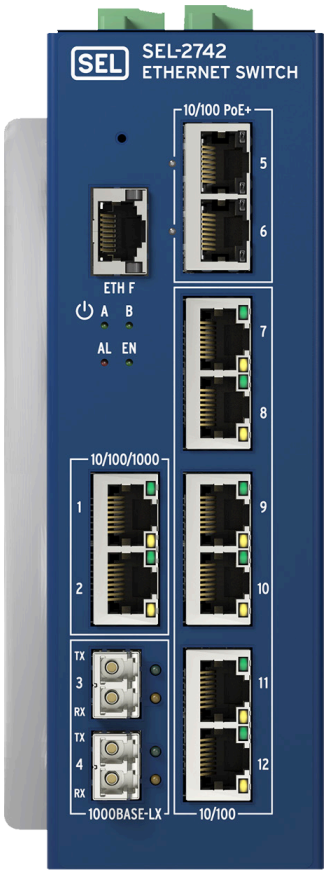
SEL-2742 Ethernet Switch Instruction Manual



Features and Benefits

The SEL-2742 Ethernet Switch is designed to perform reliably as the LAN Ethernet switch in the toughest environmental conditions commonly found in industrial applications. The SEL-2742 supports IT and operational technology (OT) requirements for control and measurement as well as data acquisition. The SEL-2742 supports even the most demanding Ethernet communications such as IEC 61850-9-2 sampled measured values as well as all the Ethernet communications found in process control systems (PCS), distributed control systems (DCS), and SCADA.

The SEL-2742 is ideally suited for use as an Ethernet switch for panels, switch gear, pad mount, and pole mount solutions, providing industry-leading network performance and cybersecurity in a compact form-factor. When used with the SEL-5056 Flow Controller, you can achieve automated commissioning, circuit provisioning, and status monitoring.

- **Reliability.** Provides a robust design that is built and tested to function in harsh environments, meeting the IEEE 1613 standard.
- **Dual Power Supply Connections.** Supports connectivity to primary and backup sources.
- **Network Performance.** Heals network faults in microseconds.
- **Power over Ethernet Plus (PoE+).** Provides two PoE+ interfaces, supporting and simplifying the safe use of IT applications such as video and voice.
- **Situational Awareness.** Provides central LAN management of all circuits when used with the SEL-5056.

- **Ease of Use.** Supports quick commissioning, automated circuit provisioning, and telemetry monitoring when used with the SEL-5056.
- **SDN Management.** Supports OpenFlow 1.3 over secure Transport Layer Security (TLS).
- **Low-Latency Forwarding.** Provides low-latency store and forwarding.
- **Large Flow Table Size.** Supports small and large networks with an 8,192 flow entry capacity.
- **Cybersecurity.** Supports deny-by-default network access control, secure management communication, and central monitoring capability of the SEL-5056.
- **Flexible Group and Action Bucket Support.** Supports 256 groups and 30 action buckets per group, enabling flexible network design and traffic engineering.
- **Switching Capacity.** Supports full bandwidth with 4.8 Gbps packet data rate and full-duplex, nonblocking design.
- **Strong Network Access Control.** Provides multilayer packet inspection on all network forwarding for each flow on Layer 1, 2, 3, and 4.
- **Quality of Service (QoS).** Provides traffic priority management through four 8:4:2:1 weighted round-robin (WRR) priority queues.
- **Flexible Time Synchronization Options.** Simple time synchronization options with Authenticated Controller Time Synchronization (ACTS) or Network Time Protocol (NTP).
- **IEEE C37.238-2017 PTP Power Profile Transparent Clock.** Supports networks that demand precise time synchronization.
- **Syslog.** Generates and sends log events directly to a central server using UDP or with encrypted and authenticated TLS.

Safety Information

Dangers, Warnings, and Cautions

This manual uses three kinds of hazard statements, defined as follows:

⚠ DANGER
Indicates a potentially hazardous situation that, if not avoided, **will** result in death or serious injury.

⚠ WARNING
Indicates a potentially hazardous situation that, if not avoided, **could** result in death or serious injury.

⚠ CAUTION
Indicates a potentially hazardous situation that, if not avoided, **may** result in minor or moderate injury or equipment damage.

Safety Symbols

The following symbols are often marked on SEL products.

	**CAUTION** Refer to accompanying documents.	**ATTENTION** Se reporter à la documentation.
	Earth (ground)	Terre
	Protective earth (ground)	Terre de protection
	Direct current	Courant continu
	Alternating current	Courant alternatif
	Both direct and alternating current	Courant continu et alternatif
	Instruction manual	Manuel d'instructions

Safety Marks

The following statements apply to this device.

Table 1 General Safety Marks

CAUTION There is danger of explosion if the battery is incorrectly replaced. Replace only with Panasonic BR-1632A/DBN or equivalent recommended by manufacturer. See Owner's Manual for safety instructions. The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100°C or incinerate. Dispose of used batteries according to the manufacturer's instructions. Keep battery out of reach of children.	**ATTENTION** Une pile remplacée incorrectement pose des risques d'explosion. Remplacez seulement avec un Panasonic BR-1632A/DBN ou un produit équivalent recommandé par le fabricant. Voir le guide d'utilisateur pour les instructions de sécurité. La pile utilisée dans cet appareil peut présenter un risque d'incendie ou de brûlure chimique si vous en faites mauvais usage. Ne pas recharger, démonter, chauffer à plus de 100°C ou incinérer. Éliminez les vieilles piles suivant les instructions du fabricant. Gardez la pile hors de la portée des enfants.
CAUTION To ensure proper safety and operation, the equipment ratings, installation instructions, and operating instructions must be checked before commissioning or maintenance of the equipment. The integrity of any protective conductor connection must be checked before carrying out any other actions. It is the responsibility of the user to ensure that the equipment is installed, operated, and used for its intended function in the manner specified in this manual. If misused, any safety protection provided by the equipment may be impaired.	**ATTENTION** Pour assurer la sécurité et le bon fonctionnement, il faut vérifier les classements d'équipement ainsi que les instructions d'installation et d'opération avant la mise en service ou l'entretien de l'équipement. Il faut vérifier l'intégrité de toute connexion de conducteur de protection avant de réaliser d'autres actions. L'utilisateur est responsable d'assurer l'installation, l'opération et l'utilisation de l'équipement pour la fonction prévue et de la manière indiquée dans ce manuel. Une mauvaise utilisation pourrait diminuer toute protection de sécurité fournie par l'équipement.
The SEL-2742 battery is the only field-serviceable part (see *Battery Change Instructions* in the instruction manual). For all other repairs, return the faulty or failed unit to the factory for repair or replacement.	La batterie SEL-2742 est la seule pièce réparable sur site (voir la section *Battery Change Instructions* dans le manuel d'instructions). Pour toutes les autres réparations, renvoyez l'unité défectueuse à l'usine pour la réparer ou la remplacer.

For use In Pollution Degree 2 environment.	Pour utilisation dans un environnement de Degré de Pollution 2.
Ambient air temperature shall not exceed 40°C (104°F) in locations where touch temperature safety is required.	La température de l'air ambiant ne doit pas dépasser 40 ° C dans des endroits où la température des surfaces doit être suffisamment basse pour les toucher en toute sécurité.
Overvoltage Category: II	Catégorie de surtension : II
Insulation Class: I	Classe d'isolation : I
Ambient air temperature shall not exceed 85°C (185°F).	La température ambiant de l'air ne doit pas dépasser 85°C (185°F).
For use in a Type 1 enclosure.	Pour utilisation dans un boîtier de Type 1.
IP Rating Power Inputs: IP2X Front-Reset Button: IP3X Enclosure: IP4X	Indice de protection Entrées d'alimentation : IP2X Bouton de réinitialisation sur le panneau avant : IP3X Boîtier: IP4X

Table 2 Hazardous Location Safety Marks

⚠WARNING – EXPLOSION HAZARD DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN REMOVED OR THE AREA IS KNOWN TO BE NON-HAZARDOUS	**⚠AVERTISSEMENT – DANGER D'EXPLOSION** Ne pas déconnecter l'équipement à moins qu'il ne soit hors tension ou que la zone ne soit pas dangereuse.
⚠WARNING This equipment is suitable for use in Class I, Division 2, Group A, B, C, and D or non-hazardous locations only.	**⚠AVERTISSEMENT** Cet équipement est adapté à l'utilisation uniquement dans les endroits de Classe I, Division 2, Groupes A, B, C et D ou dans les endroits non dangereux.
⚠WARNING Open type device intended to be mounted within a suitable enclosure that requires the use of a tool to access.	**⚠AVERTISSEMENT** Dispositif de type ouvert destiné à être monté dans une armoire appropriée qui nécessite un outil pour y accéder.
Temperature Code: T5	Code de température: T5
For UL Class I, Division 2 compliance, the ambient temperature range shall be –40°C to +40°C (–40°F to +104°F).	Pour conformer à la norme UL Classe I, Division 2, la plage de températures ambiantes sera de –40°C à +40°C (–40°F à +104°F).

Table 3 Other Safety Marks

⚠DANGER Disconnect or de-energize all external connections before opening this device. Contact with hazardous voltages and currents inside this device can cause electrical shock resulting in injury or death.	**⚠DANGER** Mettre hors tension ou débrancher tous les raccordements externes avant d'ouvrir cet appareil. Tout contact avec des tensions ou courants internes à l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.
⚠DANGER Contact with instrument terminals can cause electrical shock that can result in injury or death.	**⚠DANGER** Tout contact avec les bornes de l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.
⚠WARNING Earth connection is essential before making telecommunication network connections.	**⚠AVERTISSEMENT** Une connexion à la terre est essentielle avant de faire des connexions au réseau de télécommunications.
⚠WARNING Earth ground connections should not be removed when the equipment is energized.	**⚠AVERTISSEMENT** Il ne faut pas enlever les connexions de mise à la terre pendant que l'équipement est sous tension.
⚠WARNING Use of this equipment in a manner other than specified in this manual can impair operator safety safeguards provided by this equipment.	**⚠AVERTISSEMENT** L'utilisation de cet appareil suivant des procédures différentes de celles indiquées dans ce manuel peut désarmer les dispositifs de protection d'opérateur normalement actifs sur cet équipement.

⚠WARNING Have only qualified personnel service this equipment. If you are not qualified to service this equipment, you can injure yourself or others, or cause equipment damage.	**⚠AVERTISSEMENT** Seules des personnes qualifiées peuvent travailler sur cet appareil. Si vous n'êtes pas qualifiés pour ce travail, vous pourriez vous blesser, blesser d'autres personnes ou endommager l'équipement.
⚠WARNING Do not perform any procedures or adjustments that this instruction manual does not describe.	**⚠AVERTISSEMENT** Ne pas appliquer une procédure ou un ajustement qui n'est pas décrit explicitement dans ce manuel d'instruction.
⚠WARNING Do not look into the fiber ports/connectors.	**⚠AVERTISSEMENT** Ne pas regarder vers les ports ou connecteurs de fibres optiques.
⚠WARNING Do not look into the end of an optical cable connected to an optical output.	**⚠AVERTISSEMENT** Ne pas regarder vers l'extrémité d'un câble optique raccordé à une sortie optique.
⚠WARNING Incorporated components, such as LEDs and transceivers are not user serviceable. Return units to SEL for repair or replacement.	**⚠AVERTISSEMENT** Les composants internes tels que les leds (diodes électroluminescentes) et émetteurs-récepteurs ne peuvent pas être entretenus par l'usager. Retourner les unités à SEL pour réparation ou remplacement.
⚠WARNING Do not disconnect PoE in the presence of hazardous gases.	**⚠AVERTISSEMENT** Ne pas déconnecter l'alimentation par câble Ethernet (PoE) en présence de gaz dangereux.
⚠CAUTION Equipment components are sensitive to electrostatic discharge (ESD). Undetectable permanent damage can result if you do not use proper ESD procedures. Ground yourself, your work surface, and this equipment before removing any cover from this equipment. If your facility is not equipped to work with these components, contact SEL about returning this device and related SEL equipment for service.	**⚠ATTENTION** Les composants de cet équipement sont sensibles aux décharges électrostatiques (DES). Des dommages permanents non-décelables peuvent résulter de l'absence de précautions contre les DES. Raccordez-vous correctement à la terre, ainsi que la surface de travail et l'appareil avant d'en retirer un panneau. Si vous n'êtes pas équipés pour travailler avec ce type de composants, contacter SEL afin de retourner l'appareil pour un service en usine.
⚠CAUTION Insufficiently rated insulation can deteriorate under abnormal operating conditions and cause equipment damage. For external circuits, use wiring of sufficiently rated insulation that will not break down under abnormal operating conditions.	**⚠ATTENTION** Un niveau d'isolation insuffisant peut entraîner une détérioration sous des conditions anormales et causer des dommages à l'équipement. Pour les circuits externes, utiliser des conducteurs avec une isolation suffisante de façon à éviter les claquages durant les conditions anormales d'opération.

General Safety Notes

The SEL-2742 is designed for restricted access locations. Access should be limited to qualified service personnel.

To ensure proper safety and operation, check the equipment rating, installation instructions, and operating instructions before commissioning or maintaining the equipment. Also check the integrity of any protective conductor connection before taking any other actions. It is the responsibility of the user to ensure that the equipment is installed, operated, and used for its intended function and in the manner this manual specifies. If this equipment is used for anything other than its intended function or in a manner this manual does not specify, any safety protection the equipment provides may be impaired.

For installations requiring additional personnel protection against electrical energy hazards, SEL has connector kits available that cover the metal connector terminals and have cable retention mounts. SEL recommends using these connectors with double insulated cables or approved wire loom for best results. See available ordering options for details.

Warranty

The SEL-2742 is backed by the SEL worldwide, ten-year product warranty.

Introduction and Hardware Specifications

The SEL-2742 is a standards-based, OpenFlow 1.3-compatible, 12 port switch for critical infrastructure. The SEL-2742 supports a wide diversity of deployment options. The SEL-2742 provides two PoE+ ports, supporting as much as 30 W on each port to safely power circuits such as voice and video. The SEL-2742 supports one alarm contact, two power supply connections for redundancy, surface or rear- or side-rail mounting options, and a wide variety of Ethernet port options. Achieve microsecond networking healing, multilayer packet inspection and filtering for the highest level of cybersecurity, and centralized situational awareness with an easy-to-use and flexible DIN rail or surface mount SDN switch.

Traditional networking integrates the operation of determining how to forward packets (control plane) and the action of forwarding the packets (data plane) into the same device. The abstraction of the control plane from the data plane simplifies the deployed switch and enables centralized traffic engineering, reducing the total cost of ownership. The OT SDN solution from SEL offers the SEL-5056 with two switch options: the SEL-2742 with a DIN rail mount or the SEL-2740S with a rack mount. Both options include a wide range of Ethernet interface options. Select the best option for your needs, knowing you can scale the management out to all of your deployed assets and manage them as one asset.

The SEL-5056 is the SEL flow controller that is used to program the SEL-2742 with match and action pairings, which the SEL-2742 uses to forward packets. The SEL-2742 network appliance acts like a large look-up table, which the SEL-2742 uses to match and forward packets. Once a packet matches an entry, the switch executes actions for that match. This combination of match and action is called a flow entry.

Available Ordering Options

The SEL-2742 uses SFF Ethernet ports and a mix of interface options to choose from. *Table 4* lists the choices available. You can order all of the options listed with or without conformal coating.

Table 4 Ordering Options

Options	Gigabit Ports	Fast Ethernet Ports
1	Four 10/100/1000BASE-T	Eight 10/100BASE-T
2	Two 10/100/1000BASE-T Two 1000BASE-SX	Eight 10/100BASE-T
3	Four 1000BASE-SX	Eight 10/100BASE-T

Options	Gigabit Ports	Fast Ethernet Ports
4	Two 1000BASE-SX Two 1000BASE-LX	Eight 10/100BASE-T
5	Four 1000BASE-LX	Two 10/100BASE-T Six 100BASE-FX
6	Two 10/100/1000BASE-T Two 1000BASE-SX	Two 10/100BASE-T Two 100BASE-LX Four 100BASE-FX
7	Four 1000BASE-EX	Eight 10/100BASE-T
8	Four 1000BASE-EX	Two 10/100BASE-T Six 100BASE-FX
9	Four 10/100/1000BASE-T	Four 10/100BASE-T Four 100BASE-FX
10	Two 10/100/1000BASE-T Two 1000BASE-LX	Eight 10/100BASE-T
11	Four 10/100/1000BASE-T	Four 10/100BASE-T Four 100BASE-LX
12	Two 10/100/1000BASE-T Two 1000BASE-SX	Two 10/100BASE-T Six 100BASE-FX

You can choose from three IEEE 1613 vibration-rated mounting options that each of the variant options support (see *Table 5*).

Table 5 Mounting Options

Option	Description
Rear DIN Clip	The DIN clip is positioned on the rear of the switch so when the SEL-2742 is mounted, the Ethernet ports are facing away from the DIN rail.
Side DIN Clip	The DIN clip is positioned on the side of the switch so when the SEL-2742 is mounted, the Ethernet ports are facing parallel to the DIN rail. When looking at the DIN rail, the Ethernet ports will face left.
Surface Mount	No DIN clip is provided, and the switch comes with a metal heat sink with mounting screw holes so you can securely mount the switch on its side to any flat surface.
Axion Chassis Mount	No DIN clip is provided. The switch comes with a mounting plate that fits into the back of the Axion chassis so you can securely mount the switch into an open position. The switch is only mounted to the Axion and does not share integrated electrical signals with the Axion.
Optional Accessories and Kits	
Covered Connectors	The 915900657 kit comes with connectors that cover the electrical connection points and a cable retention feature.

Power Supply

There are two redundant power inputs that accept 24 Vdc or 48 Vdc in the SEL-2742, which can run independently or together. One power input can provide the power requirements safely and reliably, but you can connect both if your system requires redundant power sources. Select an external power supply that is class I or II and listed by a recognized agency. For electrical specifications refer to Power Supply on page 26. The SEL-2742 turns on as soon as it receives the required power. To turn off the SEL-2742, remove all sources of power.

Confirm that the source voltage range is within the tolerance of the SEL-2742 and follow the wiring instructions in *Table 6*. Power supply inputs are isolated from ground and are polarity-protected.

Table 6 Power Supply Connections

Pin	Description
1	GND
2	–
3	+

The power supply connections must have the following to comply with the rated specifications:

- The wires used for the power supply connection must be 12–24 AWG and 10 meters or less in length.
- A ferrite must be installed around all three wires running from the power supply to the SEL-2742 connections. Install the ferrite anywhere on the wire as long as all three wires pass through the center of the ferrite. The wires do not have to loop around the ferrite. Two ferrites are included with the purchase of an SEL-2742. The SEL part number for this ferrite is 427-0015. The ferrite is a snap-on cable 1 turn ferrite with an impedance of 140 Ω at 25 MHz and 250 Ω at 100 MHz.

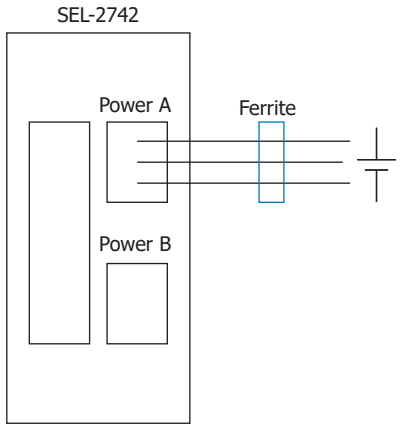


Figure 1 Power Supply Connections

LED Status Indicators and Modes

Figure 2 shows the front panel of the SEL-2742. The SEL-2742 has one LED indicator on the front panel for each power connection, labeled **A** and **B**. *Table 7* lists the LED colors and their descriptions.

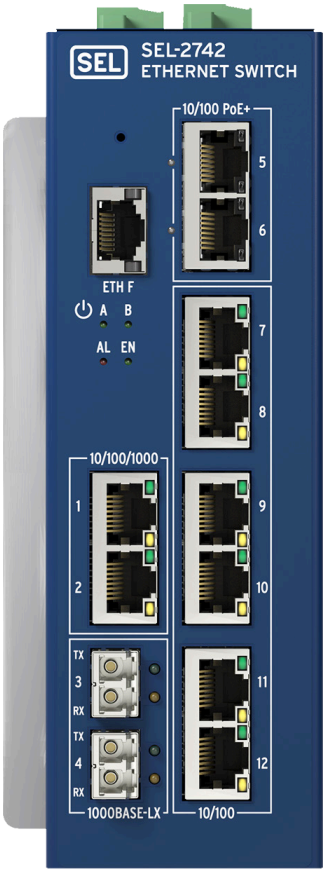


Figure 2 SEL-2742 Front Panel

Table 7 Power Connection LED

Status	Description
Off	No power applied
Red	Unacceptable power applied
Green	Acceptable power applied

The SEL-2742 has one alarm LED indicator on the front panel, labeled **AL**. *Table 8* lists the LED colors and their descriptions.

Table 8 Alarm LED

Status	Description
Off	No alarm conditions
Red	Alarm condition

The SEL-2742 has one enable LED on the front panel, labeled **EN**. *Table 9* lists the LED colors and their descriptions.

Table 9 Enable LED

Status	Description
Off	Device is not fully functional
Green	Device is fully functional

The port status LEDs operate in three different modes: Speed and Activity, Link and Activity, and Transmit and Receive. *Table 11*, *Table 12*, and *Table 13* list the different port status LED states and the descriptions for each mode. You can change the modes by using the SEL-5056.

The SEL-2742 supports PoE+ on Ports 5 and 6. The blue LEDs indicate when the port is supplying power.

Table 10 PoE+ LED

Status	Description
Off	PoE+ setting for the port is disabled, no powered devices are plugged in, or the powered device has not successfully negotiated to receive power.
On	PoE+ setting for the port is enabled, there is a powered device plugged in, and the powered device successfully negotiated to receive power.

Speed and Activity (SPEED/ACT) Mode

Table 11 LED Status Indicators for Speed and Activity (SPEED/ACT) Mode

LED	State	Description
Amber	On	Link at maximum speed for the port
	Blinking	Packet collision has occurred
Green	On	Link up
	Off	Link down
	Blinking	Port is transmitting and/or receiving data

Link and Activity (LINK/ACT) Mode

Table 12 LED Status Indicators for Link and Activity (LINK/ACT) Mode

LED	State	Description
Amber	Off	No link
	On	Link
Green	Off	No data transmitted or received
	Blinking	Port is transmitting and/or receiving data

Transmit and Receive (TX/RX) Mode

Table 13 LED Status Indicators for Transmit and Receive (TX/RX) Mode

LED	State	Description
Amber	Off	No data transmitted
	Blinking	Port is transmitting data
Green	Off	No data received
	Blinking	Port is receiving data

Pinhole Reset

A factory-default reset pinhole is located above the front Ethernet port labeled **ETH F**. Press the pinhole reset button for 10 s while the device is on and enabled to remove all programmed configurations and return the product to its decommissioned state. You can enable and disable the pinhole reset button through settings.

Alarm Contact Output

One Form C output mechanical relay contact is provided on the top of the unit. To indicate a minor alarm, the alarm contact pulses for a configurable amount of time. The minor alarm duration is set to 1 s by default, but this duration can be configured for as long as 30 s. This allows the system to capture the status of the alarm before it is cleared. Major alarms latch the contact and operate until the source of the alarm is cleared or the alarm is manually cleared. Alarm contacts are divided into specific categories. You can configure a different severity for each category. Alarms with a severity of Emergency, Alert, and Critical are major alarms. Other severities are minor alarms.

Table 14 Alarm Contact Pinout

Pin	Description
C6	Normally open
C7	Common
C8	Normally closed

Table 15 Alarm Contact Ratings

Maximum voltage:	250 Vdc
Contact protection:	270 Vdc 9.6 J MOV protected
Maximum current:	6 A
Pickup time:	≤8 ms typical
Dropout time:	≤8 ms typical

The alarm contact is configurable for three event severities. In Log Services, you can set the severity at which the alarm contact will be pulsed. This can be configured under All Categories or under each specific category for more specific control. For Link Up and Link Down events, you can configure the switch to pulse the alarm contact or to latch on state change (as well as whether a latched alarm will self-clear or require manual clearing).

Digital Inputs

The SEL-2742 includes two digital inputs that can be enabled to allow external digital outputs to control actions of the SEL-2742. Each digital input can be enabled to trigger a factory-default reset or a settings lock. By default, both digital inputs are disabled. When a digital input is enabled, an assertion applies a factory reset and a deassertion applies a settings lock in the switch.

Table 16 Digital Input Ratings

Architecture:	Externally wetted and isolated
Assertion:	9.6–60 Vdc
Deassertion:	0–6 Vdc
Polarity:	Polarity dependent (reverse polarity protection included)
Overvoltage protection:	120 Vac/dc

Table 17 details the pinout.

Table 17 Digital Input Pinout

Pin	Description
C1	IN101 +
C2	IN101 –
C3	IN102 +
C4	IN102 –

Labels and Markings

One sticker is attached to the SEL-2742 chassis that includes a serial number common to SEL devices and a Datapath ID unique to the SEL-2742. The Datapath ID number printed on the sticker uniquely identifies the SEL-2742 during adoption and is specific to the SEL-2742 chassis. The Datapath ID has the form 0000XXXXXXXXXXXX, where the Xs represent the in-band management Ethernet MAC address.

Battery Change Instructions

The battery in the SEL-2742 maintains power to the real-time clock so that it retains the time through power cycles. The battery is rated to last more than ten years, but if you need to change the battery, use the following steps:

Step 1. Disconnect power from the SEL-2742.

Step 2. Remove the SEL-2742 from the rail.

Step 3. Ground yourself, your workstation, and the SEL-2742 to the same ground.

Step 4. Remove eight of the ten screws on the chassis, allowing the piece of metal that covers the front and right side of the product to be removed. The battery is located on the outside board when viewing from the right side.

Step 5. Replace the battery with Panasonic BR-1632A/DBN.

Step 6. Reassemble the device and return it to service.

Step 7. Dispose of the battery to qualified recycle facilities or a facility that supports a hazardous waste disposal program suitable for batteries.

Installation and Configuration

Installation

The SEL-2742 comes with either a surface mount or a top-hat-style DIN rail clip, depending on the ordering options selected. You can order the DIN rail mounting as either direct facing or side facing. When you order direct facing, the Ethernet ports are facing directly out from the DIN rail. For the side-facing mount, the Ethernet ports are facing in-line with the DIN rail. The operation of the device is not dependent on the orientation of the mount, and there are no requirements for free space around the unit to meet specifications.

To satisfy safety requirements, the unit shall be installed in a suitable fire/electrical/mechanical enclosure. To protect against electrical shock hazards, the enclosure shall prevent access to the alarm contact.

Specific Conditions of Use for ATEX Installations:

- The SEL-2742 shall be installed within a tool-accessible enclosure that meets the requirements of IEC 60079-0 and provides a minimum ingress protection of IP54 in accordance with IEC 60079-7.
- The SEL-2742 shall be installed with a manual override system.

Commissioning and Adoption

By default, the SEL-2742 publishes an OpenFlow discovery packet every few seconds out of all ports. OpenFlow discovery packets are Link Layer Discovery Protocol (LLDP) in structure, so they are Layer 2 packets that stay within the subnet. This packet announces the presence of a new SDN switch and provides the default IP address to communicate with the switch. The out-of-band port, **ETH F**, has a default IP address in the 169.254.*x*.*x* subnet. The in-band management ports, Ports 1 through 20, have a default IP address in the 192.168.*x*.*x* subnet. The last two octets are random and will change on every factory-default reset action. Commission the IP address, subnet, time, certificates, and the flow controller IP address of the switch by using the representational state transfer (REST) interface. The switch listens for incoming connections to this REST interface on Port 443. Once commissioned, the switch attempts to communicate with the configured flow controller by using OpenFlow with a destination port of 6653. The term adoption is used when the switch and the flow controller are successfully bound and communicating on the OpenFlow and REST interfaces. When you use SEL-5056, the adoption process is automated for simple one-touch commissioning.

The SEL-2742 can be commissioned and adopted out-of-band or in-band before or after deployment. Special attention must be made when using in-band management to configure all the flows in the switches between the flow controller and the destination switch. The SEL-2742 communicates with one flow controller and, once commissioned, stops publishing the OpenFlow discovery packet. To adopt the switch to a different flow controller, the switch must be factory-default reset either through the current flow controller settings or through the pinhole reset button on the front of the switch.

PoE+

The SEL-2742 supports PoE+ on Ports 5 and 6. PoE+ is disabled and enabled on each port through the configuration settings found in the SEL-5056. PoE only operates when the SEL-2742 is powered with a 40–60 Vdc power supply. Ports 5 and 6 are always copper ports on the SEL-2742 and are the two ports that support PoE+. When PoE+ is enabled, the port detects and classifies powered devices. A blue LED will illuminate when the PoE port is actively classed with drawing power. When you use PoE+, the Ethernet cables between the switch and the powered device must be 10 meters or less in length to meet specifications.

Time Synchronization

The SEL-2742 supports synchronizing the local time with ACTS or NTP. The switch time is set at adoption to synchronize with the SEL-5056 time. When ACTS or NTP are enabled, those services maintain time synchronization with their respective time sources. The SEL-2742 can be configured with as many as three NTP servers. The switch will attempt to synchronize to the configured time servers in priority order of when each time server was entered into the configuration. ACTS provides ongoing time synchronization in which the SEL-5056 synchronizes the switch time with its own time source every time the flow controller checks synchronization on the switch. The configuration of time synchronization for the SEL-2742 is performed in the SEL-5056. Specific settings are detailed in the *SEL-5056 SDN Flow Controller Instruction Manual*.

Managing Precision Time Protocol

The SEL-2742 is an IEEE C37.238-2017 Power Profile peer-to-peer (P2P) transparent clock (TC) with syntonization support. The SEL-2742 can also be used in an IEEE C37.238-2011 and IEEE 1588 Default P2P network to update Precision Time Protocol (PTP) event messages. The SEL-2742 does not use PTP to set system time. PTP is disabled by default but can be enabled in the SEL-2742 configuration node settings. The SEL-2742 has the fixed PTP settings shown in *Table 18*.

Table 18 Fixed PTP Settings

Setting	Value
P2P Delay Request Interval	1 (in seconds)
Domain	0
VID	None (all PTP messages sourced from the SEL-2742 are untagged)

To meet the performance requirements of IEEE C37.238-2017 or -2011 Power Profile, the user must configure the network and end devices correctly, including ensuring the following:

- The PTP domain of the master(s) must be 0 for the SEL-2742 to syntonize.
- All equipment between the PTP master and the SEL-2742 must meet Power Profile requirements.
- The following flows must be present on each SEL-2742 between the PTP master and clients:
  - Send P2P messages to the local port to enable the P2P delay mechanism.
  - Forward Sync and Announce messages between PTP masters and between each PTP master and client.

Interruptions to the PTP flow interrupt syntonization. The SEL-2742 continuously sends untagged P2P delay requests outside of the OpenFlow pipeline at the P2P delay request interval. The local port on the SEL-2742 accepts both single-tagged and untagged packets.

Logging

The SEL-2742 logs events through Syslog and stores 4096 local events. SEL-5056 also collects the logs from each switch and, if configured to, also sends Syslog log messages to any configured log server and records them to the Windows event log files.

Syslog is configured in the SEL-2742 through the logging settings in SEL-5056. The SEL-2742 supports UDP (RFC 3164) and TLS Syslog (RFC 5424 over RFC 5425) protocols.

The Syslog delivery failure message, "Log delivery was not confirmed to behavior {behavior type} for event with id {Id}," appears once for each message if that message cannot be sent to at least one Syslog server with the TLS transport method type because the TLS connection is not present from the SEL-2742 to the Syslog server or the acknowledgment of the TCP delivery is not received.

OpenFlow changes can happen rapidly and the logs from the SEL-2742 will have combined many of the OpenFlow actions to a single log. The Syslog message "OpenFlow changes ({numberOfChanges}): {Change Description}" reports the number of changes and a list of as many as 50 of the changes in 10-second intervals. The list is comma-separated and includes an abbreviation and number. All numbers are in hexadecimal format.

Table 19 describes the meaning of the abbreviation and what the number represents.

Table 19 OpenFlow Changes Event Description

Abbreviation	Description	Number (in Hexadecimal Format)
Fa	Flow entry added	Flow ID
Fd	Flow entry deleted	Flow ID
Fm	Flow entry modified	Flow ID
Fr	Flow replaced	Flow ID

Abbreviation	Description	Number (in Hexadecimal Format)
Fto	Flow entry deleted because of time-out	Flow ID
Ga	Group entry added	Group ID
Gd	Group entry deleted	Group ID
Gm	Group entry modified	Group ID
Ma	Meter entry added	Meter ID
Md	Meter entry deleted	Meter ID
Mm	Meter entry modified	Meter ID
Pa	OpenFlow port added	Port ID
Pd	OpenFlow port deleted	Port ID
Pm	OpenFlow port modified	Port ID

Centrally Manage and Monitor With SEL-5056

All configuration and monitoring of the SEL-2742 happens through SEL-5056. Refer to the *SEL-5056 SDN Flow Controller Instruction Manual* for all configuration and monitoring options of the SEL-2742.

SNMP

The SEL SDN switches support SNMP for read-only status monitoring. SNMPv2c and SNMPv3 are supported. SNMP is disabled by default and either or both can be enabled. When you use SNMPv2c you can set the community string. If no string is supplied, the string defaults to "public". When you use SNMPv3, refer to the SEL-5056 manual under the SNMP Configuration section for details.

The SEL SDN switch supports the following MIBs:

- If-MIB
- Entity-MIB for the entPhysicalTable
- System-MIB for Description, Name, Location, Object Identifier, and System Up Time
- SEL-274XS-Alarm-Contact-MIB
- SEL-274XS-Digital-Input-MIB
- SEL-274XS-Module-MIB
- SEL-274XS-PoE-MIB
- SEL-274XS-Power-Supply-MIB
- SEL-274XS-Switch-Configuration-MIB
- SEL-Definitions-MIB
- SEL-Products-MIB

Table 20 If-MIB Table

Interface	If-Index	Description
eth0	2	Front Ethernet Port
eth1	3	

Interface	If-Index	Description
eth2	4	
eth3	5	
eth4	6	
eth5	7	
eth6	8	
eth7	9	
eth8	10	
eth9	11	
eth10	12	
eth11	13	
eth12	14	

You can download the MIBs and read their details at the SEL-2742 product page (selinc.com/SEL-2742).

OpenFlow

This section provides a reference for the parts of OpenFlow 1.3 that are supported by the SEL-2742 Ethernet Switch. The SEL-2742 is OpenFlow-compatible and does not have legacy control plane technology such as spanning tree. This allows OpenFlow to be the underlay control plane on the network, resulting in significant performance, cybersecurity, and situational awareness advantages. For detailed information on OpenFlow version 1.3, refer to the standard at www.opennetworking.org.

The SEL-2742 supports out-of-band and in-band management. When using out-of-band management, the SEL-5056 communicates with the SEL-2742 through the **ETH F** port. When using in-band management, the SEL-5056 communicates with the SEL-2742 through any port except **ETH F**.

Flow entries are the building blocks necessary for traffic engineering the network. Traffic engineering allows proactive configuration of how all packets travel through the network under normal or faulted conditions.

The SEL-2742 uses the capabilities defined in the OpenFlow standard, not legacy switch behaviors (such as Spanning Tree Protocol [STP] and dynamic MAC learning) to forward packets through the switch. As an OpenFlow switch, the SEL-2742 can be divided into the following seven separate OpenFlow components (each of these components is discussed in this section):

- Counters
- Ports and queues
- General settings
- Match fields
- Instructions and actions
- Groups and action buckets
- Meters and meter bands

Table 21 shows the OpenFlow resources available in the SEL-2742.

Table 21 Complete List of Supported OpenFlow Parameters

Parameter	Supported
Priority Queues Per Port	4
Flow Tables	4
Flow Entries Per Table	2048
Group Entries	256
Action Buckets Per Group	30
Unique Action Buckets	128
Meter Entries	64
Meter Bands Per Meter Entry	1

Counters and Parameters

Table 22 Complete List of Supported Counters

Type of Counter	Name	Description
Port	Received Packets	Packet count received per port
	Transmitted Packets	Packet count transmitted per port
	Received Bytes	Byte count received per port
	Transmitted Bytes	Byte count transmitted per port
Flow Table	Active Count	Number of flow entries in the flow table
Flow Entry	Received Packets	Packet count applied to the flow entry
	Received Bytes	Byte count applied to the flow entry
	Duration	Elapsed time from when the flow entry was programmed or last modified (in milliseconds)
Group Entry	Packet Count	Packet count applied to the group entry
	Byte Count	Byte count applied to the group entry
	Reference Count	Number of flow entries referencing the group entry
	Duration	Elapsed time from when the group entry was programmed or last modified (in milliseconds)
Meter Entry	Input Packet Count	Packet count applied to the meter entry
	Input Byte Count	Byte count applied to the meter entry
	Reference Count	Number of flow entries referencing the meter entry
	Duration	Elapsed time from when the meter was programmed or last modified (in milliseconds)
Meter Band	In-Band Packet Count	Packet count applied to the meter band
	In-Band Byte Count	Byte count applied to the meter band

Ports

Table 23 SEL-2742 Port Types

Port	Description	Value	Friendly Name	Port Diagnostics	Valid InPort	Valid OutPort	Valid Watch Port
Physical	12 ports	1–12	1–12	Yes	Yes	Yes	Yes
Ingress[a]	Alias for physical ingress port	0xfffffff8	Ingress	No	No	Yes	No
All	Forwards to all standard ports except the ingress port	0xfffffffc	All	No	No	Yes	No
Controller	Forwards packets to SEL-5056	0xfffffffd	Controller	No	Yes	Yes	No
Local	Forwards to the management interface for in-band management	0xfffffffe	Local	Yes	Yes	Yes	No
Any	The watch port used when there is no port liveness	0xffffffff	Any	No	No	No	Yes

[a] The Ingress port is an alias for the physical ingress port and must be used to send a packet out the ingress port. For example, if a packet comes in on Port 5, to send the packet back out Port 5, the OutPort must be Ingress and not 5. When capitalized, Ingress refers to the OpenFlow Ingress port. Otherwise, it refers to the ingress physical port.

The SEL-2742 has four priority queues per port. The queues are serviced according to an 8:4:2:1 weighted round-robin (WRR) schedule.

Table 24 Priority Queue Precedence

Priority Queue	Precedence
4	Highest
3	Higher
2	Default
1	Lowest

The SEL-2742 sets the priority queue with the SetQueue OpenFlow action, and if no SetQueue action is in the flow entry, the default priority is 2. The SEL-2742 does not act on the VLAN priority tag data. Egress priority can be set without a VLAN tag by including the instruction in the flow entry.

The SEL-2742 supports the administrative settings listed in *Table 25* for a physical port. Each of these settings may be True or False. These settings cannot be modified for a port that is inactive, and settings are reset to the default value if the SEL-2742 is reset.

Table 25 Port Settings

Setting	Default Value (if Supported[a])	Supported (1000/100/10)
Disable Port	False	Yes
Disable Receiving	False	Yes
Disable Transmitting	False	Yes
Disable Packet In Messages	False	Yes
Auto-Negotiation	True	Yes
Pause	Not supported	N/A

Setting	Default Value (if Supported[a])	Supported (1000/100/10)
Asymmetric Pause	Not supported	N/A
10 Mbps Full-Duplex	True	Yes
10 Mbps Half-Duplex	True	Yes
100 Mbps Full-Duplex	True	Yes
100 Mbps Half-Duplex	True	Yes
1 Gbps Full-Duplex	True	Yes
1 Gbps Half-Duplex	True	Yes

[a] If not supported, the default value is false.

Flow entries are critical to the OpenFlow system. Control how packets are forwarded through their match fields and instructions. The SEL-2742 uses match fields to match packets to a flow entry and then executes the instructions in the flow entry.

Flow entries have the following four parts:

- General settings
- Match fields
- Instructions
- Counters

The primary purposes of flow entries are to identify all the packets that belong to a conversation between the source and destination and apply uniform instructions to all packets of that conversation. Therefore, a flow entry can be divided into two functions: an ingress function of matching a packet, and an egress function of controlling what to do with that matched packet. Match fields control the behavior of packets on ingress and instructions control the behavior of packets on egress.

General Settings

Table 26 Flow Entry General Settings

Setting	Values	Description
Alias	User-defined string	Friendly name used to identify the flow when looking at the table and counters. Local to SEL-5056 only.
Flow ID	Set by the controller	ID of the flow entry.
Table ID	0 to 3	Table ID to which the flow entry is programmed.
Priority	0 to 65535[a]	Setting used for selecting a flow entry when a packet matches multiple flow entries; in this case, the SEL-2742 selects the flow entry with the highest value.
Idle Timeout	0 to 65535	The flow entry is deleted if the set number of seconds has elapsed from when a packet was last applied to the flow entry; a value of 0 disables the time-out.
Hard Timeout	0 to 65535	The flow entry is deleted after the specified number of seconds; a value of 0 disables the time-out.
Check Overlap	True or False	If true, the SEL-2742 prohibits flow entries that have the same priority and may match the same packet in the same flow table; SEL-5056 sets this to True for every flow entry; this is always enforced when using SEL-5056.

[a] 1000 to 60000 is recommended to prevent conflict with the SEL-5056 auto-generated default flow entries.

The Flow ID setting serves as a reference to a particular flow entry. SEL-5056 sets this value after you have submitted a new flow entry. This value also serves to reference a flow entry in the list of flow entry counters. If both time-outs are set and either time-out expires, the SEL-2742 deletes the flow. Modifying a flow entry resets the counters.

Supported Match Fields

Table 27 Match Fields

Name	Valid Values	Maskable	Prerequisites		Description
			Type	Value	
ArpOp	0 to 255	No	EthType	0x806	Address Resolution Protocol (ARP) Opcode
ArpSpa	Any valid IPv4 address	Yes	EthType	0x806	ARP source IPv4 address
ArpTpa	Any valid IPv4 address	Yes	EthType	0x806	ARP destination IPv4 address
Cst Match	Any name of a CST	No			Imports the match fields from the CST if not already present in the match fields list
EthDst	Any valid MAC address	Yes			Ethernet destination address
EthSrc	Any valid MAC address	Yes			Ethernet source address
EthType	0 to 65535	No			Ethernet type
InPort	Any valid InPort port listed in Table 20	No			Switch input port
IpProto	0 to 255	No	EthType	0x800	IP Protocol
Ipv4Dst	Any valid IPv4 address	Yes	EthType	0x800	IPv4 destination address
Ipv4Src	Any valid IPv4 address	Yes	EthType	0x800	IPv4 source address
TcpDst	0 to 65535	No	IpProto	6	IPv4 TCP destination port
TcpSrc	0 to 65535	No	IpProto	6	IPv4 TCP source port
UdpDst	0 to 65535	No	IpProto	17	IPv4 UDP destination port
UdpSrc	0 to 65535	No	IpProto	17	IPv4 UDP source port
VlanPcp	0 to 7	No	See VlanVid		VLAN PCP
VlanVid	None, Present, 0 to 4095; Present and 0 to 4095 for mask	Yes			VLAN ID

If the match fields represent the *if*, the instructions (and the possible included actions) represent the *then*. If a packet matches a flow entry, the SEL-2742 applies the instructions of the flow entry to the packet. *Table 28* lists the supported instructions on the SEL-2742, in order of instruction application.

Table 28 Supported Instructions in Order of Applied Priority

Instruction	Value	Description
Meter	Any valid Meter ID	Directs the packet to a meter
Clear-Actions	None	Removes all of the actions from the action set
Write-Actions	Zero or more of the actions listed in *Table 29*	Merges the specified action(s) into the action set
Goto-Table	1–3 (value must be higher than the Table ID of the Flow entry)	Sends the packet to the designated table to look for the next match

The Meter instruction sends the flow to the specified meter. If the meter drops the packet, packet processing for that packet stops. Write-Actions instruction actions are not applied to the packet immediately, but they are added to the action set of the packet. The action set is only applied to the packet when packet processing stops, so it does not affect any further matching against the packet. *Table 29* lists the supported actions of the Write-Actions instruction in the order the SEL-2742 executes the actions. The Clear-Actions instruction clears the action set of actions added in previous flow tables. The Goto-Table instruction forwards the packet to another flow table for further matching. The specified table must have a higher Table ID than the Table ID of the present flow entry. Therefore, flow entries in Flow Table 3 cannot have Goto-Table instructions, and flow entries in Flow Table 2 can only have a Goto-Table instruction for Flow Table 3.

Table 29 Supported Write-Actions (in Order of Applied Priority)

Action	Value	Description
PopVlan	None	Pops a VLAN header
PushVlan	0x8100	Pushes a VLAN header
SetVlanId	0 to 4095[a]	Sets the VLAN ID of the outermost VLAN header
SetVlanPcp	0 to 7	Sets the VLAN PCP value
SetQueue	1 to 4	Sets the priority queue
Group by Alias or Group by Value	Any valid Group ID or alias	Sends the packet to the group represented by the Group ID or alias
Output by Alias or Output by Value	Any valid port number or the alias of an adopted port	Sends the packet out of the port represented by the port name or alias

[a] The value 0 indicates a priority-tagged packet. The value 4095 is reserved by IEEE 802.1Q.

The Output action sends the packet to the specified port, referred to as the OutPort. This OutPort can be any of the valid OutPorts listed in *Table 23*. The Output action is required for egress packets coming from the SEL-2742. If an OutPort action is never executed against a packet, the packet is dropped. This Output action may be present in the Group action instead of directly in the flow entry. The Group action sends the packet to the specified group. The group can be any of the presently programmed groups on the SEL-2742. When adding a new VLAN header, the SEL-2742 copies the VLAN ID and VLAN PCP fields from the previous VLAN tag to the new VLAN tag, if present, or sets them at 0, if not present. Use the SetVlanId and SetVlanPcp actions when using the pushVLAN action to set the fields in the header. To set the VLAN ID or VLAN PCP, a VLAN header must be present. This requires that either the VlanVid match fields be present with a value of Present or of 0 to 4095, or that the PushVlan action also be present.

You can add flow entries to a flow table if you do not exceed the limit of 2,048 flow entries per table. This limit includes the default flows.

Modifying or deleting a flow entry may disrupt packets that are applied to that flow entry, including packet loss. If you delete a Group or Meter entry, all flow entries that reference that group or meter are also deleted. Flow entries with time-outs are deleted when the SEL-2742 resets or cycles power.

You can only program one flow entry with the same match fields and priority for each flow table.

Additionally, you cannot program flow entries on the same flow table with different match fields and the same priority that match the same packets.

The SEL-2742 supports all four OpenFlow group types and supports as many as the allowed amount in *Table 30*.

Table 30 SEL-2742 Supported Group Use

Parameter	Supported Number
Groups	256
Action Buckets Per Group	30
Unique Action Buckets	128

Table 31 lists the general settings supported by the SEL-2742.

Table 31 Group Entry General Settings

Setting	Values	Description
Group ID	0 to 4294967040	ID of the Group Entry
Group Type	Indirect, All, Select, Fast Failover	Type of the Group

The Group ID setting is used to reference the group in a Group action and for counters. *Table 32* lists the supported attributes in each group.

Table 32 Group Type Parameters

Group Type	Number of Group Chaining	Packet Duplication	Liveness	Relationship
Indirect	2	No	No	Aliasing
All	2	Yes	No	Duplication
Select	0	No	No	Aggregation
Fast Failover	2	No	Yes	Redundancy

The SEL-2742 supports the following action bucket configurations. *Table 33* lists all of the parameters per group type for Watch port and Watch group, supported actions, and the maximum number of action buckets.

The SEL-2742 treats each set of actions in an action bucket as its own action. A group with no action buckets drops the packet. Because the action set of a packet through the flow tables is applied before the packet is sent to a group entry, action bucket actions are applied after the SEL-2742 has applied all of the Write-Actions instruction actions to the packet. If an action bucket forwards a packet to another group, the SEL-2742 applies the actions of the second action bucket to the packet after applying the actions of the first action bucket and the action of the Write-Actions instruction of the Flow entry. There are no prerequisites for action bucket actions. If the action bucket contains a PopVlan, SetVlanId, or SetVlanPcp action without a PushVlan action and the packet did not have a VLAN tag when sent to the group (for example, if the Write-Actions Instruction action set contains a PopVlan action), the SEL-2742 discards the packet. The SEL-2742 supports 128 unique action buckets per switch. An action bucket is unique if the Watch port, Watch group, and actions are unique. If more than one action bucket has the same Watch port, Watch group, and actions, these action buckets still only count as one action bucket toward the limit of 128.

Table 33 Group Type Configuration Options

Group Type	Action Buckets Supported	Valid Watch Port	Valid Watch Group	Supported Actions
Indirect	1	Any	Any	Output, Group
All	30	Any	Any	Output, Group, PushVlan, PopVlan, SetQueue, SetVlanVid, SetVlanPcp
Select	30	Any	Any[a]	Output
Fast Failover[b]	30	Any Watch port listed in *Table 23*	Group ID of a Fast Failover group on the switch or Any	Output, Group, PushVlan, PopVlan, SetQueue, SetVlanVid, SetVlanPcp

[a] Although the watch port must be Any, action buckets with a downed OutPort are automatically skipped.
[b] Either the watch port or watch group may be Any, but not both.

Meters provide simple QoS rate limiting. The SEL-2742 supports 64 meters. Each meter must have exactly one meter band. A meter band may have only a rate, or it may have both a rate and a burst size (if Set Burst Size is True). The rate and burst size may be in packets per second (PPS) or Kbps. *Table 34* lists the SEL-2742 meter settings.

Table 34 SEL-2742 Supported Meter Use

Setting	Valid Values	Description
Meter ID	1 to 64	ID of the Meter entry
Measurement Type	Kbps or PPS	Defines the unit of measurement for the Rate and Burst Size Meter Band settings
Set Burst Size	True or False	If True, the meter band burst size is user-defined; if False, the minimum value is used

The Rate and Burst Size settings are listed in *Table 35* and depend on the Measurement Type setting of the meter band. The Burst Size setting defines the size of the meter, and the range of accepted values depends on the Meter Rate setting. If no burst size is set, or if it is set to a value below the minimum, Burst Size defaults to a minimum value as determined by the equation shown in *Table 35*. Using this minimum value with traffic in bursts may cause traffic loss even though the traffic rate is much lower than the meter rate. Burst Size is in bytes if the Rate setting is in Kbps, and in packets if the Rate setting is in PPS.

Table 35 Meter Rate and Burst Size Setting Ranges

Setting	Measurement Type	Minimum Value	Maximum Value
Meter Rate	Kbps	1	110000
	Pps	1	624999
Burst Size	Kbps	1632 / 1 – ([Rate / 125,000,000])	16,777,215 / (1 – [Rate / 125,000,000])
	Pps	256 / (1 – [Rate / 625,000])	16,777,215 / (1 – [Rate / 625,000])

If you modify or delete a meter entry, all flow entries referencing that meter entry are also deleted.

For explanations on OpenFlow, refer to the *SEL-5056 SDN Flow Controller Instruction Manual* and the OpenFlow standard at OpenNetworking.org.

Dimensions

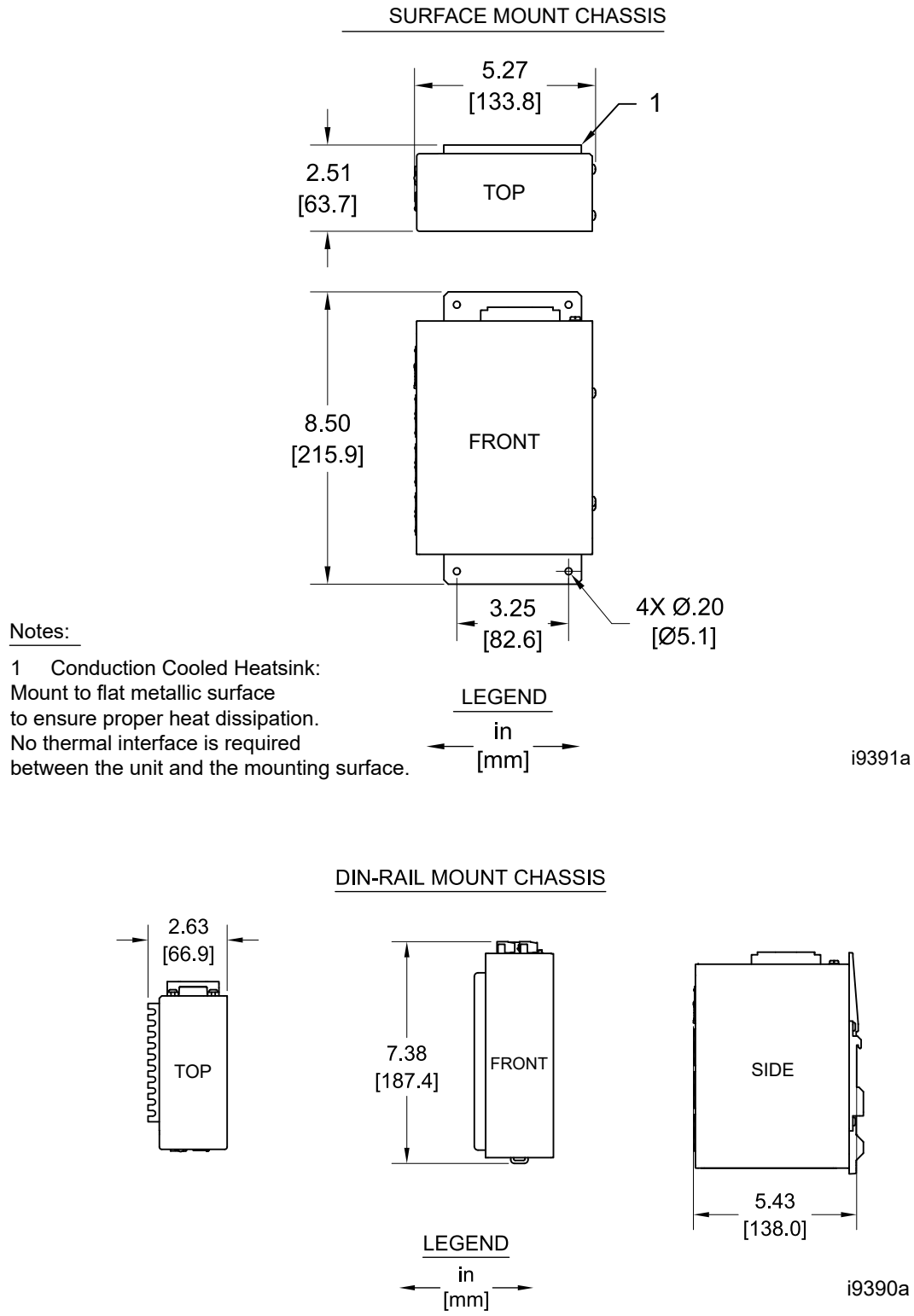


Figure 3 SEL-2742 Dimensions

Front and Rear Panels

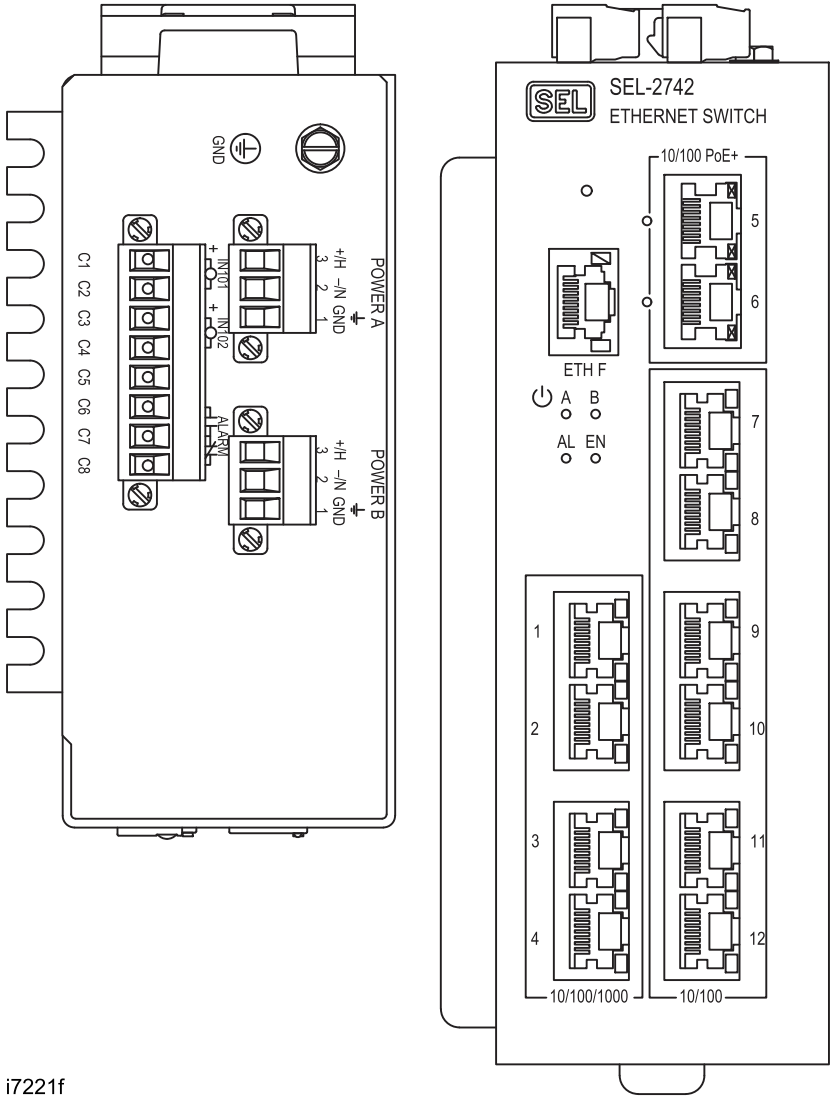


Figure 4 SEL-2742 Front and Rear Panels (DIN Rail)

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system.

UL Listed to U.S. and Canadian safety standards
(File E220228; NRAQ/NRAQ7)

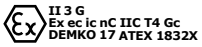
47 CFR 15B, Class A

UL Listed to U.S. and Canadian hazardous locations standards
(File E475839; NRAG/NRAG7)

Class I Division 2
Group A, B, C, D; T5

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

UKCA Mark
CE Mark
RCM Mark
Green Product
Compliant with the European Union's RoHS directive
Communications Product Testing
IEC 61850-3 Performance Class 1
IEEE 1613: 2009 + A1: 2011 Performance Class 1



FIPS 140-2 Level 1 Validation

General

Switching Properties

Switching Method:	Store and forward
Switch Fabric Throughput:	4.8 Gbps
Priority Queues:	4
Priority Queue Method:	8:4:2:1 weighted round-robin (WRR)
Flow Entries:	8,192 (2,048 per table)
Flow Tables:	4
Maximum Transmission Unit (MTU):	1632

Warranty

10 years

Network Management

OpenFlow 1.3

Group Entries:	256
Flows:	8,192
Action Buckets Per Group Entry:	30
Group Types:	All, Select, Indirect, Fast Failover
Actions:	Write-Actions, Meter, Clear-Actions, Goto-Table
Apply Actions:	Output, Group, Push Vlan, Pop Vlan, Set Queue, Set VID, Set PCP

SNMPv2c

Secure Communication

TLS with the OpenFlow controller

X.509 certificate to establish TLS connection to the OpenFlow controller

Logging and Diagnostics

Syslog

- UDP and TLS

OpenFlow 1.3

SNMP v2c, v3

Precision Time Protocol

Profile

IEEE C37.238-2017 (Power Profile)
Transparent Clock (100BASE-TX, 1000BASE-T, 100BASE-FX, 1000BASE-SX, 100BASE-LX, or 1000BASE-LX)

Communications Ports

Ethernet Ports

Ports:	13
1 Port:	10, 100, or 1000 Mbps **ETH F** management port
4 Ports:	10, 100, or 1000 Mbps
8 Ports:	10 or 100 Mbps
Connectors:	RJ45 female or LC fiber (single-mode or multimode)
Standard:	IEEE 802.3, OpenFlow 1.3

Fiber-Optic Ports

100BASE-FX Multimode Option (to 2 km)

Maximum TX Power:	–14 dBm
Minimum TX Power:	–19 dBm
Maximum RX Power:	–14 dBm
RX Sensitivity:	–31 dBm
System Gain:	12 dB
Source:	FP laser
Wavelength:	1310 nm
Connector Type:	LC (IEC 61754-20)

100BASE-LX Single-Mode Option (to 10 km)

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

1000BASE-EX Single-Mode Option (to 40 km)

Maximum TX Power:	0 dBm
Minimum TX Power:	–4.5 dBm
Maximum RX Power:	–3 dBm
RX Sensitivity:	–22.5 dBm
System Gain:	18 dB
Source:	FP laser
Wavelength:	1310 nm
Connector Type:	LC (IEC 61754-20)

1000BASE-LX Single-Mode Option (to 10 km)

Maximum TX Power:	–3 dBm
Minimum TX Power:	–11.5 dBm
Maximum RX Power:	–3 dBm
RX Sensitivity:	–19 dBm
System Gain:	7.5 dBm
Source:	FP laser
Wavelength:	1310 nm
Connector Type:	LC (IEC 61754-20)

1000BASE-SX Multimode Option (to 500 m)

Maximum TX Power:	0 dBm
Minimum TX Power:	–9.5 dBm
Maximum RX Power:	0 dBm
RX Sensitivity:	–17 dBm
System Gain:	7.5 dB
Source:	VCSEL
Wavelength:	850 nm
Connector Type:	LC (IEC 61754-20)

Power Supply

DC Power Supply

Wiring Interface:	Terminal block connector Power cables must be ≤10 meters
Rated Voltage Range:	24–48 Vdc
Min/Max Voltage:	11–60.0 Vdc
Maximum Burden	
PoE Turned Off:	<25 W
PoE in Use at 48 V With 30 W Each PoE Port:	<85 W

Note: To meet specified transient overvoltage events on the power supply lines, ensure that the connected equipment on Port 5 and Port 6 are rated to handle the maximum transient overvoltage.

Fuse Rating:	5.0 A, 125 Vdc @ 100 A interrupt rating

PoE+

Supports:	PoE+ Type 2 per IEEE 802.3at-2009
Power Delivered:	30 W per port, max two ports
Power Available at Powered Device:	25.5 W
Max Current Per Port:	640 mA
Ethernet Cables Connected to PoE+ Ports:	≤10 m
PoE+ Fuse Rating:	1.5 A, with 63 Vac/dc @ 50 A interrupt rating

Note: Fuses are not user-serviceable. Return units to manufacturer for service.

Note: After successfully detecting and classifying a valid PoE or PoE+ Powered Device (PD) on Ports 5 or 6, the SEL-2742 will supply the PD with power sourced from the external power supply. This power is directly fed to the PD and supervised for any PoE faults according to IEEE 802.3at-2009. Note that no further voltage regulation is performed on the PoE voltage and that the voltage presented to the PD is reflective of the input to the SEL-2742. Ensure that your chosen power supply operates at a voltage within operating voltage range of your intended PD devices.

Alarm Contact Output

Output Type:	Relay, Form C, break-before-make
Mechanical Endurance*:	10,000 operations
Rated Voltage*:	24–250 Vdc
Operational Voltage*:	0–300 Vdc 0–264 Vrms
Continuous Current*:	5 A
MOV Protection:	300 Vdc, 9.6 J
Pickup/Dropout Time*:	<8 ms (resistive load)

Limiting 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

UL Ratings: (Per UL 61010-1/61010-2-201)	≤30 Vdc 2 A Resistive ≤250 Vac 6 A Resistive
Thermal Continuous Test Current:	5 A

* Parameters verified by SEL per IEC 60255-1:2009 and IEEE C37.90-2005.

Digital Input

Rated Voltage:	12–48 Vdc
Architecture:	Externally wetted and isolated
Assertion:	9.6–60 Vdc
Deassertion:	0–6 Vdc
Polarity:	Dependent, reverse polarity protected
Overvoltage Protection:	120 Vac/dc

Terminal Connections

Compression Screw Terminal Blocks

Power Wiring

Insulation:	300 V minimum
Size:	12–24 AWG (4.00–0.25 mm^2)
Tightening Torque Min/Max:	0.5–0.6 Nm (4–5 in-lb)

Note: Crimp ferrule is recommended.

Alarm Wiring

Insulation:	300 V minimum
Size:	16–24 AWG (1.5–0.25 mm^2)
Tightening Torque Min/Max:	0.5–0.6 Nm (4–5 in-lb)

Note: Crimp ferrule is recommended.

Digital Input Wiring

Size:	12–24 AWG (4.00–0.25 mm^2)
Digital Input Burden:	2–4 mA

Grounding Screw

Ground Wiring

Insulation:	300 V minimum
Size:	12 AWG (4.0 mm^2)
Tightening Torque Min/Max:	0.9–1.4 Nm (8–12 in-lb)
Recommended Grounding Procedure:	Power A, Power B, and chassis ground should all be Earth ground

Note: Ring terminal is recommended.

Note: Power A and B ground pin is not intended for use as a safety ground. If used, connect the power supply ground to the chassis ground of the external power supply of the same port by using a 12–24 AWG wire and include the wire in the ferrite clamp.

Dimensions

DIN Rail Mount

Height:	200.66 mm (7.9 in)
Depth:	139.7 mm (5.5 in)
Width:	69.85 mm (2.75 in)

Weight

1.81 kg (4 lb)

Environmental

Operating Temperature

–40° to +85°C (–40° to +185°F)

Hazardous locations operating range is –20° to +40°C.

Note: UL Ambient 40°C. See *Safety Information on page 2* for additional details.

Storage Temperature

–40° to +85°C (–40° to +185°F)

Relative Humidity

0%–95% noncondensing

Altitude

2000 m
Above 2000 m, derate dielectric strength and temperature according to IEEE 1613: 2009 Table 1 and Table 2
IEC 60255-27 certification below 2000 m only

Atmospheric Pressure

80–210 kPa

Operating Environment

Pollution Degree:	2
Overvoltage Category:	II
Insulation Class:	I
Convection Cooled:	No Fans

Enclosure Protection

IEC/EN 60255-27:2014

Power Inputs:	IP2X
Front-Reset Button:	IP3X
Enclosure:	IP4X

Type Tests

Communications Product Testing

IEEE 1613-2009, Class 1

* With SEL-CA605REX or equivalent cables.

Electromagnetic Compatibility Emissions

Generic Emissions:	FCC 47 CFR:2008 Part 15.107 & 109 EN 60255-26:2013 IEC 60255-26:2013 EN 61850-3:2014 IEC 61850-3:2013 EN 55032:2012 + AC:2013 CISPR 32: 2015 ICES-001, Issue 5
Severity Level:	Class A Tested with a snap-on cable ferrite with a 1-turn minimum impedance of 140 Ω at 25 MHz and 250 Ω at 100 MHz (SEL part number 427-0015).

Electromagnetic Compatibility Immunity

Conducted RF Immunity:	EN 60255-26:2013 IEC 60255-26:2013
Radiated RF Immunity:	IEEE C37.90.2:2004 IEEE 1613:2009 IEEE 1613.1:2013 Severity Level: 20 V/m unmodulated 80 MHz–1 GHz IEC 60255-26:2013 EN 60255-26:2013 Severity Level: 20 V/m unmodulated 80 MHz–1 GHz, 1.4 GHz–2.7 GHz
Conducted Common-Mode Disturbance (CCMD):	EN 61850-3:2014 (Clause 6.7.3) IEC 61850-3:2013 (Clause 6.7.3) Test Level: 4
Electrostatic Discharge Immunity:	IEC 60255-26:2013 IEC 61000-4-2:2009 Severity Level: 2, 4, 6, 8 kV contact; 2, 4, 8, 15 kV air IEEE 1613-2009 Class 1 IEEE 1613.1-2009 Class 1 IEEE C37.90.3-2001 Severity Level: 2, 4, 6, 8 kV contact; 2, 4, 8, 15 kV air
Fast Transient/Burst Immunity:	EN 60255-26:2014 IEC 60255-26:2013 IEEE 1613-2003 ±2 kV comm ports; ±4 kV PS, I/O, Earth
Power Frequency Field Magnetic Immunity:	EN 60255-26:2013 IEC 60255-26:2013 EN 61850-3:2014 IEEE 1613.1-2013 Severity Level: 100 A/m for 60 seconds; 1000 A/m for 3 seconds
Pulse Magnetic Field Immunity:	EN 61000-4-9:2016 IEC 61000-4-9:2016 IEEE 1613.1-2013 Severity Level: 5 (1000 A/m)
Damped Oscillatory Magnetic Field Immunity:	EN 61000-4-10:2017 IEC 61000-4-10:2016 IEEE 1613.1-2013 Severity Level: 5 (40 pulses/s, 2 s duration, 100 A/m at 100 kHz; 400 pulses/s, 2 s duration, 100 A/m at 1 MHz)

Power Frequency Immunity:	IEC 60255-26:2013 EN 60255-26:2014 Severity Level: Zone A 150 Vrms
Power Supply Immunity:	IEC 60255-26:2013 IEC 61000-4-11:2004 IEC 61000-4-29:2000

Note: Applicable when the power inputs are connected to an external power source that provides the required hold-up time.

Power Supply Ripple:	IEC 60255-26:2013 IEC 61000-4-17:2008 IEEE 1613-2003 Class 1
Power Supply Gradual Shutdown and Startup:	IEC 60255-26:2013 Severity: shutdown ramp 60 seconds, power off 5 minutes, startup 60 seconds
Power Supply Discharge Capacitors:	IEC 60255-27:2013
Power Supply Reverse Polarity and Slow Ramp:	IEC 60255-27:2013
Surge Immunity:	IEC 60255-26:2013 Clause 7.2.7 IEC 61000-4-5:2005 Severity Level: Zone B

Note: The cable length must be ≤10 meters for PoE and PoE+.

Surge Withstand Capability:	IEC 60255-26:2013 IEC 61000-4-18:2010 IEC Surge Withstand Capability Severity Level: 1 MHz common mode, 2.5 kV on power and I/O, 1 kV on communications ports Severity Level: 1 MHz differential mode, 1 kV on power and I/O IEEE C37.90.1-2012 Severity Level Oscillatory: ±2.5 kV, 1 MHz common and differential mode Severity Level Fast Transient: ±4 kV, 2.5 kHz common and differential mode IEEE 1613-2003 Class 1

Environmental

Cold:	IEC 60068-2-1:2007 Severity Level: 16 hours at –40°C IEC 60255-27:2013 IEEE 1613-2003 Class 1
Damp Heat, Cyclic:	IEC 60068-2-30:2005 Severity Level: 25°C Relative Humidity: 93% Duration: 6 cycles IEC 60255-27:2013
Dry Heat:	IEC 60068-2-2:2007 Severity Level: 16 hours at +85°C IEC 60255-27:2013 IEEE 1613-2003 Class 1
Damp Heat, Steady State:	IEC 60068-2-78:2012 Severity Level: 40°C at 90% for 10 days IEC 60255-27:2013 IEEE 1613-2003 Class 1
Vibration:	IEC 60255-21-1:1988 Severity Level: Class 2 response, Class 2 endurance IEC 60255-21-2:1998 Severity Level: Class 1 shock withstand, bump, and Class 2 shock response IEC 60255-21-3:1993 Severity Level: Class 2 (quake response) IEC 60255-27:2013 IEEE 1613-2003 Class 1

Safety

Family Standards:	IEC 60255-27:2013 EN 60255-27:2014 KN 60255-27:2013 BS 60255-27:2014 IEC 61010-1:2010 + AM1:2016 IEC 61010-2-201:2017 UL 61010-1, Third Edition UL 61010-2-201, Second Edition CSA C22.2 No. 61010-1-12 CSA C22.2 No. 61010-2-201:18
Dielectric Strength:	IEC 60255-27:2013 IEEE 1613-2003 Class 1 IEEE C37.90-2005 0.82 kV (AC) binary inputs 1.5 kV (AC) Eth F, 1–4, 7–12 ±2.2 kV (DC) power supply, Eth 5–6 2.5 kV (AC) alarm contact
Impulse:	IEC 60255-27:2013 IEEE 1613-2003 Class 1 IEEE impulse standards only apply if the device is not connected directly to the station battery. IEEE C37.90-2005 Severity Level: Common Mode: 1 kV binary inputs 2 kV power supply/Ethernet ports 5 kV alarm contact Common Mode, Port to Port: 1 kV binary inputs 2 kV power supply/Ethernet ports 5 kV alarm contact
Protective Bonding Resistance:	IEC 60255-27:2013 IEEE C37.90-2005
Hazardous Locations Family Standards:	UL 121201, Ninth Edition CSA C22.2 No. 213-17 EN 60079-0:2018 EN 60079-7:2015/A1:2018 EN 60079-15:2019 BS 60079-0:2018 BS 60079-7:2015/A1:2018 BS 60079-15:2019

Appendix A: Firmware and Manual Versions

Firmware

Determining the Firmware Version

To determine the firmware version, view the status report by using the serial port **STATUS** command or the front-panel **STATUS** pushbutton. The status report displays the Firmware Identification (FID) number.

The firmware version number is after the R, and the date code is after the D. For example, the following is firmware version number R100, date code September 30, 2020.

FID=SEL-2742S-R100-V0-Z001001-D20200930

The SEL-2742 comes preinstalled with firmware. Users can use SEL-5056 to update the firmware. If an SEL-2742 must be replaced, you can use SEL-5056 to apply the configuration of one SEL-2742 to the replacement SEL-2742. When an SEL-2742 must be removed from service, you can decommission it, removing all device configuration and restoring factory-default settings.

Revision History

Table 36 lists the firmware versions, revision descriptions, and corresponding instruction manual date codes. The most recent firmware version is listed first.

Starting with revisions published after March 1, 2022, changes that address security vulnerabilities are marked with "[Cybersecurity]". Other improvements to cybersecurity functionality that should be evaluated for potential cybersecurity importance are marked with "[Cybersecurity Enhancement]".

Table 36 Firmware Revision History

Firmware Identification (FID) Number	Summary of Revisions	Manual Date Code
SEL-2742S-R112-V5-Z001001-D20240501	Includes all the functions of SEL-2742S-R112-V4-Z001001-D20230919 with the following addition: ➤ [Cybersecurity] Addressed a denial-of-service vulnerability in a third-party software component that could allow a malicious client to temporarily affect the availability of the web server.	20240501
SEL-2742S-R112-V4-Z001001-D20230919	Includes all the functions of SEL-2742S-R112-V3-Z001001-D20230111 with the following additions: ➤ [Cybersecurity] Addressed an issue in previous releases where tampering with TLS negotiation could result in weakening the key strength for OpenFlow and Syslog/TLS.	20230919
SEL-2742S-R112-V3-Z001001-D20230111	Includes all the functions of SEL-2742S-R112-V2-Z001001-D20230106 with the following additions: ➤ Added support for hardware updates.	20230111
SEL-2742S-R112-V2-Z001001-D20230106	Includes all the functions of SEL-2742S-R112-V1-Z001001-D20230105 with the following additions: ➤ Addressed an issue present in previous releases that caused the switch to lose all flow configurations after a power cycle on switches configured with IGMP IP protocol match value (2) in a flow entry.	20230106
SEL-2742S-R112-V1-Z001001-D20230105	Includes all the functions of SEL-2742S-R112-V0-Z001001-D20220909 with the following additions: ➤ Added support for hardware updates.	20230106
SEL-2742S-R112-V0-Z001001-D20220909	➤ Added support for hardware updates.	20220909
SEL-2742S-R111-V2-Z001001-D20230919	Includes all the functions of SEL-2742S-R111-V1-Z001001-D20220427 with the following additions: ➤ [Cybersecurity] Addressed an issue in previous releases where tampering with TLS negotiation could result in weakening the key strength for OpenFlow and Syslog/TLS.	20230919
SEL-2742S-R111-V1-Z001001-D20220427	Includes all the functions of SEL-2742S-R111-V0-Z001001-D20220401 with the following additions: ➤ Addressed an issue present in previous releases where multicast destinations did not receive packets in mesh topologies.	20220427
SEL-2742S-R111-V0-Z001001-D20220401	➤ [Cybersecurity] Addressed a security vulnerability allowing Transport Layer Security (TLS) authentication bypass.	20220401
SEL-2742S-R110-V1-Z001001-D20220304	Includes all the functions of SEL-2742S-R110-V0-Z001001-D20220228 with the following additions: ➤ Addressed an issue present in previous releases that may cause the switch to lose flows after a power cycle.	20220301
SEL-2742S-R110-V0-Z001001-D20220228	➤ Added support for the following product option: Two 1000BASE-LX, Two 10/100/1000BASE-T, and Eight 10/100BASE-T product option.	20220228

Firmware Identification (FID) Number	Summary of Revisions	Manual Date Code
SEL-2742S-R109-V0-Z001001-D20211105	➤ Added support for Authenticated Controller Time Synchronization (ACTS). ➤ Added support for a configurable alarm contact. ➤ Addressed an issue present in previous releases in which an OpenFlow group could become fixed and unable to be changed or deleted.	20211105
SEL-2742S-R108-V2-Z001001-D20211015	Includes all the functions of SEL-2742S-R108-V1-Z001001-D20210917 with the following additions: ➤ Addressed an issue where PTP Power Profile Transparent Clock functionality was not providing the accuracy expected. ➤ Addressed an issue where the feature that allowed for independently enabling and disabling ports' transmit and receive directions did not operate properly.	20211015
SEL-2742S-R108-V1-Z001001-D20210917	Includes all the functions of SEL-2742S-R108-V0-Z001001-D20210430 with the following additions: ➤ Addressed an issue where flows may be lost on startup. ➤ Improved packet handling on link-up events so that no packets are lost when links are established. ➤ Improved device shutdown and startup time. ➤ Updated multiple third-party packages.	20210917
SEL-2742S-R108-V0-Z001001-D20210430	➤ Increased flow table size to 8,192. ➤ Addressed an issue where previous firmware reported PoE+ diagnostic data in the wrong place. ➤ Addressed an issue where all syslogs could not be acknowledged. ➤ Improved multicast packet handling destined for the switch. ➤ Added support for 100 Mbps fiber ports.	20210430
SEL-2742S-R107-V2-Z001001-D20210402	Includes all the functions of SEL-2742S-R107-V0-Z001001-D20210312 with the following additions: ➤ Addressed an issue in R107 where SNMPv3 credentials are not saved.	20210402
Note: Firmware version R107–V1 did not release.		
SEL-2742S-R107-V0-Z001001-D20210312	➤ Addressed an issue where the PoE+ diagnostic transposed the detection and classification information. ➤ Added support for SNMPv3. ➤ Added the Entity, Alarm contact, SEL-2740S Module, Power Supply, Digital Input, and PoE+ MIBs. ➤ Achieved compliance to FIPS 140-2 Level 1.	20210312
Note: Firmware versions R101–R106 did not release.		
SEL-2742S-R100-V0-Z001001-D20200930	➤ Initial version.	20200930

Instruction Manual

The date code at the bottom of each page of this manual reflects the creation or revision date.

Table 37 lists the instruction manual versions and revision descriptions. The most recent instruction manual version is listed first.

Table 37 Instruction Manual Revision History

Date Code	Summary of Revisions
20241212	➤ Changed name of product to "SEL-2742 Ethernet Switch" throughout. ➤ Updated *Figure 2: SEL-2742 Front Panel* and *Figure 4: SEL-2742 Front and Rear Panels (DIN Rail)*.
20240913	➤ Updated *General Safety Notes* in *Safety Information*. ➤ Added information for an Axion Chassis Mount option and *Optional Accessories and Kits* to *Table 5: Mounting Options*.
20240501	➤ [Cybersecurity] Updated for firmware version R112-V5.
20230919	➤ Updated for firmware versions R111-V2 and R112-V4.
20230111	➤ Updated for firmware version R112-V3.
20230106	➤ Updated for firmware versions R112-V1 and R112-V2.
20221026	➤ Updated *Table 1: Ordering Options*.
20220909	➤ Updated for firmware version R112-V0.
20220531	➤ Updated *Table 1: Ordering Options*.
20220427	➤ Updated for firmware version R111-V1.
20220401	➤ Updated for firmware version R111-V0.
20220301	➤ Updated for firmware version R110-V1.
20220228	➤ Added *Hazardous Locations Safety Marks* Table. ➤ Updated *Table 1: Ordering Options*. ➤ Updated *Installation*. ➤ Updated *Specifications*. ➤ Updated for firmware version R110-V0.
20211105	➤ Updated *Features and Benefits*. ➤ Updated *Alarm Contact Output* in *Introduction and Hardware Specifications*. ➤ Updated *Time Synchronization* in *Installation and Configuration*. ➤ Updated for firmware version R109-V0.
20211015	➤ Updated for firmware version R108-V2.
20210917	➤ Updated for firmware version R108-V1.
20210430	➤ Updated *Features and Benefits*. ➤ Updated *Table 1: Ordering Options*. ➤ Updated *Table 8: LED Status Indicators for Speed and Activity (SPEED/ACT) Mode*. ➤ Updated *Table 18: Complete List of Supported OpenFlow Parameters*. ➤ Updated *Specifications*. ➤ Updated for firmware version R108-V0.
20210402	➤ Updated for firmware version R107-V2.
20210312	➤ Updated *Safety Information*. ➤ Updated *Power Supply*. ➤ Updated *Figure 1.1: Power Supply Connections*. ➤ Added *SNMP*. ➤ Updated *Specifications*. ➤ Updated for firmware version R107-V0.
20210218	➤ Updated *Specifications*.

Date Code	Summary of Revisions
20210114	➤ Updated footnotes, added rows 7 and 8 in *Table 1: Ordering Options*. ➤ Updated *Specifications*.
20201104	➤ Updated for release of ordering option 2. ➤ Updated *Dimensions*. ➤ Added *Front and Rear Panels*. ➤ Updated *Specifications*.
20200930	➤ Initial version.

Appendix B: Firmware Upgrade Instructions

Introduction

These instructions guide you through the process of upgrading firmware in the device. Note that these instructions are only intended for upgrading firmware from an older revision to a newer revision. Downgrading firmware—going from a newer to an older revision—should not be attempted. It may result in the loss of MAC addresses and other device configuration information. Contact SEL if you need to downgrade the firmware.

The firmware upgrade will be either a standard release or a point release. A standard release adds new functionality to the firmware beyond the specifications of the existing version. A point release is reserved for modifying firmware functionality to conform to the specifications of the existing version.

A standard release is identified by a change in the R-number of the device firmware identification (FID) number.

Existing firmware:

FID=SEL-2742S-**R100**-V0-Z001001-Dxxxxxxxx

Standard release firmware:

FID=SEL-2742S-**R101**-V0-Z001001-Dxxxxxxxx

A point release is identified by a change in the V-number of the device FID number.

Existing firmware:

FID=SEL-2742S-R100-**V0**-Z001001-Dxxxxxxxx

Point release firmware:

FID=SEL-2742S-R100-**V1**-Z001001-Dxxxxxxxx

The date code is after the D. For example, the following is firmware version number R100, date code November 04, 2016.

FID=SEL-2742S-R100-V0-Z001001-**D20161104**

SEL-2742 Firmware and SEL-5056 Software Compatibility

SEL-5056 version 2.3 or higher supports SEL-2742 R100.

Firmware Files

SEL-2742 firmware upgrade files have a tar.gz file name extension. An example firmware filename is the following:

2742S.R100.V4.tar.gz

The firmware packages are cryptographically signed to enable the device to recognize official SEL firmware. Any uploaded files that cannot be verified as being produced by SEL will not be processed.

Upgrade Procedure

To perform an upgrade, you will need the appropriate firmware upgrade file and access to the device through SEL-5056 with Permission Level 3 privileges. Upgrade the device firmware by uploading a file from a personal computer to the device via the SEL-5056 web interface. Note that only one firmware upload can be running at a time in firmware versions R103 and lower. All firmware updates are logged. If you are upgrading to R104 from R101–R103, SEL recommends that you first upgrade SEL-5056 to Version 2.0 before upgrading the firmware. Follow these steps to upgrade the SEL-2742 firmware:

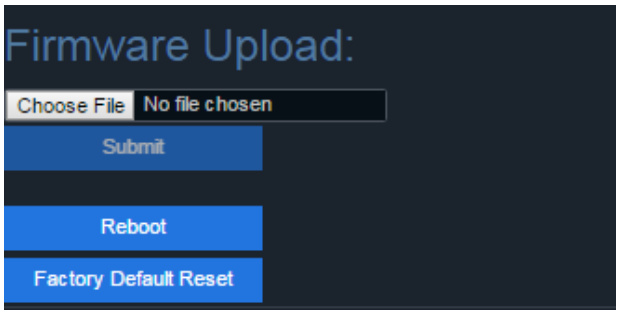
Step 1. Log in to SEL-5056 with an authorized user with the role of Permission Level 3.

Step 2. Navigate to the Topology page under the Configuration menu.

Step 3. Select the SEL-2742 device that you want to upgrade.

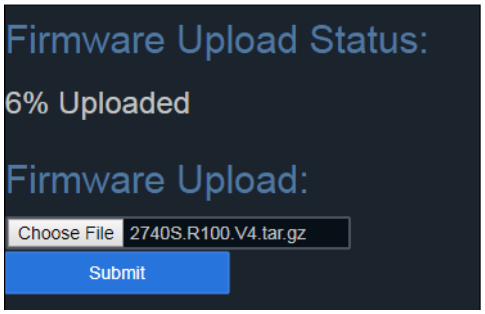
Step 4. In the configuration pane to the right, select **Choose File** under the Firmware Upload heading and select the firmware file.

Step 5. Click **Submit** when you have selected the firmware upgrade file.



Status Messages

Firmware upgrades may take as long as ten minutes. The current status of the upload and upgrade appears above the Firmware Upload.



Completion

Once the upgrade process is complete and the switch has restarted, log in and navigate to the **Device View** option in the Configuration pane. You will see the new FID.

Appendix C: Events

The Syslog Protocol is used to convey event notification messages. The SEL-2742 creates Syslog messages as defined in RFC 3164 and RFC 5424 through use of either UDP or TLS. This section also lists the category for each event on the SEL-2742.

The Syslog message is divided into five parts: priority, timestamp, source, tag, and message. The Syslogs forwarded by SEL-2742 switches are formatted as follows:

<priority> timestamp hostname tag: message

For example:

<131> Jul 19 10:15:54 ROBEMEINNB TopologyManager: Disconnected OperationalLink OpenFlow:00000030A733EEF6:B1(1)_OpenFlow: 00000030A733EEF6:B4(4) has reconnected and is now Adopted

The priority is calculated from the severity and facility of the message by the following equation:

Priority = Facility • 8 + Severity

Table 38 lists the possible values for severity and facility used by the SEL-2742.

Table 38 Syslog Severity Levels

Code	Severity
0	Emergency
1	Alert
2	Critical
3	Error
4	Warning
5	Notice
6	Informational

Table 39 Syslog Facility Levels

Code	Facility
1	User
3	System
4	Security/Authorization

The SEL-2742 sends out Syslogs for the given Syslog severity in the Syslog Server settings, as well as any Syslogs with a higher severity level (which corresponds to a lower severity code). For example, if the user configures a Syslog server with a severity level of Warning (code 4), the SEL-2742 sends out Syslogs with that severity, as well as Syslogs with severity levels of Error, Critical, Alert, and Emergency (Codes 3, 2, 1, and 0, respectively).

Table 40 SEL-2742 Event Logs

Message	Tag	Severity	Facility	Category
Device initialization completed.	System	Notice	System	Chassis and Module
Device reset because of hardware watchdog.	System	Critical	System	Chassis and Module
Failure: Power Supply A expected to be installed but absent.	System	Alert	System	Chassis and Module
Failure: Power Supply A.	System	Alert	System	Chassis and Module
Failure: Power Supply B expected to be installed but absent.	System	Alert	System	Chassis and Module
Failure: Power Supply B.	System	Alert	System	Chassis and Module
OK: Power Supply A.	System	Notice	System	Chassis and Module
OK: Power Supply B.	System	Notice	System	Chassis and Module
Certificate with common name {commonName} and thumbprint {thumbprint} internally {revokeState}	TrustAuthority	Informational	User	Configuration
Commissioning failed	CommissioningManager	Warning	User	Configuration
Commissioning succeeded	CommissioningManager	Informational	User	Configuration
Device factory reset initiated by user {userName} with role {roleName} from IP Address {ipAddress}	DeviceReset	Notice	Security/ Authorization	Configuration
Device reboot initiated by user {userName} with role {roleName} from IP Address {ipAddress}	DeviceReset	Error	User	Configuration
LED Mode: Changed by user at Front Panel.	System	Notice	User	Configuration
System Time: lost synchronization to external source.	System	Warning	System	Configuration
System Time: synchronized via NTP.	System	Notice	System	Configuration
User {userName} with role {roleName} from {ipAddress} acknowledged all local events.	LocalEventStore	Notice	User	Configuration
Port {port_num} changed link state to down.	System	Notice	System	Link
Port {port_num} changed link state to up.	System	Notice	System	Link
Device connected to OpenFlow controller at {ip} on port {port}	Openflow	Notice	System	Openflow
Device lost connection to OpenFlow controller at {ip} on port {port}	Openflow	Notice	System	Openflow
OpenFlow changes ({numberOfChanges}): {stringOfChanges}	Openflow	Informational	System	Openflow
A firmware version downgrade is not compatible with the current firmware.	FirmwareUpgrade	Error	System	System Integrity

Message	Tag	Severity	Facility	Category
Device factory reset initiated through digital input	System	Notice	User	System Integrity
Device factory reset initiated through pinhole button.	System	Notice	User	System Integrity
Device reset because of {reason}	DeviceReset	Warning	System	System Integrity
Event storage capacity ({storageCapacity}) exceeded. Oldest {numberRemoved} events removed.	LocalEventStore	Warning	User	System Integrity
Firmware upgrade from {oldVersion} to {newVersion} failed at step {failedStep} of {failedStepCount}.	FirmwareUpgrade	Critical	System	System Integrity
Firmware upgrade from {oldVersion} to {newVersion} succeeded.	FirmwareUpgrade	Warning	System	System Integrity
Firmware upgrade was initiated by user {username} with role {role} from IP address {ipaddress}.	FirmwareUpgrade	Notice	User	System Integrity
Local event storage contains <= 65% unacknowledged events.	LocalEventStore	Notice	System	System Integrity
Local event storage contains <= 80% unacknowledged events.	LocalEventStore	Notice	System	System Integrity
Local event storage contains >= 75% unacknowledged events.	LocalEventStore	Warning	System	System Integrity
Local event storage contains >= 90% unacknowledged events.	LocalEventStore	Warning	System	System Integrity
Reverted to fallback firmware version {firmwareVersion}. Previous device settings are in effect. Please contact Schweitzer Engineering Laboratories, Inc. for assistance.	FirmwareUpgrade	Critical	System	System Integrity
The firmware image is corrupted.	FirmwareUpgrade	Error	System	System Integrity

The Syslog message "OpenFlow changes ({numberOfChanges}): {stringOfChanges}" (see *Table 40*) reports the number of changes and a list of as many as 50 of the changes in 10-second intervals. The list is comma-separated and includes an abbreviation and number. All numbers are in hexadecimal format. *Table 41* describes the meaning of the abbreviation and what the number represents.

Table 41 OpenFlow Changes Event Description

Abbreviation	Description	Number (in Hexadecimal Format)
Fa	Flow entry added	Flow ID
Fd	Flow Entry deleted	Flow ID
Fm	Flow entry modified	Flow ID
Fr	Flow replaced	Flow ID
Fto	Flow entry deleted because of time-out	Flow ID
Ga	Group entry added	Group ID
Gd	Group entry deleted	Group ID
Gm	Group entry modified	Group ID
Ma	Meter entry added	Meter ID

Abbreviation	Description	Number (in Hexadecimal Format)
Md	Meter entry deleted	Meter ID
Mm	Meter entry modified	Meter ID
Pa	OpenFlow port added	Port ID
Pd	OpenFlow port deleted	Port ID
Pm	OpenFlow port modified	Port ID

Appendix D: Cybersecurity Features

Security features of the SEL-2742 provide secure communications between SEL-5056 and the SEL-2742. The SEL-2742 does not provide access for engineers or technicians; all configuration and monitoring happens from SEL-5056.

Version Information

Device Firmware

The device firmware identification (FID) number can be obtained through SEL-5056. The SEL-2742 firmware is provided in a single digitally signed file.

Ports and Services

Physical Ports

The SEL-2742 has one front port that is used only for the management of the switch itself. There are 12 ports that can be used for management and data plane packet forwarding. All physical ports are always enabled, but the SEL-2742 is a deny-by-default network switch and does not forward packets unless the flows are configured to do so.

Logical Ports

Table 42 Port Numbers

IP Port Default	Network Protocol	Default Port State	Port Configurable	Purpose
3002	UDP	Enabled	No	Only available to commission the switch. Once commissioned, the port is disabled and only can be enabled again in a factory-default reset state.
443	TCP	Enabled	No	HTTPS REST interface for switch settings managed by SEL-5056
161	SNMP	Disabled	Yes	SNMP read-only IFMIB

Access Controls

The SEL-2742 does not have any local user access because all the configuration and monitoring happens from SEL-5056 and, therefore, does not have any user accounts or passwords. The SEL-2742 supports OpenFlow communications with TLS, providing mutual authentication and encryption between the flow controller and the switch.

X.509 Certificates

The SEL-2742 uses TLS with X.509 certificates to protect communications for OpenFlow and the REST interface.

The default certificate installed on the product is intended to be used for the initial setup only and replaced by a certificate provided by SEL-5056 once the switch is commissioned. Unique default certificates are generated when the switch is manufactured.

The SEL-2742 supports using SHA-2 for signature generation and supports RSA with a 2048-bit key size.

Physical Access Controls

The SEL-2742 is designed to make it difficult to physically tamper with the device and its connections without disrupting communications and generating a log and alarm.

Alerts and Logging

Security Events

The SEL-2742 logs events by using Syslog. The SEL-2742 supports either UDP or TCP TLS Syslog and can send events to as many as three network Syslog servers, as well as activating an alarm contact for certain events. Failure of logging that uses Syslog is itself logged and causes the activation of the alarm contact. See *Appendix C: Events on page 40* for the list of events logged.

Internal Log Storage

The SEL-2742 stores logged events internally. Internal storage can hold as many as 4,096 events. In the event that storage is full, new events replace the oldest events.

Alarm Contact

The SEL-2742 uses an alarm contact, which is configurable to operate on the selected event severity level.

Backup and Restore

Saving and Restoring Settings

SEL-5056 by design saves all configurations of the SEL-2742. Simple device replacement is supported by the adoption process in SEL-5056.

Decommissioning

Preparing for Recycling or Disposal

It is often desirable to delete settings from the product when it is removed from service.

To delete the SEL-2742 settings, either factory reset the switch through SEL-5056 or press the pinhole reset button, if the pinhole reset setting is enabled, on the front of the switch.

Malware Protection Features

Operating System and Firmware

The SEL-2742 is an embedded device that does not allow additional software to be installed. The SEL-2742 only accepts digitally signed firmware upgrades. The SEL-2742 includes a self-test that continually checks running code against the known good baseline version of code in nonvolatile memory. See "The SEL Process for Mitigating Malware Risk to Embedded Devices" at selinc.com/malware_protection for more details.

Revision Management

Appendix A: Firmware and Manual Versions on page 34 contains a description of each firmware update.

See "The SEL Process for Disclosing Security Vulnerabilities" at selinc.com/security_vulnerabilities for details on vulnerability disclosure.

Firmware Update Verification

The SEL-2742 automatically checks the firmware authenticity and integrity and only loads firmware files that have been signed by SEL.

The authenticity and integrity of firmware updates also can be verified by checking the firmware hash. For instructions and firmware hash values, see selinc.com/products/firmware.

Contact SEL

For further questions or concerns about product security, contact SEL Security at:

security@selinc.com or +1.509.332.1890.

Technical Support

We appreciate your interest in SEL products and services. If you have questions or comments, please contact us at:

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Notes

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