COMMANDO Soldier C2000 Series Managed Switches
Data Sheet

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Product Overview

COMMANDO Soldier C2000 Series Switches are fully managed, perpetual PoE/PoE+ IEEE 802.2af/at (15.4W, 30W) compliant Gigabit Ethernet L2+ managed switches having power budget up to 800W with network resiliency and high availability with perpetual PoE/PoE+ IEEE 802.3 af/at (15.4W, 30W) compliant. These models also comes with additional fixed SFP having capability of 1G fiber/ 1GE copper uplink ports. With perpetual PoE/PoE+ for no power downtime and PoE budget ranging from 24W-800W depending on models required for network resiliency and high availability which delivering robust performance and intelligent switching for growing networks. This series switches are easy to deploy, use, manage and designed exclusively for enterprise-class access layer networks Switches, specially built for Security, IoT, and Cloud networking needs of growing businesses, high-end campus networks for Small-Medium Business (SMB). Designed for operational simplicity to lower total cost of ownership, they enable scalable, secure, and energy-efficient business operations with intelligent and automated services. This intelligent managed routing switches designed for networks requiring High performance, High port density, High uplink bandwidth, Flexibility, Fault Tolerance, and Advanced Software features for maximum Return on Investment (ROI). Switch models are designed for full PoE capability on all ports, power redundancy and up to 4 Temperature controlled FAN, Layer 3 feature support static and dynamic routing, these are optimized for today's surveillance, mobile and IoT needs. Designed for operational simplicity to lower total cost of ownership, they enable scalable, secure, and energy-efficient business operations with intelligent and automated services.

It has high performance fixed SFP uplink with fiber/copper 1G/1GE ports and combo uplink which helps it to meet the requirement of high-end campus LAN, Metro/Enterprise networks. Each switch is capable to deliver 15.4W PoE/ 30W PoE+ power on all ports with backward compatibility along with automated power (ON/OFF) scheduling with perpetual IEEE 802.3af compliant PoE (Power over Ethernet), 802.3at compliant PoE+ (Power over Ethernet plus) having power budget up to 800W. Switches are PoE/PoE+ capable of providing power across all access ports for wireless APs, security cameras, and other IoT devices which are used in surveillance. These switches are powerful and flexible enough for users to deploy PoE/PoE+ standard supplies up to 30W of power per port which is backward compatible with 15.4W PD which makes it ideal for applications using high power wireless access points, PTZ (Pan Tilt Zoom) IP cameras, Surveillance cameras, VoIP telephony systems, 802.11ac and 802.11ax access points, small cells, and connected LED lighting devices over longer distances up to 250

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meters. It's software include Static route, QoS Traffic classification based on Layer 2, Layer 3, Layer 4, and priority information Actions including ACL, CAR, and re-marking, Queue scheduling modes such as PQ, WFQ and PQ+WRR, Congestion avoidance mechanisms, including WRED and tail drop, Traffic shaping, SNMPv1/v2c/v3, ERPS (G. 8032), Zero Touch Provisioning (ZTP), 802.1x authentication, RADIUS and TACACS+ authentication for login, DoS, ARP, MAC address attacks, broadcast storms, and heavy-traffic and ICMP attack defenses, Remote Network Monitoring (RMON).

These switches have advanced Security features, and advanced Quality of Service (QoS), ideal for all organizations considering reliable, affordable hardware with well-known CLI and simple Web managed real time interface. Automated PoE/PoE+ scheduling, Scripting capabilities, Layer 3 static routing, Automatic MDIX and Auto-negotiation on all ports select the right transmission modes (half or full duplex) as well as data transmission for crossover or straight-through cables dynamically. Moreover, with its innovative energy-efficient technology, can save up to 58% of power consumption, making it an eco-friendly perfect solution for your business network. These switches come with lifetime free software upgrades and patching to enhance features and supports patching, which provides fixes for critical bugs and security vulnerabilities between regular maintenance upgrades. This support allows customers to add new features and upgrades without having to pay a single dollar.

It has a 4K-entry VLAN table which provides VLAN classification according to port-based, protocol-and-port-based, MAC-based, and Flow-based capability. It also supports IVL (Independent VLAN Learning), SVL (Shared VLAN Learning), and IVL/SVL (both Independent and Shared VLAN Learning) for flexible network topology architecture. It provides IEEE802.1ad (Q-in-Q) for double tag insertion and removal function. In addition, VLAN translation function is also supported for Metro Ethernet applications with up to 8K to 16K entries L2 MAC table are supported with 2-left 4-way hashing algorithm which can effectively reduce collision ratio. An independent 4K-entry Multicast table is used to support Multicast functions, such as IGMP snooping. The device supports a 4K-entry VLAN/Ingress/Egress Access Control List (ACL). The ACL function supports L2/L3/L4 match fields and performs configurable actions, such as Drop/Permit/Redirect/Mirror/Logging/Policing/Ingress VLAN conversion/Egress VLAN conversion/QoS remarking/VLAN tag status assignment. Per-port ingress/egress bandwidth control and per-queue egress bandwidth control are supported. The device provides three types of packet scheduling, including SP (Strict Priority), WFQ (Weighted Fair Queuing), and WRR (Weighted Round Robin). Each port has 8 physical queues, and each queue provides a leaky-bucket to shape the incoming traffic into the average rate behavior. The

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Broadcast/Multicast/Unknown-Multicast/Unknown-Unicast storm suppression function can inhibit external and internal malicious attacks. The switch supports 4-sets of port mirror configurations to mirror ingress and egress traffic. RSPAN are also supported for traffic monitoring purposes. For network management purposes, complete MIB counters are supported to provide forwarding statistics in real time. The link aggregation function enhances link redundancy and increases bandwidth linearly. It offers robust QoS to optimize traffic on your Business Network, these switches provide (Port-based/802.1p/DSCP) QoS to keep latency-sensitive video and voice traffic jitter-free moving smoothly. Additionally, port-based, tag-based VLAN, Voice VLANs can improve security and meet more network segmentation requirements. This series switches also have provisioning of QOS, Static and dynamic routing for IPV6 clients.

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Product Highlights

COMMANDO SoldierOS C2000 L2+ Access Series Routing Switches are Carrier Grade high-performance switch which helps it to meet the requirement of High end campus, Metro/Enterprise networks.

Full feature software Licensee free for Lifetime

- **Full featured without license installations:** COMMANDO SoldierOS switches come with inbuilt free for lifetime for across all model that provides you with an easier, faster, and more consistent experience across the COMMANDO portfolio and across your company for inbuilt all license installation.

- **No Activation key required:** No requirement of PAK (Product Activation Key) to activate L2+ features.

- **Operational Flexibility:** Free patching to enhance features for enhanced version of SoldierOS, with the objective of providing a free licensing solution that does not interrupt the operations of network.

- **Limitless term period for consumption:** For limitless time, permanent and without an expiration date and limitless term period software features can be used. You can consume all features for whatever period you like.

Higher serviceability and return on investment

- **Lower CAPEX:** Ensures network scalability and reduces investment in devices. Lowers Total Cost of Ownership with no license requirement (Lowers Capex).

- **Lower OPEX:** No licenses charge for lifetime. No license fees (Lowers OpEx) lifetime free software upgrades and patching to enhance features and supports patching, which provides fixes for critical bugs and security vulnerabilities between regular maintenance upgrades.

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- **Dual input power Option:** Dual input power AC as well as DC inbuilt So, unlike major mainstream brands have capability of dual power or RPS but originally it comes with single AC supply only. For DC power input you are required to purchase very specific DC power modules and adapter as well as power cable. DC power supply with major mainstream brands cost extra money while in COMMANDO switches it is freely available and also this DC supply do not have specific requirement of cable and adapter for DC power input it comes with standard specification which is commonly used.

- **Uninterrupted service:** Inbuilt DC power supply can give uninterrupted power supply which is vital for mission critical network operation. No need to spend extra money for dual power supply AC as well DC and also no separate special DC Adapter and cable required to provide power via DC as well AC power input.

- **Zero cost of switch maintenance:** Lifetime Free Software Licensing and Upgrades are free for lifetime. Users do not have to worry about switch license expiring and software getting outdated and purchasing license (which is constant concern and worry of few other brands) . This series has improved HTTP base firmware upgrade as well as CLI based upgrades which are freely available to all users without any cost or license fee for lifetime. It is easy to install, configure, monitor, and troubleshoot. It significantly reduces the cost of administration and Total Cost of Ownership (TCO).

- Supports and Use Open standard protocols, so interoperable with devices from other vendors, enabling long-term network evolution.

- Supports IP packet fragmentation and reassembling, enabling oversized IP packets to travel across a WAN network without limited by the MTU. The switch can also identify fragmented packets to seamlessly interconnect with routers.

High-performance IP routing

- Supports Static route and Default route configuration. Support up to 8000 to 16000 MAC address tables depending on model, 512 IP routing table entries, up to 512 host routes and dynamic routing is supported by hardware with maximum performance.

- IPv6 addressing and static routing is supported along with monitoring and troubleshooting commands.

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Inter-device Link Aggregation, High Efficiency and Reliability

- Support link aggregation LAG/LACP with 8 group. Switches in an LAG all work in an active state to share traffic and back up each other, enhancing system reliability.
- 8 Ports can be aggregated into single LAG/LACP group which allowing flexible networking.

High Reliability and Fault tolerance

- Power modules which support AC/DC.
- Fans support up to 4 with front-to-back airflow design suits equipment rooms and network racks and the innovative energy conservation technologies greatly reduce power consumption.
- Support Real-time environment monitoring technology to detect the chip set temperature, status of fan and power, etc.
- Support LACP / VARP / STP/ RSTP/ MSTP etc. to protect the network traffic all-around effectively.

Intelligent PoE/ PoE+ with Automated Scheduling

- Automates the PoE/PoE+ requirements in networks on a per port basis.
- Advanced per port PoE/PoE+ controls for remote power management to automate ON/OFF PoE/PoE+ capable devices on particular specified timing per port basis.
- Auto ON/OFF PoE/PoE+ as per Scheduled time which makes them intelligent.

Perpetual PoE/PoE+

With Perpetual PoE/PoE+, no power downtime to connected PD devices. PD devices remain power ON even when any software process is not running on the switch. Provides non-stop PoE/PoE+ power and continues to provide power during configuration and reboot, the PDs will not lose power while reloading. The Perpetual PoE provides uninterrupted power to connected powered device (PD) even when the switch is booting to make it highly available network without any interruptions.

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Varied Port Types

- Supports 24 and 48 GE switch ports PoE/PoE+ or Non PoE Models and also has 8, 18 and 48 SFP ports Models along with Fixed uplink ports.
- Support varied management interfaces, including RJ-45 Console port / USB Console port.
- Support fixed uplink having capacity 1G/1GE ports to meet requirement in surveillance and IOT networks which cover up to 20Km with fiber connectivity of SFP and also has 1GE copper modules along with combo uplink.

Support uninterrupted critical network infrastructure

- It has dual power options with AC/DC which protects it from power failures. Dual power improves availability to 100% and also increases the life of device.
- It also comes with Lighting surge thunder protection ±6KV. With this feature protect on cost and the impact to your business by losing these network devices and thus the users/servers connected to them.

System Design for Green and Energy Saving

- Support Intelligent FAN speed adjustment technology with maintenance redundancy and help to build green and energy saving switches.
- IEEE 802.3az Energy Efficient Ethernet (EEE) to reduce power dissipation during periods of low packet traffic.

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Features and Benefits

DHCP Server

Multiple IPv4 DHCP pools with Inbuild DHCP server can be set. DHCP pools and interface for individual VLANs. It also supports IPv4/ IPv6 DHCP Client, IPv4/ IPv6 DHCP Relay Option 82, IPv4/ IPv6 DHCP Snooping.

Intelligent PoE/PoE+ with Intelligent scheduling

Scheduling automates the PoE/PoE+ requirements in networks along with automatic PD detection on ports and auto PD Power rating and requirement. Advanced per port PoE/PoE+ controls for remote power management to automate ON/OFF PoE/PoE+ capable devices on particular specified timing per port basis with auto ON/OFF PoE/PoE+ as per Scheduled time which makes them intelligent.

Perpetual PoE/PoE+ for no power downtime

For connected PD devices even when for any reason switch reboots or switch process hanged or not running, It provides non-stop PoE/PoE+/PoE++ power and continue to provide power during any hung condition and reboot.

L3 Features

Supports static route and default route. It also has QoS, ACLs (Port based/ IP based/ MAC Based), DHCP Server and Client, DHCP Snooping, DHCP Snooping option82, DHCP Relay.

Watchdog Function

This ensures high availability which is used to protect a system from specific software or hardware failures that may cause the system to stop responding and self-recover from hanged state.

L2+/L2 Features

This series is having advance L2+/L2 features like Port aggregation with 8 ports, VLAN, Voice VLAN, Surveillance VLANs Spanning Tree (STP, RSTP, MST), GVRP, 802.1X authentication, centralized MAC authentication, Guest VLAN, RADIUS authentication, SSH 2.0, Port isolation, Port security, MAC address learning limit, IP Source guard, Dynamic ARP inspection, Preventing man-in-the-middle attacks and ARP DoS attacks, IP/Port/MAC binding. Flexible Software features provide wide range of Layer 2 functions like VLAN, Multicasting, and Quality of Service (QoS), Security.

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Secure Networking

IEEE 802.1X port-based access control with surveillance VLAN, Port Security, Protected Port which also Prevent ARP Spoofing. L4/L3/L2 access control lists (ACLs) for granular network access control including 802.1x port authentication. ACL, L4 to L2 feature restricts access to sensitive network resources. DHCP Snooping ensures IP address allocation integrity by only allowing DHCP messages from trusted DHCP servers and dropping malformed DHCP messages with a port or MAC address mismatch. With DHCP Snooping binding and option82 enabled, it can combine dot1x and ARP. IP-MAC-Port-VID Binding, Port Security, Storm control which protect against broadcast storms. The switches support ARP attack and DoS attack prevention to safeguard the network.

Multicast

IGMP Snooping (v1, v2, v3), Multicast Listener Discovery (MLD) (v1/v2), Multicast VLAN Registration (MVR) designed for distribution of multicast traffic across segregated access networks which enables more efficient distribution of multicast streams in Layer 2 network.

QoS Features

Advanced QoS (Quality of Service) for traffic prioritization including port based, 802.1p and L4/L3/L2 DSCP based. L4/L3/L2 QoS optimizes voice and video applications. Access Control List based, VLAN ID based IP precedence, COS and DSCP. Policy Based on Port & VLAN, Remark DSCP, COS/ 802.1p, Precedence, COS for SP, WRR for Scheduling and matching the IP fragmentation of message.

1GE/1G Uplinks

1GE/1G copper/fiber Switchports as well as Uplink supports high speed networking requirement and reduces copper cabling investment for LACP and LAGs and improves network backbone. It supports high-speed access to the network backbone or data center environment. This provides great resiliency, relieves congestion associated with bandwidth-intensive applications, and guarantees smooth hassle-free data transmission.

Easy Management

With the familiar and popular Command Line interface (CLI), there is no need for engineers to be hired or additional resources to be spent on training and/or learning the switch CLI. Management is made easy via Web GUI or industry-standard Command Line Interface (CLI), with administration traffic protected via SSL or SSH encryption. SNMP (v1/v2c/v3) and RMON support enables the switch to be polled for valuable status information and allows it to send

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traps when abnormal events occur. This series is highly reliable, conformance to international open standards, durable, serviceable, aesthetics, perceived quality, enhanced performance with larger range with copper cables and usability leads to value to money. Easy Management via lots of options like Web-based Graphical User Interface (WEBUI), Industry standard Command Line interface (CLI) via console, USB console port, telnet, SSH, HTTP, HTTPS, and Putty.

Auto MDIX Capabilities

Auto sensing/Auto PoE/PoE+ 10/100/1000 ports with auto MDIX capabilities which also removes speed and duplex mismatches automatically as well as covers larger physical distance with copper pairs compared to other brands best switches.

Lifetime Free Software Licensing and Upgrades

SoldierOS Software license and Upgrades are free for lifetime. Users do not have to worry about switch license expiring and software getting outdated and purchasing license (which is constant concern and worry of few other brands). This series has improved HTTP base firmware upgrade as well as CLI based upgrades which are freely available to all users without any cost or license fee for lifetime. It is easy to install, configure, monitor, and troubleshoot. It significantly reduces the cost of administration and Total Cost of Ownership (TCO).

Flexible Service Control

With various ACLs to flexibly control ports. It also supports Port-based VLAN assignment, MAC address-based VLAN assignment, Protocol-based VLAN assignment, and Network segment-based VLAN assignment. These secure and flexible VLAN assignment modes are used in networks where users move frequently. It also supports GARP VLAN Registration Protocol (GVRP), which dynamically distributes, registers, and propagates VLAN attributes to ensure correct VLAN configuration and reduce network administrator workloads. This series switches supports SSH v1/v2/v3, RMON, port-based traffic statistics, LLDP/LLDP-MED.

Compact Design with Flexibility of additional ports

The switches provide additional deployment flexibility, fiber connectivity for easy expansion of your networks up to 20Km. So, you can directly connect to a high-performance storage server or deploy a long-distance uplink to another switch.

Perfect for Noise-Sensitive Environments

This series comes with fans along with Small form-factor, for silent operation. Perfect for noise sensitive environments. Fan based Switches have Temperature- and load-based fan-speed up to 10000 rpm control combines accurate monitoring with minimized system acoustic noise. The Fan based switches also feature built-in smart fans that monitor and detect temperature

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changes, adjusting the fan speed for maximum efficiency. At lower temperatures, the fans run at a lower speed, reducing both the power consumption and noise output of the switch.

Zero Maintenance

Cost efficient switches, with a reasonable PoE/PoE+ power budget up to 800W along with PoE/PoE+ configurable scheduler which is backward compatible with all PD to automated Power ON/OFF connected PoE/PoE+ devices as per scheduled timing with Cost of ownership is less compared to other products of same features as well as zero maintenance. Maximum power reduction for ongoing operation cost savings.

Easy Debugging and Troubleshooting

Ping, Traceroute, SNMP, RMON, Web based real time Switch ports monitoring with WEBUI and CLI can easily troubleshoot any problem in network with various show and debug commands.

Longer Distance Coverage

State of art quality switches that can serve real time high-speed performance which covers longer physical distance up to 250 meters with copper pairs compared to other brands.

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Software

COMMANDO SoldierOS IP services switches deliver IPv4/IPv6 rich services for mid-enterprise edge and SMB aggregation along with Advanced Layer 2, Layer 3 feature set with no license required to activate. It has advanced classifier-based, time-based hardware implementation for L2 (MAC), L3 (IP) and L4 (UDP/TCP transport ports) security and prioritization, Port-Channel / LAG (802.3ad - 802.1AX), LLDP-MED IP phones automatic, QoS and VLAN configuration, DOT1X, Comprehensive IPv4/IPv6 static, default and multicast routing, Advanced IPv4/IPv6 security implementation including malicious code detection, DHCP Snooping, IP Source Guard protection and DoS attacks mitigation. Well known Industry standard SNMP, RMON, LLDP, AAA, SPAN, RSPAN, ERPS, Standard USB port for local storage, logs, configuration or image files, Industry standard command line interface (CLI) access with Console and Mini Console port with well-known commands by networking experts. Fully functional Web console (Web GUI) for Network admins who prefer an easy to use, yet advance graphical interface.

Enhance Security using Traffic control MAC Filter and Port Security help restrict the traffic allowed into and out of specified ports or interfaces in the system to increase overall security and block MAC address and avoids flooding issues. DHCP Snooping monitors DHCP traffic between DHCP clients and DHCP servers to filter harmful DHCP message and builds a bindings database of (MAC address, IP address, VLAN ID, port) that are considered authorized in order to prevent DHCP server spoofing attacks. IP source guard and Dynamic ARP Inspection use the DHCP snooping bindings database per port and per VLAN to drop incoming packets that do not match any binding and to enforce source IP / MAC addresses for malicious users traffic elimination.

Time-based Access Control Lists (ACLs) can be bound to ports like Layer 2 interfaces, VLANs and LAGs, management ACLs on CPU interface (Control Plane ACLs) are used to define the IP/MAC or protocol through which management access is allowed for increased HTTP/HTTPS or Telnet/SSH management security. Bridge protocol data unit (BPDU) Guard, Dynamic 802.1x VLAN assignment mode, TACACS+ and RADIUS enhanced administrator management provides strict "Login" and "Enable" authentication enforcement for the switch configuration, Superior quality of service with advanced classifier-based hardware implementation for Layer 2 (MAC), Layer 3 (IP) and Layer 4 (UDP/TCP transport ports) prioritization. Advanced rate limiting with 16 Kbps granularity and minimum guaranteed bandwidth can be associated with time-based ACLs for best granularity. DiffServ feature applied to class maps. Automatic Voice over IP prioritization with protocol-based (SIP, H323 and SCCP) or OUI-based Auto-VoIP for

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simultaneous voice calls. UDLD detects unidirectional links physical ports (UDLD must be enabled on both sides of the link in order to detect a unidirectional link). It can be used for various applications and network sizes in data centers and high-end campus networks, featuring network scaling, automation, programmability, and real-time visibility. The following is a summary of software features.

Software Highlights:

- DHCP Server for multiple IPv4 DHCP pools with inbuild DHCP server can be set. DHCP pools and interface for individual VLANs. It also supports IPv4/ IPv6 DHCP Client, IPv4/ IPv6 DHCP Relay Option 82, IPv4/ IPv6 DHCP Snooping.
- Intelligent PoE/PoE+ with Intelligent scheduling to automate the PoE/PoE+ requirements in networks. Advanced per port PoE/PoE+ controls for remote power management to automate ON/OFF PoE/PoE+ capable devices on particular specified timing per port basis with auto ON/OFF PoE/PoE+ as per Scheduled time which makes them intelligent.
- Perpetual PoE/PoE+ for no power downtime to connected PD devices even when any software process is not running on the switch. Provides non-stop PoE/PoE+ power and continue to provide power during configuration and reboot.
- Dual Image can be configured with one image is set as start-up image, and the other is set as the backup image. After you upgrade a firmware, the switch will automatically map the firmware file to the backup image.
- Watchdog function ensures high availability which is used to protect a system from specific software or hardware failures that may cause the system to stop responding and self-recover from hanged state.

Layer 3 Features

- Static Route, Default route and Dynamic connected route learning up to 512 route entries are supported.
- Static ARP as manually added IP network address to the hardware MAC address of a device as well dynamic ARP entries.
- Access Control List Access Control Lists (ACLs) can be used to deny and allow packets and provide flexible access control based on Standard IPV4, IPV6, MAC based, Management and also Port based Filtering.

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- **Comprehensive IPv6** supporting management, IPv6 ready QoS and ACL, ensuring investment protection and a smooth migration to IPv6-based network.
- **QoS Features** like Scheduling Mode with WRR, SP, which are Based on Port based on 802.1p DSCP (DiffServ), COS and DSCP.

Advanced L2/L2+ Switching

- **Auto Port Configuration**, Auto-Negotiation for port speed and duplex mode. Flow Control for IEEE802.3x full-duplex and half-duplex backpressure.
- **Rate Limit** enables to slow down traffic on a port to keep it from exceeding the limit set.
- **Link Aggregation** with LAG static and IEEE802.3ad Link Aggregation Control Protocol (LACP) increases bandwidth by automatically aggregating several physical links together as a logical trunk and providing load balancing and fault tolerance for uplink connections. Up to 8 maximum aggregation groups.
- **Link Layer Discovery Protocol (LLDP) neighbor** discovery protocol that allows devices to advertise device information to their directly connected peers/neighbors.
- **Unidirectional Link Detection protocol (UDLD)** that detects and disables one-way connections before they create undesired situations such as network failure, Spanning Tree loops and broadcast storm.
- **Spanning Tree Protocol (STP)** eliminates Layer 2 loops in a network by selectively blocking specific links. STP also enables link redundancy. Support IEEE 802.1D (STP), from which IEEE 802.1W (RSTP) and IEEE 802.1s (MSTP 64 to 256 instance).
- **Loopback Detection** also has BPDU Filter, BPDU Guard.
- **IGMP Snooping** listening to Internet Group Management Protocol network traffic to control delivery of IP multicast. Network switches with IGMP snooping listen in on the IGMP conversation between hosts and layer 3 devices and maintain a map of which links need which IP multicast transmission.
- **Static MAC address**, MAC Configuration for MAC binding, MAC Address Filter.
- **4094 VLAN Configuration** with advanced VLAN support for better network segmentation, VLAN Based on 802.1Q, MAC-Based VLAN, IP-Based VLAN, Protocol-Based VLAN, Voice VLAN, Guest VLAN, Private VLAN and Support 1:1 VLAN Mapping basic QinQ, Surveillance VLAN.

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- Ethernet Ring Protection Switching (ERPS) to eliminate loops at Layer 2 on a per VLAN basis with networks that are wired in a simple ring topology.

Secure Networking

- MAC address limiting to enhanced Security. Port Security ensures access to switch ports based on MAC address to limit the total number of devices from using a switch port and protects against MAC flooding attacks, SYN Flood, ICMP Flood attack and prevention of DOS, BPDU Guard and Root Guard which avoid accidental network topology loops and prevent illegal edge devices become root to cause unnecessary flapping.
- IEEE 802.1X Port-based Access Control ensures all users are authorized before being granted access to the network. User authentication is carried out using any standard-based RADIUS server. 802.1x - RADIUS, AAA - MAC-based 802.1X authentication also Support 802.1x surveillance VLAN, Port Security, Protected Port and also Prevent ARP Spoofing.
- L4/L3/L2 Access Control Lists (ACLs) for granular network access control including 802.1x port authentication. IP, MAC, Ports based Access Control Lists (ACL, L4 to L2) feature restricts access to sensitive network resources by denying packets based on source and destination MAC address, IP address, TCP/UDP ports and even VLAN ID.
- DHCP Snooping feature ensures IP address allocation integrity by only allowing DHCP messages from trusted DHCP servers and dropping malformed DHCP messages with a port or MAC address mismatch. With DHCP Snooping binding and option82 enabled, it can combine dot1x and ARP.
- IP-MAC-Port-VID Binding, Port Security, Storm control which protect against broadcast storms.
- ARP attacks prevention prevents typical DoS attacks can protect these attacks more easily ever than before.

Multicast

- IGMP Snooping (v1, v2, v3) transmits data on demand on data link layer by analyzing IGMP packets between the IGMP querier and the users, to build and maintain Layer 2 multicast forwarding table.

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- Snooping Multicast Listener Discovery (MLD) snooping (v1/v2) constrains the flooding of IPv6 multicast traffic on VLANs. MLD snooping performs the same function as IGMP snooping with the only difference being that MLD snooping is for IPv6 and IGMP snooping for IPv4 environments.
- Multicast VLAN Registration (MVR) is designed for distribution of multicast traffic on a dedicated multicast VLAN across segregated access networks, while allowing subscribers who are on different VLANs to join and leave the multicast groups carried in the Multicast VLAN. Multicast VLAN registration (MVR) enables more efficient distribution of IPTV multicast streams across an Ethernet ring-based Layer 2 network.

QoS features

- Advanced QoS (Quality of Service) for traffic prioritization including port based, 802.1p and L4/L3/L2 DSCP based.
- L4/L3/L2 QoS optimizes voice and video applications with ACL based, VLAN ID based IP precedence, COS and DSCP. Policy Based on Port & VLAN, Remark DSCP, COS/ 802.1p, Precedence, COS for SP, WRR for Scheduling and matching the IP fragmentation of message.

User friendly Maintenance Management

- With Zero Touch Provisioning with simple, secure, unified plug and play.
- CLI / Web GUI / SNMP Management with industry standard CLI and Web GUI based device-management tool that provides the ability to provision the device, to simplify device deployment and manageability, and to enhance the user experience. It comes with the software Image 0 can also have Image 1 (Dual image) simultaneously. There is no need to enable anything or install any license on the device. Then Web GUI can be used to build configurations, and to monitor and troubleshoot the device without having CLI expertise.
- Support Multi-user management at the same time.
- Supports RADIUS and TACACS+ server authentication can be performed locally or on a RADIUS/TACACS+ server can also control access to your network through Switch by using authentication methods such as 802.1X, MAC Based and Web Based.
- Configuration Upgrade easily by HTTP or TFTP Download/Upload Firmware.

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Debugging and troubleshooting feature

- **PING, TRACEROUTE, SNMP, RMON, Web based real time** switch ports monitoring with WEBUI can easily troubleshoot any problem in network with Ping, trace route, various show, debug command and WEBUI based real time status of device.
- **Cable Diagnostics** by WEB GUI as well as CLI.
- **Maintenance & Operation Management** via TFTP/FTP, CLI, Telnet, Console, Web GUI /SSL (IPv4/IPv6), SSH (IPv4/IPv6).
- **Port Mirroring** for network monitoring. Port mirroring is used on a network device to send a copy of network packets seen on one switch port, multiple other ports, or on to network monitoring connection on another port on the switch.
- **SNMP v1/v2c/v3**, management station, can monitor the performance of network devices. With SNMP, network managers can view or modify network device information, and troubleshoot according to notifications sent by those devices in a timely manner. Public and Private Management Information Base (MIB) interface
- **RMON** (Remote Network Monitoring) together with the SNMP system allows the network manager to monitor remote network devices efficiently. RMON reduces traffic flow between the NMS and managed devices, which is convenient to manage large networks.

Software Licensing and Upgrades

- **Free Software Upgrades** and patching supports with enhanced functionality, which provides fixes for critical bugs and security vulnerabilities between regular maintenance releases. This free software upgrades and licenses support lets you add patches, new features, protocols, and functionality without having to spend a single dollar. This reduces TCO.
- **Protected Ports** ensure no exchange of unicast, broadcast, or multicast traffic between the protected ports on the switch, thereby improving the security of your converged network.
- **Dynamic VLAN Assignment (RADIUS/TACACS+)** with IP phones and PCs can authenticate on the same port but under different VLAN assignment policies. Users are free to move around and enjoy the same level of network access regardless of their physical location on the network.

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- **Port Mirroring and Cable Test** many-to-one port mirroring for better and quicker network diagnostics and troubleshooting. Cable test easily identifies bad Ethernet cables.
- **Firmware updates and backup** procedure by uploading/downloading file to PC/TFTP/FTP.

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Software Features

L3 Features

- Static ARP up to 512
- Supports Gratuitous ARP
- IPv6 Neighbor Discovery (ND)
- Static Routing
  - Max. 512 IPv4 entries
  - Max. 512 IPv6 entries
  - Supports Default Routing

L2 Switching Features

Basic L2 Switching Features

- MAC Address Table with 8K to 16 K entries
- 802.3x Flow Control when using full duplex
- Back Pressure when using half-duplex
- HOL Blocking Prevention
- Jumbo Frame Up to 10,000 to 12000 bytes
- ERPS (Ethernet Ring Protection Switching)
- Port Mirroring Supports One-to-One, Many-to-One, Supports Mirroring for Tx/Rx/Both, Supports 4 mirroring groups
- Flow Mirroring supports One-to-One, Many-to-One, Supports Mirroring for Rx, Supports 4 mirroring groups
- RSPAN mirroring
- Loopback Detection
- L2 Protocol Tunneling

Link Aggregation

- Support static link aggregation
- Support 802.3ad LACP
- Up to 8 aggregation groups, containing 8 ports per group for 8, 24 & 48 ports Switches and 8 aggregation groups, containing 16 ports per group for 48 ports Switches.

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Spanning Tree Protocol (STP)

- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1s Multiple Spanning Tree Protocol
- IEEE 802.1w Rapid Spanning Tree Protocol
- STP Security with Loop back detection, TC Protect, BPDU Filter/Protect, Root Protect

Multicast

- Support IGMP Snooping V1/V2/V3, with 512 to 4K entry Multicast table depending on model for L2/IP multicast function
- Support multicast VLANs, IGMP Immediate Leave, Unknown IGMP Throttling, IGMP Filtering, Static Multicast IP
- L2 Multicast Filtering Forwards all groups, forwards all unregistered groups, Filters all unregistered groups
- MLD Snooping, MLD v1/v2 Snooping
- PIM Snooping

VLAN

- Support IEEE802.1Q with 4K VLAN groups and 4K VIDs
- Support Port VLAN, Protocol VLAN and MAC-based VLAN
- Support GARP/GVRP feature

Quality of Service (QoS)

- Support 802.1p CoS/DSCP priority
- Support 4 priority queues
- Queue scheduling with SP, WRR, SP+WRR
- Port/Flow- based Rate Limiting
- Voice VLAN assure voice applications have excellent performance

Advanced Security

- IP-MAC-Port-VID Binding
- Static/Dynamic Port Security (MAC-based)
- DoS defend feature
- Dynamic ARP Inspection

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802.1x authentication

- Support 802.1x port/MAC based authentication
- Support Radius authentication and accountability
- Guest VLAN
- RADIUS/TACACS+

Access Control List (ACL)

- L2~L4 package filtering based on source and destination MAC address, IP address, TCP/UDP ports, 802.1p, DSCP, protocol and VLAN ID.
- Time based ACL
- Support Broadcast, Multicast and Unknown unicast Storm Control
- Secure web management through HTTPS and SSLv2/v3/TLSv1
- Secure remote command line interface (CLI) management with SSH v1/V2

Management

- Support Web-based GUI management mode
- Support Command Line Interface (CLI) through console port, telnet management mode
- SNMP v1/v2c/v3
- RMON (1, 2, 3, 9 groups)
- DHCP Server
- DHCP/BOOTP Client
- DHCP Snooping
- DHCP Option 82
- CPU Monitoring
- Port Mirroring (Many to One)
- Cable Diagnostics feature
- Ping/Tracert feature
- SNTP
- System Log

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Ethernet Protocols

- IEEE 802.3i 10BASE-T
- IEEE 802.3u 100BASE-TX/FX
- IEEE 802.3ab 1000BASE-T
- IEEE 802.3z 1000BASE-X
- IEEE 802.3av GVRP
- IEEE 802.3ad Link Aggregation
- IEEE 802.3x Flow control
- IEEE 802.1p QoS
- IEEE 802.1q VLANs / VLAN tagging
- IEEE 802.1v Protocol VLAN
- IEEE 802.1d Spanning Tree Protocol (STP)
- IEEE 802.1s Multiple Spanning Tree (MSTP)
- IEEE 802.1w Rapid Spanning Tree (RSTP)
- IEEE 802.1x Network Login Security
- IEEE 802.3x flow control for Full Duplex mode and back pressure for Half Duplex mode

MIBs (Management Information Base)

- Ethernet-like MIB (RFC 3635)
- Interface Group MIB (RFC 2863)
- RMON (RFC 2819)
- Bridge MIB (RFC 1493)
- Bridge MIB Extension (RFC 2674)

GREEN Features

- IEEE 802.3az (Energy Efficient Ethernet)
- Auto FAN Speed Control, Temperature Alarm

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Table 1. COMMANDO SoldierOS IP Services software Features

KEY SOFTWARE FUNCTION	
FEATURES	PROTOCOLS
IEEE Standards	IEEE 802.3x (Full Duplex), Back-Pressure (Half-duplex) IEEE 802.3, IEEE 802.3u, IEEE 802.3ab, IEEE 802.3z IEEE 802.3ad IEEE 802.3q, IEEE 802.3q/p IEEE 802.1w, IEEE 802.1d, IEEE 802.1S
MAC Address	8000 to 16000 MAC addresses table entries Jumbo Frame 10000 to 12000 bytes with automatic MAC address learning and aging
Energy Efficient Ethernet	EEE (802.3az)
VLAN	Up to 4094 VLAN Port-based VLAN up to 8 groups IEEE 802.1Q Tagged-based MAC-based VLAN up to 256 Voice VLAN static up to 256 QoS for each Voice VLAN Data Voice VLAN OUI Mode (Auto/Manual) maximum 16 OUI Multicast VLAN Registration (MVR) IPV4 Based
Surveillance VLAN	OUI Mode (Auto/Manual) maximum 16 OUI
VLAN	QinQ (IEEE 802.1ad)

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GARP VLAN Registration Protocol (GVRP)	GVRP As per IEEE 802.1Q specification
Spanning Tree	IEEE 802.1D (STP) IEEE 802.1w (RSTP) IEEE 802.1s (MSTP) maximum 128 instances Auto Edge Port BPDU Filtering BPDU Guard Self-Loop Detection UDLD
Link Aggregation	IEEE 802.3ad LACP, Max 8 Aggregation Groups trunk, Maximum 8 to 16 ports per Trunk Static Trunk Aggregation and Dynamic Aggregation Traffic Load Balancing
Port Mirror	Many-to-one port mirroring
Port flow control	Half duplex based back pressure control Full duplex based on PAUSE frames
Line Rate	Support Port based Input/Output Bandwidth Management
IP Binding	Support Static ARP
DHCP	DHCP Server, DHCP Client mode
DNS	DNS Client mode

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Static Routing	Support Static and Default routing
IGMP Snooping	IGMP v1/v2 IGMP v3 Basic (BISS) IGMP v2/v3 Querier
MLD Snooping	MLD v1/v2
IPv6	**IPv6 Host** - Auto Configuration, Static IPv6 Address and Prefix Length, Static IPv6 Default Gateway, IPv6 Neighbor Discovery (ND), IPv6 Duplicate Address Detection, ICMPv6 **IPv6 Application Supported** - HTTP/HTTPS, TELNET, SSH, SNMP, TFTP, Syslog, PING, DHCPv6
Multicast	Multicast Groups up to 256 to 4000 Immediate Leave Static/Forbidden Router Port Static/Forbidden Forward Port Filtering up to 128 profiles Throttling
Storm suppression	Storm Control Broadcast Unknown Multicast Unknown Unicast Storm Suppression of Broadcast type Storm suppression based on bandwidth tuning and storm filtering

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Access Control List (ACL)	Access Rules Maximum 1024 to 2K+256 ACL Type- L2/L3/L4 ACL IPv4-based Up to 1024 to 2K+256 ACL IPv6-based
Security	AAA (Authentication, Authorization and Accounting) TACACS+ (Terminal Access Controller Access Control Server) Maximum up to 8 servers. RADIUS (Remote Authentication Dial-In User Service) Maximum up to 8 servers. Authentication Manager - IEEE 802.1X, MAC Auth, Web Auth, Guest VLAN, Port-based, Host-based. Port Security Using Dynamic Lock maximum 256 Protected Port (Port Isolation) Black Hole MAC CPU Defense Engine DoS Prevention DHCP Snooping (with Option 82) Dynamic ARP Inspection IP Source Guard maximum 256 IP/MAC/Port Binding (IMPB)
QoS Features	802.1p port queue priority algorithm

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	Teams that support 4 different priorities per port Queue Scheduling - WRR, WFQ, Strict Priority, Hybrid (WRR+SP or WFQ+SP) WRR (Weighted Round Robin) Weighted priority rotation Algorithm, WRR, SP, WFQ, 3 priority scheduling models Class of Service - Port-based, 802.1p, IP TOS Precedence, IP DSCP, trusted QoS Support based on port, MAC, 802.1Q, DSCP classification Rate Limit - Port-based (Ingress/Egress)
ERPS	ERPS ring with ITU-T G. 8032/Y1344 (G. 8032)
Account Manager	Local Authentication Multiple User Account Up to 8 Multilevel Security Password Recovery Procedures
System maintenance	Upgrade firmware feature via TFTP/FTP/HTTP. Support Upload/Download Configuration files through WEB Support Multi-user management GUI/ CLI based Restore Factory Configuration
Line Management	Console Telnet (RFC854)

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	SSH v1/v2
Management and Maintenance	**Management by CLI:** Console, Telnet (RFC854) up to 3 sessions **Management by WEBGUI:** HTTP, HTTPS Management Based on Remote Configuration and Maintenance Using Telnet, SNMP V1/V2C/V3, SSH V1/V2, RMON V1/V2 Software Reset to default setting
Management Access	Management VLAN Management ACL Up to 1024 to 2K+256
File Management	Firmware Upgrade/Backup Dual Images Configuration Download/Backup Multiple Configurations Upload/Download using TFTP (RFC783) HTTP (Hyper Text Transfer Protocol) UART (Universal Asynchronous Receiver/Transmitter)
Time Management	Locally using sync with PC option. NTP (Network Time Protocol)
Port Management	Friendly Port Name (Port Description) Error Disabled Recovery
Secure Sockets Layer (SSL)	Secure Sockets Layer (SSL)- SSLv2, SSLv3

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	Transport Layer Security (TLS)- TLSv1
Neighbor Discovery	IEEE 802.1AB Link Layer Discovery Protocol (LLDP) ANSI/TIA-1057 LLDP Media Endpoint Discovery (LLDP-MED)
Remote Monitoring Management	RMON Up to 32 entries / type
MIB	MIB-II (RFC 1213) Ethernet-like MIB (RFC 3635) Interface Group MIB (RFC 2863) RMON (RFC 2819) Bridge MIB (RFC 1493) Bridge MIB Extension (RFC 2674)
Diagnostics	Mirroring 4 sets Port-based (Many to One) Up to 32 entries / type Syslog (RFC3164) with Local RAM, Local Flash, Remote Server up to maximum 8. System Diagnostics with CPU Utilization, Memory Utilization, Port Utilization Port Diagnostics with Cable Test, Fiber Module Status Network Diagnostics with Ping Test, Traceroute

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Table 2. COMMANDO SoldierOS IP Base Software at a Glance

Ethernet Protocols (IEEE)	L2 Switching Features	Quality of Service (QoS)	Security	Management
802.3i 802.3u 802.3ab 802.3z 802.3av 802.3ad 802.3ae 802.3ak 802.3x 802.1p 802.1q 802.1v 802.1d 802.1s 802.1w 802.1x 802.3x	Link Aggregation, LACP, Spanning Tree Protocols, Multicasting, VLANs, ACL, Voice VLAN, GVRP, Port isolation, Port security, MAC address learning limit, DHCP Server, IP Source guard, Dynamic ARP inspection, IP /Port/MAC binding	L4, L3, L2, ingress/ Egress	Access Control List (ACL), 802.1x authentication AAA / RADIUS/TACACS+	Web GUI management mode, Support Command Line Interface (CLI) through console port, Telnet, SNMP v1/v2c/v3 and RMON

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Table 3. Performance of COMMANDO SoldierOS IP Base

VLAN	4094
MAC Table entries	8000 to 16000
ACL	1024 to 2K+256
Multicast Group	512 to 4K
Jumbo Frame	10000 to 12000
Multicast IGMP Group	16
Multiple User Account	8
Static Route	512
MSTP	16 to 256
Aggregation Trunks/Ports Per Trunk	8/8 to 8/16
TACACS+/RADIUS Servers	8

Convergence Time

By default, RSTP used for all COMMANDO SoldierOS it takes less than 10 second for entire network to converge. RSTP converges faster because it uses a handshake mechanism based on point-to-point links instead of the timer-based process used by STP.

IP multicast snooping and IGMP automatically prevent flooding of IP multicast traffic.

IEEE 802.1AB Link Layer Discovery Protocol (LLDP) facilitates easy mapping using network management applications with LLDP automated device discovery protocol

LLDP-MED (Media Endpoint Discovery) defines a standard extension of LLDP that stores values for parameters such as QoS and VLAN to automatically configure network devices such as IP phones.

STP/RSTP/MSTP for loop free network with 128 instances, IEEE 802.1s Multiple Spanning Tree provides high link availability by allowing multiple spanning trees; provides legacy support for IEEE 802.1d and IEEE 802.1w

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IEEE 802.3ad Link Layer Discovery Protocol (LACP) and port trunking support up to 8 trunk groups with each trunk having 8/16 ports. Lag links provide easy-to-configure link redundancy of active and standby links.

Security

The AAA feature allows you to verify the identity of, grant access to, and track the actions of users. It supports Remote Access Dial-In User Service (RADIUS) or Terminal Access Controller Access-Control System Plus (TACACS+) protocols.

Based on the user ID and password combination that you provide; the switch performs local authentication or authorization using the local database or remote authentication or authorization using one or more AAA servers. A pre-shared secret key provides security for communication between the Switch and AAA servers. You can configure a common secret key for all AAA servers or for only a specific AAA server.

- It supports Multiple user authentication methods
- Uses an IEEE 802.1X supplicant on the client in conjunction with a RADIUS server to authenticate in accordance with industry standards.
- Supports web-based and MAC-based authentication.
- Multiple IEEE 802.1X users per port provides authentication of multiple devices on a single port that prevents a user from piggy backing on another user's IEEE 802.1X authentication.
- Concurrent IEEE 802.1X, Web and MAC authentication schemes per port switch port will accept up to 8 sessions of IEEE 802.1X, Web and MAC authentications.
- Access control lists (ACLs) provide IP Layer 3 filtering based on source and destination IP address or subnet or source and destination TCP/UDP port number.
- Source-port filtering allows only specified ports to communicate with each other.
- RADIUS/TACACS+ eases switch management security administration by using a password authentication server.
- Secure shell encrypts all transmitted data for secure remote CLI access over IP networks.

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- Secure Sockets Layer (SSL) encrypts all HTTP traffic, allowing secure access to the browser-based management WEB GUI in the switch.
- Port security allows access only to specified MAC addresses, which can be learned or specified by the administrator.
- MAC address lockout prevents particular configured MAC addresses from connecting to the network.
- Secure FTP allows secure file transfer to and from the switch and protects against unwanted file downloads or unauthorized copying of a switch configuration file.
- Switch management logon security helps secure switch CLI logon by optionally requiring either RADIUS or TACACS+ authentication.
- Custom banner displays security policy when users log in to the switch.
- STP BPDU port protection blocks Bridge Protocol Data Units (BPDUs) on ports that do not require BPDUs, preventing forged BPDU attacks.
- DHCP protection blocks DHCP packets from unauthorized DHCP servers, preventing denial-of-service attacks.
- Dynamic ARP protection blocks ARP broadcasts from unauthorized hosts, preventing eavesdropping or theft of network data.
- Dynamic IP lockdown works with DHCP protection to block traffic from unauthorized hosts, preventing IP source address spoofing.
- STP root guard protects the root bridge from malicious attacks or configuration mistakes.
- Identity-driven ACL enables implementation of a highly granular and flexible access security policy and VLAN assignment specific to each authenticated network user.
- Per-port broadcast throttling configures broadcast control selectively on heavy traffic port uplinks.
- Monitor and diagnostics digital optical monitoring of SFP and 1000BASE-T transceivers allow detailed monitoring of the transceiver settings and parameters.

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Effective Management

COMMANDO SoldierOS offers Network Monitoring for users to observe traffic behavior with Port Mirroring, Loop Prevention and DHCP snooping features, can identify and even locate connection problems on your business network.

- Administrators can designate the priority of the traffic based on Port Priority, 802.1P and DSCP Priority, to ensure that voice and video are always clear, smooth, and lag-free.
- Voice VLAN, port-based VLAN and 802.1Q-based VLAN functions.
- RMON provides advanced monitoring and reporting capabilities for statistics, history, alarms, and events.
- Troubleshooting ingress and egress port monitoring enable more efficient problem solving.
- Unidirectional Link Detection (UDLD) monitors the link between two switches and blocks the ports on both ends of the link if the link goes down at any point between the two devices.

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Hardware

COMMANDO Soldier C2000 Series Switches have 4.1 to 12 Mbit SRAM Packet Buffer memory with Packet length of 10K bytes. L2 MAC Function with 8K entries for MAC address learning for 8, 24 port Switch models and 16K-entry L2 MAC table 48 port Switch models with the 4-way hash L2 table and searching with two hash algorithms. Independent 512-4K entry L2/IP Multicast table for multicast function, 2-hash algorithm selection for L2 table searching/learning. Aging timer ranges from 0.2s to 1600000s. It has a 4K-entry VLAN table and provides a 64-entry filtering database for 802.1Q port-based, protocol- and-port-based, 802.1Q-based, IP-subnet-based, and ACL Rules-based VLAN operation to separate logical connectivity from physical connectivity with IVL (Independent VLAN Learning), SVL (Shared VLAN Learning), and IVL/SVL (both Independent and Shared VLAN Learning) for flexible network topology architecture. The mode used depends on the FID (Filtering Identifier) setting. It also has a 1.5K to 2K+256 entry Access Control List (ACL) that parses various protocol packet types and performs configurable actions, e.g., Permit/Drop, redirect, and traffic policing.

It has per-port ingress/egress bandwidth control and per- queue egress bandwidth control. It has 8 physical queues in each port. It also has three types of packet scheduling, SP (Strict Priority), WFQ (Weighted Fair Queuing), and WRR (Weighted Round Robin). Each queue provides a leaky bucket (LB) to shape the incoming traffic into the average rate behavior. Port-based 802.1X and MAC-based 802.1X authentication prevent unauthorized users. It also has port isolation to enhance port security.

It has 4-set port mirror configuration to mirror ingress and egress traffic for network management purposes, complete MIB counter support reflects the switch status in real time. Link aggregation static and dynamic to increase link redundancy and increase linear bandwidth.

It supports VLAN Function with IVL, SVL, and IVL/SVL, IEEE 802.1Q VLAN with 4K-entry VLAN Table, Port-based VLAN, Port-and-protocol-based VLAN, ACL-based VLAN. Limited learned L2 MAC entry on each port and each VLAN. Supports flexible Q-in-Q and VLAN Tag function.

It Supports up to 64-256 spanning tree instances for MSTP (IEEE 802.1s), RSTP, and STP with Automatic loop detection and isolation (RLPP/RLDP). L3 Unicast Routing with 512 next hop MAC. IEEE 802.3az Energy Efficient Ethernet (EEE). IGMPv1/2/3 and MLDv1/2 snooping. It also Supports Reserved Multicast Addresses processing and L2 Miscellaneous Functions like

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Supports broadcast, multicast, unknown- multicast, and unknown-unicast packet suppression control, IEEE 802.1x, Port Mirroring with 4-sets of port mirrors, Flow-based mirror function, RSPAN function for remote mirroring.

It supports Link Aggregation (IEEE 802.3ad) for 8 groups of link aggregators with up to 8 ports per-group, Port isolation function to enhance port security. It also has Attack Prevention, Land attack, Blat attack, TCP control flag attack, Ping attack, Packet length attack.

It supports Access Control List (ACL) Function with 1.5K-entry to 2K+256 shared entry for ingress and egress ACL. ACL table and L4/L3/L2 format (e.g., DMAC, SMAC, and Ether-Type), IPv6 Parsing and Per-flow traffic policing with 16-entry VID range checking. It also supports 8-entry IPv4 or 2-entry IPv6 range checking. 256 to 512 leaky buckets for flow traffic policing.

It supports QoS Functions with 8 physical queues per port, Strict Priority (SP) and Weighted Fair Queue (WFQ), Weighted Round Robin (WRR) packet scheduling, QoS remarking for 802.1p and DSCP (includes IPv4/IPv6) also Supports average packet rate control leaky bucket per queue, in 16Kbps steps up to 1Gbps maximum. Ingress port bandwidth control, in 16Kbps steps up to 1Gbps maximum. Egress port bandwidth control, in 16Kbps steps up to 1Gbps maximum.

It supports MIB Functions with 256 to 2K 32-bit packet-based or 1K 64-bit byte-based log counters to enhance MIB counter log counters to enhance MIB count functionality. It also supports Ethernet-like MIB (RFC 3635), Interface Group MIB (RFC 2863), RMON (RFC 2819), Bridge MIB (RFC 1493), Bridge MIB Extension (RFC 2674).

It has Hardware Watchdog support which guards against certain types of system hangs. Watchdog timer is used to escape from if something goes wrong. Based on the situation, the Switches can automatically reset itself, or recover from the failure and generate an error message in the console logs. Long life electrolytic capacitance. High Quality PCB Circuit Board and PCB Surface Treatment Using Gold Sinking Process. Rack mount design, Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (Rack-mounting kit available); horizontal surface mounting; wall mounting with durable robust metal body. Bilateral heat dissipation. Power and ports status/ activity indicator LED lights. RJ45 Gold plated with 3U thickness.

It also supports IEEE 802.3az Energy Efficient Ethernet (EEE) for 100Base-TX in full duplex operation and supports 10Base-Te for 10Base-T in full/half duplex. The Energy Efficient Ethernet (EEE) operational mode combines the IEEE 802.3 Media Access Control (MAC) Sub-

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layer with a family of Physical Layers defined to support operation in Low Power Idle (LPI) Mode. When Low Power Idle Mode is enabled, systems on both sides of the link can disable portions of the functionality and save power during periods of low link utilization. 10Mbps PHY with reduced transmit amplitude requirements in EEE operational mode. This new PHY is fully interoperable with legacy 10Base-T PHYs over 100m of Class-D (Category 5) or better cabling. It has Temperature Control Fan control circuitry that varies the fan speed to increase or decreases the airflow needed to keep the system operating in a desired temperature by adjusting fan speeds to optimize cooling. These Energy Efficient switches optimize air circulation to provide more effective cooling throughout rack systems in data centers where the switches are used when compared to side-to-side airflow. The switches also feature built-in smart fans with internal heat sensors that monitor and detect temperature changes and react accordingly by utilizing different fan speeds for different temperatures. At lower temperatures, the fans will run slower, reducing the switch's power consumption and noise. It has Hardware watchdog support which guard against certain types of system hangs. Watchdog timer is used to escape from if something goes wrong. Based on the situation, the Switches can automatically reset itself, or recover from the failure and generate an error message in the console logs. It has long life electrolytic capacitance with high Quality PCB Circuit Board and PCB Surface Treatment Using Gold Sinking Process. Rack mount design, Mounts in an EIA-standard 19-inch telco rack or equipment cabinet (Rack-mounting kit available), horizontal surface mounting, Wall mounting and also having durable robust metal body and has bilateral heat dissipation. It comes with LED indications like Power, ports status/ activity indicator LED lights, PoE Max.

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Hardware Highlights

Solid performance with non-blocking architecture

- CPU Dual Core having frequency 500 to 700 MHz along with CPU Memory DRAM of 1GB, Flash memory of 256 MB and Packet Buffer memory of 4.1MB to 12 MB.
- All ports are capable of Gigabit Ethernet speed. Full speed of data transferring with (Auto-Negotiation/Auto MDI/MDIX)
- Solid performance with non-blocking architecture, 8000 to 16000 entries MAC Address Table with 4-way hashing algorithm
- 4094 VLANs can be created
- 1024 to 2K+256 ACL entries
- Up to 512 static routes
- Independent 512 to 4K entry L2/IP Multicast table for multicast function.
- Maximum packet length 10000 bytes
- Jumbo frames of 10000 to 12000 bytes.
- 2-hash algorithm selection for L2 table searching/learning with Aging timer range from 0.2s to 1600000s.
- L2/L3/L4 QoS optimizes voice and video applications with 256 leaky buckets for flow traffic policing.
- Switching Capacity: Up to 104Gbps
- Forwarding Capacity: Up to 77.37Mpps
- Store-and-forward Switching Scheme.
- VLAN L3 Interface: 16
- Port Queues: 8
- PoE Budget up to 800W depending on models

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Physical Ports and Networking Interfaces

- Up to 48 x 1GE or SFP Ports with 2/4 SFP or 4GE ports uplinks or 8 combo ports 4 GE (RJ-45) or 4 SFP Uplinks. 24 & 48 ports PoE/PoE+ models.
- Management Interface: Console, Mini USB.
- LED Indicators: Power, Sys, Link/Act, PoE Max.
- Additional DC input power to enable UPS to mitigate power supply failures and support critical network infrastructure.

IEEE 802.3af/at/bt Compliant Power over Ethernet

- Various power budget of 600W and 800W for 24 and 48 ports perpetual PoE/PoE+ Switch models. POE power supply transmission is more reliable due to the design of robust network transformer which uses high current. All PoE/PoE+ ports are IEEE 802.3af-compliant PoE and IEEE802.3at-compliant PoE+ . Each port delivers 15.4 W PoE and 30 W PoE+ power capacity with backward compatibility.
- PD detection will automatically detect and provide required power for your PoE/PoE+ devices.

Extra Long operational life

- High Quality PCB Circuit Board and PCB Surface Treatment Using Gold Sinking Process.
- Support temperature range 0° C to 55° C
- Surge protection up to ±6KV to designed to automatically protect Switches from surge events by limiting transient voltages and diverting surge currents.
- Long life electrolytic capacitance to increase the operational life of switches.
- Rack and wall mount design enables to mount the switch in an EIA-standard 19-inch telco rack or equipment cabinet along with Rack-mounting kit available with the device. It enables horizontal surface mounting, wall mounting with durable robust metal body.

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Green Energy and Silent operation

- Comply with IEEE 802.3az (Energy-Efficient Ethernet) standard, reduces power consumption up to 58% and reduces the noise pollution. Energy Efficient Ethernet (EEE) on the RJ-45 ports and low-power operations for industry best-in-class power management and power consumption capabilities. The ports support reduced power modes so that ports not in use can move into a lower power utilization state.
- Automatic up to 4 Temperature Controlled fans with Temperature Sensor. Small form-factor, fan-less as well as fan design for silent operation. Perfect for noise sensitive environments.
- Temperature Control fan to optimize cooling and noise with bilateral heat dissipation.

Highly reliable and Enterprise design

- High Quality as for all Mean Time Before Failure of system, MTBF > 200,000 hours
- Stability: 64bit packet, time delay < 10us, packet loss rate: 0
- Restorability of Network shaking or device breakdown, restart (recovery) time < 60 sec.
- RoHS Compliant with most of the packaging material can be recycled and reused.

Table 4. Hardware Product Highlights

1. Basic Hardware product highlights	
Product Positioning	Network Access
Switching Method	Store and Forwarding
Packet Buffer	Up to 12MB
CPU Model/ Frequency	CPU Dual Core 500 to 700 MHz
Flash	256 MB

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Memory(DRAM)		1GB
	Main Board Specification	24/48 x 10/100/1000 Mbps Ports 8/18/48 x SFP Ports(1G/1GE) 4CF/4GE/4SFP/8CF Uplink depending on model
	Console Type	RJ45 , Mini USB
	USB Console Management Port	Support
	USB Ports	Support USB port
2. Performance Specification		
	Switching Capability	Up to 104 Gbps
	Throughput	Up to 77.37 Mpps
	Latency	Min: 660ns Max: 960ns
3. Hardware Summary and reboot time		
Hardware Summary		Standard 1U 19'' Rack Mountable or Desktop
Software Upgrade Method		TFTP/FTP/HTTP
Service interruption time when reboot system for software update		Less Than 120s
4. Power Supply and Power Requirements		
	AC DC	Support Support
	AC	Operating Voltage: 100 ~ 240V; 50/60Hz

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		Maximum Voltage: 90 ~ 264V; 47~63Hz
	DC	Operating Voltage: DC: 12V, Amp as per model and 52V, as per model
Double Power Input		Support
PoE Budget		Up to 800W depending on models
Max Power Drawn by switch		24W -100W depending on models
5. Over-current and Over-voltage protection		
Overcurrent/Overvoltage Protection		Yes
Surge Protection Level		±6 kV
6. Hardware content		
Hardware Size (H×W×D) in.		4.4 x 44.4 x 30.0 cm (1.7 x 17.5 x 11.8 inches) 4.4 x 44.4 x 34.7 cm (1.7 x 17.5 x 13.7 inches) 4.4 x 33.3 x 22.2 cm (1.7 x 13.1 x 8.7 inches)
Weight (kg)		Up to 6.4Kg
Cooling Mode		Fan Cooling (Front-to-Rear Airflow)
Quantity of Fans		Up to 4
Fan Module Pluggable		Not support (Fixed fan)
Fan Module Intelligent Speed Control		Supported up to 10000 rpm.
Operating Temperature Range		0ºC - 55ºC
LED Indicator		Power, System, Link/Act, PoE Max.
Energy Saving		EEE Compliant with IEEE802.3az
Certification		CE, FCC

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Specifications

COMMANDO Soldier C2000 L2+ Access Series Routing Switches has a 4K-entry VLAN table which is used by 802.1Q and Q-in-Q VLAN. It supports 4K FID (Filtering Database ID) in total. IVL (Individual VLAN Learning), SVL (Shared VLAN learning) and IVL/SVL mixed mode are supported and per VLAN basis can specify the VLAN learning mode for unicast/broadcast and L2/IP multicast traffic respectively. It has IP multicast data packets involving L2 and port-mask table lookup. If the L2 table lookup returns a hit, the data packet is forwarded to all member ports and router ports retrieved from port-mask table. If the multicast address is not stored in the address table (i.e., lookup miss), the packet is broadcast to all ports of the broadcast domain.

The switch features an 8K-16K-entry Layer 2 table. It uses a 2-left 4-way hashing structure to store L2 entries so that it could provide higher learning capability. Each entry can be recorded in one of the two formats, L2 Unicast and L2 Multicast. Both L2 Unicast and Multicast use (FID/VID, MAC) as hash key. The learn unicast entries are aged out after the specified aging period. The device per port supports a configuration to disable the aging out function. Support Source/Destination MAC filtering or Secure Source MAC Address mode that device only accepts packets whose SA is known to system. IEEE 802.1d/1w/1s (STP/RSTP/MSTP) with 128 spanning tree instances supported by the device.

The device has a 4K-entry VLAN table that is used by 802.1Q and Q-in-Q VLAN and shared by CVLAN and S-VLAN. Up to three-layer VLAN tags (Outer Tag, Inner Tag, Extra Tag) are supported for Q-in-Q applications. The device supports global four outer TPIDs, four inner TPIDs and one extra TPID which are all configurable and per port has a TPID mask to select the recognized TPID. For VLAN tag manipulation, VLAN untag set and the egress port tag status configurations are coordinated for determining the tag status for a packet. Per ingress port and per tag status can specify the forwarding VLAN is either from inner tag or outer tag. Forwarding VLAN is used for doing VLAN table lookup and ingress/egress VLAN filtering. The device also supports 8 protocol-based (IEEE 802.1v), 2K MAC-based/IP-subnet-based (shared with Ingress VLAN translation), and application-based VLANs. Per VLAN provides a 16-bit group mask which can be used as a key by ACL and provides forwarding options of some predefined types of packets (e.g., IGMP, MLD, DHCP, and ARP) for VLAN-based applications.

The device supports 2K ingress (shared with MAC-based/IP-based VLAN) and 1K egress VLAN translation table. They are used to support the 1:1 and port-based N:1 VLAN translation. For MAC-based N:1 VLAN translation, per egress port has a configuration to enable the function. In addition to the dedicated VLAN translation tables, VLAN translation can also be done by ACL. The device supports 802.3ad (Link Aggregation) for 8 groups of link aggregators with up to 8 ports per-group.

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Link aggregation group frames are sent to an aggregation port of the link aggregation group according to a distribution algorithm. Two trunk distribution algorithms are supported and per group can bind to a specific distribution algorithm. L2 and L3 packets can have different parameters of the distribution algorithm. Each trunk group can optionally separate the known multicast and flooding traffic to the MSB port. Besides, H/W fail-over is also supported to prevent forwarding traffic to a link down port in stand-alone mode.

There are four mirror configurations supported in the device. Each mirror configuration can specify the ingress and egress mirrored ports, mirroring port, isolation state, and enable state. Normal forwarding packets cannot be forwarded to the mirroring port if isolation state is enabled. The mirrored traffic can cross the VLAN, that is, the mirrored port and mirroring port can reside in different VLANs. Multiple mirrored ports are matched for a multiple egress port packet. The packet transmitted through the lowest mirrored port ID is duplicated to the mirroring port. The mirroring port drops the mirrored traffic instead of triggering the flow control if it is congested. The device supports ingress and egress port sampling. Each mirror session can specify the sample rate for packet sampling.

Most common attacks can be blocked by the device including LAND attack, UDP Blat attack, TCP Blat attack, Ping of Death attack, Smurf attack, TCP NULL scan and so on. The attack prevention function is per port enabled and each attack type is globally enabled. The device provides 512 L3 interface (shared with Tunnel interface), 512 hash-based (SRAM) L3 entries and 512 LPM-based (TCAM) L3 entries which can support 512 IPv4 unicast entries or 512 IPv6 unicast entries as maximum. The switch supports IPv4/IPv6 multicast routing and provides maximum 512 to 4K IPv4/ IPv6 multicast routing entries .

The VLAN ACL function supports packet color-dependent drop, permit and QoS remarking functionalities. Each VLAN ACL entry corresponds to multiple actions. When a multi-match occurs (i.e., there are several ACL entries matching concurrently), these matched actions will be divided into different action groups. Each group will then execute the lowest block logic ID of lowest block group ID address entry corresponding action.

The ingress ACL function supports packet color-dependent drop, permit and QoS remarking functionalities. The egress ACL function supports packet color-dependent drop and QoS remarking functionalities. The device supports 512 policers. Policers belonging to different block groups can be executed concurrently to support hierarchy policing. The policer is flow controlled via leaky bucket. The rate ranges from 16Kbps~1Gbps with 16Kbps granularity. Each ACL entry has an index to point to 512 ACL policers. One limitation is that different phase ACL or different block group cannot share the same policer.

The per-port L2 storm filtering control mechanism suppresses the flow rate of storm packets. The device supports five control types: Unknown Unicast, Unicast, Unknown Multicast, Multicast, and Broadcast Storm. Egress bandwidth control configurations are supported to

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each port and each egress queue. Per-queue is also provided assured bandwidth and maximum bandwidth. Each bandwidth setting ranges from 16Kbps~1Gbps. The Packet Scheduler controls the multiple traffic classes (i.e., controls the packet sending sequence of the priority queue). The device scheduling algorithm is divided into Weighted Fair-Queuing (WFQ) and Weighted Round-Robin (WRR). Note that the Strict Priority queue is the highest priority of all queues, and overrides WFQ & WRR. A larger strict priority queue ID indicates the priority is higher. Remarking can be divided into Inner 1p, Outer 1p, DEI and DSCP Remarking. Per egress port per type supports a configuration to turn on the remarking function. For Inner 1p Remarking and Outer 1p Remarking, the remarking source can be internal priority, original inner 1p priority, original outer 1p priority or original DSCP value. For DEI Remarking, the remarking source can be either from internal priority or internal drop precedence (DP). For DSCP Remarking, the remarking source can be internal priority, original inner 1p priority, original outer 1p priority, original DSCP value, internal DP and internal-priority-and-internal-DP.

There are two mechanisms for half duplex backpressure, Collision-Based Backpressure (Jam Mode) and Carrier-Based Backpressure (Defer Mode). WRED is not configured, output buffers fill during periods of congestion. When the buffers are full, tail drop occurs. All additional packets are dropped. Since the packets are dropped all at once, global synchronization of TCP hosts can occur as multiple TCP hosts reduce their transmission rates. The congestion clears, and the TCP hosts increase their transmissions rates, resulting in waves of congestion followed by periods where the transmission link is not fully used. WRED reduces the chances of tail drop by selectively dropping packets when the output interface begins to show signs of congestion. By dropping some packets early rather than waiting until the buffer is full, SWRED avoids dropping large numbers of packets at once and minimizes the chances of global synchronization. Thus, WRED allows the transmission line to be used fully at all times. The device supports 512 ACL policers which can also be used as color-aware/color-blind srTCM (Single Rate Three Color Marker) and color-aware/color-blind trTCM (Two Rate Three Color Marker).

The srTCM meters a traffic stream and marks its packets according to three traffic parameters, Committed Information Rate (CIR), Committed Burst Size (CBS), and Excess Burst Size (EBS), to Green, Yellow, or Red. The trTCM meters a traffic stream and marks its packets based on two rates, Peak Information Rate (PIR) and Committed Information Rate (CIR), and their associated burst sizes to be green, yellow, or red. Each policer can specify the counting mode to be either PPS (Packet-Per-Second) or BPS (Bit-PerSecond). The packet is marked a color by srTCM/trTCM and the color is then referenced by associated ACL entry to perform drop or remark action. The color of packet is also referenced by SWRED to perform egress random dropping for congestion avoidance. The supported MIB (Management Information Base) which include TCP/IP-based MIB-II (RFC 1213), Ethernet-like MIB (RFC 3635), Interface Group MIB (RFC 2863), RMON (Remote Network Monitoring) MIB (RFC 2819), Bridge MIB (RFC 1493), Bridge MIB Extension (RFC 2674).

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It supports OAM (Operation, Administration, Maintenance) IEEE 802.3ah which provides mechanisms useful for monitoring link operation such as remote fault indication and remote loopback control. In general, OAM provides network operators with the ability to monitor the health of the network and quickly determine the location of failing links or fault conditions. The OAM loopback function supported by the device is wire-speed guaranteed and the source/destination MAC address can be swapped for the loopback packet. It supports 802.1ag CFM (Connectivity Fault Management) specifies protocols and protocol entities within the architecture of VLAN-aware Bridges that provide capabilities for detecting, verifying, and isolating connectivity failures in Virtual Bridged Local Area Networks. CFM describes the protocols and procedures used by Maintenance Points to detect and diagnose connectivity faults within a MD (Maintenance Domain).

It has EEE proposes a low power idle (LPI) mode where the MAC and PHY can shut down parts of electric circuits to reduce power consumption. If there is no traffic to be transmitted, the TX part of a port can enter LPI mode to sleep. If the link partner enters TX LPI mode, the connected port can enter RX LPI mode. The device per port can enable the TX/RX EEE function separately for different link speed (excludes 10Mbps)

Table 5. Technical Specifications

Feature	Highlights	Technical Specifications	C2000 Supported Parameters
	Jumbo frame	Maximum Jumbo frame size	Up to 12000
		MAC Address Table Capacity	8000-16000
		MAC Learning Rate (SW)	> 4000pps
		MAC Learning Rate (HW)	> 1Gbps
		Blackhole MAC address capacity	128
	Multicast MAC	MAC address Capacity	Up to 16000
		VLAN IDs	4094
		VLAN Instances	4094
		VLANs to enable statistics	256

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	VLAN Mapping	Maximum mapping table	64
		Maximum rules Number	1024
	EVC	Maximum EVC Number	4094
		Maximum Member Number per group	8
		Maximum Group Number	8
		Load balance key mode	Static/Dlb/rr/Resilient /Self-healing
		Convergence time	< 50ms
		Maximum Rule Number	4096
		Maximum Group Number	1
		Base MAC Capacity	512
		Base IPv4 Capacity	16
		Base IPv6 Capacity	16
		Base Protocol Capacity	7
	STP	Convergence time	< 30s
	RSTP	Convergence time	< 1s
		Instance Number	64
		Convergence time	< 1s
	ARP	ARP Capacity	512
	IPv4	FIB	512
		Multicast Routing Table	512 to 4K

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Multicast		Number of interfaces that support Multicast routing table	-
	IGMP Snooping	Maximum Groups Number	-
		Maximum Group Number	-
		Maximum Member Number	-
	Host Route	NDP Capacity	-
	IPv6	FIBv6	-
		Multicast Routing Table	-
		Number of interfaces that support Multicast routing table	-
		Maximum Entry Number	-
		Maximum Member Number	-
		Unicast Queue Multicast Queue Monitor Queue	
	Packet Buffer	System Packet Buffer Capacity	4.1MB to 12 MB
		Policer granularity Queue Shape granularity	
		Port Shape granularity	-
		Ingress Port qos IPv4 flow entries Ingress Port qos IPv6 flow entries	

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ACL	IPv4 ACL	Ingress Port ACL for IPv4 Ingress VLAN ACL for IPv4 Egress Port ACL for IPv4 Engress VLAN ACL for IPv4	512
		Ingress Port ACL for IPv6 Ingress VLAN ACL for IPv6 Egress Port ACL for IPv6 Egress VLAN ACL for IPv6	
		Ingress Port ACL for MAC Ingress VLAN ACL for MAC Egress Port ACL for MAC Egress VLAN ACL for MAC	
		IPv4 maximum rules Number IPv6 maximum rules Number	- -
	802.1x base MAC	Maximum Entries	-
	DHCP-Snooping	Maximum bound entry	-

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Table 6. Hardware Specification Enclosure, Fan and Power Budget

PRODUCT CODE	Enclosure Type	FAN (Temperature Control Fans)	Power Budget (Watts)
C2000-16GP-8CF	Rack/Wall mountable - 1U	1	290W
C2000-24GP-8CF	Rack/Wall mountable - 1U	3	600W
C2000-48GP-8CF	Rack/Wall mountable - 1U	4	800W
C2000-8SFP-4CF	Desktop, Rack/Wall mountable	Fan-less	24W

Table 7. COMMANDO Soldier C2000 Series ports specifications

Product Code	Ports	Main Interface	Uplink Interfaces
C2000-16GP-8CF	16 x 10/100/1000Mbps Ethernet PoE+ ports 4 x 10/100/1000Mbps Ethernet / 4 x 1G SFP Combo Uplink ports	16 GE	4 GE or 4 SFP Combo
C2000-24GP-8CF	24 x 10/100/1000Mbps Ethernet PoE+ ports 4 x 10/100/1000Mbps Ethernet / 4 x 1G SFP Combo Uplink ports	24 GE	4 GE or 4 SFP Combo
C2000-48GP-8CF	48 x 10/100/1000Mbps Ethernet PoE+ ports 4 x 10/100/1000Mbps Ethernet / 4 x 1G SFP Combo Uplink ports	48 GE	4 GE or 4 SFP Combo
C2000-8SFP-4CF	8 x 1G SFP ports 2 x 10/100/1000Mbps Ethernet + 2 x 1G SFP Uplink ports	8 SFP	2GE and 2 SFP

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COMMANDO Soldier C2000 Series Switches have AC as well as additional DC input power to enable UPS to mitigate power supply failures. It automatically senses when the internal power supply of a connected device fails and provides power to that device, preventing loss of network traffic and support critical network infrastructure. These series Switches protect from power surges through their inline power supply automatically and have in build Surge protection of ±6KV. With this feature protect on cost and the impact to your business by losing these network devices and thus the users/servers connected to them.

Table 8. Power specifications

PRODUCT CODE	Max no. of PoE+/Ultra PoE++ (IEEE 802.3at/bt) Ports	Max no. of PoE (IEEE 802.3af) Ports	Power Supply Dual 1+1 Power Supplies (AC + DC)
C2000-16GP-8CF	8 ports Up to 30W	All ports Up to 15.4W	AC: 100~240V 50/60Hz, DC: 12V and 52V
C2000-24GP-8CF	18 ports Up to 30W	All ports Up to 15.4W	AC: 100~240V 50/60Hz, DC: 12V, 4.1A and 52V, 10.2A
C2000-48GP-8CF	24 ports Up to 30W	All ports Up to 15.4W	100~240V 50/60Hz, DC: 12V, 6A and 52V, 14A
C2000-8SFP-4CF	-	-	AC: 100~240V 50/60Hz, DC: 12V, 2A

Note: Due to Intelligent PoE/PoE+ Power distribution number of PDs Supported may increase.

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Bandwidth Specifications

It uses store-and-forward switching which means that the LAN switch copies each complete frame into the switch memory buffers and computes a cyclic redundancy check (CRC) for errors. The switching capacity (backplane bandwidth) of a switch refers to the maximum amount of data that can be transmitted between a switch interface processor or interface card and a data bus. The switching capacity indicates the total data exchange capability of the switch, Switch supports up to 104 Gbps. The Forwarding Rate is a measure of how many packets per second the switch can process for certain sized packets. Forwarding rate, refers to the number of network packets that can be processed by switch. The Forwarding rate is measured in Million packets per second (Mpps).

Table 9. Bandwidth Specifications

Model Number	Switching Capacity (Gbps)	Switching Capacity Forwarding rate (mpps)	MTBF (hours)
C2000-16GP-8CF	40	29.76	212400
C2000-24GP-8CF	56	41.66	212367
C2000-48GP-8CF	104	77.37	212367
C2000-8SFP-4CF	24	17.86	214752

Table 10. Environmental Properties

Property	Description
Operation Temperature	0°C to 55°C
Operating temperature and altitudes:	0°C to +55°C, up to 5000 feet (1500m) 0°C to +55°C, up to 10,000 feet (3000m) Minimum ambient temperature for cold start is 32°F (0°C) Short-term* exceptional conditions: 0°C to +55°C, up to 5000 feet (1500m) 0°C to +50°C, up to 10,000 feet (3000m) 0°C to +55°C, at sea level with single fan failure

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	Not more than following in one-year period: 96 consecutive hours, or 360 hours total, or 15 days
Storage Temperature	-20° to 70°C
Operating Humidity (relative, noncondensing)	10% to 90% (non-condensing)
Storage Humidity	5% to 90%(non-condensing)

Weight and Dimension specifications

It offers the best in class from package dimensions to weight, destination, value, and shipment type. They are suitable for Industry standard Rack/Wall mounting. Industry Standard Rack/Wall mounted describes a unit of electronic equipment that is housed in a metal framework called an equipment rack. Usually, an equipment rack contains multiple "bays," each designed to hold a unit of equipment of standard dimensions.

Table 11. Weight and Dimension

Product Code	Weight & Dimension		
	Weight (Kg)	Centimeters (H x D x W)	Inches (H x D x W)
C2000-16GP-8CF	5.00	4.4 x 44.4 x 30.0	1.7 x 17.5 x 11.8
C2000-24GP-8CF	5.00	4.4 x 44.4 x 30.0	1.7 x 17.5 x 11.8
C2000-48GP-8CF	6.40	4.4 x 44.4 x 34.7	1.7 x 17.5 x 13.7
C2000-8SFP-4CF	2.45	4.4 x 33.3 x 22.2	1.7 x 13.1 x 8.7

SFP ports Slots specifications

It has 1G/1GE Gigabit Ethernet fiber-based, or Gigabit Ethernet copper based Small Form-Factor Pluggable with granular port densities that fit diverse campus needs. The SFP transceiver is a compact, hot-swappable device that plugs into a physical port of a

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network device. SFP optics are used in communication networks and have a transmitting side (Tx) and a receiving side (Rx). The different SFP transceivers work with different wavelengths at an appointed distance. 1G fiber solution or 1GE copper fixed uplinks.

Table 12. SFP specifications

PRODUCT CODE	SUPPORTING SFP/SFP+
SFP-SM-1G	COMMANDO LightningFIBER 1000BASE-LX/LH, SFP, 1310nm, 20km, SMF, DDM, Multi-vendor Compatible
SFP-MM-1G	COMMANDO LightningFIBER 1000BASE-SX, SFP, 850nm, 550m, MMF, DDM, Multi-vendor Compatible
SFP-EX-1G	COMMANDO FiberX 1000BASE-EX, SFP, 1310nm, 40km, SMF, DDM, Multi-brand
SFP-ZX-1G	COMMANDO FiberX 1000BASE-ZX, SFP, 1550nm, 80km, SMF, DDM, Multi-brand
SFP-EZX-1G	COMMANDO FiberX 1000BASE-EZX, SFP, 1550nm, 120km, SMF, DDM, Multi-brand
SFP-UTP-1G	COMMANDO LightningCOPPER 1000BASE-T Copper RJ-45, SFP, 100m, CAT5/6, Multi-vendor Compatible
SFP-SM-1G-BD-20K	COMMANDO FiberX GE/FC BiDi SFP, SM, Single LC, Tx1490/Rx1310nm, 20km, DDM, Multi-brand

Power Supply Specifications

Power supply is a king of all electronic devices without the power supply switch cannot work. Following rating power input required to make switch work.

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Table 13. Power supply specifications

Description	Rating
Power supply rated maximum	240V AC, 12V DC and 52V DC
Input-voltage range and frequency	100 to 240V AC, 50 to 60 Hz DC 12V, Amp depending on model specification and DC 52V, Amp depending on model specification
Power cord rating	15A

Table 14. LED Indication

LED Indication on Switch	LED Status
Power	Green OFF: No power on the switch. Green ON: The switch powered on
Link/Act	LINK/ACT bi-color LED: OFF: Port disconnected or link fail. Green ON: 1000Mbps connected. Amber ON: 10/100Mbps connected. Green Flashing: 1G/10G connected and Data in transit Amber Flashing: 10/100Mbps connected and Data in transit
System	Green OFF: The system is starting, please wait Green ON: The system is up and running
PoE	OFF: PoE/PoE+ power is not provided on port

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	Blue ON: PoE/PoE+ power is provided on port
PoE MAX	PoE MAX OFF: PoE Power budget is available in switch Red ON: PoE Power budget is 95%

Power Budget According to Cable Length

Ideally, shorter cables would use less power because of less power degradation over their length. This is not the case with most devices as they will use the same amount of power across the cable regardless of whether it is 10 or 100 meters in length. These switches analyze the length of the Ethernet cable connected and adjust the power usage accordingly, rather than keeping the power consumption in a conventional solution.

Table 15. COMMANDO Soldier C2000 Series Switches Cable Lengths

Connection Cable Type	Category and Speed	Maximum Cable Distance Supported
Unshielded Twisted Pair cable	10/100Base-TX: UTP category 5/5e/6 cables (Maximum 100m) 1000Base-T: UTP Category 5/5e/6 cable (Maximum 100m)	100Meter
Shielded Twisted Pair cable	10/100Base-TX: STP category 5/5e/6 cables (Maximum 250m) 1000Base-T: UTP Category 5/5e/6 cable (Maximum 100m)	250/100Meter
Optical Fiber Cable	550M~20Km depending on SFP	20Km

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Included in the bundle/box

All Soldier C2000 Series Switches are made available for use globally along with accessories in the bundle to facilitate or enhance operations.

The switch box comes included with the following accessories:

- 1x COMMANDO Soldier C2000 Series Managed Switch
- 1x Power cable
- 1x Console cable
- 1x Grounding Cable
- 1x Rack/Wall mountable Kit

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Support and Warranty

- Same-day assistance.
- Comprehensive 24-hour support using common communication/chat platforms, Email and Telephone.
- Provide FAQs and troubleshooting help online (self-service) through cloud-based solutions.
- Highly technical and trained representatives to resolve issues.
- One-year default warranty with option of warranty extension up to 5 years

Table 16. Warranty and Support

Warranty and Support	
Products covered	COMMANDO Soldier C2000 Series Managed Switches
Warranty duration	One Year RTB (Return To Base) replacement warranty – optionally extendable up to 5 years.
Hardware replacement	COMMANDO, its resellers or its service center will use commercially reasonable efforts to replace the product subject to stock availability. Otherwise, a replacement will be arranged within 15 working days after receipt of the Return Materials Authorization (RMA) request.
End-of-life policy	In case of discontinuation of the product, support is limited to 3 years from announcement date.
Effective date	Hardware warranty commences from the date of shipment to customer (and in case of resale by a COMMANDO reseller, not more than 90 days after original shipment by COMMANDO).
Support duration	Lifetime support.
COMMANDO Care	COMMANDO will provide 24x7 support for basic configuration, diagnosis, and troubleshooting of device-level problems for up to one year from the date of shipment of the originally purchased product. This support does not include solution or network-level support beyond the specific device under consideration.
Online Portal Access	Warranty allows guest access to commandonetworks.com for all available technical queries.

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COMMANDO Soldier C2000 Series L2+ Managed Switches come with replacement warranty and provided support according to COMMANDO WarrantyX Program available on:

https://www.commandonetworks.com/warranty

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Ordering Information

Table 17 lists ordering information for the COMMANDO Soldier C2000 Series Switches. To place an order, please contact your local reseller/distributor or COMMANDO Sales Representative at www.commandonetworks.com/catalog

Table 17. COMMANDO Soldier C2000 Series Switches Ordering Information

Ordering Information - COMMANDO E2000 Series Switches

Product Code	Description
C2000-16GP-8CF	COMMANDO Soldier C2000 16x1GbE Full PoE/PoE+, 4x1GbE/4x1GSFP Combo Uplinks, 290W, L2+ Managed Switch
C2000-24GP-8CF	COMMANDO Soldier C2000 24xGbE Full PoE/PoE+, 4x1GbE/4x1G SFP Combo, 600W, AC+DC, L2+ Managed Switch
C2000-48GP-8CF	COMMANDO Soldier C2000 48x1GbE Full PoE/PoE+, 4x1GbE/4x1G SFP Combo, 800W, AC+DC, L2+ Managed Switch
C2000-8SFP-4CF	COMMANDO Soldier C2000 8x1G SFP, 2x1G SFP+2x1GbE Uplinks, AC+DC, L2+ Managed Switch

Please note:
The model numbers of newer version products are further simplified such as + is updated to -. However, the product remains same and can be treated interchangeably.

Examples:
C2000-16GP+8CF is updated to C2000-16GP-8CF
C2000-24GP+8CF is updated to C2000-24GP-8CF

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Can’t Find the Right Switch? Explore Our Full Range of Managed Switches

COMMANDO Soldier E1300 L2 Smart Managed Switches

COMMANDO Soldier E1300 L2 Smart Managed Switch Series is designed to meet the evolving needs of modern businesses. Built for seamless connectivity and reliable performance, these switches deliver a powerful combination of full PoE/PoE+ support, flexible uplink options, and enterprise-grade features at a cost-efficient price point. Equipped with smart management capabilities, the E1300 Series makes it easy to configure, monitor, and optimize your network without the complexity or high costs. The PoE/PoE+ models power devices such as IP cameras, wireless access points, and VoIP phones directly through the network cable, eliminating the need for separate power sources and reducing infrastructure costs. Flexible uplink options via Gigabit and SFP ports further enhance scalability, allowing smooth integration into larger or evolving networks.

Product Code	Description
E1300-8GP-2G	COMMANDO Soldier E1300 8x1GbE Full PoE/PoE+, 2x1GbE Uplinks, 130W, L2+ Smart Managed Switch
E1300-4GP-2SFP	COMMANDO Soldier E1300 4x1GbE Full PoE/PoE+, 2x1G SFP Uplinks, 65W, L2+ Smart Managed Switch
E1300-8GP-2SFP	COMMANDO Soldier E1300 8x1GbE Full PoE/PoE+, 2x1G SFP Uplinks, 96W, L2+ Smart Managed Switch
E1300-16GP-2SFP	COMMANDO Soldier E1300 16x1GbE Full PoE/PoE+, 2x1G SFP Uplinks, 200W, L2+ Smart Managed Switch
E1300-24GP-2SFP	COMMANDO Soldier E1300 24x1GbE Full PoE/PoE+, 2x1G SFP Uplinks, 300W, L2+ Smart Managed Switch
E1300-4G-2SFP	COMMANDO Soldier E1300 4x1GbE, 2x1G SFP Uplinks, L2+ Smart Managed Switch
E1300-8G-2SFP	COMMANDO Soldier E1300 8x1GbE, 2x1G SFP Uplinks, L2+ Smart Managed Switch
E1300-16G-2SFP	COMMANDO Soldier E1300 16x1GbE, 2x1G SFP Uplinks, L2+ Smart Managed Switch
E1300-24G-2SFP	COMMANDO Soldier E1300 24x1GbE, 2x1G SFP Uplinks, L2+ Smart Managed Switch
E1300-4GP-2G	COMMANDO Soldier E1300 4x1GbE Full PoE/PoE+, 2x1GbE Uplinks, 65W, L2+ Smart Managed Switch

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COMMANDO Soldier E2000 Series Managed Switches

COMMANDO Soldier E2000 Series Managed Switches are L2+ Access layer switches with Intelligent PoE/ PoE+ with Automated Scheduling and Perpetual POE/PoE+. It is a suitably best choice switch for Enterprise, Telecom, ISP, Industrial, Campus, Retail and Hospitality, Security and Surveillance, IoT, Cloud, Metro, SMBs Networks. Soldier E2000 is designed with performance and cost efficiency priority. Soldier E2000 Switches come with Dual-image SoldierOS offering higher availability, redundancy and operational flexibility. These switches are built for quality, offer high and heavy-duty performance in most demanding networking environment.

Product Code	Description
E2000-8G-4CF	COMMANDO Soldier E2000 8x1GbE, 2x1GbE+2x1G SFP Uplinks, L2+ Managed Switch
E2000-16G-4CF	COMMANDO Soldier E2000 16x1GbE, 2x1GbE+2x1G SFP Uplinks, L2+ Managed Switch
E2000-24G-8CF	COMMANDO Soldier E2000 24x1GbE, 4x1GbE/4x1G SFP Combo Uplinks, L2+ Managed Switch
E2000-48G-8CF	COMMANDO Soldier E2000 48x1GbE, 4x1GbE/4x1G SFP Combo Uplinks, L2+ Managed Switch
E2000-8GP-4CF	COMMANDO Soldier E2000 8x1GbE Full PoE/PoE+, 2x1GbE+2x1G SFP Uplinks, 150W, L2+ Managed Switch
E2000-8GP-4SFP	COMMANDO Soldier E2000 8x1GbE Full PoE/PoE+, 4x1G SFP Uplinks, 150W, L2+ Managed Switch
E2000-16GP-4CF	COMMANDO Soldier E2000 16x1GbE Full PoE/PoE+, 2x1GbE+2x1G SFP Uplinks, 260W, L2+ Managed Switch
E2000-24GP-8CF	COMMANDO Soldier E2000 24x1GbE Full PoE/PoE+, 4x1GbE/4x1G SFP Combo Uplinks, 450W, L2+ Managed Switch
E2000-48GP-8CF	COMMANDO Soldier E2000 48x1GbE PoE/PoE+, 4x1GbE/4x1G SFP Combo Uplinks, 600W, L2+ Managed Switch

COMMANDO Soldier E3000 Series Routing Switches

COMMANDO Soldier E3000 Managed Routing Switches are L3 Aggregation and Access layer switch with Intelligent PoE/PoE+ with Automated Scheduling, Perpetual POE/PoE+ with 10G uplinks. It is a suitably best choice switch for Enterprise, Telecom, ISP, Industrial, Campus, Retail and Hospitality, Security and Surveillance, IoT, Cloud, Metro, SMBs networks. Soldier E3000 is designed with performance and cost efficiency priority. COMMANDO Soldier E3000 Switches come with Dual-image OS offering higher availability, redundancy and operational flexibility. These

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switches are built for quality, offer high and heavy-duty performance in most demanding networking environment.

Product Code	Description
E3000-24GP-4X	COMMANDO Soldier E3000 24x1GbE Full PoE/PoE+, 4x10G SFP+ Uplinks, 450W, L3 Routing Switch
E3000-48GP-6X	COMMANDO Soldier E3000 48x1GbE PoE/PoE+, 6x10G SFP+ Uplinks, 600W, L3 Routing Switch
E3000-24G-4X	COMMANDO Soldier E3000 24x1GbE, 4x10G SFP+ Uplinks, L3 Routing Switch
E3000-48G-6X	COMMANDO Soldier E3000 48x1GbE, 6x10G SFP+ Uplinks, L3 Routing Switch
E3000-8X	COMMANDO Soldier E3000 8x10G SFP+, 10G Fiber L3 Routing Switch
E3000-8XG	COMMANDO Soldier E3000 8x10GbE, 10GbE L3 Routing Switch
E3000-8XGP	COMMANDO Soldier E3000 8x10GbE Full PoE/PoE+, 150W, 10GbE L3 Routing Switch
E3000-16X	COMMANDO Soldier E3000 16x10G SFP+, 10G Fiber L3 Routing Switch
E3000-16XG	COMMANDO Soldier E3000 16x10GbE, 10GbE L3 Routing Switch
E3000-16XGP	COMMANDO Soldier E3000 16x10GbE Full PoE/PoE+, 260W, 10GbE L3 Routing Switch
E3000-24X	COMMANDO Soldier E3000 24x10G SFP+, 10G Fiber L3 Routing Switch
E3000-24XG	COMMANDO Soldier E3000 24x10GbE, 10GbE L3 Routing Switch
E3000-24XGP	COMMANDO Soldier E3000 24x10GbE Full PoE/PoE+, 450W, 10GbE L3 Routing Switch

COMMANDO Soldier C3000 Series Routing Switches

COMMANDO Soldier C3000 Series Managed Routing Switches are L3 Aggregation and Access layer switch with Intelligent PoE/PoE+ with Automated Scheduling, Perpetual POE/PoE+ with 10G uplinks. It is a suitably best choice switch for Enterprise, Telecom, ISP, Industrial, Campus, Retail and Hospitality, Security and Surveillance, IoT, Cloud, Metro, SMBs Networks. Convenient Deployment as dual power design allows customers to use either AC or DC power sources

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according to need of deployment. Soldier C3000 Switches come with Dual-image SoldierOS offering higher availability, redundancy and operational flexibility. These switches are built for quality, offer high and heavy-duty performance in most demanding networking environment.

Product Code	Description
C3000-24GP-4X	COMMANDO Soldier C3000 24x1GbE Full PoE/PoE+, 4x10G SFP+, 600W, AC+DC, L3 Routing Switch
C3000-48GP-6X	COMMANDO Soldier C3000 48x1GbE Full PoE/PoE+, 6x10G SFP+, 800W, AC+DC, L3 Routing Switch
C3000-8X	COMMANDO Soldier C3000 8x10G SFP+, AC+DC, 10G Fiber L3 Routing Switch
C3000-8XG	COMMANDO Soldier C3000 8x10GbE, AC+DC, 10GbE L3 Routing Switch
C3000-8XGP	COMMANDO Soldier C3000 8x10GbE Full PoE+, 150W, AC+DC, 10GbE L3 Routing Switch
C3000-24X	COMMANDO Soldier C3000 24x10G SFP+, AC+DC, 10G Fiber L3 Routing Switch
C3000-24X-2Q	COMMANDO Soldier C3000 24x10G SFP+, 2x40G QSFP+, AC+DC, L3 Fiber Routing Switch
C3000-24X-2C	COMMANDO Soldier C3000 24x10G SFP+, 2x100G QSFP28, AC+DC, L3 Fiber Routing Switch
C3000-24X-6Y2C	COMMANDO Soldier C3000 24x10G SFP+, 6x25G SFP28 + 2x100G QSFP28, AC+DC, L3 Fiber Routing Switch
C3000-24Y	COMMANDO Soldier C3000 24x25G SFP28, AC+DC, 25G Fiber L3 Routing Switch

COMMANDO Soldier IE3000 Industrial Routing Switch

COMMANDO Soldier IE3000 Industrial Managed Routing Switches are L3 Aggregation and Access layer switch which can withstand extreme temperatures ranging from -40° C to 80° along with surges, vibrations, and shocks found in industrial automation, outdoor applications. It has Intelligent PoE/ PoE+ with Automated Scheduling, Perpetual POE/PoE+ with 10G uplinks. Convenient Deployment as telecom grade DC power sources suitable and best choice for Enterprise, Telecom, ISP, Industrial, Campus, Retail and Hospitality, Security and Surveillance, IoT, Cloud, Metro, SMBs Networks. Soldier IE3000 Switches come with Dual-image SoldierOS offering higher availability, redundancy and operational flexibility. These switches are built for quality, offer high and heavy-duty performance in most demanding networking environment.

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Product Code	Description
IE3000-4GP-2X	COMMANDO Soldier IE3000 4x1GbE Full PoE+, 2x10G SFP+ Uplinks, L3 Industrial Routing Switch
IE3000-8GP-4X	COMMANDO Soldier IE3000 8x1GbE Full PoE+, 4x10G SFP+ Uplinks, L3 Industrial Routing Switch
IE3000-24GP-4X	COMMANDO Soldier IE3000 24x1GbE Full PoE+, 4x10G SFP+ Uplinks, L3 Industrial Routing Switch
IE3000-8G-4X	COMMANDO Soldier IE3000 8x1GbE, 4x10G SFP+ Uplinks, L3 Industrial Routing Switch
IE3000-24G-4X	COMMANDO Soldier IE3000 24x1GbE, 4x10G SFP+ Uplinks, L3 Industrial Routing Switch

COMMANDO Marshall C3500 Series Routing Switches

COMMANDO Marshall C3500 Fiber Routing Switches are Next Generation Core and Data Center L3+ Managed Routing Switch comes with L3+ full feature software licensee free for Lifetime, making it suitable for enterprise, data center, and large network environments. It provides high availability, scalability, security, energy efficiency, and ease of operation with innovative features ideal for high-density aggregation, core layer and data center as its high performance, availability and reliability requirement. It is a suitably best choice switch for Enterprise, Data Centers, Telecom, ISP, Industrial, Campus, Retail and Hospitality, Security and Surveillance, IoT, Cloud, Metro, HCI, SMBs Networks. Convenient Deployment as dual power design allows customers to use either AC or DC power sources according to need of deployment

Product Code	Description
C3500-24X	COMMANDO Marshall C3500 24x10G SFP+, AC+DC, L3+ Fiber Routing Switch
C3500-24X-2Q	COMMANDO Marshall C3500 24x10G SFP+, 2x40G QSFP+, AC+DC, L3+ Fiber Routing Switch
C3500-24X-2C	COMMANDO Marshall C3500 24x10G SFP+, 2x100G QSFP28, AC+DC, L3+ Fiber Routing Switch

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Document History

Release	What's new	Date
Release 1	First Release	January 4, 2021
Release 2	Model Updates	July 5, 2021
Release 3	Software Upgrade	September 18, 2023
Release 4	Content Updated	April 20, 2026

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