Cisco 2520 Connected Grid Switch

The Cisco® 2520 Connected Grid Switches (CGS 2520) are rugged switches designed for the harsh, rugged environments often found in the energy and utility industries. The Cisco CGS 2520 is designed to support the communications infrastructure needs for the energy delivery infrastructure across the generation, transmission, and distribution sectors. This infrastructure includes utility- and customer-owned energy infrastructure, such as substation applications supporting electrical transmission and distribution, renewable generation, oil and gas, water, distributed generation, co-generation, and trackside operations. The infrastructure also includes communications infrastructure for delivery applications such as transmission pipelines, distribution mains, and service lines for oil and gas and water.

The CGS 2520 uses Cisco IOS® Software, which is the operating system powering millions of Cisco switches and routers worldwide. Cisco IOS Software delivers the benefits of integrated security for NERC / CIP (North American Electric Reliability Corporation / Critical Infrastructure Protection) compliance, quality of service, ease of use and network management to help ensure integrity and priority of operational data and nonoperational data communications.

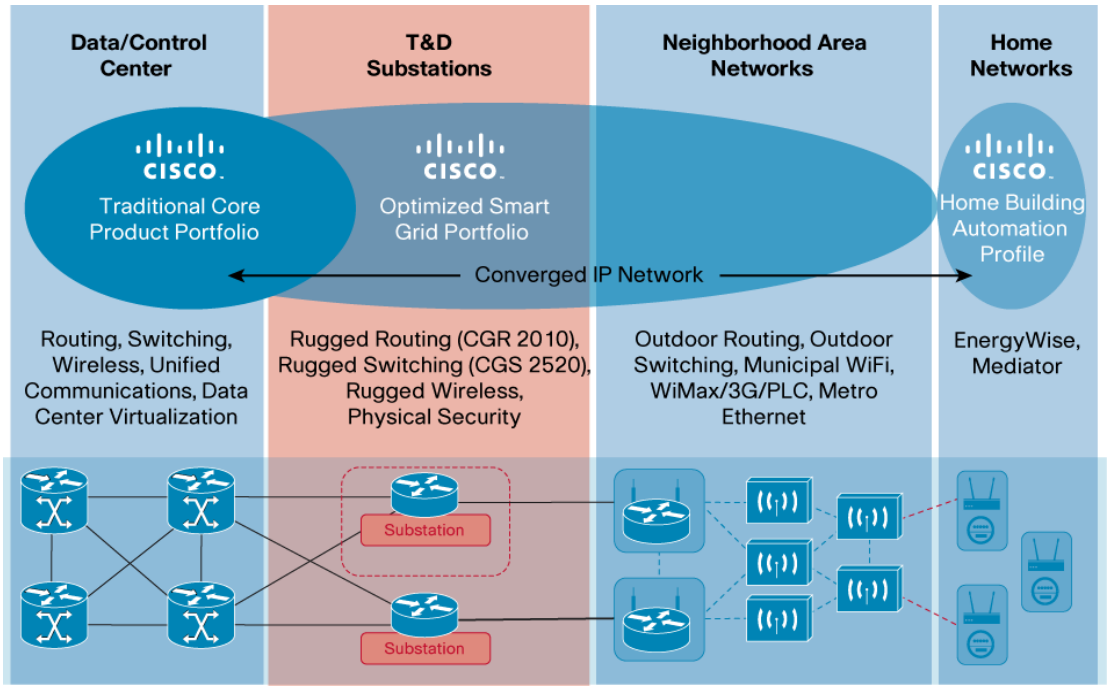
Primary CGS 2520 features:

- Rugged industrial design and substation compliance: IEC-61850-3 and IEEE 1613 for utility substation environments
- Tools for easy deployment, management, and replacement
- Extensive instrumentation and remote diagnostic capabilities
- Advanced quality of service (QoS) capabilities to support mission-critical substation applications such as SCADA (Supervisory Control and Data Acquisition) and IEC 61850 GOOSE (Generic Object Oriented Substation Events) messaging
- Comprehensive network security features based on open standards

Networking Solutions and the CGS 2520: Substation Automation Example

Substation automation promises to bring more automation and intelligence to the power grid network to address a myriad of utility concerns, such as how to reduce operational expenses and meet new regulatory requirements. The CGS 2520 switch, deployed together with the Cisco 2010 Connected Grid Router (CGR 2010) router, offers utilities a rugged networking solution to enable reliable and secure two-way communication for substation automation. Figure 1 shows a converged end-to-end IP network from the data center to the home and depicts the place in the network where the CGS 2520 switch and CGR 2010 router are typically deployed.

Figure 1. Places in the Network: CGS 2520



Product Overview

The CGS 2520 is designed for harsh environments. The CGS 2520 offers:

- Rugged design for transmission and distribution (T&D) power substations, including compliance with IEC-61850-3 and IEEE 1613 specifications for extended environmental, shock/vibration, and surge ratings; a complete set of DC and AC power input options; a focus on redundancy; and convection cooling (no fans)
- Compact 1RU (rack unit), 19 in. network rack-mountable switch, with support for reverse cabling
- Dual LEDs on front and back of switch to provide ease of monitoring and troubleshooting
- Easy setup and management, using the Cisco Configuration Professional graphical user interface and supporting management tools, including CiscoWorks LAN Management Solution (LMS)
- Easy switch replacement with the Connected Grid Swap Drive feature: removable flash memory, allowing the user to quickly replace a switch in the field without having to manually reconfigure the switch
- High availability, deterministic QoS behavior, and reliable security using Cisco IOS Software
- Smartport templates that implement recommended software configurations for T&D substation applications at the touch of a button
- Hardware support for IEEE1588v2, a precision timing protocol with nanosecond-level precision for precise timing applications
- Improved ring and hub-and-spoke resiliency, with the support of Resilient Ethernet Protocol (REP) and Flexlink
- Transparent IT integration with the support of Layer 3 routing protocols (IP Services image optional)
- Hardware-based security with IEEE 802.1AR that cryptographically binds security credentials to the CGS 2520 during manufacturing

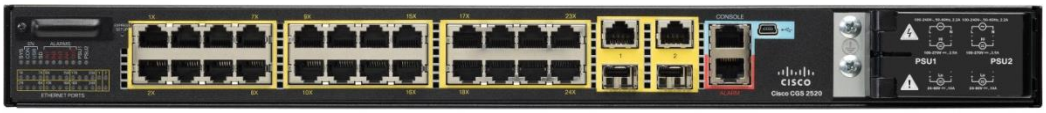
Configurations

The CGS 2520 (Figure 2) includes the following configurations:

- **Cisco CGS-2520-24TC**: Rugged Ethernet switch with 24 10/100BaseTX ports and two dual-purpose Gigabit Ethernet uplinks (dual-purpose Gigabit Ethernet uplinks allow the user to activate either copper or fiber media). There are two 10/100/1000BaseTX ports and two 100/1000 Small Form-Factor Pluggable (SFP) ports on board. The user can select two fiber ports, two copper ports, or a combination of fiber and copper ports. The Layer 2 LAN Base image is included.
- **Cisco CGS-2520-16S-8PC**: Rugged Ethernet switch with 16 Fast Ethernet (FE) SFP ports, eight 10/100BaseTX/PoE ports, and two dual-purpose Gigabit Ethernet uplinks. The Layer 2 LAN Base image is included.
- **PWR-RGD-LOW-DC**: Low DC (24/48V) power supply module for the CGS 2520 switch, which can also be used in the CGR 2010 router.
- **PWR-RGD-AC-DC**: High AC/DC (88-300VDC/85-264VAC) power supply module for the CGS 2520 switch, which can also be used in the CGR 2010 router.

Figure 2. CGS 2520

CGS-2520-24TC, cable side view



CGS-2520-16S-8PC, cable side view

Power supply, side view

The CGS 2520 offers two different Cisco IOS Software feature images: LAN Base and IP Services. The LAN Base image offers advanced QoS, flexible VLAN handling, SCADA protocol classification support, Resilient Ethernet Protocol (REP) for improved convergence time in ring topologies, Flexlink for fast failover in hub-and-spoke topologies, and comprehensive security features. In addition, the IP Services image adds advanced Layer 3 features such as support for advanced IP routing protocols, Multi-VPN Routing and Forwarding Customer Edge (Multi-VRF CE/VRF-Lite), and policy-based routing (PBR).

The SFP-based uplink ports accommodate a range of industrial-grade SFP transceivers, including 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX, 100BASE-FX, and 100BASE-LX10.

Primary Business Benefits

The CGS 2520 is designed for network security, high availability, ease of use, and durability. Table 1 lists the business benefits of the CGS 2520.

Table 1. Primary Business Benefits of the CGS 2520

Benefits	Description
Rugged design for substation compliance	• Compliant with IEEE 1613 and IEC-61850-3 substation standards for rugged design. • Convection cooled, with no moving parts or fans for maximum reliability and reduced network outages.
Network security	• Advanced Cisco IOS Software features such as 802.1x, Layer 2-Layer 4 access control lists (ACLs), port security, protected port/private VLAN, UNI/ENI default control traffic shut down and configuration file security to prevent unauthorized network access and reduce operational costs of securing the network.
High availability and redundancy	• Advanced Cisco IOS Software features such as REP and Flexlink provide fast reconvergence in ring and hub-and-spoke topologies, minimizing network downtime and associated costs. • Field-replaceable components such as power supplies and SFPs reduce redeployment time. • Optional redundant, hot-swappable power supply provides additional redundancy.
Ease of use	• Intuitive graphical user interface (GUI) in Cisco Configuration Professional simplifies configuration of switches and reduces training time and costs. Utility-focused enhancements have been added to further increase ease of use. • Smartport templates provide one-touch global and port-level macros to simplify switch deployments.
Investment protection	• Two Cisco IOS Software images are available to choose from. This choice allows you to choose the right feature set for your networking needs. • Advanced Layer 2 switching feature set comes standard with the CGS 2520; Layer 3 feature set optional. • Ongoing development of software capabilities leads to a longer product lifecycle, lowering the total cost of ownership.
Energy efficiency	The CGS 2520 architecture provides energy-saving features that include the following: • High-efficiency power supplies are provided with each platform. • No fans are used, which reduces overall power consumption.

Software Optimized for Energy Applications

The CGS 2520 software is optimized for energy applications and builds on the strength of Cisco IOS Software, which powers mission-critical networks across the world. Numerous new features make the CGS 2520 the optimal Ethernet switch for energy network operators, such as Smartport templates, which enable simple configuration for utility environments. In additon, many default behaviors of the CGS 2520 are different from those of traditional Ethernet switches, making the CGS 2520 easier to configure, manage, secure, and troubleshoot.

High Availability and Redundancy

High availability is a vital requirement for networks that transport mission-critical data. The CGS 2520 supports dual-redundant, field-replacable power supplies and SFP modules and the Connected Grid Swap Drive, which increase network uptime and minimize redeployment time in the field. In addition, external alarm inputs/outputs allow network operators to monitor changes in the switch’s environmental condtions before a failure occurs.

To further increase high availability on a networkwide level, CGS 2520 offers REP and Flexlink for fast reconvergence, link-state tracking, IEEE 802.1w Rapid Spanning Tree Protocol (RSTP), per-VLAN Rapid Spanning Tree Plus (PVRST+), and the Cisco Hot Standby Router Protocol (HSRP). These capabilities help to create redundant, failsafe topologies. Strong, built-in security helps prevent the device and the network from succumbing to malicious attacks, thereby enhancing network uptime.

Security

The wide range of security features on the CGS 2520 protects mission-critical traffic, prevents unauthorized access, and maintains uninterrupted operation. The CGS 2520 protects operational and nonoperational data by focusing on securing connectivity, defending against network threats, and providing trust and identity features.

Protecting a network begins with securing connectivity. For example, ACLs can be used to restrict access to sensitive portions of the network. To defend against network threats such as Dynamic Host Configuration Protocol (DHCP) spoofing, DHCP snooping can be used to allow only DHCP requests (but not responses) from untrusted user-facing ports. Workforce management is a critical-use case, where trust and identity features such as IEEE 802.1x can be used to enable strong security policies, yet provide maximum mobility to a remote workforce.

Table 2 lists these and other primary features of the security solution.

Table 2. Primary Features for Each Area of Comprehensive Security Solution

Secure Connectivity	Threat Defense	Trust and Identity
UNI/ENI default: control traffic shut down	Configurable control plane security	ACLs
DHCP snooping and IP source guard	Storm control	IEEE 802.1x
Dynamic ARP inspection	Port security	UNI/ENI default: port down
Private VLAN	Configurable per-VLAN MAC learning	Configuration file security

Switch Management Options

The CGS 2520 offers an easy-to-use graphical user interface (GUI) for configuration through the Cisco Configuration Professional tool, as well as a superior command-line interface (CLI) for detailed configuration. In addition, the switches support CiscoWorks and Simple Network Management Protocol (SNMP) for networkwide management. Network operators can integrate the CGS 2520 transparently into their network operations centers and enable improved flow-through provisioning.

Network operators can also manage the CGS 2520 using SNMP Versions 2 and 3. A comprehensive set of MIBs is provided for network operators to collect traffic information in the CGS 2520.

Primary Features and Benefits

Table 3 lists the main features and benefits of the CGS 2520.

Table 3. Features and Benefits

Feature	Benefit
Designed for harsh energy applications	• Extended temperature, vibration, shock and surge, and noise immunity ratings comply to specifications for substation environments • Compact, 19 in., 1 RU form factor ideal for control houses • Variety of power input options covers a wide range of power requirements for T&D power substations • Copper and fiber connectivity options; SFP modules provides uplink connectivity, supporting 100BASE-LX10, 100BASE-FX, 1000BASE-SX, 1000BASE-LX, and 1000BASE-ZX options. • Alarm relay contacts can be used for an external alert system. • Four external alarm inputs allow utility personnel to monitor and respond quickly to changes in the switch's environmental conditions before failure occurs. Alarm inputs can also be used to monitor building/cabinet door open events to address physical security concerns.
Availability and Scalability	
High-availability mechanisms	**Hardware** • Dual field-replaceable, hot-swappable power supplies and SFP modules increase network uptime. **Software** • Resilient Ethernet Protocol (REP) provides fast Layer 2 reconvergence in a ring topology and offers an alternative to Spanning Tree Protocol. • Flexlink provides fast link failover for hub-and-spoke topologies, including dual-homed designs. • Link-state tracking accelerates network reconvergence by binding the state of downlink ports to the state of associated uplink ports. • Bandwidth aggregation up to 2 Gbps through Cisco EtherChannel technology enhances fault tolerance and offers greater aggregated bandwidth between switches and to routers and individual servers. • IEEE 802.1w Rapid Spanning Tree Protocol (RSTP) provides rapid spanning-tree convergence, independent of spanning-tree timers, and offers the benefit of distributed processing. • Per-VLAN Rapid Spanning Tree (PVRST+) allows rapid spanning-tree reconvergence on a per-VLAN spanning-tree basis, without requiring the implementation of spanning-tree instances. • IEEE 802.1s Multiple Spanning Tree Protocol allows a spanning-tree instance per VLAN, enabling Layer 2 load sharing on redundant links. • Cisco Hot Standby Router Protocol (HSRP) is supported to create redundant, fail-safe routing topologies. • Unidirectional Link Detection Protocol (UDLD) and Aggressive UDLD allow unidirectional links caused by incorrect/failed fiber-optic connections or port faults to be detected and disabled on fiber-optic interfaces. • Switch-port autorecovery (error disable) automatically attempts to reactivate a link that is disabled because of a network error. • Equal-cost routing provides for load balancing and redundancy.
High-performance IP routing (Optional IP Services image required)	• Cisco Express Forwarding hardware routing architecture delivers extremely high-performance IP routing. • Basic IP Unicast routing protocols (static and RIP versions 1 and 2) are supported for small-network routing applications. • Advanced IP Unicast routing protocols (OSPF, EIGRP, IS-IS, and BGPv4) are supported for load balancing and constructing scalable LANs. • HSRP provides dynamic load balancing and failover for routed links; up to 32 HSRP links are supported per unit. • Inter-VLAN IP routing provides for full Layer 3 routing between two or more VLANs. • Protocol Independent Multicast (PIM) for IP Multicast routing is supported, including PIM sparse mode (PIM-SM), PIM dense mode (PIM-DM), and PIM sparse-dense mode. The IP Services image is required. • Cisco recommends 128 switch virtual interfaces (SVIs). A maximum of 1000 are supported (depending on the number of routes and multicast entries). • IPv6 improves the scalability of IP networks by supporting the growing number of users, applications, and services. The functionalities supported include ACLs, DHCP, routing (Unicast routing, RIP, OSPFv3, static routes), MLD snooping, stateless autoconfig, default router preference, HTTP/HTTPS.
QoS and Control	
Advanced QoS	• Hardware-based advanced QoS functionality based on Cisco's ASIC technology enabling control-plane and data-plane QoS ACLs to help ensure proper marking on a per-packet basis. • The Cisco modular QoS CLI provides a modular and highly extensible framework for deploying QoS, by standardizing the CLI and semantics for QoS features across all platforms that are supported by Cisco IOS Software. • 2-rate, 3-color ingress policing to enable more flexible QoS offerings.

Feature	Benefit
	• Standard 802.1p class of service (CoS) and VLAN-based classification are provided, allowing for granular control and monitoring of GOOSE traffic (on a per VLAN basis). • Differentiated services code point (DSCP) and Layer 4 TCP/UDP port number-based classification allow granular classification/control and monitoring of TCP/IP-based SCADA protocols DNP3 IP, IEC 60870-5-104, and so on. • Ingress marking and remarking capabilities to help ensure proper QoS treatment and to prevent DoS attacks from improperly marked traffic streams. • Shaped Round Robin (SRR) scheduling helps ensure differential prioritization of packet flows by intelligently servicing the queues. • Weighted Tail Drop (WTD) provides per QoS class congestion avoidance at the queues before a disruption occurs. • Strict priority queuing helps ensure that the highest-priority packets are serviced ahead of all other traffic. Optionally, priority queue rate limiting provides optional protection against lower-priority queue starvation. • Configurable control plane queue assignment allows prioritization of control plane traffic. This is done by setting QoS markings globally for CPU-generated traffic, so these protocol packets will receive priority in the network.
Network Security	
Comprehensive security solutions	**Trust and Identity** • IEEE 802.1x allows dynamic, port-based security, providing user authentication. • IEEE 802.1x with VLAN assignment allows a dynamic VLAN assignment for a specific user, regardless of where the user is connected. • IEEE 802.1x and port security are provided to authenticate the port and manage network access for all MAC addresses, including those of the client. • IEEE 802.1x with an ACL assignment allows for specific identity-based security policies, regardless of where the user is connected. • IEEE 802.1x with Guest VLAN allows guests without 802.1x clients to have limited network access on the guest VLAN. • Web authentication for non-802.1x clients allows non-802.1x clients to use an SSL-based browser for authentication. • MAC Auth Bypass (MAB) for voice allows third-party IP phones without an 802.1x supplicant to get authenticated using their MAC address. **Secure Connectivity** • Control Plane Security prevents DoS attacks on the CPU. • Cisco security VLAN ACLs (VACLs) on all VLANs prevent unauthorized data flows from being bridged within VLANs. • Cisco standard and extended IP security router ACLs (RACLs) define security policies on routed interfaces for control- and data-plane traffic. • Port-based ACLs (PACLs) for Layer 2 interfaces allow application of security policies on individual switch ports. • SSHv2, Kerberos, and SNMPv3 provide network security by encrypting administrator traffic during Telnet and SNMP sessions. SSHv2, Kerberos, and the cryptographic version of SNMPv3 require a special cryptographic software image because of U.S. export restrictions. • Private VLAN Edge provides security and isolation between switch ports, helping ensure that users cannot snoop on other users' traffic. • TACACS+ and RADIUS authentication enable centralized control of the switch and restrict unauthorized users from altering the configuration. • Multilevel security and configuration file security on console access prevents unauthorized users from altering the switch configuration. **Threat Defense** • Port security secures Layer 2 access or trunk ports based on MAC address. • Unknown unicast and multicast port blocking allows tight control by filtering packets that the switch has not already learned how to forward. • Bidirectional data support on the Switched Port Analyzer (SPAN) port allows the Cisco Secure Intrusion Detection System (IDS) to take action when an intruder is detected. • MAC address notification allows administrators to be notified of users added to or removed from the network. • Dynamic ARP Inspection (DAI) helps ensure user integrity by preventing malicious users from exploiting the insecure nature of the ARP protocol. • DHCP snooping allows administrators to help ensure consistent mapping of IP to MAC addresses. This feature can be used to prevent attacks that attempt to poison the DHCP binding database, and to rate-limit the amount of DHCP traffic that enters a switch port. • IP source guard prevents a malicious user from spoofing or taking over another user's IP address by creating

Feature	Benefit
	a binding table between the client's IP and MAC address, port, and VLAN. • Spanning-Tree Security mechanisms such as Spanning tree BPDU guard and Spanning Tree Root Guard (STRG) prevent edge devices not in the network administrator's control from becoming Spanning Tree Protocol root nodes. • Remote Switched Port Analyzer (RSPAN) allows for remote monitoring of the user interface.
Manageability	
Superior manageability	• The Cisco IOS Software command line interface (CLI) provides a common user interface and command set with Cisco routers and switches. • CGS 2520 switches can be configured and monitored using Cisco Configuration Professional with enhanced menus targeted to simplify utility-specific configurations. • For easier deployments, the CGS 2520 switches support default global or port-level macros with Cisco recommended configurations, allowing the user to easily set up the switch in a configuration optimized for utility deployments. • The CGS 2520 ships with MODBUS memory map support that can be used by human machine interface (HMI) applications to query the switch for information using the MODBUS protocol. • Switching Database Manager templates for Layer 2 and Layer 3 deployment allow administrators to easily optimize memory allocation to the desired features based on deployment-specific requirements. • VLAN trunks can be created from any port, using standards-based 802.1Q tagging. Up to 1005 VLANs per switch and up to 128 spanning-tree instances per switch are supported simultaneously. 4096 VLAN IDs are supported. • RSPAN allows administrators to remotely monitor ports in a Layer 2 switch network from any other switch in the same network. • For enhanced traffic management, monitoring, and analysis, the embedded Remote Monitoring (RMON) software agent supports four RMON groups (history, statistics, alarms, and events). • All nine RMON groups are supported through a SPAN port, permitting traffic monitoring of a single port, a group of ports, or the entire stack from a single network analyzer or RMON probe. • Domain Name System (DNS) provides IP address resolution with user-defined device names. • Trivial File Transfer Protocol (TFTP) reduces the cost of administering software upgrades by downloading from a centralized location. • Network Timing Protocol (NTP) provides an accurate and consistent time stamp to all intranet switches. • The CGS 2520 supports the Cisco CNS 2100 Series Intelligence Engine and SNMP for networkwide management. • Configuration Rollback helps in error recovery by providing the capability to replace the current running configuration with any saved Cisco IOS Software configuration file. • Embedded Events Manager (EEM) offers the ability to monitor events and take user-defined action when the monitored events occur or a threshold is reached. • Dynamic Host Configuration Protocol (DHCP)-based auto configuration and image update simplifies management of large number of switches by automatically downloading specified configuration and image.
Remote monitoring and diagnostics	• The Cisco IOS Software CLI provides a common user interface and command set with all Cisco routers and Cisco Catalyst® desktop switches. • Cisco Service Assurance Agent (SAA) provides service-level (latency/frame loss) management throughout the network. • IEEE 802.1ag Connectivity Fault Management provides standard support for transport fault management. It allows for discovery and verification of path for Layer 2 paths, allowing utilities to monitor the safe transmission of GOOSE messages, both inside the substation and between substations. • Ethernet Local Management Interface enables utilities to communicate service configuration and status information to the switches/routers. • IEEE 802.3ah Ethernet in the first mile provides standard support for monitoring, remote failure indication, loopback, and OAM discovery on a per-Ethernet-link between the complaint switching and routing equipment. The CGS 2520 as well as CGR 2010 are IEEE 802.3ah compliant. • ITU-T Y.1731 introduces the support for fault management functions, including alarm indication signal (AIS), remote defect indication (RDI), and locked signal (LCK) to detect and signal a failure in a Layer 2 path. This capability allows utilities to proactively monitor the health of Layer 2 network. • Cisco IP SLA provides service-level management throughout the network. CGS 2520 supports IP SLA for both Layer 2 and Layer 3-based services, allowing network operators to monitor parameters such as latency and frame loss for critical protection and control traffic (such as GOOSE). • Port and VLAN loopbacks allow utility network operators to proactively monitor the end-to-end network characteristics on a per port/per VLAN basis. This capability would be very useful for proactively determining the health of the network for critical time-sensitive traffic such as GOOSE messages. • Digital optical monitoring (DOM) support enables service providers to perform in-service transceiver monitoring and troubleshooting operations. DOM threshold functions allow the monitoring of real-time optical parameters on DOM SFPs and the comparison against factory-reset values, generating alarm and warning thresholds.

Feature	Benefit
Cisco Configuration Professional software	• Cisco Configuration Professional is a free, Windows-based, easy-to-use graphical user interface application that simplifies the administration of substation network. Cisco Configuration Professional has been enhanced with utility-specific configuration and monitoring features for ease of use. • In addition to the CGS 2520 switches, Cisco Configuration Professional also supports CGR 2010 rugged routers, providing a single management tool for both the substation switches and routers. • Using Cisco configuration professional, the CGS 2520 switches can be remotely managed from any supported desktop or laptop. • Upgrading the Cisco IOS Software on CGS 2520 switches is a simple matter of pointing and clicking, with one-click upgrades. • Task-based Cisco Configuration Professional user interface provides for faster and easier configuration of specific functionality such as QoS and Security. The interface also provides a quick snapshot of switch configuration through the dashboard view on the homepage. • Role-based access feature uses the Cisco IOS Software CLI views feature to define restricted task-based roles for different switch administrators and users.
Cisco Express Setup	• Cisco Express Setup simplifies initial configuration of a switch through a web browser, eliminating the need for more complex terminal emulation programs and CLI knowledge. • The web interface helps less-skilled personnel quickly and simply set up switches, thereby reducing the cost of deployment.
CiscoWorks support	• CiscoWorks network-management software provides management capabilities on a per-port and per-switch basis, providing a common management interface for Cisco routers, switches, and hubs. • SNMP v1, v2c, and v3 and Telnet interface support delivers comprehensive in-band management, and a CLI-based management console provides detailed out-of-band management. • Cisco Discovery Protocol Versions 1 and 2 help enable a CiscoWorks network-management station for automatic switch discovery. • The CiscoWorks LAN Management Solution supports the CGS 2520.

Table 4 lists the primary features in the LAN Base and IP Services images.

Table 4. Primary Features for LAN Base and IP Services Image

LAN Base		IP Services
Per port per VLAN ingress policing	Resilient Ethernet Protocol	All LAN Base features plus:
SCADA protocol classification using ACLs	Flexlink	Static routing, Inter-VLAN routing
Per GOOSE VLAN classification/statistics	Link-state tracking	Multi-VRF CE (VRF-lite)
Configurable egress queue bandwidth	UDLD	Policy-based routing
Configurable egress buffers/thresholds	xSTP: 802.1s/802.1w	RIP Versions 1 and 2
Strict priority queuing with optional policer	EtherChannel/LACP/PAgP	EIGRP, OSPF, and IS-IS
IEEE 802.1x and identity-based network services	Dying gasp for loss of power	BGPv4
Web- and MAC-based authentication	External alarm contacts	IPv6 routing
Port security + Cisco enhancements	Modbus memory map support	HSRP
DHCP snooping, dynamic ARP inspection, IP source guard	Express Setup	Multicast routing: PIM (SM, DM)
Spanning Tree Protocol security mechanisms	Cisco Configuration Professional	Source Specific Multicast
Storm control	Utility Specific Smartport macros	Source Specific Multicast mapping
Wire-speed L2-L4 ACLs	DHCP Auto Config/Image upgrade	Bidirectional Forwarding Detection
Private VLAN	Config Rollback/Replace	Multicast support for VRF (mVRF-Lite)
Secure connectivity: SSH/SSL/SCP	SPAN/RSPAN	VRF-aware services (ARP, ping, SNMP, HSRP, uRPF syslog, traceroute, FTP, and TFTP)
RADIUS/TACACS+	Layer 3 IP SLA	
SNMPv3 crypto	IETF TWAMP Responder Support	
Configuration file security	Port and VLAN Loopback	
UNI/ENI and NNI port types (configurable on all ports)	Time Domain Reflectometry (Copper ports)	

LAN Base		IP Services
Configurable per VLAN MAC learning	Digital Optical Monitoring (DOM), Optical ports	
MAC address learning and aging notifications	Ethernet OAM Connectivity Fault Management (CFM): IEEE 802.1ag Ethernet in the first mile (EFM): IEEE 802.3ah Ethernet LMI (PE) -MEF Ethernet LMI (CE): MEF CFM to E-LMI Interworking CFM to EFM Interworking 802.1ag + IPSLA (Ethernet SLAs)	
Configurable control plane security		
IEEE 802.1AR for hardware-based security		

Product Specifications

Table 5 lists product specifications for CGS 2520.

Table 5. Product Specifications

Description	Specification
Performance	• Forwarding bandwidth: ◦ Cisco CGS-2520-24TC: 8.8 Gbps ◦ Cisco CGS-2520-16S-8PC: 8.8 Gbps • Forwarding rate: ◦ Cisco CGS-2520-24TC: 6.5 mpps ◦ Cisco CGS-2520-16S-8PC: 6.5 mpps • 256-MB DDR2 SDRAM • Configurable up to 8000 MAC addresses • Configurable up to 5000 unicast routes • Configurable up to 1000 IGMP groups and multicast routes • Configurable maximum transmission unit (MTU) of up to 9000 bytes, for bridging on Gigabit Ethernet ports, and up to 1998 bytes for bridging and routing on Fast Ethernet ports
Connectors and cabling	**10/100 Ports:** • 10/100BASE-TX ports: RJ-45 connectors, 2-pair Category 5 unshielded twisted pair (UTP) cabling **100FX SFP Ports (CGS-2520-16S-8PC only):** • 100BASE-FX and -LX: Duplex LC receptacle fiber connectors (multimode and single mode) • 100BASE-BX: Single-fiber LC receptacle connector (single-mode fiber) • 100BASE-EX and -ZX: Single mode fiber, which respectively spans up to 40 kilometers long and 80 kilometers long **Gigabit Ports:** • 1000BASE-T SFP-based ports: RJ-45 connectors, 4-pair Category 5 UTP cabling, 10/100/1000BASE-T operation in host systems with SGMII interface • 1000BASE-BX: Single-fiber LC receptacle connector (single-mode fiber) • 1000BASE-EX: Single Mode Fiber with DOM support • 1000BASE-SX, -LX/LH, and -ZX and CWDM and DWDM: Duplex LC receptacle fiber connectors (multimode and single-mode fiber) • Cisco Catalyst 3560 SFP Interconnect Cable for establishing low-cost Gigabit Ethernet point-to-point connections **Console Ports** • Management console port: RJ45-to-DB9 cable for PC connections • Management console port: USB mini type B console port connector for USB connections

Description	Specification
Indicators	• Per-port status LEDs: Link integrity, port disabled, and activity indications • System-status LED: System activity, system integrity, • Alarm-In status LED: Four-level alarm status indicator (no alarm, minor, major, critical) • Alarm-Out status LED: Alarm status indicator • Power Supply Unit LED: Power output integrity and power supply presence • PoE (CGS-2520-16S-8PC only): PoE activity, PoE integrity, and PoE disabled • SD Flash LED: SD flash integrity and SD flash presence • RS232 LED: RS232 console selection • USB LED: USB console selection
Dimensions (H x W x D)	• Cisco CGS-2520-24TC: 1.75 x 17.5 x 14.0 in. (4.45 x 44.5 x 35.6 cm) • Cisco CGS-2520-16S-8PC: 1.75 x 17.5 x 14.0 in. (4.45 x 44.5 x 35.6 cm)
Rack height	• Cisco CGS-2520-24TC: 1RU (rack unit) • Cisco CGS-2520-16S-8PC: 1RU (rack unit)
Weight	• Cisco CGS-2520-24TC (no power supply unit): 9.1lb (4.1 kg) • Cisco CGS-2520-16S-8PC (no power supply unit): 10 lb (4.5 kg)

Power Specifications

Table 6 gives power specifications for the CGS 2520.

Table 6. Power Specifications (preliminary data and subject to change)

Description	Specification
Power consumption	• Cisco CGS-2520-24TC: 28.6 W • Cisco CGS-2520-16S-8PC: 40.3 W
AC input voltage and frequency	• Cisco CGS-2520-24TC: 100-240 VAC, 2-0.75 A, 50-60 Hz • Cisco CGS-2520-16S-8PC: 100-240 VAC, 2-0.75 A, 50-60 Hz
DC input voltages	• Cisco CGS-2520-24TC Low DC: 24-60 VDC (+/- 25%), 10-2.5 A • Cisco CGS-2520-24TC High DC: 100-250 VDC (+20%/-12%), 2-0.75 A • Cisco CGS-2520-16S-8PC Low DC: 24-60 VDC (+/- 25%), 10-2.5 A • Cisco CGS-2520-16S-8PC High DC: 100-250 VDC (+20%/-12%), 2-0.75 A

Management and Standards

Table 7 provides management and standards support information for the CGS 2520.

Table 7. Management and Standards

Description	Specification	
Management	• BRIDGE-MIB (RFC1493) • BGP4-MIB (RFC1657) • CISCO-CABLE-DIAG-MIB • CISCO-BULK-FILE-MIB • CISCO-CDP-MIB • CISCO-CONFIG-COPY-MIB • CISCO-CONF-MAN-MIB • CISCO-DATA-COLLECTION-MIB • CISCO-ENVMON-MIB • CISCO-ERR-DISABLE-MIB • CISCO-ETHERNET-ACCESS-MIB • CISCO-FLASH-MIB • CISCO-FTP-CLIENT-MIB • CISCO-HSRP-MIB • CISCO-HSRP-EXT-MIB • CISCO-IETF-DOT3-OAM-MIB • CISCO-IGMP-FILTER-MIB • CISCO-IPLSA-ETHERNET-MIB • CISCO-PAGP-MIB • CISCO-PAE-MIB • CISCO-PING-MIB • CISCO-POE-EXTENSIONS-MIB • CISCO-PRIVATE-VLAN-MIB • CISCO-PROCESS-MIB • CISCO-PORT-QOS-MIB • CISCO-PORT-SECURITY-MIB • CISCO-PORT-STORM-CONTROL-MIB • CISCO-IMAGE-MIB • CISCO-LAG-MIB • CISCO-L2L3-INTERFACE-CONFIG-MIB • CISCO-MAC-NOTIFICATION-MIB • CISCO-MEMORY-POOL-MIB • CISCO-RTTMON-MIB • CISCO-STACK-MIB • CISCO-STP-EXTENSIONS-MIB	• CISCO-SYSLOG-MIB • CISCO-TCP-MIB • CISCO-UDLDP-MIB • CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB • CISCO-VLAN-MEMBERSHIP-MIB • ENTITY-MIB (RFC2737) • ETHERLIKE-MIB • IEEE8021-PEA-MIB • IEEE8023-LAG-MIB • IF-MIB (RFC 1573) • IGMP-MIB • IPMROUTE-MIB • OLD-CISCO-CHASSIS-MIB • OLD-CISCO-FLASH-MIB • OLD-CISCO-INTERFACES-MIB • OLD-CISCO-IP-MIB • OLD-CISCO-SYS-MIB • OLD-CISCO-TCP-MIB • OLD-CISCO-TS-MIB • OSPF-MIB (RFC 1253) • PIM-MIB • RFC1213-MIB (MIB-II) • RMON-MIB (RFC 1757) • RMON2-MIB (RFC 2021) • SNMP-FRAMEWORK-MIB (RFC2571) • SNMP-MPD-MIB (RFC 2572) • SNMP-NOTIFICATION-MIB (RFC 2573) • SNMP-TARGET-MIB (RFC 2573) • SNMPv2-MIB (RFC 1907) • SNMP-USM-MIB (SNMP-USER-BASED-SM-MIB) (RFC2574) • SNMP-VACM-MIB (SNMP-VIEW-BASED-ACM-MIB) (RFC2575) • TCP-MIB (RFC 2012) • UDP-MIB (RFC 2013)
Standards and protocols	• IEEE 802.1s • IEEE 802.1w • IEEE 802.1x • IEEE 802.3ad • IEEE 802.3ah • IEEE 802.1ag • IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports • IEEE 802.1D Spanning Tree Protocol • IEEE 802.1p CoS classification • IEEE 802.1Q VLAN • IEEE 802.3 10BASE-T • IEEE 802.3u 100BASE-T • IEEE 802.3ab 1000BASE-T • IEEE 802.3z 1000BASE-X	

Description	Specification
	• IEEE 802.3af (on CGS-2520-16S-8PC only) • IEEE 1588v2 hardware ready • IP routing: Static, RIP versions 1 and 2, EIGRP, OSPF, BGPv4, PIM-SM, and PIM-DM (metro IP access only) • IPv6: MLD Snooping v1 and v2 • IPv6: RIP, OSPFv3, static routes Management: SNMP versions 1, 2, and 3

SFPs for Cisco 2520 Connected Grid Switch

Table 8. SFP Support

Description	Description	Temperature Range*
GLC-FE-100FX-RGD=	100Base-FX Multi Mode Rugged SFP	IND
GLC-FE-100LX-RGD=	100 Mbps Single Mode Rugged SFP	IND
GLC-SX-MM-RGD=	1000 Mbps Multi-Mode Rugged SFP (supported on gigabit SFP ports only)	IND
GLC-LX-SM-RGD=	1000 Mbps Single Mode Rugged SFP (supported on gigabit SFP ports only)	IND
GLC-ZX-SM-RGD=	1000BASE-ZX Single Mode Rugged SFP (supported on gigabit SFP ports only)	IND
GLC-LH-SMD=	1000BASE-LX/LH SFP (DOM)	EXT
GLC-SX-MMD=	1000BASE-SX SFP (DOM)	EXT
GLC-ZX-SMD=	1000BASE-ZX Gigabit Ethernet SFP (DOM)	EXT
GLC-EX-SMD=	GE SFP, LC Connector, EX transceiver	EXT
GLC-BX-D=	1000BASE-BX SFP, 1490NM	COM
GLC-BX-U=	1000BASE-BX SFP, 1310NM	COM
GLC-FE-100LX=	100BASE-LX SFP for FE port	COM
GLC-FE-100BX-D=	100BASE-BX10-D SFP	COM
GLC-FE-100BX-U=	100BASE-BX10-U SFP	COM
GLC-FE-100FX=	100BASE-FX SFP for FE port	COM
GLC-FE-100EX=	100BASE-EX SFP (40 km)	COM
GLC-FE-100ZX=	100BASE-ZX SFP (80 km)	COM
CWDM-SFP-1xxx= (i.e., 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610)	CWDM SFP w/ DOM (8 channels)	COM

**If nonindustrial (i.e., EXT, COM) SFPs are used, the CGS 2520 operating temperature range must be de-rated.*

Temperature Range	CGS 2520 Operating Temperature Range Support
IND	-40ºF to +140ºF (-40ºC to +60ºC)
EXT	+23ºF to +140ºF (-5ºC to +60ºC)
COM	+32ºF to +113ºF (0ºC to +45ºC)

Safety and Compliance

Table 9 gives safety and compliance information for the CGS 2520.

Table 9. Safety and Compliance Specifications

Description	Specification
Environmental substation compliance	• IEC 61850-3 (reference certificate of approval) • IEEE1613 (reference certificate of approval)
EMC interface immunity	• IEC61000-4-2 [Criteria A—Class 2] • IEC61000-4-3/ENV50204 [Criteria A]

Description	Specification
	• IEC61000-4-4 [Criteria A/Criteria B] • IEC61000-4-5 [Criteria B] • IEC61000-4-6 [Criteria A]
Standard electromagnetic emissions certifications	• FCC Part 15 Class A • EN 55022B Class A (CISPR22 Class A) • EN 55024 • EN 300 386 • VCCI Class I • AS/NZS 3548 Class A or AS/NZS CISPR22 Class A • KCC • CE Marking
Standard safety certifications	• UL 60950-1 • CSA 60950-1 • EN 60950-1 • IEC 60950-1 • UL 508 (on CGS-2520-24TC)
UL approval for physical security	• UL 294 • UL 1076
Operating environment	• -40 ºF to 140ºF (-40 to +60ºC) continuous operating temperature range • -40 ºF to 185ºF (-40 to +85ºC) type test for 100 hours at 85ºC • Operating altitude: -60 m (-200 ft) to 3,000 m (10,000 ft), de-rate maximum operating temperature per IEEE 1613a-2008: • Relative humidity: 5% to 95% non-condensing
Storage environment	• Temperature: -40 to +85 ºC • Altitude: 15,100 ft (4,600 m)

Ordering Information

These products can be ordered by a Cisco authorized partner. Please refer to the partner locator on cisco.com: http://www.cisco.com/web/partners/index.html. For more information about product availability, please contact your Cisco representative.

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