or external reference timing

Timing inputs interfaces

- 4-wire wire wrap pins on the back of the E9-2
- T1/E1 BITS clock (sink)

Fiber interfaces

- All optical ports use pluggable optics (SFP, XFP, SFP+, QSFP+,QSFP-28)
- LC or SC connectors on modules

Copper inter-connects

- Pluggable cables : C-QSFP (4x100GE)

Notes: For NGPON-2 OIM, XGS-PON, GPON OIM, 10GE XFP, 10GE SFP+, 40 GE QSFP+ and 100GE QSFP28 pluggable transceivers and Direct Attach cables, only products purchased from Calix are supported. The use of NG-PON2, XGS-PON, GPON OIM, 10GE XFP, 10GE SFP+, 40GE QSFP+ and 100GE QSFP28 pluggable transceivers and Direct Attach cables not purchased directly from Calix is not supported and will void all product warranties covering the Calix equipment to which such third-party materials are connected.

Copper Direct Attach cables can operate in SFP, SFP+, QSFP+, QSFP28, C-QSFP sockets at 1GE, 10GE, 40GE, 100GE, 4x100GE data rates, respectively, as supported by the card type.

ORDERING INFORMATION

Calix E9-2 Ethernet Service Access Platform

000-00916 .....E9-2 System Package (Shelf, 4 Fan Modules, Fiber Management, Installation Kit)
100-00573 .....Calix Circuit Breaker Panel (90 Amp total, 3x 30 Amp positions with A/B protection)

Calix E9-2 System Recommended Spare Components

100-04469 .....E9-2 Shelf
100-04470 .....E9-2 Fan Module
100-04471 .....E9-2 Air Filter / Cover
100-04715 .....E9-2 Installation kit
100-04472 .....100G QSFP28 Direct Attach Cable, 1m
100-04489 .....QSFP28 to 4 x SFP+ Direct Attach Breakout Cable, 3m
100-04713 .....4x100G C-QSFP to 4 x QSFP28 Direct Attach Breakout Cable, 1m
100-04980 .....4x100G C-QSFP to 4 x QSFP28 Direct Attach Breakout Cable, 2m
100-04716 .....Air filter replacement
100-04746 .....Blank Line Card

Calix Pluggable Transceiver Modules

The E9-2 supports pluggable modules for all service and network interfaces. Refer to the Calix Optical Transceiver Modules Datasheet (#250-00191) for a complete list of modules and specifications.

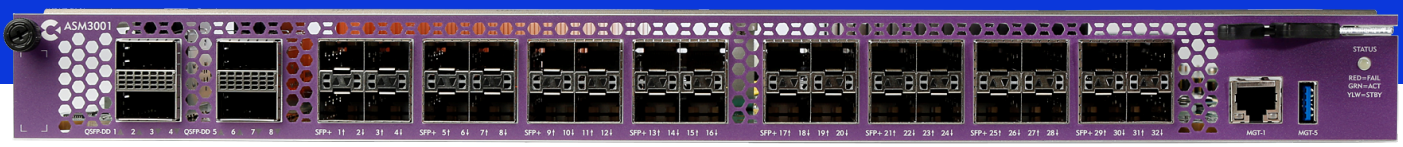
SFP.....1GE and 2.5GE optical and copper Small Form-factor Pluggable (SFP) modules
SFP+.....10GE optical Enhanced Small Form-factor Pluggable (SFP+) modules
SFP+ Direct Attach.....Multi-rate copper Small Form-factor Pluggable (SFP/SFP+) cables
XFP.....10GE optical Small Form-factor Pluggable (XFP) modules
QSFP+.....40GE optical Quad Small Form-factor Pluggable (QSFP+) modules
QSFP28 Direct Attach.....40GE-100GE Quad Small Form-factor Pluggable (QSFP-28) Direct Attach Cables
QSFP28 DAC Break Out.....40GE to 4x10GE, QSFP to 4 SFP+ Direct Attach Breakout Cable
C-QSFP-QSFP28 DAC Break Out.....4x100GE C-QSFP to 4 x QSFP28 Direct Attach Breakout Cable
GPON OIM.....2.5Gbps GPON (Class B+ ODN with minimum 28dB link budget)
ER-GPON OIM.....2.5Gbps Extended Reach GPON (up to 40 km with 1:8 split
NG-PON2 OIM.....NG-PON2 XFP 10/10Gbps, Class N1) (1596.34nm, 1597.19nm, 598.04nm, 1598.89nm)
XGS-PON OIM.....XGS-PON XFP OIM 10/10Gbps, 1577/1270nm

AXOS®

Data Sheet

AXOS e9 2®

Aggregation Service Manager (ASM3001)



Calix

The Calix Aggregation Service Manager (ASM3001) line card is designed to enable service providers to redefine the access edge of their existing network. The Aggregation Services Manager is part of the AXOS Intelligent Access Edge Solution enabling service providers to collapse aggregation, subscriber management and advanced routing into a single location in the network closer to subscribers and services where they can see significantly reduced operational expenses and increased security.

It is built on the AXOS – Access eXtensible Operating System and allows service providers to deploy rapidly and meet the demands of the always-on world.

AXOS e9-2®

Aggregation Service Manager
(ASM3001)

Data Sheet

Key Components of the Intelligent Access Edge

The Calix Intelligent Access Edge is powered by the AXOS platform with optional modules like ARm, and SMm. The AXOS platform is a hardware independent, service abstracted, modular software platform that allows service providers to simplify a network in a cost and time efficient manner.

From hardware perspective Intelligent Access Edge includes a E9-2 Shelf with two ASM3001 aggregation cards or two CLX3001 control cards. It can be placed in the data center or central office.

INTELLIGENT ACCESS EDGE

The Aggregation Services Manager (ASM3001) is part of the AXOS Intelligent Access Edge solution that enables service providers to simplify their network and operations while maintaining their existing Layer 2 access network. The Intelligent Access Edge consolidates all the critical functions of subscriber and services policy and management into a single network location and includes the ability to connect existing MPLS networks to the access network.

The Intelligent Access Edge Solution enables service providers to take advantage of the following benefits that a Layer 3 access network offers:

- Reduced network elements
- Reduced time to provision subscribers and new services
- Reduced time to coordinate multiple network elements to deploy new services
- Increased security in the access network

LAYER 3 ACCESS NETWORK

The access network has long been built on a Layer 2 architecture. Technology availability and scale were the limiting factors driving this architecture. By moving key subscriber and service-related functions such as: policy, performance monitoring, Authentication Authorization Accounting (AAA), Hierarchical QoS, Security, and IPv4 / IPv6 IP Address assignment closer to the subscriber the network is dramatically simplified as well as more efficient at critical functions including security and reduced latency.

AXOS PLATFORM

The Calix Intelligent Access Edge solution is powered by the AXOS platform with optional modules like ARm, and SMm. The AXOS platform is a hardware-independent, service-abstracted, modular software platform that enable always-on stateful operation and integrates easily into any BSS/OSS system and allows service providers to simplify their network and operations reducing time to revenue and operational cost.

CARRIER GRADE SYSTEM

The Aggregation Services Manager line card enables full carrier grade redundancy for network and equipment connections with LAG/LACP and BFD. In addition, it supports redundancy for subtended Access shelves via LAG/LACP and ring configurations.

SYSTEM OVERVIEW

The E9-2 Intelligent Edge System has two slots enabling two ASM3001 line cards to be installed, providing full network and equipment redundancy in a single shelf. Each ASM3001 has QSFP-DD ports and 32 SFP+ ports. A wide range of Layer 2 access shelves and systems may be subtended from SFP+ ports. The E9-2 with the ASM3001 is designed to aggregate traffic from existing distributed access deployments and connect directly to the existing MPLS or routed edge network.

AXOS e9 2®

Aggregation Service Manager
(ASM3001)

Data Sheet

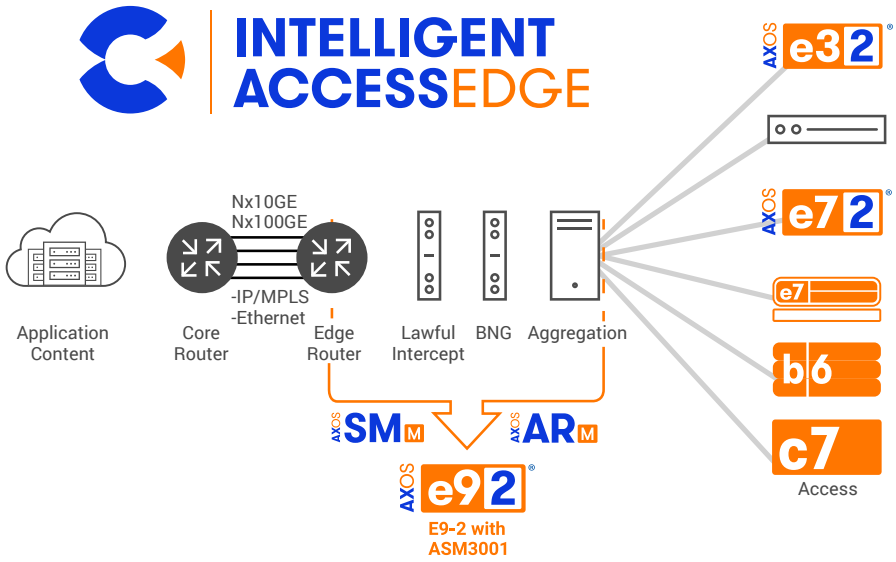
Capability Overview

Carrier Class solution for remote system aggregation with Integrated Subscriber Management and/or Routing functions.

- Flexible aggregation support with SFP+ interfaces supporting 10GE, 2.5GE or 1GE
- Ring (G.8032v2) and Point-to-Point
- (Unprotected/LAG) topologies
- Supports Layer 2 and 3 aggregation for business and residential services
- Q-Q, IPv4, IPv6, Dual stack, OSPF/ISIS/BGP, MPLS, L2/L3 VPN
- Subscriber Management

Application Overview

The ASM3001 can aggregate up to 32 remote access shelves.



NETWORKING SERVICES

The Intelligent Access Edge Solution enable a rich set of L2 and L3 services. This enables the service providers to deliver comprehensive access solutions and services across a diverse Residential, Business and Mobile subscriber base.

HIERARCHICAL QUALITY OF SERVICE (QOS)

One of the key differentiators is the state-of-the-art QoS implementation that is necessary to support enhanced Access solutions for Residential, Business and Mobile consumers over a Unified Access Network. The support for per service, per subscriber per PON, per Access, per ISP policing and shaping are among some of the key features enabled in the Intelligent Access Edge Solution.

SUBSCRIBER SERVICE MANAGEMENT

Another important differentiation of the Intelligent Access Edge Solutions is the full support for the subscriber management function. A full suite of subscriber management protocols ranging from AAA, dynamic subscriber policy updates, walled garden, and IP address Management are among the key capabilities enabled.

SPECIFICATIONS

Supported Software Modules

- Advanced Routing Protocol Module (ARm)
- Subscriber Management Module (SMm)

Card Per Shelf

- 2 ASM3001 cards per E9-2 shelf

Ports

- All ports use pluggable modules
- 32 SFP+ (10GE, 2.5GE, or 1GE)
- 4 QSFP-DD (2x100G)

Synchronization

- Synchronization is enabled by the ASM3001 as required with internal and/ or external reference timing

Timing Inputs Interfaces

- 4-wire wrap pins on the back of the aggregation chassis T1/E1 BITS clock (sink)

Management Interface (port)

- Two Ethernet 10/100/1000 BASE-T interfaces (RJ-45 connector ports on back of E9-2 shelf)
- Two RS-232 interfaces (RJ-11 connector ports on back of E9-2 shelf)
- One Ethernet 10/100/1000 BASE-T interface (RJ-45 connector port on the front of each line card)

WAN Routing Options

- 802.1Q
- Q-Q
- Routed VLANs
- IPv4/IPv6
- Static Routes
- OSPFv2/v3
- ISIS
- BGP
- BGP-MP
- MPLS
- VPLS
- MPLS VPN
- BGP-VRF
- IRB
- VRRP (IPv4)

Subscriber Management

- Diameter
- TACACS+
- Radius
- PPPoE Server for IPv4
- AAA
- IP Address Management
- DHCPv4/v6
- Walled Garden
- DDoS
- Performance Monitoring
- Mirroring
- Lawful Intercept

Compliance

- UL-60950, Standard for Safety, Issue 1, April 1, 2003
- NEBS Level 3 compliance (GR-63- CORE, GR-1089-CORE, GR-3028)
- FCC Part 15 Class A
- CE mark

Power Dissipation

- Power consumption:300 Watts (with Optics)
- Heat dissipation:1023 BTU/Hour

Storage Environment

- Temperature: 23º to +131º F (-40º C to +85 º C)
- Humidity: 5 to 95% (non-condensing)

Operating Environment

- Temperature: 23º to +131º F (-5º to +55º C)
- Humidity: 5 to 95% (non-condensing)
- Operating altitude: 10,000 ft (3,049 m)

Weight

- 6lbs., 0 oz.
- 2.72 kg

Dimensions

- Width: 17” (43 cm)
- Height: 1.7” (4.3 cm)
- Depth: 13” (33 cm)

Notes: High-speed optic module operational tolerances and performance vary significantly and can dramatically affect network operations. To maintain predictable performance and product reliability, Calix E-Series systems are supported with Calix GPON, XGS-PON, and NG-PON2 optical modules only ("Optical Modules"). Ethernet-based SFP, CSFP, CDFP, XFP, SFP+, QSFP+, QSFP-DD, QSFP-28 pluggable transceivers ("Optical Transceivers") and direct attach cables are available directly from Calix. Calix does not guarantee full compliance to product specifications for units using non-Calix modules and does not provide customer service support for optical network issues when non-Calix modules are used. Some third-party optics do not fully comply to the standard power and reach characteristics and in several cases have overheated and damaged the Calix equipment resulting in service outages. Calix Product Warranty shall not apply to any third-party products used with Calix Products, nor shall the Product Warranty apply in the event that the Product's defect or nonconformance is due to its use with hardware which is not purchased directly from Calix, including any optical interfaces, optical transceivers and direct attach cables. For complete Product Warranty terms and exclusions, please refer to the Calix Purchase Agreement.

ORDERING INFORMATION

Calix E9-2 Intelligent Edge System Line Card

100-05123.....E9-2 ASM3001 Aggregation Services Manager (4xQSFP-DD, 32xSFP+)

Calix ASM3001 System QSFP Modules

100-04041 .....QSFP, 40GE Multi-Mode Optical Transceiver, 150m, 850nm, MPO12, C-Temp

100-04045 .....QSFP, 40GE Single Mode Dual Fiber Transceiver, 10km, 1310nm, Duplex LC, C-temp

100-05465.....QSFP, 40GE Single Mode Dual Fiber Transceiver, 15km, 1310nm, Duplex LC, I-Temp

100-05477 .....QSFP, 40GE Single Mode Dual Fiber Transceiver, 25km-40km, 1310nm, Duplex LC, I-Temp

100-04651.....QSFP, 40GE Single Mode Transceiver 40km, 1310nm, Duplex LC, C-Temp

Calix ASM3001 System QSFP28 Modules

100-04650 .....QSFP28 100GE Multi Mode Optical Transceiver 100m, 850nm, MPO12, C-Temp

100-04744 .....QSFP28 100GE Single Mode Optical Transceiver 10km, 1310nm, Dual LC, C-Temp

100-04997.....QSFP28 100GE Single Mode Optical Transceiver 25km-40km, 1310nm, Dual LC, C-Temp

100-05744 .....QSFP28 100GE Single Mode Optical Transceiver 80km, 1310nm, Dual LC, C-Temp

Calix ASM3001 System QSFP-DD Direct Attach Cable

100-05369 .....200G QSFP-DD to 2x100G zQSFP+ Passive DAC 3m 30AWG C-temp RoHS

Calix ASM3001 System QSFP28 Direct Attach Cable

100-05587 .....QSFP28 to QSFP28 100GE Direct Attach Cable (DAC), 1m, 30AWG, I-Temp, passive

100-05588 .....QSFP28 to QSFP28 100GE Direct Attach Cable (DAC), 2m, 30AWG, I-Temp, passive

Calix Pluggable Transceiver Modules

The E9-2 supports pluggable modules for all service and network interfaces. Refer to the Calix Optical Transceiver Modules Data sheet (#250-00191) for a complete list of modules and specifications.

SFP.....1GE and 2.5GE optical and copper Small Form-factor Pluggable (SFP) modules

SFP+.....10GE optical Enhanced Small Form-factor Pluggable (SFP+) modules

SFP+ Direct Attach.....Multi-rate copper Small Form-factor Pluggable

AXOS®

Data Sheet

AXOS e7 2®

Intelligent Modular System

Calix

What could unparalleled flexibility and network convergence mean to you?

The E7-2 is a highly extensible, standards-based Ethernet service access platform that offers service providers a modular chassis-based option to address the emerging bandwidth challenges of today's world. As next-generation Ethernet services gain momentum in the marketplace and begin to extend out from the metropolitan area networks, they will drive demand for versatile, cost-effective aggregation out at the network edge.

By adding the AXOS platform, the E7-2 is now even more of a disruptive and compelling enabler to next generation networks that connect the world. The Calix AXOS E7-2 Intelligent Modular System is a breakthrough evolutionary system that provides a transformational path to next generation networks, fiber technologies, and Software Defined Access. The E7-2 is the industry's benchmark for a modular, small form factor, environmentally hardened access solution for service providers. The E7-2 leads a rapidly expanding family of AXOES E-Series systems capable of supporting both centralized and decentralized network architectures that range from the data center edge, central office, or headend, to the remote cabinet, or MDU.

Functional Description

ETHERNET SERVICE ACCESS PLATFORM:

Residential and business services are converging as more subscribers work from home offices and internet “over the top” video services consume an increasing percentage of both enterprise and service provider network capacity.

IP and Ethernet are the dominant network and transport protocols, and all services – voice, data, and video – are rapidly migrating to a packet-based architecture. High performance applications demand high performance solutions; the Calix E7-2 Ethernet Service Access Platform meets the demanding requirements of Ethernet services access networks.

The Calix E7-2 delivers a wide array of high performance applications, including 10GE Ethernet transport, delivery of high density residential triple play services over GPON and point-to-point (Active) Ethernet, copper pairs (VDSL2/ADSL2+), Metro Ethernet Forum (MEF) compliant business services, mobile backhaul, and protected GE aggregation of other Calix platforms.

HIGH DENSITY SUBSCRIBER ACCESS

With two cards per system, the E7-2 provides flexible, high density subscriber access options in a 1RU shelf:

- 96 VDSL2/ADSL2+ & POTS Combo (48 Overlay)
- 16 GPON and 8 GE ports (1024 ONTs)
- 48 point-to-point GE ports (48 ONTs)
- 8 XGS-PON/NG-PON2 ports

With Multi-dwelling unit (MDU) ONTs, the subscribers per 1RU system can exceed several thousand.

MODULAR CHASSIS ARCHITECTURE

The Calix E7-2 modular chassis enables a pay-as-you-grow architecture, combining the most advantageous attributes of a small form factor product with a large chassis-based system.

- 1RU design can expand from a single slot, for very low first install cost, to multiple chassis to add subscriber growth yielding a near linear cost curve
- Twenty line cards are managed as a single chassis for operational efficiency
- Mix and match line cards in a common chassis – no common control equipment required
- Line cards can be added or replaced without uninstalling/installing power, alarms, or cables – reducing MTR from hours to minutes
- Subscribers are easily aggregated and network resources efficiently shared across protected trunk facilities
- Hardened 1RU system delivers GPON and Ethernet with 10GE transport from CO, cabinet or pole mount
- Resilient, hot-swappable line cards and fan tray

With the E7-2, service providers no longer need to decide between a single service product and a high growth chassis solution. E7-2 provides low first install cost, operational efficiency and near linear incremental cost per subscriber, enabling Calix customers to maximize their business return.

FULL SPECTRUM OF SERVICES

The E7 delivers a full spectrum of access services over GPON and Point-to-Point Ethernet using the family of Calix ONTs, including Single Family Unit (SFU), Small Business Unit (SBU), Multi-Dwelling Unit (MDU), and rack-mount models.

- IPTV – broadcast and Video on Demand (VoD)
- MEF compliant business services
- High-Speed Internet (HSI) access
- Voice – Native SIP/VoIP and TDM Gateway support
- T1 services
- CATV video: RF video overlay with RF return

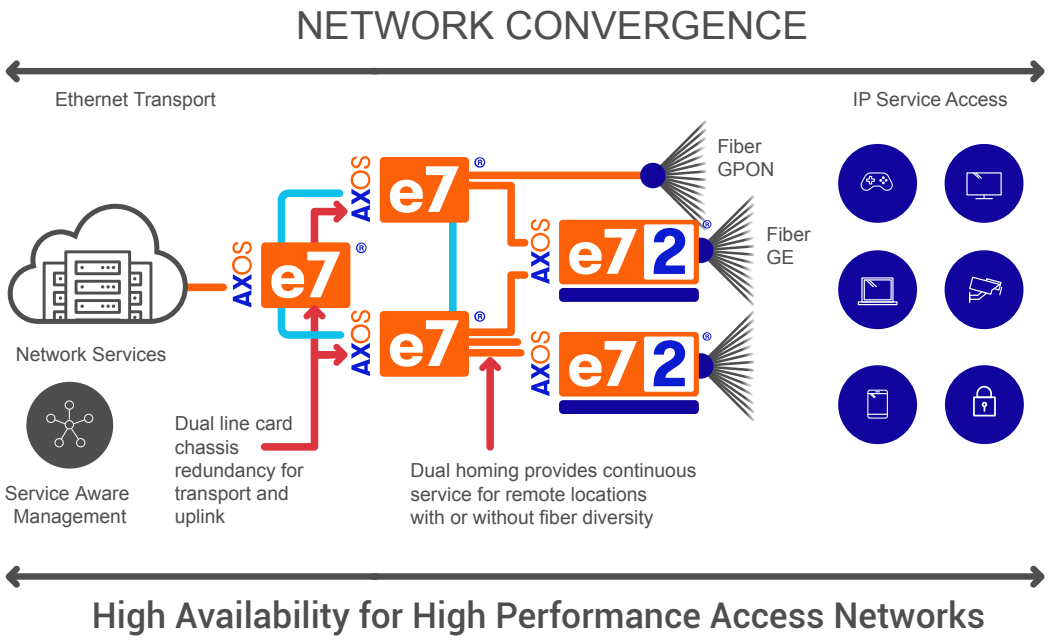
Calix ONTs support auto sensing GPON and GE network interfaces, allowing service providers to manage service changes without subscriber onsite technical support.

DELIVERING "QUALITY OF EXPERIENCE"

The E7 provides per-subscriber and per-service hierarchical QoS to deliver uncompromised triple play and business services. A powerful collection of classification, policing, queuing and scheduling algorithms let operators manage per-subscriber and per-service traffic flows to maintain priority/delay/loss service differentiation within the E7 network.

SCALABLE IPTV SUPPORT

IPTV services are by far the most demanding in terms of quality, and user expectations are very high. The E7 supports industry standard IGMP snooping to identify and replicate multicast video sent between the set-top box and the video distribution network, providing efficient, scalable, high-quality IPTV distribution on both GPON and Ethernet interfaces.



INTEGRATED HIGH-CAPACITY AGGREGATION

The E7 is built on a core Layer 2 and Layer 3 switch capable of full-duplex, line rate forwarding at all frame sizes and traffic types across all interfaces. This capacity makes the E7 ideal for aggregation and transport of IP/Ethernet services across the access network.

The E7 platform supports industry standard pluggable modules for all service and network interfaces, including ITU G.984 compliant GPON, Small Form-Factor Pluggable (SFP) Gigabit Ethernet, XFP 10GE ports, and SFP+ 10GE ports.

NETWORK RESILIENCY

The Calix E7 supports a flexible set of standards-based network topology protocols for use in aggregation, ring-based transport, and uplink applications.

- ITU G.8032 Ethernet Ring Protection Switching (ERPS)
- IEEE 802.1w Rapid Spanning Tree Protocol (RSTP)
- IEEE 802.3ad/802.1AX Link Aggregation

SERVICE AWARE MANAGEMENT

The E7, along with the Calix Management System (CMS), allows operators

to manage services while understanding their relationship to the network infrastructure. Service-oriented management includes rapid service provisioning, service templates and policies, and service assurance. Comprehensive network management tools let operators create physical and logical topology maps, engineer traffic flows, and manage network commissioning and software upgrades. Network inventory, alarm surveillance and PM collection are enabled by the E7 system. The E7 provides locally hosted Web GUI, CLI and SNMP interfaces

AXOS e7 2® Intelligent Modular System

Data Sheet

SPECIFICATIONS

Backplane Bandwidth

- 100 Gbps between slots

Slots

- 2 universal line card slots
- 1 Fan Tray slot

Dimensions (W x H x D)

- 17.5 x 1.7 x 11.45 inches
- 44.5 x 4.3 x 29.1 cm
- Height is 1 RU

Weight

- 5.9 lb (2.7 kg) E7 shelf
- 7.4 lb (3.4 kg) shelf with Fan Tray

Operating Environment

- Temperature: -40 to +65° C (-40° F to +149° F)
- Humidity: 10 to 95% (non-condensing)
- Operating altitude: 10,000 ft (3,049 m)

Storage Environment

- Temperature: -40 to +85° C (-40° F to +185° F)
- Humidity: 5 to 95%

Management Support

- Calix CMS network management
- Calix CLI and Web GUI for local management interface
- SNMP v2c and v3 performance and fault monitoring

Management Interfaces

- Ethernet 10/100 (RJ-45 connector on Calix E7-2 Fan Tray)
- Ethernet 10/100 (RJ-45 connector on back of Calix E7-2)
- RS-232 (RJ-11 connector on Calix E7-2 Fan Tray)

Synchronization

- Synchronization is enabled by the E7-2 line cards as required
- External reference timing
- Built-in Stratum-3 clock
- Hardware-ready to support Synchronous Ethernet

Alarm I/O Interfaces

- Wire wrap pin access on E7 back
- User definable alarm inputs: 7; outputs: 1

Fiber Interfaces

- All optical ports use pluggable optics (SFP, XFP, SFP+)
- LC or SC connectors on modules

Analog/Metallic Interfaces

- Two standard 25-pair RJ-21 connectors per slot

Timing I/O Interfaces

- Access through wire wrap pins on the back of the Calix E7
- BITS clock (sink and source)
- STANDARDS COMPLIANCE NEBS Level 3 compliance (GR-63-CORE, GR-1089-CORE, GR-3028)
- UL 60950
- FCC Part 15 Class A

Power Feeds

- Integrated power management on Calix E7-2 line cards
- Redundant –48/60 VDC battery feeds (A and B)
- Input Range: -42.5VDC to -72VDC
- Fuse: 7.5 Amps (A and B)

SPECIFICATIONS

Fan Tray Assembly (100-014551)

Fans:

- 4 fans housed in fan tray
- Resilient design maintains system cooling with one fan failure

Management Interfaces

- Ethernet 10/100 (RJ-45 connector)
- RS-232 (RJ-11 connector)

System Information

- 7-segment LCD display System Controller (MGT) – GREEN

Shelf Alarm Indicator

- Critical (CR) - RED
- Major (MJ) - RED
- Minor (MN) - AMBER
- Alarm Cut-Off (ACO) button

Power Specifications

- Min Input Power: 22 Watts @ -48V
- Max Input Power: 65 Watts @ -48V

Maintenance

- Field-replaceable air filter (not used in RT locations) Hot-swappable fan tray assembly

Fan Tray Assembly 2 (100-03590)

Fans:

- 4 fans housed in fan tray
- Resilient design maintains system cooling with one fan failure
- Variable speed operation depending on operating temperature*

Management Interfaces

- Ethernet 10/100 (RJ-45 connector)
- RS-232 (RJ-11 connector)

System Information

- 7-segment LCD display System Controller (MGT) – GREEN

Shelf Alarm Indicator

- Critical (CR) - RED
- Major (MJ) - RED
- Minor (MN) - AMBER
- Alarm Cut-Off (ACO) button

Power Specifications

- Min Input Power: 8.5 Watts @ -48V
- Max Input Power: 48 Watts @ -48V

Maintenance

- Field-replaceable air filter (not used in RT locations) Hot-swappable fan tray assembly

Notes: For GPON OIM, 10GE XFP, 10GE SFP+ pluggable transceivers, Direct Attach cables, and all transceivers used in CSFP Option 2 sockets, only products purchased directly from Calix are supported. The use of GPON OIM, Active Ethernet CSFPs, 10GE XFP, 10GE SFP+ pluggable transceivers and Direct Attach cables not purchased directly from Calix is not supported and will void all product warranties covering the Calix equipment to which such third-party materials are connected.

- SFP modules may also be used in CSFP Option 2 sockets, and in SFP+ sockets at 1GE rate.
- Copper Direct Attach cables can operate in SFP, CSFP Option 2, and SFP+ sockets at 1GE, 2.5GE, and 10GE data rates as supported by the card type.

ORDERING INFORMATION

Calix E7-2 Ethernet Service Access platform

000-00372 ..... E7-2 Chassis with Fan Tray Assembly and Installation Kit

100-01451 ..... E7-2 Fan Tray Assembly

000-00228 ..... E7-2 Fan Tray Assembly Filter, Package of 10 units

100-03590 ..... E7-2 Fan Tray Assembly 2 (FTA2)*

000-00760 ..... E7-2 Fan Tray Assembly 2 (FTA2) Filter, Package of 10 units

Note: *Variable speed operation under software control requires a minimum of E7 Release 2.2 software. In releases prior to 2.2, the FTA2 fan speeds are identical to the original FTA.

The Calix Pluggable Transceiver Modules

The E7-2 supports pluggable modules for all service and network interfaces. Refer to the Calix Optical Transceiver Modules Datasheet (#250-00191) for a complete list of modules and specifications.

CSFP Option 2 .....1GE optical dual-port Compact Small Form-factor Pluggable (CSFP) Option 2 modules

SFP .....1GE and 2.5GE optical and copper Small Form-factor Pluggable (SFP) modules

SFP+ .....10GE optical Enhanced Small Form-factor Pluggable (SFP+) modules

Direct Attach ..... Multi-rate copper Small Form-factor Pluggable (SFP/SFP+) cables

XFP .....10GE optical Small Form-factor Pluggable (XFP) modules

GPON OIM ..... 2.5Gbps GPON (Class B+ ODN with minimum 28dB link budget, up to 1:64 splits)

ER-GPON OIM ..... 2.5Gbps Extended Reach GPON (up to 58 km with 1:4 split)

Calix Mount Kit

100-03382..... E7-2 ETSI Rack Mount Kit

INTELLIGENT ACCESSEDGE

Data Sheet

AXOS e7 2®

E7-2 XGS-PON 16 Port Line Card (XG1601)

Calix

Service providers looking to ensure their networks are ready for the continued increase of bandwidth and services demands are looking to deploy 10G PON. The Calix E7-2 XG1601 line card makes this possible by supporting high-density XGS-PON across all deployment environments. Broadband service providers can deploy the line card utilizing XGS-PON optics into any E7-2 chassis providing up to 32 ports of XGS-PON per chassis. To assist with the transition from GPON, the XG1601 line card also supports standard GPON OIM optics as well as Multi-PON Module (GPON + XGS-PON) optics. The E7-2 is the industry's benchmark for a modular, small form factor, environmentally hardened access solution for broadband service providers (BSPs).

The AXOS E7-2 leads a rapidly expanding family of Intelligent Access EDGE systems capable of supporting both centralized and decentralized network architectures that range from the data center edge, central office, or headend, to the remote cabinet.

E7-2 XGS-PON 16 Port Line Card (XG1601)

Data Sheet

Key Attributes

AXOS: Utilizing AXOS, the only true SDA (Software Defined Access) architecture, the E7-2 XG1601 line card enables service providers to maintain an always on network.

PON optics: Service providers have the flexibility to choose the PON technology that meets their needs. The XG1601 supports dual-density XGS-PON, XGS-PON, GPON, or MPM modules (XGS + GPON) based on the optics inserted into the PON ports.

Flexible service delivery: Utilize layer 2 Open Access service delivery for residential/ business services based on your specific needs with carrier class network redundancy options.

THE AXOS PLATFORM

The E7-2 Intelligent Edge System is built on the Calix Intelligent Access EDGE platform, ensuring faster time to revenue, standards-based APIs, and northbound interfaces for simplified OSS/BSS/SDN Controller integration and an always-on network.

FUNCTIONAL DESCRIPTION

The Calix E7-2 AXOS XG1601 line card provides multi-service capability over IP/Ethernet-based networks. Each XG1601 provides eight SFP-DD PON OLT ports that can support dual density XGS-PON optics, providing a card capacity of sixteen XGS-PON optical distribution networks and up to 2,048 ONTs. Two 10GE/2.5GE/GE SFP+ ports provide additional aggregation or service line capacity (via optical links from central office locations, or via DAC cable connections to collocated E7-2 systems in RT locations). Two 100GE QSFP28 sockets per card can provide high-bandwidth connectivity uplinks.

DEPLOYMENT OPTIONS

As with all E7-2 line cards, the Calix E7-2 AXOS XG1601 can be deployed into any E7-2 chassis slot for both Central Office and remote cabinet installations supporting Layer 2 use cases. The E7-2 XG1601 line card interoperates with other AXOS-based line cards from the same location providing services providers the flexibility to meet the deployment requirements for subscribers. Each line card enables 100G uplinks allowing the Service Provider network to grow and scale to meet future networks requirements.

FLEXIBLE OPTICS SUPPORT

The Calix E7-2 AXOS XG1601 line card supports flexible optics types, allowing a service provider to select the PON technology supported on a port-by-port basis. To optimize the XG1601 line card for XGS-PON networks, Service Providers may deploy dual-density XGS-PON optics which provide up to sixteen XGS PONs per card (up to 32 XGS PONs per E7-2 chassis). To ease the transition from GPON to XGS-PON, the XG1601 card supports MPM (Multi PON Modules) optics, providing both XGS-PON and GPON output from a single optical fiber. Finally, the XG1601 also supports standard single-port XGS-PON and GPON SFP OIMs.

NETWORK RESILIENCY

All Calix E7-2 line cards support a flexible set of standards-based network topology protocols for use in aggregation, ring-based transport, and uplink.

- IEEE 802.3ad/802.1AX Link Aggregation
- ITU G.8032 Ethernet Ring Protection Switching (ERPS)
- ITU G.8032v2 Ethernet Ring Protection Switching (ERPS)
- ITU G.983.5 - Type B Protection and enhanced survivability for XGS-PON OLTs

SERVICES DELIVERY

The Calix E7-2 XG1601 line card delivers a full spectrum of IP access services over fiber networks.

- High-Speed Internet (HSI) access
- IPTV – broadcast and Video on Demand (VOD)
- MEF CE 2.0 compliant business services
- Voice – Native SIP/VoIP, H.248 and MGCP

SPECIFICATIONS

Ports

- 8 SFP-DD ports supporting XGS Dual Density/ XGS-PON/GPON/ MPM optical modules
- 2 SFP+ ports supporting 10GE/2.5GE/GE direct attach cable or optical connections
- 2 QSFP28 ports supporting 100GE/40GE optical modules

Wavelength Support

- XGS-PON: 1577nm down, 1270 nm up
- GPON: 1490nm down, 1310nm up

Split Ratio

- XGS-PON: 1:128
- GPON: 1:128

Quality and Service

- Service classification based on port, SVLAN-ID, CVLAN-ID, p-bit
- Strict priority and Weighted Round Robin (WRR) based scheduling
- Hierarchical QoS Congestion avoidance: Tail Drop

Standards and RFC Supports

- ITU-T G.9807.1 XGS-PON
- ITU-T G.984 GPON
- TR-101 VLAN Service models IEEE 802.1p CoS Prioritization
- IEEE 802.1 MAC Bridges IEEE
- 802.1Q VLAN tagging IEEE
- 802.1ad VLAN stacking (Q-in-Q)
- ITU-T G.8032 Ethernet Ring Protection Switching (ERPS)/ Enhanced EAPS
- ITU-T G.8032v2 Ethernet Ring Protection Switching (ERPS)
- RFC 2236 IGMP v2
- RFC 3376 IGMP v3
- RFC 3810 MLDv2
- RFC 3046 DHCP Relay Agent Information Option (“Option 82”)
- RFC 4541 IGMP Proxy RFC 4553 Structure Agnostic Time Division Multiplexing
- (TDM) over Packet (SAToP)
- Dynamic Bandwidth Allocation (DBA)
- Advanced Encryption Standard (AES)
- Forward Error Correction (FEC)

Frame Size

- XGS-PON: 9,216 byte frames
- GPON: 2,048 byte frames

Synchronization

- External reference timing
- Built-in Stratum-3 clock

Compliance

- NEBS Level 3 compliance (GR-63-CORE, GR-1089- CORE)
- UL 62368 FCC Part 15 Class A
- CE Mark

Power and Heat Dissipation

- XG1601 power consumption: 135 Watts max (with optics)

Operating Environment

- Temperature: -40° to +65° C (-40° F to +149° F)
- Humidity: 10 to 95% (non- condensing)

Storage Environment

- Temperature: −40° to +85° C (−40°F to +185°F)
- Humidity: 5 to 95%

Dimensions

- 14 x 10.1 x 0.78 inches
- 35.6 x 25.7 x 2 cm

Weight

- 2.08 lbs. (0.94 Kg) – (without optical modules)

Notes: Among other exclusions, the Calix Product Warranty shall not apply to any third party products used with Calix Products, nor shall the Product Warranty apply in the event that the Product's defect or nonconformance is due to its use with hardware which is not purchased directly from Calix, including any optical interfaces, optical transceivers and direct attach cables. For complete Product Warranty terms and exclusions, please refer to the Calix Purchase Agreement.

ORDERING INFORMATION

Calix E7-2 XGS-PON 16-Port Line Card

100-05770.....E7-2 XG1601 line card (16 ports XGS-PON)

The Calix Pluggable Transceiver Modules

The E7-2 supports pluggable modules for all service and network interfaces. Refer to the Calix Optical Transceiver Modules Datasheet (#250-00191) for a complete list of modules and specifications.

SFP.....1GE and 2.5GE optical and copper Small Form-factor Pluggable (SFP) modules

SFP+.....10GE optical Enhanced Small Form-factor Pluggable (SFP+) modules

Direct Attach.....Multi-rate copper Small Form-factor Pluggable (SFP/SFP+/QSFP28) cables

AXOS XGS-PON / GPON Modules

B+ OIM..... 2.5Gbps GPON (Class B+, 20km, C-Temp, AXOS) 2.5Gbps GPON (Class B+, 20km, I-Temp, AXOS) AXOS GPON

C+ OIM..... 2.5Gbps GPON (Class C+, 60Km, I-Temp, AXOS)

N1 OIM..... 10Gbps XGS-PON (Class N1, 20km, I-Temp, AXOS)

N2 OIM..... 10Gbps XGS-PON (Class N2, 40km, I-Temp, AXOS)

E1 OIM.....10Gbps XGS-PON (Class E1, 20km, I-Temp, AXOS)

N2/C+ OIM.....10Gbps XGS-PON/2.5Gbps GPON/ (Class N2/C+, 20km, I-Temp, AXOS)

N1-DD OIM..... 10Gbps Dual-Density XGS-PON (Class N1, 20km, I-Temp, AXOS)

N2-DD OIM..... 10Gbps Dual-Density XGS-PON (Class N2, 40km, I-Temp, AXOS)

E1-DD OIM..... 10Gbps Dual-Density XGS-PON (Class E1, 20km, C-Temp, AXOS)

CALIX SOURCED MODULES

High-speed optic module operational tolerances and performance vary significantly and can dramatically affect network operations. To maintain predictable performance and product reliability, Calix E-Series systems are supported with Calix GPON, XGS-PON, and NG-PON2 optical modules only (“Optical Modules”). Ethernet based SFP, CSFP, CDFP, XFP, SFP+, QSFP+, QSFP-DD, QSFP-28 pluggable transceivers (“Optical Transceivers”) and direct attach cables are available directly from Calix. Calix does not guarantee full compliance to product specifications for units using non-Calix modules and does not provide customer service support for optical network issues when non-Calix modules are used. Some third-party optics do not fully comply to the standard power and reach characteristics and in several cases have overheated and damaged the Calix equipment resulting in service outages. Calix Product Warranty shall not apply to any third-party products used with Calix Products, nor shall the Product Warranty apply in the event that the Product’s defect or nonconformance is due to its use with hardware which is not purchased directly from Calix, including any optical interfaces, optical transceivers and direct attach cables. For complete Product Warranty terms and exclusions, please refer to the Calix Purchase Agreement.

Note: Calix believes the information in this publication to be accurate as of publication date, and is not responsible for error. Product Specifications are subject to change without notice.

REVENUE EDGE

Data Sheet

GigaSpire® BLASTu4xg

Calix

The Calix GigaSpire BLAST u4xg (GS2128XG) is a new generation smart home system that integrates XGS ONT and residential gateway functionality into a single system. It supports XGS WAN, while providing the ultimate Wi-Fi experience. Besides supporting broadband connectivity of data and video services, this intelligent, high-performance system offers the latest 802.11ax 'Wi-Fi 6' technology. The GigaSpire BLAST u4xg provides switching and routing functions that support multi-Gigabit throughput for IPTV video and data services.

10-GIGABIT SUBSCRIBER EXPERIENCE

The GigaSpire BLAST u4xg is a premium smart home integrated system that delivers the latest Wi-Fi 6 certified technology (802.11ax). The GigaSpire BLAST u4xg integrates an XGS ONT to provide carrier-class WAN. On the LAN side, Wi-Fi and two (2) Gigabit Ethernet interfaces are available for customer multi-media devices.

The GigaSpire BLAST u4xg enables residential subscribers to receive 10 Gigabit broadband data, Internet Protocol (IP) video, and voice (POTS) services. Using the latest 802.11ax technology in both the 2.4 and 5 GHz radios, the GigaSpire BLAST u4xg incorporates 4x4 streams of Wi-Fi delivery (2x2 @ 2.4 GHz and 2x2 @ 5 GHz). In addition, with multi-user multiple-input and multiple-output (MU-MIMO) and beamforming, the GigaSpire BLAST u4xg allows service providers to extend the access network inside the home and establish a strategic location for the delivery and control of broadband services.

With Wi-Fi being the de facto wireless data communication technology of choice for consumers, Calix engineered the GigaSpire BLAST u4xg for optimal whole-home coverage with simultaneous dual-band 2.4 GHz and 5 GHz operation and dynamic beamforming in both spectrums. Leveraging the latest Wi-Fi 6 features, the GigaSpire BLAST u4xg provides longer range, higher efficiency, and less interference compared to earlier generations of Wi-Fi technology. The GigaSpire BLAST u4xg also supports the entire 5 GHz band, including Dynamic Frequency Selection (DFS) channels. The GigaSpire BLAST u4xg easily delivers HD and UHD (ultra-HD) video and data throughout a subscriber's home in an increasingly video-rich and mobile broadband environment.

Ensuring consumers can have ultra-fast Wi-Fi throughout their premises, the GigaSpire BLAST u4xg provides the latest generation of redundant Wi-Fi 6 mesh via the Calix GigaSpire BLAST u4m (GM1028 – please see the data sheet for more information). With the GigaSpire BLAST u4xg as the hub, and the GigaSpire BLAST u4m as the satellite extenders, consumers can truly gain the whole home/smart home experience.

VOICE SUPPORT: GigaSpire BLAST u4xg also provides a voice port supporting a comprehensive family of voice protocols such as SIP and H.248.

EASY TO INSTALL, ACTIVATE, AND MAINTAIN

With the GigaSpire BLAST u4xg integrated system, Calix has redefined how to install and activate residential services at a subscriber's premises. Using the Calix Command**IQ**® mobile app and a phone or laptop, a field technician can install and apply the subscriber's service profile without special equipment or assistance from the central office. Calix also provides the innovative Calix Support Cloud, which allows the service provider to configure, activate and upgrade the GigaSpire BLAST u4xg quickly from a remote location using in-band management and TR-069.

Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service activation features ensure that services are delivered and maintained without needless truck rolls and hardware upgrades. Deploying GigaSpire BLAST u4xg systems allows service providers to reduce their operational expenses while effectively delivering the Gigabit experience to their subscribers. XGS configuration and management is done via the OMCI protocol.

CALIX EXPERIENCE INNOVATION PLATFORM

All GigaSpire BLAST systems are powered by the Calix Innovation Experience Platform. This container-based platform allows service providers to quickly change and adapt their services to embrace new technologies and offer new, value-added services. This approach can generate recurring revenue and increase subscriber satisfaction.

KEY ATTRIBUTES

Home Gateway

- Layer 2 bridge and Layer 3 routing for High Speed Internet (HSI) data and IPTV video services
- DHCP server options
- DHCP (IPoE) and PPPoE network connections
- Network Access Translation (NAT), public to private IP addressing
- Configurable IP address schemes, subnets, static-IP addresses
- DNS server
- Bridge port assignment and data traffic mappings
- Port forwarding
- Firewall and security
- Application and website filtering
- Selectable forwarding and blocking policies
- DMZ hosting
- Parental controls, time of day usage
- Denial of service (DoS) protection
- MAC filtering
- Time/Zone support
- Universal Plug-and-Play (UPnP)

Wi-Fi

- 2.4 GHz and 5 GHz simultaneous dual-band
- 4x4 streams (2x2 @ 2.4 GHz, 2x2 @ 5 GHz)
- 2.4 GHz (Wi-Fi 6), 802.11ax
- compatible
- 5 GHz 802.11ax (Wi-Fi 6) certified, 802.11a/b/g/n/ac compatible
- WPA/WPA2/WPA3; WEP 64/128 bit encryption
- PuF (Physical Unclonable Functions)
- WPS push-button
- 2x2 DL/UL MU-MIMO, implicit/ explicit high-power, dynamic beamforming
- 1024 QAM; OFDMA; BSS Coloring
- DCM (Dual Carrier Modulation)
- TWT (Target Wake Time) for IoT clients

Wi-Fi Redundant Mesh

- Self Managed: self configuration, air time fairness
- Dynamic Mesh: load balancing, band/node steering; interference management
- Self Healing: backhaul failover; diagnostics; events

Interfaces

- XGS WAN interface: Optical SC/APC connector
- Gigabit Ethernet (GE) LAN interfaces: Two (2) ports of multi-rate 10/100/1000 BASE-T Ethernet, auto-negotiating for residential IPTV and data services
- One voice line: Carrier grade SIP and H.248 (aka Megaco)
- USB port: USB 2.0 - Type A host interface
- Supports multiple data service profiles

Traffic management and Quality of Service (QoS)

- 802.1Q VLANs
- 802.1p service prioritization
- Q-in-Q tagging
- Multiple VLANs
- DiffServ
- Pre-defined QoS on service type
- LAG of GE ports
- MAP-T

IPTV, IGMPv2, future support of IGMPv3

- IGMP Snooping and Proxy
- IGMP Fast Leaves

Gateway Management

- Calix Support Cloud
- TR-069
- Local Home Gateway GUI, access provisionable
- Remote WAN side GUI access
- Default username/password

AC to 12 V DC power adapter

SPECIFICATIONS

Dimensions

- Width: 8.3 inches (210 mm)
- Height: 3.3 inches (83 mm)
- Depth: 7.5 inches (191 mm)
- Weight: 1.6 pounds (0.73kg)

WAN Interface

- XGS SC/APC

Interfaces

- Wireless: 2x2 2.4 GHz, 2x2 5 GHz, internal antennas
- LAN Data/IPTV: Two 100/1000 BASE-T Ethernet port, RJ 45 connectors
- Power: 2-pin barrel connector
- WPS Switch: Push-button actuator
- Reset button for factory default

Data

- Drop length: 328 feet (100 m) maximum using CAT5 cable for GigE
- Auto MDI/MDIX crossover for 1000BASE-TX, 100BASE-TX
- Traffic Management and QoS: 802.11Q VLAN; 802.11p voice, video, data and management priorities; Q-in-Q tagging

Wireless

- 2.4 GHz 802.11 b/g/n/ac/ax
- 2x2 UL/DL MU-MIMO
- 5 GHz 802.11 a/n/ac/ax
- 2x2 UL/DL MU-MIMO, Explicit high-power, dynamic beamforming
- 2.4 GHz, 5 GHz simultaneous
- DCM, TWT, extended GI
- Auto channel selecting and interference detection
- WPS push button
- Wi-Fi multimedia (WMM)
- 802.11k,802.11v,802.11r
- Supports up to 200 wireless clients

Remote Management

- TR-069 remote management
- TR-098 Internet Gateway Device Data Model

Environmental

- Operating temperature: Indoor ambient temperature, 0°C to 40° C (32° F to 104° F)
- Operating and storage relative humidity: 10 to 90 % and 5 to 95% non-condensing respectively

Certification and Compliance

- Emissions: FCC Part 15 Class B, IC ICES-003 Class B, ISPR-22
- Safety: UL 62368 and UL 1697 approved
- IEEE: 802.3, 802.3AB, 802.3U, 802.11p, 802.11Q
- Wi-Fi Alliance Certified 802.11ax (Wi-Fi 6)

- USB-IF Compliance USB 2.0

Powering and Alarms

- 2-pin barrel connector
- Input voltage: 12 V DC (nominal), 10 V DC (min), 15 V DC (max)
- External Power Adapter: 12 V DC, 2.5A

Ookla-based Performance Testing

- Subscribers can run an Ookla-based performance test from within the Calix Command**IQ**® mobile app
- Symmetrical speed test results of 2.5 Gbps are possible with the GigaSpire BLAST u4xg system (owing to the integrated XGS-PON WAN)

ORDERING INFORMATION

Calix GigaSpire BLAST u4xg (GS2128XG)

100-05811..... GS2128XG GigaSpire BLAST u4xg , GPON, 2 GE LAN, 1 POTS, Dual Wi-Fi – AM Power Adapter

100-05842..... Spare Power Adapter for GigaSpire BLAST u4xg

Note: Calix believes the information in this publication to be accurate as of publication date, and is not responsible for error. Product Speci ications are subject to change without notice.

Calix

Data Sheet

GP1100X GigaPoint®

The Calix GP1100X GigaPoint® is an indoor, 10 Gbps XGS-PON small form-factor service delivery terminal that provides broadband connectivity to the subscriber. This high-performance terminal features one 2.5 Gigabit Ethernet (GE) interface delivering IPTV video and data services, and one voice line supporting carrier-grade VoIP (SIP). Connecting a Calix GigaSpire or GigaCenter to the LAN port of the GP1100X allows for the delivery of a sensational Wi-Fi experience to your subscribers. Decoupling the broadband demarcation from the premises system provides more flexibility and reduces costs. The GP1100X GigaPoint is designed for the industry-leading Calix E-Series fiber access XGS-PON optical line terminals (OLTs).

GP1100X GigaPoint®

Data Sheet

EASY TO INSTALL, ACTIVATE, AND MAINTAIN

With the GP1100X GigaPoint, Calix has redefined how to install and activate residential services at a subscriber's premises. Using the Calix Smart Activate feature and a phone or laptop, a field technician can install and apply the subscriber's service profile without special equipment or assistance from the central office. Calix also provides an innovative software portfolio, including management via SMx enabling the service provider to configure, activate and upgrade the GigaPoint using in-band management. Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service activation ensures that services are delivered and maintained without needless truck rolls and hardware upgrades. Employing the GP1100X GigaPoint allows service providers to reduce their operational expenses while effectively delivering the Gigabit experience to their subscribers.

KEY ATTRIBUTES

- Standards-based Full Service Access Network (FSAN), ITU-T XGS-PON compliant
- One 2.5 Gigabit Ethernet (GE) interface:
  - Symmetrical 2.5 Gbps bandwidth for residential IPTV and data services
  - Multi-rate 10/100/1000/2500 BASE-T Ethernet, auto-negotiating
- One voice line
  - Carrier grade MetaSwitch SIP
  - MGCP
  - H.248
- Supports multiple data service profiles
- Traffic management and Quality of Service (QoS):
  - 802.1Q VLANs
  - 802.1p service prioritization
  - Q-in-Q tagging
  - Multiple VLANs
  - Rate limiting
  - DiffServ
  - Pre-defined QoS on service type
- Connectivity Fault Monitoring (CFM):
  - Connectivity Check Message (CCM)
  - Loopback (LBM)
  - Line Trace (LTM)
- IPTV, IGMPv2, IGMPv3:
  - IGMP Snooping and Proxy
  - IGMP Fast Leaves
- Complete OAM&P support via Calix Management System (CMS)
- Calix Support Cloud (CSC)
- Indoor mounting options:
  - Wall mount with key holes
  - Desktop mount: horizontal
- AC to 12 V DC power adapter available for non-lifeline services
- Optional uninterruptible power supply (UPS) for voice lifeline service power

SPECIFICATIONS

Dimensions

- Length: 4.13 in (10.5 cm)
- Width: 4.13 in (10.5 cm)
- Height: 1.22 in (3.1cm)
- Weight: 7.23 oz (205 g)

PON Characteristics

- Max. split*: 128 XGS-PON
- Max. reach*: 20 km (12.4 miles)
- Maximum Optical Distribution (ODN) Attenuation: XGS, 29 dB
- Optical receiver 1577nm:
- -28dBm to 9dBm
- Optical transmitter 1270nm:
- +4 to +9 dBm

Interfaces

- Data/IPTV: One 10/100/1000/2500 BASE-T Ethernet port, RJ-45 connector
- Telephony: One RJ-11 connector
- PON: Single 9/125 µm (single mode) fiber, SC/APC connector, minimum 50 dB return loss
- Power: 2-pin connector, 8-pin connector

Telephony

- General: SIP
- Number of lines: 1
- RENs: 5 maximum
- Drop length: Maximum 500 feet (152.4 m)
- DS0 Output: 23.5 mA to 25 mA
- Ring Voltage: 55 V AC

Data

- Drop length: 328 feet (100 m) maximum, using CAT5 cable, 1000BASE-TX 262 feet (80 m) maximum, using CAT5e cable 2500BASE-TX, 262 feet (80 m) maximum, using CAT6 cable
- Auto MDI/MDIX crossover for 2500BASE-TX, 1000BASE-TX, 100BASE-TX, and 10BASE-T ports
- Traffic Management and QoS: 802.1Q VLAN; 802.1p Video, Data and Management Priorities; Q-in-Q tagging; Per-Port Rate Shaping; Rate Limiting
- MTU 2000 Bytes

Environmental

- Operating temperature: Indoor ambient temperature, 0° to 40°C (32° to 104°F)
- Operating/storage relative humidity: 5 to 95% non-condensing

Certification and Compliance

- Emissions:
  FCC Part 15 Class B
  IC ICES-003 Class B
  CISPR24 and CISPR35
- Safety:
  UL62368 and UL1697 approved
- IEEE: 802.3, 802.3AB, 802.3U, 802.1p, 802.1Q, 802.3bz (2500BASE-T)

Powering and Alarms

- 2-pin connector for use with AC/DC adapter
- 8-pin connector for use with UPS
- Input voltage: 12 V DC (nominal), 10.5 V DC (min), 14.4 V DC (max)
- External Power Adapter: 12 V DC, 1.5 A (Sold Separately)
- Typical Power: 7 W
- Maximum Power: 10 W
- Battery backup time rated capacity: 8 hours based on Telcordia GR-909 calculation methods using recommended UPS. Contact Calix for recommended UPS.

ORDERING INFORMATION

Calix GP1100X GigaPoint

100-05463 .....GP1100X GigaPoint, 2.5 GE, 1 POTS - AM Power Adapter

100-05625* ..... GP1100X GigaPoint, 1 2.5GE, 1 POTS - Universal Power Adapter

Note: *Available 21.1; Refer to PPG for supported regions.

The GP1100X ONT comes with a power adapter. If additional replacement power adapters are needed, please refer to the Calix Power Adapter section below to order item(s) separately.

Calix Power Adapter

100-05559 ..... Power Adapter CPA3 12V 1.5Amp - AM Type A

100-05626 ..... Power Adapter CPA3 12V 1.5Amp - Universal

Accessories

100-05537.....GigaPoint Wall Mount Fiber Mgmt. Bracket – Quantity 50

100-04068 ..... Indoor UPS, 12 V, 7.2 AH, 36 W, Black - AM Type B Grounded

100-03893 ..... Indoor UPS Power Cord, 7 pin UPS to 8 pin ONT Male, 1M Black

100-03894 ..... Indoor UPS Power Cord, 7 pin UPS to 8 pin ONT Male, 3M Black

100-03895 ..... Indoor UPS Power Cord, Un-terminated to 8 pin ONT Male, 6M Black

Note: Calix believes the information in this publication to be accurate as of publication date, and is not responsible for error. Product Specifications are subject to change without notice.

Calix

Data Sheet

GP1101X GigaPoint®

The Calix GP1101X GigaPoint® is an indoor, 10 Gbps XGS-PON small form factor service delivery terminal that provides broadband connectivity to the subscriber. This high-performance terminal features one 10 GigabitEthernet (GE) interface delivering IPTV video and data services, and voice line supporting carrier grade VoIPand network-based TDM voice circuits. Connecting a Calix GigaSpire or GigaCenter to the LAN port of the GP1101X allows for the delivery of a sensational Wi-Fi experience to your subscribers. Decoupling the broadbanddemarcation from the premises system provides more flexibility and reduces costs. The GP1101X GigaPoint is designed for the industry-leading Calix E-Series fiber access XGS-PON optical line terminals (OLTs).

EASY TO INSTALL, ACTIVATE, AND MAINTAIN

With the GP1101X GigaPoint, Calix has redefined how to install and activate residential services at a subscriber's premises. Using the Calix Smart Activate feature and a phone or laptop, a field technician can install and apply the subscriber's service profile without special equipment or assistance from the central office. Calix also provides an innovative software portfolio, including management via SMx enabling the service provider to configure, activate and upgrade the GigaPoint using in-band management. Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service activation ensures that services are delivered and maintained without needless truck rolls and hardware upgrades. Employing the GP1101X GigaPoint allows service providers to reduce their operational expenses while effectively delivering the Gigabit experience to their subscribers.

KEY ATTRIBUTES

Standards-based Full Service Access Network (FSAN), ITU-T XGS-PON compliant

One 10 Gigabit Ethernet (GE) interface

- Symmetrical bandwidth for residential IPTV and data services
- Multi-rate 1000/2500/10G BASE-T Ethernet, auto-negotiating

One voice line

- FXS ports, ANSI or ETSI
- Carrier grade SIP, H.248, MGCP VoIP
- TDM GR-303/TR-08 Mode II/ GR-57, GR-08 (TR-08 Mode I) voice services

Supports multiple data service profiles

Traffic management and Quality of Service (QoS)

- 802.1Q VLANs
- 802.1p service prioritization
- Q-in-Q tagging
- Multiple VLANs
- Rate limiting
- DiffServ

Pre-defined QoS on service type

IPTV, IGMPv2, IGMPv3

- IGMP Snooping and Proxy
- IGMP Fast Leaves

Complete OAM&P support via Calix Management System (CMS)

Indoor mounting options

- Wall mount with key holes
- Desktop mount: horizontal

AC to 12 V DC power adapter available for non-lifeline services

Optional uninterruptible power supply (UPS) for voice lifeline service power

SPECIFICATIONS

Dimensions

- Length: 5.3 in (135 mm)
- Width: 5.3 in (135 mm)
- Height: 1.30 in (33 mm)
- Weight: 14.6 oz (413 g)

PON Characteristics

- Max. split: 128 XGS-PON
- Max. reach*: 40 km (24.9 miles)
- Maximum Optical Distribution, (ODN) Attenuation: XGS, 29 dB
- Optical receiver 1577nm: -28dBm to 9dBm
- Optical transmitter 1270nm: +4to +9 dBm

Interfaces

- Data/IPTV: One 1000/2500/10G BASE-T Ethernet port, RJ-45 connector
- Telephony: One RJ-11 connector
- PON: Single 9/125 µm (single mode) fiber, SC/APC connector, minimum 50 dB return loss
- Power: 2-pin connector, 8-pin connector

Telephony

- General: SIP, H.248, MGCP
- Number of lines: 1
- RENs: 5 maximum
- Drop length: Maximum 500 feet (152.4 m)
- DS0 Output: 23.5 mA
- Ring Voltage: 55 V AC

Data

- Drop length: 328 feet (100 m) maximum, using CAT5 cable
- Auto MDI/MDIX crossover for 1000/2500/10G BASE-T ports
- Traffic Management and QoS: 802.1Q VLAN; 802.1p Video, Data and Management Priorities; Q-in-Q tagging; Per-Port Rate Shaping; Rate Limiting
- MTU 9600 Bytes

Environmental

- Operating temperature: Indoor ambient temperature, 0° to 40°C (32° to 104°F)
- Operating/storage relative humidity: 8 to 95% non-condensing

Certification and Compliance

- Emissions:
  - FCC Part 15 Class B
  - IC ICES-003 Class B
  - CISPR24 and CISPR35
- Safety:
  - UL62368 and UL1697 approved
  - IEEE: 802.3, 802.3AB, 802.3U,
  - 802.1p, 802.1Q, 802.3bz

Powering and Alarms

- 2-pin connector for use with AC/DC adapter
- 8-pin connector for use with UPS
- Input voltage: 12 V DC (nominal), 10.5 V DC (min), 14.4 V DC (max)
- External Power Adapter: 12 V DC, 1.5 A
- Typical Power: 12 W
- Battery backup time rated capacity: 8 hours based on Telcordia GR-909 calculation methods using recommended UPS. Contact Calix for recommended UPS.

Note: * 40 km reach supported via use of N2 OLT optics.

ORDERING INFORMATION

Calix GP1101X GigaPoint

100-05638 .....GP1101X GigaPoint, 1 10GE, 1 POTS - AM Power Adapter

100-05639 .....GP1101X GigaPoint, 1 10GE, 1 POTS - Universal Power Adapter

Accessories

100-05640.....GigaPoint (GP1101X) Wall Mount Fiber Management Bracket - Quantity 50

Note: Calix believes the information in this publication to be accurate as of publication date, and is not responsible for error. Product Specifications are subject to change without notice.

Calix

Data Sheet

-DRAFT-

GP4201X GigaPoint® (ONT)

NOTE: Product photo is for illustrative purposes only. Final photo representation will be published shortly.

Calix GP4201X optical network terminal is an indoor, 10 Gbps XGS-PON service delivery terminal that provides broadband connectivity to the subscriber. This high-performance terminal features one 10 Gigabit Ethernet (GE) interface and three 1 Gigabit Ethernet interfaces delivering IPTV video and data services. Two voice lines supporting carrier-grade VoIP are also available. Connecting a Calix GigaSpire or GigaCenter to the LAN port of the GP4201X allows for the delivery of a sensational Wi-Fi experience to your subscribers. Decoupling the broadband demarcation from the premises system provides more flexibility and reduces costs.

GP4201X GigaPoint® (ONT)

Data Sheet (Draft)

The GP4201X Optical Network Terminal (ONT) is designed for the industry-leading Calix E-Series platforms. The GP4201X ONT terminates an XGS-PON fiber link at the subscriber's location and provides industry-standard interfaces for the customer premises equipment. The ONTs enable subscribers to receive broadband data, IPTV, and VOIP on a single fiber. At the ONT, the optical signal is converted to the appropriate electrical signals for transmission over the residence's existing twisted pair and CAT5 cables.

The GP4201X ONT is easy to install, activate, and maintain. Innovative software management tools allow the broadband service provider to quickly configure, activate and upgrade ONTs from a remote location. Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service profile menus ensure that services are delivered and ONTs are maintained without the need to initiate unnecessary truck rolls and hardware upgrades.

Smart Activate simplifies installation and turn-up by using a laptop or phone to configure and activate the ONT at the premises location. The technician can install andturn up an ONT without assistance from the central office or use of special equipment.

KEY ATTRIBUTES

Standards-based Full Service Access Network (FSAN), ITU-T XGS-PON compliant

One 10 Gigabit Ethernet (GE) interface

- Symmetrical 10 Gbps bandwidth for residential IPTV and data services
- Multi-rate 100M/1G/2.5G/5G/10G BASE-T Ethernet, auto-negotiating

Three 1 Gigabit Ethernet (GE) interfaces

- Symmetrical 1 Gbps bandwidth for residential IPTV and data services
- Multi-rate 10/100/1000 BASE-T Ethernet, auto-negotiating

Two voice lines

- Carrier grade SIP, H.248,
- MGCP VoIP
- • TDM GR-303/TR-08 Mode II/
- GR-57, GR-08 (TR-08 Mode I)
- Voice services

Supports multiple data service profiles

Traffic management and Quality of Service (QoS)

- 802.1Q VLANs
- 802.1p service prioritization
- Q-in-Q tagging
- Multiple VLANs
- Rate limiting
- DiffServ
- Pre-defined QoS on service type

IPTV, IGMPv2, and IGMPv3

- IGMP Snooping and Proxy
- IGMP Fast Leaves

Complete Operations, Administration, Maintenance, and Provisioning (OAM&P) support via SMx

SPECIFICATIONS

Dimensions

- Length: 7.02 in (178.40 cm)
- Width: 5.05 in (128.20 cm)
- Height: 1.23 in (31.20 cm)

PON Characteristics

- Max. split: 128 XGS-PON
- Maximum Optical Distribution Network (ODN) Attenuation: XGS 29 dB
- Optical Receiver: 1577 nm: -28 dbM to -9 dBm
- Optical Transmitter: 1270 nm: +4 to +9 dBm

Interfaces

- Telephony: Two RJ-11 connectors
- Data/IPTV:

  One 100M/1G/2.5G/5G/10G Base-T Ethernet ports, RJ-45 connector

  3 10/100/1000 Base-T Ethernet ports, RJ-45 connectors
- PON: Single 9/125 µm (single mode) fiber, SC/APC connector, minimum 50 dB return loss
- Power: 2-pin connector, 8-pin connector

Telephony

- General: SIP, H.248, MGCP
- Number of lines: 2
- RENs per line: 5 maximum
- Drop length: Maximum 500 feet (305m)
- DSO Output: 23.5 to 25 mA
- Ring Voltage: 55 VAC

Environmental

- Operating temperature: Indoor ambient temperature 32°F to 104°F (0°C to 40°C)
- Operating/storage relative humidity: 8 to 95 % non-condensing

Data

- Drop length: 328 feet (100 m) maximum using CAT5e cable for 1G and CAT6a or better for 10G
- Auto MDI/MDIX crossover for 1000/2500/10G BASE-TX ports
- Traffic Management and QoS:

  802.1Q VLAN; 802.1p Video,

  Data and Management Priorities; Q-in-Q tagging; Per Port Rate Shaping; Rate Limiting
- MTU 9600 Bytes

Certification and Compliance

- Emissions:
  - FCC Part 15 Class B
  - IC ICES-003 Class B
  - CISPR24 and CISPR35
- Safety:
  - UL 62368
  - UL 1697approved
  - CE Mark
- IEEE: 802.3, 802.3AB, 802.3U, 802.1p, 802.1Q, 802.3bz (2500BASE-T)

Powering and Alarms

- 2-pin connector for use with AC/DC adapter
- 8-pin connector for use with UPS
- Input voltage: 12 V DC (nominal), 10.5V DC (min), 14.4V DC (max)
- Battery backup time rated capacity: 8 hours based on Telcordia GR-909 calculation methods using recommended UPS. Contact Calix for recommended UPS.

ORDERING INFORMATION

Calix GP4201X GigaPoint Optical Network Terminal

100-05880 .....GP4201X GigaPoint, 2 POTS, 1 10GE, 3 GE - AM Power Adapter

100-05881 .....GP4201X GigaPoint, 2 POTS, 1 10GE, 3 GE - Universal Power Adapter

Note: Calix believes the information in this publication to be accurate as of publication date, and is not responsible for error. Product Specifications are subject to change without notice.

REVENUE EDGE

Data Sheet

GigaSpire® BLAST u6xw

Calix

The Calix GigaSpire® u6xw (GS4227W) is a new generation smart home system that integrates optical network termination (ONT) and residential gateway functionality into a single system*. It supports virtually any passive optical network (PON) and Ethernet technology, while providing the ultimate Wi-Fi experience. Besides supporting broadband connectivity of data and video services, this intelligent, high-performance system offers the latest 802.11ax 'Wi-Fi 6' technology. The GigaSpire BLAST u6xw provides switching and routing functions that support multi-Gigabit throughput for IPTV video and data services.

MULTI-GIGABIT SUBSCRIBER EXPERIENCE

The GigaSpire BLAST u6xw is a premium smart home integrated system that delivers the latest Wi-Fi 6 certified technology (802.11ax). The GigaSpire BLAST u6xw uses an SFP+ cage supporting a 10 Gigabit link* at the subscriber's premises to provide carrier-class WAN, including GPON and XGS PON, as well as 1 and 10 Gigabit Ethernet (both copper and Active Ethernet) options. On the LAN side, Wi-Fi and four (4) Gigabit Ethernet interfaces are available for customer multi-media devices.

The GigaSpire BLAST u6xw enables residential subscribers to receive Gigabit broadband data, Internet Protocol (IP) video, and voice (POTS) services. Using the latest 802.11ax technology in both the 2.4 and 5 GHz radios, the GigaSpire BLAST u6xw incorporates 6x6 streams of Wi-Fi delivery (2x2 @ 2.4 GHz and 4x4 @ 5 GHz). In addition, with multi-user multiple-input and multiple-output (MU-MIMO) and beamforming, the GigaSpire BLAST u6xw allows service providers to extend the access network inside the home and establish a strategic location for the delivery and control of broadband services. With Wi-Fi being the de facto wireless data communication technology of choice for consumers, Calix engineered the GigaSpire BLAST u6xw for optimal whole-home coverage with simultaneous dual-band 2.4 GHz and 5 GHz operation and dynamic beamforming in both spectrums.

Leveraging the latest Wi-Fi 6 features, the GigaSpire BLAST u6xw provides longer range, higher efficiency, and less interference compared to earlier generations of Wi-Fi technology. The GigaSpire BLAST u6xw also supports the entire 5 GHz band, including Dynamic Frequency Selection (DFS) channels and can be provisioned to support 160 MHz channel bandwidth at 5 GHz. The GigaSpire BLAST u6xw easily delivers HD and UHD (ultra-HD) video and data throughout a subscriber's home in an increasingly video-rich and mobile broadband environment. Ensuring consumers can have ultra-fast Wi-Fi throughout their premises, the GigaSpire BLAST u6xw provides the latest generation of redundant Wi-Fi 6 mesh via the Calix GigaSpire Mesh GigaSpire BLAST u4m (please see the GM1028 data sheet for more information). With the GigaSpire BLAST u6xw as the hub, and the Mesh GigaSpire BLAST u4m as the satellite extenders, consumers can truly gain the whole home/smart home experience. For even higher mesh performance, an additional GigaSpire BLAST u6 system, such as the GigaSpire BLAST u6.1, can also be deployed as a mesh unit. This means that two GigaSpire BLAST u6 systems can connect to each other with one being the residential gateway and the other being the mesh.

EASY TO INSTALL, ACTIVATE, AND MAINTAIN

With the GigaSpire BLAST u6xw integrated system, Calix has redefined how to install and activate residential services at a subscriber's premises. Using Command**IQ**® and a phone or laptop, a field technician can install and apply the subscriber's service profile without special equipment or assistance from the central office. Calix also provides the innovative Calix Support Cloud (CSC), which allows the service provider to configure, activate and upgrade the GigaSpire BLAST u6xw quickly from a remote location using in-band management, TR-069, or ONT Management Control Interface (OMCI).

Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service activation features ensure that services are delivered and maintained without needless truck rolls and hardware upgrades. Deploying GigaSpire BLAST u6xw systems allows service providers to reduce their operational expenses while

Note: XGS PON technology, although referred to as "10 Gig PON" is limited to a maximum symmetrical throughput of approximately 8.5 Gbps, owing to various overhead limitations and network conditions.

effectively delivering the Gigabit experience to their subscribers. If a PON module is being used, PON configuration and management is done via the OMCI protocol.

CALIX EXPERIENCE INNOVATION PLATFORM

All GigaSpire BLAST systems are powered by the Calix Innovation Experience Platform.

This container-based platform allows service providers to quickly change and adapt their services to embrace new technologies and offer new, value-added services. This approach can generate recurring revenue and increase subscriber satisfaction.

KEY ATTRIBUTES

Home Gateaway:

- Layer 2 bridge and Layer 3 routing for High Speed Internet (HSI) data and IPTV video services
- DHCP server options
- DHCP (IPoE) and PPPoE network connections
- Network Access Translation (NAT), public to private IP addressing
- Configurable IP address schemes, subnets, static-IP addresses
- DNS server
- Bridge port assignment and data traffic mappings
- Port forwarding
- Firewall and security
- Application and website filtering
- Selectable forwarding and blocking policies
- DMZ hosting
- Parental controls, time of day usage
- Denial of service (DoS) protection
- MAC filtering
- Time/Zone support
- Universal Plug-and-Play (UPnP)

Wi-Fi:

- 2.4 GHz and 5 GHz, simultaneous dual-band
- 5 GHz 802.11ax (Wi-Fi 6) certified, 802.11a/n/ac compatible
- 6x6 streams (2x2 @ 2.4 GHz and 4x4 @ 5 GHz)
- 2.4 GHz 802.11ax (Wi-Fi 6) certified, 802.11b/g/ac compatible
- WPA/WPA2/WPA3; WEP 64/128 bit encryption
- PuF (Physical Unclonable Functions)
- WPS push-button
- 4x4 DL/UL MU-MIMO with beamforming
- 1024 QAM; OFDMA; BSS Coloring
- DCM (Dual Carrier Modulation)
- TWT (Target Wake Time) for IoT clients

Wi-Fi Redundant Mesh:

- Self Managed: self configuration, Air time fairness
- Dynamic Mesh: load balancing, band/node steering; interference management
- Self Healing: backhaul failover; diagnostics; events

SFP+ interface:

- Full 10 Gigabit bandwidth
- Supporting several SFP WAN modules, including: GPON, 10 Gigabit Ethernet (copper), 1G and 10G Active Ethernet, and XGS PON

Gigabit Ethernet (GE) LAN interfaces:

- Four (4) ports of multi-rate 10/100/1000 BASE-T Ethernet, auto-negotiating for residential IPTV and data services

Two voice lines:

- Carrier grade SIP, H.248 (aka Megaco) and MGCP[1]

USB port:

- USB 2.0 - Type A host interface

Supports multiple data service profiles

Traffic management and Quality of Service (QoS):

- 802.1Q VLANs
- 802.1p service prioritization
- Q-in-Q tagging
- Multiple VLANs
- DiffServ
- Pre-defined QoS on service type
- MAP-T

IPTV, IGMPv2, future support of IGMPv3:

- IGMP Snooping and Proxy
- IGMP Fast Leaves

Gateway Management:

- CSC (Calix Support Cloud)
- TR-069
- Local Home Gateway GUI, access provisionable
- Remote WAN side GUI access
- Default username/password

AC to 12 V DV power adapter

Optional UPS power unit available

[1] Currently supporting MetaSwitch and Ribbon softswitches

SPECIFICATIONS

Dimensions

- Width: 5.13 in (13 cm)
- Height: 10.13 in (25.73 cm)
- Depth: 5.13 in (13 cm)
- Weight: 42 oz (1.19 kg)

WAN Interface

- Interface: SFP+ cage (with options for GPON, 1 GBT, 10 GBT, XGS, and both 1G and 10G Active Ethernet)

Interfaces

- Wireless: 2.4 GHz 2x2 and 5 GHz 4x4 internal antennas
- LAN Data/IPTV: Four (4) 10/100/1000 BASE-T Ethernet port, RJ 45 connectors
- WAN: SFP+ cage
- USB: USB 2.0 Type A
- Voice: Two ports supporting Metaswitch; C15; C20 SIP; H.248 and MGCP
- Power: Single pin and 8-pin

Data

- Drop length: 328 feet (100 m) max using CAT5 cable for GigE
- Auto MDI/MDIX crossover for 1000BASE-TX, 100BASE-TX
- 10GBT: 110 feet (30m) CAT6e/7 cable
- Traffic Management and QoS: 802.11Q VLAN; 802.11p voice, video, data and management priorities; Q-in-Q tagging

Wireless

- 2.4 GHz 802.11 b/g/n/ac/ax
- 2x2 UL/DL MU-MIMO
- 5 GHz 802.11 a/n/ac/ax
- 4x4 DL/UL MU-MIMO, implicit/ explicit high-power, dynamic beamforming (5 GHz radio)
- 2x2 DL/UL MU-MIMO explicit high-power, dynamic beamforming (2.4 GHz radio)
- 2.4 GHz and 5 GHz simultaneous
- DCM, TWT, extended GI
- Auto channel selecting and interference detection
- WPS, WPS push button
- Wi-Fi multimedia (WMM)

Remote Management

- TR-069 remote management
- TR-098 Internet Gateway Device Data Model

Environmental

- Operating temperature: Indoor ambient temperature, 0° to 40°C (32° to 104° F)
- Operating and storage relative humidity: 10 to 90 % and 5 to 95% non-condensing respectively

Certification and Compliance

- Emissions: FCC Part 15 Class B IC ICES-003 Class B CISPR-22
- Safety: UL 62368 and UL 1697 approved
- IEEE: 802.3, 802.3AB, 802.3U, 802.11p, 802.11Q
- Wi-Fi Alliance Certified 802.11ax

- USB-IF Compliance USB 2.0

Powering and Alarms

- Single pin and 8-pin
- Input voltage: 12 V DC (nominal)
- External Power Adapter: 12 V DC, 3A
- Optional UPS power unit available

Ookla-based Performance Testing

- Subscribers can run an Ookla-based performance test from within the Calix Command**IQ**® mobile app
- Symmetrical speed test results in excess of 3 Gbps are possible with the GigaSpire BLAST u6xw system when using a 10 GigE (copper), 10 GigE (Active Ethernet) or XGS SFP module.

ORDERING INFORMATION

Calix GS4227W GigaSpire BLAST u6xw

100-05613..... GS4227W GigaSpire BLAST u6xw, SFP+, 4 GE LAN, 2 POTS, Dual Wi-Fi – AM Power Adapter

Calix GS4227W GigaSpire BLAST u6xw Bundles

000-01205..... GS4227W GigaSpire BLAST u6xw, SFP+, 4 GE LAN, 2 POTS, Dual Wi-Fi – AM Power Adapter (with GPON SFP module)

000-01204..... GS4227W GigaSpire BLAST u6xw, SFP+, 4 GE LAN, 2 POTS, Dual Wi-Fi – AM Power Adapter (with XGS SFP module)

000-01210..... GS4227W GigaSpire BLAST u6xw, SFP+, 4 GE LAN, 2 POTS, Dual Wi-Fi – AM Power Adapter (with GE Active Ethernet SFP module)

Calix GS4227W GigaSpire BLAST u6x/u6xw SFP Modules

100-05609..... GPON ONT SFP module

100-05656..... 1GE SFP, UTP Copper, RJ-45, 100m, I-Temp

100-05622..... 10GE SFP+, UTP Copper, RJ-45, 100m, I-Temp

100-05610..... XGS ONT SFP+ module

100-05620..... 1 Gigabit Active Ethernet, 20 km, SFP module

100-05654..... 1 Gigabit Active Ethernet, 60 km, SFP module

100-05721..... 10 Gigabit Active Ethernet, 20 km, SFP+ module

Calix GS4227W GigaSpire BLAST u6xw Power Adapter

100-05793..... GigaSpire BLAST u6xw (GS4227W) Power Adapter, 12 V, 3 A – AM Type A

Optional Mounting Bracket

100-05751..... GS4227W Mounting Bracket — Quantity 14

Optional Uninterruptible Power Supply (UPS)

100-04068..... Indoor UPS (8 hour support), Wall Mount or Desktop, 12 V, 7.2 AH, 36 W, Black – AM, Type B, Grounded

100-05345..... Indoor UPS (24 hour support), Wall Mount or Desktop, 12 V, 20 AH, 75 W, Audible Alarm, Regulated Output R3 Production

ORDERING INFORMATION

UPS Power Adapters

100-03893..... Indoor UPS Power cord, 7-pin UPS to 8-pin ONT Male, 1m, black

100-03894..... Indoor UPS Power cord, 7-pin UPS to 8-pin ONT Male, 3m, black

100-03895..... Indoor UPS Power cord, Unterminated to 8-pin ONT Male, 6m, black

Removeable Branding Plate

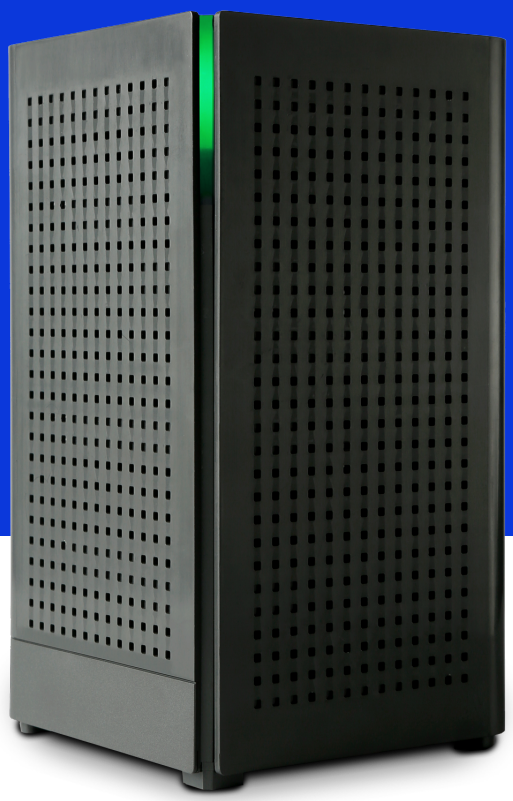
100-05763..... Blank, removable branding plate. Contact your sales representative to order branding plates that can be customized with your company logo

Note: Calix believes the information in this publication to be accurate as of publication date, and is not responsible for error. Product Specifications are subject to change without notice.

REVENUE EDGE

Data Sheet

GigaSpire® BLAST u6.1



Calix

The Calix GigaSpire® BLAST® u6.1 (GS4220E) is a new generation smart home system that extends the access network into the home and acts as a strategic location for control of the ultimate Wi-Fi experience. Besides supporting broadband connectivity of data and video services, this intelligent, high-performance system offers the latest 802.11ax 'Wi-Fi 6' technology. The GigaSpire BLAST u6.1 provides switching and routing functions that support multi-Gigabit throughput for IPTV video and data services.

MULTI-GIGABIT SUBSCRIBER EXPERIENCE

The GigaSpire BLAST u6.1 is a premium smart home system that delivers the latest 'Wi-Fi 6' certified technology (802.11ax). The GigaSpire BLAST u6.1 uses a 1 Gigabit Ethernet link at the subscriber's premises to provide carrier-class Wi-Fi and four (4) Gigabit Ethernet interfaces for customer multi-media devices. The GigaSpire BLAST u6.1 enables residential subscribers to receive Gigabit broadband data, Internet Protocol (IP) video, and voice

(POTS) services. Using the latest 802.11ax technology in both the 2.4 and 5 GHz radios, the GigaSpire BLAST u6.1 incorporates 6x6 streams of Wi-Fi delivery (2x2 @ 2.4 GHz and 4x4 @ 5 GHz). In addition, with multi-user multiple-input and multiple-output (MU-MIMO) and beamforming, the GigaSpire BLAST u6.1 allows service providers to extend the access network inside the home and establish a strategic location for the delivery and control of broadband services.

With Wi-Fi being the de facto wireless data communication technology of choice for consumers, Calix engineered the GigaSpire BLAST u6.1 for optimal whole-home coverage with simultaneous dual-band 2.4 GHz and 5 GHz operation and dynamic beamforming at 5 GHz. Leveraging the latest Wi-Fi 6 features, the GigaSpire BLAST u6.1 provides longer range, higher efficiency and less interference compared to earlier generations of Wi-Fi technology. The GigaSpire BLAST u6.1 also supports the entire 5 GHz band, including Dynamic Frequency Selection (DFS) channels and can be provisioned to support 160 MHz channel bandwidth at 5 GHz. The GigaSpire BLAST u6.1 easily delivers HD and UHD (ultra-HD) video and data throughout a subscriber's home in an increasingly video-rich and mobile broadband environment.

Ensuring consumers can have ultra-fast Wi-Fi throughout their premises, the GigaSpire BLAST u6.1 provides the latest generation of redundant mesh via the Calix Mesh

BLAST u4m (GM1028) (please see the GM1028 data sheet for more information). With the GigaSpire BLAST u6.1 as the hub, and the BLAST u4m as the satellite extenders, consumers can truly gain the whole home/smart home experience. For even higher mesh performance, GigaSpire BLAST u6.1 can also be a mesh unit. This means that two GigaSpire BLAST u6.1 systems can connect to each other with one being the residential gateway and the other being the satellite.

EASY TO INSTALL, ACTIVATE, AND MAINTAIN

With the GigaSpire BLAST u6.1, Calix has redefined how to install and activate residential services at a subscriber's premises. Using the Command**IQ**® mobile app and a phone

or laptop, a field technician can install and apply the subscriber's service profile without special equipment or assistance from the central office. Calix also provides the innovative Calix Support Cloud (CSC), which allows the service provider to configure, activate

and upgrade the GigaSpire BLAST u6.1 quickly from a remote location using in-band management or TR-069. Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service activation features ensure that services are delivered and maintained without needless truck rolls and hardware upgrades. Employing GigaSpire BLAST u6.1 systems allows service providers to reduce their operational expenses while effectively delivering the Gigabit experience to their subscribers.

CALIX EXPERIENCE INNOVATION PLATFORM

All GigaSpire BLAST systems are powered by the Calix Innovation Experience Platform.

This container-based platform allows service providers to quickly change and adapt their services to embrace new technologies and offer new, value-added services. This approach can generate recurring revenue and increase subscriber satisfaction.

KEY ATTRIBUTES

Home Gateaway:

- Layer 2 bridge and Layer 3 routing for High Speed Internet (HSI) data and IPTV video services
- DHCP server options
- DHCP (IPoE) and PPPoE network connections
- Network Access Translation (NAT), public to private IP addressing
- Configurable IP address schemes, subnets, static-IP addresses
- DNS server
- Bridge port assignment and data traffic mappings
- Port forwarding
- Firewall and security
- Application and website filtering
- Selectable forwarding and blocking policies
- DMZ hosting
- Parental controls, time of day usage
- Denial of service (DoS) protection
- MAC filtering
- Time/Zone support
- Universal Plug-and-Play (UPnP)

Wi-Fi:

- 2.4 GHz and 5 GHz, simultaneous dual-band
- 5 GHz 802.11ax (Wi-Fi 6) certified, 802.11a/n/ac compatible
- 6x6 streams (2x2 @ 2.4 GHz and 4x4 @ 5 GHz)
- 2.4 GHz 802.11ax (Wi-Fi 6) certified, 802.11b/g/ac compatible
- WPA/WPA2/WPA3; WEP 64/128 bit encryption
- PuF (Physical Unclonable Functions)
- WPS push-button
- 4x4 DL/UL MU-MIMO with beamforming (5 GHz radio)
- 2x2 DL/UL MU-MIMO with beamforming (2.4 GHz radio)
- 1024 QAM; OFDMA; BSS Coloring
- DCM (Dual Carrier Modulation)
- TWT (Target Wake Time) for IoT clients

Wi-Fi Redundant Mesh:

- Self Managed: self configuration, Air time fairness
- Dynamic Mesh: load balancing, band/node steering; interference management
- Self Healing: backhaul failover; diagnostics; events

1 Gigabit Ethernet (GE) WAN interface:

- Multi-rate 100/1000 BASE-T Ethernet, auto-negotiating

Gigabit Ethernet (GE) LAN interfaces:

- Four (4) ports of multi-rate 10/100/1000 BASE-T Ethernet, auto-negotiating for residential IPTV and data services

Two voice lines:

- Carrier grade SIP, H.248 (aka Megaco) and MGCP[1]

USB port:

- USB 2.0 - Type A host interface

Supports multiple data service profiles

Traffic management and Quality of Service (QoS):

- 802.1Q VLANs
- 802.1p service prioritization
- Q-in-Q tagging
- Multiple VLANs
- DiffServ
- Pre-defined QoS on service type
- LAG of GE ports
- MAP-T

IPTV, IGMPv2, future support of IGMPv3:

- IGMP Snooping and Proxy
- IGMP Fast Leaves

Gateway Management:

- CSC (Calix Support Cloud)
- TR-069
- Local Home Gateway GUI, access provisionable
- Remote WAN side GUI access
- Default username/password

AC to 12 V DV power adapter

[1] Currently supporting MetaSwitch and Ribbon softswitches

SPECIFICATIONS

Dimensions

- Width: 4.75 in (12.1 cm)
- Height: 8.5 in (21.6 cm)
- Depth: 4.75 in (12.1 cm)
- Weight: 36 oz (1.02 kg)

WAN Interface

- Interface: One 2.5 Gigabit-Ethernet Port, RJ-45 connector

Interfaces

- Wireless: 2.4 GHz 2x2 and 5 GHz 4x4 internal antennas
- LAN Data/IPTV: Four (4) 10/100/1000 BASE-T Ethernet port, RJ 45 connectors
- WAN: One (1) 10/100/1000
- USB: USB 2.0 Type A
- Voice: Two ports supporting carrier grade SIP, H.248 (aka Megaco) and MGCP
- Power: Single pin and 8-pin

Data

- Drop length: 328 feet (100 m) max using CAT5 cable for GigE
- Auto MDI/MDIX crossover for 1000BASE-TX, 100BASE-TX
- Traffic Management and QoS: 802.11Q VLAN; 802.11p voice, video, data and management priorities; Q-in-Q tagging

Wireless

- 2.4 GHz 802.11 b/g/n/ac/ax
- 5 GHz 802.11 a/n/ac/ax
- 4x4 DL/UL MU-MIMO, implicit/explicit high-power, dynamic beamforming (5 GHz radio)
- 2x2 DL/UL MU-MIMO implicit/explicit high-power, dynamic beamforming (2.4 GHz radio)
- 2.4 GHz and 5 GHz simultaneous
- DCM, TWT, extended GI
- Auto channel selecting and interference detection
- WPS, WPS push button
- Wi-Fi multimedia (WMM)
- Supports up to 250 wireless clients

Remote Management

- TR-069 remote management
- TR-098 Internet Gateway Device Data Model

Environmental

- Operating temperature: Indoor ambient temperature, 0° to 40°C (32° to 104° F)
- Operating and storage relative humidity: 10 to 90 % and 5 to 95% non-condensing respectively

Certification and Compliance

- Emissions: FCC Part 15 Class B IC ICES-003 Class B CISPR-22
- Safety: UL 60950 and UL 1697 approved
- IEEE: 802.3, 802.3AB, 802.3U, 802.11p, 802.11Q
- Wi-Fi Alliance Certified 802.11ax

- USB-IF Compliance USB 2.0

Powering and Alarms

- Single pin and 8-pin
- Input voltage: 12 V DC (nominal)
- External Power Adapter: 12 V DC, 3A

Ookla-based Performance Testing

- Subscribers can run an Ookla-based performance test from within the Calix Command**IQ**® mobile app
- Symmetrical speed test results in excess of 2 Gbps are possible with the GigaSpire BLAST u6.1 system (owing to the 1 GigE WAN port)

ORDERING INFORMATION

Calix GS4220E GigaSpire BLAST u6.1

100-05413..... GS4220E GigaSpire BLAST u6.1, 1 GE WAN, 4 GE LAN, 2 POTS, Dual Wi-Fi – AM Power Adapter

Calix GS4220E GigaSpire BLAST u6.1 Power Adapter

100-05484..... GigaSpire BLAST u6.1/u6.2 (GS4220E/GS4227E) Power Adapter, 12 V, 3 A – AM Type A

Optional Mounting Bracket

100-05467..... GS4227E/GS4220E Mounting Bracket — Quantity 10

Optional Uninterruptible Power Supply (UPS)

100-04068..... Indoor UPS (8 hour support), Wall Mount or Desktop, 12 V, 7.2 AH, 36 W, Black - AM, Type B, Grounded

100-05345..... Indoor UPS (24 hour support), Wall Mount or Desktop, 12 V, 20AH, 75W, Audible Alarm, Regulated Output R3 Production

UPS Power Adapters

100-03893..... Indoor UPS Power cord, 7-pin UPS to 8-pin ONT Male, 1m, black

100-03894..... Indoor UPS Power cord, 7-pin UPS to 8-pin ONT Male, 3m, black

100-03895..... Indoor UPS Power cord, Unterminated to 8-pin ONT Male, 6m, black

Removeable Branding Plate

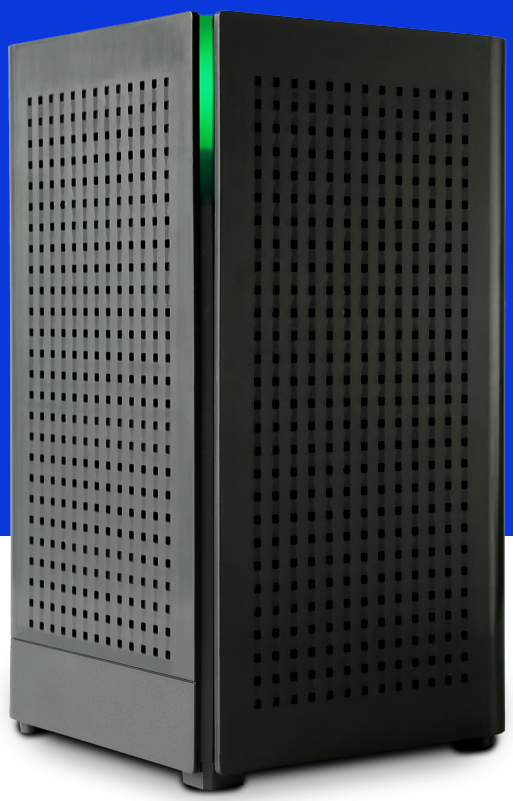
100-05522..... Blank, removable branding plate. Contact your sales representative to order branding plates that can be customized with your company logo

Note: Calix believes the information in this publication to be accurate as of publication date, and is not responsible for error. Product Specifications are subject to change without notice.

REVENUE EDGE

Data Sheet

GigaSpire® BLAST u6.2



Calix

The Calix GigaSpire® BLAST® u6.2 (GS4227E) is a new generation smart home system that extends the access network into the home and acts as a strategic location for control of the ultimate Wi-Fi experience. Besides supporting broadband connectivity of data and video services, this intelligent, high-performance system offers the latest 802.11ax 'Wi-Fi 6' technology. The GigaSpire BLAST u6.2 provides switching and routing functions that support multi-Gigabit throughput for IPTV video and data services.

REVENUE EDGE

Data Sheet

GigaSpire® BLAST u4m

Calix

The GigaSpire® Mesh BLAST® u4m is the new generation Wi-Fi 6 mesh satellite that complements the Calix GigaSpire family of products. With the broad portfolio of GigaSpire smart home systems, the GigaSpire Mesh BLAST u4m extends Wi-Fi coverage and capacity within the subscriber's home. The GigaSpire Mesh BLAST u4m backhaul allows communications service providers (CSPs) to deploy satellites with either a wired or wireless connection to the GigaSpire. When connected wirelessly, the 5 GHz 802.11ax 2x2 radio acts as an access point (AP) to the end subscribers' wirelessly connected devices. The GigaSpire Mesh BLAST u4m enables subscriber self installs and results in fewer costly truck rolls.

MULTI-GIGABIT SUBSCRIBER EXPERIENCE

The GigaSpire Mesh BLAST u4m is a high performance wireless satellite that delivers the latest 802.11ax Wi-Fi technology in a consumer friendly form factor. Subscribers want their Wi-Fi to work with any device in any location throughout their home. Over time, the numbers, types and locations of these devices has exploded. In response to the rapid adoption of Wi-Fi IoT devices – like door locks, IP cameras and thermostats – CSPs must now provide ubiquitous Wi-Fi coverage. In addition, the demand for video content continues to grow and subscribers expect to watch anywhere on any device.

The Calix GigaSpire Mesh BLAST u4m enhances coverage and capacity with the latest 802.11ax Wi-Fi radios, transmitting at the maximum allowable regulatory limits. For homes that need additional coverage and capacity, the Calix Mesh-Enhanced Carrier Class Wi-Fi solution has three components: GigaSpire, GigaSpire Mesh BLAST u4m (GM1028) satellites, and the Calix Cloud. The GigaSpire Mesh BLAST u4m satellites are optimized for interoperability with GigaSpire's 5 GHz 802.11ax radio., thus allowing for the delivery of throughput rates of over 1.2 Gbps. Along with the 2x2 2.4 GHz radio, the GigaSpire Mesh BLAST u4m provides over 1.8 Gbps of total service bandwidth.

In addition to support for high-speed Internet (HSI) services, CSPs need solutions that allow them to support a full complement of additional services, including IPTV and guest Wi-Fi. In response, the Calix solution supports differentiated quality of service (QoS) as well as isolation between the services. To ensure a seamless mobile streaming experience, the software used by the GigaSpire and GigaSpire Mesh BLAST u4m has been enhanced to support both band steering and network-assisted node steering. Steering directs subscriber Wi-Fi devices to connect to the radio signal that results in the best user experience.

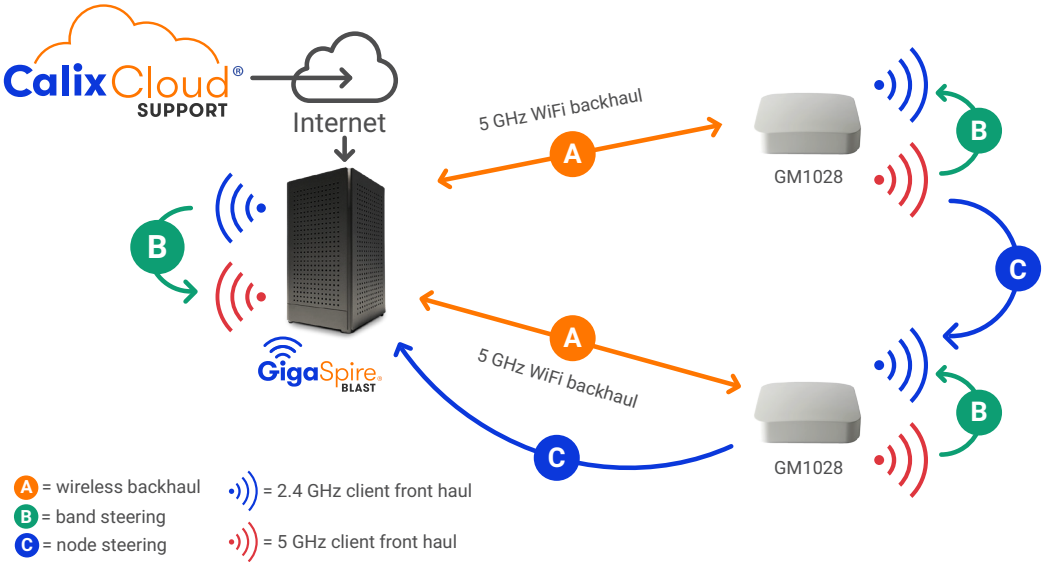
Calix leverages the latest standards for roaming and steering, including 802.11k, 802.11r and 802.11v. The combination of GigaSpire and GigaSpire Mesh BLAST u4m satellites enables subscribers to receive Gigabit broadband data, IP video, and voice over (VoIP). Using the latest 802.11ax 5 GHz technology – incorporating 2x2 multi-user multiple-input and multiple-output (MU-MIMO) with beamforming – the GigaSpire Mesh BLAST u4m satellite allows CSPs to extend the access network inside the home and establish a strategic location for the delivery and control of broadband services.

Calix engineered the GigaSpire Mesh BLAST u4m for optimal whole-home coverage with simultaneous dual-band 2.4 GHz and 5 GHz operation and dynamic beamforming at 5 GHz. For maximum performance, the GigaSpire Mesh BLAST u4m supports high-power 2x2 MU-MIMO spatial diversity at 2.4 GHz and 2x2 MU-MIMO at 5 GHz. The GigaSpire/GigaSpire Mesh BLAST u4m solution easily delivers high definition (HD) and Ultra HD (UHD) video and data throughout a subscriber's home. The Calix solution is scalable, allowing CSPs to initially deploy a GigaSpire and then add GigaSpire Mesh BLAST u4m satellites to the end subscriber's home network as the need arises for additional coverage. One of the strengths of the Calix solution is that CSPs can leverage the instrumentation provided by the GigaSpires and GigaSpire Mesh BLAST u4m satellites to identify when the end subscriber can benefit from an additional GigaSpire Mesh BLAST u4m. This allows them to be proactive and upsell additional services and assets.

Market research projects that tens of billions of residential IoT devices will be deployed in the coming years. The GigaSpire and GigaSpire Mesh BLAST u4m provides powerful Wi-Fi to support the growing IoT deployment. Service providers can now deploy the GigaSpire Mesh BLAST u4m with plug-and-play Wi-Fi IoT devices such as security cameras, sensors and smart plugs.

CALIX GIGASPIRE AND GIGASPIRE MESH BLAST U4M SOLUTION OVERVIEW

Mesh-enhanced Carrier Class Wi-Fi includes GigaSpire BLAST systems, Calix Cloud, and GigaSpire Mesh BLAST u4m.



EASY TO INSTALL, ACTIVATE AND MAINTAIN

With the GigaSpire Mesh BLAST u4m satellites, Calix has redefined how to install and activate residential services. When deployed with a wired connection it's as simple as plugging a Cat 5/6 cable in between the GigaSpire Mesh BLAST u4m RJ-45 port and the parent GigaSpire. The GigaSpire Mesh BLAST u4m leverages its TR-069 interface to communicate its presence to the Calix Support Cloud, which adds the GigaSpire Mesh BLAST u4m to the subscriber account.

The system harmonizes the services on the GigaSpire Mesh BLAST u4m. This removes all human error-prone touch points. When deployed with a wireless connection, the subscriber uses the Wi-Fi Protected Setup (WPS) button on both the GigaSpire Mesh BLAST u4m and the GigaSpire to pair the mesh network. In addition, built-in signal strength indicator on the GigaSpire Mesh BLAST u4m provides identification for the best placement location. Once this step is done, discovery, configuration and harmonization steps occur. The Calix Support Cloud's extensive troubleshooting capabilities, remote software downloads, and easy-to-use service activation features ensure that services are delivered and maintained without needless truck rolls and hardware upgrades. Employing the GigaSpire and GigaSpire Mesh BLAST u4m satellites allows CSPs to reduce their operational expenses while effectively delivering an elevated Gigabit experience to their subscribers.

KEY ATTRIBUTES

Whole Home Coverage Wi-Fi Mesh Satellite

- Layer 2 bridge and Layer 3 routing for High Speed Internet (HSI) data and IPTV video services
- Self-Organizing Network (SON)
- Auto configuration
- Band and node steering
- Increased network capacity
- Bridge port assignment and data traffic pings
- MAC filtering Wi-Fi

Wireless

- 2.4 GHz and 5 GHz, simultaneous dual-band
- 2.4GHz and 5 GHz 802.11ax (Wi-Fi 6) certified, 802.11a/n/ac compatible
- 4x4 streams (2x2 @ 2.4 GHz and 2x2 @ 5 GHz)
- WPA/WPA2/WPA3; WEP 64/128 bit encryption
- PuF (Physical Unclonable Functions)
- WPS push-button
- 2x2 DL/UL MU-MIMO, implicit/ explicit high-power, dynamic beamforming (5 GHz radio)
- 2x2 DL/UL MU-MIMO implicit/ explicit high-power, dynamic beamforming (2.4 GHz radio)
- 1024 QAM; OFDMA; BSS Coloring
- Support for 802.11k/r/v/s o (11k Radio Resource Management, 11r Fast Roaming, 11v Wireless Network Management)
- Support 4-address WDS mode
- Support 16 SSIDs Replication per band
- 1.2 Gbps Radio Backhaul with GigaSpire
- Channel Optimization DFS
- Wireless Backhaul Signal Strength

Wi-Fi redundant mesh

- Self Managed: self configuration, Air time fairness
- Dynamic Mesh: load balancing, band/node steering; interference management
- Self Healing; diagnostics; events

1 gigabit ethernet (GE) WAN interface

- Symmetrical 1 Gbps for residential IPTV and data services
- Multi-rate 10/100/1000 BASE-T Ethernet, auto-negotiation

Supports multiple data service profiles

IPTV, IGMPv2, future support of IGMPv3

- GMP Snooping and Proxy
- IGMP Fast Leaves

Gateway management

- CSC (Calix Support Cloud)
- TR-069
- Local Home Gateway GUI, access provisional
- Remote WAN side GUI access
- Default username/password

AC to 12 V DC power adapter

GigaSpire BLAST u4m

Data Sheet

SPECIFICATIONS

Dimensions

- Width: 5 in (12.7 cm)
- Height: 1.6 in (4 cm)
- Depth: 5 in (12.7 cm)
- Weight: 10.6 oz. (0.3 kg

LAN/WAN INTERFACE

- Wired: 10/100/1000 BASE-TX Ethernet Port, RJ-45 connector

Interfaces

- Wireless: 2.4 GHz 2x2 and 5 GHz 2x2 internal antennas
- Power: Single barrel connector
- WPS Switch: Push-button actuator
- Reset button for factory default

Data

- Drop length: 328 feet (100 m) maximum using Cat5/6 cable for GigE
- Auto MDI/MDIX crossover for 1000BASE-TX, 100BASE-TX
- Traffic Management and QoS802.11Q VLAN; 802.11p voice, video, data and management priorities; Q-in-Q tagging

Wireless

- 2.4 GHz 802.11 b/g/n/ac/ax
- 5 GHz 802.11 a/n/ac/ax
- 2x2 DL/UL MU-MIMO, implicit/ explicit high-power, dynamic beamforming (5 GHz radio)
- 2x2 DL/UL MU-MIMO implicit/ explicit high-power, dynamic beamforming (2.4 GHz radio)
- 2.4 GHz and 5 GHz simultaneous 1024 QAM
- Auto channel selecting and interference detection
- WPS push button
- Wireless Security: Wi-Fi protected access (WPA/WPA2/ WPA2) WEP, MAC address filtering
- Wi-Fi multimedia (WMM)
- 802.11k,802.11v,802.11r
- Supports up to 200 wireless clients
- US Wi-Fi Output Power: 30 dBm
- EU: ETSI Wi-Fi Output Power compliant

Interoperability

- Calix GigaSpire BLAST portfolio

Remote Management

- TR-069 remote management
- TR-098 Internet Gateway Device Data Model

Environmental

- Operating temperature: Indoor ambient temperature, 0° to 40°C (32° to 104° F)
- Operating and storage relative humidity: 10 to 90 % and 5 to 95% non-condensing respectively

Certification and Compliance

- Emissions: FCC Part 15 Class B IC ICES-003 Class B CISPR-22
- Safety: UL 60950 and UL 1697 approved
- IEEE: 802.3, 802.3AB, 802.3U, 802.11p, 802.11Q
- Wi-Fi Alliance Certified 802.11ax

Wi Fi 6 CERTIFIED

Powering and Alarms

- Single barrel connector
- Input voltage: 12 V DC (nominal)
- External Power Adapter: 12 V DC, 1.5 A

ORDERING INFORMATION

Calix GigaSpire Mesh BLAST u4m (GM1028E)

000-01178..... GM1028 GigaSpire Mesh BLAST u4m, dual band 2x2 Wi-Fi 6, GE WAN/LAN, AM Power Adapter

Calix GS2028E/GM1028 Power Adapter

100-05544..... GigaSpire BLAST u4/u4m (GS2028E/GM1028) Power Adapter, 12 V, 2 A – AM Type A

Optional Uninterruptible Power Supply (UPS)

100-04068..... Indoor UPS (8 hour support), Wall Mount or Desktop, 12 V, 7.2 AH, 36 W, Black - AM, Type B, Grounded

100-05345..... Indoor UPS (24 hour support), Wall Mount or Desktop, 12 V, 20AH, 75W, Audible Alarm, Regulated Output R3 Production

UPS Power Adapters

100-04235..... Indoor UPS Power cord, 7-pin UPS to 2-pin 800 GC, 1m, black

100-04236.....Indoor UPS Power cord, 7-pin UPS to 2-pin 800 GC, 3m, black

Note: Calix believes the information in this publication to be accurate as of publication date, and is not responsible for error. Product Specifications are subject to change without notice.

MULTI-GIGABIT SUBSCRIBER EXPERIENCE

The GigaSpire BLAST u6.2 is a premium smart home system that delivers the latest

'Wi-Fi 6' certified technology (802.11ax). The GigaSpire BLAST u6.2 uses a 2.5 Gigabit Ethernet link at the subscriber's premises to provide carrier-class Wi-Fi and four (4) Gigabit Ethernet interfaces for customer multi-media devices. The GigaSpire BLAST u6.2 enables residential subscribers to receive Gigabit broadband data, Internet Protocol (IP) video, and voice (POTS) services. Using the latest 802.11ax technology in both the 2.4 and 5 GHz radios, the GigaSpire BLAST u6.2 incorporates 6x6 streams of Wi-Fi delivery (2x2 @ 2.4 GHz and 4x4 @ 5 GHz). In addition, with multi-user multiple-input and multiple-output (MU-MIMO) and beamforming, the GigaSpire BLAST u6.2 allows service providers to extend the access network inside the home and establish a strategic location for the delivery and control of broadband services.

With Wi-Fi being the de facto wireless data communication technology of choice for consumers, Calix engineered the GigaSpire BLAST u6.2 for optimal whole-home coverage with simultaneous dual-band 2.4 GHz and 5 GHz operation and dynamic beamforming at 5 GHz. Leveraging the latest Wi-Fi 6 features, the GigaSpire BLAST u6.2 provides longer range, higher efficiency and less interference compared to earlier generations of Wi-Fi technology. The GigaSpire BLAST u6.2 also supports the entire 5 GHz band, including Dynamic Frequency Selection (DFS) channels and can be provisioned to support 160 MHz channel bandwidth at 5 GHz. The GigaSpire BLAST u6.2 easily delivers HD and UHD (ultra-HD) video and data throughout a subscriber's home in an increasingly video-rich and mobile broadband environment.

Ensuring consumers can have ultra-fast Wi-Fi throughout their premises, the GigaSpire BLAST u6.2 provides the latest generation of redundant mesh via the Calix Mesh

BLAST u4m (GM1028) (please see the GM1028 data sheet for more information). With the GigaSpire BLAST u6.2 as the hub, and the BLAST u4m as the satellite extenders, consumers can truly gain the whole home/smart home experience. For even higher mesh performance, a GigaSpire BLAST u6.1 can also be a mesh unit. This means that two GigaSpire BLAST u6 systems can connect to each other with one being the residential gateway and the other being the satellite.

EASY TO INSTALL, ACTIVATE, AND MAINTAIN

With the GigaSpire BLAST u6.2, Calix has redefined how to install and activate residential services at a subscriber's premises. Using the Command**IQ**® mobile app and a phone

or laptop, a field technician can install and apply the subscriber's service profile without special equipment or assistance from the central office. Calix also provides the innovative Calix Support Cloud (CSC), which allows the service provider to configure, activate

and upgrade the GigaSpire BLAST u6.2 quickly from a remote location using in-band management or TR-069. Extensive troubleshooting capabilities, remote software downloads, and easy-to-use service activation features ensure that services are delivered and maintained without needless truck rolls and hardware upgrades. Employing GigaSpire BLAST u6.2 systems allows service providers to reduce their operational expenses while effectively delivering the Gigabit experience to their subscribers.

CALIX EXPERIENCE INNOVATION PLATFORM

All GigaSpire BLAST systems are powered by the Calix Innovation Experience Platform.

This container-based platform allows service providers to quickly change and adapt their services to embrace new technologies and offer new, value-added services. This approach can generate recurring revenue and increase subscriber satisfaction.

KEY ATTRIBUTES

Home Gateaway:

- Layer 2 bridge and Layer 3 routing for High Speed Internet (HSI) data and IPTV video services
- DHCP server options
- DHCP (IPoE) and PPPoE network connections
- Network Access Translation (NAT), public to private IP addressing
- Configurable IP address schemes, subnets, static-IP addresses
- DNS server
- Bridge port assignment and data traffic mappings
- Port forwarding
- Firewall and security
- Application and website filtering
- Selectable forwarding and blocking policies
- DMZ hosting
- Parental controls, time of day usage
- Denial of service (DoS) protection
- MAC filtering
- Time/Zone support
- Universal Plug-and-Play (UPnP)

Wi-Fi:

- 2.4 GHz and 5 GHz, simultaneous dual-band
- 5 GHz 802.11ax (Wi-Fi 6) certified, 802.11a/n/ac compatible
- 6x6 streams (2x2 @ 2.4 GHz and 4x4 @ 5 GHz)
- 2.4 GHz 802.11ax (Wi-Fi 6) certified, 802.11b/g/ac compatible
- WPA/WPA2/WPA3; WEP 64/128 bit encryption
- PuF (Physical Unclonable Functions)
- WPS push-button
- 4x4 DL/UL MU-MIMO with beamforming (5 GHz radio)
- 2x2 DL/UL MU-MIMO with beamforming (2.4 GHz radio)
- 1024 QAM; OFDMA; BSS Coloring
- DCM (Dual Carrier Modulation)
- TWT (Target Wake Time) for IoT clients

Wi-Fi Redundant Mesh:

- Self Managed: self configuration, Air time fairness
- Dynamic Mesh: load balancing, band/node steering; interference management
- Self Healing: backhaul failover; diagnostics; events

2.5 Gigabit Ethernet (GE) WAN interface:

- Multi-rate 100/1000/2500 BASE-T Ethernet, auto-negotiating

Gigabit Ethernet (GE) LAN interfaces:

- Four (4) ports of multi-rate 10/100/1000 BASE-T Ethernet, auto-negotiating for residential IPTV and data services

Two voice lines:

- Carrier grade SIP, H.248 (aka Megaco) and MGCP[1]

USB port:

- USB 2.0 - Type A host interface

Supports multiple data service profiles

Traffic management and Quality of Service (QoS):

- 802.1Q VLANs
- 802.1p service prioritization
- Q-in-Q tagging
- Multiple VLANs
- DiffServ
- Pre-defined QoS on service type
- LAG of GE ports
- MAP-T

IPTV, IGMPv2, future support of IGMPv3:

- IGMP Snooping and Proxy
- IGMP Fast Leaves

Gateway Management:

- CSC (Calix Support Cloud)
- TR-069
- Local Home Gateway GUI, access provisionable
- Remote WAN side GUI access
- Default username/password

AC to 12 V DV power adapter

[1] Currently supporting MetaSwitch and Ribbon softswitches

SPECIFICATIONS

Dimensions

- Width: 4.75 in (12.1 cm)
- Height: 8.5 in (21.6 cm)
- Depth: 4.75 in (12.1 cm)
- Weight: 36 oz (1.02 kg)

WAN Interface

- Interface: One 2.5 Gigabit-Ethernet Port, RJ-45 connector

Interfaces

- Wireless: 2.4 GHz 2x2 and 5 GHz 4x4 internal antennas
- LAN Data/IPTV: Four (4) 10/100/1000 BASE-T Ethernet port, RJ 45 connectors
- WAN: One (1) 10/100/1000/2500
- USB: USB 2.0 Type A
- Voice: Two ports supporting carrier grade SIP, H.248 (aka Megaco) and MGCP
- Power: Single pin and 8-pin

Data

- Drop length: 328 feet (100 m) max using CAT5 cable for GigE
- Auto MDI/MDIX crossover for 1000BASE-TX, 100BASE-TX
- Traffic Management and QoS: 802.11Q VLAN; 802.11p voice, video, data and management priorities; Q-in-Q tagging

Wireless

- 2.4 GHz 802.11 b/g/n/ac/ax
- 5 GHz 802.11 a/n/ac/ax
- 4x4 DL/UL MU-MIMO, implicit/explicit high-power, dynamic beamforming (5 GHz radio)
- 2x2 DL/UL MU-MIMO implicit/explicit high-power, dynamic beamforming (2.4 GHz radio)
- 2.4 GHz and 5 GHz simultaneous
- DCM, TWT, extended GI
- Auto channel selecting and interference detection
- WPS, WPS push button
- Wi-Fi multimedia (WMM)
- Supports up to 250 wireless clients

Remote Management

- TR-069 remote management
- TR-098 Internet Gateway Device Data Model

Environmental

- Operating temperature: Indoor ambient temperature, 0° to 40°C (32° to 104° F)
- Operating and storage relative humidity: 10 to 90 % and 5 to 95% non-condensing respectively

Certification and Compliance

- Emissions: FCC Part 15 Class B IC ICES-003 Class B CISPR-22
- Safety: UL 60950 and UL 1697 approved
- IEEE: 802.3, 802.3AB, 802.3U, 802.11p, 802.11Q
- Wi-Fi Alliance Certified 802.11ax

- USB-IF Compliance USB 2.0

Powering and Alarms

- Single pin and 8-pin
- Input voltage: 12 V DC (nominal)
- External Power Adapter: 12 V DC, 3A

Ookla-based Performance Testing

- Subscribers can run an Ookla-based performance test from within the Calix Command**IQ**® mobile app
- Symmetrical speed test results in excess of 2 Gbps are possible with the GigaSpire BLAST u6.2 system (owing to the 2.5 GigE WAN port)

ORDERING INFORMATION

Calix GS4227E GigaSpire BLAST u6.2

100-05415..... GS4227E GigaSpire BLAST u6.2, 2.5 GE WAN, 4 GE LAN, 2 POTS, Dual Wi-Fi – AM Power Adapter

Calix GS4227E GigaSpire BLAST u6.2 Power Adapter

100-05484..... GigaSpire BLAST u6.1/u6.2 (GS4220E/GS4227E) Power Adapter, 12 V, 3 A – AM Type A

Optional Mounting Bracket

100-05467..... GS4227E/GS4220E Mounting Bracket — Quantity 10

Optional Uninterruptible Power Supply (UPS)

100-04068..... Indoor UPS (8 hour support), Wall Mount or Desktop, 12 V, 7.2 AH, 36 W, Black - AM, Type B, Grounded

100-05345..... Indoor UPS (24 hour support), Wall Mount or Desktop, 12 V, 20AH, 75W, Audible Alarm, Regulated Output R3 Production

UPS Power Adapters

100-03893..... Indoor UPS Power cord, 7-pin UPS to 8-pin ONT Male, 1m, black

100-03894..... Indoor UPS Power cord, 7-pin UPS to 8-pin ONT Male, 3m, black

100-03895..... Indoor UPS Power cord, Unterminated to 8-pin ONT Male, 6m, black

Removeable Branding Plate

100-05522..... Blank, removable branding plate. Contact your sales representative to order branding plates that can be customized with your company logo

Note: Calix believes the information in this publication to be accurate as of publication date, and is not responsible for error. Product Specifications are subject to change without notice.

Calix E9-2 Installation Guide

August 2023

#220-01017-24

Contents

About This Guide

This document provides a general installation practice for the Calix E9-2 Intelligent Edge System. This document includes guidance for planning, power installation, installation kits, cabling, and maintenance.

Intended Audience

This document is intended for use by network planning engineers, outside plant engineers, CO technicians, and field support personnel, as well as craft personnel responsible for equipment installation, cabling, and maintenance. Familiarity with standard telecom and datacom terminology and practices, as well as standards-based Ethernet technologies and conventions, is recommended.

Related documentation

You can access Calix product documentation by logging into My Calix (*www.calix.com/my-calix* (*https://www.calix.com/mycalix*)) and browsing the My Calix Documentation Library.

Safety Notices

DANGER! Danger indicates the presence of a hazard that will cause severe personal injury or death if not avoided.

WARNING! Warning indicates the presence of a hazard that can cause severe personal injury if not avoided.

CAUTION! Caution indicates the presence of a hazard that can cause minor to moderate personal injury if not avoided.

ALERT! Alert indicates the presence of a hazard that can cause damage to equipment or software, loss of data, or service interruption if not avoided.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

Preventing ESD Damage

E9-2 shelf and E9-2 card components are sensitive to damage from electrostatic discharge (ESD). ESD occurs when electronic printed circuit cards are handled improperly and can result in intermittent or complete failures. Static voltages as low as 30 volts can damage circuitry. Make sure to observe all standard anti-static procedures when handling electronic equipment and components. Observe the following guidelines to prevent ESD damage:

ESD ALERT! Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

- Remember that the wrist strap only protects the E9-2 shelf or E9-2 cards from ESD voltages present on the body. ESD voltages can also be present on clothing and can cause ESD damage to equipment.
- Ground yourself by touching the metal part of the chassis if you do not have a wrist strap available.

In addition to these warnings, please follow all other standard anti-static procedures.

Chapter 1

Calix E9-2 Product Overview

This chapter introduces the Calix E9-2 Intelligent Edge System and provides a general overview of the E9-2 small form factor chassis and components.

Topics Covered

This chapter covers the following topics:

- Introducing the Calix E9-2
- Product dimensions

Introducing the Calix E9-2

There are two types of Calix E9-2 Intelligent Edge systems:

- Calix E9-2 ASM3001 systems:
  - For access aggregation and edge routing applications, each E9-2 shelf is equipped with one or two Aggregation Service Manager (ASM3001) cards and operates as a standalone system.
- Calix E9-2 CLX3001 systems:
  - For L3/L2 FTTx access applications, a collection of E9-2 shelves comprises an OLT system, where one shelf is equipped with one or more control and aggregation (CLX3001) cards, and the remaining shelves—minimum of one, maximum of eight—are equipped with xPON access cards.
  - An E9-2 chassis becomes an aggregation shelf or an access shelf once a card of that type is inserted into the chassis. The E9-2 OLT system is a disaggregated collection of access shelves, with each access line card connecting externally to the aggregation shelf—forming a larger OLT system. With the aggregation card, the E9-2 collapses the functions of the traditional OLT, aggregation switch, and edge router with subscriber management into a single system. This disaggregated system uses data center high bandwidth interconnect technology to support scaling to a very high density, non-blocking capacity to enable service providers to converge mobile, business and residential services networks over a single unified network structure. A two-shelf OLT system is shown below, with one aggregation shelf (top) and one access shelf (bottom).

E9-2 front chassis view

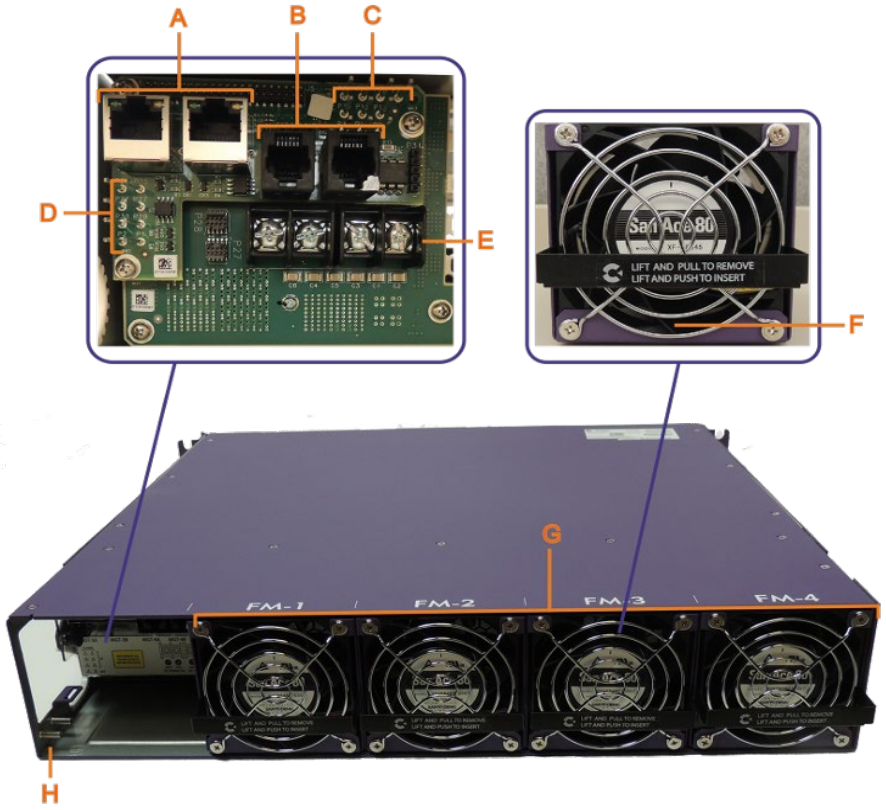
The Calix E9-2 shelf consists of a 2-slot 2RU chassis, with up to two aggregation or two access line cards installed into the front of the shelf:

- Slot 1 (bottom)
- Slot 2 (top)

Note: An E9 'blank' card plugs into either of the two universal slots and is used to maintain emissions and facilitate proper airflow in E9-2 systems with only one card. Whenever an E9-2 shelf operates with only one card, a blank card must be installed in the other slot.

E9-2 rear chassis view

The following components can be viewed from the rear panel of the E9-2 chassis:



A	**MGT-3A/MGT-3B**: (2) 10/100/1000 Ethernet management interface ports with RJ-45 connectors for a fixed out-of-band management connection
B	**MGT-4A/MGT-4B**: (2) RS-232 serial management interface ports with RJ-11F connectors to connect to a PC for a console management connection
C	BITS timing interfaces to support synchronization with an external clock source. **Note:** There is no BITS timing input capability on access line cards. Access line cards receive timing from the control and aggregation cards
D	Alarm I/O**:** (4) external alarm input/output wire wrap pins
E	-48 VDC and RTN power inputs (A/B)
F	(4) Fan module status LEDs, located behind the fan blades at the bottom of the module
G	FM-1 to FM-4: Fan modules that pull air from the front of the chassis and exhaust out the rear
H	Frame ground connection

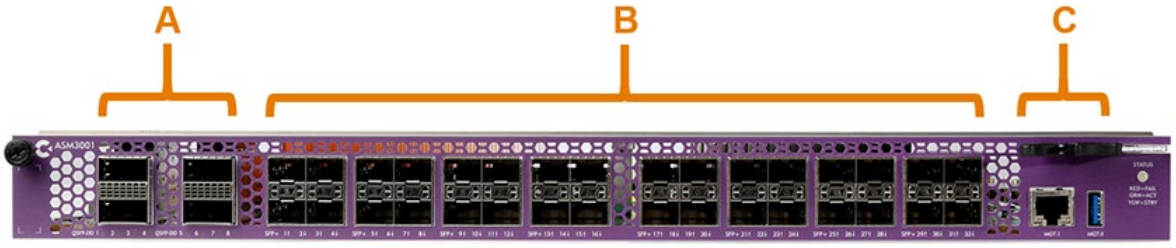
E9-2 aggregation cards

An E9-2 shelf supports up to two aggregation cards, which must be of the same type:

- For access aggregation applications where each E9-2 shelf is a standalone system, use the E9-2 aggregation service manager (ASM) card(s) in that shelf.
- For L3/L2 FTTx OLT applications, where each multi-shelf OLT system contains one aggregation shelf per node, use the E9-2 control & aggregation switch (CLX) card(s) in that shelf.

E9-2 aggregation service manager card (ASM3001)

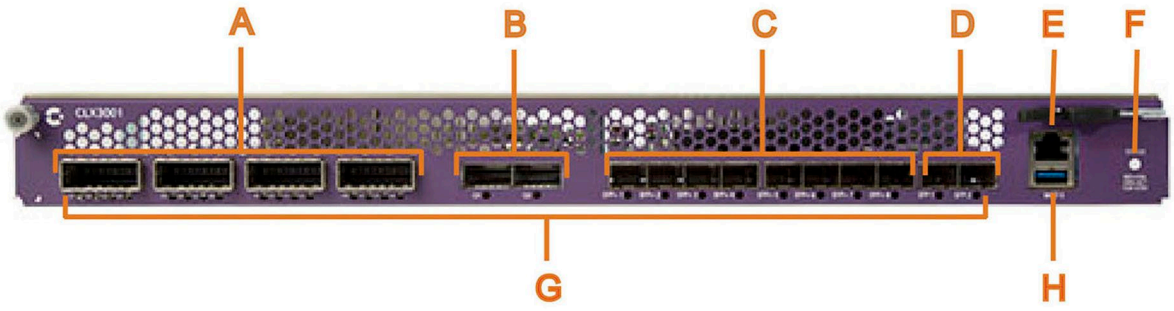
An E9-2 shelf supports up to two aggregation service manager cards. The following ports and components can be viewed from the faceplate of an ASM3001 card, for example:



A	**QSFP-DD:** Four (4) QSFP-DD sockets for up to 200G uplink connections. Each QSFP-DD socket may house one of the following: • A single QSFP28 optical module for 100GE • A QSFP-DD to 2x QSFP28 DAC or AOC breakout cable for 200G (2 x 100GE)
B	**SFP+**: (32) SFP+ 10GE ports for aggregation (support 10G/2.5G/1G Ethernet SFP+ modules)
C	**MGT-1**: (10/100/1000 Ethernet port, RJ-45 connector) Craft port for use in lab qualification, testing, configuration, and maintenance activities **MGT-5**: Ethernet management port with a USB 2.0 interface for local upgrade and rescue functions (future)

E9-2 control and aggregation switch card (CLX3001)

An E9-2 shelf supports up to two control and aggregation cards. The following components can be viewed from the faceplate of a CLX3001 aggregation card, for example:



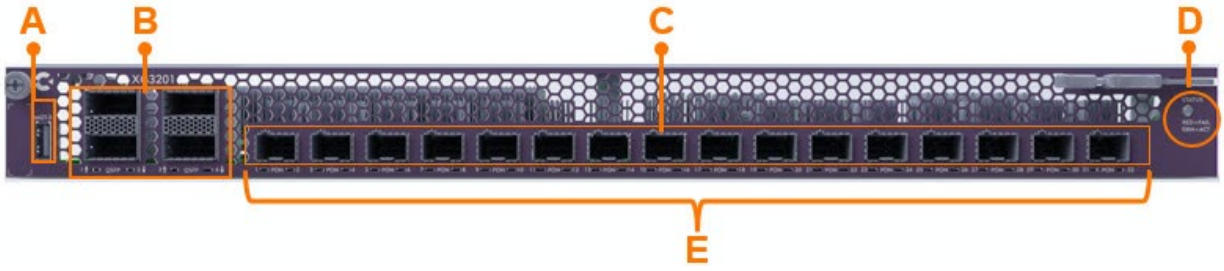
A	**C-QSFP**: (4) CDFP ports, each containing (4) QSFP interfaces with CDFP copper connectors to support 4x100GE line rates for interconnecting to access line cards The E9-2 system uses CDFP–4x QSFP28 fan out cables to interconnect a control and aggregation card to access line cards.
B	**QSFP**: (2) QSFP-28 sockets for housing QSFP+ modules to support 100GE uplink connections
C	**SFP+**: (8) SFP 10GE uplink ports
D	**SFP**: (2) SFP 1GE uplink ports
E	**MGT-1**: (10/100/1000 Ethernet port, RJ-45 connector) Craft port for use in lab qualification, testing, configuration, and maintenance activities
F	Status LED (red/green/yellow) that shows the card's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information
G	Port status LEDs located below each C-QSFP/QSFP/SFP socket that show the given port's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information
H	**MGT-5**: Ethernet management port with a USB 2.0 interface for local upgrade and rescue functions (future)

E9-2 fiber access line cards

For FTTx OLT applications, each E9-2 shelf supports up to two fiber access line cards, managed individually. Access line cards include 2.5G PON (GPON) and 10G PON (NG-PON2/XGS-PON) varieties, described below.

E9-2 XGS-PON

XG3201

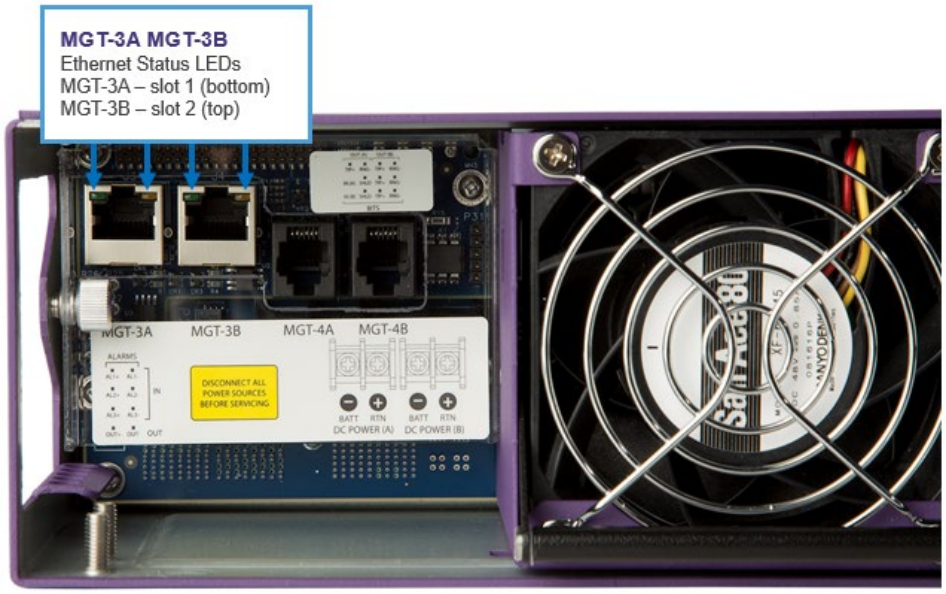


A	**USB 2.0:** (1) Craft management port; connects to a USB Wi-Fi or Ethernet adapter for temporary local Craft access
B	**QSFP-28:** (4) QSFP-28 sockets for 4x100GE or 4x40GE uplink inter-connections to the aggregation shelf (two active, two standby)
C	**PON XFP:** (16) SFP+ access ports (XGS-PON/GPON/MPM). The following types of optical modules are accepted in any of the PON ports: • Single mode optic (GPON or XGS-PON) • Double-Density optic (XGS-PON) • Multi-PON/Combi optic SFP+ (GPON & XGS-PON)
D	Status LED that show the card's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information
E	A pair of port status LEDs are located below each XFP socket that show the given port's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information

E9-2 system management port status LEDs

The status LEDs associated with MGT3A and MGT3B work independently as follows:

- MGT3A - represents the card in slot 1 (bottom)
- MGT3B - represents the card in slot 2 (top)

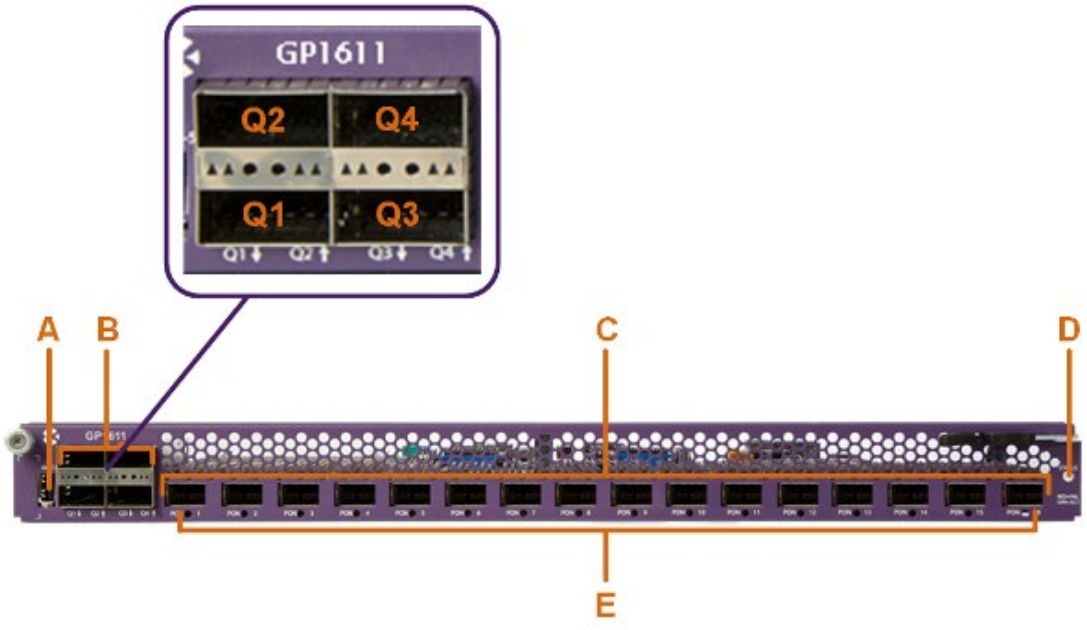


- The Link LED (green) is solid when an Ethernet connection is established.
- The Activity LED (amber) blinks when there is live link activity.

E9-2 GPON line cards (GP1611 and GP1612)

GP1611

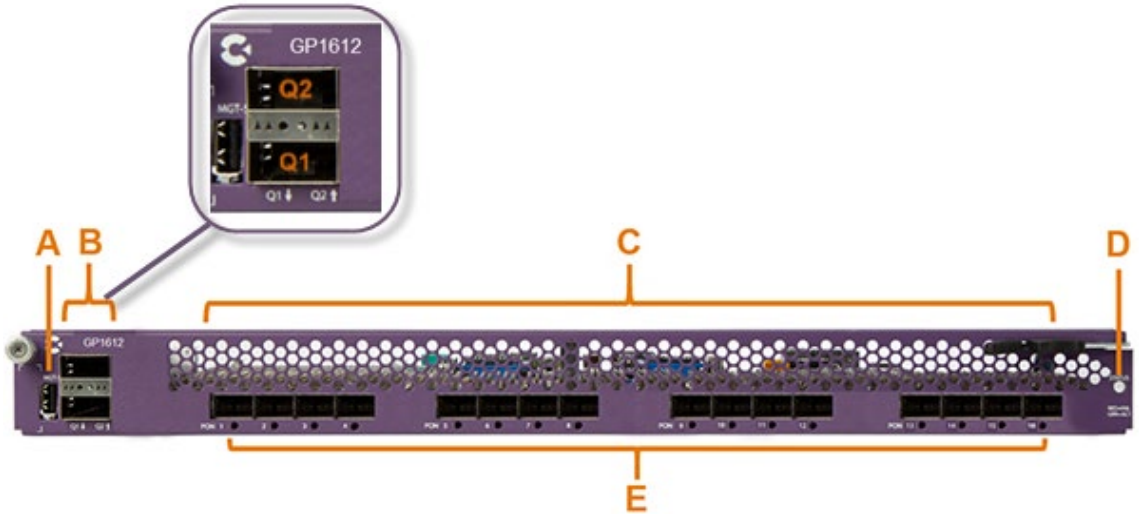
The following components can be viewed from the faceplate of a GP1611 card:



A	MGT-5: Ethernet management port with a USB 2.0 interface that connects to a USB Wi-Fi or Ethernet adapter for temporary local Craft access during turn-up and maintenance activities
B	Q1–Q4: QSFP-28 ports (two active, two standby) to support 4x10GE, 40GE or 100GE line rates for interconnecting to aggregation cards. 4x10GE connections support fan out cables; 40GE and 100GE connections support Direct Attach cables.
C	PON 1–PON 16: 16 SFP sockets for 2.5G/1.25G GPON access links.
D	Status LED (red/green) that shows the card's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information
E	Port status LEDs located below each XFP socket that show the given port's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information

GP1612 card

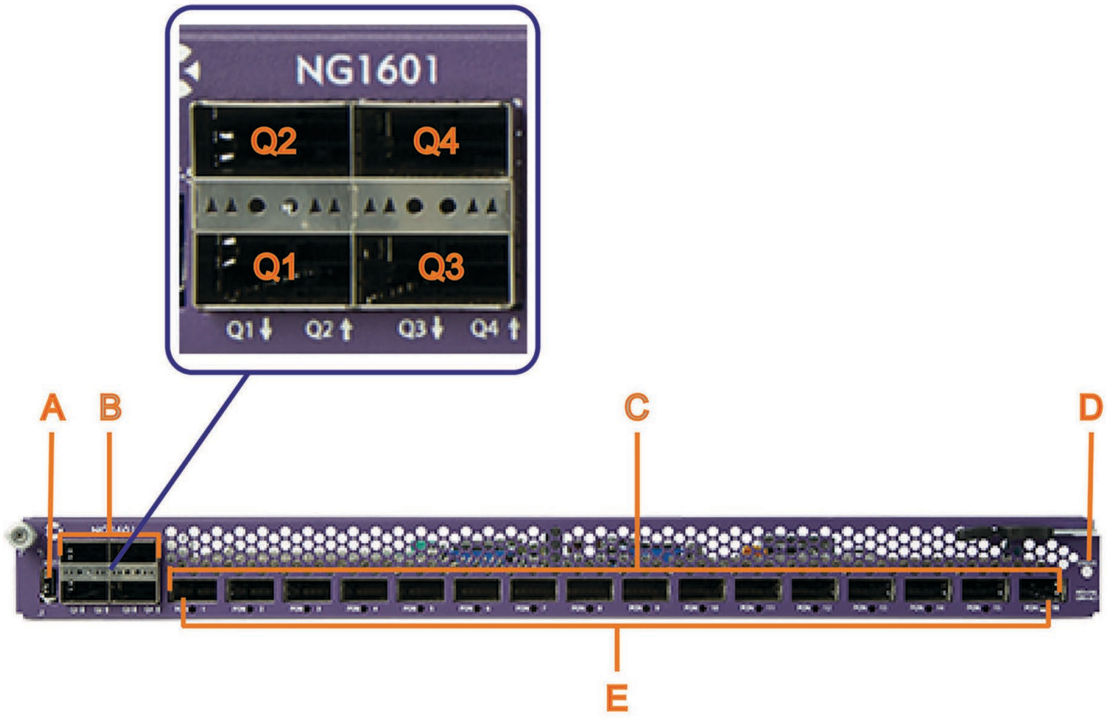
The GP1612 card operates identically to the GP1611 card while consuming 30% less power (and equipped with two 100GE QSFP ports instead of four).
The following components can be viewed from the faceplate of a GP1612 card:



A	MGT-5: Ethernet management port with a USB 2.0 interface that connects to a USB Wi-Fi or Ethernet adapter for temporary local Craft access during turn-up and maintenance activities
B	Q1–Q2: QSFP-28 ports (active, standby) for interconnecting to aggregation cards. Use QSFP Direct Attach cables to support 100GE or 40GE inter-connect links (ICLs).
C	PON 1–PON 16: 16 SFP sockets for 2.5G/1.25G GPON access links.
D	Status LED (red/green) that shows the card's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information
E	Port status LEDs located below each XFP socket that show the given port's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information

E9-2 10G PON line card (NG1601)

The E9-2 NG1601 10G PON access line card supports both NG-PON2 and XGS-PON technologies, depending on the type of optical modules are installed in the PON ports. The following components can be viewed from the faceplate of a NG1601 card:



A	MGT-5: Ethernet management port with a USB 2.0 interface that connects to a USB Wi-Fi or Ethernet adapter for temporary local Craft access during turn-up and maintenance activities
B	Q1–Q4: QSFP-28 ports (two active, two standby) to support 4x10GE, 40GE or 100GE line rates for interconnecting to aggregation cards. 4x10GE connections support fan out cables; 40GE and 100GE connections support Direct Attach cables.
C	PON 1–PON 16: XFP sockets housing NG-PON2 or XGS-PON optic modules to support 10G/10G or 10G/2.5G access links
D	Status LED (red/green) that shows the card's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information
E	Port status LEDs located below each XFP socket that show the given port's operational status; refer to *E9-2 LED Behavior* (on page 93) for more information

Air filter assembly

The E9-2 shelf supports an optional front-mounted air filter assembly. The filtration system allows for viewing of the card status LEDs and can be removed for card servicing.

Note: E9-2 systems that are installed in environments that comply with ISO 14644-1 Class 8 standards (accomplished through use of facility MERV-13 level air filtration or equivalent) do not require use of the Calix air filtration assembly. For other non-qualifying indoor environments, Calix strongly recommends using the air filtration assembly to protect the E9-2 electronics from airborne contaminants.

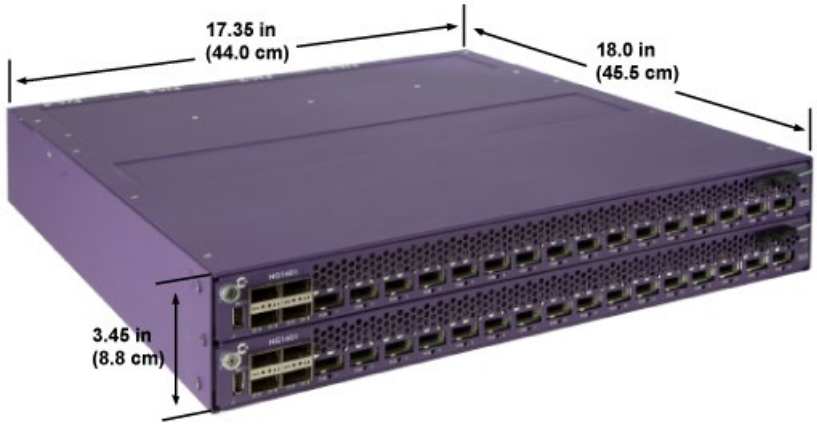
Note: Airflow direction is front to back through the shelf, with cooling fan modules located at the rear of the shelf.

Product Dimensions

E9-2 shelf dimensions

The E9-2 shelf stands two rack units tall (2RU) with the following exterior dimensions:

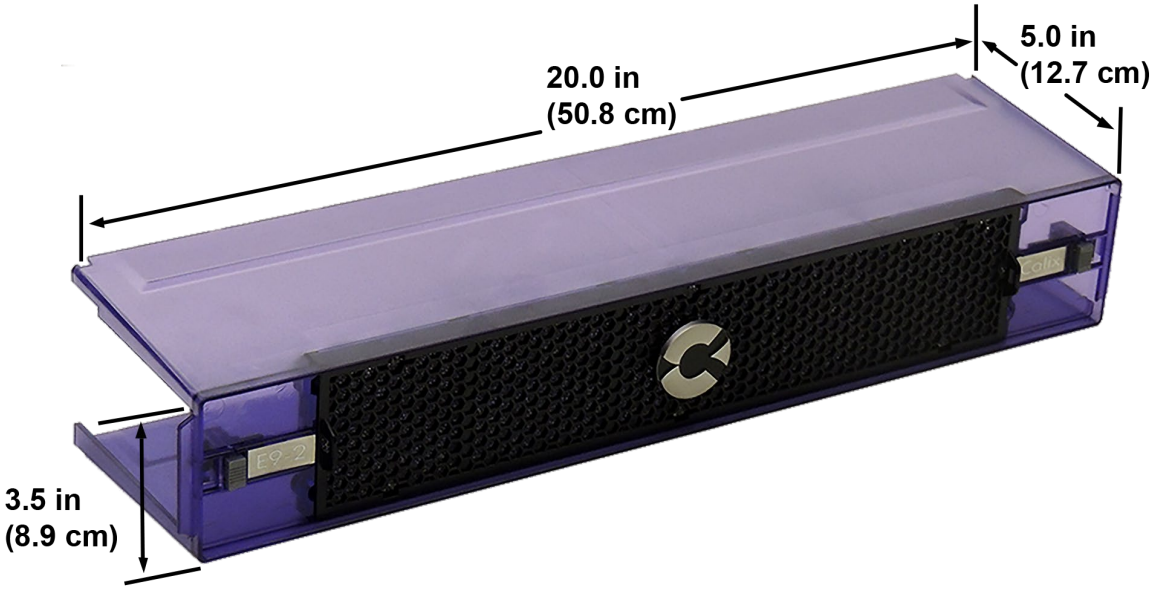
- Height: 3.45 inches (8.8 cm)
- Width: 17.35 inches (44.0 cm)
- Depth: 18.0 inches (45.5 cm)



E9-2 air filter assembly dimensions

The Calix E9-2 air filter assembly exterior dimensions follow:

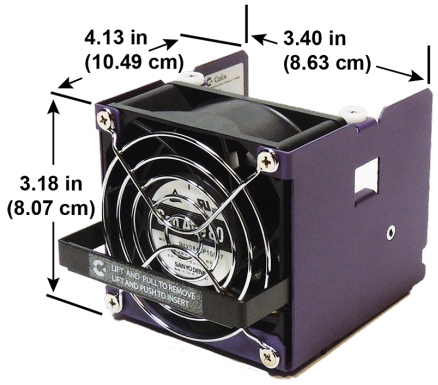
- Height: 3.5 inches (8.9 cm)
- Width: 20.0 inches (50.8 cm)
- Depth: 5.0 inches (12.7 cm)



E9-2 fan module dimensions

The Calix E9-2 fan module exterior dimensions follow:

- Height: 3.18 inches (8.07 cm)
- Width: 3.40 inches (8.63 cm)
- Depth: 4.13 inches (10.49 cm)



E9-2 dimensions with fan modules installed and air filter assembly attached

- Height: 4.2 inches (10.7 cm)
- Width: 19.5 inches (49.5 cm)
- Depth: 23.0 inches (58.4 cm)

Chapter 2

Installation Considerations

This section discusses general installation considerations and guidelines. Review this information before starting the installation process.

Topics Covered

This section covers the following topics:

- Installation guidelines
- Safety recommendations and notices
- Items required for installation (tools and materials)
- Preparations before you begin

Installation Guidelines

Review the following guidelines before starting installation activities.

General guidelines

Follow these general guidelines and practices:

- Read this document completely before starting any installation activities.
- Only qualified, professional personnel should perform the procedures described in this document.
- Follow standard safety precautions when performing installation and maintenance tasks.
- Always wear standard safety gear when performing installation and maintenance tasks (hardhats/safety headgear, reflective vest, eye protection, insulated gloves).
- For safety, keep bystanders and other unauthorized personnel away from work operations at all times.
- Install E9-2 shelves with a minimum 1/3RU (one-third RU) space between each shelf.
- E9-2 shelves support both horizontal (standard) and vertical (alternate) rack mounting orientations. For vertical orientations, use a vertical mounting bracket on the rack, available for 19- or 23-inch racks from Clearfield and other suppliers.
- The E9-2 installation kit includes a 10 foot (3.05 m) power and 4 foot (1.22 m) ground cable. If you cannot locate the E9-2 within 10 feet or 4 feet of the power/ground source, respectively, you must supply your own cables.
- The E9-2 does not include integrated circuit breakers. Calix recommends installing a breaker panel at the top of the rack for system protection, providing two 30A circuit breakers per E9-2 chassis.
- The E9-2 fan modules draw air through the front of the shelf and exhaust to the rear (airflow is front to back).

Safety Recommendations and Notices

WARNING! The intra-building port(s) on the equipment is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) on the equipment MUST NOT be metallically connected to interfaces that connect to the Outside Plant (OSP) or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

WARNING! This product should be protected by a surge protector that meets the applicable criteria of GR-974-CORE or GR-1361-CORE. Failure to utilize an appropriate surge protector could result in susceptibility to lightning surges or create a potential hazard due to power faults.

WARNING! Restricted Access Location: Only qualified technical personnel should perform the procedures in this document. These procedures involve potentially hazardous activities that could cause injury to untrained personnel.

DANGER! Risk of high power current surge and electric shock. Read and understand all power procedures before performing tasks. Take necessary precautions and use appropriate insulated tools when working with power. This equipment must be installed, operated, and serviced by qualified technical personnel only.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

ESD ALERT! Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

Required Items

Verify that the following items are on hand before you begin the installation.

Calix-supplied items

The Calix E9-2 system package includes the following items for horizontal rack mounting:

Qty	Description
1	Calix E9-2 two-slot chassis (2 RU), with 19-inch (48.26-cm) rack mounting ears attached (2 ea.) **Note:** A 23-inch shelf requires the supplied bracket adapters along with the rack mounting ears.
2	Bracket adapters for 23-inch rack, plus (4) 10-32 screws (to attach the adapter to either the rack mounting ears or to the cable management bracket, if used) 
4	Calix E9-2 fan modules
4	Self-tapping mounting screws, 12-24 (for rack mounting)
2	Power cable pairs for A/B feeds; 10 AWG, 10 ft (3.05 m) • (2) Red cables, -48V, A & B • (2) Black cables, -48V RTN, A & B **Note:** Supplied power cables are terminated with ring lugs of different sizes on each end: One lug size (#8) fits the E9-2 power terminals, and the other size (#6) fits common office power supply connections.
1	Ground cable; 6 AWG, 4 ft (1.22 m), plus termination hardware (2 ea. washers and Keps nuts) **Note:** The two lugs supplied with this cable are different sizes: One size fits the E9-2, and the other size is intended to fit office ground connections.

1	Right-side bracket (fiber) for cable management, plus (3) hole plugs (bagged separately) Dimensions: 4.20 in (H) X 5.29 in (L) X .85 in (W)  **Note:** The bracket ships with (2) installed cable air seal systems.
1	Left-side bracket (copper) for cable management, plus (3) hole plugs (bagged separately) Dimensions: 4.20 in (H) X 5.29 in (L) X .85 in (W)  **Note:** The bracket ships with (2) installed cable air seal systems.

The following equipment is ordered and packaged separately, as required:

- Rear bracket shelf support for 19-inch non-Telco shelf

- Cable management system, if not using the supplied left- and right-side brackets for cable management
- Pluggable transceiver modules and/or direct-attach cables (required for line termination)

Note: Only modules purchased from Calix are supported.

- For FTTx applications: CDFP–4x QSFP28 fan out cables (required for interconnecting aggregation cards and access cards), available in the following lengths:
  - 3.28 ft (1 m)—supports interconnecting an aggregation shelf with an access shelf up to 4 shelf positions away in the same rack. [See *Installing E9-2 Shelves* (on page 34), > *Rack configuration guidelines*.]
  - 6.56 ft (2 m)—supports various other rack layouts

Note: Only Calix-supplied fan out cables are supported.

- Air filter assembly, consisting of an air filter cover, air filter frame and a filter
- RS-232 console cable (DB-9F to RJ-11M) to connect to a PC for console management

User-supplied items

The following user-supplied tools and materials are required for installation.

- (2) 30A GMT fuses per E9-2 shelf to install in DC circuit breaker fuse panel
- ESD wristband
- Power drill with universal sockets and screwdriver bits
- Socket wrench/nut driver set (standard)
- Screwdriver set (standard)
- Cable ties (tie-wraps)
- Wire stripper
- Crimp connectors of appropriate size to connect to DC power source terminals
- Compression crimping tool
- Digital multi-meter
- Fiber splicer
- Fiber jumpers (SC/UPC for PON interfaces)
- Fiber management system (distribution, vertical ducts, raceways, etc.)

Preparations Before You Begin

Before starting the installation, verify that the following conditions are true:

- All materials are onsite and inventoried.
- An equipment rack and grounding system are available
- Minimum clearances are met for each device.
- Access to a -48 VDC power source with fuse-protected distribution is available.
- The installation site has restricted access.
- Cable lengths and wire gauges are adequate for the services provided.
- Thermal budget is accounted for and approved.
- Assignments for power, transport, services, alarms, timing, and other interfaces have been defined.

Determining an installation location

- The E9-2 has been designed for indoor rack installations.
- The E9-2 requires two rack units (2RU) of mounting space on a standard 19-inch (48.26-cm) equipment rack.
- Locate the E9-2 near power supply and ground termination locations.
- Power, alarm and ground wiring at the front and rear of the E9-2 chassis must be properly secured with strain relief.
- Fibers attached to pluggable transceiver modules on the front of the E9-2 unit must be appropriately dressed and secured with strain relief to avoid exceeding the manufacturer's bend radius standards.

Chapter 3

Installing the Calix E9-2

This section describes how to install the Calix E9-2 chassis and components onto a standard equipment rack.

Topics Covered

This section covers the following topics:

- Installing the E9-2 chassis
- Grounding the E9-2 chassis
- Connecting DC power to the E9-2 chassis
- Installing the E9-2 fan modules
- Installing E9-2 cards

Installing E9-2 Shelves

Review the guidelines and complete the steps below to install Calix E9-2 shelves horizontally into a standard Telco or Relay equipment rack.

Guidelines

- The shelf depth requires an equipment rack that can accommodate approximately 20-inches (front to rear) to allow for cabling in the front of the shelf and power, ground and other cabling on the rear of the shelf.
- Install E9-2 shelves with a minimum gap of 1/3RU (one-third RU; 15mm) between each shelf.

  Note: If you elect for the minimum allowed space between shelves, you must use a 1/3RU blank in-gap panel between the shelves to prevent back-leakage of exhaust air to the front of the shelf. The 1/3RU blank panel is a standard rack component available from Calix and other suppliers. No in-gap panel is required if you provide 1RU or more spacing between shelves.

- E9-2 shelves support flush mount only; projection mounting is not supported.
- Each shelf houses either two aggregation cards or two access line cards.
- You can interconnect up to eight access shelves to one aggregation shelf.
- Based on your desired rack configuration, Calix offers fan-out cables (required for inter-connecting access shelves to the aggregation shelf) in various lengths. For details, see *Required Items* (on page 28).

  CAUTION: Before installing the shelves, verify that your shelf interconnect link (ICL) cables (aka 'fan-out cables') will reach from the planned aggregation shelf location to each access shelf location. For guidance, see *Rack configuration guidelines* below.

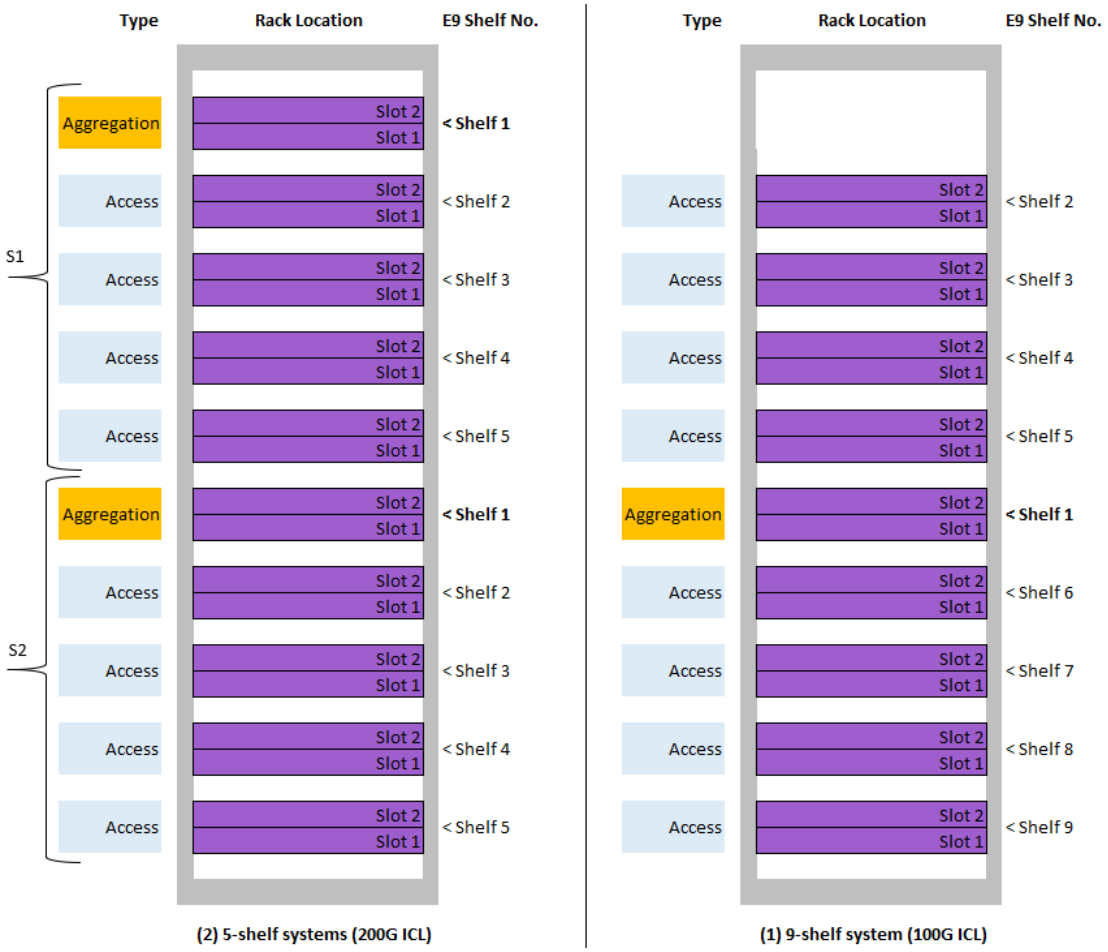
- The E9-2 shelves require cable management; you may provide your own cable management or use the cable management system provided by Calix (left- and right-side brackets).
- An ESD jack is located on the left side of each shelf; use one jack on any shelf in the equipment rack.

ESD ALERT! Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

Rack configuration guidelines for FTTx access applications

Before installing shelves in the rack, verify that your ICL fan-out cables will reach from the planned aggregation shelf location to each access shelf location. Consider the guidelines above, the number of access shelves, and the length of your ICL fan-out cables.

For example, if using 1-meter cables (shortest available length) and 1/3RU between shelves (minimum required), a maximum of four access shelves may be located above or below the aggregation shelf. Therefore, in a 9-shelf system, the aggregation shelf must be located in the center position (see example diagram to the right). In a 5-shelf system, the aggregation shelf may be located in the top or center position (see example diagram to the left).

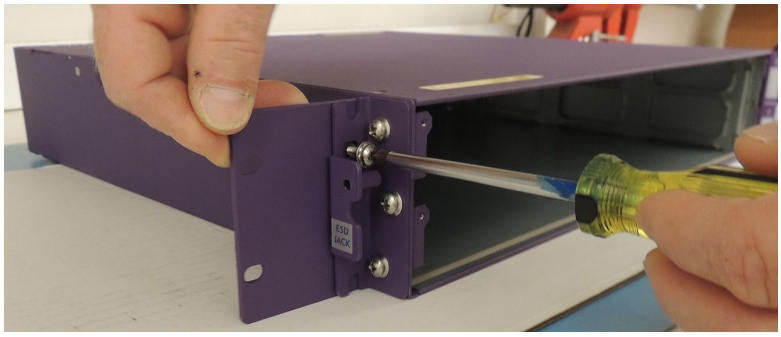


Complete the steps below to install Calix E9-2 shelves horizontally into a standard Telco or Relay equipment rack.

Note: 19-inch rack mounting ears ship attached to the shelf.

To install the E9-2 shelf (without Calix cable management and filter assembly)

1. Unpack the E9-2 chassis and installation kit from the shipping package.
2. Determine the rack configuration, including the mounting position for each shelf. Refer to the guidelines above for more information.
3. Verify the equipment rack width (19-inch or 23-inch).
4. (For 23-inch shelf) Attach the (2) bracket adapters to the rack mounting ears as follows:
   a. Locate (2) 10-32 screws and (2) press fit nuts from the installation kit.
   b. Position the bracket behind the rack mounting ear, aligning the mounting holes with the counterpart holes on the ears.
   c. Install the screws and nuts into secure in place, as shown below.
   d. Repeat steps 4a–4c for the second bracket adapter.

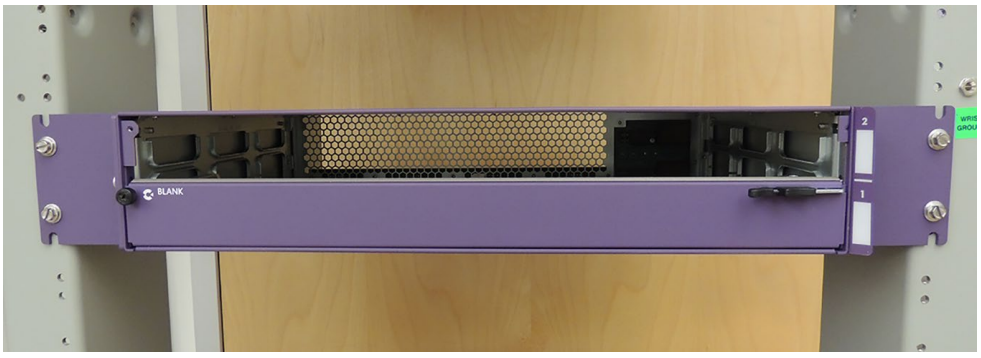


5. Mount the E9-2 shelf onto the equipment rack.
   a. Identify the mounting location.

Note: The mounting position must allow for up to four inches for cables protruding from the front of the chassis.

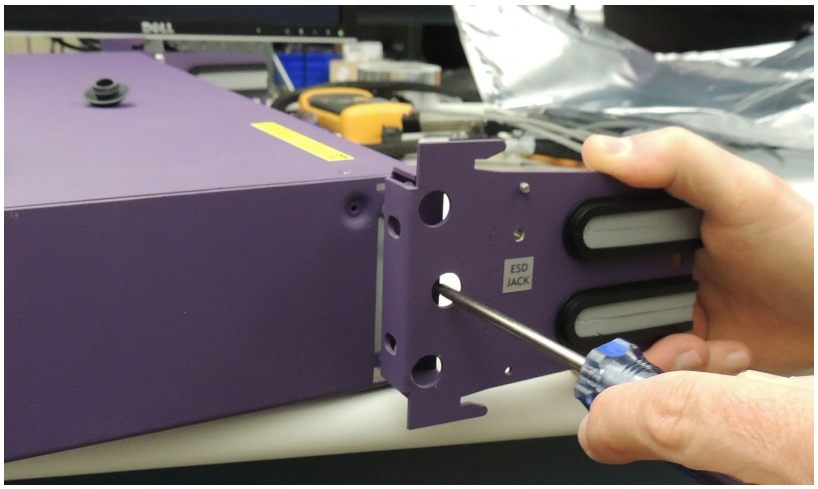
   b. Position the E9-2 chassis against the rack at the identified location, aligning its ear holes with the counterpart holes on the rack.
   c. Install (4) mounting screws to secure the unit in place.

   A 23-in rack mount is shown below.



To install the E9-2 shelf (with Calix cable management)

1. Unpack the E9-2 chassis and installation kit from the shipping package.
2. Determine the rack configuration, including the mounting position for each shelf. Refer to the guidelines above for more information.
3. Verify the equipment rack width (19-inch or 23-inch).
4. Attach the cable management brackets to the shelf as follows:
   a. Remove the rack mounting ears from the shelf, and set the (3) 10-32 screws aside.
   b. Position the bracket against the shelf, aligning its (3) mounting holes with the counterpart holes on the shelf.
   c. Insert a screwdriver through each bracket clearance hole to reinstall the (3) screws set aside in step 4a.



   d. Tighten the screws to secure the bracket to the shelf.
   e. (Required for air filter assembly use) Install (3) hole plugs into the bracket clearance holes.
   f. Repeat steps 4a–4e for the second bracket.
5. (For 23-inch shelf) Attach (2) bracket adapters to the cable management brackets as follows:
   a. Locate (2) 10-32 screws from the installation kit.
   b. Position the adapter bracket behind the cable management bracket, aligning the mounting holes.
   c. Install the screws to secure the bracket adapter in place.
   d. Repeat steps 5a–5c for the second bracket adapter.

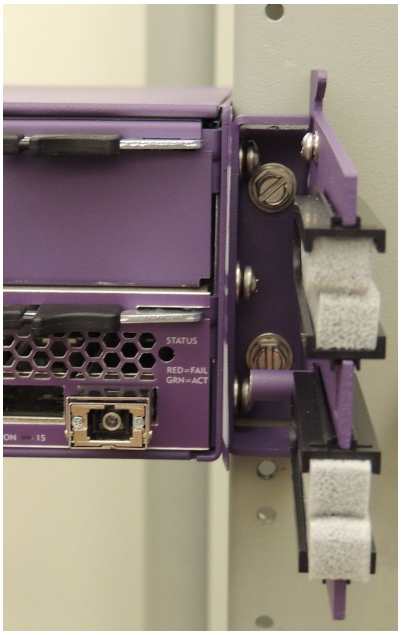
6. Mount the E9-2 shelf onto the equipment rack.

a. Identify the mounting location.

Note: The mounting position must allow for up to four inches for cables protruding from the front of the chassis, and up to five inches with the optional air filter assembly installed.

b. Position the E9-2 chassis against the rack at the identified location, aligning either the rack ear or adapter bracket holes with the counterpart holes on the rack.

c. Secure the E9-2 to the rack using (4) 12-24 mounting screws.

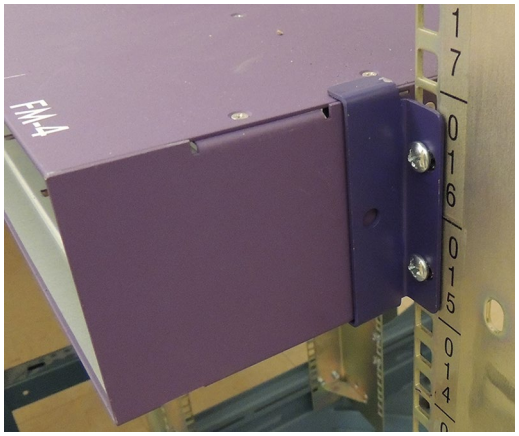


A 19-in rack mount is shown below.

To install the rear bracket shelf support (for non-Telco racks, as required)

This installation applies to racks equipped with adjustable rear mounting rails and where the front rail material is not strong enough to bear the weight of the shelf without sagging.

1. Position the bracket against the shelf, aligning its (2) mounting holes with the counterpart holes on the rack.
2. Install (2) mounting screws to secure the unit in place, as shown below.
3. Repeat steps 1–2 for the second bracket adapter.



Grounding the Chassis

The Calix E9-2 ground system can be connected to a Common Bonding Network (CBN) or Isolated Bonding Network (IBN).

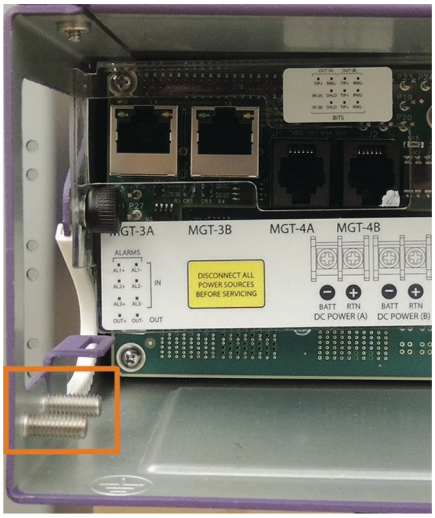
Note: For environments that employ an IBN scheme, the low voltage and frame grounds on the E9-2 chassis are isolated from the input power DC-return.

The installation kit includes a 4-foot (1.22 m) ground cable, plus hardware to attach it to the E9-2 frame ground.

ESD ALERT! Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

To ground the E9-2 chassis

1. Get the ground cable and supplied hardware (pair of 10-32 Keps nuts and washers) from the installation kit.
2. Connect the ground cable to the E9-2 chassis as follows:
   a. Locate the frame ground connection (lug 2-hole 0.20-inch diameter stud, 0.63-inch spacing) on the rear of the chassis.



   b. Install (2) star washers and then the ground cable's 2-hole lug onto the dual-post Frame Ground terminal (located on the rear of the chassis).
   c. Install (2) 10-32 Keps nuts onto the Frame Ground posts to secure the lug in place. Tighten to 27 in-lbs of torque.

3. Connect the chassis ground cable to the main ground system (preferred) or to the rack frame as follows:

   a. Route the ground cable to the grounding termination location. If the cable is too long, cut the cable to length and crimp on an appropriate lug. (A spare lug is included in the installation kit.)

   b. Connect the ground cable to the main ground system or rack frame per PANI guidelines.

   Note: When grounding to a rack frame, ensure that there is no paint or debris between the ground lug and the rack frame. To ensure a reliable ground bond, apply an anti-oxidant and use paint piercing star washers and thread forming screws to secure a metal-to-metal ground contact to the rack frame.

4. Power, ground, and alarm wiring at the rear of the E9-2 must be properly secured with strain relief.

Connecting Power to the Chassis

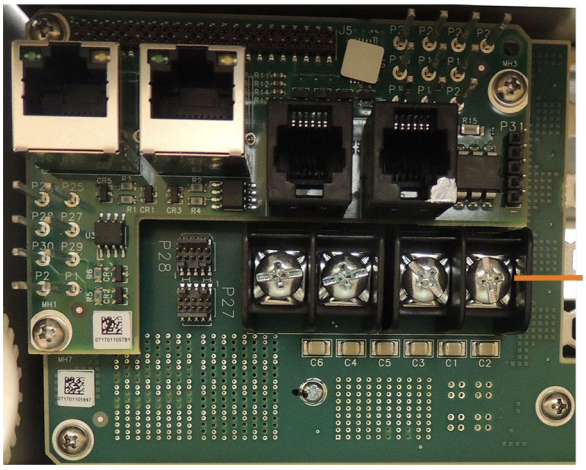
The Calix E9-2 requires -48 VDC input power. The installation kit includes two pairs of 10-foot (3.66-meter) 10 AWG DC power cables (A and B leads).

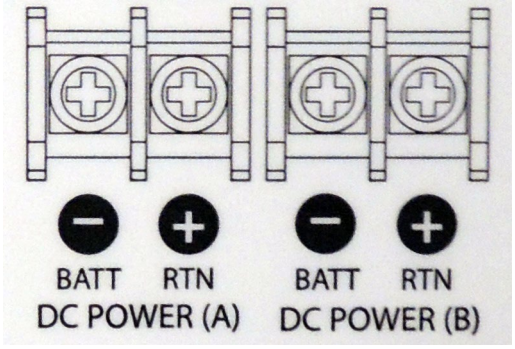
DANGER! Risk of electric shock. Only a qualified technician should perform this procedure

To connect DC power to the E9-2

Note: In environments that employ an IBN scheme, the E9-2 must be installed in an Isolated DC return (DC-I) configuration, where the DC return is not connected to the grounding system.

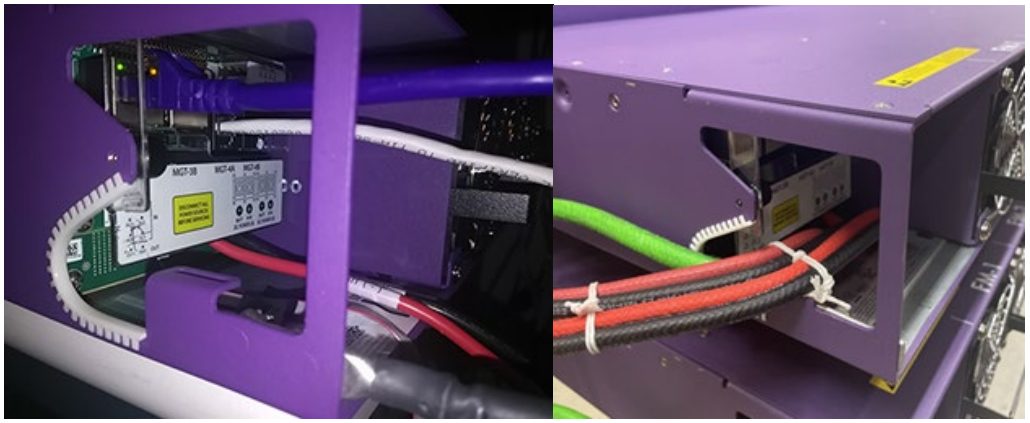
1. Get the DC power cable from the installation kit.
2. On E9-2 rear recessed panel, remove the protection cover to access the power inputs.





3. Connect the DC power cable to the E9-2 chassis as follows:
   a. Connect to the A-side power input:
      - Connect the black **(A) RTN** wire to the **(A)** + **RTN** terminal.
      - Connect the red **(A) BATT** wire to the **(A) - BATT** terminal.
   b. Connect to the B-side power input:
      - Connect the black **(B) RTN** wire to the **(B)** + **RTN** terminal.
      - Connect the red **(B) BATT** wire to the **(B) - BATT** terminal.
   c. Tighten the power termination screws to 9 in-lbs.
4. Make sure all wires exit cleanly to the bottom of the chassis.
5. Reinstall the protection cover, routing the power cable under the cover and out the bottom or side, as shown.

Note: If wiring external alarm and/or BITS timing interfaces, install the cover after wiring these interfaces.



6. Route the power cable to the local DC power source and connect it per local practice.

Note: User-supplied crimp connectors must be of appropriate size to connect to the DC power source terminals.

Installing the Fan Modules

Install the fan modules individually into the E9-2 chassis as described below.

Note: To avoid overheating the system, do not leave a powered E9-2 operating for more than a few minutes without at least three fan modules installed or for more than 90 seconds without fans.

- E9-2 chassis airflow is from front to back. Fan modules pull air from the front of the chassis and exhaust out the rear.
- The fan modules provide 3:1 redundancy and continue to operate with a single fan failure.
- The fans support three automatically adjustable speeds (cycles), controllable via software:
  - Fans operate at low duty cycle when the ambient temperature is below 25° C
  - Fan speed increases in gradual steps as the ambient temperature increases above 25° C to maintain acceptable temperature input readings from sensors on the cards
  - Fan speed reduces when the ambient temperature falls to a point where temperature measurements on the cards are reduced sufficiently to safely lower the fan speed

Note: The E9-2 fan control system defaults to high speed operation of the fans until the controlling software becomes operational, and when a communication failure occurs between the cards and fans.

To install E9-2 fan modules

1. Unpack the (4) fan modules.
2. From the rear of the E9-2, install the fan modules from the right side of the shelf to the left side as follows:
   a. Insert the fan module into the farthest-right available fan slot, aligning the module with the grooves on the bottom of the housing.

   b. Use the gripping bar to push the fan module all the way back into the slot. The unit seats once the connector engages and the retention tabs click in place.
3. Repeat steps 1–3 to install the remaining fan modules.
4. Power up the shelf to verify that all installed fans are functioning properly.

Installing E9-2 Cards

The Calix E9-2 shelf is equipped with two universal card slots. Install E9-2 aggregation and access line cards as described below.

Guidelines

- Before installing cards in a shelf, Calix recommends powering up the shelf to verify that all installed fans are functioning properly.
- The E9-2 shelf becomes and aggregation shelf or an access shelf once an aggregation card or access card is inserted into the chassis.
- Do not install *different* types of aggregation cards in the same shelf.
- **Do not install an aggregation card and an access line card in the same shelf.**
- An aggregation shelf must have at least one aggregation card, and typically has two cards: One in the role of the active aggregator and other in the standby role.
- An access shelf may have one or two line cards installed.
- An E9-2 *node* may include a mix of different access card types; and each access *shelf* may include a mix of different access card types. However, to reduce provisioning complexity and risk of human configuration error, Calix strongly encourages following these installation **best practices** for access cards:
    - Install only 'alike' access card types (even of different models) in each access shelf. For example, GP1611 and GP1612 are 'alike' as both are 2.5G PON (GPON) access cards that use 100G ICL connections to the aggregation shelf, and so can conveniently coexist in the same shelf.
    - Avoid installing different types of access card in the same shelf. For example, NG1601 and GP1612 cards are not alike in that the NG1601 is a 10G PON (XGS-PON or NG-PON2) access card that requires a 200G ICL connection to the aggregation shelf, whereas the GP1612 is a 2.5G PON (GPON) access card that uses a 100G ICL connection.
- For applications using only one E9-2 card, a 'blank' card (no circuitry) must occupy the other slot.

To install an E9-2 card

1. Unpack the E9-2 card from its packaging.
2. Install the E9-2 card into a vacant universal slot as follows:
   a. Orient the card with the ejector lever on the right.
   b. On the card faceplate, push the slider on the ejector lever to the left with your index finger to release the retention tab, and with your thumb pull the ejector lever into the open (unlocked) position.


   c. Insert the card into a vacant E9-2 card slot:
      - Slot 1 (bottom)
      - Slot 2 (top)
   d. Push the card completely into the slot until it engages the backplane. To ensure the card's contact pins mate with the backplane connectors, **press firmly against the lower left and right corners of the card simultaneously with your thumbs** (as shown) to fully seat the card.

   e. While continuing to apply firm pressure against the installed card, press the card ejector lever into the closed (locked) position.
   f. Tighten the thumb screw (located at the upper left) to secure the card in place.
3. Repeat the steps above to install a second card into the E9-2 shelf, as required. Otherwise, install a blank card into the vacant slot.

Note: Due to airflow control considerations, the E9-2 shelf should not be operated with a vacant slot. If you are using only a single E9-2 access card at this time, install a blank card into the other slot.

To install pluggable modules and to connect cables and fibers, see *Wiring the E9-2 Interfaces* (on page 47).

Chapter 4

Wiring the E9-2 Interfaces

This chapter describes how to wire out the Calix E9-2 interfaces, including management, service line, and alarm interfaces.

Topics Covered

This section covers the following topics:

- Connecting the E9-2 management interfaces
- Interconnecting E9-2 shelves (FTTx access applications only)
- Connecting the E9-2 line interfaces
- Wiring the E9-2 alarm interfaces
- Wiring the BITS timing interface
- Installing an air filter kit

Connecting the Management Interfaces

This section describes how to connect to the E9-2 rear Ethernet management ports and RS-232 serial port.

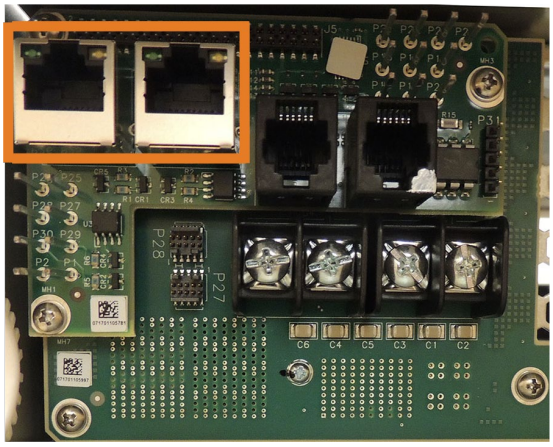
Connecting to the RJ-45 Ethernet Management Ports

The Calix E9-2 shelf is equipped with two 10/100/1000 Ethernet management ports with RJ-45 connectors located on the recessed rear panel (labeled **MGT-3A** and **MGT-3B**). Use the Ethernet ports for a fixed out-of-band management connection to the E9-2 active aggregation card via a standard 'straight-through' Ethernet patch cable or a cross-over cable.

Note: When you connect a disabled MGT port on the E9-2 to an Ethernet switch, the link status lights on the switch light up (yellow, and then green after 30 seconds). A link is established between the E9-2 and the switch, but the management interface on the E9-2 is not enabled and no traffic will pass over the link.

To connect to an Ethernet management port

1. Get a 'straight-through' Ethernet patch cable or a crossover cable with RJ-45 connectors on both ends.
2. Connect the cable to an E9-2 Ethernet management port, located on the rear panel.



Note: For card slot 1 (bottom), connect to the port labeled MGT-3A; for card slot 2 (top), connect to the port labeled MGT-3B.

3. Connect the cable's other end to the Ethernet port on your PC, or to a LAN Ethernet hub or switch.

For instructions to log in to the E9-2 management interface, refer to the *Calix AXOS Turn-Up and Transport Guide.*

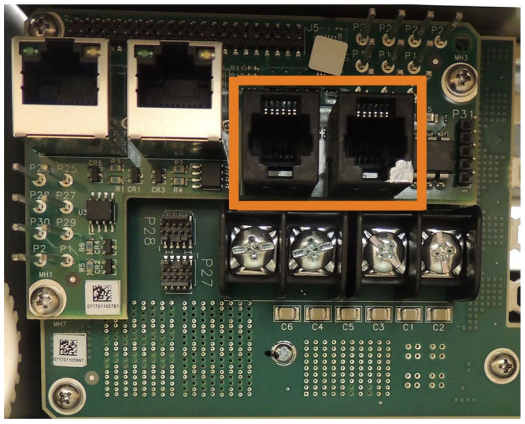
Connecting to a RS-232 Serial Port

The E9-2 has two RS-232 serial ports with RJ-11F connectors that you can connect to a PC for console management connections. The serial ports are located on the recessed rear panel (labeled **MGT-4A** and **MGT-4B**).

Note: Calix provides an optional RS-232 console cable, or you may supply your own cable with an RJ-11 male connector on one end and a DB-9 female connector on the other end. See *RS-232 Serial Port Pins* (on page 96) for more information.

To connect to a RS-232 serial port

1. Get an appropriate RS-232 console cable (DB-9F to RJ-11M) to connect to the E9-2.
2. Connect the cable's RJ-11 end to the E9-2 serial port (labeled **MGT-4B or MGT-4B**, located on the rear panel).



Note: For card slot 1 (bottom), connect to the port labeled MGT-4A; for card slot 2 (top), connect to the port labeled MGT-4B.

3. Connect the cable's DB-9 end to your PC.

Warning: When connecting the RJ-11 end of the console cable to the E9-2, do not leave the DB-9 end of the cable unterminated.

Use the following settings to establish a console connection from the serial port:

- Baud Rate - 115200
- Parity - None
- Stop Bits - 1
- Data Bits - 8
- Flow Control - None

For instructions to log in to the E9-2 management interface, see the *Calix AXOS Turn-Up and Transport Guide*.

Interconnecting E9-2 Shelves (FTTx Applications Only)

For L3/L2 FTTx access applications, a single E9-2 OLT system is comprised of at least two E9-2 shelves, with up to nine total shelves supported in a single node (one aggregation shelf, with up to eight xPON access shelves).

The cable(s) that interconnect the aggregation cards to access cards in other shelves have a custom CDFP connector on the aggregation card side, and N x 100 Gbps Ethernet cables which split out (or 'fan out') into four individual QSFP28 connectors on the access line card side. This shelf interconnect link (ICL) cable is called a CDFP–4x QSFP28 fan-out cable. Install fan-out cables to connect access shelves to the aggregation shelf as described below.

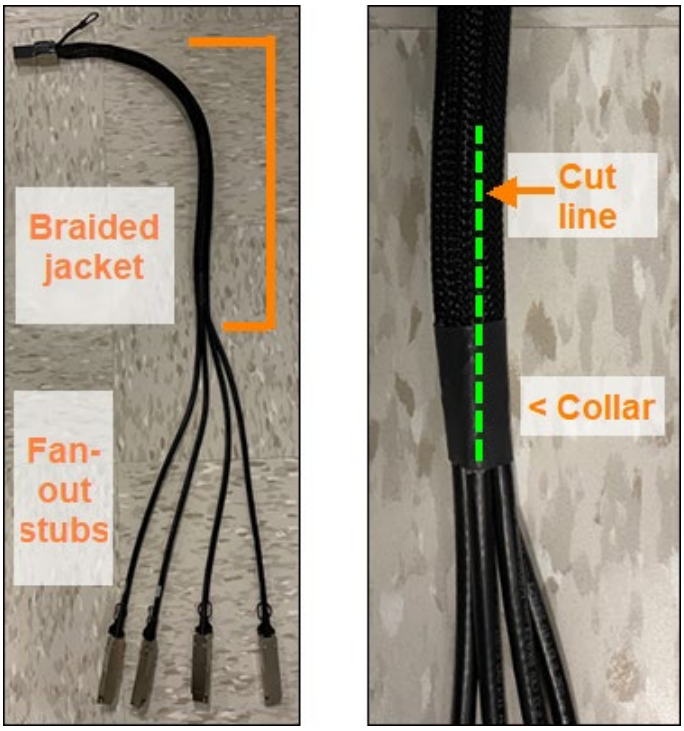
Guidelines

- Prerequisites:
  - Install E9-2 shelves in a rack according to *Installing E9-2 Shelves* (on page 34).
  - Verify that fan-out cables reach from the aggregation shelf location to each access shelf location. (For rack layout examples, see *Installing E9-2 Shelves* (on page 34) > *Rack configuration guidelines*.)
  - Install E9-2 cards into shelves before connecting the fan-out cables as described in this procedure.
- E9-2 OLT nodes support two primary configurations:
  - **200G ICL:** 10G PON access cards with total access port bandwidth capacity greater than 100 Gbps per card, typically use a 200 Gbps interconnect links (ICLs) connection to the aggregation shelf. However, the E9-2 supports a flexible cabling scheme, so this approach is not required. When using 200G ICLs, an E9-2 node supports a **maximum of five total shelves**, consisting of one aggregation shelf and up to four 10G PON access shelves. (The 200G ICL node configuration may be referred to as a '5-shelf' configuration, even though the node may consist of fewer than five shelves.)
  - **100G ICL:** GPON access cards which have total access port bandwidth capacity less than 100 Gbps per card, typically use a 100 Gbps interconnect links (ICLs) connection to the aggregation shelf. However, you can use the 100G ICL scheme with any access shelf/any PON access card. When using 100G ICLs, an E9-2 node supports a **maximum of nine total shelves**, consisting of one aggregation shelf and up to eight PON access shelves. (The 100G ICL node configuration may be referred to as a '9-shelf' configuration, even though the node may consist of fewer than nine shelves.)

- Mixing access shelves with 200G and 100G ICLs within the same OLT is supported.
- Per access shelf, both cards must be wired for the same type of ICL (200G or 100G).
  - Cards with 2 Q ports (Q1 and Q2) can be wired for 100G ICLs.
  - Cards with 4 Q ports (Q1, Q2, Q3, Q4) can be wired for 200G or 100G ICLs

  Note: If such cards (e.g., XG3201s) are wired for 100G ICLs, ports Q3 and Q4 will be unused.
- The aggregation card is equipped with four CDFP connectors to terminate ICLs, each consisting of four 100GE ports to support a total of 16 x 100GE ports for access line card connectivity.
- Each CDFP connector on the aggregation card provides connectivity to either two access cards via 200G ICLs, or four access cards via 100G ICLs. For example, each CDFP connects to two NG1601 access cards or four GP1612 access cards.
- Access cards have four or two QSFP uplink connectors, each providing one 100GE port.
  - XG3201: Two pairs of QSFP ports on each access card connect to two aggregation cards, providing 200 Gbps of redundant uplink capacity.
  - NG1601: Two pairs of QSFP ports on each access card connect to two aggregation cards, providing 200 Gbps of redundant uplink capacity.
  - GP1611: Two pairs of QSFP ports on each access card connect to two aggregation cards, providing 200 Gbps of redundant uplink capacity.
  - GP1612: One pair of QSFP ports on each access card connect to two aggregation cards, providing 100 Gbps of redundant uplink capacity.

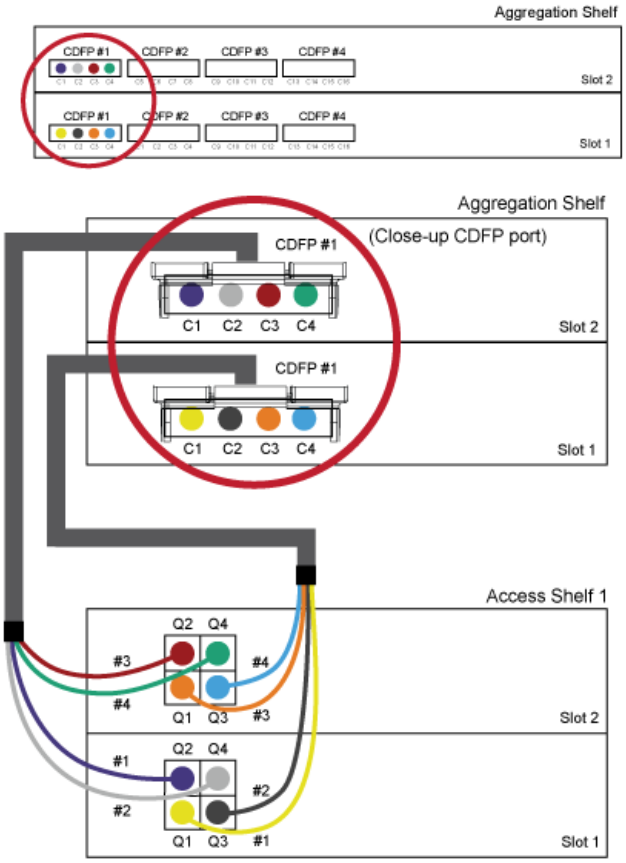
- If the cable's braided outer jacket runs long and restricts the fan-out stubs from reaching two different access shelves (100G ICL configurations), you can cut back the jacket's collar to expose additional length for the stubs. Use scissors or a box cutter to cut a slit in the collar end of the jacket to required length, as shown (3 to 6 inches as needed).



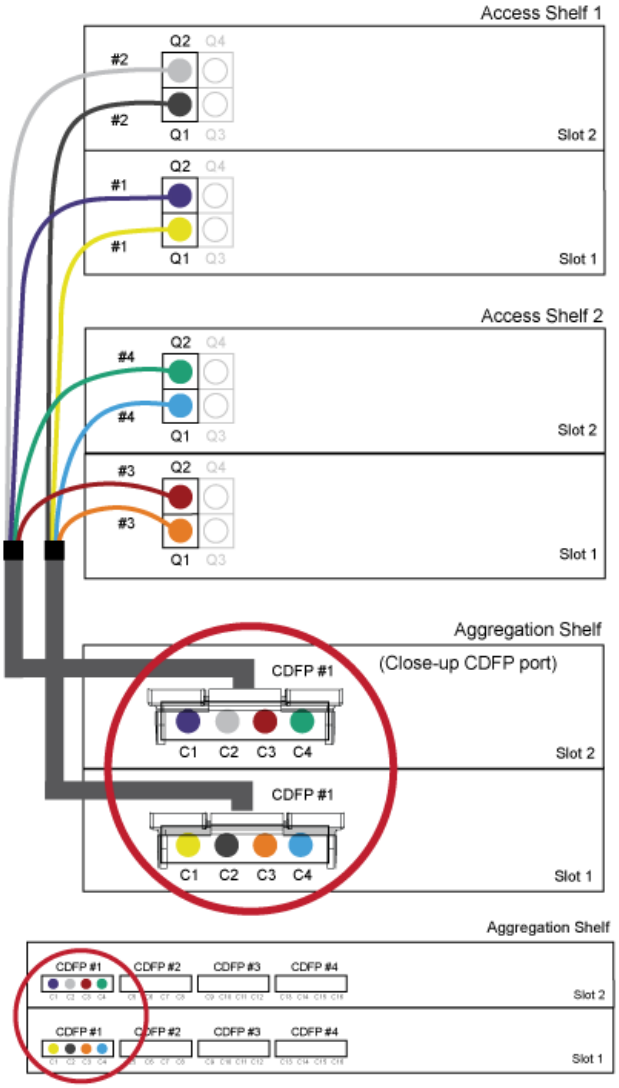
- Fan-out cables require cable management; the installation kit includes left- and right-side brackets for cable management, or you can provide the cable management.
- When cabling the system, it is imperative to maintain the cable manufacturer's recommended bend radius to ensure accurate signal integrity.

The illustrations below show how access shelves connect to the aggregation shelf for both 200G ICL (max 5-shelf) and 100G ICL (max 9-shelf) node configurations. Each C-QSFP port on each aggregation card (slot 1 and slot 2) connects to up to four QSFP28 ports on the access line cards via a fan-out cable. This pattern is repeated to connect the access line cards in additional E9-2 access shelves (as needed) to form a larger multi-shelf system.

200G ICL pattern (5-shelf configuration)



100G ICL pattern (9-shelf configuration)

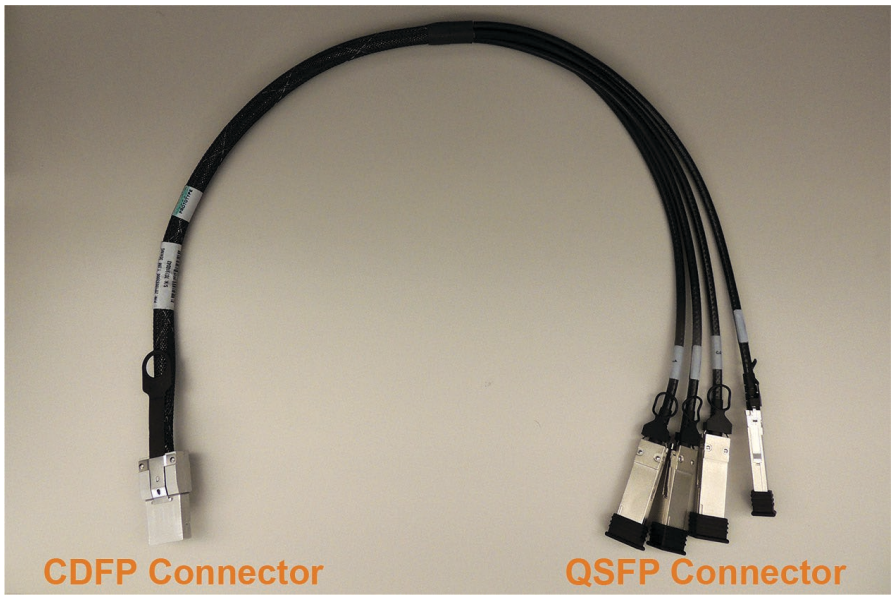


For illustrations of how each access shelf (200G ICL) or pair of access shelves (100G ICL) connects to the E9-2 aggregation shelf, please refer to the appendix topic *E9-2 Access Shelf Interconnection Diagrams* (on page 76).

To interconnect E9-2 shelves

Note: If using the optional air filter kit, *install* (on page 68) the air filter brackets and cable seals *before* installing the fan-out cables.

1. Locate a CDFP–4x QSFP28 fan-out cable.



2. Determine the number of CDFP ports required for your installation (to be utilized from left to right), and make note of the right-most required port. For example, for three 10G PON access shelves, only the first three CDFP ports on the aggregation shelf will be used, with the third CDFP port being the right-most required port.

Note: The required CDFP ports should be utilized starting from the left, but connected for cabling starting from the right.

3. At the aggregation shelf, do the following:
   a. Insert the first CDFP connector into the right-most required CDFP port (labeled C-QSFP) on the aggregation card (slot 2 shown below).
   b. Pull back on the hand-grip ring with one hand while pressing the connector firmly into the port with your other hand until it clicks into place.

c. Route the cable through the cable seal on the left cable management bracket, if present.

d. If required, insert the next CDFP connector into the next available CDFP port (working from right to left), click into place as described in step 3b, and route under the previous cable as shown. Repeat until all required cables have been connected.

4. For the second aggregation shelf, repeat steps 3a–3d.

5. On the other end of each cable, locate the fan-out cables labeled **1**–**4** and remove the cap from each QSFP connector.

6. Connect the fan-out cables from the slot 1 aggregation card to the access cards:

Caution: Inserting a fan-out cable into the wrong QSFP port (Q1-4) on an access card will result in a system malfunction. Be sure to follow the instructions below carefully.

- **For 200G interconnection links (for 10G PON access cards):** At the first access shelf, connect the fan-out cables from left most available CDFP to QSFP-28 cable (C1-C4) connected to the aggregation card in slot 1 as follows:
  - Route fan-out cable ends 1 and 2 to the access card in slot 1, and insert the connectors into QSFP ports labeled Q1 and Q3, respectively.
  - Route fan-out cable ends 3 and 4 to the access card in slot 2, and insert the connectors into QSFP ports labeled Q1 and Q3, respectively.
- **For 100G interconnection links (for GPON access cards):** At the first and second access shelves, connect the fan-out cables from left most available CDFP to QSFP-28 cable (C1-C4) connected to the aggregation card in slot 1 as follows:
  - Route fan-out cable ends 1 and 2 to access shelf 1. Insert the cable 1 connector into QSFP port labeled Q1 on the slot 1 access card, and insert the cable 2 connector into QSFP port labeled Q1 on the slot 2 access card.
  - Route fan-out cable ends 3 and 4 to access shelf 2. Insert the cable 3 connector into QSFP port labeled Q1 on the slot 1 access card, and insert the cable 4 connector into QSFP port labeled Q1 on the slot 2 access card.

- Press each connector firmly into its port until it clicks into place (NG1601 card shown below).

- Route the cables through the cable seal on the left cable management bracket, if present.

7. Connect the fan-out cables from the slot 2 aggregation card to the access cards:

Caution: Inserting a fan-out cable into the wrong QSFP port (Q1-4) on an access card will result in a system malfunction. Be sure to follow the instructions below carefully.

- **For 200G interconnection links (for 10G PON access cards)** At the first access shelf, connect the fan-out cables from left most available CDFP to QSFP-28 cable (C1-C4) connected to the aggregation card in slot 2 as follows:
  - Route fan-out cable ends 1 and 2 to the access line card in slot 1, and insert the connectors into QSFP ports labeled Q2 and Q4, respectively.
  - Route fan-out cable ends 3 and 4 to the access line card in slot 2, and insert the connectors into QSFP ports labeled Q2 and Q4, respectively.
- **For 100G interconnection links (for GPON access cards)** At the first and second access shelves, connect the fan-out cables from left most available CDFP to QSFP-28 cable (C1-C4) connected to the aggregation card in slot 2 as follows:
  - Route fan-out cable ends 1 and 2 to access shelf 1. Insert the cable 1 connector into QSFP port labeled Q2 on the slot 1 access card, and insert the cable 2 connector into QSFP port labeled Q2 on the slot 2 access card.
  - Route fan-out cable ends 3 and 4 to access shelf 2. Insert the cable 3 connector into QSFP port labeled Q2 on the slot 1 access card, and insert the cable 4 connector into QSFP port labeled Q2 on the slot 2 access card.
- Press each connector firmly into its port until it clicks into place.
- Route cables through the cable seal on the left cable management bracket, if present.
- Remove and trim the cable seal foam as needed to accommodate the fan out cables.

8. For additional access shelves repeat steps 6–7; the next CDFP connectors (moving left to right) connect to the second access shelf, and so on.

   If you are installing an air filter assembly, skip step 8 and go to *Installing the Air Filter Assembly* (on page 68) (step 5).

9. Neatly dress and secure all cables per local practice.

Note: To confirm that the interconnection links are working properly, refer to the *AXOS Monitoring, Maintenance, and Troubleshooting Guide > Checking E9-2 Node Inter-Chassis Links.*

Connecting the E9-2 Card Interfaces

This section describes how to connect the Calix E9-2 card interfaces to the network.

Installing Pluggable Transceiver Modules

Install pluggable transceiver modules into the E9-2 aggregation and access cards to equip the sockets for optical interface connections.

To install pluggable transceiver modules

1. Unpack the pluggable module. Remove the dust cover from the transceiver interface, if present.
2. Orient the module with the exposed PCB side facing down. Insert the module into an appropriate socket as follows:

   Aggregation cards

   - To equip QSFP-DD sockets, insert QSFP-DD modules into sockets labeled **QSFP-DD 1** to **4** and **QSFP-DD 5** to **8**, as required. (ASM)
   - To equip QSFP+ sockets, insert QSFP+ modules into sockets labeled **QSFP 1** and **QSFP 2**, as required. (CLX)
   - To equip SFP+ sockets, insert SFP+ or SFP modules into sockets labeled **SFP+ 1** to **SFP+ 32** (ASM) or **SFP+ 1** to **SFP+ 8** (CLX), as required.
   - To equip SFP sockets, insert SFP modules into sockets labeled **SFP 1** and **SFP 2**, as required. (CLX)

   Access cards

   - To equip QSFP-28 sockets, insert QSFP+ modules (from ICL cables) into sockets labeled **QSFP 1** and **QSFP 2**, as required. Refer to the *access shelf interconnection diagrams* (on page 76) for proper link/port mapping from the Agg shelf.
     - For cards with four QSFP ports present (for 200G ICL connections), insert additional QSFP+ modules into sockets labeled **QSFP 3** and **QSFP 4**, as required.

- To equip XFP sockets PON ports, insert appropriate PON optics modules into the port sockets as follows:
  - To equip SFP+ port sockets, insert SFP+ optics modules (XGS-PON, double-density XGS-PON, Multi-PON, or GPON) into sockets labeled PON 1-2 to PON 31-32, as required.
  - To equip XFP port sockets, insert XFP optics modules (XGS-PON or NG-PON2) into sockets labeled PON 1 to PON 16, as required.
  - To equip SFP port sockets, insert SFP optics modules (GPON) into sockets labeled PON 1 to PON 16, as required.

3. Press the module firmly into the socket until it clicks into place.

Once the module is installed, you can connect interface cables (fibers) to it. For the line card, see *Connecting Fibers* (on page 60) for instructions.

Connecting Fibers

Once the E9-2 line card sockets are equipped with pluggable transceiver modules, you can connect fibers/cables to the ports as described below.

Guidelines

- Be sure the fiber connector type matches the connector type of the module(s).
- Avoid tight bend radius for fibers and provide adequate strain relief.
- Do not route fiber above or below the shelf.
- Fibers connected to the card installed the top slot must follow the card, and exit the top cable air seal in the bracket; fibers connected to the card installed the bottom slot must follow the card, and exit the cable air seal in bottom of the bracket.
- Dress and secure fiber jumpers using velcro straps or other soft-tie method designed for fiber. Avoid using plastic cable ties, which can damage a fiber.
- If the laser at the far end of the fibers is enabled, you can use an optical power meter to test signal strength before connecting fibers to the equipment. Defer to local practice wherever applicable.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

To connect fibers to the E9-2

1. Route fibers to the E9-2 shelf, approaching from right side.
2. Remove the caps or plugs from the fiber connector ends, if present.
3. Connect fibers to transceiver modules on the E9-2 line card.
4. Repeat the steps above to connect additional fiber links, as required.
5. Route the fibers through the cable seal on the right cable management bracket, if present.

   If you are installing an air filter assembly, go to *Installing the Air Filter Assembly* (on page 68) (step 5).
6. Neatly dress and secure all fibers/cables per local practice.

   Note: To avoid pinching or interference with the equipment, neatly coil or bundle any slack fiber and dress it toward the right side of the E9-2 shelf.

For best practices, confirm that all fiber cables that route out to the ODN are properly grounded.

To ground OSP fiber cables

1. At the cut end of the OSP cable sheath, twist the cable's metal strength members together into a single strand.
2. Install a lug connector on the twisted end of the strength members.

   Note: Calix recommends using a two-hole lug connector where possible.
3. Install a #6 AWG bond strap onto the lug connector, together with the twisted strength members, and tighten the lug connector.
4. Terminate the other end of the bond strap to the ground bar per local practice.

Installing Direct Attach Cables for Uplink / Trunk Connections

If neighboring equipment (e.g., router or switch) to connect to is physically located near the E9-2 system (three meters or less), you can use copper direct attach cables instead of fiber links to provide the uplink or aggregation trunk connections.

For 100GE+ uplink connections, install direct attach cables (DAC) with QSFP connectors into the aggregation card's QSFP-DD or QSFP+ port sockets to equip those ports for uplink/trunk connections. For 10GE (or lower) trunk connections, install DACs with SFP+ connectors into the SFP+ or SFP port sockets to equip those ports for trunk connections.

Guidelines

- Be sure the DAC connector type matches the connector type of the port socket.
- Avoid tight bend radius for cables and provide adequate strain relief.
- Cables connected to the card in slot 2 (top) must exit the cable air seal in the top of the bracket; cables connected to the card in slot 1 (bottom) must exit the cable air seal in the bottom of the bracket.
- Dress and secure cables using velcro straps or other soft-tie method.

To install direct attach cables (uplink connections)

1. Get the QSFP-DD or QSFP+ direct attach cable.
2. Install the direct attach cable to provide the aggregation card's uplink connection:
   a. Insert the cable's first QSFP connector into a QSFP-DD or QSFP+ port socket on the aggregation card.
   b. Pull back on the handgrip ring with one hand while pressing the connector firmly into the port socket with your other hand until it clicks into place. **Important!** The latch 'click' must occur to indicate a properly mated connection.
   c. Route the cable through the comb on the left cable management bracket, if present.

3. Connect the far end of the cable to the upstream equipment (router or switch).
4. Repeat steps 1–3 to cable out additional uplink ports.
5. Neatly dress and secure all cables per local practice.

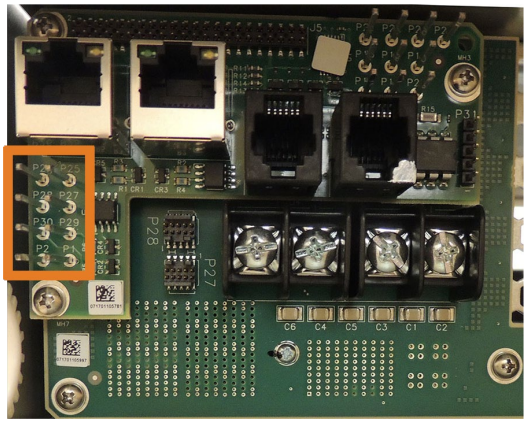
To install direct attach cables (aggregation / trunk connections)

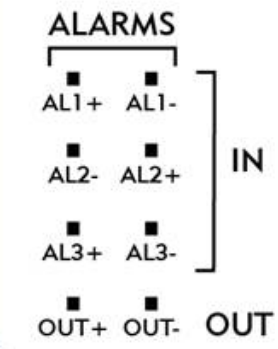
1. Get an SFP+ direct attach cable.
2. Insert the direct attach cable's SFP+ connector into an SFP+ port socket on the aggregation card.
3. Route the cable through the cable comb on the nearest (left or right side) cable management bracket, if present.
4. Connect the far end of the cable to the neighboring equipment.
5. Repeat steps 1–3 to cable out additional trunk ports, as needed.
6. Neatly dress and secure all cables per local practice.

Wiring External Alarm Interfaces

Wire the E9-2 audible and visual alarms to a Central Office alarm system as described below.

There are three pairs of wire-wrap pins for input alarms (critical, major, minor) and one pair for output alarms, located on the E9-2 rear recessed panel.





The E9-2 is only for Central Office applications, and does not process input alarms normally used for OSP environmental alarm inputs.

The E9-2 alarm contacts are normally open (default). The circuit closes when an alarm condition occurs.

To wire external alarms

1. Get three 26 AWG minimum (19 AWG maximum) wire pairs of sufficient length to reach the far-end contacts from the E9-2.
2. At the E9-2 end, strip approximately one inch (2.54 cm) of insulation from the alarm wire ends to connect to the unit.
3. Route and dress the wire pairs – one pair each for the major, minor, and critical alarms – from the E9-2 rear panel to the office alarm system.
4. If needed, reinstall the protection cover, routing the wires under the cover and out the bottom.

   Note: If wiring BITS timing interfaces, install the cover after wiring these interfaces.

5. Route and dress the alarm wires out to the appropriate far-end interfaces and connect per local practice.

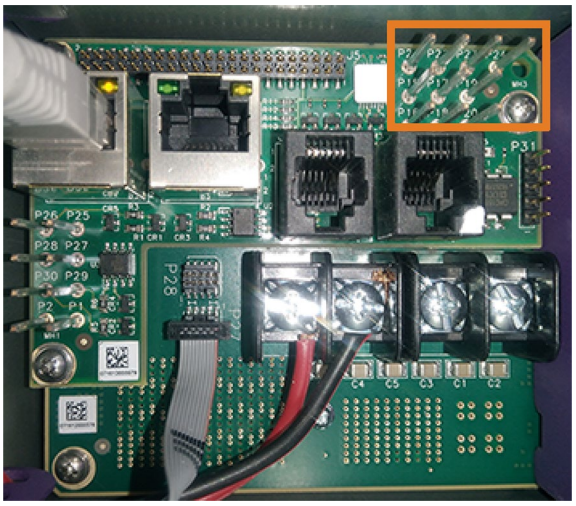
Refer to the *AXOS Monitoring, Maintenance, and Troubleshooting Guide* for supported alarms and alarm provisioning information.

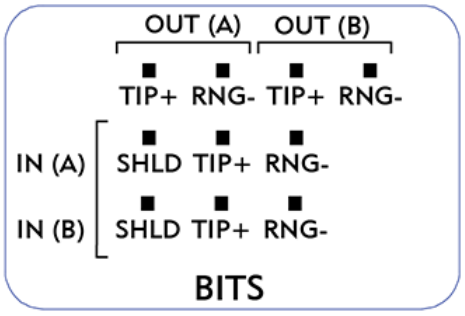
Wiring the BITS Timing Interface

The E9-2 aggregation shelf supports synchronization to a local traceable network clock source via two timing inputs located on the recessed rear panel. Redundant input connections (A and B) connect to a BITS clock source.

BITS A and B are routed via the E9-2 backplane to aggregation card slots 1 and 2, respectively. For FTTx applications, timing is distributed from the aggregation shelf to the access shelves via the CDFP–4x QSFP28 fan out cables, synchronizing the access card PON interfaces to a reference clock.

Note: BITS outputs and daisy chaining of E9-2 shelves is not supported.





Backplane pin designations for the BITS timing inputs are listed in the table below.

	OUT (A)		OUT (B)	
	TIP+ (P21)	RNG- (P22)	TIP+ (P23)	RNG- (P24)
IN (A)	SHLD (P15)	TIP+ (P17)	RNG- (P19)	
IN (B)	SHLD (P16)	TIP+ (P18)	RNG- (P20)	

To wire the BITS timing input interface

1. Get up to two 24 AWG shielded 2-wire cables of sufficient length to reach the local BITS clock interface from the E9-2. Use one cable to provide a single timing input (A only), or two cables for a redundant input (A + B).
2. Strip approximately one inch (2.54 cm) of insulation from the wire ends.
3. At the E9-2 aggregation shelf, wire the external timing input(s) as follows:
   a. Connect the timing wires to the E9-2 BITS **IN (A)** input position:
      - Wrap the positive (tip) wire to the **TIP+** pin.
      - Wrap the negative (ring) wire to the **RNG-** pin.
      - Wrap the cable shielding to the **SHLD** pin.
   b. To provide a redundant connection to the BITS clock source, repeat Step 3a to wire the E9-2 BITS **IN (B)** input position, as required.
4. If needed, reinstall the protection cover, routing the wires under the cover and out the bottom.
5. Route and dress the timing input cable to the local BITS clock interface and connect per local practice.

Installing the Air Filter Assembly

The E9-2 shelf supports an optional field installed air filter assembly for use in indoor environments. Install the cable management mounting brackets before installing the air filter assembly.

Note: E9-2 systems that are installed in environments that comply with ISO 14644-1 Class 8 standards (accomplished through use of facility MERV-13 level air filtration or equivalent) do not require use of the Calix air filtration assembly. For other non-qualifying indoor environments, Calix strongly recommends using the air filtration assembly to protect the E9-2 electronics from airborne contaminants.

To install the air filter assembly

Note: The removable air filter frame ships installed in the air filter cover.

1. *Install the fan out interconnect cables* (on page 50) and *fibers* (on page 59).
2. Install the air filter assembly as follows:
   a. Hold the cover in front of the E9-2 shelf, with the E9-2 label on the left and the Calix label on the right.
   b. Align the cover with the top and bottom of each bracket, so that the edge of the cover wraps over each bracket.
   c. Slide the cover over the brackets until it snaps in place.

3. Dress the cable.

Chapter 5

Maintenance

This chapter describes how to perform routine maintenance on worn or failed E9-2 equipment.

Topics Covered

This chapter covers the following topics:

- Replacing pluggable transceiver modules on E9-2 cards
- Replacing an E9-2 card
- Replacing the fan module

Replacing Pluggable Transceiver Modules

Use the following procedure to replace a damaged or failed pluggable transceiver module.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

To replace a pluggable transceiver module

1. Disconnect the fiber(s) from the module to replace, if present.
2. Remove the pluggable module from the E9-2 card as follows:
   a. Unlock the latch on the module, if so equipped (latch styles vary).
   b. Gently pull the latch to unseat the module.
   c. Carefully slide the module out of the socket and set it aside.
3. Insert a replacement module into the vacant socket and re-connect fibers. See *Connecting the E9-2 Line Interfaces* (on page 59) for detailed instructions.

Replacing a Line Card

Use the following procedure to replace a damaged or failed E9-2 aggregation or access card.

ESD ALERT! Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

To replace an E9-2 card

1. Disconnect all line interface cables (fibers) from the card to replace, if applicable.
2. To disconnect the Direct Attach cable from the card, uninstall the connectors as follows:
   a. Pull on the tab to release the connector (an aggregation card is shown below).

   b. Slide the connector out of the port.
3. If the replacement card will reuse modules from the replaced card, remove all pluggable modules from the card.

4. Remove the card from the E9-2 shelf as follows:
   a. Loosen the thumb screw located on the upper left side of the card.
   b. On the card faceplate, push the slider on the ejector lever to the left with your index finger to release the retention tab, and with your thumb pull the ejector lever into the open (unlocked) position.


   c. On the card faceplate, pull the ejector lever open into the unlocked position to unseat the card.
   d. Carefully slide the card out of the slot and place it in protective packaging. Return the faulty unit to Calix.
5. Insert a replacement card into the vacant slot. See *Installing E9-2 Cards* (on page 45) for detailed instructions.

Note: If you are not installing a replacement card, or no replacement card is available, install a blank card into the vacant slot.

6. Install pluggable modules into the card and connect cables and fibers as required. See *Wiring the E9-2 Interfaces* (on page 47) for detailed instructions.

Replacing a Fan Module

Calix E9-2 fan modules are hot-swappable, so you can remove and install the fan module while the system remains powered.

CAUTION: Fans serving a powered E9-2 shelf should only be removed one at a time when necessary for service; shelf thermal parameters are against minimum of three operating fans.

Use the following procedure to replace a damaged or failed fan module. Return the faulty unit to Calix.

To replace the fan module

1. Lift the gripping bar to release the fan module retention tabs, and then pull forward to unseat the module and remove it from the E9-2 fan slot.
2. Install the new fan module as follows:
   a. Insert the fan module into the vacant slot, aligning the module with the grooves on the bottom of the housing.
   b. Use the gripping bar to push the fan module all the way back into the slot. The unit seats once the connector engages and the retention tabs click into place.

Air Filter Maintenance

The E9-2 air filter assembly includes one filter.

The filter is made of Quadrafoam, which is an open cell polyurethane foam media that can be carefully cleaned one time before filter replacement is required.

Note: The filter media can tear during installation or cleaning. Be sure to visually inspect filters for tears and punctures.

Filter cleaning and replacement intervals depend on the environment.

- For new deployments, Calix recommends conducting a visual inspection of the filter every three months.
  - If the filter is clogged with dust or dirt, the filter must be cleaned or replaced.
  - If the filter material is damaged, badly worn, or cannot be cleaned, the filter should be replaced.

Replacement Guidelines

- Replace the filter after six months in operations under harsh conditions.
- Replace the filter after one year in operation (maximum) under normal conditions.
- Replace the filter during the next maintenance cycle if it was cleaned during the previous maintenance cycle.

Cleaning Guidelines

- The filter can only be cleaned one time before replacement is required.
- Use low pressure compressed air (30PSI - 80PSI) to clean the filter as the filter can be damaged by high PSI compressed air.

To clean the filter

1. Carefully remove the air filter frame from the assembly as follows:
   a. Firmly grasp the handles on the sides of the frame.
   b. Pull forward to remove the frame from the assembly.
2. Carefully remove the filter from the frame.
3. Clean the filter using **low** pressure compressed air (30PSI - 80PSI) to spray the filter to remove loose dust particles from the surface.
4. Reinstall the filter into the frame, and then install the frame on the air filter assembly.

Appendix A

Appendix

This appendix provides general reference information about the Calix E9-2 system.

Topics Covered

This appendix covers the following topics:

- E9-2 access shelf interconnection diagrams
- E9-2 port mappings
- E9-2 LED behavior
- RS-232 serial port pin assignments
- E9-2 specifications
- Fiber handling techniques

E9-2 Access Shelf Interconnection Diagrams

For FTTx access applications, connect E9-2 access shelves to the aggregation/control shelf via interconnect links (ICLs) using direct attach fan-out cables.

This section illustrates how each E9-2 access shelf connects to the aggregation shelf using the 1xCDFP-to-4xQSFP28 fan-out cable. The E9-2 supports a 200G ICL cabling scheme for 10G PON access shelves (maximum 5-shelf configuration per node: one aggregation shelf, plus up to four access shelves) and a 100G ICL cabling scheme for GPON access shelves (maximum 9-shelf configuration per node: one aggregation shelf, plus up to eight access shelves).

Although less common, the E9-2 supports a mix of 10G PON and GPON access shelves in the same system, requiring a mix of 200G ICL and 100G ICL cabling between the aggregation shelf and the PON access shelves. All supported shelf interconnection schemes are illustrated below:

- 200G ICL scheme on a maximum 5-shelf system
- 100G ICL scheme on a maximum 9-shelf system
- Example mixed 200G + 100G ICL scheme on a 2-shelf system (one access shelf) with:
  - (1) 10G PON card (slot 2/1)
  - (1) GPON card (slot 2/2)
- Example mixed 200G + 100G ICL scheme on a 3-shelf system (two access shelves) with:
  - (2) GPON cards (slots 2/1, 2/2)
  - (2) 10G PON cards (slots 3/1, 3/2)

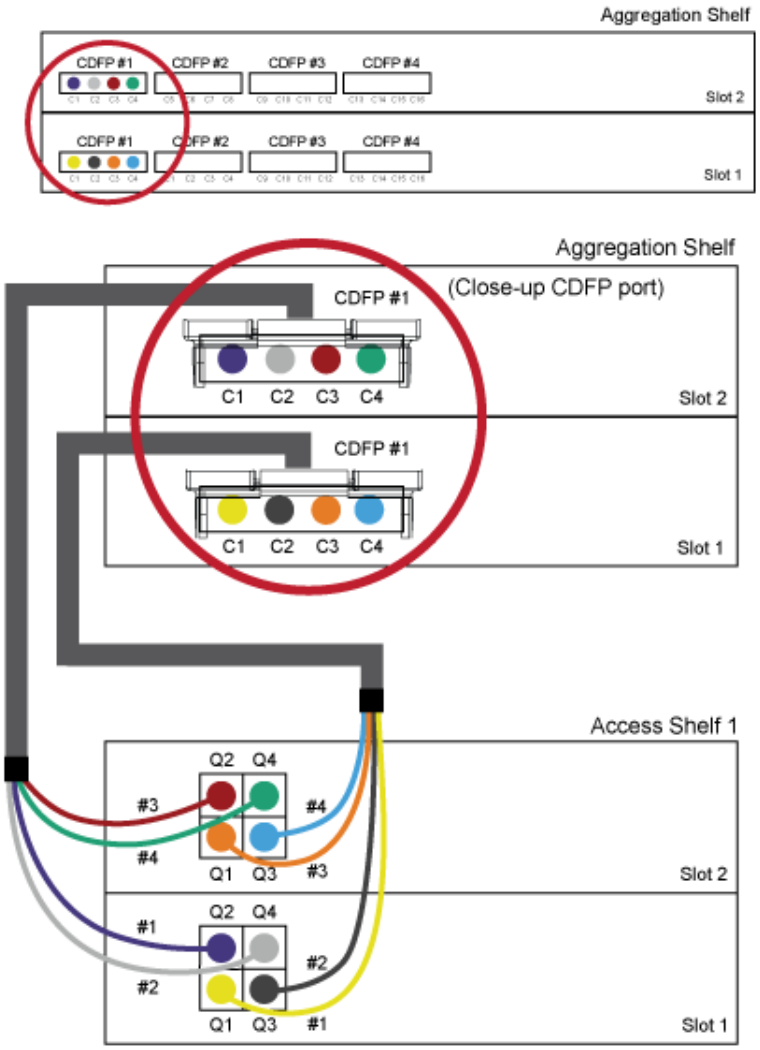
200G ICL Scheme for 10G PON Access

The following diagrams illustrate how to connect 10G PON access cards to CLX aggregation cards using the 1xCDFP-to-4xQSFP28 fan-out cables in a 200 Gbps interconnect link (ICL) cabling scheme.

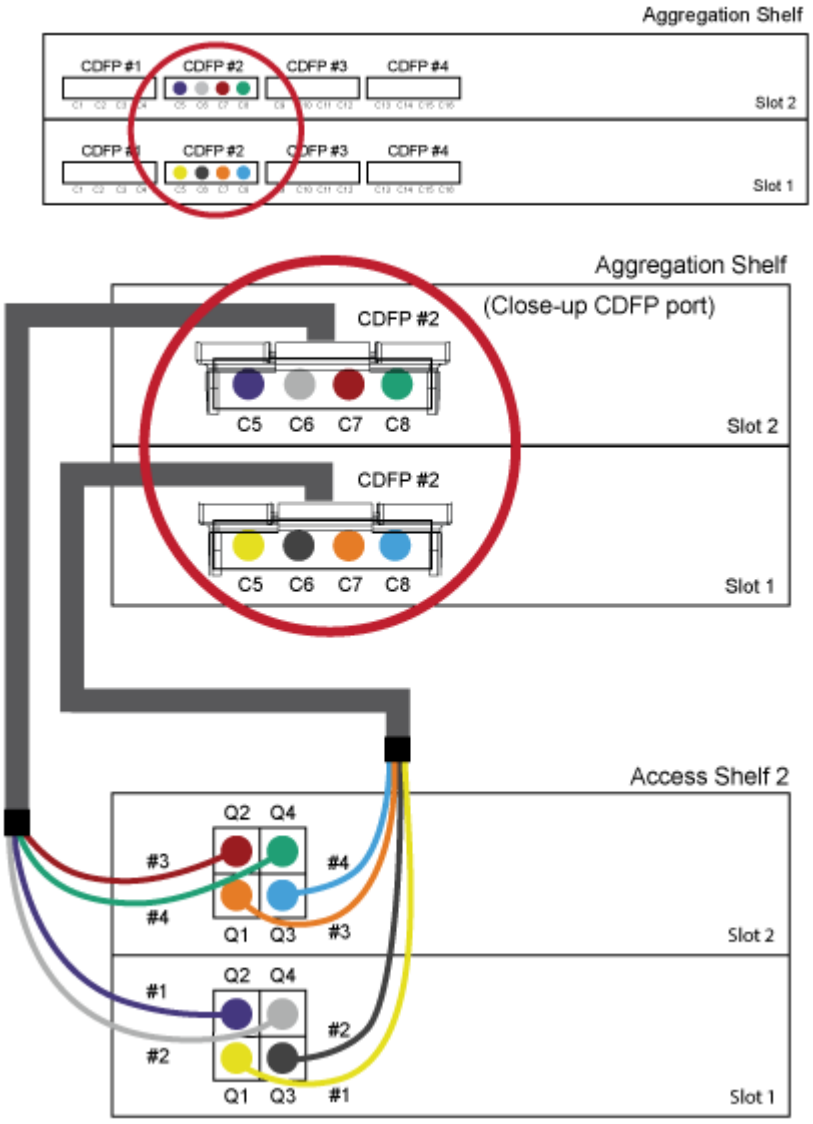
During startup, the aggregation card provides each access line card with a shelf number which is derived from the physical port(s) used to connect the aggregation card to the access line card.

Note: In the wiring diagrams, the numbers (#1-#4) seen at the end of each fan-out cable stub (at the access shelves) correspond to the labels attached to each cable stub.

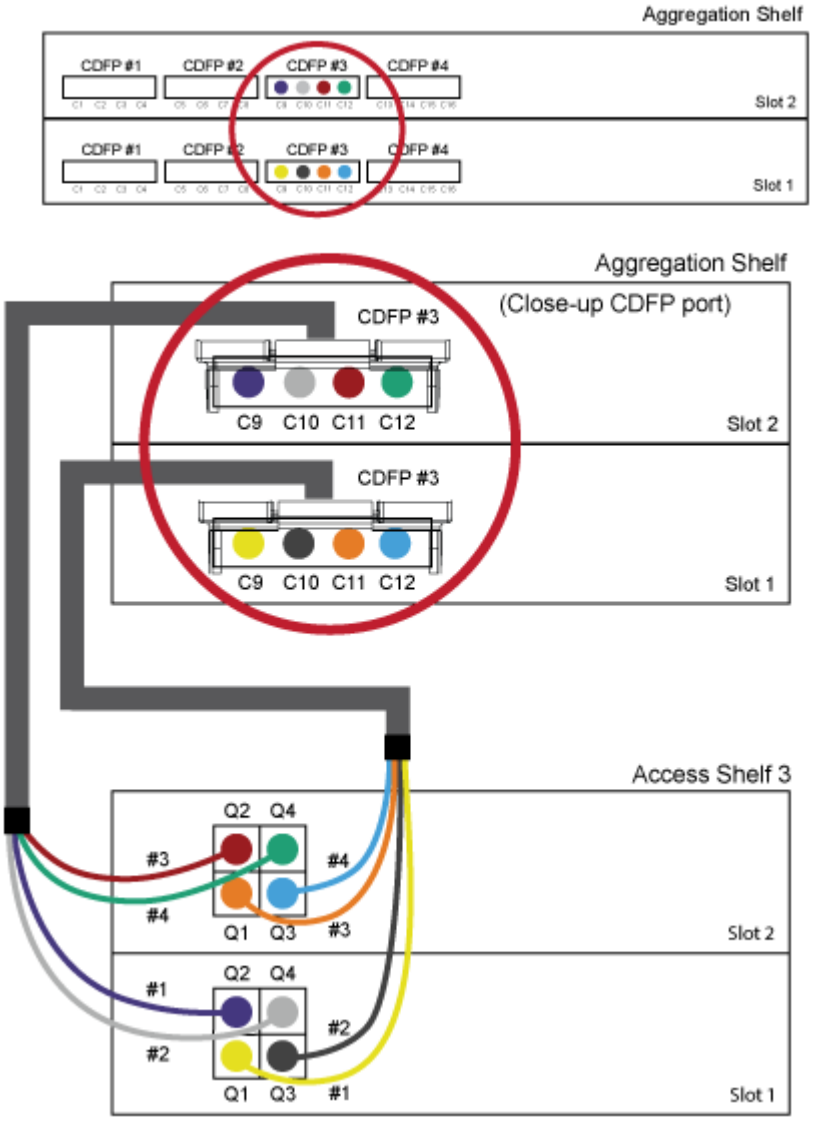
200G ICL connection to access shelf 1



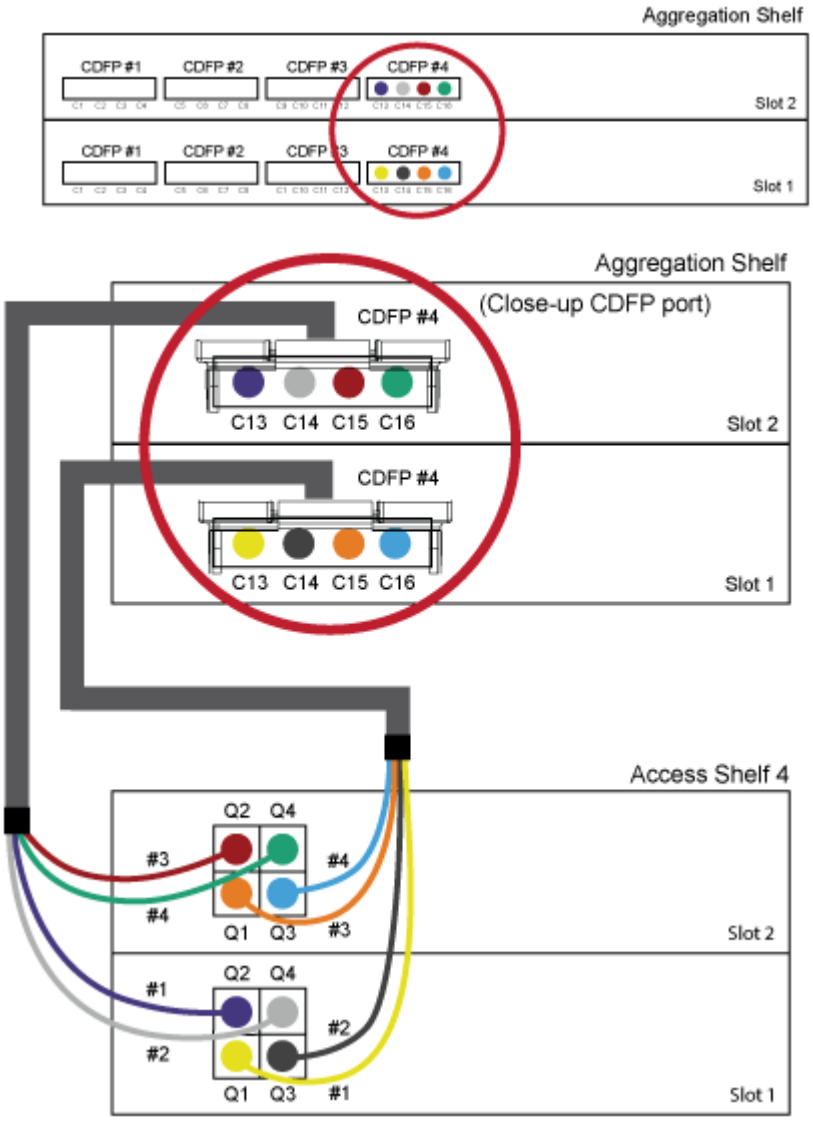
200G ICL connection to access shelf 2



200G ICL connection to access shelf 3



200G ICL connection to access shelf 4



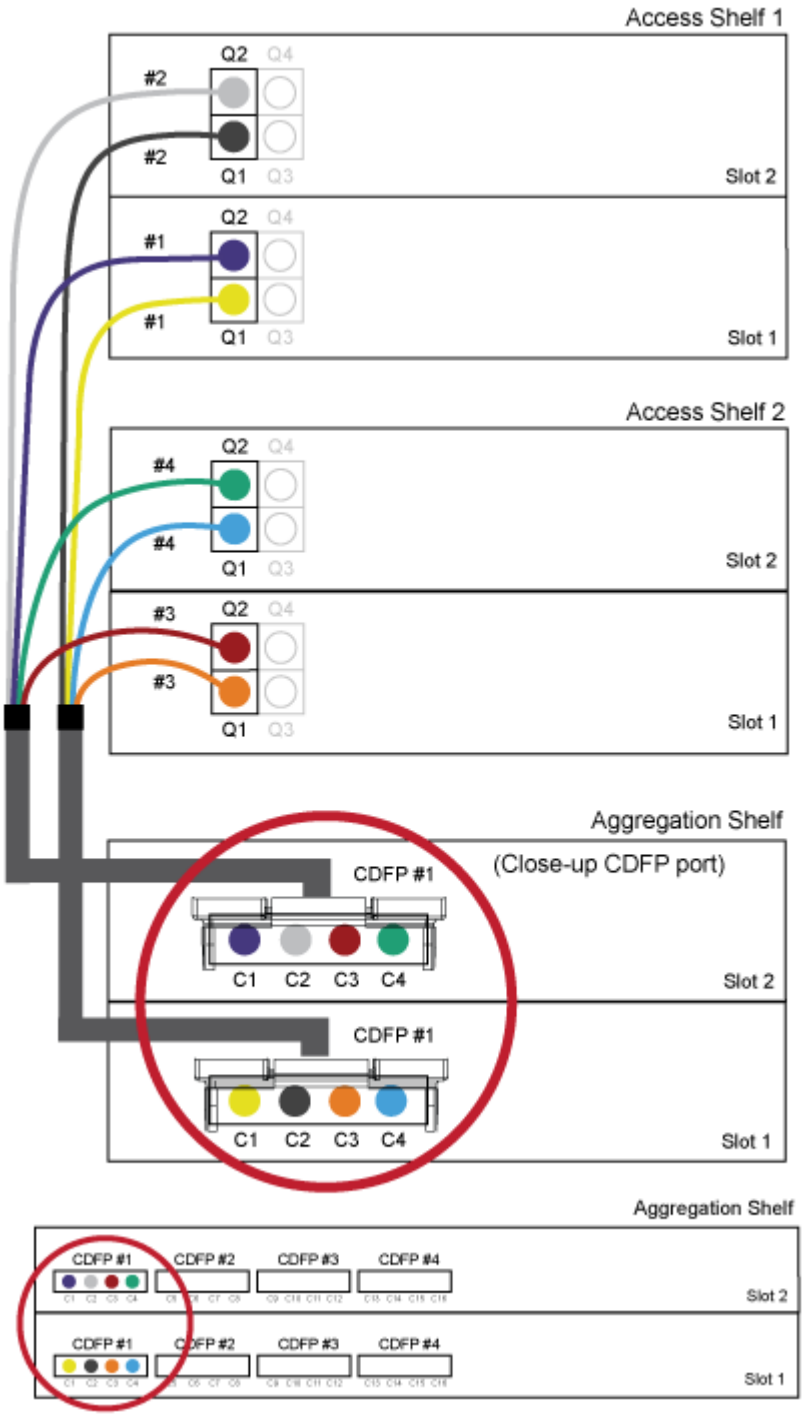
100G ICL Scheme for GPON Access

The following diagrams illustrate how to connect GPON access cards to CLX aggregation cards using the 1xCDFP-to-4xQSFP28 fan-out cables in a 100 Gbps interconnect link (ICL) cabling scheme.

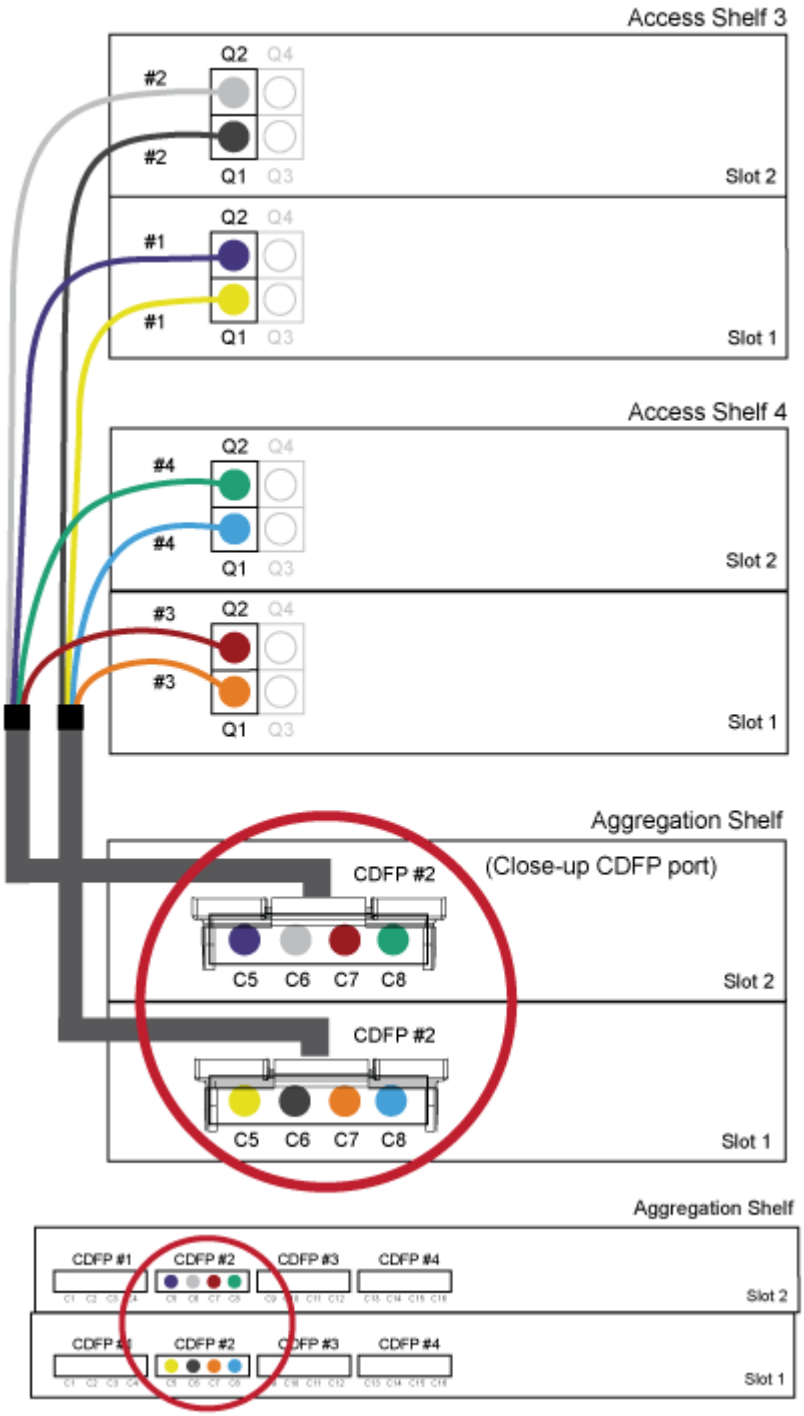
During startup, the aggregation card provides each line card with a shelf number which is derived from the physical port(s) used to connect the aggregation card to the access line card.

Note: In the wiring diagram, the numbers (#1-#4) seen at the end of each fan-out cable stub (at the access shelves) correspond to the labels attached to each cable stub.

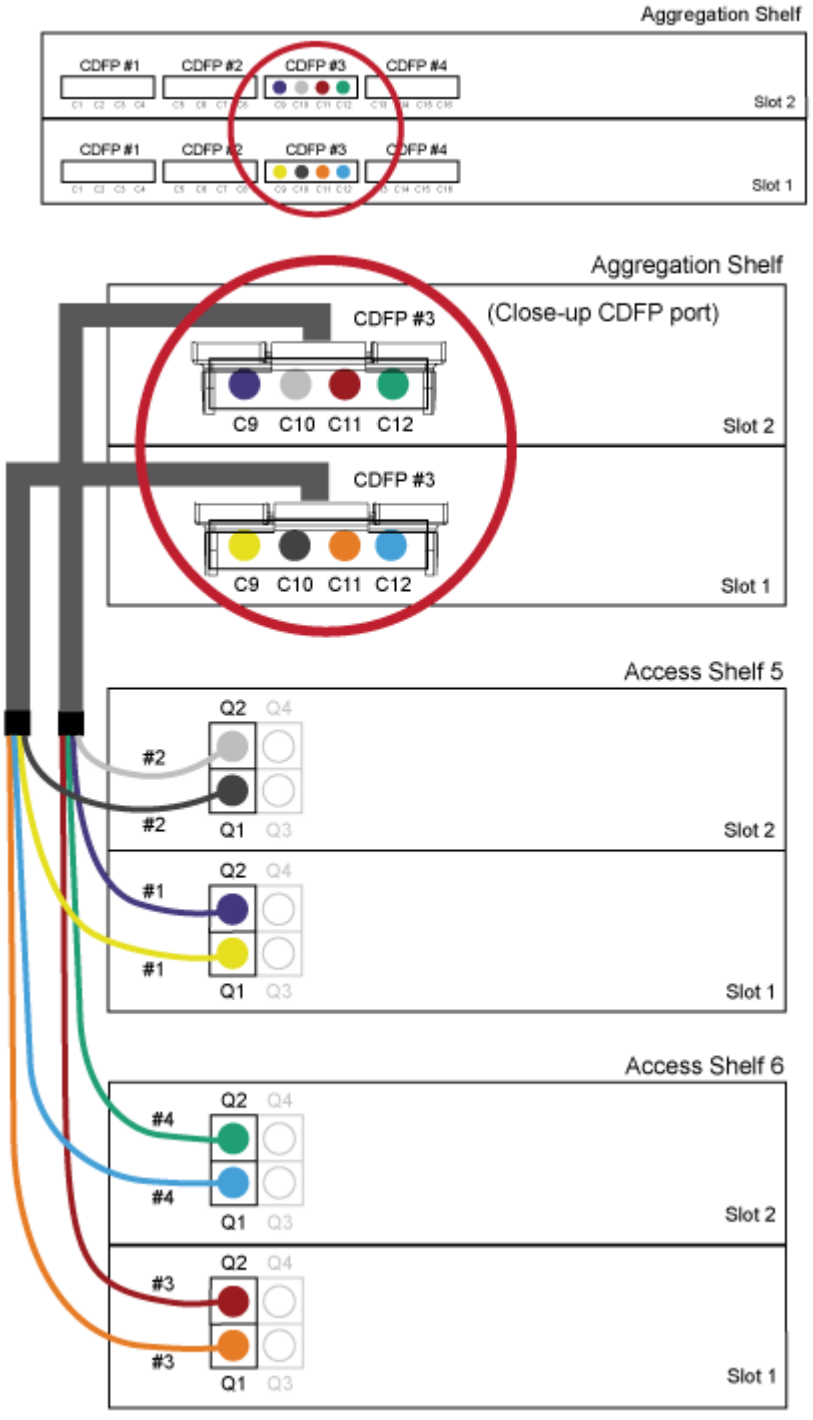
100G ICL connections to access shelves 1 and 2



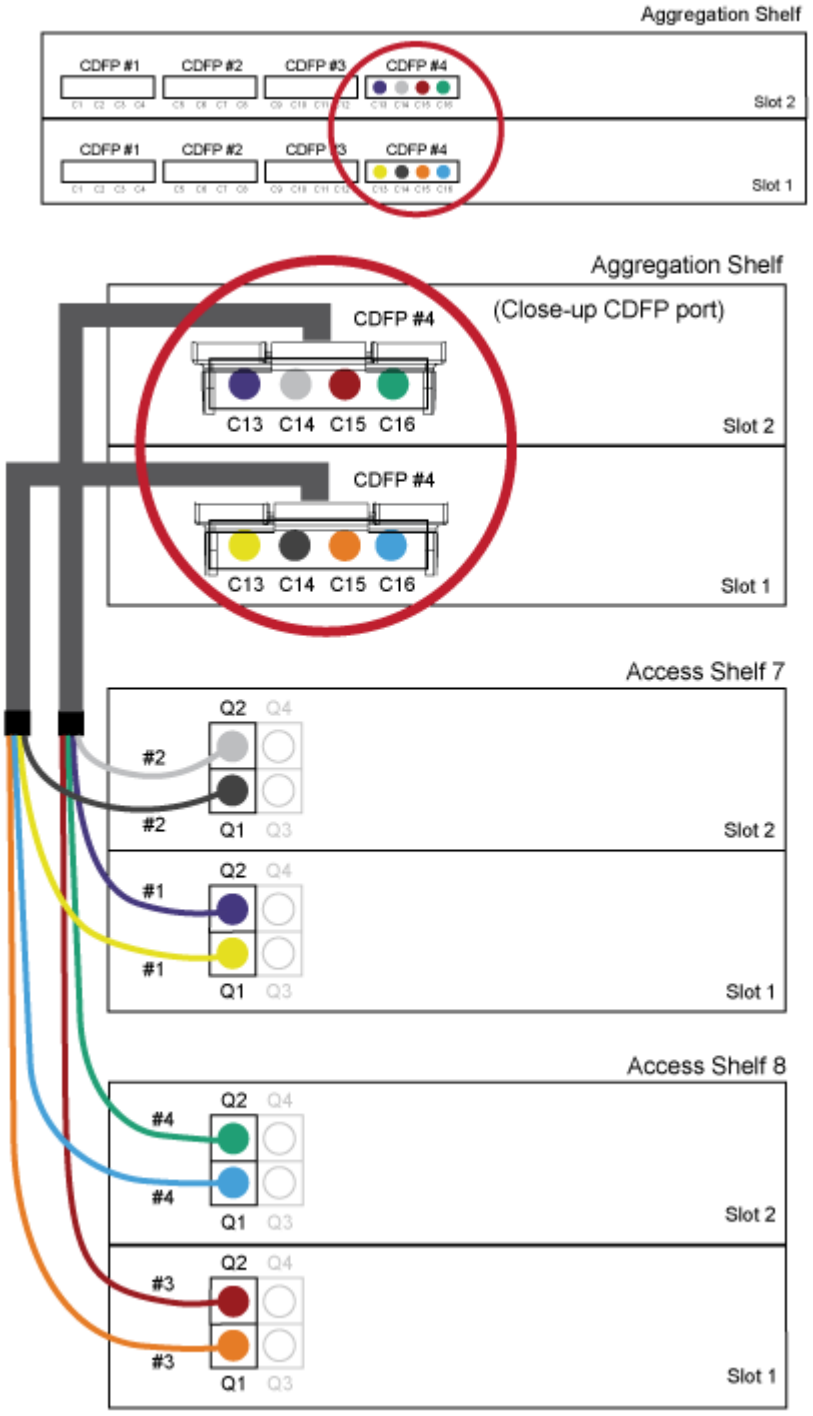
100G ICL connections to access shelves 3 and 4



100G ICL connections to access shelves 5 and 6



100G ICL connections to access shelves 7 and 8



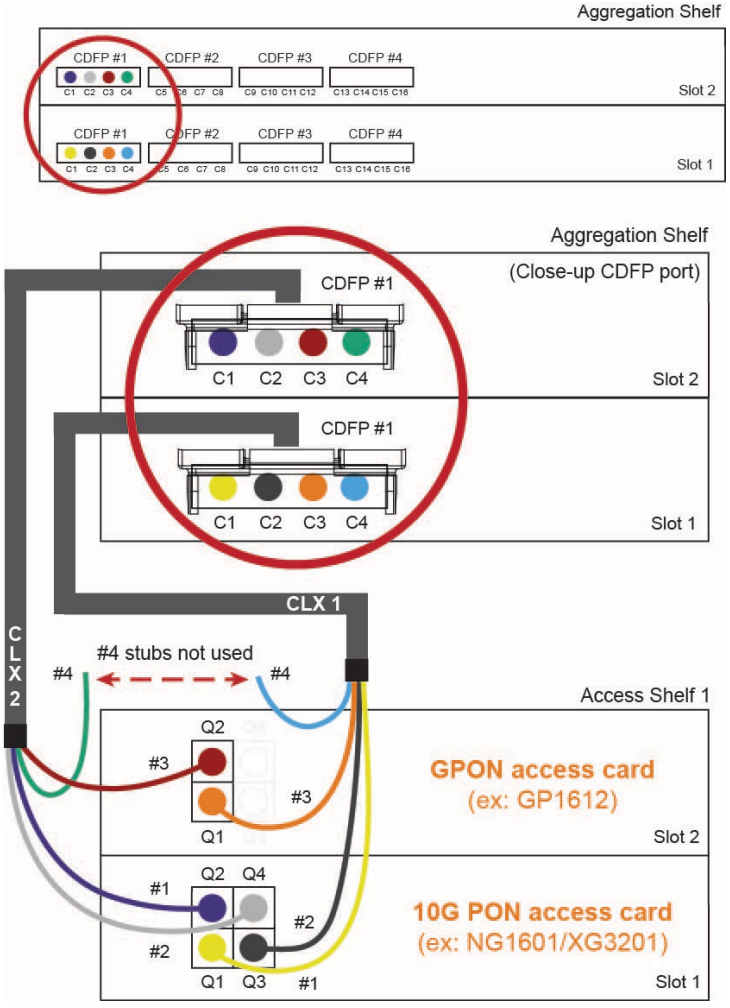
Mixed 200G + 100G ICL Schemes: One Access Shelf

The following diagram illustrates how to connect an access shelf containing a mix of 10G PON and GPON cards to the CLX aggregation cards using the 1xCDFP-to-4xQSFP28 fan-out cables. Mixing PON card types in the same access shelf requires using both the 200 Gbps and 100 Gbps interconnect link (ICL) cabling schemes, one scheme per slot.

This diagram illustrates a single-shelf example of mixed access card types, where the access shelf contains two different PON card types (uncommon). This mixed card arrangement is typically seen only in systems with one access shelf. If your E9-2 system requires multiple access shelves with a mix of card types, Calix recommends pairing common PON card types per shelf, so that each access shelf uses only one ICL cabling scheme. (See the next topic for example.)

Note: In the wiring diagram, the numbers (#1-#4) seen at the end of each fan-out cable stub at the access shelf correspond to the labels attached to each cable stub.

Mixed 200G + 100G ICL connections to one access shelf



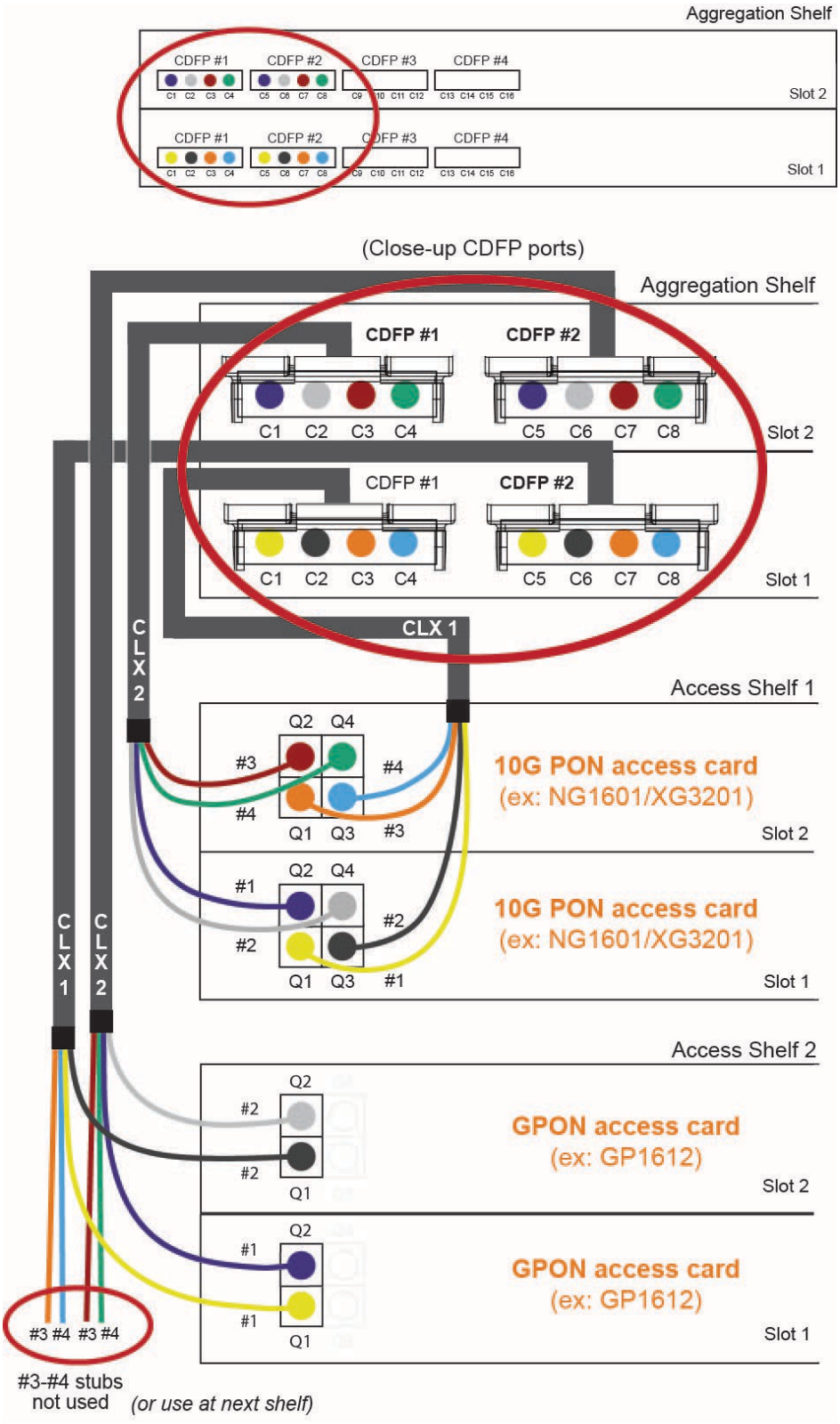
Mixed 200G + 100G ICL Schemes: Multiple Access Shelves

The following diagram illustrates how to connect multiple access shelves to the CLX aggregation cards (using the 1xCDFP-to-4xQSFP28 fan-out cables) when the system contains a mix of 10G PON and GPON cards. If your E9-2 system requires multiple access shelves with a mix of PON card types, Calix recommends arranging the access shelves to pair common PON card types in each shelf, so that each access shelf uses only one ICL cabling scheme (i.e., one access shelf hosts a pair of 10G PON cards; another access shelf hosts a pair of GPON cards).

This diagram illustrates a multi-shelf example of mixed access card types, where each access shelf contains a common pair of PON cards (preferred). If you have additional access shelves that fit this arrangement, propagate the same cabling scheme to the additional shelves, with each interconnect cable connected to a different CDFP port at the aggregation shelf.

Note: In the wiring diagram, the numbers (#1-#4) seen at the end of each fan-out cable stub (at the access shelves) correspond to the labels attached to each cable stub.

Mixed 200G + 100G ICL connections to multiple access shelves



E9-2 Port Mapping

ASM3001 Port Mapping			
Physical Label	**# of Ports**	**Line Rate**	**CLI Interface Name (format = shelf/slot/interface)**
Card faceplate (left to right):			
QSFP-DD	4	2x100GE	interface ethernet 1/{1|2}/{q1–q4}
SFP+	32	10GE	interface ethernet 1/{1|2}/<x1–x32>
MGT-1	1	10/100/1000 Mbps	interface craft 1/{1|2}/1
MGT-5	1	480 Mbps	wifi <name>
Rear panel of shelf:			
MGT-3A[1]	1	10/100/1000 Mbps	interface craft 1/1/2
MGT-3B[1]	1	10/100/1000 Mbps	interface craft 1/2/2

[1] MGT-3A connects to the card slot 1 and MGT-3B connects to the card slot 2.

CLX3001 Port Mapping			
Physical Label	**# of Ports**	**Line Rate**	**CLI Interface Name (format = shelf/slot/interface)**
Card faceplate (left to right):			
C (CDFP)[1]	4	4x100GE	interface ethernet 1/{1|2}/<c1–c16>[1]
Q1-Q2 (QSFP)	2	100GE	interface ethernet 1/{1|2}/{q1|q2}
SFP+	8	10GE	interface ethernet 1/{1|2}/<x1–x8>
SFP	2	1GE	interface ethernet 1/{1|2}/{g1|g2}
MGT-1	1	10/100/1000 Mbps	interface craft 1/{1|2}/1
MGT-5	1	480 Mbps	wifi <name>
Rear panel of shelf:			
MGT-3A[2]	1	10/100/1000 Mbps	interface craft 1/1/2
MGT-3B[2]	1	10/100/1000 Mbps	interface craft 1/2/2

[1] Each CDFP port contains four QSFP interfaces with CDFP copper connectors.

[2] MGT-3A connects to the card slot 1 and MGT-3B connects to the card slot 2.

Access (PON) Card Port Mapping			
Physical Label	**# of Ports**	**Line Rate**	**CLI Interface Name (format = shelf/slot/interface)**
Card faceplate (left to right):			
MGT-5	1	480 Mbps	wifi <name>
Q1–Q4	4	100GE	interface ethernet <2–5>/{1|2}/<q1–q4>
PON 1-2 PON 31-32	32	10G	XG3201 (See *E9-2 XG3201 Mapping Examples* (on page 91)) interface pon <2-5>/{1|2}/<xp1-xp32>
PON 1 - PON 16	16	10G	NG1601 interface pon <2–5>/{1|2}/<xp1–xp16>
		2.5G	GP1611 / GP1612 interface pon <2–5>/{1|2}/<gp1–gp16>
Rear panel of shelf:			
MGT-3A[(1)]	1	10/100/1000 Mbps	interface craft <2–5>/1/1
MGT-3B[(1)]	1	10/100/1000 Mbps	interface craft <2–5>/2/1

[(1)] MGT-3A connects to the card in slot 1 and MGT-3B connects to the card in slot 2.

E9-2 XG3201 Mapping Examples

Each of the 16 physical PON ports (SFP+ sockets) are equipped with a pair of internal logical ports.

- All PON ports, regardless of PON mode, are addressed using the prefix **xp**
  - Port pairs are grouped xp1 and xp2, xp3 and xp4, **…** xp31 and xp32
- PON OIMs with a single laser, use the first logical port number within a physical port
  - For single-density optics (GPON or XGS-PON), the odd numbered interfaces xp1, xp3, xp5 ... xp31 are active, and the even numbered interfaces xp2, xp4, xp6 ... xp32 are not used.
- PON OIMs with two lasers, use both logical port numbers within a physical port
  - For a dual-density (XGS-PON) optics the odd and even numbered interfaces are available for XGS-PON (using 2 fibers).
  - For a Multi-PON (Combi) optics, the odd numbered interfaces are used for XGS-PON, and the even numbered interfaces are used for GPON (using 1 fiber).

Depending on the type of optic used, there will be a connection to just the first port in the pair, or there will be a connection to both ports in the pair.

Double-Density XGS-PON Modules

In this example, each port contains a double-density OIM, giving each an XGS-PON laser (that uses xp1, the first logical port number), and an XGS-PON laser (that uses xp2, the second logical port number). The pattern repeats up to the sixteenth physical port where xp31 represents the XGS-PON laser and xp32 represents the XGS-PON laser.

OIM Type	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD
Port Address	xp1	xp3	xp5	xp7	xp9	xp11	xp13	xp15	xp17	xp19	xp21	xp23	xp25	xp27	xp29	xp31
	xp2	xp4	xp6	xp8	xp10	xp12	xp14	xp16	xp18	xp20	xp22	xp24	xp26	xp28	xp30	xp32

Multi-PON Modules (MPM)

In this example, each port contains a MPM OIM, giving each an XGS-PON laser (that uses xp1, the first logical port number), and a GPON laser (that uses xp2, the second logical port number). The pattern repeats up to the sixteenth physical port where xp31 represents the XGS-PON laser and xp32 represents the GPON laser.

OIM Type	MPM	MPM	MPM	MPM	MPM	MPM	MPM	MPM	MPM	MPM	MPM	MPM	MPM	MPM	MPM	MPM
Port Address	xp1	xp3	xp5	xp7	xp9	xp11	xp13	xp15	xp17	xp19	xp21	xp23	xp25	xp27	xp29	xp31
	xp2	xp4	xp6	xp8	xp10	xp12	xp14	xp16	xp18	xp20	xp22	xp24	xp26	xp28	xp30	xp32

Single Density XGS-PON or GPON Modules

In this example, each port contains a single-density XGS-PON SFP+ or GPON SFP OIM. Since only a single laser is used, the even-numbered logical ports are not used. The PON ports are addressed as xp1, xp3, xp5, …, xp31.

OIM Type	XGS	XGS	XGS	XGS	XGS	XGS	XGS	XGS	XGS	XGS	XGS	XGS	XGS	XGS	XGS	XGS
Port Address	xp1	xp3	xp5	xp7	xp9	xp11	xp13	xp15	xp17	xp19	xp21	xp23	xp25	xp27	xp29	xp31
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

OIM Type	GPON	GPON	GPON	GPON	GPON	GPON	GPON	GPON	GPON	GPON	GPON	GPON	GPON	GPON	GPON	GPON
Port Address	xp1	xp3	xp5	xp7	xp9	xp11	xp13	xp15	xp17	xp19	xp21	xp23	xp25	xp27	xp29	xp31
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Mixed Modules

In this example, the first port contains a dual-density optic. Since dual lasers are used in this physical port, it is addressed as xp1 and xp2. The second port contains a Multi-PON optic. It also uses both logical port numbers, xp3 for the XGS-PON laser and xp4 for the GPON laser. The third port contains a single density GPON optic and is addressed as xp5. Other ports in this example follow the same logic.

OIM Type	DD	MPM	GPON	XGS	GPON	DD	XGS	XGS	MPM	DD	MPM	GPON	XGS	GPON	DD	XGS
Port Address	xp1	xp3	xp5	xp7	xp9	xp11	xp13	xp15	xp17	xp19	xp21	xp23	xp25	xp27	xp29	xp31
	xp2	xp4	--	--	--	xp12	--	--	xp18	xp20	xp22	--	--	--	xp30	--

E9-2 LED Behavior

Active CLX3001 card status indicators

Each active CLX3001 card has a status LED to indicate the card's operational status.

Color	Status	Description
Blue	On	Indicates the card is in the process of collecting a log during a core dump
Red	On	Indicates either: • A card is in the early boot process (on a power cycle) • A fault has occurred that should be addressed
	Blinking (50/50)	Indicates either: • Local host booting in process • A card is reloading
Green	On	Indicates normal operation Aggregation card is up and operational
Amber	Blinking	Indicates normal operation A software upgrade is in progress

Standby CLX3001 card status indicators

Each standby CLX3001 card has a status LED to indicate the card's operational status.

Color	Status	Description
Blue	On	Indicates the card is in the process of collecting a log during a core dump
Red	On	Indicates either: • A card is in the early boot process (on a power cycle) • A fault has occurred that should be addressed
	Blinking (50/50)	Indicates either: • Local host booting in process • A card is reloading
Green	On	Indicates normal operation Aggregation card is up and operational
Amber	On	Indicates normal operation Software image has been copied from the active CLX3001 and installed on the standby CLX3001; card is STBY HOT
	Blinking	Indicates normal operation, either: • Software image is being copied from the active CLX3001 card to the standby CLX3001 card • Card is in the process of booting

Line card status indicators

Each access line card has a status LED to indicate the card's operational status.

Color	Status	Description
Blue	On	Blue is the default color on boot initiation, before it changes to red during the boot process. If an LED is stuck in Blue, an early process failure likely occurred where the boot process never fully began before getting stuck.
Red	On	Indicates a card is in the process of early booting or a fault has occurred that should be addressed
	Blinking (50/50)	Indicates the card is about to reboot or the local host booting is in process
Green	On	Indicates normal operation Line card is connected to the active aggregation card; a software load is installed on the card
	Blinking	Indicates normal operation Line card is connecting to the active aggregation card
Amber	Blinking	Indicates normal operation Line card is connected to the active aggregation card; a software upgrade is in progress

PON port status indicators

PON interface ports on GP1611, GP1612 and NG1601 access line cards have one LED located below the module socket to indicate port status. PON interface ports on XG3201 access line cards have a pair of LEDs located below each module socket to indicate port status.

Color	Status	Description
Green	On	Indicates that at least one ONT is in service on the PON
	Blinking	After module insertion, blinks (3) times to indicate the inserted module is recognized and allowed to operate Blinks steadily while the first ONT on the port is ranging (see notes below)
	Off	Socket is vacant, the port is not enabled, or an invalid module is inserted
Amber	On	Indicates at least one ONT is trained, and the represented PON is in hot standby for a TYPE-B PON protection group.

XG3201 Notes:

- When a single density GPON/XGS-PON module is detected, only the left side Green LED blinks.
- When a single density Combo module is detected, only the left side Green LED blinks.
- When a double density GPON/XGS-PON module is detected, both Green LEDs blink.

Fan module status indicators

Each E9-2 fan module has a LED visible inside the fan.

Color	Status	Description
Green	On	Inserted module is recognized and allowed to operate
	Off	No power present
Red	On	A fault has occurred that should be addressed
	Off	No power present

RS-232 Serial Port Pins

The E9-2 RS-232 serial port enables console connections to the E9-2 CLI, accessible via an RJ-11 connector located on the recessed rear panel (labeled **MGT-4**).

E9-2 Serial Port

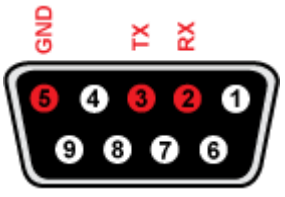
RJ-11F Connector

RS-232 Signal (From E9-2)	Serial Port RJ-11F
TX	Pin 3
RX	Pin 4
GND	Pin 5

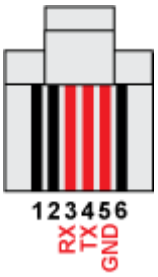
Calix offers an RS-232 console cable (DB-9F to RJ-11M) to connect a PC to the E9-2 serial port. Alternatively, you may use the pin assignments below to make your own console cable, as required.

Console Cable

RS-232 Signal (From PC)	PC End: DB-9F	E9-2 End: RJ-11M
RX	Pin 2	Pin 3
TX	Pin 3	Pin 4
GND	Pin 5	Pin 5



DB-9F Connector



RJ-11M Connector

E9-2 Specifications

Specifications for the Calix E9-2 follow:

Dimensions	
Chassis	3.45 (H) x 17.35 (W) x 18.0 (D) inches 8.8 (H) x 44.0 (W) x 45.5 (D) cm
Weight	
E9-2 chassis only	16 lbs (7.26 kg)
E9-2 chassis with 4 fan modules	19.4 lbs (8.80 kg)
Mounting	
Width	19-inch (48.26-cm) and 23-inch (58.42-cm) racks
Orientation	Horizontal mounting
Electrical	
Power input	-48 VDC redundant battery feeds (A and B) -40 VDC to -56 VDC input range (5% of 48 VDC nominal inclusive)
Circuit breaker	30 Amps maximum per input A and B
Environmental	
Operating range	-5 degrees C to +55 degrees C (-41 degrees F to +131 degrees F) Humidity: 10 to 95% (non-condensing) Altitude: up to 10,000 feet (3049 m)
Storage range	-40 degrees C to +85 degrees C (-40 degrees F to +185 degrees F) Humidity: 5 to 95%
Power dissipation (with 2 access cards)	Up to 600 Watts maximum
Fan tray assembly (4 modules) cooling capacity	Sufficient cooling for a 700W chassis (or 350W per card slot) in a CO environment with an ambient temperature range of 0–55 degrees C, or 40 degrees C with one fan failure. Fan airflow (in E9-2 shelf with 2 cards installed; 4 fan modules, max fan speed at 55C): • Maximum capacity: 15 cubic meters per minute • Typical: 9 cubic meters per minute
Alarming	3 user definable alarm inputs (3 inputs, 1 output)
Compliance	
Compatibility, Electrical Safety, and Electromagnetic emissions criteria	UL/cUL 62368 European Union EN 62368 (CE Mark) UL 62368-1 EIA-310D FCC Part 15 Class A Network Equipment-Building System (NEBS) Level 3: Telcordia GR-63-CORE Telcordia GR-1089-CORE Telcordia GR-3028-CORE ETSI EN 300 019, ETSI 300 386

Fiber Handling Techniques

To ensure fiber splices are made within optical link budget loss specifications, follow the suggestions below.

Important: Calix strongly recommends using the fusion splice method for all fiber splices.

Jacket preparation (OSP fiber)

Remove the jacket, buffer tubes and strength member using a wire stripper or cutting pliers. The plastic buffer coating should be removed with a high-quality wire stripper.

Fiber preparation

Proper preparation of the fiber end face is critical to any fiber optic connection. Perpendicularity and end finish must be within allowable tolerances in order to minimize signal loss at these connections. A divergence of as little as 2° from perpendicular should be considered unacceptable. The end finish should have a smooth, mirror-like finish free of blemishes, hackles, lips, and burrs.

Ends should be prepared using the scribe and break method. While holding the fiber under slight pressure, run the cutting tool across the stationary fiber at a perpendicular angle. Properly done, the cleave produces a perpendicular, mirror-like finish without hackles or lips. If major flaws are noticed, the process must be repeated. Inspect the fiber end under a microscope to ensure proper finish.

Small scratches on the face or small pits on the outside rim of the cladding are common and should be considered acceptable. Fusion splicer readings and experience more than anything determines the definition of "small."

Prior to putting the fiber ends into the fusion splicer, clean each end with pure optical grade isopropyl alcohol and a lint free pad such as Texwipe™ Alco Pad or Texwipe™ Cloth.

Cleaning fiber optic connectors

The process described here should not be applied routinely. This procedure should only be performed in cases where degraded performance of the assembly is noted or there is evidence of contamination. Excessive cleaning may actually increase the likelihood of fiber contamination.

Materials used for cleaning fiber-optic devices should be consistent with the function. Wiping cloths should be made of lint free, non-abrasive materials. Cotton swabs should have a tightly wrapped tip and be talcum-free. Pure optical grade isopropyl alcohol is the recommended solvent for cleaning connector tips. For removing dust from receptacles, a canned compressed gas is recommended.

Cleaning procedures

- Remove any accumulated dust or debris from the connector by blowing off the cylindrical and end-face surfaces of the connector using the compressed gas.
- Use a pad or a wipe saturated with optical-grade isopropyl alcohol to gently wipe the cylindrical and end-face surfaces.
- Use compressed gas to blow dry the connector surfaces or allow them to air dry.
- Avoid touching the connector surfaces after cleaning. If the connector is not going to be used, it should be covered with a dust cap to prevent contamination.

Handling of connectors

Although ruggedly constructed, fiber connectors should be handled with care during insertion. Follow these tips to make secure, long lasting connections:

- After removing the protective cap, make sure the fiber end remains clean and moisture free.
- Insert the connector into the fitting by grasping the rigid plastic fitting directly behind the fiber output shroud. The connection is fully seated when you hear it snap (click) into place.
- Never attempt to insert the connector by gripping the white or green flexible shroud. This may cause the fiber to kink in the jacket, introducing unwanted noise to the line.

Calix E7-2 Installation Guide

August 2022

#220-00320-18

Contents

About This Guide

This document provides a general installation practice for the Calix E7-2 intelligent modular system. This document includes guidance for planning, power installation, cabling, and maintenance.

Intended Audience

This document is intended for use by network planning and outside plant engineers, CO technicians, field support personnel, and craft personnel responsible for equipment installation, cabling, and maintenance. Familiarity with standard telecom and datacom terminology and practices, as well as standards-based Ethernet and PON technologies and conventions, is recommended.

Related Documentation

You can access Calix product documentation by logging into *My Calix* (*https://www.calix.com/mycalix*) and browsing the Documentation Library.

Safety Notices

This document uses the following safety notice conventions.

DANGER! Danger indicates the presence of a hazard that will cause severe personal injury or death if not avoided.

WARNING! Warning indicates the presence of a hazard that can cause severe personal injury if not avoided.

CAUTION! Caution indicates the presence of a hazard that can cause minor to moderate personal injury if not avoided.

ALERT! Alert indicates the presence of a hazard that can cause damage to equipment or software, loss of data, or service interruption if not avoided.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

CE Marking Conformity

The Calix E7-2 product complies with the Council of European Communities Directive 93/68/EEC. A copy of the **CE marking EC Declaration of Conformity** for the Calix E7-2 is available upon request. Contact your Calix Sales Engineer for more information.

Chapter 1

Calix E7-2 Product Overview

This chapter introduces the Calix E7-2 system and provides a general overview of the E7-2 small form factor chassis and components.

Topics Covered

This chapter covers the following topics:

- Introducing the Calix E7-2
- Product dimensions

Introducing the Calix E7-2

The Calix E7-2 intelligent modular system is a compact IP services networking system that provides high performance Ethernet-based transport, aggregation, and FTTx access services delivery from an environmentally hardened, small form factor chassis.

Calix E7-2 system

The Calix E7-2 delivers a wide array of high performance applications, including 40GE or 10GE Ethernet transport, high-density residential triple play services over PON (XGS-PON, GPON) and point-to-point Ethernet, Metro Ethernet Forum (MEF) compliant business services, mobile backhaul, and protected Ethernet aggregation.

Calix E7-2 shelf views

The Calix E7-2 system consists of the 2-slot E7-2 chassis, a removable fan module, and up to two high capacity line cards in universal card slots.

Calix E7-2 (front)

The Calix E7-2 line cards and fan module install into the front of the E7-2 shelf. When equipped with line cards, the E7-2 front panel also terminates system line interfaces (fibers). The E7-2 fan module is equipped with craft Ethernet and serial ports for management and features several system status indicators.

Calix E7-2 (rear)

The E7-2 power inputs (A/B), ground, alarm I/O, craft management, and BITS timing interfaces are located on the rear of the E7-2 shelf. The E7-2 rear panel also has four RJ-21 copper interface connectors for xDSL services (EXA only).

Calix E7-2 line cards

The Calix E7-2 is equipped with two universal line card slots, supporting a flexible array of high capacity line cards, including:

- **Access aggregation line cards**: E7-2 aggregation cards provide line ports on the faceplate for front access termination.
- **Fiber access service line cards**: E7-2 fiber access cards provide line ports on the faceplate for front access termination.
- **Copper access service line cards**: E7-2 copper cards (VDSL2) terminate on the E7-2 rear panel.

All E7-2 line cards use pluggable transceiver modules for optical and copper-based interfaces, including industry standard SFP, SFP+ and XFP modules. Each port on each card has an LED to indicate an established link and data traffic activity.

WARNING! Intra-building ports with copper SFP / SFP+ on the equipment must use shielded intra-building cabling/wiring that is grounded at both ends.

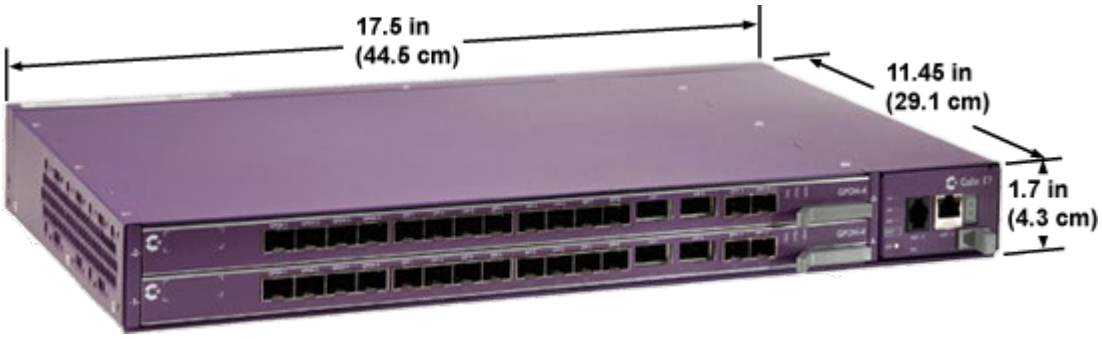
An E7 'blank' card (equipped with no electronics) ships with every E7-2 shelf. The blank card plugs into either of the two universal slots and is used to maintain emissions and facilitate proper airflow in E7-2 systems with only one line card. Whenever an E7-2 shelf operates with only one line card, a blank card must be installed in the other slot.

Product Dimensions

E7-2 chassis dimensions

The Calix E7-2 chassis exterior dimensions follow:

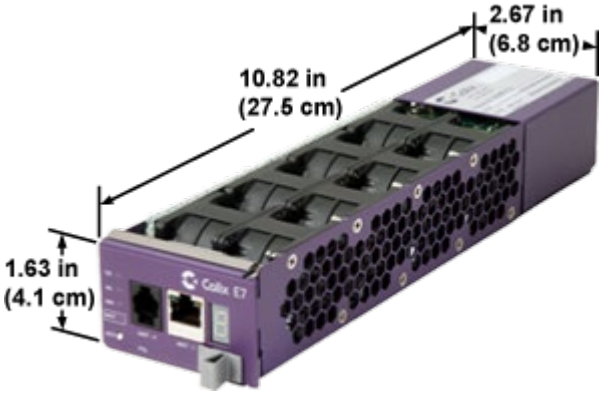
- Height: 1.7 inches (4.3 cm)
- Width: 17.5 inches (44.5 cm)
- Depth: 11.45 inches (29.1 cm)



E7-2 fan module dimensions

The Calix E7-2 fan module exterior dimensions follow (FTA shown):

- Height: 1.63 inches (4.1 cm)
- Width: 2.67 inches (6.8 cm)
- Depth: 10.82 inches (27.5 cm)



Chapter 2

Installation Considerations

This section discusses general installation considerations and guidelines. Review this information before starting the installation process.

Topics Covered

This section covers the following topics:

- Installation guidelines
- Safety recommendations and notices
- Items required for installation (tools and materials)
- Preparations before you begin

Installation Guidelines

Review the following guidelines before starting installation activities.

General guidelines

Follow these general guidelines and practices:

- Read this document completely before starting any installation activities.
- Only qualified, professional personnel should perform the procedures described in this document.
- Follow standard safety precautions when performing installation and maintenance tasks.
- Always wear standard safety gear when performing installation and maintenance tasks (hardhats/safety headgear, reflective vest, eye protection, insulated gloves).
- For safety, keep bystanders and other unauthorized personnel away from work operations at all times.
- If the E7-2 is to be installed in an outdoor cabinet, do not perform installation activities during thunderstorms or when the threat of lightning is present.
- The E7-2 installation kit includes power and ground cables that are 12 feet (3.66 m) in length. If you cannot locate the E7-2 within 12 feet (3.66 m) of the power/ground source, you must supply your own cables.
- Calix offers 3rd party DC distribution panels with dual power feed, 10+10 (A+B) GMT fuse positions.

Safety Recommendations and Notices

WARNING! The intra-building port(s) on the equipment is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) on the equipment MUST NOT be metallically connected to interfaces that connect to the Outside Plant (OSP) or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

WARNING! This product should be protected by a surge protector that meets the applicable criteria of GR-974-CORE or GR-1361-CORE. Failure to utilize an appropriate surge protector could result in susceptibility to lightning surges or create a potential hazard due to power faults.

WARNING! Restricted Access Location: Only qualified technical personnel should perform the procedures in this document. These procedures involve potentially hazardous activities that could cause injury to untrained personnel.

DANGER! Risk of high power current surge and electric shock. Read and understand all power procedures before performing tasks. Take necessary precautions and use appropriate insulated tools when working with power. This equipment must be installed, operated, and serviced by qualified technical personnel only.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

ESD ALERT! Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

Required Items

Verify that the following items are on hand before you begin the installation.

Calix-supplied items

The Calix E7-2 installation package includes the following items:

Qty	Description
1	Calix E7-2 two-slot chassis (1 RU)
1	Calix E7-2 fan module
1	Calix E7-2 blank line card
4	Rack mounting ears; 19-inches (48.26-cm) (2 ea.) and 23-inches (58.42-cm) (2 ea.)
8	Flathead Phillips screws, 4-40 x .1875 inches (.6 cm) (for attaching mounting ears)
4	Self-tapping mounting screws, 12-24 (for rack mounting)
2	Power cables (A/B feeds bundled together);16 AWG, 12 ft (3.66 m)
1	Ground cable; 8 AWG, 12 ft (3.66 m), plus termination hardware (2 ea. washers, nuts, spare 2-hole ground lug)
4	Cable tie mounts (for RJ-21 connector using a 90 degree exit)
4	Panhead Phillips screws, 4-40 x .25 inches (.6 cm) (for securing cable tie mounts to RJ-21 connectors that use a 90 degree exit)

The following optional equipment is ordered and packaged separately, as required:

- Pluggable transceiver modules (required for line termination)
- Fiber guide suitable for all E7-2 deployments, including ETSI racks
- Cool air intake and rear heat exhaust system to redirect airflow to the rear of the chassis
- 10-pack of fan tray air filters (for use in indoor/office deployments only)

User-supplied items

The following user-supplied tools and materials are required for installation.

- Power drill with universal sockets and screwdriver bits
- Socket wrench/nut driver set (standard)
- Screwdriver set (standard)
- Cable ties (tie-wraps)
- Wire stripper
- Compression crimping tool
- Digital multi-meter
- Fiber splicer
- Fiber jumpers (Be sure the fiber connector type matches the connector type of the module(s) for Ethernet and PON interfaces.)
- Fiber management system (distribution, ducts, raceways, etc.)

Preparations Before You Begin

Complete the following preparations before you begin the installation process.

Site requirements

Before starting the installation, verify that the following conditions are true:

- All materials are onsite and inventoried.
- An equipment rack and grounding system are available
- Minimum clearances are met for each device.
- Access to a -48 VDC power source with fuse-protected distribution is available.
- The installation site has restricted access.
- Cable lengths and wire gauges are adequate for the services provided.
- Thermal budget is accounted for and approved.
- Assignments for power, transport, services, alarms, timing, and other interfaces have been defined.

Determining an installation location

For indoor rack-mounted units, keep the following requirements in mind when choosing an installation location:

- As an environmentally hardened system, the Calix E7-2 is suitable for installation in network telecommunication facilities including outside plant (OSP) locations.
- The E7-2 requires one rack unit (1 RU) of mounting space on a standard 19- or 23-inch (48.26- or 58.42-cm) equipment rack.
- The E7-2 fan module is located on the right side of the unit. The system requires adequate airflow space on the right side (intake) and left side (exhaust) of the unit for proper cooling. For this reason, EIA or 23-inch (58.42-cm) racks are preferred over 19-inch (48.26-cm) telco racks.

  Note: Calix offers an optional cool air intake and rear heat exhaust system to assure adequate airflow. Refer to *Installing an Intake/Exhaust System* (on page 32) for installation instructions.

- Locate the E7-2 near power supply and ground termination locations.

  Note: The power and ground cables supplied with the E7-2 installation kit are 12 feet (3.66 meters) long.

- Power, ground, and alarm wiring at the rear of the E7-2 must be properly secured with strain relief.
- Fibers attached to pluggable transceiver modules on the front of the E7-2 unit must be appropriately dressed and secured with strain relief to avoid exceeding the manufacturer's bend radius standards.

Zero Touch Provisioning (ZTP) Considerations

QR Code for ZTP

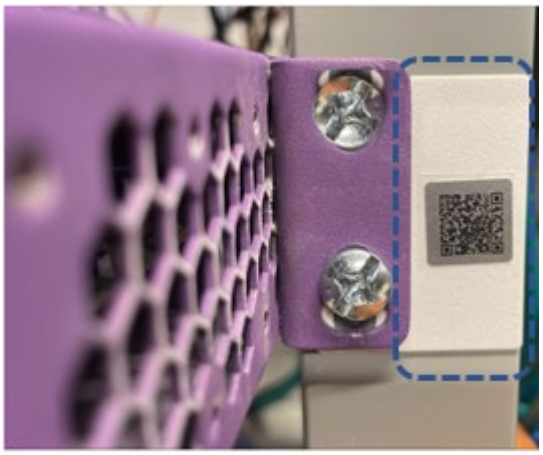
For operators that use the system MAC address to identify OLTs for ZTP turn-up, Calix prints the system MAC address on the OLT product label for easy identification, in the form of a QR code for device scanning.* This label allows installers to quickly identify the system MAC without logging in to the AXOS CLI. Once scanned by a QR code reader app on your mobile device, the system MAC becomes human readable.

To get the system MAC address via a QR code scan, your mobile device (smart phone or tablet) must be equipped with a built-in camera and a QR code reader app (widely available in the app stores).

During the installation process, you can identify the system MAC address for ZTP purposes as described below.

To identify the E7-2 system MAC address

The E7-2 QR code appears on the back of the E7-2 chassis, which can be difficult to scan once the chassis is installed in a cabinet or on a rack. Newer systems (produced after July 15, 2022) ship with a plastic QR label holder that installs behind one of the mounting ears to provide operators a standard placement option that is easy to scan.



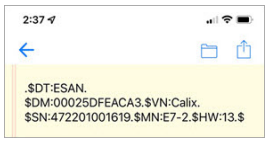
1. Using a QR code reader app on your mobile device, scan the QR code.
2. In the QR code reader app, identify the system MAC address in the text string, shown as the "device MAC" (DM) value seen between the **.$DM:** and **.$VN** characters:

   For example:

   `.$DT:ESAN.$DM:84D343D1CE35.$VN:Calix.$SN:472204019337.$MN:E7-2.$HW:13.$`

   (where **84:d3:43:d1:ce:35** is the MAC address).

3. Take a screen capture of the scanned data display or write down the system MAC address for later use.



4. Use the identified system MAC address when configuring your back office provisioning system for ZTP purposes, per local practice.

Note: To identify the system MAC address from AXOS software, issue the 'show inventory' command from the AXOS CLI.

Chapter 3

Installing the Calix E7-2

This section describes how to install the Calix E7-2 chassis and components onto a standard equipment rack.

Topics Covered

This section covers the following topics:

- Installing the E7-2 chassis
- Grounding the E7-2 chassis
- Connecting DC power to the E7-2 chassis
- Installing the E7-2 fan module
- Installing E7-2 line cards

Installing the E7-2 Chassis

This topic describes how to install the E7-2 chassis into an equipment rack.

Calix offers the following rack mount options:

- E7-2 vertical mounting kits for vertical chassis orientation in 19- or 23-inch racks
- E7-2 ETSI rack mounting kit to provide a 75 mm forward offset limitation from the rack mounting rail

To install the E7-2 chassis

1. Get a pair of mounting ears and (8) flat head screws from the installation kit.

   Note: The kit includes two sets of mounting ears, one pair for 19-inch (48.26-cm) racks and another for 23-inch (58.42-cm) racks.

2. Attach (2) mounting ears to the E7-2 chassis using supplied hardware. You can install the ears in a flush-mount or projection-mount position as required.

3. Mount the E7-2 chassis onto the equipment rack:

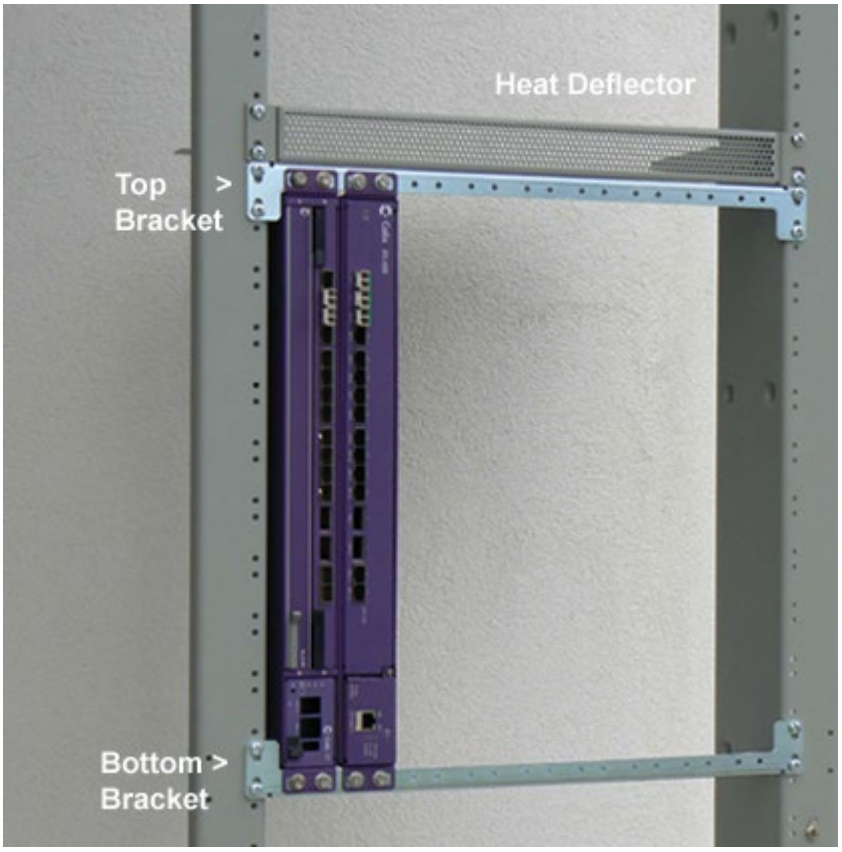
   a. Identify the E7-2 mounting location on the rack.

   b. Position the E7-2 chassis against the rack at the identified location, aligning its ear holes with the counterpart holes on the rack.

   c. Install (4) mounting screws to secure the unit in place.

To install an E7-2 vertical mounting frame

1. Identify the exact mounting location on the equipment rack for the E7-2 mounting frame. The frame requires approximately 22 inches (55.88 cm) of vertical rack space.
2. Install the mounting frame's top bracket as follows:
   a. Orient the bracket with its equipment-mounting flange on the top.
   b. Position the bracket against the rack at the identified location, aligning the bracket's mounting holes with counterpart holes on the rack.
   c. Attach the top bracket to the rack using (4) supplied mounting screws (2 per side).



3. Install the mounting frame's bottom bracket as follows:
   a. Orient the bracket with its equipment-mounting flange on the bottom.
   b. Position the bottom bracket against the rack 19 inches (48.26 cm) below the top bracket, aligning the bracket's mounting holes with counterpart holes on the rack.
   c. Attach the bottom bracket to the rack using (4) supplied mounting screws (2 per side).

4. Install the heat deflector above or below the mounting frame (typically above) as follows:
   a. Orient the deflector with the baffle directly above the mounting frame's top bracket.
   b. Position the deflector against the rack at the identified location, aligning the deflector's mounting holes with counterpart holes on the rack.
   c. Attach the deflector to the rack using (4) supplied mounting screws (2 per side).

After the vertical mounting frame is installed, you can install Calix E7-2 units onto the frame as required. Mount the E7-2 chassis with its right side (fan tray) on the bottom, to direct airflow upward.

To install an E7-2 with the ETSI rack mounting kit

1. Get the pair of ETSI rack mounting ears from the installation kit.
2. Attach each mounting ear to the E7-2 chassis as follows:
   a. Position the bracket against the side of the chassis, aligning the bracket's (4) equipment mounting holes with the counterpart holes on the chassis.

   b. Attach the mounting ear to the E7-2 chassis using (4) supplied flat head screws.
3. Mount the E7-2 chassis onto the equipment rack:
   a. Identify the E7-2 mounting location on the rack.
   b. Position the E7-2 chassis against the rack at the identified location, aligning its ear holes with the counterpart holes on the rack.
   c. Install (4) mounting screws to secure the unit in place.

Grounding the Chassis

The Calix E7-2 ground system can be connected to a Common Bonding Network (CBN) or Isolated Bonding Network (IBN).

Note: For environments that employ an IBN scheme, the low voltage and frame grounds on the E7-2 shelf are isolated from the input power DC-return.

The installation kit includes a 12-foot (3.66-meter) ground cable, plus hardware to attach it to the E7-2 frame ground.

ESD ALERT! Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

To ground the E7-2 chassis

1. Get the ground cable and supplied hardware (pair of 10-32 Keps nuts and washers) from the installation kit.

   Note: The Calix-supplied ground cable uses UL-listed ground compression lugs (p/n 615-0001). If you use a ground cable other than the one supplied by Calix, be sure to coat the bare conductor with an appropriate antioxidant compound before making any crimp connections

2. Connect the ground cable to the E7-2 chassis as follows:

   a. Install (2) star washers and then the ground cable's 2-hole lug onto the dual-post Frame Ground terminal (located on the rear of the chassis).

   b. Install (2) 10-32 Keps nuts onto the Frame Ground posts to secure the lug in place. Tighten to 27 in-lbs. of torque.

3. Connect the chassis ground cable to the main ground system (preferred) or to the rack frame as follows:

   a. Route the ground cable to the grounding termination location. If the cable is too long, cut the cable to length and crimp on an appropriate lug. (A spare lug is included in the installation kit.)

   b. Connect the ground cable to the main ground system or rack frame per PANI guidelines.

Note: Grounding surfaces must be brought to a bright finish and coated with antioxidant before being joined. When grounding to a rack frame, ensure that there is no paint or debris between the ground lug and the rack frame. To ensure a reliable ground bond, apply an anti-oxidant and use paint piercing star washers and thread forming screws to secure a metal-to-metal ground contact to the rack frame.

Connecting DC Power

The Calix E7-2 requires -48 VDC input power. The installation kit includes two 12-foot (3.66-meter) DC power cables (A and B leads) bundled together.

DANGER! Risk of electric shock. Only a qualified technician should perform this procedure

To connect DC power to the E7-2

Note: The E7-2 must be installed in an Isolated DC return (DC-I) configuration, where the DC return is not connected to the grounding system.

1. Get the DC power cable from the installation kit.
2. On E7-2 rear panel, loosen the captive thumbscrew securing the clear plastic power terminal cover to the chassis, and then remove the cover.
3. Connect the DC power cable to the E7-2 chassis as follows:

   a. Connect to the A-side power input:
      - Connect the black **(A) RTN** wire to the **(A)** + **RTN** terminal.
      - Connect the red **(A) BATT** wire to the **(A) - BATT** terminal.
   b. Connect to the B-side power input:
      - Connect the black **(B) RTN** wire to the **(B)** + **RTN** terminal.
      - Connect the red **(B) BATT** wire to the **(B) - BATT** terminal.
   c. Tighten the power termination screws to 9 in-lbs.
4. Replace the terminal cover and tighten the thumbscrew. Make sure all wires exit cleanly to the left.
5. Route the power cable to the local DC power source and connect it per local practice.

Note: Use 7.5 Amp GMT fuses to protect the E7-2 DC distribution circuits.

Installing the Fan Module

Install the E7-2 fan module into the E7-2 shelf as described below.

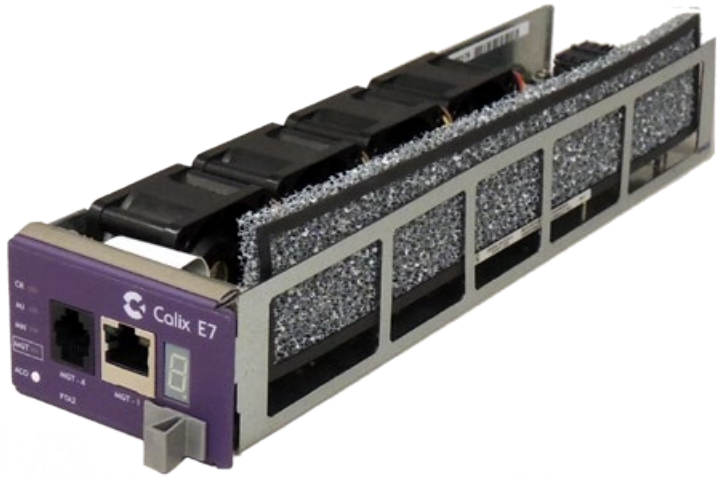
Two versions of the E7-2 fan module exist: FTA and FTA2 (as labeled on the fan module faceplate). FTA supports two fan speeds, and FTA2 supports four fan speeds.

Note: The E7-2 fan module includes an air filter for use in indoor/office environments only. **Do not** use the air filter for outdoor/cabinet deployments, to ensure maximum airflow to cool the E7-2 electronics.

To install the E7-2 fan module

1. Unpack the E7-2 fan module from its packaging.
2. **For indoor deployments only**, insert the air filter into the fan module. (The filter resides on the right edge of FTA2 or on left edge of the FTA, against the fans; for the FTA, the filter is green.)

   Note: FTA2 is shown below. For the FTA, proper orientation of the air filter requires the frame side to face the fans, and the rough side to face away from the fans.



ALERT! For the FTA model, improper orientation of the air filter will interfere with fan operation. Make sure the filter element's rough side faces the left edge of the module, away from the fans.

3. Insert the fan module into the housing on the right side of the E7-2 chassis.
4. Push the fan module all the way back into the slot. The unit seats once the latch clicks into place.

Installing E7-2 Line Cards or Resource Cards

The Calix E7-2 shelf is equipped with two universal line card slots. Install E7-2 line cards as described below.

Note: The E7-2 shelf ships with a 'Blank' card (no circuitry) installed in Slot 2. For applications using only one E7-2 line card, the Blank card must occupy the second slot to ensure proper airflow through the shelf. Remove the Blank card for applications using two E7-2 line cards.

ESD ALERT! Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

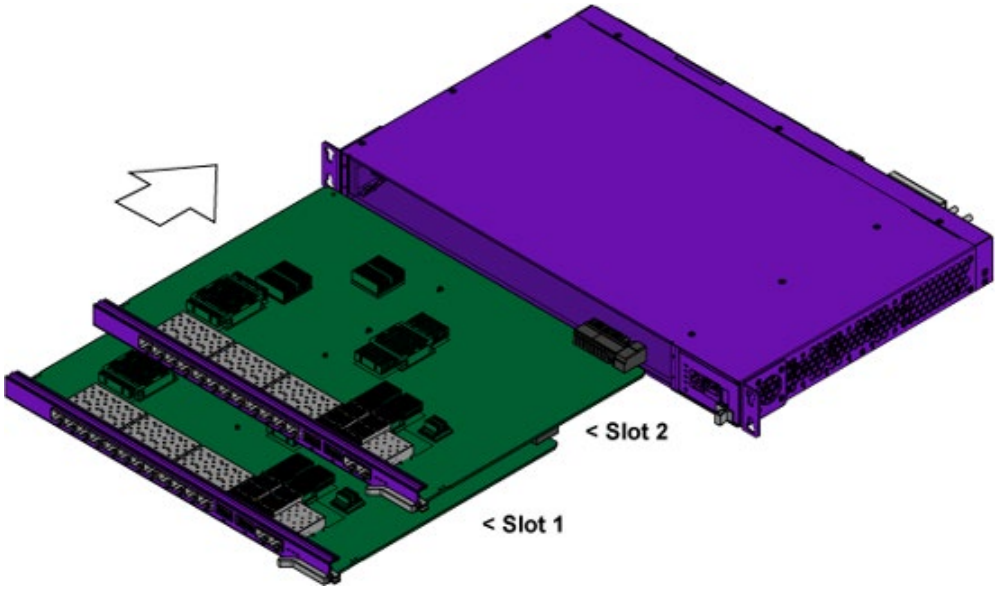
Note: Some EXA-based E7-2 cards, such as the VDSL2 Overlay card, occupy two slots in the E7-2 shelf. Adjust the card installation procedure below as needed to install a "double wide" card into both E7-2 card slots simultaneously.

To install an E7-2 line card or resource card

1. Unpack the E7-2 card from its packaging.
2. Install the E7-2 card into a vacant universal slot as follows:
   a. On the card faceplate, pull the ejector lever into the open (unlocked) position.
   b. Orient the card horizontally, with the ejector lever on the right side.

ALERT! To avoid damaging the card or shelf, align the card correctly with the guide rails in the slot before inserting the card.

   c. Insert the card into a vacant E7-2 card slot:
      - Slot 1 (bottom)
      - Slot 2 (top)



   d. Push the card ejector lever into the closed (locked) position to fully seat the card.
3. Repeat the steps above to install a second line card into the E7-2 shelf, as required. Otherwise, install the Blank card into the vacant slot.

Note: Due to airflow control considerations, the E7-2 shelf should not be operated with a vacant slot. If you are using only a single E7-2 line card at this time, install the Blank card into the other slot.

To install pluggable transceiver modules and to connect fibers, see *Connecting the E7-2 Line Interfaces* (on page 43).

Installing a Fiber Guide (Option)

The E7-2 chassis supports a field-installed fiber guide option suitable for all E7-2 deployments, including:

- Flush mounts, horizontal or vertical
- Mid-mounts, horizontal or vertical
- ETSI rack mount kit installations (See *Installing the E7-2 Chassis* (on page 20) for instructions on installing the ETSI rack mount kit.)

The fiber guide installation kit includes mounting brackets for flush and mid-mount deployments, and a 1RU fiber guide assembly.

After installing the E7-2 chassis, install the fiber guide as described below. Alternatively, for flush and mid-mounts you can install the fiber guide while installing the E7-2 chassis.

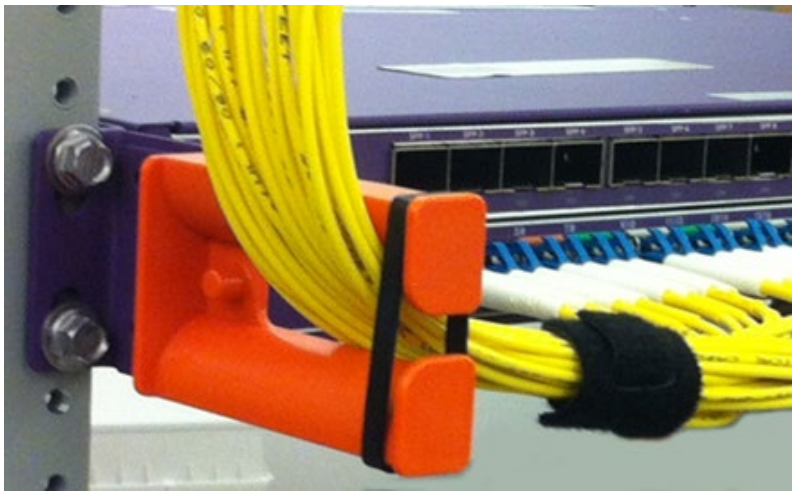
To install the fiber guide for E7-2 flush mounts (horizontal or vertical)

Note: This procedure applies to any 19- or 23-inch rack.

1. Unpack the fiber guide kit, and locate the rack mounting bracket.

2. Install the rack mounting bracket as follows:
   a. On the left rack rail or top vertical mounting frame, remove the (2) mounting screws securing the E7-2 chassis to the rack or frame and hold the chassis in place.
   b. Align the bracket's rack mounting holes with the same holes used to mount the E7-2 chassis.
   c. Secure the bracket and E7-2 to the rack or frame using the mounting screws removed in step 2a.

3. Attach the fiber guide assembly to the bracket using the bracket's two captive screws.



To install the fiber guide for E7-2 mid-mounts (horizontal or vertical)

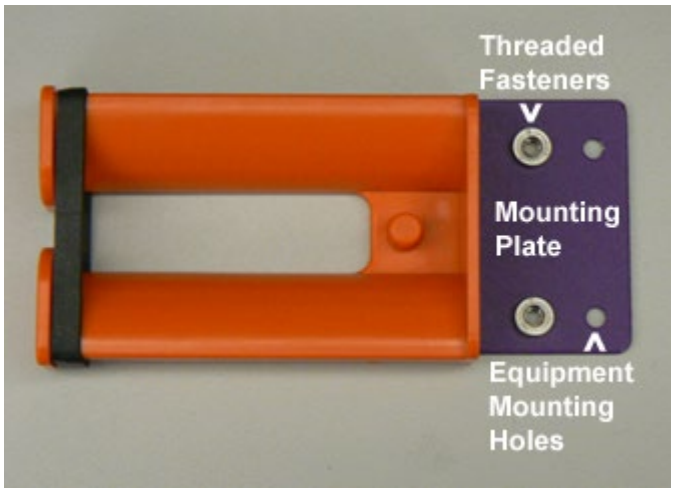
Note: This procedure applies to any 19- or 23-inch rack.

1. Unpack the fiber guide kit, and locate the mid-mounting bracket.

2. On the left side of the E7-2 chassis (oriented horizontally or vertically), align one set of the bracket's captive screws with the forward mounting holes on chassis, and tighten the screws to secure the bracket to the chassis.
3. Attach the fiber guide assembly to the bracket using the bracket's remaining set of captive screws.

To install the fiber guide for an E7-2 mounted with an ETSI rack mount kit

1. Unpack the fiber guide assembly from its packaging.



2. Orient the fiber guide with the fiber management on the left outside.
3. Position the fiber guide's flat mounting plate against the right side of the installed ETSI mounting ear, aligning:
   - the threaded fasteners on the fiber guide with the clearance holes on the ETSI mounting ear, *and*
   - the equipment mounting holes on the fiber guide with the counterpart holes on the ETSI mounting ear.
4. Attach the fiber guide assembly to the ETSI mounting ear using the (2) supplied SEMS screws.

Installing an Intake/Exhaust System (Option)

The E7-2 chassis supports an optional field installed front cool air intake and rear heat exhaust system. The intake/exhaust system assures adequate airflow by redirecting airflow from the front of the chassis to the rear. Prior to installing the E7-2 chassis, mount the intake/exhaust system on the unit as described below.

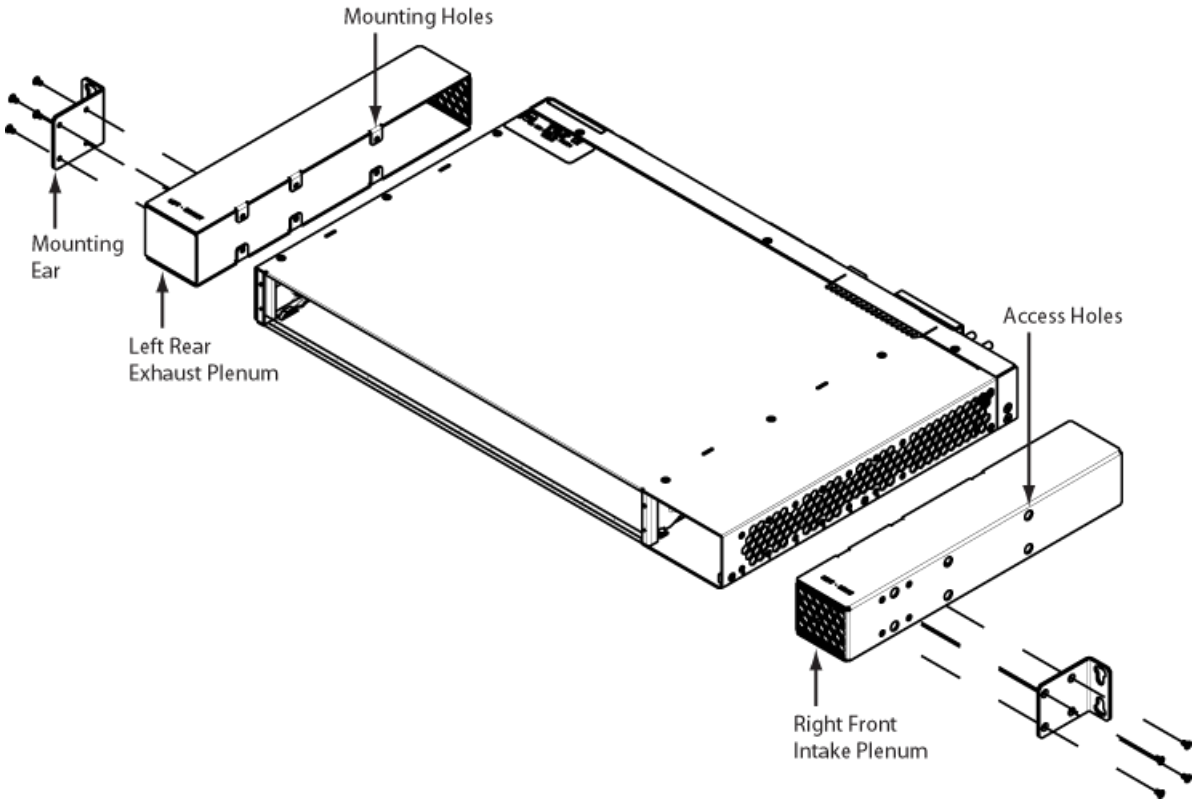
Note: The intake/exhaust system converts the E7-2 into a 23-inch shelf.

To install an intake/exhaust system

1. Unpack the intake/exhaust kit from its packaging.
2. Orient the left rear exhaust plenum on the left side of the E7-2 chassis with the vent in the back, aligning the plenum's inner mounting holes with the counterpart holes on the chassis.

   Note: The right and left plenums are not interchangeable.

3. Attach the plenum to the E7-2 chassis as follows:
   a. Route a Phillips screwdriver through the access hole, and then through the chamber to the captive screw, and tighten the screw.
   b. Repeat step 3a to tighten the (5) remaining captive screws, securing the plenum in place.
4. Orient the right front intake plenum on the right side of the E7-2 chassis with the vent in the front, aligning the plenum's mounting holes with the counterpart holes on the chassis.
5. Repeat steps 3a–3b to attach the right front intake plenum to the E7-2 chassis.
6. Install a rack mounting ear to each plenum as follows:
   a. Position a mounting ear against the plenum, aligning its mounting holes with the counterpart holes on the plenum.
   b. Attach the mounting ear to the plenum using (4) supplied flathead screws.



Chapter 4

Wiring the E7-2 Network Interfaces

This section describes how to wire out the Calix E7-2 network interfaces, including management, alarms, and service line interfaces.

Topics Covered

This section covers the following topics:

- Connecting the E7-2 management interfaces
- Wiring the E7-2 alarm and timing interfaces
- Connecting the E7-2 line interfaces

Connecting the E7-2 Management Interfaces

This section describes how to connect to the E7-2 management interface ports, including front and rear Ethernet management ports and RS-232 serial port.

Connecting to the Ethernet Management Ports

The Calix E7-2 is equipped with two out-of-band 10/100 Ethernet management ports (RJ-45 connectors). The front Ethernet management port is located on the E7-2 fan module (labeled **MGT-1**). The rear Ethernet management port is located on the E7-2 rear panel (labeled **MGMT-3**).

Use the front Ethernet port for (temporary) local Craft access to the E7-2. If you require a permanent out-of-band management connection to the E7-2, Calix recommends using the rear Ethernet management port to connect to the LAN.

Note: Use a standard 'straight-through' Ethernet patch cable to connect to the E7-2 Ethernet management ports.

Note: When you connect a disabled MGT port on the E7-2 to an Ethernet switch, the link status lights on the switch light up (yellow, and then green after 30 seconds). A link is established between the E7-2 and the switch, but the Management interface on the E7-2 is not enabled and no traffic will pass over the link.

To connect to the front Ethernet management port

1. Get a 'straight-through' Ethernet patch cable with RJ-45 connectors on both ends.
2. Connect the cable to the E7-2 front Ethernet management port (labeled **MGT-1**, located on the E7-2 fan module).

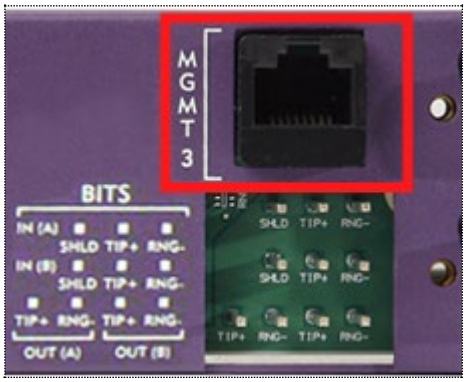
3. Connect the cable's other end to the Ethernet port on your PC.

For instructions to log in to the E7-2 management interface, refer to the system operation documentation.

Use the rear Ethernet management port to establish a fixed out-of-band management connection to the E7-2.

To connect to the rear Ethernet management port

1. Get an Ethernet patch cable with RJ-45 connectors on both ends.
2. Connect the cable to the E7-2 rear Ethernet management port (labeled **MGMT-3**, located on the E7-2 rear panel).



3. Connect the cable's other end to a LAN Ethernet hub or switch.

For instructions to log in to the E7-2 management interface, refer to the system operation documentation.

Connecting to the RS-232 Serial Port

The E7-2 has an RS-232 serial port that you can connect to a PC for CLI console management connections. The serial port is located on the E7-2 fan module (RJ-11F connector).

Note: Calix no longer offers an optional RS-232 console cable, so you must supply your own cable to use this port. See *RS-232 Serial Port Pins* (on page 62) for more information.

To connect to the RS-232 serial port

1. Get an appropriate RS-232 console cable (for example, a DB-9F to RJ-11M) to connect to the E7-2.
2. Connect the cable's RJ-11 end to the E7-2 serial port (labeled **MGT-4**, located on the E7-2 fan module).

3. Connect the cable's DB-9 end to your PC.

Use the following settings to establish a console connection from the serial port:

AXOS System*	EXA System*
• Baud Rate: 115200 • Data Bits: 8 • Parity: None • Stop Bits: 1 • Flow Control: None	• Baud Rate: 38400 • Data Bits: 8 • Parity: None • Stop Bits: 1 • Flow Control: None

*** Note:** When equipped with AXOS-based line cards, the E7-2 is considered an AXOS system. When equipped with EXA-based line cards, the E7-2 is considered an EXA system.

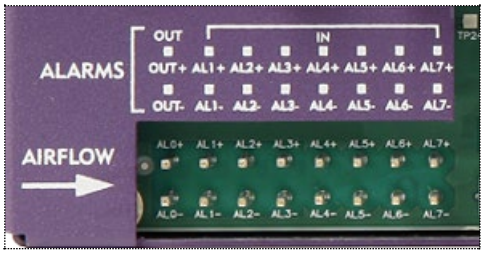
For instructions to log in to the E7-2 CLI, refer to the system operation documentation.

Wiring the External Alarm and Timing Interfaces

This section describes how to wire external alarms and external (BITS) timing interfaces to the Calix E7-2. The E7 terminates its alarm and BITS timing interfaces via wire-wrap pins located on the rear panel.

Wiring External Alarms

The E7-2 supports eight external alarm input/output (I/O) positions via wire wrap pins located on the E7-2 rear panel. The eight external alarm positions include seven inputs and one output position.



Output	Input						
OUT+	AL1+	AL2+	AL3+	AL4+	AL5+	AL6+	AL7+
OUT-	AL1-	AL2-	AL3-	AL4-	AL5-	AL6-	AL7-

Alarm Inputs (AL1 to AL7): You can configure the E7-2 alarm input positions to interface with up to (7) external input sources, typically for environmental alarm conditions. The input alarm contacts are Normally Open (default), and close when an alarm condition occurs. You can configure the alarm type and severity for each input from the E7-2 user interfaces.

Alarm Output (OUT): You can configure the E7-2 alarm output position to interface with external office alarm systems such as lights or horns. The output alarm contacts are Normally Open (default).

Note: Press the ACO button (located on the fan tray) to turn the external office alarm off; subsequent alarms will trigger the alarm again. Pressing the ACO button does not affect alarms in the system.

Wire the E7-2 external alarm input/output (I/O) positions as described below. Typically, alarm wiring consists of black and white wire pairs.

To wire external alarms

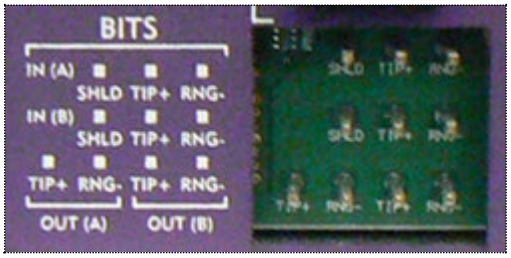
1. Get up to eight 24 AWG wire pairs of sufficient length to reach the far-end contacts from the E7-2.
2. At the E7-2 end, strip approximately one inch (2.54 cm) of insulation from the alarm wire ends.
3. Wire the E7-2 alarm inputs as follows:
   a. Connect a pair of alarm wires to the first input position (**AL1**):
      - Wrap the first wire (typically black) to the **AL1+** pin.
      - Wrap the second wire (typically white) to the **AL1-** pin.
   b. Repeat Step 3a for each additional alarm input to use (**AL2**–**AL7**), as required.
4. Wire the E7-2 alarm output position (**OUT**) as follows:
   - Wrap the first wire (typically black) to the **OUT+** pin.
   - Wrap the second wire (typically white) to the **OUT-** pin.
5. Route and dress the alarm wires out to the appropriate far-end interfaces and connect per local practice.

Refer to the system operation documentation for supported environmental alarms and alarm provisioning information.

Wiring the BITS Timing Interface

For EXA-based systems, the E7-2 supports synchronization with an external clock source via timing inputs located on the E7-2 rear panel. The E7-2 accepts a standard DSX-level timing source. The BITS interface is designed to support both DS1 (T1) and E1 inputs. Wire the E7-2 timing inputs to a Building Integrated Timing System (BITS) clock source using shielded cable.

Calix recommends providing traceable clock synchronization for E7-2 GPON applications.



IN (A)	SHLD	TIP+	RNG-
IN (B)	SHLD	TIP+	RNG-
TIP+	RNG-	TIP+	RNG-
OUT (A)		**OUT (B)**	

You can link up to ten collocated E7-2 shelves to share a BITS timing input. Calix offers a connectorized daisy-chain BITS cable, or you can wire-wrap the individual daisy-chain links between shelves.

To wire the BITS timing input interface

1. Get up to two 24 AWG shielded 2-wire cables of sufficient length to reach the local BITS clock interface from the E7-2. Use one cable to provide a single timing input (A only), or two cables for a redundant input (A + B).
2. Strip approximately one inch (2.54 cm) of insulation from the wire ends.
3. Wire the E7-2 external timing input(s) as follows:
   a. Connect the timing wires to the E7-2 BITS **IN (A)** input position:
      - Wrap the positive (tip) wire to the **TIP+** pin.
      - Wrap the negative (ring) wire to the **RNG-** pin.
      - Wrap the cable shielding to the **SHLD** pin.
   b. To provide a redundant connection to the BITS clock source, repeat Step 3a to wire the E7-2 BITS **IN (B)** input position, as required.
4. Route and dress the timing input cable to the local BITS clock interface and connect per local practice.

To provide timing relays to one or more additional collocated E7-2 units, you can wire the E7-2 external timing output interface as described below.

To wire the BITS timing output interface

1. Get up to two 24 AWG shielded 2-wire cables of sufficient length to reach the next E7-2 shelf. Use one cable to provide a single link (A only), or two cables for a redundant link (A + B).

   Note: You can use the optional Calix-supplied BITS daisy-chain cable instead. See the note after Step 4 for installation instructions.

2. Strip approximately one inch (2.54 cm) of insulation from the wire ends.
3. Wire the E7-2 external timing output as follows:
   a. Connect the timing wires to the E7-2 BITS **OUT (A)** output position:
      - Wrap the positive (tip) wire to the **TIP+** pin.
      - Wrap the negative (ring) wire to the **RNG-** pin.
   b. To provide a redundant timing link to the next E7-2, repeat Step 3a to wire the E7-2 BITS **OUT (B)** position, as required.
4. Route and dress the timing output cable to next E7-2 and connect per the input wiring procedure above.

   Note: If you are using the Calix-supplied BITS daisy-chain cable, connect the **WW Pins Out** end to the BITS **OUT** pins on the upstream E7-2 unit, and connect the **WW Pins In** end to the BITS **IN** pins on downstream unit. Repeat for each additional daisy-chained E7-2 unit.

Connecting the E7-2 Line Interfaces

This section describes how to connect the Calix E7-2 line interfaces to the network.

Equipping the E7-2 interface ports

Calix E7-2 line cards use pluggable transceiver modules to provide interface connections, but the cards do not ship equipped with modules. You must install pluggable modules (or Direct-Attach Copper [DAC] cables) into the cards to equip the ports.

Calix offers a full suite of optical and copper pluggable modules to support a wide array of applications. PON ports require use of Calix-keyed modules. Ethernet ports on EXA-based line cards may carry some Calix keying restrictions. Consult the Product Planning Guides for complete details.

Note: If using non-Calix SFP modules, you must use modules that comply with the SFP Transceiver MultiSource Agreement (MSA). See the Small Form Factor (SFF) committee INF-8074i specification Rev 1.0 for details.

Pluggable modules are available to support different facility types and connectors:

Port Type	Module Type	Interface Options
100GE	QSFP-DD	100GE (100 Gbps) optical or DAC cables
40GE	QSFP-DD	40GE (40 Gbps) optical or DAC cables
10GE	XFP	10GE (10 Gbps) optical
	SFP+	10GE (10 Gbps) optical and copper
1GE	SFP*	1GE (1000 Mbps) and 2.5GE (2500 Mbps) dual-fiber and single-fiber modules 1000/100BaseT copper modules
XGS-PON	XFP	10/10 Gbps PON optical
NG-PON2	XFP	10/10 Gbps PON optical
GPON	SFP OIM	2.5/1.2 Gbps PON optical, Class B+ and C+ options

*All SFPs must be Class 1 laser devices in accordance with FDA regulation 21CFR 1040.10, 1040.11, and IEC 60825-1.

Note: For E7-2 deployments in outdoor/remote environments, be sure to use Industrial-rated (i-temp) modules.

Installing Pluggable Transceiver Modules

Install pluggable transceiver modules into the E7-2 line cards to equip the ports for optical or copper interface connections.

To install pluggable transceiver modules

1. Unpack the pluggable module. Remove the dust cover from the transceiver interface, if present.
2. Orient the module with the exposed PCB side facing down. Insert the module into an appropriate socket on an E7-2 line card as follows:
   - To equip 100GE or 40GE ports, insert QSFP modules or DAC cable connectors into sockets labeled **QSFP 1/2** or **QSFP 3/4*** as required.
   - To equip 10GE ports:
     a. Insert XFP modules into sockets labeled **XFP 1** to **XFP 4**, as required.
     b. Insert SFP+ modules into sockets labeled **SFP+ 1** to **SFP+ 12**, as required.
   - To equip 1GE ports, insert SFP modules into sockets labeled **SFP 1** to **SFP 12**, as required.
   - To equip GPON OLT ports, insert GPON OIM modules into sockets labeled **GPON 1** to **GPON 8**, as required.
   - To equip 10G-PON OLT ports, insert XGS-PON XFP modules into sockets labeled **PON 1** to **PON 8**, as required.
3. Press the module firmly into the socket until it clicks into place.

Once the module is installed, you can connect interface cables (fibers) to it. See *Connecting Fibers* (on page 44) for instructions.

*__Note:__ The XG801 and CE201 cards are equipped with an ejector lever for use with insertion or extraction of modules from the QSFP 3/4 slot. While the QSFP can safely be inserted/extracted without use of the lever, the lever action relieves pressure from the thermal transfer assembly to ease of insertion/extraction of the QSFP from the 3/4 slot.

Connecting Fibers

Once the E7-2 line card sockets are equipped with pluggable transceiver modules, you can connect fibers/cables to the ports as described below. Be sure the fiber connector type matches the connector type of the module(s).

If the laser at the far end of the fibers is enabled, you can use an optical power meter to test signal strength before connecting fibers to the equipment. Defer to local practice wherever applicable.

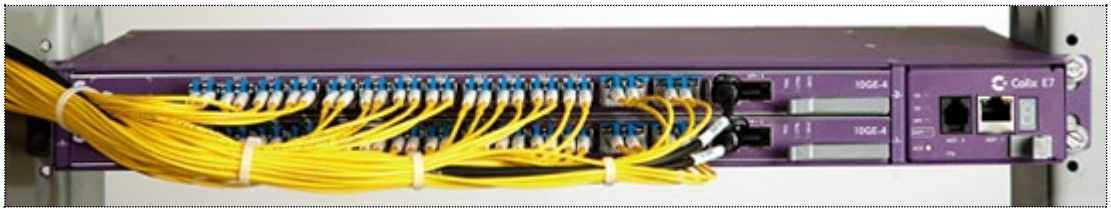
DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

To connect fibers to the E7-2

1. Route fibers (or copper Ethernet cables) to the E7-2 shelf, approaching from left side.

   Important: Route fibers to the left side of the E7-2 shelf to ensure visibility of system and card status LEDs located on the right side of the E7-2 shelf.

2. Remove the caps or plugs from the fiber connector ends, if present.
3. Connect fibers to transceiver modules on the E7-2 line card.
4. Repeat the steps above to connect additional fiber links, as required.



5. Neatly dress and secure all fibers/cables per local practice.

   Note: To avoid pinching or interference with the equipment, neatly coil or bundle any slack fiber and dress it toward the left side of the E7-2 shelf.

For best practices, confirm that all fiber cables that route out to the ODN are properly grounded.

To ground OSP fiber cables

1. At the cut end of the OSP cable sheath, twist the cable's metal strength members together into a single strand.
2. Install a lug connector on the twisted end of the strength members.

   Note: Calix recommends using a two-hole lug connector where possible.

3. Install a #6 AWG bond strap onto the lug connector, together with the twisted strength members, and tighten the lug connector.
4. Terminate the other end of the bond strap to the ground bar per local practice.

Connecting to Copper Access Interfaces

To terminate subscriber line interfaces for copper access services (ex: VDSL2/POTS) on EXA-based systems, connect 25-pair twisted pair cables with RJ-21 connectors to the Champ connectors on the rear of the E7-2 unit(s).

Cable assignments

The image below shows the RJ-21 connectors (Champ) identified on the rear of the E7-2.

The table below lists the cable assignments for a single-slot VDSL2 Combo card.

Interface Cable	Card	RJ-21 ID	Service	Protection Block Location	Subscriber Ports
Equipment 1	1	P1	xDSL/POTS	1 (ports 1-24)	1-24
Equipment 1	1	P2	xDSL/POTS	2 (ports 25-48)	25-48
Equipment 2	2	P3	xDSL/POTS	3 (ports 1-24)	1-24
Equipment 2	2	P4	xDSL/POTS	4 (ports 25-48)	25-48

The table below lists the cable assignments for a double-slot VDSL2 Overlay card.

Interface Cable	RJ-21 ID	Service	Protection Block Location	Subscriber Ports
Equipment 1	P1	xDSL	1 (ports 1-24)	1-24
Equipment 1	P2	xDSL	2 (ports 25-48)	25-48
Equipment 2	P3	POTS	3 (ports 1-24)	1-24
Equipment 2	P4	POTS	4 (ports 25-48)	25-48

Note: Calix equipment uses a 'dead pair' scheme, where the 25th pair in each 25-pair cable group is unterminated (dead). Therefore, on each protection block, positions 25 and 50 are not wired. Line identification labels cover the dead pair positions.

Guidelines

- Calix recommends using CAT5 cables to achieve optimal Signal to Noise (SNR) margins and performance.
- Calix recommends using 110-degree right exit Avaya 525e RJ-21 connectors on the CAT5 cables to avoid interference with the cables and adjacent connectors. Using an RJ-21 connector with a 90-degree exit on the back of the E7-2 shelf requires special attention. Only one side of the RJ-21 male connector can be secured with a screw; the other side of the connector must be secured with a cable tie wrap and cable tie mount (provided by Calix in the E7-2 field install kit). The head of the cable tie must align with the bottom edge of the connector to achieve a robust connection.
- Tighten the screws on each side of the RJ-21 connectors to no more than **3-4 inch-lbs of torque** (maximum) to secure subscriber cable RJ-21 connectors to the E7-2 shelf.

  As a best practice, do not over-tighten the screws when securing the RJ-21 connectors to the E7-2 chassis. Ensure that the RJ-21 connector is fully engaged to the connector on the rear of the chassis, and tighten screws only to secure the connector in place without applying excessive force.

To wire out the E7-2 subscriber line interfaces

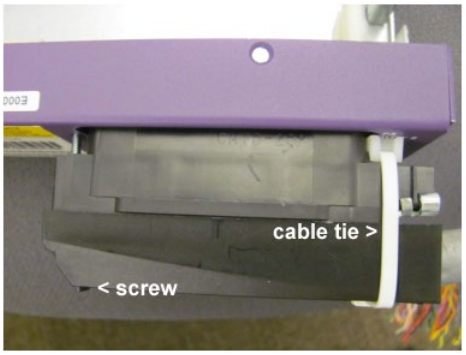
1. Route the 25-pair equipment interface cables (RJ-21 connectors) to the rear of the E7-2 shelf.
2. On the rear of the E7-2, terminate the interface cable(s) for slot 1 to the RJ-21 connector labeled **P1** or **P2** and the interface cable(s) for slot 2 to the RJ-21 connector labeled **P3** or **P4**, as required for the installed line card(s). See *Cable assignments* above for more information.

   - For an RJ-21 male connector with a 110-degree exit, do the following:
     a. Insert the RJ-21 male connector into the female connector on the back of the E7-2 shelf.
     b. Tighten the screws on each side to 3–4 inch-lbs of torque to secure the connector.

   - For an RJ-21 male connector with a 90-degree exit, do the following:
     a. Using a 4-40 screw, attach a cable tie mount to the right side of the shelf RJ-21 female connector as shown.

     b. Insert the RJ-21 male connector into the female connector on the back of the E7-2 shelf.
     c. Secure the connector by tightening the screw at the bottom of the connector to 3–4 inch-lbs of torque and attaching a tie wrap at the top of the connector.

Note: To provide a securely mated connection, be sure to align the head of the cable tie along the bottom edge of the connector as shown. Failure to install the cable tie correctly may result in an inadequate connection.



3. Dress the cable and secure them to the equipment rack (and cable tie bars) every 6–8 inches (15.24–20.32 cm) with cable ties or lacing cord.

For pin pair assignments, refer to *RJ-21 Pin Assignments* (on page 63).

Connecting Vectoring Control Links to a VCP Card

EXA-based E7-2 systems (in standalone or modular chassis configurations) support xDSL System-Level Vectoring (SLV) on E7-2 VDSL2 **r2** cards by using a dedicated external Vector Control Processor (VCP) card for SLV control.

Each two-slot VCP card (SLV-Host) is installed in its own E7-2 shelf and connects to VDLS2 r2 cards (SLV Targets) located other E7-2 shelves via a Vector Control Y-Cable (VCC). Each VCC cable connects two VDLS2 r2 cards to the VCP card, with the maximum number of VDLS2 r2 cards per SLV system determined by which VCP card is used:

- **VCP-384:** Connect up to eight VDLS2 r2 cards to the VCP card (four VC ports), to support SLV for up to 384 lines.
- **VCP-192:** Connect to four VDLS2 r2 cards to the VCP card (two VC ports), to support SLV for up to 192 lines.

When connecting each Vectoring Control Y-cable to VDSL2 r2 SLV Target cards, follow these constraints:

- For single-slot VDSL2 r2 cards (VDSL2-48C r2 or VDSL2-48D r2), both cards must be located in the same shelf, where each cable connects one shelf to the VCP.
- For dual-slot VDSL2 r2 overlay cards (VDSL2-48 r2), each card must be located in its own E7-2 shelf, where each cable connects two shelves to the VCP (standalone shelves or modular chassis).

Note: All E7-2 cards in each SLV system must run the same EXA software version. The minimum EXA releases to support SLV are R2.5.20 (for VCP-192) and R2.6.0 (for VCP-384).

To install a Vector Control Y-Cable (to connect an SLV Host card to SLV Target cards)

1. Connect the VCC Y-cable's single-ended side to the VCP card:
   - **VCP-384:** Connect to one of the four VC ports (**VC 1-2**, **VC 3-4**, **VC 5-6**, **VC 7-8**)
   - **VCP-192:** Connect to one of the two VC ports (**VC 1-2**, **VC 3-4**)
2. Connect the VCC Y-cable's other two ends to the **VCC** port on each of two VDSL2 r2 cards per the guidance above.
3. Repeat steps 1 and 2 to install another VCC Y-cable for each additional pair of VDSL2 r2 cards (SLV Targets) to connect to the VCP card.

Chapter 5

Maintenance

This chapter describes how to perform routine maintenance on worn or failed E7-2 equipment.

Topics Covered

This chapter covers the following topics:

- Replacing pluggable transceiver modules on E7-2 line cards
- Replacing an E7-2 line card
- Replacing the fan module
- Fan filter maintenance

Replacing Pluggable Transceiver Modules

Use the following procedure to replace a damaged or failed pluggable transceiver module.

DANGER! CLASS 1 LASER PRODUCT. INVISIBLE LASER RADIATION MAY BE PRESENT. Fiber optic radiation can cause severe eye damage or blindness. Do not look into the open end of an optical fiber.

To replace a pluggable transceiver module

1. Disconnect the fiber(s) from the module to replace, if present.
2. Remove the pluggable module from the E7-2 line card as follows:
   a. Unlock the latch on the module, if so equipped (latch styles vary).
   b. Gently pull the latch to unseat the module.
   c. Carefully slide the module out of the socket and set it aside.
3. Insert a replacement module into the vacant socket and re-connect fibers. See *Connecting the E7-2 Line Interfaces* (on page 43) for detailed instructions.

Replacing an E7-2 Line Card

Use the following procedure to replace a damaged or failed E7-2 line card.

ESD ALERT! Beware of electrostatic discharge. Follow standard ESD precautions. Always wear a grounded ESD wristband to avoid damaging the electronic equipment.

To replace an E7-2 line card

1. Disconnect all line interface cables (fibers) from the card to replace.
2. If the replacement card will reuse optics modules from the replaced card, remove all pluggable modules from the card.
3. Remove the line card from the E7-2 shelf as follows:
   a. On the card faceplate, pull the ejector lever open into the unlocked position to unseat the card.
   b. Carefully slide the card out of the slot, and place it in protective packaging. Return the faulty unit to Calix.
4. Insert a replacement line card into the vacant slot. See *Installing E7-2 Line Cards* (on page 27) for detailed instructions.

   Note: If you are not installing a replacement card, or no replacement card is available, install a Blank card into the vacant slot.
5. Install pluggable transceiver modules into the card and connect fibers as required. See *Connecting the E7-2 Line Interfaces* (on page 43) for detailed instructions.

Replacing the E7-2 Fan Module

Calix E7-2 fan modules are hot-swappable, so you can remove and install the fan module while the system remains powered.

Note: Do not leave a powered E7-2 operating for more than a few minutes without a fan module installed, to avoid overheating the system.

Replacing an FTA with an FTA2 (as labeled on the fan module faceplate) is supported as long as system is running a software version that supports the FTA2 (AXOS R3.1 or higher, or EXA R2.2 or higher).

Use the following procedure to replace a damaged or failed fan module. Return the faulty unit to Calix.

To replace the fan module

1. Remove the fan module from the E7-2 housing as follows:
   a. Firmly grasp the fan module latch and slide it to the left, and then pull forward to unseat the module.
   b. Pull the fan module forward to remove it from the E7-2 chassis.

2. Insert a new fan module into the vacant slot.
3. Push the fan module back into the slot until the latch clicks into place, completely seating the module.

E7-2 Fan Filter Maintenance

The E7-2 fan module includes an air filter for use in indoor/office environments. The filter resides on the left side of the FTA, and on the right side of the FTA2.

The air filter is made of closed-cell fiber composite material and can be washed and replaced. Calix recommends conducting a visual inspection of the filter every three months. When the filter becomes visibly clogged with dust or dirt, the filter must be cleaned.

Note: Do not leave a powered E7-2 operating for more than a few minutes without a fan module installed, to avoid overheating the system.

To clean the air filter

1. Remove the fan module from the E7-2 housing as follows:
   a. Firmly grasp the fan module latch and slide it to the left, and then pull forward to unseat the module.
   b. Pull the fan module forward to remove it from the E7-2 chassis.
2. Remove the air filter from the fan module (located on the left side of the FTA or on the right side of the FTA2). For the FTA, the filter is green.

   The FTA2 is shown below.

3. Clean the filter as follows:

   a. Using compressed air, spray the filter to remove loose dust particles from the surface.

   b. Thoroughly wash the filter in soapy water, removing any trapped dust/dirt particles. Rinse the filter with water.

   c. Pat dry the filter using an absorbent towel or cloth.

   d. Spray the filter with compressed air to remove any remaining moisture on the outside of the filter.

   Note: If the filter is badly worn, replace it with a new filter (available from Calix).

4. Reinstall the filter into the fan module, and then install the fan module into the E7-2 chassis.

Appendix A

Appendix

This appendix provides general reference information about the Calix E7-2 Ethernet service access platform.

Topics Covered

This appendix covers the following topics:

- E7-2 specifications
- E7-2 LED behavior
- ACO button operation
- RS-232 serial port pin assignments
- RJ-21 connector pin assignments
- Fiber handling techniques

E7-2 Specifications

Specifications for the Calix E7-2 follow:

Dimensions	
Chassis	1.7 (H) x 17.5 (W) x 11.45 (D) inches 4.3 (H) x 44.5 (W) x 29.1 (D) cm
Weight	
E7-2 chassis only	5.9 lbs (2.7 kg)
E7-2 chassis with FTA E7-2 chassis with FTA + 2 line cards	7.4 lbs (3.4 kg) 11.5 lbs (5.2 kg)
E7-2 chassis with FTA2 E7-2 chassis with FTA2 + 2 line cards	7.0 lbs (3.2 kg) 11.1 lbs (5.0 kg)
Mounting	
Width	19-inch (48.26-cm) and 23-inch (58.42-cm) racks
Depth	Front (flush) mounting Center (projection) mounting, 5 depth options
Orientation	Horizontal and vertical mounting supported
Electrical	
Power input	-48 VDC redundant battery feeds (A and B) -42.5 VDC to -72 VDC input range
Fusing	7.5 Amps maximum (A and B)
Environmental	
Operating range	-40º C to +65º C (-40º F to +149º F) Humidity: 10 to 95% (non-condensing) Altitude: up to 10,000 feet (3049 m)
Storage range	-40º C to +85º C (-40º F to +185º F) Humidity: 5 to 95%
Heat dissipation (with 2 line cards)	Up to 185 Watts maximum
Fan module cooling capacity	FTA: 200 Watts, 108 CFM; (2) automatic variable fan speed operations FTA2: 200 Watts, 115 CFM; (4) automatic variable fan speed operations **Note**: For EXA systems, FTA2 requires EXA R2.2 or higher to support four fan speeds.
Alarming	8 user definable alarm inputs (7 inputs, 1 output)
Compliance	
Compatibility, Electrical Safety, and Electromagnetic emissions criteria	UL/cUL 60950 European Union EN 60950 (CE Mark) EIA-310D FCC Part 15 Class A Network Equipment-Building System (NEBS) Level 3: Telcordia GR-63-CORE Telcordia GR-1089-CORE Telcordia GR-3028-CORE ETSI EN 300 019, ETSI 300 386

E7-2 LED Behavior

System status indicators

The Calix E7-2 fan module has four LEDs to indicate system alarm and operational status.

LED	Name	Color	Status	Description
CR	Critical	Red	On	A critical alarm is present in the system
			Off	No critical alarms are present in the system
MJ	Major	Red	On	A major alarm is present in the system
			Off	No major alarms are present in the system
MN	Minor	Amber	On	A minor alarm is present in the system
			Off	No minor alarms are present in the system
MGT	System Control	Green	On	An active E7-2 shelf controller (card) is present
			Off	No active E7-2 shelf controller (card) is present

Note: The E7-2 fan module also features a 7-segment LCD display (for future use).

Card status indicators

Each Calix E7-2 line card has three LEDs to indicate the card's operational status.

LED	Name	Color	Status	Description
FAIL	Failure	Red	On	A fault has occurred that should be addressed
			Off	Normal card operation
CTRL	Control	Green	On	This card is the active shelf controller
		Amber	On	This card is the standby shelf controller
SRVC	Service	Green	On	One or more ports are enabled and may carry services
			Off	No ports on this card are enabled

Note: LED behaviors are shown for the card's primary operational states. The card LEDs exhibit additional behaviors associated with boot up cycles and other activities. Refer to the system operation documentation for full details.

Port status indicators

Each interface port on an E7-2 line card has an LED located below its module socket to indicate port status. (E7-2 cards contain a mix of some or all port types listed below).

LED	Port	Color	Status	Description
QSFP (1/2, 3/4)	100GE	Green	On	(Left-most LED) Indicates that an Ethernet link has been established when an optical module is present, or an aggregate Ethernet link has been established when a Direct-Attach Copper (DAC) cable is present
			Blinking	(Left-most LED) Blinks (3) times to indicate link activity
			Off	(Left-most LED) Socket is vacant or an invalid module is inserted
		Amber	On	(Right-most LED) Indicates a module has been inserted into a QSFP socket but cannot link, typically because the socket's power has failed or is not enabled
QSFP (1/2)	40GE	Green	On	Indicates that an Ethernet link has been established
XFP (1, 2)	10GE		Blinking	After module insertion, blinks (3) times to indicate the inserted module is recognized and allowed to operate Blinks at variable speeds to indicate the link is transmitting/receiving traffic
SFP+ (1–12)			Off	Socket is vacant or an invalid module is inserted
		Red	On	Indicates a module has been inserted into a 10GE socket that is directed to the backplane for connectivity between two cards (Applies to **XFP 2** and **SFP+ 2** only)
CSFP (1–24) or **SFP (1–12)**	1GE	Green	On	Indicates that an Ethernet link has been established
			Blinking	After module insertion, blinks (3) times to indicate the inserted module is recognized and allowed to operate Blinks at variable speeds to indicate the link is transmitting/receiving traffic
			Off	Socket is vacant or an invalid module is inserted
GPON (1–8) or **PON (1–8)**	GPON XGS-PON	Green	On	Indicates that at least one ONT is in service on the PON
			Blinking	After module insertion, blinks (3) times to indicate the inserted module is recognized and allowed to operate Blinks steadily while the first ONT on the port is ranging
			Off	Socket is vacant or an invalid module is inserted

ACO Button Operation

The E7-2 has an Alarm Cut Off (ACO) button located on the fan tray to turn off an external alarm. When the alarm output position (located on the E7-2 rear panel) is configured to interface with an external alarm system and an alarm is raised in the system, the environmental output pins short (close) and cause the external alarm (such as horns or lights) to start.

By default, major alarms and higher short the output pins, however you may provision the alarm severity via the user interface.

To turn the external alarm off, press the Alarm Cut-Off (ACO) button located on the fan tray; alarms raised in the system before the ACO button was last pressed are no longer considered, however a new alarm in the system will cause the external alarm to start again. The ACO button does not affect alarms in the system. The output pins affect the ACO button by default, and can be disabled via the user interface.

See *Wiring External Alarms* (on page 39) for more information.

RS-232 Serial Port [MGT-1] Pins

The RS-232 serial port enables local console connections to the CLI, accessible via an RJ-11 connector (labeled **MGT-1**), located on the E7-2 fan tray and E3-2 control module.

Use of the port requires a non-standard cable, with a pre-fabricated cable no longer available from Calix. However, you can use the port signal information shown below to build your own cable for this management interface.

E7-2 Serial Port

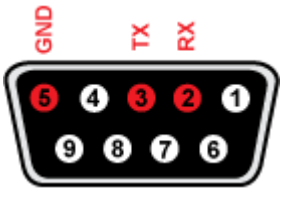
RJ-11F Connector

RS-232 Signal (from E7-2)	Serial Port RJ-11F
TX	Pin 3
RX	Pin 4
GND	Pin 5

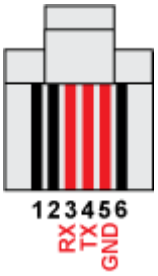
You can use an RS-232 console cable (DB-9F to RJ-11M) to connect a PC to the E7-2 serial port. Make sure the user-supplied console cable follows the pin scheme below, as required.

Console Cable

RS-232 Signal (From PC)	PC End: DB-9F	E7-2 End: RJ-11M
RX	Pin 2	Pin 3
TX	Pin 3	Pin 4
GND	Pin 5	Pin 5



DB-9F Connector

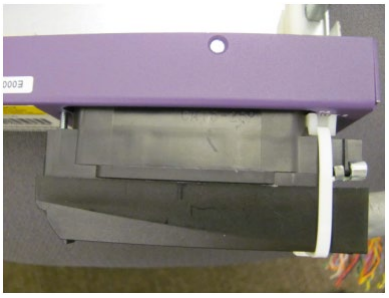


RJ-11M Connector

RJ-21 Pin Assignments

To wire the E7-2 system for DSx services (e.g., VDSL2/POTS), use 25-pair cables with an RJ-21 male connector. This topic provides the RJ-21 connector pin assignments. Calix recommends that RJ-21 connectors on the 25-pair cables have a 110 degree exit or 90-degree exit (at pins 1 and 26).

110-degree exit



90-degree exit

For instructions on installing an RJ-21 connector, see *Connecting to the Subscriber Interfaces* (on page 46).

Pin assignments

The E7-2 standard RJ-21 pinout assignments follow:

Pin	Color	Tip/Ring	Circuit		Pin	Color	Tip/Ring	Circuit
1	BL/WH	Ring	1		26	WH/BL	Tip	1
2	OR/WH	Ring	2		27	WH/OR	Tip	2
3	GN/WH	Ring	3		28	WH/GN	Tip	3
4	BR/WH	Ring	4		29	WH/BR	Tip	4
5	SL/WH	Ring	5		30	WH/SL	Tip	5
6	BL/RD	Ring	6		31	RD/BL	Tip	6
7	OR/RD	Ring	7		32	RD/OR	Tip	7
8	GN/RD	Ring	8		33	RD/GN	Tip	8
9	BR/RD	Ring	9		34	RD/BR	Tip	9
10	SL/RD	Ring	10		35	RD/SL	Tip	10
11	BL/BK	Ring	11		36	BK/BL	Tip	11
12	OR/BK	Ring	12		37	BK/OR	Tip	12
13	GN/BK	Ring	13		38	BK/GN	Tip	13
14	BR/BK	Ring	14		39	BK/BR	Tip	14
15	SL/BK	Ring	15		40	BK/SL	Tip	15
16	BL/YL	Ring	16		41	YL/BL	Tip	16
17	OR/YL	Ring	17		42	YL/OR	Tip	17
18	GN/YL	Ring	18		43	YL/GN	Tip	18
19	BR/YL	Ring	19		44	YL/BR	Tip	19
20	SL/YL	Ring	20		45	YL/SL	Tip	20
21	BL/VI	Ring	21		46	VI/BL	Tip	21
22	OR/VI	Ring	22		47	VI/OR	Tip	22
23	GN/VI	Ring	23		48	VI/GN	Tip	23
24	BR/VI	Ring	24		49	VI/BR	Tip	24
25	SL/VI		Not used		50	VI/SL		Not used

Fiber Handling Techniques

To ensure fiber splices are made within optical link budget loss specifications, follow the suggestions below.

Important: Calix strongly recommends using the fusion splice method for all fiber splices.

Jacket preparation (OSP fiber)

Remove the jacket, buffer tubes and strength member using a wire stripper or cutting pliers. The plastic buffer coating should be removed with a high-quality wire stripper.

Fiber preparation

Proper preparation of the fiber end face is critical to any fiber optic connection. Perpendicularity and end finish must be within allowable tolerances in order to minimize signal loss at these connections. A divergence of as little as 2° from perpendicular should be considered unacceptable. The end finish should have a smooth, mirror-like finish free of blemishes, hackles, lips, and burrs.

Ends should be prepared using the scribe and break method. While holding the fiber under slight pressure, run the cutting tool across the stationary fiber at a perpendicular angle. Properly done, the cleave produces a perpendicular, mirror-like finish without hackles or lips. If major flaws are noticed, the process must be repeated. Inspect the fiber end under a microscope to ensure proper finish.

Small scratches on the face or small pits on the outside rim of the cladding are common and should be considered acceptable. Fusion splicer readings and experience more than anything determines the definition of "small."

Prior to putting the fiber ends into the fusion splicer, clean each end with pure optical grade isopropyl alcohol and a lint free pad such as Texwipe™ Alco Pad or Texwipe™ Cloth.

Cleaning fiber optic connectors

The process described here should not be applied routinely. This procedure should only be performed in cases where degraded performance of the assembly is noted or there is evidence of contamination. Excessive cleaning may actually increase the likelihood of fiber contamination.

Materials used for cleaning fiber-optic devices should be consistent with the function. Wiping cloths should be made of lint free, non-abrasive materials. Cotton swabs should have a tightly wrapped tip and be talcum-free. Pure optical grade isopropyl alcohol is the recommended solvent for cleaning connector tips. For removing dust from receptacles, a canned compressed gas is recommended.

Cleaning procedures

- Remove any accumulated dust or debris from the connector by blowing off the cylindrical and end-face surfaces of the connector using the compressed gas.
- Use a pad or a wipe saturated with optical-grade isopropyl alcohol to gently wipe the cylindrical and end-face surfaces.
- Use compressed gas to blow dry the connector surfaces or allow them to air dry.
- Avoid touching the connector surfaces after cleaning. If the connector is not going to be used, it should be covered with a dust cap to prevent contamination.

Handling of connectors

Although ruggedly constructed, fiber connectors should be handled with care during insertion. Follow these tips to make secure, long lasting connections:

- After removing the protective cap, make sure the fiber end remains clean and moisture free.
- Insert the connector into the fitting by grasping the rigid plastic fitting directly behind the fiber output shroud. The connection is fully seated when you hear it snap (click) into place.
- Never attempt to insert the connector by gripping the white or green flexible shroud. This may cause the fiber to kink in the jacket, introducing unwanted noise to the line.

INTELLIGENT ACCESSEDGE

Solution Brief

AXOS SMx

Enabling the power of AXOS®

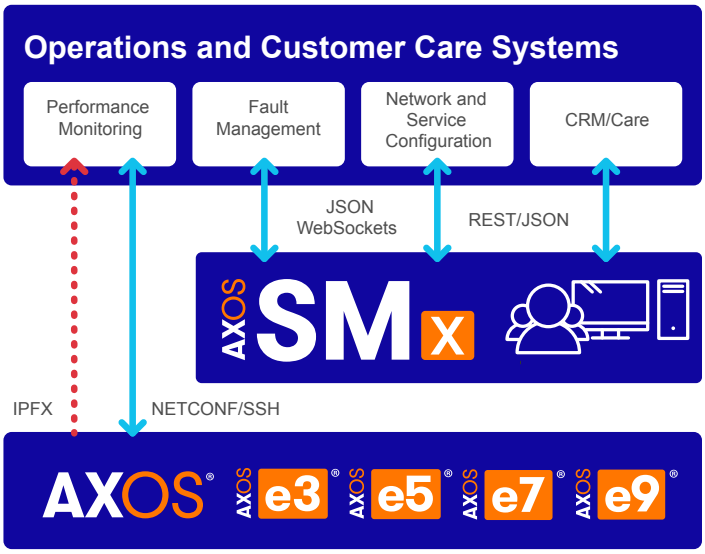
There is a real opportunity for service providers to simplify their OSSs by introducing a highly automated and dynamic approach to service operations. As API-based approaches are now used deep inside the network, increased automation and highly dynamic operational processes can now extend from the OSS into the cloud control domain. Automation is key, and by automating manual back-office integration functions, service providers can immediately begin to decrease time to market while simultaneously reducing their service delivery intervals.

Calix

AXOS®

AXOS is an open Linux-based componentized Operating System designed for Software Defined Access networks to accelerate Broadband service delivery.

AXOS SMx is the latest addition to the Calix AXOS family of connectors, which allow service providers to bridge the gap from older technologies to next generation solutions via cutting-edge software. Built to give service providers another option for their transition to SDN beyond the native AXOS NETCONF/YANG interfaces, AXOS SMx gives them the flexibility to deploy an SDN network with automated workflows today using existing back-office business systems.



SMx is the Calix next generation service delivery and assurance platform designed specifically for AXOS systems. SMx leverages the Open Daylight (ODL) SDN controller platform and the latest web echnologies, to create a horizontally scalable domain controller for managing carrier deployments.SMx is designed with virtualization in mind, and capable IPFX NETCONF/SSHof management and control of current generation Calix Physical Network Functions (PNF), and designed to support future Calix Virtual Network Functions (VNF).

SMx leverages the power of AXOS systems to deliver and control services on Fiber-to-the-Node, Fiber-to-the-Distribution Point and Fiber-to-the-Premises networks. It is designed to manage G.Fast and VDSL2 based copper as well as GPON, 10G XGS-PON and NGPON2 systems, and future anyPHY and anyPON PNF or VNF systems.

SMX DELIVERS:

- Element and network state visibility
- Workflow based configuration and policies
- Command Center pointand-click GUI
- Dashboards, network topology views
- Software image management

Integration and Automation

Calix SMx solution is designed to automate delivery and management of Gigabit and 10 Gigabit Ethernet high speed Internet, RF video, IPTV video, SIP and MGCP voice over IP services across the entire Calix access network. Calix SMx software is designed to simplify integration of AXOS platforms into Business (BSS) and Operations (OSS) Support Software by normalizing Service Delivery and Assurance APIs across anyPHY systems. The APIs are also designed to integrate with higher layer domain SDN controllers to allow providers automate functions at the Element Management (EML) or Network Element Layer (NEL).

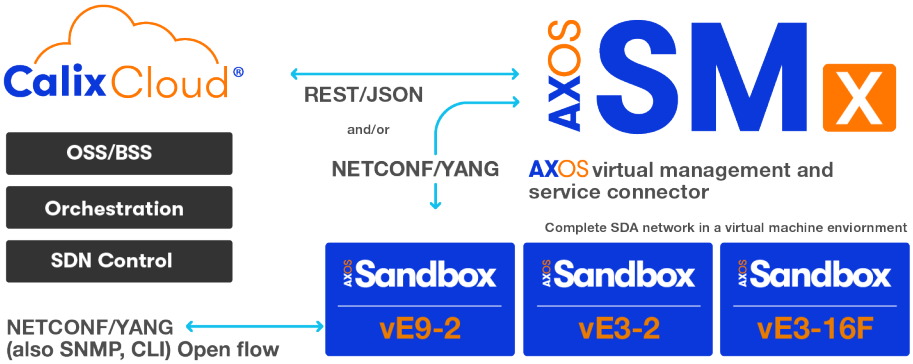
Additionally, Calix SMx integrates with AXOS Sandbox to accelerate back office even prior to hardware availability.

Architecture

SMx implements a micro-services architecture designed to automate service delivery and management on Calix anyPON and anyPHY systems. These services are exposed through a published open REST/JSON API to simplify back office integration. It exposes its API through a Swagger interface integrated in the application server platform, and leverages that API to implement its browser based GUI to ensure consistency between BSS/OSS and SMx. SMx implements a virtualized high available architecture that clusters cloud application and persistence servers for resiliency and scale. SMx support full FCAPS management for AXOS systems. Persistent Management Agent (PMA) ODL plugin and tenant application, conformant to BBF WT-301 architecture, to provide persistence for both pre-configured and offline systems. This enables the provider to fully configure systems and services before they are deployed.

Persistent Management Agent Aggregator (PMAA) ODL tenant application that provides service delivery and assurance functions, as well as service and network persistence. User and Application Programmer (API) Interfaces: SMx was designed from the ground up with integration and automation in mind. It's REST/JSON APIs are designed to enable full programmability from back office systems and SDN domain controllers. The web base User Interface is a façade that leverages the API and provides work flow business logic for OAM&P and administrative functions.

Service Support



SMx implements a micro-services architecture that leverages ODL and the latest Cloud technologies to deliver a highly available horizontally scalable architecture designed to manage thousands of AXOS systems. The architecture implements a service oriented architecture to support delivery of network services including:

Voice	Video
SIP	IPTV
MGCP	RF*

Internet Data	Business Services
Up to 1 G per second on copper	CE 2.0*
Up to 10 G per second on fiber*	SAT*
L3 service flows	SOAM*
L2 service flows	
Wi-Fi	

SMx delivers a rich set of management and control functions required to operationalize AXOS systems. Service delivery and management functions are designed to take advantage of AXOS anyPHY and anyPON architecture to provide platform and PHY neutral service configuration leveraging service templates that abstract platform and technology to provide a simple consistent work flow for copper and fiber based systems.

Key management and control functions are highlighted below:

Configuration Management	Performance Management
Node discovery and Network configuration	Real time statistics
Service administration and provisioning	Node, port service performance
Bulk configuration changes	Collection scheduling (Y.1731*)
Software management and upgrades	Reporting*
Configuration backup and restore	

Accounting	Security
Logging and reporting	CE 2.0*
Usage data collection scheduling (IPFIX*)	Reporting
	Secure NBI/SBI communications

Note: *Coming soon.

System Specifications

SMx supports all AXOS based systems (running AXOS Releases 2.x and higher). SMx supports the latest major AXOS release for each system, plus two previous major AXOS software releases

System Requirements

SMx is fully virtualized and supports VMWare ESXi. minimum and mid-scale requirements

Supported Systems

E5-16F MDU, E3-16F DPU, E3-2* ROLT, E7-2*, E9-2*

Min. AXOS Software Required

AXOS R2.1, 2.2, 2.3, AXOS R3.0, AXOS R3.1, AXOS R4.0

Min. System Requirements

Linux CentOS 7 64bit or Linux RedHat 7 64bit, 32 GB RAM, 8 cores, Minimum of 250 GB

AXOS Systems Support:

E7-2 NGPON-2, E7-2 GPON-8 r2, E3-2 GPON, E9-2 NG1601, E9-2 GP1611, E5-16F, E3-16F

Learn more about SMx

More information about SMx:

https://www.calix.com/software-defined-access/software-defined-access-integration-with-dpx.html

Or, contact your Calix sales representative.

AXOS
Modules
Solution Brief

Advanced Routing Protocol Module (ARm)

OVERVIEW

Subscriber demands continue to increase and new applications like VR/AR and higher capability gaming are not only getting more bandwidth intensive but have stricter latency requirements as well. These changes are happening at an ever increasing speed and they require service providers to be quick or miss the window of opportunity. Existing network architectures have lot of inherent complexities which make it costly and difficult for service providers to keep up and meet subscriber demands. So, a simplified network that reduces TCO and time to market is necessary.

Calix Advanced Routing Protocol module (ARm), which is part of Calix Intelligent Access Edge solution, helps service providers simplify their network architectures and operations by bringing layer 3 functionality – including MPLS routed networking – to their new or existing Layer 2 access network. This helps consolidate multiple network functions there by

AXOS
The OS for Access

AXOS ARM

2777 Orchard Parkway, San Jose, CA 95134 | **T:** 1 408 514 3000 | **F:** 1 707 283 3100 | **www.calix.com**

AXOS

AXOS is an open Linux-based modular architecture Operating System designed for Software Defined Access networks to accelerate Broadband service delivery.

reducing design, deployment and maintenance costs of the access and aggregation networks. This also reduces the time to market for new services.

The new ARm module is yet another example of the benefits of the AXOS architecture because the AXOS modular architecture makes it very simple to add new modules and therefore new capabilities rapidly.

AXOS Architecture

AXOS Connectors	AXOS DPX™ AXOS OFX™ AXOS SMX™
AXOS Modules	AXOS SMM™ AXOS RPM™ AXOS ARM
AXOS Toolboxes	AXOS Diagnostics Toolbox
AXOS Systems	AXOS Sandbox AXOS eSeries AXOS e3 AXOS e5 AXOS e7 AXOS e9

INTELLIGENT ACCESS EDGE:

The Advanced Routing Protocol Module (ARm) is part of the AXOS Intelligent Access Edge solution that enables service providers to simplify their network and operations while maintaining their existing Layer 2 access network. The Intelligent Access Edge consolidates all the critical functions of subscriber and services policy and management into a single network location and includes the ability to connect existing MPLS networks to the access network.

The Intelligent Access Edge Solution enables service providers to take advantage of the following benefits that a Layer 3 access network offers:

- Reduced network elements
- Reduced time to provision subscribers and new services
- Reduced time to coordinate multiple network elements to deploy new services
- Increased security in the access network

The AXOS Advanced Routing Protocol Module includes all the capabilities of the existing AXOS Routing Protocol module (RPm), additional Layer 3 capabilities including

ARM KEY ATTRIBUTES:

SIMPLIFY: ARm plays a key role in network simplification by providing routing functionality in the form of a software module and eliminating the need for a separate hardware to handle it.

FLEXIBLE: ARm enables you to utilize layer 2 or layer 3 service delivery model based on your specific needs.

One System, Two Ways to Simplify: ARm works with ASM3001 cards as well as the CLX3001 cards to deliver the layer 3 routing functionality to the access network. With ASM3001, it aggregates and routes traffic from remote L2 OLT systems where as with CLX3001 it aggregates and routes on the same system which has OLT capability as well. This ability of ARm to work on different hardware enables one E9-2 system to simplify networks in two different ways.

Layer 3 multicast / PIM-SSM as well as significantly expands the options for WAN connectivity including MPLS LSR / LER with Pseudo wire. The Advanced Routing Protocol Module (ARm) works in conjunction with the Subscriber Management module (SMm), to consolidate all the critical functions of subscriber and services management into a single network location and includes the ability to connect existing MPLS networks to the access network. By collapsing many network functions into a single system the ARm helps radically simplify the network and reduce TCO and time-to-market dramatically.

The ARm in junction with ASM3001 provides access service aggregation and advanced routing functions with L2 or L3 handoff to the ISPs. The Intelligent Access Edge solution provides support for performance monitoring, Authentication Authorization Accounting (AAA), Hierarchical QoS, Security, L2 and L3 VPN at the edge of the IP/MPLS network.

AXOS ARCHITECTURE

The Advanced Routing Protocol Module (ARm) is an optional module in the AXOS platform.

The AXOS architecture provides service providers the opportunity to have:

- Hardware Independence – enabling operation over all physical layer access technologies
- Common Service Models – The software abstraction layer ensures common methods of operation regardless of physical layer technology and deployment locations
- Modular architecture – Ensures independent modules can be easily added, upgraded and restarted without impact to other modules
- Stateful Operation – Modules maintain their operational state ensuring when restarts occur operation of the other modules are maintained
- SDN Interfaces – Standard northbound interfaces to ensure easy integration with new and existing BSS/OSS systems and SDN controllers

The AXOS architecture ensures new modules such as the Advanced Routing Protocol can be easily and rapidly introduced enabling service providers to simply take advantage of new capabilities.

Management	REST	SNMP	**NETCONF/ YANG**	CLI	OpenFlow
Control & Data	Oos Manager	Performance Manager	Subscriber Management	Diagnostics	Syslog
	Timing	Routing Protocols	OAM	Advanced Routing Protocol	3rd Party
	Topology & Discovery Protocols	Layer 2 Protocols	Multi-cast Protocols	Traffic Management	Multi-Service Protocols
Infrastructure	SERVICE ABSTRACTION LAYER				
	HARDWARE ABSTRACTION LAYER				

SIMPLIFIED OPERATIONS

Fewer network elements mean simpler design, deployment, provisioning and operations. This dramatically reduces Total Cost of Operations (TCO) and time-to-market. The AXOS hardware abstraction layer, hides the differences between the physical layers required to deliver common services across the network while maintaining common operational procedures for all subscribers.

Hierarchical Quality of Service (QoS)

One of the key differentiations of the ASM is the state-of-the-art QoS implementation that is necessary to support enhanced Access solutions for Residential, Business and Mobile consumers over a unified Access (e.g., PON). The support for per service, per subscriber per PON, per Access, per ISP policing and shaping are among the key features enabled on ASM3001.

Multiple Networking Options

The Intelligent Access Edge Solution enables a rich set of L2 and L3 network services including 802.1Q, Q-Q, IPv4, IPv6, MPLS, LDP, PWE, PIM-SIM, OSPF, IS-IS, BGP,L2 and L3 VPNs. These enable the service providers to deliver comprehensive access solutions and services across a diverse Residential, Business and Mobile subscriber base.

Subscriber Service Management

The ARm operates in conjunction with the Subscriber Management Module (SMm) and provides a full suite of protocols ranging from AAA, dynamic subscriber policy updates, walled garden, IP address Management are among the key capabilities enabled by the Intelligent Access Edge Solution.

PROTOCOLS SUPPORTED

Static Routes (IPv4/v6)

BGP (iBGP/eBGP)

Routed VLANs

L3 LAG

OSPFv2

IS-IS

VRF

PW Encapsulation (EoMPLS)

IP Multicast (PIM-SM/SSM)

IGMPv2/v3

ASM-SSM Mapping

ECMP

MPLS LDP (LER)

BFD

RELATED AXOS MODULES

Can be combined with the AXOS Subscriber Management Module (SMm)

SUPPORTED AXOS SYSTEMS

E9-2 Intelligent Edge System

QUALITY AND SERVICE

Service classification based on port, Ethernet and VLAN Headers, L3 5-tuple

Strict priority and Weighted Round Robin (WRR) based scheduling

Hierarchical QoS (per subscriber, per service, per PON Congestion avoidance: Tail Drop

SUPPORTED LINE CARDS

CLX3001 Control card

ASM3001 Aggregation Services Manager

STANDARDS AND RFC SUPPORTS

ITU-T G.989 NG-PON2

ITU-T G.9807.1 XGS-PON

TR-101 VLAN Service models IEEE 802.1p CoS Prioritization

IEEE 802.1 MAC Bridges IEEE 802.1Q VLAN tagging IEEE 802.1ad VLAN stacking (Q-in-Q) support

RFC 2236 IGMP v2

RFC 3376 IGMP v3

RFC 3810 MLDv2

RFC 3046 DHCP Relay Agent Information Option (“Option 82”)

RFC 4541 IGMP Proxy RFC 4553 Structure

Dynamic Bandwidth Allocation (DBA) Advanced Encryption Standard (AES)

Forward Error Correction (FEC)

RFCs: 6241, 2597, 2460, 2131, 2474, 3077, 5880, 5881, 4271, 4260, 2698, 3315, 3392, 4360, 2131, 2464, 792, 4893, 3246, 2918, 2439, 4274, 5277, 4278, 5701, 2309, 4861, 3031, 3376, 4601, 3032, 4379, 3985, 4447, 4448, 2328, 2933, 2463, 4443, 3810, 4604, 6242,

Calix Services

Service Description Document

E9-2 Layer 3 Deployment Service

Leverage Calix experts to help you rapidly plan and deploy the E9-2 Node utilizing Layer 3 and Subscriber Management functions. Our teams have decades of experience in helping existing and new service providers design, deploy and maintain best-in-class broadband access networks.

SCOPE OF WORK

Calix will:

- Provide up to 32 hours of Consulting to plan the high-level network design of the E9-2 Node
  - Lead planning and design sessions for the deployment of the E9 Node into the Customer network
  - Plan and determine WAN routing deployment (e.g. BGP, MPLS, OSPF, BGP-VRF, EVPN, ISIS, 802.1Q, Q-Q, etc.)
  - Plan and determine Subscriber Management functions deployment (e.g. Diameter, RADIUS, AAA, IP address management, DHCPv4/6, PPPoE IA, L2TP, LNS, Walled Garden, DDoS, Mirroring, Lawful Intercept, etc.)
  - Review existing systems, software and hardware (if applicable)
  - Identify solution design requirements and integration challenges
  - Determine and recommend deployment and integration paths
- Create a Network Engineering Spec Book to detail the new Calix equipment and configuration details with the following:
  - Physical Network architecture and connection detail
  - Detailed configuration data
  - Detailed provisioning data
  - IP network information
  - Network diagrams
  - Calix equipment list
- Schedule a call with the Customer and review the Network Engineering Spec Book
- The Calix Engineer will remotely access the network to turn up and test the new Node as detailed in the approved NESB. The following is the test plan that will be followed, the results will be recorded in a final report to the Customer:

Grounding	*Customer will verify grounding is properly completed*
Power	*Customer will record power levels at the shelf inputs, rectifier outputs, PDBs and fuse/ breaker panels*
Optical Readings	*Customer to test Optical levels with a light meter. Levels will be verified to be within range of Calix equipment specifications*
Uplink Protection	*Customer and Calix - Protected facilities between the E9-2 and the upstream router will be tested by causing link failures and verifying service continuity on work and protect paths*
Alarming	*Customer and Calix will test battery, environmental (contact closures), equipment removal from shelf (remove 1 card per shelf), and optical failure alarms, as applicable*
In-band Management	*Calix will verify the shelf (or shelves) are reachable via management channel*
Data Test	*Customer and Calix - Data/Internet will be tested on one port per Calix Node. Upload and download speeds will be recorded and verified. If Internet connectivity is not available, data will be validated by performing up and downstream file transfer successfully*
Voice Test	*Customer and Calix - Voice services will be tested on one port per Calix Node. This includes inbound calling and outbound calling*

- Calix will update the NESB with test results and provide document to Customer

REQUIREMENTS

- Base Package is for one (1) new Calix E9-2 Node with ASM or CLX cards
  - A Node with ASM cards is a single shelf
  - A Node with CLX cards can have multiple Access shelves that share a single management IP address
- Part number 110-01518 is the base package for the first Node and part number 110-01341 is an add-on package for each additional node on the same network.
    - E7-2 AXOS Nodes are single shelves and each will require part number 110-01341 to be added.
- Remote support only; uninterrupted remote network access required
- Customer to provide all details for any new Calix equipment that will be added to the network
- The NESB must be approved by all parties prior to scheduling the turn up of the shelf
- Customer is responsible for all physical tasks required
- Customer is responsible for provisioning and testing all 3rd party equipment required to implement this scope
- This package assumes work is continuous without delay, time spent troubleshooting issues will require a change notice
- Customer is responsible for service provisioning
- This package does not include software upgrades
- SMx or CMS turn up is not included in this Service
- This service is for remote support. On-site support requires a custom quote
- Service is a new Node Turn up, ring insertions or maintenance work is not included

ORDERING INFORMATION

Calix Package Description: **E9 Layer 3 Deployment Service**
Calix Package Part Number: **110-01518**

ADDITIONAL NODES

Calix Package Description: **E9 Layer 3 Deployment Service - Add 1 Node**
Calix Package Part Number: **110-01527**

Calix Package Description: **Network Design, Turn up - L2 - Add 1 E9 Node**
Calix Package Part Number: **110-01525**

Calix Package Description: **Network Design, Turn up - L2 - Add E7, E3, C7 Node**
Calix Package Part Number: **110-01341**

Calix Services

Service Description Document

Remote Network Turn-up and Test

The Calix Professional Services Network Engineer will remotely access the Customer network to turn up and test one new Calix Layer 2 Node installed by the Customer, Calix will also create a Network Engineering Spec Book (NESB) for the Node being tested. The following tasks will be performed on this package:

SCOPE OF WORK

- The Professional Services Network Engineer will create a Network Engineering Spec Book to detail the new Calix equipment and configuration details
  - Consult with the Customer on the network configuration details
    - Customer to provide all required physical and logical details
  - Review the data and prepare a Network Engineering Spec Book for the new Calix equipment with the following:
    - Physical Network architecture and connection detail
    - Detailed configuration data
    - Detailed provisioning data
    - IP network information
    - Network diagrams
    - Calix Equipment List
  - Schedule a call with the Customer and review the Network Engineering Spec Book
- The Professional Services Network Engineer will remotely access the network to turn up and test the new Node as detailed in the approved NESB.
- The following is the test plan that will be followed:

Grounding	*Customer will verify grounding is properly completed*
Power	*Customer will record power levels at the shelf inputs, rectifier outputs, PDBs and fuse/ breaker panels*
Optical Readings	*Customer to test Optical levels with a light meter. Levels will be verified to be within range of Calix equipment specifications*
Uplink Protection	*Customer and Calix - Protected facilities between the node and the upstream router will be tested by causing link failures and verifying service continuity on work and protect paths*
Alarming	*Customer and Calix will test battery, environmental (contact closures), equipment removal from shelf (remove 1 card per shelf), and optical failure alarms, as applicable*
In-band Management	*Calix will verify the node is reachable via management channel*

Data Test	*Customer and Calix - Data/Internet will be tested on one port per Calix Node. Upload and download speeds will be recorded and verified. If Internet connectivity is not available, data will be validated by performing up and downstream file transfer successfully*
Voice Test	*Customer and Calix - Voice services will be tested on one port per Calix Node. This includes inbound calling and outbound calling*

REQUIREMENTS

- Base Package is for one (1) new Calix Layer 2 Node
  - A Node is a shelf or multiple shelves that are combined with a single Management IP address. EXA - Can be multiple E7's in a MCC configuration. AXOS - E3-2, each shelf is a Node; E7, each shelf is a Node; E9 can be multiple shelves
- Add-on Package is available for each additional node turned up and test on the same network. The additional node package is not valid if there is more than a six (6) week delay between each shelf being turn up
- A network is defined as a ring with an uplink. All nodes on the ring use services on the uplink node
- Remote support only; uninterrupted remote network access required
- Customer to provide all details for any new Calix equipment that will be added to the network
- The NESB must be approved by all parties prior to scheduling the turn up of the node
- Installation/Turn-up of the management system (SMx, CMS or DPx) is not included in this Service
- Customer is responsible for all physical tasks required
- Customer is responsible for provisioning and testing all 3rd party equipment required to implement this scope
- This package assumes work is continuous without delay, time spent troubleshooting issues will require a change notice
- Customer is responsible for subscriber services provisioning
- This package does not include software upgrades for existing network elements
- This service is for remote support. On-site support requires a custom quote
- A custom quote is required for any exceptions to this package
- Service is a new Node Turn up, ring insertions or maintenance work is not included

ORDERING INFORMATION

Calix Package Description: Network Design, Turn up - L2 - 1 Node Base
Calix Package Part Number: 110-01340

ADDITIONAL NODES

Calix Package Description: Network Design, Turn up - L2 - Add E7, E3, C7 Node
Calix Package Part Number: 110-01341

Calix Package Description: Network Design, Turn up - L2 - Add 1 E9 Node
Calix Package Part Number: 110-01525

Calix Services

Service Description Document

Network Management Software - Turn up or Upgrade

The Calix Professional Services Project Engineer assists the Customer with turn up or upgrade of SMx or CMS

SCOPE OF WORK

Calix will:

- Access customer network via VPN or agreed mechanism
- Download the latest approved management software (CMS or SMx) from the Calix web portal to the Customer server
- Install new management software or upgrade existing management software
- Verify all management software processes start and are functional

REQUIREMENTS

- Any Northbound Interface, OSS/BSS Integration and/or API call assistance to the Customer server is not included in this service
- Customer to provide the Virtual Machine, CentOS and all required hardware
- All physical work (installation and power of physical hardware) required has been completed prior to implementation by the Customer
- Customer will furnish necessary information to provision services promptly
- Customer's technician will be on-site to assist with all physical tasks and services verification
- Remote support only; uninterrupted remote network access required
- Customer's server specifications must meet or exceed the management software requirements
- Service is for SMx or CMS only
- This Service is available in conjunction with the Remote Network Turn up and Test Service (i.e., this Service does not include turn-up of the node or the services provisioning of the node)
- Service is for a single instance of the management software on the Customer network
- Service assumes the software upgrade will be a single step, multiple upgrade steps will require a custom quote

ORDERING INFORMATION

Calix Package Description: **Network Management Software - Turn up or Upgrade**
Calix Package Part Number: **110-01370**

Calix Support Services

Calix Support Policy: Premier Support

Calix Premier Support is designed for Service Providers who want to improve subscriber experience and get a faster resolution of service impacting problems through a higher level of partnership with Calix Support. With Premier Support, your technical team will be speaking and interacting directly with a Calix Support Engineering Specialist in thirty minutes or less for all service effecting issues, no matter the severity.

The Calix Technical Assistance Center (TAC) provides 24-hours-a-day, 7-days-a-week coverage by our experienced staff of system engineers to help with critical hardware and software issues on all Calix products. Premier support allows you to contact the TAC immediately via the Calix Service Station online support center.

ONLINE SUPPORT CENTER

Log in to the My Calix customer portal and click the Calix Service Station link to:

- Submit a technical service request or check the status of a current request
- Request an RMA
- Request access to controlled availability software
- Review product sales orders, including ship dates and tracking information

Support Entitlement

An active Premier Support agreement is required to receive non-warranty related technical support per Premier Support service terms. The Calix Customer Service team will check entitlement at the time of the support requires. If no agreement is in place, customers may opt to receive support on a per-incident basis.

SOFTWARE ENTITLEMENT

An active Premier Support agreement is required to download software for all products from the My Calix customer portal. In addition, an active software license for AXOS and EXOS products is required to download AXOS and EXOS software. Calix Cloud upgrades (performed in the cloud) are also included with this entitlement.

PER INCIDENT PRICING

For customers without an active Calix Support agreement, technical support is available on a per incident basis.

- Technical service requests - $1500 per request. Fee does not include access to any software updates (production software releases, LDAs, patches) that may be needed to address the issue.
- Software downloads, including Calix systems products operating software and element manager software, are only available under a Calix Support agreement. (Not available on per incident basis)

TAC RESCUE ME RATE

For support requests beyond the scope of the Calix Premier Support agreement, emergency or escalated technical support is available in 4 hour increments for $1500.

SUPPORT RESPONSE TIME OBJECTIVES

Response time is defined as the time from when a case is submitted into the Calix case management system by the Case Submitter, to the time when Calix support engineer has made contact regarding the reported issue. The table below outlines Calix's response time objectives.

SUPPORT TIER	TAC COVERAGE	CRITICAL CASE	MAJOR CASE	MINOR CASE	INFORMATION REQUEST CASE
Premier	24x7 via Web	30 minutes	30 minutes	30 minutes	2 business hours

INCIDENT SEVERITY	DEFINITIONS
Critical	A network, node, or critical circuit is down, or there is a critical impact to Customer's business operations. Calix and the Customer will work around the clock (24x7) to resolve the problem.
Major	Operation of a network, node, or critical circuit is severely degraded, or significant aspects of the Customer's business operation are negatively impacted by unacceptable network performance. Calix and Customer will commit full-time re-sources during normal business hours to resolve the problem. We will develop a plan for appropriate after-hour actions.
Minor	System operations are impaired, but with minimal performance impact. Calix and Customer will commit resources during normal business hours to resolve the problem.
Information Request	Customer requires information or assistance on the Calix product capabilities, installation, operation, administration or configuration. There should be little or no impact to the Customer's business operation. Calix and the Customer are willing to provide appropriate resources during normal business

SUPPORT ESCALATION GUIDELINES

If reasonable progress on a case is not being made, or the quality of the Calix TAC service is not in accordance with the agreement, customers may escalate any such issue by asking for the assigned Calix Support manager.

Calix TAC Contact Information – Services Station online support center : www.calix.com/mycalix

Calix Education Services

Solution Brief

Calix Education Services

IS YOUR TEAM EQUIPPED TO KEEP UP WITH THE PACE OF INNOVATION?

As the pace of technical and business innovation accelerates, it's more important than ever to provide your marketing, operations, engineers, and customer support staff with opportunities for continuous learning. A well-trained team with the right mix of technical know-how and hands-on skills, gives you a competitive edge in the market and has a measurable impact on revenue growth and profitability.

Calix Education Services offers a wide range of flexible training solutions to meet the diverse learning needs of your employees across your entire organization. We strive to ensure that your teams are performing at the highest level and are equipped with everything they need to deploy, configure, manage, and grow broadband networks.

CALIX UNIVERSITY

Calix University is designed for broadband service providers (BSPs) to provide a unique persona-based learning experience with access to high-value, job-centric courses. Calix University combines the existing training courses into the Calix Solutions Academy and will expand the learning options with the addition of other Academies under a single digital campus.

Calix Solutions Academy accelerates time to knowledge and proficiency on Calix premises, cloud, and access solutions.

Broadband Marketing Academy (coming soon) is designed to enable marketing professionals to take subscriber engagement to the next level and achieve impressive marketing ROI.

LEARNING PLANS MAKE IT EASIER TO DETERMINE WHICH TRAINING IS RIGHT FOR YOUR TEAM

FIND YOUR LEARNING PLAN

Learning Plans within the Calix Solutions Academy make it easy to determine the specific training requirements for each employee. Courses are curated by platform, job role or persona, and technology, and each Learning Plan defines the courses a learner needs to become proficient across the portfolio of Calix solutions. Available Learning Plans include the following:

REVENUE EDGE LEARNING PLANS

Revenue EDGE Learning Plans: Get your teams more productive and accelerate your Revenue EDGE initiatives faster with select courses on Calix Cloud, GigaSpire BLAST premises platforms, Wi-Fi, and troubleshooting that fit the training needs of Marketers, Field Technicians, Network Operations, and Customer Support teams.

Customers with Premier Success programs get additional educational opportunities with access to select Revenue EDGE Learning Plan eLearning courses. Contact your Account Executive to find out more.

FIELD TECHNICIAN LEARNING PLAN

The Field Technician Learning Path helps your customer facing teams get up to speed on an array of premises and Cloud solutions to help you deliver managed and whole-home Wi-Fi services. This Learning Plan comes with a Certification path and covers GigaFamily systems, Support Cloud, and Wi-Fi technology and capabilities.

AXOS LEARNING PLANS

Multiple AXOS Learning Plans train your team on what's required to deploy and support the latest AXOS platforms in your operating environment. AXOS Learning Plans are available for the E9-2, E3-2, and E7-2 platforms and cover the latest in PON, Next Generation PON technology, and how to deliver layer 2 and 3-based services.

2777 Orchard Parkway, San Jose, CA 95134 | **T:** 1 707 766 3000 | **F:** 1 707 283 3100 | www.calix.com | 110-4001 V1 | 01/22

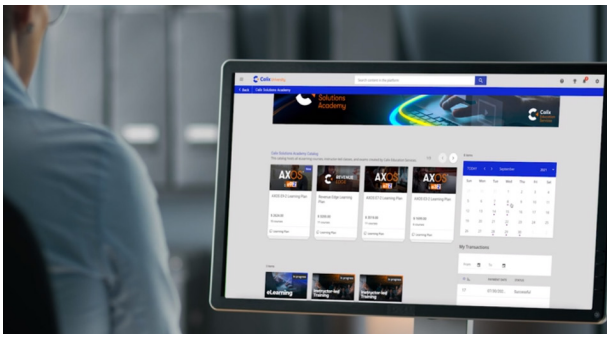
THE TRAINING YOU NEED, DELIVERED WHEN, WHERE AND HOW YOU NEED IT

We offer an extensive catalog of eLearning, hands-on, and remote or on-site instructor-led training courses. Our instructor led courses are facilitated by our team of professional training instructors, who deliver more than 5,500 hours of BSP training each year. These courses consist of the up-to-date materials and many include in-depth, hands-on exercises to ensure learners master the required skills.

We also provide a complete library of eLearning courses, which can be accessed on demand from the Calix University learner portal. eLearning courses are self-paced and make use of a variety of multimedia training tools designed to maximize comprehension and retention. Learners actively engage and interact with the content as they progress through each course.

A NEW EXPERIENCE IN LEARNING

Learners begin their journey at Calix University by logging in to an intuitive and personalized learning portal that provides access to the various Calix academies and communities. From there, learners can enjoy an engaging experience that is:



Personalized - Easily find and take the courses, learning plans, and training resources that are right for your job role and that can advance your career. Automated course suggestions help you expand your knowledge with additional learning opportunities based on your searches and course history.

Easier to Manage - Easily navigate and learn course material and comfortably gain new skills at your own pace. Manage your learning progress and performance as you gain job skills and badges that demonstrate your mastery of the topics.

Enhanced - A gamified learning environment adds fun and friendly competition to the learning program with Champion Points that mark training and certification milestones.

LEARNING SUBSCRIPTIONS MAKE LEARNING EASIER FOR INDIVIDUALS AND TEAMS

Calix subscription programs are designed to make learning continuous and cost effective. Options include an individual subscription with access to multiple Learning Plans and an enterprise subscription to upskill entire organizations on specific Revenue EDGE topics.

INDIVIDUAL EDUCATION SUBSCRIPTION

A Calix education subscription makes it easy for operations and technical team members to get the access and premises cross-platform, technical and services training needed to build proficiency. For one low annual fee, you can take the courses you need, when you need them, to help you get your job done. Then go on to diversify your skills with additional courses that we keep updated from all our different Learning Paths and gain knowledge on other technology platforms and services.

If your job role spans multiple disciplines and you're looking for a flexible and cost-effective way to gain technical and platform knowledge across multiple Learning Paths, the Education Subscription Program is your most cost-effective option.

ENTERPRISE SUBSCRIPTION FOR REVENUE EDGE

Enterprise Subscription for Revenue EDGE gives all team members in your organization access to a collection of job role-based eLearning courses on Calix Cloud, GigaSpire BLAST systems, and business and technology topics. These highly recommended courses will accelerate team competency and skills of your Marketing, Customer Support, and Field Technicians.

For one annual fee all employees within your company will have the ability to access the Revenue EDGE eLearning courses and any of the periodic updates to those courses as features are added or capabilities change. Your team will also be able to access any additional courses as Calix Education Services expands the library of designated Revenue EDGE Subscription-related eLearning courses. Contact your Calix Account Executive for more information on subscription options.

CERTIFICATION OPTIONS FOR BROADBAND PROFESSIONALS

Calix offers certification for key learning plans in Calix Solutions Academy. Certification validates mastery of Calix platform and technology knowledge. Learners that have invested in the certification process not only positively impact their business and performance but also help their career. Certification requires successful completion and passing of the associated learning plan and exam. Calix offers the following certification programs:

CERTIFICATION	LEARNING PLAN
Home Wi-Fi Certification	Field Technicians/Installers Learning Plan
E7-2 AXOS PON Certification	AXOS E7-2 Blended Learning Plan - PON Track
E7-2 AXOS AE Certification	AXOS E7-2 Blended Learning Plan - Active Ethernet Track
Ethernet Access Network Certification	Unified Access Network Learning Plan
E7-2 GPON Certification	EXA E7-2 Blended Learning Plan - GPON Track
E7 VDSL Certification	EXA E7-2 Blended Learning Plan - VDSL Track
E7-2 AE Certification	EXA E7-2 Blended Learning Plan - Active Ethernet Track

ARE YOU READY TO TAKE YOUR LEARNING TO THE NEXT LEVEL?

Calix Education Services consultants are ready to work with you to discuss and fulfill your learning needs with the right combination of instructor-led and eLearning courses. Contact your Calix Account Executive to discover how you can start to upskill your entire team today or go to the Calix Education Services website to find out more.

2777 Orchard Parkway, San Jose, CA 95134 | **T:** 1 707 766 3000 | **F:** 1 707 283 3100 | www.calix.com | 110-4001 V1 | 01/22