FL SWITCH EP 7400 Series
Substation hardened managed switches

Advanced network platform for electric power systems

PHOENIX CONTACT
INSPIRING INNOVATIONS

1. Introduction:

The FL SWITCH EP 7400 series of advanced modular managed network switches provides an adaptable platform to meet the electric power industry's increasing requirements for scalable network performance, uptime, and security.

The modular 19" rack-mount switch is hardened for areas heavily affected by EMI, such as switchgear, transformer stations, and local substations. The switch works reliably under extreme environmental conditions (-40°C to +75°C / 85°C) and complies with the IEC 61850-3 Ed 2, and IEEE 1613 specifications. The expandable "all gigabit capable" architecture combines cost-effective answers for near-term needs with upgrade paths for port quantity/bandwidth and functions. A powerful Layer 2 and Layer 3 feature set with hardware-based IEEE 1588 V2 PTP synchronization based on the IEC 61850-9-3 Utility Power Profile provides extensive options to meet changing performance and security needs.

The 28-port switch has 4 module slots. 3 slots accept 10/100/1000Mbps port modules (up to 8 ports) for device connections, and a 4th slot supports a 4-port SFP module with 1 or 10 Gigabit uplinks for device connections. SFP module options provide further single-point TX/fiber connection customization, while allowing for electrically isolated and secure communication lines between the control house and equipment throughout the station. Power is provided by redundant modular power supplies. The modules are designed for power source flexibility (AC/DC) and allow hot-swappable replacement for uninterrupted 24/7 operation.

Main features and application benefits:

Main features	Application benefits
28-port rack-mount switch with modular port and power supplies	Cost-effective expansion: Use what is needed now, expand to meet future growth
Modules allow device connections to expand from 10/100 to 1000 Mbps, and uplink connections from 1 Gigabit to 10 Gigabit	Cost-effective bandwidth expansion: Easily increase bandwidth as application traffic grows
Hot-swappable port and power supply modules	Increase uptime in 24/7 applications
Layer 2 and Layer 3 functions	More solutions as needs increase, while reducing site support complexity, training, and spares
Extensive security functions for remote access, local access, and network access areas	IEEE-based security tools guard against unauthorized access and potential system disruptions
Hardware-based IEEE 1588 V2 PTP synchronization for all device ports	Allows sub USEC-level time stamping for critical diagnostics and power status sampling
SD card extendable system logging memory	Increased troubleshooting capability: Extended time between uploading diagnostic log files
Color LCD port status	Faster and more accurate system status diagnostics

2. Product range and selection:

Article number	Item code description	Description
Ethernet switch bases (require separately-ordered power supply and port modules)		
1144353	FL SWITCH EP7428R-L3F1	61852 28 port modular rack switch-L2/ L3, 128 Bit Encryption
Power supply modules		
1144367	FL SWITCH EP7400-PS-LV	EP 7400 switch power supply module: 24 V DC nominal (10-36 V DC)
1144372	FL SWITCH EP7400-PS-MV	EP 7400 switch power supply module: 48 V DC nominal (36-72 V DC)
1144175	FL SWITCH EP7400-PS-HV	EP 7400 switch power supply module: HVAC/DC (88-370 V DC or 85-264 V AC)
Port modules		
1144375	FL SWITCH EP7400-M8GRJ45	EP 7400 port module: 8 RJ45 ports, 10/100/1000 Mbps
1144383	FL SWITCH EP7400-M8GSFP	EP 7400 port module: 8 SFP slot ports, 100/1000 Mbps
1144388	FL SWITCH EP7400-M4TGSFP	EP 7400 slot 4 port module: 4 SFP slot ports, 1G/10G
1144428	FL SWITCH EP7400-ABLK	EP 7400 blank slotf filler plate: slots 1-4

3. Technical specifications:

Switch base interfaces	
Total Ethernet port capacity	28
Module slots (rear mount)	3x 10/100/1000 Mbps (actual depends on the plug-in module)
	1x 1000 Mbps/10,000 Mbps (actual depends on the plug-in module)
	All slots support hot-swappable modules
Power supply slots (front mount)	2 redundant, hot-swappable (power supplies ordered separately)
	Power connections, fixed screw terminals, in rear of switch
RS232c communication interface (console)	RJ45 format, 115,200 Kbaud
	Data bits: 8, parity: none, stop bits: 1
USB port	USB 3.0 for firmware updating, backup/restore configuration files, and transfers syslog files
SD memory card slot	2 slots: slot 2 for sys log file storage (up to 32 GB), slot 1 for factory service personnel
Alarm contact	24 V DC, 1A
Factory service personnel access only	1x RJ45 management port
	1x SD memory card slot (top)
Reset (pinhole)	Reboot switch (press for less than 2 seconds), or return switch to factory default configuration (press for 2 seconds or more)
Factory default IP address	192.168.10.1

Diagnostic display and LEDs (front)	
Color LCD display (front mount)	Displays port link status
Power supply	PS1, PS2: power ok (on), power off or error (off)

Power	
Redundant module options	Low voltage: 10-36 V DC
	Medium voltage: 36-72 V DC
	High voltage AC/DC: 88-300 V DC, or 85-264 V AC
	All modules are hot-swappable and power supplies can be used in any combination
Switch power consumption	60 watts
Overload current protection	Internal fixed fuse (not user replaceable), fast-acting 3.15 A
Installation class	Overvoltage category III, pollution degree II

Housing	
Housing type	Galvanized steel
Degree of protection	IP-30
Dimensions (mm)	W 486.2 x H 44.4 x D 446.7

Packet switching characteristics	
MAC address table size (entries)	16K
Priority ques	8
Switch packet processing	Store and forward
Latency	7 us (64 byte packets)
Switching bandwidth	128Gbps
Jumbo frame support	Up to 10,000 bytes

Port module specifications	
FL SWITCH EP 7400-M8GRJ45	8 RJ45 ports, 10/100/1000 Mbps
FL SWITCH EP 7400-M8GSFP	8 SFP slot ports, support 100/1000 Mbps
FL SWITCH EP 7400-M4TGSFP	Slot 4 port module: 4 SFP+ slot ports, supports user-selectable 1G or 10G bps

3. Technical specifications: (continued)

Environmental specifications and approvals according to IEC 61850-3 Ed2, IEEE 1613, IEC	
Operating temperature	-40°C to +75°C nominal, type-tested to +85°C for 16 hours
Storage temperature	-40°C to +85°C
Humidity (operation and storage)	5% to 95%, no condensation
Shock test	Using IEC 60255-21-2: 25G, 11ms half sine shock pulse
	Using IEEE 1613 Clause 9 shock: 250 mm
Vibration	Using IEC60255-21-1 : 5g 150hz, Criterion 3
	Using IEEE 1613 clause 9 vibration: 30 mm/s 1…150 Hz
Free fall	Using IEC 60068-2-32: 1m
Weight	9.8kg

Environmental specifications and approvals according to IEC 61850-3 Ed2, IEEE 1613, IEC: electrical noise related	
IEC 61000-4-2 (ESD)	Contact: ±6 kV, Air: ±8 kV
IEEE C37.90.3 (ESD)	Contact: ±8 kV, Air: ±15 kV
IEC 61000-4-3 (radiated-noise immunity)	10 V/m
IEEE C37.90.2 (RF susceptibility)	Ports: 20 V/m
IEC 61000-4-4 (burst)	Ports: ±4 kV DC power: ±2 kV
IEEE C37.90.1 SWC (fast transient)	Ports: ±4 kV 2.5 kHz, DC power: ±4 kV
IEC 61000-4-5 (surge)	Ports: ±4 kV DC power: ±2 kV
IEC 61000-4-6 (conducted noise immunity)	Ports: 10 V DC power: 10 V
IEEE C37.90 (dielectric power frequency test)	Ports: 2 kV
IEEE C37.90 (impulse voltage test)	DC power: 5 kV
IEC 61000-4-8 (noise immunity against magnetic fields)	100 A/m continuous, 1000 A/m for 3 s
IEC 61000-4-10 (damped oscillatory magnetic field immunity)	30 A/m
IEC 61000-4-16 (immunity to conducted common mode disturbances)	Ports and DC power: 30 Vrms continuous, 300 Vrms for 1 s (50 Hz)
IEC 61000-4-18 (oscillatory waves)	2.5 kV common mode (100 kHz, 1 MHz), 1 kV differential mode (100 kHz, 1 MHz)
EEE C37.90.1 SWC (oscillatory)	Ports: ±2.5 kV common mode, 1 MHz, DC power: ±2.5 kV common mode, ±2.5 kV differential mode, 1 MHz
IEC 61000-4-29 (voltage dips and voltage interruptions)	30% reduction 0.1 s, 60% reduction (dips) 0.1 s, 100% interruptions 0.05 s
EN 55022 (radiated RF emissions)	Class A and B
EN 55022 (noise emission)	Class A and B
Electromagnetic emissions	FCC Part 15, CISPR 32 common mode (asymmetric mode), EN 55032 class A

Approvals	
Country specific	CE, ROHS II, WEEE , China ROHS, EAC
Safety	UL/cUL 62368 (replaces obsolete 60950, in preparation)

4. Managed switch functions:

Increase network performance

As the demand for intelligent power distribution and control increases, more devices are connected at a growing number of sites. The ability to define and prioritize peer-to-peer messages such as GOOSE messages, which travel horizontally through a substation's station bus but extend into the lower process bus, are critical to the operation of breakers and relays. This will be increasingly needed as more utilities utilize sequence of events fault identification and finer control using sampled values (SV). Whether it is needed for a remote local municipality installation or multisite regional control through a region, the FL SWITCH EP 7400 managed switch series has hardware and firmware functions that can manage the growing bandwidth and data traffic flows.

Scalable performance
24x 10/100/1000 device connections
4x 1/10 gigabit uplink connections
Supports PTP hardware-based IEC61850-9-3 utility power profile (V2), with peer-to-peer communications, transparent and end-to-end clocks on slots 1-3
SNTP time synchronization
VLAN-aware bridging (port-based VLAN, protocol-based VLAN), supports 4000 VLANs
IGMP v1, v2, v3 snooping with query – explicit host tracking and fast leave, 128 multicast groups per VLAN
Link aggregation with LACP
QoS (classification based on ACL and priority map table, traffic shaping, scheduling and queueing)
QoS – pre-marking support for IP, DSCP, metering TRTCM, frames for IP, DSCP
Metering and priority marking of frames for IP, DSCP, Egress port scheduler and shaper
Rate limiting and storm control, flow control
Unicast routing: (static, RIPv1/v2, OSPF- multiple areas) route redistribution between protocols
Multicast routing – PIM-SSM
VRRP v2/v3
Jumbo frames support
Supports configuring of static MAC addresses up to 16K, MAC learning limit per port and per VLAN

IEEE supported standards
IEEE 802.3 for 10Base-T
IEEE 802.3u for 100Base-TX and 100Base-FX IEEE 802.3ab for 1000Base-T
IEEE 802.z for 1000Base-X
IEEE 802.3ae for 10 gigabit ethernet
IEEE 802.3x for flow control
IEEE 802.3ad for LACP (Link Aggregation Control Protocol)
IEEE 802.1Q – 2014 bridged networks
IEEE 802.1-2010 port-based network access control
IEEE 802.1AB – 2016 station and media access connectivity discovery (LLDP)
IEEE 802.1AX link aggregation
IEEE 1588 v2 PTP (one-step and two-step compatible*) with power profile

* If the one-step transparent clock receives a two-step signal, it will understand it and respond using one-step signals

4. Managed switch functions: (continued)

Maximize system uptime

Power automation networks are required to run 24/7. Period. The FL SWITCH EP 7400 switch contains hardware designed for extreme environments using IEC 61850-3 and IEEE 1613 standards and is backed by Phoenix Contact's experience with selling and supporting over 2 million industrial Ethernet switches deployed in over 40 countries. Modular power supplies with hot-swap capabilities help overcome unusual situations. Optional DIN rail-mount (with rack-mount option) PRP redundancy modules provide zero packet loss recovery to communication disruption events.

Maximize uptime
Hot-swap port and power supply modules
RSTP (IEEE 802.1D, 2004) /MSTP/PVRST+
RSTP: BPDU load/attack prevention mechanism
RSTP: BPDU guard; root guard; loop guard; BPDU filter; supports port fast on edge/trunk ports

Configuration and responsive maintainability for all personnel

Secure configuration is possible with IT-friendly CLI and site personnel-friendly web interfaces. Hardware modularity combined with color LCD switch port status display and extended system logging memory allows fast response to problem situations. The full range of functions provides the tools to deploy systems and quickly identify root causes in changing situations.

Configuration and maintainability
SNMP (v1, v2c, and v3) agent and MIB support
CLI (Console, Telnet) and web configuration
Configuration save and restore in the form of text (default) MIB format (MSR and CSR)
DHCP (client, server and relay) for IPv4
DHCP – support for option 82
DHCP relay IPv4
SNMP subagent, SNMP proxy
Link Layer Discovery Protocol (LLDP)
Proxy ARP

Diagnostics and troubleshooting
Syslog, with external memory (SD) expansion
Backup/restore configuration (when copying the configuration file from a flash drive to external TFTP server and vice versa)
Debug logging ability
Port mirroring: supports up to 7 simultaneous sessions
System resource monitoring (temperature and CPU utilization)
RMONv1

4. Managed switch functions: (continued)

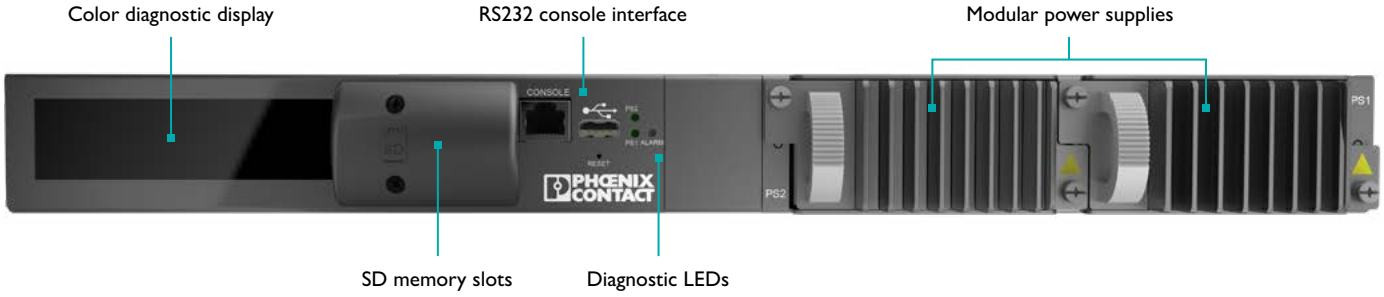
Scalable security options

Strong security is required in critical infrastructure applications. State-of-the-art managed switch security functions provide the tools to limit local access, remote access, and network access to switch management. The switch is based on a scalable platform approach that will provide a growing array of security options in the future. Features such as VLANs allow utilities to segment various critical zones within the electronic security perimeter that connect systems, such as IEDs, RTUs, and PLCs within the substation infrastructure. With the increasing deployment of protocols such as IEC 61850, this segmentation prevents unauthorized access or interference by non-critical substation processes on networks that are processing and transmitting time-sensitive and critical communications for measurement and control. Additionally, the use of user authentication and Syslog support allows for monitoring and auditing to detect change to network hardware and status by users, further ensuring a secure and reliable network.

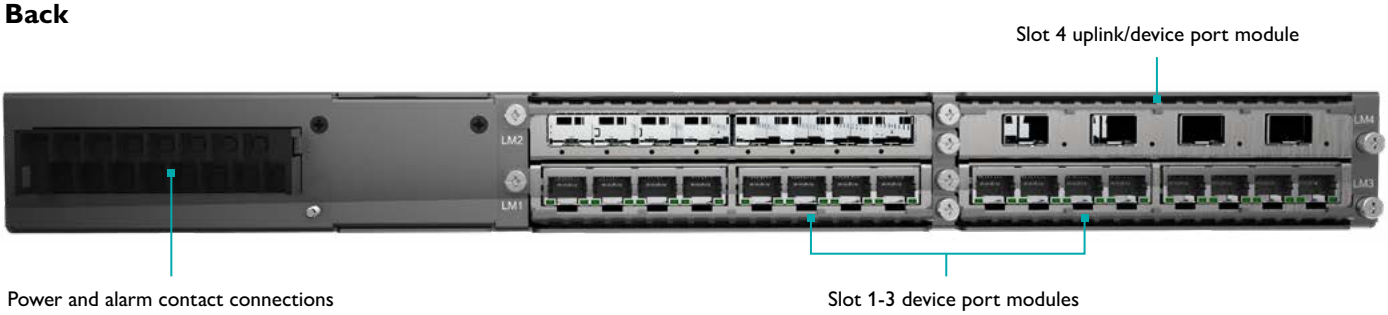
Scalable Security
Multiple-level user management (admin, guest, tech), Syslog server/client
SSH (CLI) and SSL (Web-HTTPS) interface security
Software and configuration upgrade through TFTP or SFTP
802.1x radius authentication
TACACS+ authentication
Access control lists (L2/L3) for traffic filtering on over 10 parameters
Port mac security: Up to 128 mac addresses per port

5. Installation:

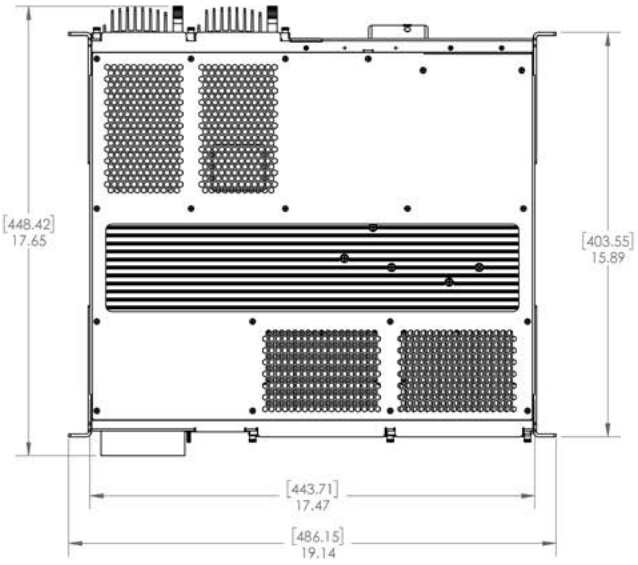
Front

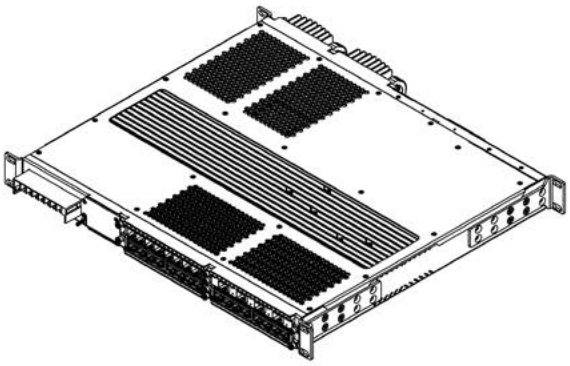


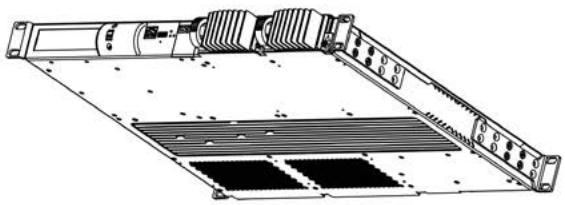
Back

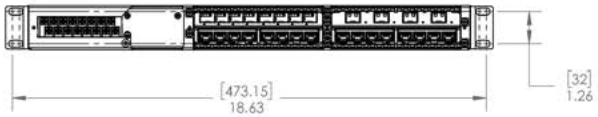


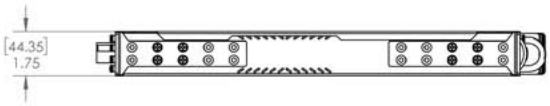
6. Dimensions:











P.O. Box 4100, Harrisburg, PA 17111-0100 | Phone: 717-944-1300 | Fax: 717-944-1625 | Technical Service: 800-322-3225
E-mail: info@phoenixcon.com | Website: www.phoenixcontact.com