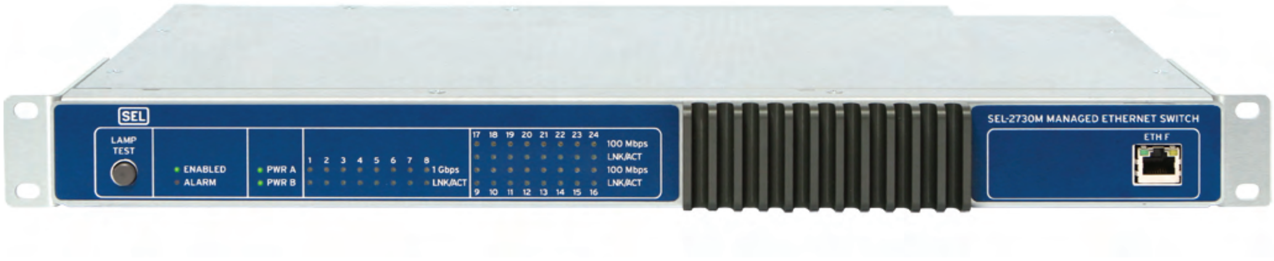
SEL-2730M 24-Port Managed Ethernet Switch

Reliable Ethernet Communication for Substation and Plant Networks



Major Features and Benefits

The SEL-2730M Managed Ethernet Switch is designed for the harsh environments commonly found in the energy and utility industries. The SEL-2730M supports communications infrastructures built for engineering access, supervisory control and data acquisition (SCADA), and real-time data communication and offers the same reliability found in SEL protective relays.

- **Reliable.** Increase availability with the SEL-2730M, which is designed, built, and tested to function in harsh environments such as substations. Optional hot-swappable, dual power supplies allow connectivity to primary and backup power sources.
- **Flexible.** Maximize flexibility by using SEL-2730M ordering options to meet different network configurations. Order the SEL-2730M with Ethernet ports in combinations of copper, single-mode fiber, and multimode fiber. Add even more flexibility by using the four small form-factor pluggable (SFP) modules to change port configurations when network designs change.
- **Ease-of-Use.** Simplify configuration and maintenance with a secure web interface that allows convenient setup and management. Configure settings offline using ACSELERATOR QuickSet® SEL-5030 Software or through an exported settings file that can be imported later on the switch.
- **Virtual Local Area Networks (VLANs).** Segregate traffic and improve network organization and performance. Take advantage of IEEE 802.1Q-2005 VLANs to separate IEC 61850 GOOSE messages from other traffic with as many as 4094 LANs.
- **Traffic Prioritization.** Support critical substation messaging by classifying and prioritizing traffic into one of four priority levels through VLAN-based 802.1Q-2005 Class of Service (CoS) and IP-based DiffServ Differentiated Services Code Points (DSCP).
- **Rapid Spanning Tree Protocol (RSTP).** Use IEEE 802.1D-2004 Rapid Spanning Tree Protocol (RSTP) to speed network recovery and convergence after a topology change caused by a link or device failure.
- **Bridge Protocol Data Unit (BPDU) Guard.** Improve network robustness by enabling BPDU Guard to disable a port when unexpected BPDUs are received.
- **Port Rate Limiting.** Prevent network storms from disabling your network by configuring maximum allowed rates for ingress (incoming) or egress (outgoing) traffic on each port.

- **Multicast MAC Filtering.** Filter multicast traffic to reduce network load on end devices.
- **Port-Based MAC Security.** Use port-based MAC security to limit network access to authorized devices.
- **Time Synchronization.** Synchronize time by using network time protocol (NTP). Time-align events and user activity across your system.
- **Syslog.** Log events for speedy alerts, consistency, compatibility, and centralized collection. Use the switch to forward syslog system and security logs to as many as three central servers.
- **Dynamic Host Configuration Protocol (DHCP).** Easily connect a laptop computer during initial setup by using settings that enable the front-panel 10/100BASE-T Ethernet port to function as a DHCP server.
- **Security and Monitoring.** Increase security by taking advantage of SNMPv3 and HTTPS features. SNMPv3 provides secure network management and is interoperable with existing network management systems (NMS). An HTTPS web interface provides secure and intuitive switch management. Map system and security events to configurable alarm contact behavior for alarming through an external system, such as an existing SCADA network.
- **Port Mirroring.** Monitor ingress and egress traffic for viewing network statistics and performing troubleshooting.
- **User-Based Accounts.** Provide user accountability and separate authorization levels for configuration and maintenance. Use LDAP or RADIUS with two-factor authentication for centralized user authentication.

Functional Overview

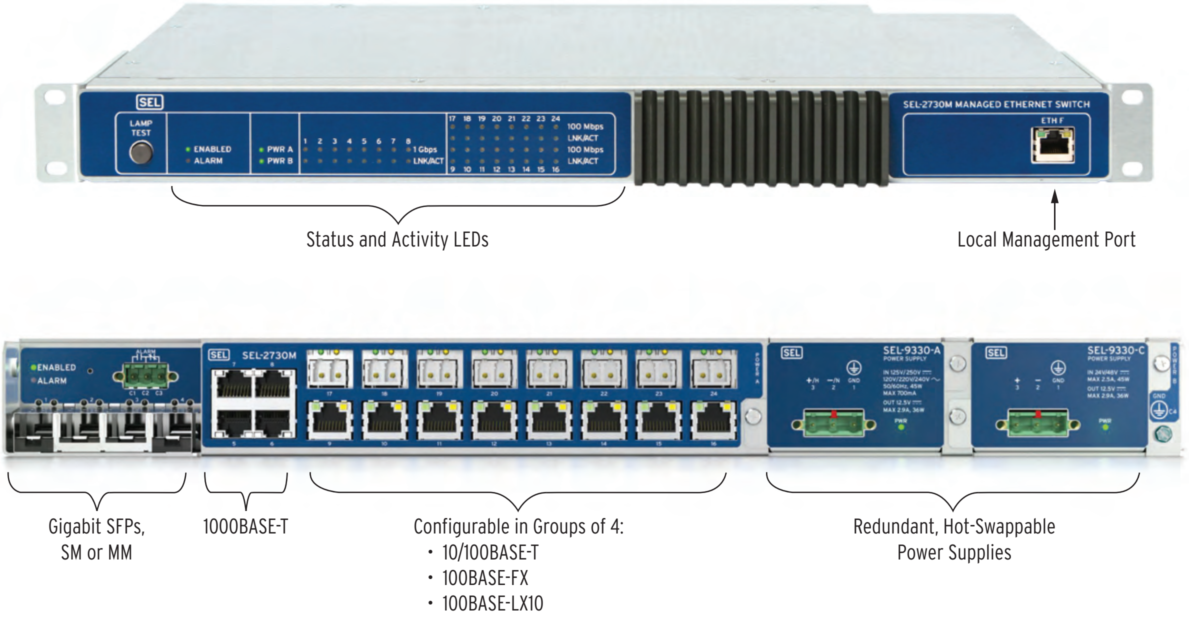


Figure 1 Functional Diagram

The base-model SEL-2730M has four Gigabit Ethernet copper ports and sixteen 10/100 Mbps copper Ethernet ports, built as 4-port modules. You can order each of the 10/100 Mbps copper port modules as single- or multimode 100 Mbps fiber-optic ports to meet the unique requirements of your network. You can also add as many as four fiber-optic Gigabit Ethernet ports via small form-factor pluggable (SFP) transceivers, for a total of 24 ports.

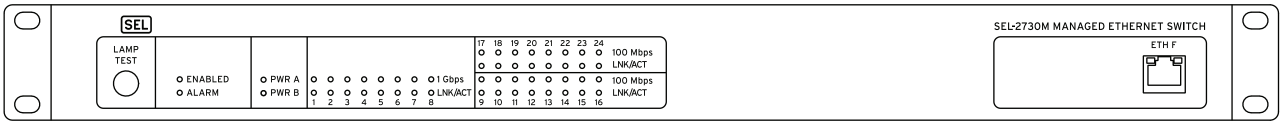
- **Four small form-factor pluggable (SFP) ports.** Ports 1–4 are compatible with the single- or multimode fiber SFP transceivers orderable from SEL.
- **Four Gigabit Ethernet ports.** Ports 5–8 support 10/100/1000 Mbps copper Gigabit Ethernet.
- **Sixteen Fast Ethernet ports.** Ports 9–24 can be ordered in combinations of 4-port groups of either copper or fiber.

- **Redundant, hot-swappable power supplies.** Optional redundant power supplies provide failover protection. Connect a separate power source to each power supply. If one source fails, the other continues to keep the switch operational. The power supply has an estimated MTBF of 3000 years.
- **Reversible mounting.** The SEL-2730M comes with reversible mounting ears to support both front and rear-panel installations.

SEL manufactures the SEL-2730M with the same high standards as those for SEL protective relays and backs it with the same 10-year worldwide warranty.

The SEL-2730M meets or exceeds the IEEE 1613 Class 1, IEC 61850-3, and IEC 60255 industry standards for communications devices in electrical substations for vibration, electrical surges, fast transients, extreme temperatures, and electrostatic discharge.

Front- and Rear-Panel Diagrams



Note: For some port options, a heat sink will be present on the front panel.

Figure 2 SEL-2730M Front-Panel Diagram

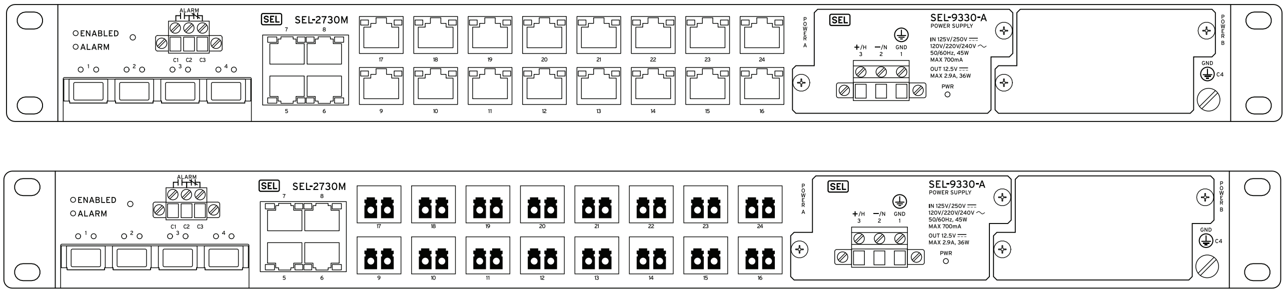


Figure 3 SEL-2730M Rear-Panel Diagrams

Dimensions

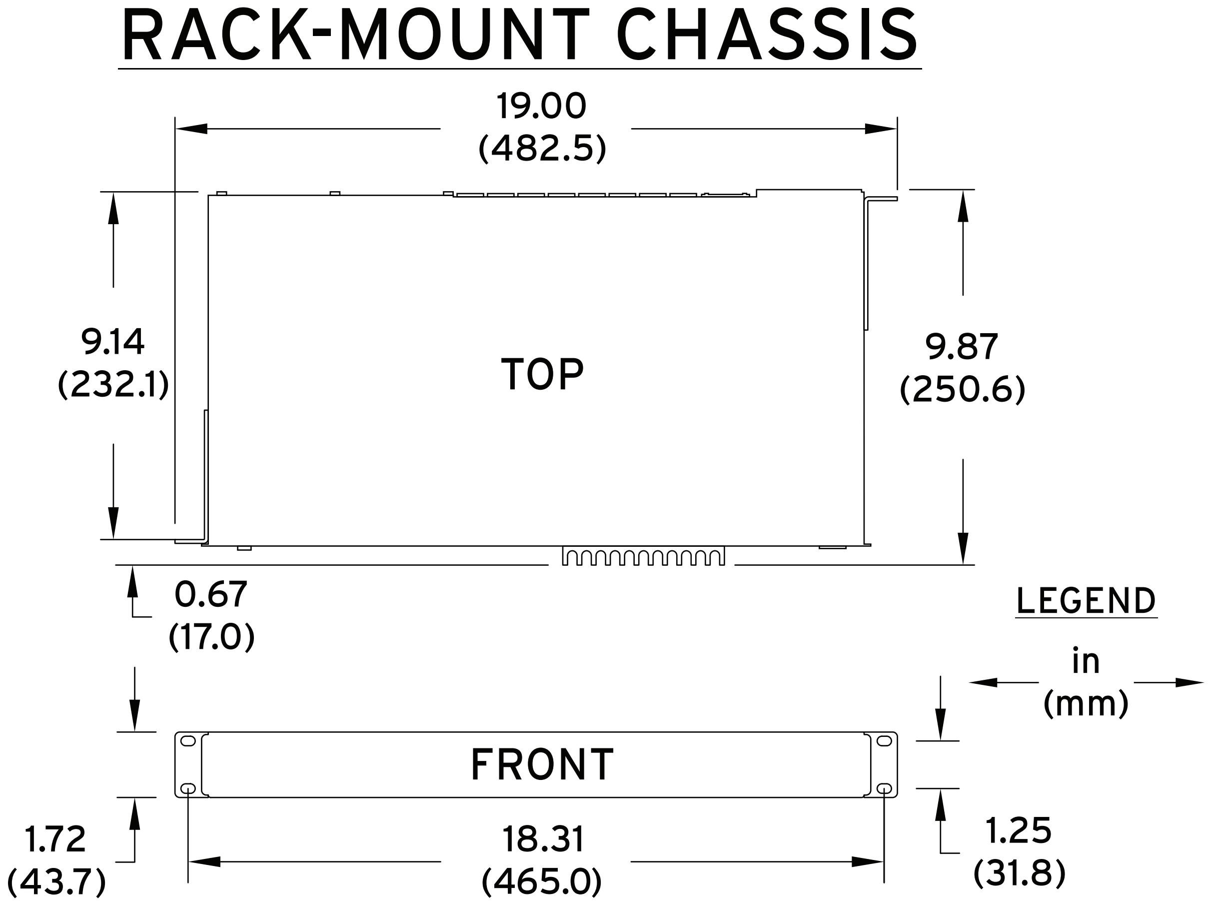


Figure 4 SEL-2730M Dimensions

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

UL Recognized to U.S. and Canadian safety standards (File E231500; NWGQ2, NWGQ8)

CE Mark

RCM Mark

General

Switching Properties

Switching Method:	Store and Forward
Switching Latency:	<7 µs
Switch Fabric Throughput:	19.2 Gbps
Priority Queues:	4
Maximum VLANs:	4094
MAC Learning Architecture:	Shared VLAN Learning (SVL)
VLAN ID Range:	1–4094
MAC Address Table Size:	8192 addresses

Warranty

10 Years

Network Management

HTTPS Web User Interface

SNMP v1/v2c/v3

ACSELERATOR QuickSet SEL-5030 Software

Settings Import/Export

Interoperable With SEL-5051 Network Management Software and Third-Party Network Management Systems (NMS)

User-Based Accounts

Maximum Local Accounts:	256
Password Length:	8–72 characters
Password Set:	All printable ASCII characters
User Roles:	Administrator, Engineer, User Manager, Monitor

Syslog

Storage for 60,000 local syslog messages.

Support for three remote syslog destinations.

Processing and Memory

Processor Speed:	313 MHz
Memory:	512 MB
Storage:	512 MB

Communications Ports

Ethernet Ports

Ports:	24 rear, 1 front
Data Rate:	10, 100, or 1000 Mbps
Front Connector:	RJ45 Female
Rear Connectors:	RJ45 female or LC fiber (single-mode or multimode)
Standard:	IEEE 802.3 IEEE 802.3X

Fiber-Optic Ports

Multimode Option (to 2 km)

Maximum TX Power:	–14 dBm
Minimum TX Power:	–19 dBm
RX Sensitivity:	–30 dBm
System Gain:	11 dB
Source:	LED
Wavelength:	1300 nm
Connector Type:	LC (IEC 61754-20)

Single-Mode Option (to 15 km)

Maximum TX Power:	–8 dBm
Minimum TX Power:	–15 dBm
RX Sensitivity:	–25 dBm
System Gain:	10 dB
Source:	Laser
Wavelength:	1310 nm
Connector Type:	LC (IEC 61754-20)

Digital Output

Rated Operational Voltage:	24–250 Vdc
Continuous Carry:	2 A

Power Supply

125/250 Volt Power Supply

Rated Supply Voltage:	125/250 Vdc; 120/220/240 Vac, 50/60 Hz
Input Voltage Range:	88–300 Vdc or 85–264 Vac
Maximum Burden:	AC: <60 VA DC: <45 W
DC Ripple:	<15% rated voltage
Peak Inrush:	8 A
Insulation:	3100 Vdc
Power Factor:	>75%
Isolated from Chassis Ground:	Yes
Input Voltage Interruptions:	50 ms @ 125 Vac/Vdc 100 ms @ 250 Vac/Vdc

24/48 Volt Power Supply

Rated Supply Voltage:	24/48 Vdc (polarized)
Input Voltage Range:	19.2–60.0 Vdc
Maximum Burden:	<42 W
DC Ripple:	<15% rated voltage
Peak Inrush:	18 A
Insulation:	3100 Vdc
Isolated from Chassis Ground:	Yes
Input Voltage Interruptions:	50 ms @ 48 Vdc 10 ms @ 24 Vdc

Recommended External Overcurrent Protection

Breaker Type:	Standard
Breaker Rating:	15 A at 250 Vdc
Current Breaking Capacity:	10 kA
Grounded Neutral Systems:	Device in series with the HOT or energized conductor
DC and Isolated Systems:	Device in series with both conductors

Fuse Ratings

Power Supply Fuse

SEL-9330-A:	2.5 A, 250 Vdc/300 Vac Time-lag T, 250 Vac/1500 A break rating
SEL-9330-C:	4.0 A, 150 Vdc Time-lag T, 250 Vac/1500 A break rating

Note: Fuses are not user-serviceable.

Alarm Contact Output

Per IEC 255-0-20:1974, Using Simplified Method of Assessment:

Output Type:	Relay, Form C, break-before-make
Power Supply Burden:	<1 W maximum
Mechanical Life:	2000000 operations
Operational Voltage:	250 Vac/Vdc
Make:	30 A at 250 Vdc
Carry:	6 A continuous at 70°C
1 s Rating	50 A
MOV Protection:	270 Vac, 23 J
Insulation Voltage:	300 Vdc
Pickup Time:	<8 ms
Dropout Time:	<8 ms

Breaking Capacity (10,000 Operations):

24 V	0.75 A	L/R = 40 ms
48 V	0.50 A	L/R = 40 ms
125 V	0.30 A	L/R = 40 ms
250 V	0.20 A	L/R = 40 ms

Cyclic Capacity (2.5 Cycles/Second):

24 V	0.75 A	L/R = 40 ms
48 V	0.50 A	L/R = 40 ms
125 V	0.30 A	L/R = 40 ms
250 V	0.20 A	L/R = 40 ms

Terminal Connections

Compression Screw Terminals

Power Wiring

Insulation:	300 V minimum
Size:	12–18 AWG

Tightening Torque:

Minimum:	0.6 Nm (5 in-lb)
Maximum:	0.8 Nm (7 in-lb)

Crimp Ferrule Recommended

Alarm Wiring

Insulation:	300 V minimum
Size:	16–24 AWG

Tightening Torque:

Minimum:	0.5 Nm (4 in-lb)
Maximum:	0.6 Nm (5 in-lb)

Crimp Ferrule Recommended

Mounting Ear Tightening Torque

Minimum:	2 Nm (18 in-lb)
Maximum:	4 Nm (35 in-lb)

Grounding Screw

Ground Wiring

Insulation:	300 V minimum
Size:	12 AWG
Length:	<3 m

Tightening Torque

Minimum:	0.9 Nm (8 in-lb)
Maximum:	1.4 Nm (12 in-lb)

Ring Terminal Recommended

Dimensions

1U Rack Mount

Height:	43.7 mm (1.72 inches)
Depth:	232.1 mm (9.14 inches)
Width:	482.5 mm (19 inches)

Weight

1.96 kg (4.3 lb)

Environmental

Operating Temperature

–40° to +85°C (–40° to +185°F)

Relative Humidity

0% to 95% non-condensing

Altitude

2000 m

Atmospheric Pressure

80–110 kPa

Operating Environment

Pollution Degree:	2
Overvoltage Category:	II
Insulation Class:	I

Enclosure Protection

IEC 60529:2001 + A2:2013
Severity Level: IP20

Green Product

Compliant with the European Union's RoHS directive

Type Tests

Communication Product Testing

IEEE 1613-2009, Class 1*	KEMA certified
IEC 61850-3:2013	KEMA certified
IEC 61850-90-4	KEMA certified

* With SEL-C627-R or equivalent cables.

Electromagnetic Compatibility Emissions

Generic Emissions: EN 60255-26:2013
EN 61850-3:2014
47 CFR Part 15
ICES-003, Issue 6
CISPR 11:2009 + A1:2010
CISPR 22:2008
EN 55011:2009 + A1:2010
EN 55022:2010 + AC:2011
EN 55023:2012 + AC:2013
Severity Level: Class A

Electromagnetic Compatibility Immunity

Conducted RF Immunity: IEC 60255-26:2013
IEC 61000-4-6:2008
Severity Level: 10 Vrms

Electrostatic Discharge Immunity: IEC 60255-26:2013
IEC 61000-4-2:2008
IEEE C37.90.3-2001
Severity Level: 2, 4, 8 kV contact; 4, 8, 15 kV air

Fast Transient/Burst Immunity: IEC 60255-26:2013
IEC 61000-4-4:2011
Severity Level: Zone A

Magnetic Field Immunity: IEC 60255-26:2013
IEC 61000-4-8:2009
Severity Level: 1000 A/m for 3 seconds, 100 A/m for 1 minute
IEC 61000-4-9:2001
Severity Level: 1000 A/m
IEC 61000-4-10:2001
Severity Level: 100 A/m

Power Supply Ripple: IEC 60255-26:2013
IEC 61000-4-17:2008

Power Supply Dips and Interruptions: IEC 60255-26:2013
IEC 61000-4-11:2004
IEC 61000-4-29:2000

Power Supply Gradual Shutdown and Startup: IEC 60255-26:2013

Power Supply Discharge Capacitors: IEC 60255-27:2013

Power Supply Reverse Polarity and Slow Ramp: IEC 60255-27:2013

Radiated RF Immunity: IEC 60255-26:2013
Severity Level: 10 V/m unmodulated 80 MHz–1 GHz, 1.4 GHz–2.7 GHz
IEEE C37.90.2-2004
Severity Level: 20 V/m 80% AM, 0.5 s keyed, 80 MHz–1 GHz

Surge Immunity: IEC 60255-26:2013
IEC 61000-4-5:2005
Severity Level: Zone A

Surge Withstand Capability: IEC 60255-26:2013
Severity Level: 2.5 kV peak common mode, 1.0 kV peak differential mode
IEC 61000-4-18:2006
IEEE C37.90.1-2002
Severity Level: 2.5 kV oscillatory, 4 kV fast transient waveform

Environmental

Cold: IEC 60255-27:2013
IEC 60068-2-1:2007
Severity Level: 16 hours at –40°C

Dry Heat: IEC 60255-27:2013
IEC 60068-2-2:2007
Severity Level: 16 hours at +85°C

Damp Heat, Cyclic: IEC 60255-27:2013
IEC 60068-2-30:2005
Severity Level: 25°C to 55°C
Relative Humidity: 93% to 95%
Duration: 6 cycles, 1 cycle/day

Damp Heat, Steady State: IEC 60255-27:2013
IEC 60068-2-78:2002
Severity Level: 40°C
Relative Humidity: 93%
Duration: 4 days

Vibration (Front-Panel Mount Only): IEC 60255-27:2013
IEC 60255-21-1:1988
Severity Level: Class 1 endurance, Class 2 response
IEC 60255-21-2:1988
Severity Level: Class 1 - shock withstand, bump, and Class 2 - shock response
IEC 60255-21-3:1993
Severity Level: Class 2 (quake response)

Safety

Dielectric Strength: IEC 60255-27:2013
IEEE C37.90-2005
3600 Vdc on power supply and alarm contact; 2250 Vdc on Ethernet ports
Type tested for 1 minute
IEEE 802.3-2012
2250 Vdc on electrical Ethernet ports
Type tested for 1 minute
Ports 5–8 comply with Environment A requirements between ports
Ports 9–24 comply with Environment B requirements between ports

Impulse: IEC 60255-27:2013
IEEE C37.90-2005
Severity Level:
Common Mode
5 kV power supply, alarm contact
2.4 kV Ethernet ports
Common Mode, Port to Port
5 kV power supply, alarm contact
Zero-Rated, Ethernet ports

Protective Bonding Resistance: IEC 60255-27:2013
IEEE C37.90-2005